

## News bits

### Bill Metz

Bill Metz, Hewlett-Packard/Agilent Technologies Corporate ESD Program Manager, passed away on April 23, 2002. Bill was a major contributor to the *HP Workmanship Specification for Electrostatic Discharge Control*. He served in the capacity of “technical advisor” for the ESD Northwest chapter and was active in the ESD Association. Additional details about ESD Northwest’s plans for a memorial to Bill will be available in the next issue of *Threshold*.

### Charity golf tournament

The ESD Association will sponsor its second annual charity golf tournament on Saturday, October 5, at the Charles T. Myers Golf Course in Charlotte, NC. Proceeds from the event will be donated to the Children’s Miracle Network. Contact ESD Association headquarters or visit the ESDA Web site ([www.esda.org](http://www.esda.org)) for additional information.

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## EOS/ESD Symposium

### Join us in Charlotte

Dear Colleagues and Friends,

*Kon-nich-chua,  
Hola, Saalam  
Aleikum,  
Sawatdee ka, Ciao  
ti, Zimdohbre,  
Greetings!*



Steve Voldman

On behalf of the ESD Association and the EOS/ESD Symposium 2002 steering committee, it is my privilege to invite you to join us at the 24<sup>th</sup> EOS/ESD Symposium in Charlotte, North Carolina. This international ESD event will be held at the new Charlotte Convention Center.

### Keep pace with tomorrow

It’s an *ESD Race to Excellence!* Technology is moving at giga-hertz speeds with tera-hertz around the corner. The ESD world will need to keep pace with new applications, new fields, and new problems. Quality, reliability, flexibility, automation, and supplying total “ESD solutions” will continue to challenge us. These challenges will provide opportunities and sometimes bumps in the road in manufacturing sectors, factories, test, design, software, and product development.

### Are we ready? Are you ready?

This year’s Symposium program reflects the vitality of these new fields, interests,

challenges, and phenomena in the electrostatic discharge discipline. The Symposium program—the technical papers, the workshops, tutorials, and exhibits—should provide a window to peek at the changing field of ESD. The EOS/ESD Symposium team has worked toward crystalizing synergy between the technical papers, tutorials, and workshops, creating educational tracks throughout Symposium week. This synergy will provide both an educational and enjoyable event at the ESD Symposium.

### New events

This year there is a special program on S20.20. Additionally, there are social events, receptions, luncheons, award ceremonies and even a charity golf outing. Participate in the David F. Barber Sr. Charity Golf Tournament and help benefit a local charity in our host community! Please join us for this special event!

Visit the ESDA Web site ([www.esda.org](http://www.esda.org)) for all the details, and register early!

*Li-he-tra-ot! Hasta luego! Ciao! Tsei jen! Paca! Dosvidanya!*

See you there!

Dr. Steven H. Voldman  
General Chairman  
2002 EOS/ESD Symposium

From the Threshold chair

## Threshold of pain

It would be safe to say that we are all aware of the pain of not getting a product to market in a timely manner, of not completing a project on time, of not completing a weekly or monthly report on time, or, mostly, the pain



Leo G. Henry

of not paying our bills on time. This July/August issue of *Threshold* could well become the source of some pain because

some of us have failed to act in a timely manner.

It is my understanding that, like me, most of you enjoy the newsletter and read it for events, issues, and news associated with ESD and the ESDA. Yet, some of you have not taken the necessary step to ensure that you will continue to receive future issues of *Threshold*. It appears that some of you are prepared to endure some pain before taking this next step.

In the January/February 2002 issue, we announced that *Threshold* was going to become a Web-based publication, downloadable from the ESDA Web site ([www.esda.org](http://www.esda.org)). Because we planned to send our members an e-mail announce-

ment when each issue was available for downloading, we requested that ALL members sign in to the *For Members* section of the ESDA Web site, using their membership number (sent to you sometime in 2001) and email address. Not only was this an easy way for you to provide an e-mail address for future *Threshold* announcements, but it also gave you access to the newsletters already posted there, downloadable copies of all ESDA technical reports, copies of key design papers compiled by Charvaka Duvvury, plus other benefits available only to members. It is your section; please take advantage of all the benefits.

In spite of these benefits, many members have not yet logged in.

The reasons for moving the newsletter online are to ensure the timely arrival of *Threshold* to you and to reduce the costs for printing, postage, and paper (save some trees?) to the ESDA, your not-for-profit organization. While a high percentage of you have already signed up, we need to achieve a 100% on-line registration. So, if you have not already done so, please sign in, and then tell a friend/colleague to do the same. If you have logged in, still tell a friend.

The decision to go Web-based was made "many moons" ago. It will be painful for those of you who have not yet signed up to receive announcements of the on-line version of the newsletter. The question is: how much pain will you endure before you sign up? What will be your threshold before you will be able to read the next issue of *Threshold*?

Until next time

*Leo G*

### Calendar of events

#### July 2002

**ESD Northwest Chapter Annual Bar-B-Q and Meeting:** July 10, 2002, Overall Services; [www.esdnw.org](http://www.esdnw.org)

**Texas Chapter Family Night:** July 23, 2002; Round Rock Express Baseball Game; [www.centxesd-assoc.homestead.com](http://www.centxesd-assoc.homestead.com)

#### August 2002

**ANSI/ESD S20.20 Seminar for Independent Assessors, Program Managers, and Consultants:** August 20-21, Austin, TX; [www.esda.org](http://www.esda.org)

#### September 2002

**ESD Northwest Chapter Meeting:** September 4, 2002, Overall Services; [www.esdnw.org](http://www.esdnw.org)

**Midwest Chapter Meeting:** September 10, 2002, Bimbo's Restaurant; Lightning ... Mother Nature's ESD, [www.midwestesd.org](http://www.midwestesd.org)

#### October 2002

**ESDA Standards and Committee Meetings:** October 3-5, 2002 (Tentative); Omni Hotel, Charlotte, NC; [www.esda.org](http://www.esda.org)

**David F. Barber Sr. Memorial Golf Tournament:** October 5, 2002; Charles T. Myers Golf Course, Charlotte, NC; [www.esda.org](http://www.esda.org)

**ANSI/ESD S20.20 Seminar for Independent Assessors, Program Managers, and Consultants:** October 6-7, Charlotte, NC; [www.esda.org](http://www.esda.org)

**EOS/ESD Symposium:** October 6-10, 2002; Charlotte Convention Center, Charlotte NC; [www.esda.org](http://www.esda.org)

**ESDC Certification Exams:** October 11, 2002; Charlotte, NC; [www.esda.org](http://www.esda.org)

**Midwest Chapter Meeting:** October 16, 2002, Bimbo's Restaurant; ESD and the Automotive Industry, [www.midwestesd.org](http://www.midwestesd.org)

## Comprehensive, concentrated, customizable, cost-effective

The 24<sup>th</sup> annual EOS/ESD Symposium packages research, technology, education, and peer networking into the premier international ESD event scheduled October 6-10 at the Charlotte Convention Center in Charlotte, NC.

### Comprehensive

Tutorials, workshops, and technical papers cover the latest information, research, and technology in electrostatic discharge and electrical overstress. With topics ranging from the basics of ESD and on-chip protection to the newest developments in the emerging fields of RF ESD design and transmission line pulsing, the Symposium offers something for everyone.

### Concentrated

Fifty-three technical papers presenting the world's leading research and technology, 15 tutorials from basic to advanced,

seven workshops for peer interchange of ideas and information, and more than 100 exhibits are packed into five full days of activity. And, it's all in one location.

### Customizable

Organized and programmed in four technical tracks, attendees will be able to customize their Symposium experience along specific areas of interest: *Design and Device Technology*, *Factory Issues and Materials*, *System Level ESD*, and *Magnetic Recording*.

### Cost-effective

With so much ESD education and technology concentrated in one location in a single time period, the Symposium is a cost-effective way to focus on new developments or to gain basic background on ESD. This year's fee structure has been revised to provide additional savings for

attendees who participate in the entire five-day program.

In addition, individuals interested in the ESDC certification program will be able to take the certification exams on Friday, October 11. Special tutorials during the week will help applicants prepare for the examinations.

Symposium highlights can be found elsewhere in this issue of *Threshold*. The detailed program is available on the Association's web site, [www.esda.org](http://www.esda.org).

The Symposium is sponsored by the ESD Association in cooperation with the IEEE. It is technically co-sponsored by the Electron Devices Society. The general chair is Steven H. Voldman, IBM Microelectronics. The vice general chair is Joseph Bernier, Intersil Corporation. The technical program chair is John Kinnear, Jr., IBM.

## Advance your professional career! Get certified!

### Preparing for the certification exams

If you're considering taking either the ESDC Engineer or ESDC Technician certification exam on Friday, October 11, there are a number of tutorials that will help you prepare. The following tutorials have been identified as being especially useful in preparing for the exams.

#### Preparing for the technician exam

ESD Basics (Sunday)  
Electrostatic Fundamentals (Monday)  
Understanding and Implementing ANSI/ESD S20.20 (Monday)  
How To's of In-Plant ESD Survey and Evaluation Measurements (Monday)

Air Ionization: Issues and Answers (Monday)

ESD Standards and Procedures (Thursday)

#### Preparing for the engineer exam

ESD Basics (Sunday)  
Electrostatic Fundamentals (Monday)  
How To's of In-Plant ESD Survey and Evaluation Measurements (Monday)  
EOS/ESD Failure Models and Mechanisms (Monday)  
Air Ionization: Issues and Answers (Monday)

ESD Standards and Procedures (Thursday)

Electrostatic Calculations for the ESD Engineer (Thursday)

#### Certification exams Friday, October 11

ESDC Engineer Exam  
ESDC Technician Exam

Additional information is available in the registration area, at the ESD Association booth, or by contacting ESD Association headquarters.

## Program and Schedule Summary

October 6–10, 2002

Charlotte Convention Center, Charlotte, North Carolina, USA

(Program subject to change)

### Saturday, October 5

Registration Opens  
Charity Golf Tournament

### Sunday, October 6

Registration  
Spouse/Companion Hospitality  
ANSI/ESD S20.20 Seminar, Part 1  
Tutorials

### Monday, October 7

Registration  
Spouse/Companion Hospitality  
ANSI/ESD S20.20 Seminar, Part 2  
Tutorials  
Welcome Reception (In Exhibit Hall)  
Exhibits

### Tuesday, October 8

Registration  
Spouse/Companion Hospitality  
Awards Breakfast  
Exhibits  
Technical Sessions  
On-Chip Protection  
Systems Issues  
RF ESD Design and Technology  
MR Device Issues

### Wednesday, October 9

Registration  
Spouse/Companion Hospitality  
Technical Sessions  
Transmission Line Pulsing and Standardization  
Factory and Materials  
Simulation and Modeling

Exhibits  
ESD Association Luncheon/ Keynote Speaker  
Workshops

### Thursday, October 10

Registration  
Spouse/Companion Hospitality  
Technical Sessions  
MR Factory Issues  
Device Effects  
Tutorials

### Friday, October 11

ESDC Technician Exam  
ESDC Engineer Exam

## Register early and save

You can save money and you can save time by registering in advance. Advance registration fees are valid only if received no later than **August 30, 2002**. Registrations received after this date will be processed at the on-site fees.

You can save several hundred dollars by registering early. Plus, attendees who participate in the "total Symposium experience" and full-time students will save even more.

To register, use the registration you received in the mail, download the form from the ESDA Web site, [www.esda.org](http://www.esda.org), or contact Association headquarters.

## Registration and Fees

	Advance Fees On or Before August 30, 2002	On-Site Fees After August 30, 2002
<b>Symposium</b>		
ESD Association Members	\$495	\$695
Non-Members	\$595	\$695
<b>Tutorials</b>		
Sunday (Full Day)	\$475	\$550
Monday (Full Day)	\$475	\$550
Thursday (Full Day)	\$475	\$550
Thursday (Half Day, AM or PM)	\$275	\$275
<b>Total Symposium Experience: Save with Bundled Fees</b> (Symposium plus 3 full days of tutorials)		
ESD Association Members	\$1,725	\$2,110
Non-Members	\$1,815	\$2,110
<b>Student Fees</b>		
50% discount for full-time students. Proof of enrollment required.		
<b>S20.20 Seminar</b> (Attendance limited to first 30 registrants)	\$1,495	\$1,495
<b>Exhibits Only</b>	No Charge	No Charge

## Technical sessions feature hot topic areas, invited paper, authors corners

Another banner year...53 technical papers presented in ten sessions will highlight current international technological issues and research on ESD and EOS. The papers will be offered in parallel sessions to allow attendees to concentrate on those sessions of greatest interest to them.

Year after year, the Symposium technical sessions reflect continuing strong interest in the traditional areas of CMOS design, novel devices, and systems and factory issues. Over the last five years, the magnetic recording industry has brought new issues influencing the MR industry to the forefront of the Symposium.

The Symposium technical sessions also emphasize growth areas and emerging technologies, such as recticle damage and micro-machines (MEMs). In recent years, for example, transmission line pulse (TLP) testing has been recognized in the technical sessions and will be again this year.

Interest in RF wireless communications, high data rate wired transmission, optical interconnects, and fast test equipment has resulted in ESD issues never before experienced. RF CMOS, BiCMOS silicon germanium (SiGe), and gallium arsenide (GaAs) technical publications continue to be highlighted in the technical papers.

Two sessions introduced last year are being presented again this year: *RF ESD Design & Technology* and *Transmission Line Pulsing & Standardization*. Other technical sessions during the week will cover *On-Chip Protection*, *Device Effects*, *Simulation and Modeling*, *Systems Issues*, *MR Device Issues*, *MR Factory Issues*, and *Factory and Materials*.

### Authors corners

The technical program doesn't end with the presentation of the papers. It also includes the opportunity to meet with the authors after each technical session. This

is your opportunity for further discussion and more detailed questions.

### Invited paper

The technical sessions also feature the award winning paper from the 2001 RCJ EOS/ESD Symposium-Japan. Presented in the Tuesday afternoon technical session on MR Device Issues, the paper is titled *Barkhausen Noise Potential of ESD in GMR Heads and an Analysis of Magnetically Damage Process*. In the paper, the authors, T. Hamaguchi, T. Ichihara, and T. Ohtsu from Hitachi, Ltd., discuss a new magnetic failure mode in giant magnetoresistive (GMR) heads from ESD current. They conclude it was Barkhausen noise caused by unexpected domain walls in free-layer of GMR head. Based on modified machine model (0 ohm, 50 pF), this damage occurred at around 0.5 V, a quarter of the conventional pinned-layer reversal failure.

Detailed descriptions of the technical papers can be found in the Symposium program, available on the ESDA web site, [www.esda.org](http://www.esda.org)

### Technical session schedule

#### Tuesday, October 8

On-Chip Protection  
Systems Issues  
RF ESD Design and Technology  
MR Device Issues

#### Wednesday, October 9

Transmission Line Pulsing and Standardization  
Factory and Materials  
Simulation and Modeling

#### Thursday, October 10

MR Factory Issues  
Device Effects

## Symposium promotional opportunities

The 24th annual EOS/ESD Symposium will offer exhibitors and other companies a number of marketing and promotion opportunities, several of them new for this year's event.

### Exhibits directory

The Symposium will again publish a separate exhibits directory containing detailed information on the 3-day exhibits program. In addition to the free company and product listings in the directory, exhibiting companies also may purchase half and full page advertisements to expand awareness of their company products and services. Details are in the exhibitor kits mailed to all exhibitors.

### Charity golf tournament

The second annual David F. Barber Sr. Charity Golf Tournament on October 5 offers several opportunities including hole sponsorships, team sponsorships, and door prizes. Check the exhibitors kit or the ESDA Web site, [www.esda.org](http://www.esda.org), for more information.

### Symposium advertising opportunities

New this year is the opportunity for companies to support the Symposium and create company awareness at various events such as the tutorial lunches, coffee breaks, the welcome reception, and the opening breakfast. Event signage or on-screen slides will prominently identify and promote companies participating in these opportunities.

Costs, deadlines, and other requirements for each of these programs are included in the exhibitors kit mailed to each exhibiting company. Additional information also may be obtained by contacting ESD Association headquarters.

## Tutorials offer training and in-depth education

Have a new employee who needs comprehensive training in the basics of electrostatic discharge? Or perhaps you want to increase your own understanding of the impact of ESD in the emerging RF technologies?

Where do you find the training and information you need? Look no further than the three days of in-depth tutorials offered at this year's EOS/ESD Symposium. Internationally recognized instructors will present a total of 15 courses appealing to both beginners and advanced practitioners.

The program opens Sunday, October 6, with two full day tutorials. Thirteen additional sessions will be presented on Monday, October 7, and Thursday, October 10. The sessions cover a wide range of topics, including ESD basics, RF protection design, on-chip protection, S20.20, ESD standards, and device testing.

In addition, several tutorials will help you prepare to take the ESDC certification examinations for engineers and technicians. See story on page 3.

To help you make your selections, several tutorials are highlighted below. The complete list of tutorials and abstracts is in the Symposium program available at [www.esda.org](http://www.esda.org).

### Tutorial Highlights

#### Tutorial A: ESD Basics

8:30 AM–4:30 PM, Sunday, October 6  
Burt Unger, Burt Unger Associates

One of the most popular offerings year after year, the ESD Basics tutorial covers the fundamentals of ESD. Whether you are a newly appointed ESD coordinator or need a review to prepare for the ESDC certification exam, this tutorial will provide answers, answers, and more answers. The course will include the fundamentals of charging and discharging, how and why different materials charge, and how

to measure the charge. Instructor Burt Unger will discuss the three generalized models that describe how ESD events occur, the use and pitfalls of field meter measurements, various ESD control techniques, and properties and characteristics of ESD control products.

#### Tutorial D: Understanding and Implementing ANSI/ESD S20.20

8:30 AM–10:10 AM, Monday, October 7  
Dave Swenson, 3M/Electronic Handling and Protection Division

ANSI/ESD S20.20 was written to eventually replace Mil Std 1686 as well as provide commercial industry with a realistic, credible, and certifiable methodology for controlling static in the work place. This tutorial will take the S20.20 discussion to the next level, providing both background about why recommendations were made as well as guidance in interpreting specific elements of the standard. In addition, this tutorial will give practical assistance to attendees who are responsible for preparing, implementing, and simply participating in a basic ESD control program plan process.

#### Tutorial F: HBM, CDM, MM, and TLP Device Testing

10:30 AM–Noon, Monday, October 7  
Dr. Leo G. Henry, Ion Systems, Inc.

This tutorial addresses the basics of HBM, CDM, MM, and transmission line pulse (TLP) ESD stress testing of the ESD protection structures of ICs. The differences between these models will be emphasized, and then used to show how the different circuit parasitics affect the waveforms from each model-type simulator. The importance of doing ESD testing as an integral part of a high quality component development effort will be stressed. The behavior of the ESD protection structure measured with different rise times

pulses will be demonstrated. Standards issues and test procedures will be discussed, and comparisons will be made between the ESDA and JEDEC standards.

#### Tutorial M: ESD Standards and Procedures

8:30 AM–Noon, Thursday, October 10  
Louis W. Patterson, K & L Services

This tutorial focuses on ESD Association standards and their applicability to the workplace. It is designed to provide ESD coordinators, engineers, technicians, and vendors with an understanding of how to use these standards to determine requirements and procedures for performing ESD related functions in the work environment. It includes the relationships between different standards and advisories and how they are used jointly to establish ESD safe work areas or to satisfy requirements. This material will be very helpful to those who are planning to take the ESDC certification exams, particularly the technician exam, which is focused heavily on standards.

#### Tutorial L: ESD Protection Design for RF and Advanced Technology Applications

3:00 PM–4:30 PM, Monday, October 7  
Koen Verhaege, Sarnoff Europe

This advanced ESD design class concentrates solely on the protection of high-speed application ICs in very advanced silicon technologies. It is assumed that participants are conversant in ESD protection design or have attended the basic ESD design tutorials. The challenges of protecting high speed ICs from the full chip point of view will be reviewed. Protection devices and strategies will be assessed. Data from 0.13-0.10µm CMOS and below, and from 0.35µm BiCMOS will be used. A set of "golden rules" for successful full chip RF ESD protection design will be defined.

## Workshops generate interaction and discussion

Seven interactive workshops on Wednesday afternoon, October 9, provide attendees with the opportunity to explore specific topics in depth. The workshops encourage discussion, questions, and audience interaction and participation.

### Workshop Summary

#### A.1 ESD in Magnetic Recording

Moderator: Ferruh Gocemen, Maxtor Corporation

Extremely ESD-sensitive components, such as MR heads, and the lack of convenient, integrated ESD protection devices make ESD a key concern in the magnetic recording industry. Because of the unprotected sensitivity, the industry is forced to develop cutting edge ESD control processes, materials, and technologies. Panel members have direct experience with ESD testing, EMI, and ESD control, as well as all aspects of GMR wafer, head, and disk drive assembly and manufacturing. Although the discussion is likely to include topics unique to magnetic recording, many concerns also apply to the broader ESD community.

#### A.2 S20.20 ESD Control Program Certification

Moderator: Ron Gibson, Celestica, Inc.

This interactive workshop is designed to provide an insight into the workings of a typical ANSI/ESD S20.20 certification audit. The S20.20 certification requirements will be reviewed and excerpts from actual ESD program documents will be utilized to stage mock certification audits. At the conclusion of the workshop, the attendee should have a good understanding of the approach taken by S20.20 certification auditors and how to modify internal ESD control documents to avoid audit non-conformance.

#### A.3 On-Chip Protection for RF Technologies

Moderator: Richard Ida, Motorola SPS

Mixed-signal RF IC circuit operational requirements limit and dictate the possible on-chip protection strategies utilized. In this interactive workshop, panelists will discuss some of these challenges and possible solutions. In addition, open discussions will be held on this and a number of other ESD protection issues raised by the audience such as high frequency requirements, signal isolation and noise issues, supply sequencing issues, lab-to-fab and fab-to-fab transfer issues, protection of integrated passives, and protection of compound semiconductor devices.

#### A.4 ESD in Cleanrooms

Moderator: Tom Albano, Eastman Kodak Company

This workshop will cover issues of electrostatic control compatibility in cleanrooms and clean manufacturing areas. A panel of industry manufacturers and end users of electrostatic control equipment and materials, cleanrooms, and cleanroom products will present and discuss ESD, EMI, and contamination considerations. The focus will be on methods of identifying and avoiding problems.

#### B.1 System Level ESD Considerations

Moderator: Douglas Smith, D. C. Smith Consultants

As system speeds have increased, system level ESD issues have become increasingly important. Workshop discussion will follow the interests of the attendees and likely will include both theoretical and practical issues with an emphasis on the practical side. The workshop format will include a brief introduction from each panelist followed by an open discussion and questions from the audience.

There also will be demonstrations of ESD principles as applied to the system level. Time and equipment permitting, audience members will be able to operate some of the experiments themselves.

#### B.2 Transmission Line Pulse Testing (TLP)—Ideas and Applications

Moderator: Natarajan Mahadeva Iyer, IMEC

After the introduction of the TLP testing method in the mid-eighties, extensive efforts have been spent in utilizing the methodology to quantify the ESD robustness of semiconductor devices. While most of these efforts were directed towards characterizing the intrinsic device performance, there were also attempts to characterize the material reliability (dielectric, interconnects, etc.) and to correlate the results to conventional HBM and CDM test data. The workshop panel will present their understanding and views on TLP testing methodology, its hidden applications, ideas to improve system performance, and issues of correlating to standard ESD testing results.

#### B.3 Auditing Measurements According to ESD Association Standards Test Methods

Moderator: Kimberly Becker, Prostat Corporation

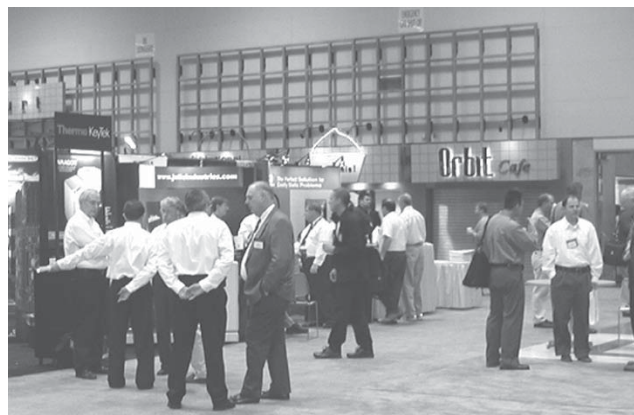
This workshop is a hands-on demonstration of the auditing techniques discussed in the "How To's of In-Plant ESD Auditing & Evaluation Measurements" tutorial. Testing and auditing demonstrations will be conducted according to the ESD Association standard test methods and accepted industry practices. Workshop attendees will be allowed to try the various methods, ask questions, and obtain measurement advice at each station. Actual techniques demonstrated will include grounding, floors, worksurfaces, garments, packaging, ionizers, footwear, chairs and carts, wrist straps, and other equipment.

## Exhibits emphasize products, services, solutions, information

When you're looking for ESD products and services, where does your search begin? If you're looking through a myriad of purchasing directories, checking the magazine ads, or walking the floors of major electronics trade shows, you're probably doing things the hard way.

The easy alternative? The 2002 EOS/ESD Symposium featuring over 100 exhibit spaces displaying ESD products and services from leading companies. All in one place, you'll cover the broad spectrum of static protection, control, testing, and analysis, as well as prominent trade publications.

Admission to the exhibits is free. You don't even need to register for the Symposium or tutorials, although if you don't, you'll miss out on a lot of information.



### List of Exhibitors

As of July 3, 2002

3M Electronic Handling and Protective Products  
ACL/Staticide  
Aesops, Inc.  
Barth Electronics, Inc.  
Boliddt Synthetic Products & Systems  
Bradford Company  
ByStat International, Inc.  
Cabot Corporation  
Carmelstat by Carmel Olefins  
Conductive Containers, Inc.  
Credence Technologies, Inc.  
Desco  
Edco Supply Corporation  
Electro-Tech Systems, Inc.  
Ex-Tech Plastics, Inc.  
Flexco  
Forbo Linoleum, Inc.  
Gary Plastic Packaging Corporation  
H.C. Starck, Inc.  
ION Systems, Inc.  
Julie Industries, Inc.  
Iron Age Corporation  
Klockner Pentaplast of America, Inc.  
Kostat, Inc.  
Lehigh Safety Shoe Company  
Milliken Chemical  
Molded Fiber Glass Tray Company

Monroe Electronics  
NoiseKen  
Nora Rubber/Freudenberg Building Systems, Inc.  
Noveon Static Control  
NOVX Corporation  
NRD, L.L.C.  
Premix Thermoplastics, Inc.  
Prostat Corporation  
Richmond Technology - ITW  
RTP Company  
Sarnoff Corporation  
Semtronics Corporation  
Siegel-Robert, Inc.  
Simco Static Control & Cleanroom Products  
Static Control Components, Inc.  
Static Solutions, Inc.  
Statico  
Stephen Halperin & Associates, Ltd.  
TAKO Astatic Technology SDN BHD  
TDI International, Inc.  
Tech Wear, Inc.  
Technical Coating International  
Tek Stil Concepts, Inc.  
Thermo KeyTek  
Trek, Inc.

Uniglobe Kisco, Inc.  
Vidaro Corporation  
VPI (Vinyl Plastics, LLC)  
VPI Mirrex  
Z-Mar Technology, Inc.

#### Publications

A2C2  
Canon Communications  
Cleanrooms Magazine  
Evaluation Engineering - EE

#### Sponsor

ESD Association

#### Exhibit Hours

Monday, October 7, 7:00 PM-10:00 PM  
Tuesday, October 8, 9:00 AM-5:00 PM  
Wednesday, October 9, 9:00 AM-Noon  
and 2:00 PM-4:00 PM

Information on exhibiting may be obtained by contacting David F. Barber, Jr., Scien-Tech Associates, Inc., P.O. Box 2097, Banner Elk, NC 28604-2097, Phone: 828-898-6375, Fax: 828-898-6379.

## ESDA Basement Sale

### Savings on overstocked EOS/ESD Symposium proceedings and tutorial notes

#### Overstocked Proceedings

<i>EOS-4, 1982 EOS/ESD Symposium Proceedings</i>	Sale Price: \$30 (Reg. \$90)
<i>EOS-20, 1998 EOS/ESD Symposium Proceedings</i>	Sale Price: \$30 (Reg. \$90)
<i>EOS-23, 2001 EOS/ESD Symposium Proceedings</i>	Sale Price: \$30 (Reg. \$90)

#### Overstocked Tutorial Notes (2000 Symposium Tutorials)

<i>2000 Thursday Tutorial Notes</i>	Sale Price: \$50 (Reg. \$100)
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Includes notes from these tutorials: *ESD Program Development using ANSI/ESD S20.20; RF On-Chip ESD Protection Network Physics and Design; Fundamentals of Electrostatics; Circuit Pack Transient Protection; ESD Systems Testing to IEC Standards; Teach'n Ain't Learning: How to Make Your Training Programs Interesting, Fun, and Effective; Electric Fields: Fundamentals Concepts; On-Chip Protection Circuit Modeling and Simulation; ESD Failure Mechanisms; Air Ionization; Trouble-Shooting On-Chip ESD Failures*

<i>2000 Monday Tutorial Notes</i>	Sale Price: \$50 (Reg. \$100)
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Includes notes from these tutorials: *ESD Standards and Procedures; EOS and ESD Laboratory Simulations for Failure Signature Analysis; Triboelectrification: Theory and Applications; ESD Dynamics; In-Plant ESD Auditing & Evaluation Measurements; Electrostatic Calculations for the ESD Engineer; Device Testing; Electrostatic Measurements; Transmission Line Pulse Testing of ICs; ESD Control in Cleanrooms*

<i>2000 ESD On Chip Tutorial Notes</i>	Sale Price: \$50 (Reg. \$100)
<i>2000 MR Session Tutorial Notes</i>	Sale Price: \$50 (Reg. \$100)
<i>2000 ESD Basics Tutorial Notes</i>	Sale Price: \$50 (Reg. \$100)

#### Symposium Proceedings Sets

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## ESDA expands S20.20 seminar schedule

The ESDA has expanded its initial schedule of ANSI/ESD S20.20 Seminars for Independent Assessors, Program Managers, and Consultants by adding a session in Austin, TX in August.

The first seminar will be held August 20 and 21 in Austin, TX. The second session, previously announced, will be held October 6 and 7 in conjunction with the October EOS/ESD Symposium in Charlotte, NC.

This two-day seminar is intended for companies or individuals who wish to help clients design and implement an ESD control program based on ANSI/ESD S20.20. This course will also provide the attendee with the tools and techniques to help clients prepare for a facility audit (pre-assessment).

The seminar will cover the following topics:

- Overview of ANSI/ESD S20.20
- Administrative Elements
- Technical Elements
- ESD Program Techniques for Different Applications
- Overview of the Assessment Process
- How to Approach an Assessment
- The Audit Checklist and Follow-up Questions

Examples of control programs will be presented and general audit role-playing will be used in the assessment section.

Ron Gibson, Celestica, Inc., and John Kinnear, Jr., IBM Corporation, will be the presenters of this intensive seminar.

Seminar fees are \$1,495. Attendance is limited to the first 30 registrants. Register for this separate two-day program using the Symposium registration form. Additional information is available from ESDA headquarters.

## June 2002 standards meetings and activities

by Michael T. Brandt, Editor

The ESD Association standards committee and standards working groups held their spring meetings in Las Vegas, NV. Much of the activity continues to focus on updates and revisions to existing documents and the continuing development of various technical reports. A summary of the various working group activities appears below.

**Ionization WG-3** reviewed its draft technical report covering alternate test methods to the charged plate monitor (CPM) for determining discharge time and offset voltage. The group also continued evaluation of a new CPM test fixture, developing test procedures and modifications to reduce stray capacitance and minimize corner field intensification in the plate perimeter vs. plate area testing.

**Human Body Model Device Testing WG-5.1** has developed a new WIP document that revises the method for calculating critical HBM waveform parameters. Added as an appendix, the methodology automates calculating the waveform parameters by using spreadsheet software. Discussion with test equipment manufacturers is under way to better understand how the proposed automated procedure would impact these manufacturers.

**Machine Model Device Testing WG-5.2** reviewed the initial response to an industry survey assessing usage of machine model testing, user ability of users to replicate product factory and field failures, and tester correlation issues. The group will collect additional survey data during the EOS/ESD Symposium. The group also discussed potential development of an EOS machine model document. There have been field reports of machine model EOS failures, but the group wants to study the issue before determining whether such a document is needed.

**CDM Device Testing WG-5.3.1** continued evaluation of various "hot topics" (dielectric materials, verification modules, ground plane, calibration, and CDM stress testing) as related to future improve-

ments to the existing standard. The group also discussed the metrology chain data being collected, as well as a new approach to calibrating the test head, which removes the variations of air-arc discharges.

**Socket Discharge Model (SDM) Device Testing WG-5.3.2** continued work on the draft of its standard practice document. New data has been collected on SDM test equipment to better understand properties of the equipment. Some of the data indicated that the stress voltage levels across the pins were not constant and additional data needs to be collected.

**Transient Latch-Up Device Testing WG-5.4** reviewed comments to its standard practice document evaluating data and procedures for determining the waveform shape and period. The group plans to collect additional data on the procedures prior to beginning round robin evaluation.

**Transmission Line Pulsing WG-5.5** also reviewed comments on draft J of its standard practice document, addressing several areas for improvement. The group also had a number of presentations and discussions on multiprobe verification and calibration systems, fast HBM testing with TLP implications, and TLP verification and calibration procedures. The group is considering the development of two separate documents. The first would cover test structures or simple circuits. The second would focus on multiple pin-count sub-circuits and product chip applications where failure criteria, methodology, and pin configuration test procedures are established analogous to an HBM method.

**Handlers WG-10** reviewed final changes to its technical report on automated handlers and anticipates publication prior to the Symposium. The group also discussed future work such as measuring discharge from small objects and voltage on small isolated conductors.

**Packaging WG-11** resolved comments on the draft 541 document and the document should be released as a draft later in the year.

**Two Point Resistance (Packaging) WG-11.13** reviewed initial data from its round robin testing of the proposed procedure for measuring surface resistance. The data showed repeatable and reproducible data and the group will be finalizing its document for further review. The group also modified the document's scope to cover materials with resistance ranges of  $10^4$  to  $10^{12}$  ohms rather than the previously proposed  $10^3$  to  $10^{12}$  ohms.

**Handtools WG-13** has begun initial work on a document covering vacuum pencils and tweezers, preparing an initial purpose and discussing various test procedures. The group concluded that some existing documents in this area were limited to special applications and would not meet the general needs of the industry.

**Simulators WG-14** reviewed initial data on measurements of radiated ESD fields from the simulator discharge event.

**Gloves WG-15** reviewed its draft WIP document and partially completed several revisions to the document. After reviewing the initial round robin test data the group decided to use the NFPA-type electrode for measuring the resistance of the glove's palm and to use a constant area/force electrode for measuring the glove's fingers.

**Workstations WG-53** worked on its initial draft of a compliance verification document.

**Cleanrooms WG-55** concentrated on editing the packaging section of the addenda to its cleanroom technical report. The group anticipates having the addenda ready for final review by the October meeting series.

A revision and update of the standards **Glossary** is under way.

### October meeting series

The next meeting of the Standards Committee and working groups will be October 3-5 in conjunction with the EOS/ESD Symposium in Charlotte, NC. The final schedule has not yet been set.

## From the president

## ESDA board explores the future

A pleasant benefit of serving on the Association's board is the opportunity to see emerging new programs that will impact our membership and the industry overall. In this respect, we had a



Steve Halperin

very creative and productive summer meeting series in Las Vegas. Here are a few highlights that will affect our entire organization and our industry in the very near future.

**Five-year plan reviewed, approved**

In the last issue of *Threshold* (*The ESDA: Bridging the Gaps*), we introduced a comprehensive five-year plan that has been in development since fourth quarter of 2001. In Las Vegas, the BoD approved it as the ESDA's organizational guideline. Some highlights of the plan are discussed below and additional plan details will be provided in future issues of *Threshold*.

**New professional certification programs are proposed****ESDA senior engineer and technician certifications**

The Association Committee on Education (ACE) and Standards/Facility Certification have proposed new programs focusing on the professional development and ESDA certification that ultimately may form the basis for a new "ESDA Institute" dedicated to the education and development of professional ESD engineers, technicians, and managers.

The ACE proposal developed by Charvaka Duvvury and presented by ACE chair Tom Diep proposes establishing two new certifications, ESD test technician and senior ESD engineer, oriented to device and system design engineers and the test technicians. Introduction

and availability of this program is targeted for late 2003.

The proposed new certifications *are not* replacements for our current NARTE certification programs. The ESDA certifications focus on engineering design technology, while the NARTE programs are more general for supporting typical electronic manufacturing operations. Both programs may stand alone. In effect, the NARTE programs may serve as prerequisites for the ESDA Senior certifications.

**ESDA and S20.20 related personnel certifications**

Standards/certification chair Ron Gibson introduced the ESD Program Manager and ESD Internal Auditor certification programs emphasizing S20.20 facility ESD program design, management, and assessment. These programs have been in development for several months and are scheduled for availability sometime in 2003.

Also discussed was the possibility of integrating a proposal by Steve Voldman for an ESD fellowship program with these advanced ESDA certification programs. The BoD enthusiastically supports the new ESDA certification proposals and established a task force to prepare an integrated "ESDA Institute" plan for presentation at the December Board meeting.

**New S20.20 program design and assessment seminar is completed**

Facility certification leaders Ron Gibson and John Kinnear developed and successfully tested a new 2-day S20.20 seminar. The seminar was designed in response to industry requests for an in-depth educational package that addresses ESD program design and assessment conforming to the ANSI/ESD S20.20. Day one helps the attendee define ESD program needs based on product value, criticality and manufacturing process and the other day focuses on assessing the ESD program in accordance with S20.20. The first seminar was presented in Shenzhen, China

to 15 diverse ESD practitioners. Initial attendee response was exceptional.

This new seminar is scheduled for Austin, Texas, August 20 and 21, and during Symposium Week in Charlotte. Tentatively, this unique seminar also may be offered at ESDA headquarters later this year or early in 2003. For reservations, contact ESDA headquarters.

**HR workgroup formed**

The ESDA's plans for future growth in programs, education, and services will require more active volunteer participation throughout the organization. To this end, a human resources workgroup has been formed to develop methods and procedures for recruiting and supporting volunteers to fill several positions in the ESDA. Board director Mike Chaine will chair this new initiative. Looking for a challenging and personally satisfying opportunity? Give Mike a call.

**Financial challenges**

Last year we experienced the first financial loss in our history. The economy is a major contributor, but facing September 11 during the Portland Symposium increased our losses. To deal with this complex problem, the BoD streamlined the 2002 budget, eliminating and modifying a variety of expenditures without sacrificing service to our members or program quality. Our entire accounting process was reviewed and budget tracking modified to enhance timely information flow to our business unit managers. As a result, we have a clearer picture of our financial situation and can confirm organizational spending is under control and well within plan. However, like many organizations revenue is less than expected and we are addressing this with increased communication to membership and new programs designed to enhance industry's attendance at our Charlotte Symposium this October. We look forward to seeing everyone there.

## ESDA introduces corporate sponsor program

The ESD Association is introducing a new corporate sponsor program that provides opportunities that benefit the companies, the individual ESDA members, and the Association itself.

In introducing the program, the ESDA recognizes that one of the challenges for many professional membership organizations is how to effectively allow for increased company participation and recognize their support, yet retain the essential individual nature and structure of the organization. Many organizations have turned to some type of corporate sponsorship program to accomplish these goals. The new ESD Association corporate sponsorship program is differentiated from many other sponsorship programs in that it returns significant value to its corporate sponsors in exchange for the company's support.

### Increased participation, reduced costs

"The corporate sponsorship program recognizes the support of our various companies, as well as providing them with a means of increased participation at reduced costs," explains, Kay Adams, chair



Kay Adams

of the Association's Member Services committee that developed the program in conjunction with other Association business units. "It is designed for OEMs and contract manufacturers as well as suppliers of ESD products and services who have an ongoing inter-

est in the benefits of technology, standards, services, and education that the Association has to offer."

### Customized packages

In actuality, the corporate sponsorship program is two separate packages customized specifically for OEMs and contract manufacturers and for suppliers of static control products and services. The program provides a number of services and benefits such as multiple individual memberships in the ESD Association at a total cost that is substantially less than if the individual components were purchased separately. For example, the user package for OEMs/contract manufacturers includes a standards site license while the supplier package includes advertising and promotion components. An overview of each is provided below; the specific provisions of each package are available from Association headquarters.

### User package

The program for OEMs and contract manufacturers includes multiple individual memberships, a standards site license, a paper \$20.20 review of the company's ESD control program documentation, admissions to the Symposium and tutorials, Symposium proceedings, and attendance at ESDA-sponsored educational programs. The annual fee for the user program is \$8,000, a savings of approximately 45% if the services and benefits were purchased separately.

### Vendor package

The program for suppliers of ESD control products and services includes multiple individual memberships, an annual standards subscription, a single Sympo-

sium booth, a web site buyers guide listing, institutional listings in *Threshold*, attendance at ESDA-sponsored educational programs, and other benefits. The annual fee for the vendor program is \$4,000, a savings of approximately 27% if the services and benefits were purchased separately.

### Early sign-up pricing

Companies who choose to participate in the corporate sponsorship program will receive special pricing (\$7,500 for the user package and \$3,500 for the vendor package) if the package is purchased and paid for in full before July 31, 2002. Contact ESD Association headquarters for more information.

"Our goals in introducing this new program are to strengthen the organization, deliver expanded services to industry, recognize the support of the many companies over the years, and provide a means for expanded participation of these companies at a cost savings," says Steve Halperin, Association president. "Kay and her member services committee have provided us with a good foundation upon which we can build for the future."

For additional information on the new corporate sponsor program, contact ESD Association headquarters.



On the factory floor

# Electrostatic management in cleanrooms-Part 1

(Part 2 will appear in the September/October issue)

by  
Ted Dangelmayer  
Director of Technology and Program  
Design  
Ion Systems, Inc.  
and  
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Chief Technology Officer  
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## Introduction

It is hard to imagine processing in the cleanroom that does not involve contact and separation of materials, and the resulting generation of static charge. Thus, static charge control has become a necessity in cleanroom environments to enhance the production of semiconductors, disk drives, flat panel displays, medical and optical devices, and a variety of other products. Three basic problems result from failing to control static charge in cleanroom environments:

- Product contamination due to electrostatic attraction and bonding of particulate to critical product surfaces
- Damage done directly to products by electrostatic discharge (ESD)
- Malfunction of production equipment caused by ESD-generated electromagnetic interference (EMI)

Managing a static charge control pro-



*Ted Dangelmayer*



*Arnold Steinman*

gram is difficult in a cleanroom environment that encourages static charge generation, and where many static control methods designed for use outside cleanrooms are not compatible with the cleanroom contamination control requirements.

The interaction of static charge in all aspects of cleanroom manufacturing is just beginning to be recognized. Only a small number of engineers and technicians possess expertise in both areas, as electrostatics and ESD are not commonly taught at universities. There are few sources of impartial technical training [1], and rapid changes in technology of products manufactured in cleanrooms worldwide make the development of appropriate static control knowledge even more challenging. Finally, securing management commitment to an ongoing static control program in cleanrooms is difficult when cleanroom operations have many other serious problems that need to be solved.

## Electrostatic program management (EPM)

The process of successful EPM begins with diagnosis and analysis of the causes and magnitude of the static charge problems. Defective product or specialized test devices may be examined for evidence of ESD damage or contamination, static charge levels in the cleanroom environment may be measured, and measuring equipment may detect the signature of ESD-related EMI. Trial methods of eliminating static charge need to be tested to determine their effects on the static charge problems. At the end of this stage, management will be able to estimate the possible cost savings from implementing EPM, providing a justification for continuing the process.

Once the static problems have been identified and the associated costs quantified, the process of eliminating the problem can begin. There are many effective ways of controlling static charge for the manufacturing facility, the personnel, and

the production equipment. For each static control problem and location, one or a combination of these methods will need to be selected. In most cases, some in-house personnel will need to be trained in the verification and maintenance of the static control methods. All through this process, the costs of implementing the static control solutions will need to be tracked to assure that they are in line with the benefits anticipated. Management is watching.

Effective static control is rarely a one element, single application event. Generally EPM has many elements and they must be coordinated and managed over long periods of time with a total system approach. An example of such a system approach is shown below.

### Twelve critical factors of ESD program management excellence

- An effective implementation plan
- Management Commitment
- A long-term process owner
- An active leadership team
- Realistic requirements
- Training for measurable goals
- Auditing using scientific measures
- ESD test facilities
- A communications program
- Systemic planning
- Human factors engineering
- Continuous improvement

*From ESD Program Management by T. Dangelmayer [2]*

In a cleanroom environment where products and processes are constantly changing, this systematic approach is highly effective and produces sustained results. EPM should be viewed as part of an ongoing process of managing the factory to produce high quality product. ISO9000/14000 standards have defined

*Continued on next page*

## On the factory floor

Continued from previous page

**Electrostatic management in cleanrooms-Part 1**

the elements of a successful quality control program. Many of the same elements are found in a successful static control program. A well-designed static control program should integrate very easily with ISO programs. The ESD Association static control program standard, ANSI ESD S20.20-1999 "Development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment" is an example of such a program. This standard defines the basic elements of a static control program and is compatible with the requirements of ISO 9000/14000 quality programs. The ESD Association has also trained ISO auditors to provide third party certification to the S20.20 program [3].

A static control program begins with the technical elements, problem definition, and the static control methods. Then the administrative portion of the program should be addressed. This includes the definition of the purpose of the program, job responsibilities for maintaining the program, and the important management factors noted above. For example, an audit program to monitor performance and a database to record the results are critical elements of any effective program. Metrics from the auditing program can produce essential information to manage the program and leverage limited resources.

Additionally, procedures for determining problems connected to the program need to be identified and corrected. This invariably involves employee training to make everyone in the factory aware of the new methodologies used in the static control program. Finally, some certification method will need to be put in place to assure that the program, as defined, conforms to the requirements of the in-house quality system.

**Getting management buy-in**

Justification for EPM begins with a static audit to locate and determine the magnitude of static charges throughout the

cleanroom. This data indicates probable locations of static problems, opportunities for the use of alternate materials, and a baseline against which the subsequent success of the static control program can be measured. Defective product can be disassembled and analyzed to determine if failures are the result of static charge, and there are a number of instruments available for analyzing surface contamination. High frequency storage oscilloscopes coupled to directional antennas, or a variety of handheld EMI locators may be used to detect the signature of ESD-related EMI.

An alternative method for verifying the existence of static hazards in the cleanroom is to take known good product, or something that simulates the product, pass it through all or a part of the cleanroom process. An example is the CanaryESD™ device from DuPont Photomasks, used to look for ESD hazards for the photomasks used in semiconductor production [4]. This device is designed to imitate the size and features of a production photomask. It has both a lower threshold for ESD events and experiences more catastrophic damage when an ESD event occurs. CanaryESD™ catches ESD damage during abbreviated testing (days) that might occur in actual production photomasks over longer times (weeks, months). Figure 1 shows typical damage to a photomask and the layout of the CanaryESD™ device [4,5].

Once static problems have been identified, trial methods of eliminating static charge will need to be tested to determine their effects on the problems. For example, using the results of the original static au-



Figure 1. Typical photomask damage and layout of the CANARYESD™ test device

dit as a baseline, static charge levels may be measured after static control methods have been installed. While this verifies that the static control methods are lowering static charge levels, additional testing may be needed to verify the impact on the actual static problem. While this may only be done for a small part of the cleanroom operations, it should be possible to provide a reasonable estimate to management of the cost savings from implementing EPM in the entire area.

Many ESD control practitioners consider that obtaining management buy-in to start the static control program is their most difficult task. In reality, while this is a difficult initial task, the true challenge is in creating a static control program that continues to demonstrate its value to management. In most cleanroom areas, the product trends are to increased device sensitivity. A successful static control program must be able to anticipate changes in static control requirements before they result in product losses. This can only occur when all elements of the static control program are working together. These elements will be discussed in Part 2 of this article appearing in the next issue.

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## Institutional Listings

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More institutional listings, next page

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<p><b>Kenflex Corporation</b> 460 NE Hemlock, Suite A, Redmond, OR 97756 Tel: 541-923-4765 Fax: 541-923-4190 <a href="mailto:kenflex@coinet.com">kenflex@coinet.com</a> Manufactures FLEXCELL®, FLEXSTAND®, FLEXTOTE® circuit board transport and protection units, also on Web. For additional information: <a href="http://www.kenflex.com">www.kenflex.com</a></p>	<p><b>ACL Staticide</b> 1960 E. Devon Avenue, Elk Grove Village, IL 60007 Tel: 847-981-9212 Fax: 847-981-9278 <a href="http://www.aclstaticide.com">www.aclstaticide.com</a> Cleanroom products, topical antistats, floor finishes and coatings, static detection meters, monitors, computer cleaning products</p>
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