

Reliability Society Newsletter



Editor: Alan Plait

January 1979 - Vol. XXII - Issue 1

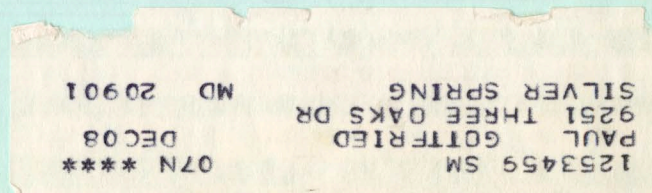
EDITORIAL

THE WAY I SEE IT

That time is upon us again—the Annual RAM Symposium. But, this time, at least for me, a difference. You may remember that we announced a new addition to the tutorial sessions. Myron Lipow and Marty Shoorman will present a session on Software Reliability. We welcome your interest and participation. However, the tutorials are geared to the reliability newcomer or one who needs a refresher in certain forgotten principles. I find that many who certainly cannot be put in either of these categories sometimes attend. May I suggest that we need the space for those who need the material. Attendance at the tutorials has been substantial and space is at a premium. In the beginning, it was hoped that a small college-sized class would be the norm; maybe, twenty to forty students (attendees?). In the last four years of the sessions, we have averaged over 80! And, its not getting any better. If you plan to attend, please so indicate on

the registration form, particularly those who would like to be included in the Software Reliability sessions.

Last month (October) I had the pleasure of listening to Mr. Willoughby of the Naval Material Command address a meeting of the local ASQC group. As a result, one might pose several hard questions—questions that Mr. Willoughby has asked in some circles. Why are some companies expending money to retest/rescreen semiconductors when they (the parts) were purchased using hi-rel specifications? Indeed, why are hi-rel semiconductor manufacturers delivering such parts if they are found to have more (sometimes much more) than a 10 percent reject rate? Why are good reliability designs getting so screwed up in the manufacturing process? Why is Quality getting blamed for poor quality when it should be called poor manufacturing? Once again, several of us at the meeting felt the wrong audience was listening. Do the VPs of Manufacturing or the Presidents ever get that message? When they get it from the company accountants and economists and public relations boys, its already too late. What are you doing about it?



AUTHORS—AUTHORS—AUTHORS—

The 1980 RAM Symposium is ready to receive abstracts for papers to be presented. Abstracts are solicited having up to 500 words. Please send them to:

A. M. Smith, M/C S-65
General Electric Company
Fast Breeder Reactor Dept.
310 De Guigne Drive
Sunnyvale, CA 94086

MEETING REPORTS— SECTION ACTIVITIES

There was a meeting on Sept. 13, 1978 of the Northern Virginia/Washington Section Reliability Society (Joint). There were 26 attendees with Chairman Vernon E. Gardner as Presiding Officer. The paper discussed was: "The Risks from Nuclear Power Plants in Virginia" by speaker State Senator Clive L. VuVal II.

WASHINGTON, DC CHAPTER RELIABILITY SOCIETY, IEEE

Date: 18 October 1978.
Time: 8:00 with dinner at 6:30 p.m.
Subject: Susceptibility of Solid State Electronics to Electrostatic Discharges.
Speaker: Toshio Oishi, Naval Ship Engineering Center.
Place: Ramada Inn, 8400 Wisconsin Avenue, Bethesda, MD.

TOPIC SUMMARY

Electrostatic discharges are sometimes a major failure cause in solid state electronics systems. Mr. Oishi will allow a 20 minute film on causes, effects of, and control of electrostatic discharge phenomena; after he will discuss recent advances in the field with relation to design, testing, and training to minimize electrostatic damage.

SPEAKER

Mr. Oishi is presently Section Head, System Effectiveness, at the Naval Ship Engineering Center, Washington, DC. He has previous experience with Bell Helicopter and General Dynamics, since graduating from the University of Arkansas in 1963.

"A limited number of PLP-78 Proceedings are available to members of IEEE Rel. Soc. on a first come, first serve basis. When writing for a copy it is necessary to include your membership number. The address is PLP Conference, 23 Rumsom Road, Livingston, NJ 07039.

AUTHORS—AUTHORS—AUTHORS—

Original papers on Reliability and Computer systems exploitation are being requested for the RELCOMEX '79 conference being held 25-29 September 1979 in Poland. One-half typed page abstracts are to be submitted as soon as possible. Manuscripts are due by 1 March 1979. The address to contact:

Prof. W. Zamojski, RELCOMEX '79
Institute of Engineering Cybernetics
Wroclaw Technical University
Janiszewskiego St. 11/17
50-372 Wroclaw, Poland

Author kits will be mailed when abstracts are received. The conference will be held in Ksiaz Castle, near Wroclaw.

NOTICE—NOTICE—NOTICE—NOTICE

Members of Reliability and the Electron Devices organizations will obtain, free, the February 1979 issue of the Electron Devices Transactions on "Device Reliability". Other GR members who would like their own copy are requested to notify the Newsletter editor, Alan Plait.

Also, don't forget our own special issue on Software Reliability, appearing in August 1979.

★HELP WANTED:

Reliability Engineer—5-10 yrs. experience.

Electric power plant experience: designing, maintaining, operating. MS in physics, engineering or math desirable. Service company for Middle South Utilities System.

Middle South Services, Inc.
PO Box 61000
New Orleans, LA 70161

MR. NEWTON SPITZFADEN
Personnel Assistant

(504) 529-5262

EEs' Pay Ought To Exceed That of Technicians and Blue-Collar Workers

Industry and Government should normally be paying engineers more than they pay craftsmen, tradesmen, and technicians, according to IEEE's Board of Directors. In a resolution passed 13 to 6 with 2 abstentions, the Board took a stand in support of principles of engineering compensation originally drafted and brought before it by IEEE's Portland, Ore., Section. The resolution, which is reprinted in its entirety on page 8, noted, among other things, that

- An engineer's compensation should be adjusted to maintain comparability with that of engineers "employed in institutions of similar mission located within the same geographic or economic zone" and that compensation includes salary plus fringe benefits.
- Periodic salary-step increases should be offered "in recognition of increasing performance, knowledge, capability, and changes in local cost of living;" and promotion should be offered "on a competitive basis" and be "restricted to engineers for engineer positions."
- Recognition and weight, in determining engineer compensation relative to other professions and occupations, should be given to college curriculum demands, local licensing requirements, problem-solving versatility, and professional responsibility and liability.

While the resolution may, at first, appear noncontroversial,

several Board members expressed concern that it might be a step toward collective bargaining. Proponents, however, noted that the resolution is nothing more than a statement of principle on IEEE's part and, as such, is no different than the Intersociety Employment Guidelines endorsed by some 31 engineering societies.

Argued proponents—who included such high management figures as IEEE's Executive Vice President C. Lester Hogan, vice chairman of the board of Fairchild Camera and Instrument Corp.—the resolution permits industry and Government the latitude to pay its employees according to the demands made on them. For example, an experienced construction worker on the Alaska pipeline might be justly deemed to deserve more dollars than an inexperienced engineer working under close supervision in the home office.

Such circumstances, however, would fall outside of the resolution's phraseology, which states: "Compensation for an engineer with four years satisfactory experience in the practice of engineering...should normally exceed" that provided craftsmen, tradesmen, and technicians.

Responding to concerns that industry might see this resolution as placing IEEE between the employer and employee, proponents argued that each engineer was still responsible for negotiating his or her own salary.

Microprocessor Home Study Course Available From IEEE Educational Services Dept.

IEEE's Educational Services Department has announced the availability of a new home-study program "Understanding Microprocessors Through Software Design". Conducted for IEEE by The MGI Management Institute, Larchmont, New York, the course is designed to give the participant a user level understanding of microprocessor chips and their applications in industrial and control environments.

"Understanding Microprocessors" is divided into 2 five-section learning units, each containing in its own loose-leaf binder. Unit 1 covers basic software concepts, while Unit 2 deals with computations, peripherals and advanced functions.

Each of the ten course sections include a series of *key element review questions* designed to help the student focus on the important concepts in that section, along with several *Skill Development Exercises* in which the student is given the opportunity to immediately apply the concepts he has learned. He sends these completed exercises to the MGI Analysis Center for review, comment and written response to any questions he sends in.

Unit 1 of the course also contains three background sections designed to give the student an understanding of basic digital techniques and fundamental computer concepts. Each of these background sections is preceded by a *self-assessment* exercise to

help the student assess his prior knowledge of this background material.

"The microprocessor chip represents a golden opportunity for every electronics engineer" says John Wilhelm, IEEE's Director of Educational Services. "The engineer's technical training and step-by-step approach to problem solving give him a major advantage in learning to use and apply the microprocessor chip in industrial and control applications". He continues. "All he really needs is some training in the details of applying these devices. That's what this course is designed to give him".

The two units of the course and their individual sections are listed below:

Unit One:

Background and Basic Microprocessor Software Concepts

- Background A: Basic Concepts of Digital Control and Computation.
- Background B: An Introduction to Software.
- Background C: The Hardware/Software Tradeoff in Microprocessor Applications.
- Section One: Understanding the Microprocessor.
- Section Two: How to Analyze any Software Problem.
- Section Three: Software Techniques I—Sequence and Decision.
- Section Four: Software Techniques II—Repeated Computations.
- Section Five: Software Techniques III—Stacking and Subroutines.

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

Unit Two:

Computations, Peripherals Interfacing and Advanced Concepts

Section Six: Digital Control Arithmetic.

Section Seven: Input/Output Techniques I—Serial/Parallel and Timing Concepts.

Section Eight: Input/Output Techniques II—Interrupt and Real-Time Operations.

Section Nine: Higher Level Languages.

Section Ten: Microprocessor System Synthesis.

Appendices

A. A glossary of commonly used microprocessor terms

B. Number systems and conversion charts

C. Assembly Programs

D. 8080A instruction execution times

E. Selected References

"Understanding Microprocessors Through Software Design" is available on a no advance payment, 15 day free examination basis. The cost in the U.S. and Canada is \$125.00 U.S. for the complete course, and \$85.00 U.S. for Unit One along. In other countries, these prices are increased by \$15.00 U.S. per unit to cover airmail of all course materials. To receive the course on a 15 day free trial basis, send your name and address to:

Educational Services Department ES-1

IEEE

445 Hoes Lane

Piscataway, New Jersey 08854



**BARDEN DEBATES
JAVITS-WILLIAMS BILL ON NBC-TV**

New York City—Robert Barden, vice chairman of IEEE's Pension Task Force, represented engineers' concerns on pension reform in a one-hour nationally televised broadcast.

Appearing on NBC's *America Alive*, Mr. Barden questioned Senators Jacob Javits (R-N.Y.) and Harrison Williams (D-N.J.) on S. 3017, a bill to amend the 1974 Employee Retirement Income Security Act (ERISA). The bill incorporates limited pension reform for employed workers, and other major ERISA changes.

The broadcast linked Mr. Barden, in New York, with both Senators in NBC's Washington, D.C., studio. Also in the Washington studio was pension expert Karen Ferguson of the Pension Rights Center, a consumer-advocate group.

"Engineers are mobile—they constantly chase defense contracts around the country," IEEE's Barden stated. "What, if anything,

can S. 3017 do to alleviate this problem and ensure that engineers and other mobile employees receive some kind of pension compensation?"

Responding to the question, Sen. Javits noted that he recognized the "particular problem of engineers" and promised relief.

"I was there," Mr. Barden says, "to point out the particular problems with mobile professions."

Although IEEE's Pension Task Force considers the Javits-Williams bill to be inadequate (see *THE INSTITUTE*, June, p. 1), Mr. Barden, interviewed following the broadcast, stated that he hoped modifications could be made when the legislation reached committee hearings. "Hopefully, it was introduced to stimulate discussion such as this," he says.

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Robert Barden, Vice Chairman of the Pension Task Force of the United States Activities Board of the Institute of Electrical and Electronics Engineers, Inc., (IEEE) appeared recently on national television on the "America Alive" show at the National Broadcasting Company to discuss his personal experience in the pension field as an electrical engineer. He appeared on a program jointly with Senators Jacob Javits (R-NY) and Harrison Williams (D-NJ). Mr. Barden explained the IEEE's important public position in the area of pension reform.



Left to right—Robert Barden, Senator Harrison Williams, Senator Jacob Javits.

**1979 POWER ELECTRONICS
SPECIALISTS CONFERENCE**

JUNE 19-21, 1979

SAN DIEGO

This will be the tenth annual IEEE Power Electronics Specialists Conference sponsored by the IEEE Aerospace and Electronic Systems Society.

Five IEEE Societies are cooperating with the PESC '79 conference. These are: the Electron Devices Society, the Industrial Electronics & Control Instrumentation Group, the Magnetics Society, the Power Engineering Society, and the Circuits and Systems Society. A local IEEE Section, the Region Six San Diego Section will co-sponsor the conference.

The conference provides a continuing forum for the presentation of the latest advances in the field of power electronics. Through the use of tutorial sessions and invited papers the conference also provides a stimulating and informative atmosphere for engineers who have recently entered the power electronics field.

Topics of interest include but are not limited to:

Power Components

- Semiconductor devices
- Magnetic devices
- Capacitors
- Surge suppressors

Power System Applications

- Military terrestrial
- Space
- Industrial
- Commercial

Power Circuits

- Inverters
- Rectifiers
- DC to DC converters
- AC to AC converters
- Motor Drives
- Reliability
- Active filters

The conference will be held June 19-21, 1979 with a preconference seminar on June 18, 1979 and a post conference tour June 19, 1979.

PESC '79 will be held at the Bahia Hotel in San Diego, California.

The record of the conference will be published in a 8½ x 11 inch soft-bound volume that will be mailed to the attendees within 90 days after the conference.



RELIABILITY AWARDS LUNCHEON

The Administrative Committee of the IEEE Reliability Society will sponsor an Awards Luncheon during the RAM Symposium in Washington, DC, on Tuesday, 23 January. Members and guests are invited to attend. The cost is \$5.00. The luncheon will be held in the Tudor Room of the Shoreham-Americana, at noon. A cash bar will be available. For further information, contact:

J. W. Thomas
Evaluation Associates, Inc.
2341 Jefferson Davis Highway
Suite 525-Century Bldg.
Arlington, VA 22202
(703) 979-2766



The Keynote Address at the RAM Symposium will be given by:

Alfred J. Whittle, Jr.
Admiral, U.S. Navy
Chief of Naval Material

Admiral Alfred J. Whittle, Jr., U.S. Navy, became the Chief of Naval Material on 1 August 1978.

Admiral Whittle's military career began upon graduation from the U.S. Naval Academy in June 1945. He first served on board the destroyers USS HARRY E. HUBBARD (DD-748) and USS BANNER (DDR-807). He then served on board the first GUPPY submarine, USS ODAX (SS-484) and later as commissioning Engineer Office of USS BONITA (SSK-3), as Executive Officer aboard the submarine USS GUDGEON (SS-567), and in March 1957 assumed command of the submarine USS STERLET (SS-392).

After studying the technical aspects of nuclear propulsion in Washington, D.C. and Arco, Idaho, he reported for duty as prospective commanding officer of the nuclear-powered submarine USS SEAWOLF (SSN-575) and commanded her until early 1962. He then served as first commanding officer of the Blue Crew aboard the nuclear-powered fleet ballistic submarine, USS ANDREW JACKSON (SSBN-619), for four years.

From June 1966 to June 1969, Admiral Whittle served as a student at the Institute of Defense Analysis, Arlington, Virginia, and then in the Office of the Chief of Naval Operations, Washington, D.C. before assuming duties as Chief of Staff and Aide to Com-

mander Submarine Flotilla SIX. In August 1970, he assumed command of Submarine Squadron SIX followed by duty in the Office of the Chief of Naval Operations.

In July 1972, Admiral Whittle assumed duties as Commander Submarine Flotilla SIX; in April 1974 became Deputy Director of Navy Program Planning in the Office of the Chief of Naval Operations; in July 1974, Director, General Planning Program Division, and served as Chief of Staff to the Supreme Allied Commander Atlantic (SACLANT) from September 13, 1976 to 31 March 1978. He then served as the Deputy Chief of Naval Operations for Logistics from April 1978 until his present duty as the Chief of Naval Material.

Admiral Whittle has been awarded the Distinguished Service Medal (second award); Legion of Merit (third award); the Meritorious Service Medal, and various area and campaign ribbons.

The Banquet Address Speaker for the RAM Symposium will be:

Dr. James Vollmer
Division V.P. & G.M.
Government Systems Division
RCA Corporation

Dr. James Vollmer was appointed Division Vice President and General Manager, Government Systems, Morrestown, NJ, on September 1, 1976. The Division encompasses four major RCA businesses which serve government customers: Astro-Electronics, Automated Systems, Government Communications Systems, and Missile and Surface Radar Systems.

Since August 1975 Dr. Vollmer had been Division Vice President and General Manager of the Government Communications Systems Division, Camden, NJ.

Previously, Dr. Vollmer had executive responsibility for RCA's Palm Beach Division, Palm Beach Gardens, Florida. He was General Manager for three years, culminating in June 1975 and with his promotion to Division Vice President and General Manager.

Dr. Vollmer joined RCA in 1959 as a physicist in the Applied Research activity and in 1963 was advanced to Manager of Allied Physics. Three years later he was appointed Manager of Applied Research.

In 1968 Dr. Vollmer became Director, Advanced Technology Laboratories, Camden, NJ, the research and development arm of RCA Government and Commercial Systems; he held that post for four years before moving to the Palm Beach Division.

Prior to joining RCA, Dr. Vollmer taught physics for five years at Temple University, and lead a research group in the Industrial Division of Honeywell for eight years.

Dr. Vollmer holds a B.S. degree in general science from Union College and M.A. and Ph.D. degrees in physics from Temple University. he also was graduated from Harvard University's Advanced Management Program.

Dr. Vollmer is a Fellow of the Institute of Electrical and Electronics Engineers, a Fellow of the American Association for the Advancement of Science, and a member of the American Physical Society, and The Franklin Institute of Philadelphia. He is also a member of the honorary societies, Phi Beta Kappa, Sigma Xi, Sigma Pi Sigma, and Eta Kappa Nu.

He has been awarded many patents on scientific devices and has authored a wide variety of articles which have been published in technical journals.

A Unique Product Liability Session will be held at the RAM Symposium consisting of a **Mock Trial**.

A class action suit is brought against an automobile manufacturer concerning "defective steering linkage design" on a Model Classic X automobile manufactured in 1976. The defective design is alleged to have caused significant injuries and fatalities to persons who had purchased and operated the Model Classic X automobile and were substantially involved in an accident.

The emphasis on this presentation will be the detailed examination of expert witnesses who will reveal the specific design characteristics that are considered by a major automobile manufacturer in the design and development phase of the car. There will be intriguing aspects of the relevant factors that would be considered in court for providing criteria to determine what a manufacturer should do to provide "a reasonable and prudent design" for their product. Specifically, major testimony will be developed on the (1) gravity of danger posed by the challenged design (severity of the consequence should a failure occur), (2) the probability that such a danger would occur (frequency, likelihood, or exposure of the failure mode) (3) the mechanical feasibility of a safer alternative (the technical feasibility of remedies or corrective actions). (4) the financial cost of an improved design (economic feasibility of alternative remedies), and (5) the adverse consequences to the product and to the customer that would result from an alternative design (the over all net system effectiveness).

Current judicial trends in providing criteria for instruction to juries will be emphasized. Definitions of excessive preventable danger will be presented. Additionally, the importance of reliability, maintainability and system safety design requirements and analysis will be comprehensively explained by the testimony in this case.



"MICRO ELECTRONICS WITH SPECIAL EMPHASIS ON SURFACE ANALYTICAL TECHNIQUES" will be the subject of a two and half day workshop on April 18-20, 1979 at Washington, D.C. during the **Scanning Electron Microscopy/1979** meetings sponsored by Scanning Electron Microscopy, Inc.

This workshop will focus on SEM and Surface analysis applications related to micro electronic device fabrication. Included will be the characterization of normal and defective devices for quality control. Specific areas to be covered are:

- Quality control related to device manufacture from wafer to finished integrated circuit.
- Testing of LSI by SEM.
- Failure Analysis—Special Techniques: CL, EBIC, new and modified instrumentation.
- Material Characterization in microelectronics—SEM, X-ray analysis, Auger analysis, ion spectroscopy and complementary analytical techniques such as ESCA. Electron-beam specimen interactions and advances in understanding/interpretation as well as instrumentation in analytical methods.

SCANNING ELECTRON MICROSCOPY/1979 meetings consisting of several tutorials, annual SEM Symposium and workshops (on e.g., analytical electron microscopy/STEM, stereo techniques, particulate matter characterization, sediments including coal and its derivatives, Failure analysis by fracture surface examination, archeology and art history, forensic applications, materials characterization, plants and animals, and biomedical applications), and an **equipment exhibition** will take place from **April 16-20, 1979** at the **Sheraton-Park Hotel** in Washington, D.C., USA.

CONFERENCE SCHEDULE

1979	CONFERENCE	LOCATION	INFORMATION CONTACT	PUBLICATION
Jan. 3-4	THIRD BIENNIAL UNIVERSITY/INDUSTRY/GOVERNMENT MICRO-ELECTRONICS SYMP. Sponsors: IEEE Reg.5 & IEEE South Plains Section Exhibits: No Est. Attendees: 150	Texas Tech University Lubbock, Texas	William M. Portnoy, Symposium Chairman Dept. of Electrical Engr. Texas Tech University Lubbock, Texas 79409 (806) 742-3532, 3533	Record 79CH1385-4 Reg.5 OOP OPTION 1 SUB-OPTION 1H
Jan. 10-12	CONFERENCE ON DECISION AND CONTROL (17th) Sponsors: CS Exhibits: No	Islandia Hyatt House San Diego, Calif.	Dr. Robert E. Larson, General Chairman Systems Control, Inc. 1801 Page Mill Road Palo Alto, CA 94304 (415) 494-1165	Record

1979	CONFERENCE	LOCATION	INFORMATION CONTACT	PUBLICATION PLANS
Jan. 23-25	<u>RELIABILITY AND MAINTAINABILITY</u> Sponsors: R Exhibits: No Ext. Attendees: 600	Shoreham Americana Washington, D.C.	D.F. Barber POB 1401 Branch PO Griffiss AFB, N.Y. 13441	Record
Feb. 4-9	<u>POWER ENGINEERING SOCIETY WINTER MEETING</u> Sponsors: PE Exhibits: No	Statler Hilton New York, N.Y.	J.G. Derse Bedminster, N.J. (201) 725-4388	Record
Feb. 6-8	<u>AEROSPACE & ELECTRONIC SYSTEMS WINTER CONF. (WINCON)</u> Sponsors: AES, L.A. Council	Los Angeles, Calif.	Sheldon Jones, Gen. Chrm. Marvin D. Boatright, Ass't. General Chrm. Aerojet Electrosystems P.O. Box 296 Azusa, Calif. 91702 (213) 334-6211 ext. 3123	
Feb. 15-17	<u>INT'L SOLID STATE CIRCUITS</u> Sponsors: SSC Exhibits: No	Sheraton Hotel Philadelphia, PA.	Lew Winner 301 Almeria Ave. P.O. Box 343788 Coral Gables, Fla. 33134 (305) 446-8193	Digest <u>79CH1375-5 SSCC</u> OOP OPTION 1 SUB-OPTION 1A
March 6-8	<u>OPTICAL FIBER COMMUNICATION</u> Sponsors: QEA, OSA Exhibits: Yes	Shoreham Americana Hotel Washington, D.C.	Optical Society of America 2000 L Street, N.W. Suite 620 Washington, D.C. 20036 (202) 293-1420	
March 12-14	<u>PARTICLE ACCELERATOR CONFERENCE</u> Sponsors: NPS	Sheraton Palace San Francisco, Calif.	R.B. Neal SLAC P.O. Box 4349 Stanford, Calif. 94305	Nuclear Science Trans.
Mar. 14-16	<u>SIMULATION SYMPOSIUM</u> Sponsors: C, ACM, SCS	Tampa, Florida	Dr. Joe Clema Simulation Tech. 4124 Linden Ave. Dayton, Ohio 45432	Record <u>79CH1376-3 C</u> OOP OPTION 1 SUB-OPTION 1F
Mar. 19-21	<u>FOURTH ANNUAL CONTROL OF POWER SYSTEMS</u> Sponsors: Houston Sec. IEEE, Texas A&M Univ. Exhibits: Yes Est. Attendees: 400	Texas A&M University	B. Don Russell Electric Power Institute Dept. of Elect. Engr. Texas A&M University College Station, Texas 77843	Record <u>79CH1377-1 Reg. 5</u> OOP OPTION 1 SUB-OPTION 1H
Mar. 22-23	<u>FLORIDA-ECLECTIC '79</u> Sponsors: IEEE Secs. in Florida Exhibits: Yes	Florida Institute of Technology Melbourne, Florida	George F. McClure Martin Marietta Aerospace P.O. Box 5837, MP-362 Orlando, Florida 32855 (305) 352-2782	
Mar. 27-30	<u>VEHICULAR TECHNOLOGY</u> Sponsors: VT	Arlington Heights Chicago, Illinois	Al Goldstein National Manager Field Engr. Motorola, Inc. 1301 E. Algonquin Road Schaumburg, Illinois 60196	Record <u>79CH1378-9 VT</u> OOP OPTION SUB-OPTION 1B