

## News bits

### Discount deadline extended for corporate sponsor programs

The July 31 deadline for taking advantage of the early signing discount for the ESDA's recently announced corporate sponsor program has been extended indefinitely. In addition to substantial savings on many ESDA products and services, both vendors and users can realize additional savings by signing up now. For more details, see the July/August 2002 issue of *Threshold*.

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## EOS/ESD Symposium



Photo courtesy of the Charlotte Convention and Visitors Bureau

## Still time to compete in the ESD race to excellence

When the speed and excitement of the Busch Grand National 300 NASCAR race subside at Lowe's Motor Speedway in Charlotte, NC on October 12, you can be assured that there will be a victor in the winner's circle.

But, where will you be this fall when the checkered flag drops? If you're committed to keeping pace in the ESD world of new applications, new fields, and new problems, you'll be at the 24<sup>th</sup> annual EOS/ESD Symposium October 6-10 at the Charlotte Convention Center in Charlotte, NC.

Once again, this premier international event will package research, technology, education, and peer networking into five full days of activity.

### It's 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

*Continued on page 2*

Download the Symposium program at [www.esda.org](http://www.esda.org)

**EOS/ESD Symposium**

*Continued from page 1*

**Still time to compete in the ESD Race to Excellence**

protection to the newest developments in the emerging fields of RF ESD design and transmission line pulsing, the Symposium offers something for everyone.

**It's 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 nearly 100 exhibits are concentrated in a single location in a single time frame.

**It's 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.*

**It's 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 includes additional savings for attendees who participate in the entire five-day program.

**It's time to get certified**

In addition, individuals interested in the ESDC certification program will be able to take the certification exams on Friday, October 11. Special tutorials dur-

ing the week will help applicants prepare for the examinations.

**S20.20 seminar**

New this year is a separate, two-day seminar on S20.20 for independent assessors, program managers, and consultants. See the story on page 4 of this issue for more details.

For the detailed program, visit 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.

**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

## 2003 EOS/ESD Symposium issues call for papers

This year's EOS/ESD Symposium is still a few weeks away from opening, but it's already time to think about next year. It's time to think about presenting a paper. It's time to finish up the research, formulate your conclusions, and share your work with the rest of the international ESD community.

The ESD Association is formally requesting abstracts for technical papers covering the effects of electrostatic discharge (ESD), electrical overstress (EOS), and static electricity for presentation at its 25th Annual EOS/ESD Symposium September 21-25, 2003 in Las Vegas, NV. Be there to help celebrate a quarter century of ESD and static control!

Papers for the EOS/ESD Symposium should deal with work in the following areas: *Component, System or Factory Level EOS/ESD; EOS/ESD Materials Technology; Magnetic Recording Heads; ESD Standards; Electrostatic Considerations in Manufacturing, MEMS, Advanced Technologies; Novel ESD Designs or Circuits, ESD Failure Mechanisms*, or related areas.

Paper submittals should include data and analysis that advance state-of-the-art knowledge, enhance or review general knowledge, or address new topics. The technical program committee especially encourages new areas and fields relevant to EOS and ESD at the Symposium.

The deadline for submission of abstracts and paper summaries is Monday, January 13, 2003. Submissions must include a 50-word abstract and a 4-page (maximum) summary of the work. The final submission deadline for the finished paper is Monday, June 2, 2003.

Persons interested in submitting a paper may obtain copies of the Symposium call for papers from ESD Association headquarters beginning in October. The call for papers also may be downloaded from the Association's Web Site at [www.esda.org](http://www.esda.org) beginning in October.

### October Meeting Schedule

#### ESD Association Standards and Association Committee Meetings October 3-10 Omni Charlotte Hotel, Charlotte, NC

#### Thursday, October 3

- |                   |                                           |
|-------------------|-------------------------------------------|
| 1:00 PM - 5:00 PM | Standards Working Group 3, Ionization     |
| 8:00 AM - 5:00 PM | Standards Working Group 5, Device Testing |

#### Friday, October 4

- |                   |                                           |
|-------------------|-------------------------------------------|
| 8:00 AM - 5:00 PM | Standards Working Group 5, Device Testing |
| 8:00 AM - Noon    | Standards Working Group 4, Worksurfaces   |
| 8:00 AM - Noon    | Standards Working Group 10, Handlers      |
| 1:00 PM - 5:00 PM | Standards Working Group 9, Footwear       |
| 1:00 PM - 5:00 PM | Standards Working Group 53, Workstations  |
| 1:00 PM - 5:00 PM | Standards Working Group 55, Cleanrooms    |

#### Saturday, October 5

- |                     |                                           |
|---------------------|-------------------------------------------|
| 8:00 AM - Noon      | Standards Working Group 5, Device Testing |
| 8:00 AM - Noon      | Standards Working Group 7, Flooring       |
| 8:00 AM - Noon      | Standards Working Group 11, Packaging     |
| 11.30 AM - 12:30 PM | Symposium Steering Committee              |

#### Sunday, October 6

- |                   |                                            |
|-------------------|--------------------------------------------|
| 8:00 AM - 5:00 PM | Standards Working Group 14, ESD Simulators |
| 8:00 AM - Noon    | Standards Working Group 15, Gloves         |
| 9:00 AM - Noon    | Local Chapters Committee                   |
| 1:00 PM - 5:00 PM | Standards Committee                        |
| 5:00 PM - 6:00 PM | Technical Liaison Committee                |
| 5:30 PM - 6:30 PM | Board of Directors                         |

#### Monday, October 7

- |                   |                                   |
|-------------------|-----------------------------------|
| 1:00 PM - 5:00 PM | 2003 Symposium Steering Committee |
|-------------------|-----------------------------------|

#### Tuesday, October 8

- |                |     |
|----------------|-----|
| Noon - 2:00 PM | ACE |
|----------------|-----|

#### Thursday, October 10

- |         |                            |
|---------|----------------------------|
| 4:30 PM | Board of Directors Wrap-Up |
|---------|----------------------------|

## ESDA standards enterprise-wide license offers savings, up-to-date documents

Need a cost-effective way to obtain quantities of ESDA standards documents to satisfy your company's multiple users and multiple facilities?

The Association's Standards Enterprise-Wide License may be a cost effective way for your company to obtain the documents you need and distribute them to employees throughout your company, even in other countries.

Developed specifically for companies who have multiple users in multiple facilities, the Standards Enterprise-Wide License provides you with copies of all ESDA standards documents in PDF format on a CD. Included on the CD are all current standards, standard test methods, standard practices, the *Glossary of Terms*, and the *ESD Handbook*. You also will receive all updated and new documents issued during the year.

You can place the documents on your company's intranet or print them out for internal distribution to all company departments, divisions, or wholly owned subsidiaries located anywhere in the world. The documents, however, cannot be distributed to vendors or customers.

The cost for the Enterprise-Wide License is \$5,000 (US) and allows one year of use. Purchasers will be notified three months in advance that their license is about to expire. At the time of renewal, the purchaser will receive a new disk if there are new documents that have been released since they received their last update.

"The license has a number of advantages over the single-user standards subscription program," says Ron Gibson ESDA standards chair. "It allows unlimited employee access to the information. The ESD program manager, for example, can recommend the documents to designers, process engineers, and management without the need to purchase additional documents. The program also ensures that the most current release of the standard is always on the company's system, which helps with ISO 9000 requirements for document control."

There are price advantages as well. "The site license program is an economical alternative to the ESD Association subscription program for companies that have

between 20 and 25 users," continues Gibson. The exact savings to a company would vary, depending on the number of standards users.

For information on purchasing the Standards Enterprise-Wide License, contact Association headquarters. Phone: 315-339-6937 or e-mail [info@esda.org](mailto:info@esda.org).

## Space available in S20.20 seminar

It's filling up fast, but there's still space available in the special ANSI/ESD S20.20 Seminar for Independent Assessors, Program Managers, and Consultants presented in conjunction with the October EOS/ESD Symposium.

This two-day seminar on October 6 and 7 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 also will 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. Use the Symposium registration form to register. Additional information is available from ESDA headquarters.

### Calendar of events

#### 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)

## 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

<i>EOS/ESD Symposium Proceedings Set</i>	Sale Price: \$250 (Reg. \$500)
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Includes Proceedings from 1980,1982,1983,1986,1989-2001

A Shipping/Handling fee of \$15 will be added to each order. An additional UPS shipping charge will apply for the Proceeding Sets and is assessed based on actual UPS charges.



7900 Turin Road, Building 3, Rome, NY 13440

Phone: 315-339-6937 • Fax: 315-339-6793

## Follow-up on machine model ESD survey

First, I would like to thank those of you who responded to my first request for completing the MM survey. It has been said that repetition is the "mother" of all accomplishments. It is my



Leo G. Henry

hope that repeating the call to complete the MM survey will increase the responses over the approximately 28% received so far.

This request was sent to the 85 members of standards working groups (WGs). To date I have received about 20-25 responses. At the STDCOM meeting in June in Las Vegas, I reported on this MM survey activity and requested additional feedback. The subsequent "corridor discussions" suggested that a reminder request to participate in the survey would be "the thing to do" to increase the responses.

You will recall from the May/June 2002 issue, that I reported more and more companies are using the MM ESD test to look for damage in products like MEMS and RF devices because they are more sensitive than the other traditional ICs.

I have already sent out my repeat request to respond to the MM survey and you should have received it long before this issue of the newsletter hits the website. If you have not had the time to respond by the time you read this, please consider this as another reminder, re-check your email for the survey form, and respond to [leogesd@pacbell.net](mailto:leogesd@pacbell.net).

Last but not least, I would like to thank all of you in advance for your cooperation. I am looking forward to ALL 85 of you participating in the MM ESD survey (there are only 12 questions).

Be Happy--

*Leo G*

From the president

## ESDA visions and plans for the future

In a previous issue of *Threshold*, we discussed ESDA's position in our industry and ANSI/ESD S20.20's important role in our future. This important document is the cornerstone for development and expansion for many current and future ESDA programs and services.



Steve Halperin

### Bridging the gap

A key point of the article, *The ESDA: Bridging the Gap*, was identification of a gap between device design, manufacturing, and systems that encumbered industry's ESD performance, productivity and growth. To bridge that gap it is our plan to

- Expand our professional certification programs to address the needs of the design community, as well as production line personnel
- Enhance our education programs in support of certification and S20.20
- Increase the availability of our educational programs domestically and internationally
- Enjoin the technical design aspects of ESD with manufacturing and system operations

### Where do we go from here?

To accomplish our goals, we have created and are implementing a detailed five-year plan that we believe is helpful to industry, supportive of S20.20 intentions, and within the capabilities of ESDA volunteers and the organization's by-laws. Our plan specifically addresses both engineering technology and manufacturing and operations technology. It proposes

new ESDA personnel training and certification programs that focus on

- Electronic device and system design technology, and
- Electronic device and system manufacturing, use, and maintenance

The plan also provides the necessary delivery systems, such as the expansion of Symposium week and the development of training teams for ongoing domestic and international delivery of educational and certification programs.

### Priority goals

The board and its executive committee are focused and determined to achieve the ultimate ESDA objective of becoming the international resource for electronics industry ESD technology, facility certification, and personnel education and certi-

fication. To meet this objective, we have established 10 priority goals for completion in late 2007.

1. Increase domestic and international Symposium Week recognition with total attendance of more than 1,500 paid attendees for Symposium, seminars, workshops, national tutorials, and certification
2. Enhance international acceptance of ESD S20.20 as the primary program standard for ESD control, having more than 1,000 certified facilities
3. Educate and certify 275 ESDA S20.20 program managers
4. Educate and certify 330 ESDA S20.20 program auditors

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### Priority ESD Association Goals

Achieve by 2007

- Increase domestic and international Symposium Week recognition with total attendance of more than 1,500 paid attendees for Symposium, seminars, workshops, national tutorials, and certification
- Enhance international acceptance of ESD S20.20 as the primary program standard for ESD control, having more than 1,000 certified facilities
- Educate and certify 275 S20.20 ESDA program managers
- Educate and certify 330 S20.20 ESDA program auditors
- Educate and certify a minimum of 50,000 S20.20 ESDA plant operators
- Educate and certify a minimum of 75 ESDA senior ESD device and systems design engineers
- Educate and certify 350 new ESD device/system engineers
- Educate and certify 500 new ESD device/system technicians
- Increase ESDA membership to 3,500
- Acquire and support 100 ESDA corporate sponsors

## From the president

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### ESDA visions and plans for the future

5. Educate and certify a minimum of 50,000 S20.20 ESDA plant operators
6. Educate and certify a minimum of 75 ESDA senior ESD device and systems design engineers
7. Educate and certify 350 new ESD device/system engineers
8. Educate and certify 500 new ESD device/system technicians
9. Increase ESDA membership to 3,500
10. Acquire and support 100 ESDA corporate sponsors

#### Strategies to achieve the goals

Lofty goals are easier said than done. Achieving them requires planning and extensive organizational development, not to mention work and commitment from staff, business units, all our committees, and our membership. Our strategic plan includes a number of detailed strategies to help us reach our objectives. Many of the programs and strategies are already in development and some will be introduced in Charlotte this coming October. Our key strategies are highlighted below.

1. Develop a professional seminar series to run parallel to and in conjunction with the national tutorial series. Potential seminar topics include basic issues, unique new areas, S20.20 program design and assessment, S20.20 program manager education module, S20.20 program auditor education module, ESDA senior ESD design engineer topics, systems engineers and technicians topics, and exhibitor related sessions, such as us-

*It's an exciting time to be a member of the ESDA Association!*

- ing ESDA standards or developing product specification sheets.
2. We have already initiated a strategy to expand the training and certification of ISO level registrars, auditor training, and promotion of S20.20 certification of manufacturing and operations facilities. The plan includes enhanced registrar auditor certification and training to maintain quality and international availability of audit services. To date, three international registrars have been certified and over 70 auditors and lead assessors have been trained in North America, Europe, and the Far East.
3. Develop ESDA S20.20 program manager certification program with related materials and examination for highly qualified ESD managers in areas of manufacturing, process, maintenance, operations, or repair programs.
4. Develop ESDA S20.20 program internal auditor certification program with related materials and examination. This program will establish the minimum requirements for S20.20 internal program audit, maintenance, and process problem analysis, as well as become a prerequisite for S20.20 program manager certification.
5. Develop and produce an ESDA S20.20 plant operators training program supported by computer-aided training for periodic re-certification.
6. Develop ESDA senior ESD device and systems design engineering certification program(s), including materials, references, tutorials, seminars, and guidelines to support development of exceptional design engineers.

7. Modify or otherwise enhance current NARTE ESDC engineer and technician certification program requirements to expand and emphasize device and system design engineering and testing. Develop seminars, tutorials, study materials, references, and guidelines to support the program.
8. Establish a human resources committee to identify and develop future activity managers, board of directors and officer candidates. The committee would be responsible for overall HR plans development and maintenance and has already been created.
9. Establish an expanded membership committee responsible for the development and implementation of a plan to recruit new individual ESDA members and corporate sponsors.
10. Establish New Technologies Road Map task force to identify, prioritize, and timeline emerging technologies of ESDA interest. Utilize the work of this task force to program the Symposium.

#### Support for industry

Our five-year plan outlined above forms the basis of a comprehensive program for industry support that includes existing ESDA programs as well as other elements contained in the plan. These elements are presented below.

1. We provide manufacturers and users of electronics with an effective ESD control standard (ANSI/ESD S20.20) that defines the minimum requirements for enhancing product reliability, productivity and ensuring their profitability.

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## From the president

*Continued from previous page*

### ESDA visions and plans for the future

2. We support the standard by providing a means to confirm control through 3<sup>rd</sup> party certification and comprehensive guidelines for program design:
  - We train and certify ISO registrars
  - We provide a current S20.20 Advisory Handbook, related support materials, and approved standards for manufacturers' guidance
3. We will support industry's efforts to design products with current and appropriate ESD protection technology through ESD qualified engineers and technicians:
  - ESDA senior device (system) design engineer certification
  - ESDA engineering technology certification
  - ESDA device or system technician certification
4. We will support industry's efforts to manufacture products with appropriate process and handling controls through ESD qualified supervisory and operations personnel:
  - ESDA S20.20 certified program managers
  - ESDA S20.20 certified technicians and internal auditors
  - ESDA S20.20 operators training programs
5. We will develop and update appropriate industry standards that serve the ESD testing, characterization, protection, manufacturing, and handling constituencies.
6. We will keep industry current in areas of ESD technology evolution and changes in procedures, standards, and guidelines through an expanded Symposium week:
  - Enhanced Symposium technical paper tracks for the exchange of many new ESD related technologies
  - Increased workshops with focus on disseminating the "how to's" of meeting various technical and manufacturing objectives
  - Multiple professional seminars to support engineering and manufacturing personnel, facility program development, and related certification programs
  - Enhanced national tutorial modules for emphasis on basic to intermediate manufacturing process control, device, system and other technologies
  - Increased personnel certification preparation through specialized focus programs
7. We will keep industry current in areas of personnel training and certification in ESD through expanded regional and international activities:
  - We will provide specialized S20.20 personnel certification programs for service providers, program managers, and auditors
  - We will provide specialized seminars for device and system engineers and technicians
8. We will support our sponsoring corporations through priority programs. We will support ESD product and service suppliers and provide them with:
  - Timely and supportive personnel training
  - Access to all Symposium activities
  - Current standard documents through ESDA subscriptions
  - Technical information on testing and marketing high performance ESD control products/materials in accordance with current standards
9. We will work with electronic industry manufacturers to provide them with:
  - Timely and supportive personnel training
  - Access to all Symposium activities
  - Current Standards utilizing facility site license programs
  - Technical information on selecting high performance ESD control products, materials, and services in accordance with current standards
  - Offer access to ESDA operator programs under facility license with timely updates and revisions
  - S20.20 program development review support
- Access to ESDA programs and related updates for distribution and service to their customers

*Achieving our goals requires planning, extensive organizational development, work and commitment.*

Clearly we have a lot of work ahead of us. Our job is to support industry and our membership through technical information exchange, standards development, and education. We believe that our five-year plan supports these Association charter objectives. It's an exciting time to be a member of the ESDA Association!

## Electrostatic management in cleanrooms-Part 2

(Part 1 appeared in the July/August issue)

by  
Ted Dangelmayer  
Director of Technology and Program  
Design  
Ion Systems, Inc.  
and  
Arnold Steinman, MSEE  
Chief Technology Officer  
Ion Systems, Inc.

### Static control program development

There is no doubt that the careful selection of a few static control methods can have an immediate positive effect on manufacturing results. However, if one is looking to maximize and sustain the positive results in the complex, rapidly changing environment of cleanroom manufacturing, more is required. Administrative elements and a total system approach must be added to the static control program [3]. In creating these administrative elements, pay attention to the requirements of existing quality control standards, such as ISO 9000/14000. The static control program must conform to existing quality plan requirements and infrastructure.

*Define the scope* of the program – why there is a need for static control, what ar-



Ted Dangelmayer



Arnold Steinman

reas will be included, and what are the intended results. Testing or other types of analysis should establish the static charge sensitivity of the products being manufactured in the cleanroom, as this is important to defining the extent and complexity of the static control program.

*Program tasks, activities, and procedures* will then need to be clearly defined. Definition of the technical elements and selection of the materials for static control falls into this category. The technical requirements of the static control program will be affected by the nature of the static problems, product sensitivities to these problems, and any limitations for installing static control methods in the cleanroom.

Each static control method will need to be evaluated for its cleanroom compatibility. This includes grounding techniques and material selection for everything in the cleanroom, such as building elements (ceilings, walls, and floors), furniture (tables, chairs, and carts), personnel, tools and equipment, and product packaging and transport materials. Air ionization will be necessary to neutralize charges on the insulators and isolated conductors that are always present in the cleanroom. Finally, both the electrostatic protected area (EPA) and any static sensitive product should be clearly marked to indicate their presence.

Each technical element in the program will have defined limits of acceptance, installation requirements, maintenance requirements, and a periodic verification interval. A decision needs to be made whether to accept vendor material specifications, or to do in-house laboratory or in situ testing.

*Audit Procedures* - A static control program without adequate audit procedures is doomed to fail, usually placing considerable amounts of product at risk before the failure of the static control is noted.

This is particularly true of product produced in cleanrooms, whose defects may not be discovered until long after the product has left the cleanroom. Auditing is also considered the binding force behind sound ESD program management. Develop a list of items requiring verification, define the required measurement including its limits and frequency, and define the measuring instrument and its calibration interval.

*Preventive and corrective action procedures* will also need to be a part of the administrative plan to deal with deficiencies uncovered in the auditing process. These procedures are usually an integral part of any existing ISO 9000/14000 quality plan. Some problems are simply corrected by procedural changes, but in the worst case may require the isolation of product or product recalls. Management may be very concerned about the possibility of selling product to customers that has been damaged by ESD in the period between audits.

*Employee training* is essential to the success of any manufacturing process. All personnel need to understand the goals, procedures, and technical elements of the static control program in the cleanroom. Training occurs at the start of the program, in a tailored response to audit findings, and as regular refresher courses. The administrative section of the static control plan should define who needs to be trained, when the training should occur, the type of training to be offered, and testing to demonstrate that the employee has the required knowledge. Training records will need to be maintained.

*Support documents*, usually industry standards, are the final administrative element. When specifying or developing these documents it is essential that they

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## On the factory floor

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### **Electrostatic management in cleanrooms-Part 2**

be realistic requirements for the cleanroom production area. These documents support all aspects of the static control program, but particularly the technical elements and their audit procedures. Test methods, instrument calibration, and specification limits are typically contained in these documents.

In the general field of static charge control, the ESD Association ([www.esda.org](http://www.esda.org)) has an extensive range of documents addressing the testing of static control methods. Specialized documents on static charge control in the semiconductor industry are available from Semiconductor Equipment and Materials International (SEMI) and JEDEC. Static control standards for the disk drive industry are available from IDEMA. Static control programs used in cleanrooms will likely have support documents that relate to contamination control aspects as well.

#### **Certification programs**

A successful static control program will include certification for two basic reasons. First, management may desire assurance that the program, as defined, conforms to the requirements of the in-house quality system, and continues to supply the benefits of increased productivity and quality. Second, and perhaps more important to management, it satisfies customer requirements that the product has been protected from static charge during its manufacture.

In setting up a static control program, you will define those items that require certification. You will have to decide who will perform the certification – in-house personnel, industry experts, or perhaps a third party licensed to do this type of certification. For example, third party certi-

fication is required for ISO 9000/14000. Administrative documentation will need to record the results of the certification, and include procedures for corrective action if some activity in the cleanroom does not pass certification.

#### **Conclusion**

Static charge control has become essential in cleanrooms. Damaged or defective product and inefficiencies in the production process show up as manufacturing yield losses, but even more serious are the impacts of static charge on long term reliability of the product. Advances in the technology of products produced in cleanrooms will tend to make the static problems worse. The complexity of modern cleanroom operations requires a well thought out electrostatic management program, designed and executed by experts in the field.

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## Association news

### **ESDA expands university education efforts**

Like Rodney Dangerfield, ESD sometimes gets "no respect", a common situation in many graduate or undergraduate electronics engineering programs. In most of these programs, ESD is not even mentioned. Or, if mentioned at all, it's only very briefly. Today's graduating electronics engineers enter the real world with almost no information on ESD and how it affects their work, and not even knowledge of the ESD career opportunities that potentially await them.

As part of its commitment to furthering education in the area of electrostatic discharge, the ESD Association has begun developing a ready-made ESD lecture program that university faculty can use to provide their students with relevant exposure to the ESD phenomenon. Initiated in cooperation with a few university professors, the program is now ready to reach additional relevant universities.

Presented in one or two lecture segments, the program has been created as an easy-to-use PowerPoint® presentation. Emphasizing device and design issues suitable for university courses related to semiconductor technologists, the presentation provides a general overview of ESD phenomenon, device physics, process and technology effects, design methodology, ESD control, and ESD materials.

"We already have had three institutions use the program," says Charvaka Duvvury, who is responsible for initiating the project. "The University of California at Berkeley used it first in a graduate class on a trial basis. Later, faculty at the University of Texas at Austin and the Berkeley Extension for local California community colleges have begun using it for their course offerings in electronics."

An updated and revised program for the coming year is being prepared, and several additional schools have expressed interest in the program. University faculty who are interested in the 2002-03 ESD lecture presentation material with a device and design focus should contact Charvaka Duvvury at [c-duvvury@ti.com](mailto:c-duvvury@ti.com).

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7900 Turin Road, Building 3  
Rome, NY 13440-2069

Tel: (315) 339-6937 Fax: (315) 339-6793  
E-mail: [info@esda.org](mailto:info@esda.org) Web: <http://www.esda.org>

### Newsletter Staff

#### Threshold Chair

Leo G. Henry, Ph.D.  
ESD/TLP Consulting  
P.O. Box 1665, Fremont, CA 94538  
Tel: 510-657-5252 Fax: 510-647-9661  
E-mail: [leogesd@pacbell.net](mailto:leogesd@pacbell.net)

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Mike Chaine  
Micron Technology, Inc.  
M/S502, 8000 S. Federal Way, Boise, ID 83707  
Tel: 208-368-4883  
E-mail: [Mchaine@micron.com](mailto:Mchaine@micron.com)

#### Editor

Michael T. Brandt  
Marketing Resources Ltd.  
12638 W. Virginia Ave., Lakewood, CO 80228  
Tel/Fax: 303-274-1222  
E-mail: [mtb@mrlweb.com](mailto:mtb@mrlweb.com)

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