

Electrostatic Discharge Association

Setting the Global Standards for Static Control!

THRESHOLDTM

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13th International Electrostatic Discharge Workshop

March 31 - April 4, 2019

Experience IEW



IEW 2018 Turnout Belgium

From the President



EOS/ESD Association, Inc., President;
Ginger Hansel, Dangelmayer Associates

As we start 2019, the Standards Business Unit has 30 groups working to clarify manufacturing, design, and process capability issues by creating standards, standard test methods, standard practices, technical reports, and white papers. We currently have 78 published documents and expect to publish 10 new and revised documents in 2019. You can keep your standards library up-to-date with one of our subscription programs. Visit <https://www.esda.org/standards/> for complete information.

Existing documents revised in 2018 include the Technical Reports ESD TR53-01-2018, ESD TR22.0-02-18, TR5.5-04-2018, and Standard Test Methods 11.13, 11.31, 2.1 and 4.1. In addition to the on-going review of existing Standards documents, new work is being done in these areas:

-ESD TR21.0-01-18 (ESD Association Technical Report for Challenges in Controlling ESD in the Manufacturing of Flat Panel Display),

-ESD SP27.1-2018 (ESD Association Standard Practice for

the Recommended Information Flow Regarding Potential EOS Issues between Automotive OEM, Tier 1, and Semiconductor Manufacturers),

-ESD TR5.3.1-01-2018 (Contact Charged Device Model (CCDM) vs. Field Induced CDM (FICDM) a Case Study)

In addition to our two Face-to-Face Standards meeting series, we recently introduced two Virtual Meeting Series so more people can be involved. The documents are viewed by the entire team simultaneously and edits can be made in real time. Our winter meeting series just ended in January and 183 different individuals from many countries participated in at least one working group. Since frequent travel can be an issue, the virtual meeting series enables new people to get involved as guests, team members, or industry reviewers. Pretty exciting!

In 2018, lunch was offered to all attendees on three of the Face-to-Face meeting days which allowed discussions to continue and enabled people from different working groups to meet and share interests. Access to work in process documents is now available to working group guests so they can follow the discussion and make informed contributions. Guests have been recognized as potential new volunteers so each guest will be invited to join the working group after attending two consecutive meetings or two virtual meetings in a row.

Surprisingly, people find that working diligently and debating respectfully while creating or reviewing documents can be

kind of fun. Your brain gets a workout and you get to know other experts. Each face-to-face meeting series stocks the "standards workroom" with coffee, juice, and snacks to serve as a gathering point where you can catch up with colleagues. And the conversations continue with other volunteers during meals and after meetings. Guests and industry commenters are always welcome at our meetings. Our next meeting series is scheduled for April 11-14 at the Riverside Convention Center in Riverside, CA. Please join us there!

Ginger Hansel
President

Ginger

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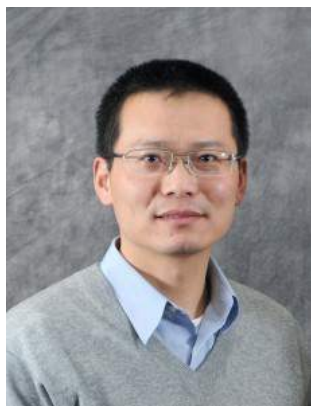
13th International Electrostatic Discharge Workshop

Keynote

Radio-Frequency Interference in Wireless Devices

Professor Jun Fan

A variety of wireless devices ranging from cell phones to smart hardware and IoT devices have emerged and will continue to develop rapidly, together with the emerging new technologies such as IoT and 5G wireless. While wireless communication enables convenient connections of the devices, it also makes them inherently vulnerable to electromagnetic interference. Any radio frequency (RF) antenna used as a radio receiver can easily pick up the unintended electromagnetic noise from digital circuits, resulting in RF interference. Unlike conventional EMI issues, RF interference usually deals with noise at a much lower level and does not have standards or regulations to follow. In this talk, fundamentals of RF interference issues in wireless devices will be introduced. Challenges and progress in noise source characterization, understanding of coupling mechanisms, and mitigation solutions will be discussed and illustrated using real-world examples. RF interference and ESD are two dominant design issues in wireless devices. It will be shown that ESD protection circuits could be a source for RF interference. Modulation and intermodulation generated in these circuits could result in the noise components falling into the receiver band and thus degrade the performance of the receiver. Effort in modeling and characterizing this problem will be proposed.



Jun Fan (S'97-M'00-SM'06-F'16) received his B.S. and M.S. degrees in Electrical Engineering from Tsinghua University, Beijing, China, in 1994 and 1997, respectively. He received his Ph.D. degree in Electrical Engineering from the University of Missouri-Rolla in 2000. From 2000 to 2007, he worked for NCR Corporation, San Diego, CA, as a Consultant Engineer. In July 2007, he joined the Missouri University of Science and Technology (formerly University of Missouri-Rolla), and is currently the Cynthia Tang Missouri Distinguished Professor in Computer Engineering and Director of the Missouri S&T EMC Laboratory. Dr. Fan also serves as the Director of the National Science Foundation (NSF) Industry/University Cooperative Research Center (IUCRC) for Electromagnetic Compatibility and Senior Investigator of Missouri S&T Material Research Center. His research interests include signal integrity and EMI designs in high-speed digital systems, dc power-bus modeling, intra-system EMI and RF interference, PCB noise reduction, differential signaling, and cable/connector designs. In the IEEE EMC Society, Dr. Fan served as the Chair of the TC-9 Computational Electromagnetics Committee from 2006 to 2008, the Chair of the Technical Advisory Committee from 2014 to 2016, and a Distinguished Lecturer in 2007 and 2008. He currently is an associate editor for the IEEE Transactions on Electromagnetic Compatibility and IEEE EMC Magazine. Dr. Fan received an IEEE EMC Society Technical Achievement Award in August 2009. He is an IEEE fellow.

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13th International Electrostatic Discharge Workshop

Tutorial Sunday 2:00 - 3:30 PM

What Does the ESD Control Program Coordinator or Manager Actually do for a Living?

Instructor: David E. Swenson, Affinity Static Control Consulting

Fundamentally, the responsibility of the ESD Control Program Coordinator or Manager is to make certain all the elements used to control electrostatic charging and electrostatic discharging are working properly – all the time. To do that, the Coordinator or Manager will have to know how to make the necessary measurements that define the performance attributes of a variety of items and materials, including people. This hands-on tutorial will allow the Electronic Device Design Engineer and other Electronic Component Specialists the opportunity to experience first hand the measurements of triboelectric charging (sort of), electrostatic charge (components, people, and materials), electrostatic decay (which includes a large variety of electrical resistance measurements), electrostatic discharge shielding, and ESD event detection. Starting with the basic concepts involved with control of static electricity, each of the measurements will be demonstrated and the participants given the opportunity to try the procedures.

Invited Talks

Invited Speaker Co-Chairs:

Alain Loiseau, GLOBALFOUNDRIES

Tom Meuse, Thermo Fisher Scientific

Invited talks are one of the key elements of the workshop, allowing attendees intimate exposure with industry leaders in focused areas of interest, as well as exposure to expertise outside our core fields. There are two invited talks this year where industry and university experts will share their thoughts on topics of keen interests to our engineering and scientific communities. The talk from Prof. Ming-Dou Ker is on one of the focus topics of this year: Latch-up. Professor Ker will discuss different latch-up triggers, methods of prevention and will also review methods for improving latch-up immunity of CMOS ICs by following design guidelines. The talk from Kathy Muhonen will focus on System Level ESD and HMM component level. It will explain in detail, recommendations for testing components to the IEC 61000-4-2 standard. While components are not completed systems, OEMs still ask their vendors to test components outside the system according to this standard, leading to questions in the testing method.

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Seminars

Seminar Co-Chairs:

Alain Loiseau, GLOBALFOUNDRIES

Tom Meuse, Thermo Fisher Scientific

We have asked recognized experts from the industry to give seminar talks on some of the hottest areas at this year's IEW. All seminar talks are centered around the main challenges that today's ESD engineers face every day. The seminar from Scott Ruth is on one of the focus topic, Latch-up: it will highlight some of the challenges seen in latch-up testing and review the present status of industries main latch-up test method, JESD78. In the second seminar, Michael Stevens will discuss EOS failures, gaps in design requirements and also highlight some of the ineffective methods being used to mitigate problems in manufacturing. The third seminar, from Prof. Mayank Shrivastava, will cover the topic of ESD behavior of carbon nano tubes as well as Graphene devices, covering unique shell by shell breakdown of CNTs under ESD stress condition and dependence of current transport on the nature of CNT.

Discussion Groups

Discussion Groups Co-Chairs:

Marty Johnson, Texas Instruments, Inc.

Michael Stockinger, NXP Semiconductors

The discussion groups are an integral part of the workshop. Four discussion groups are being offered, with two parallel sessions on Monday evening and two on Tuesday afternoon. The topics include Electrical Overstress (EOS) and the related Absolute Maximum Rating (AMR) of a product, the future of CDM testing, ESD models of IC components for system design, and latch-up data analysis and real world relevance. Each discussion group has a moderator with extensive expertise on the topic to help guide and inspire the discussion. The success of these sessions depends on your active participation. We encourage you to bring along data, ideas, and other items of interest to share.

Register online at: <http://www.cvent.com/d/gbq2zk>

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HOW DO I KNOW IF THE GLOVES I USE IN MY PRODUCTION PROCESS POSE AN EOS/ESD THREAT?

By: Matt Strickland, L3 Communications

Many companies in the electronics manufacturing industry use various types of gloves to protect product during the manufacturing and handling process. There are many different types of areas such as cleanrooms, circuit card processing lines and many other processes where oils from the hands can have very adverse effects to the circuit card or component.

The oils and materials residing on human hands and fingers are very corrosive. Often the acidic nature of residues on fingers will actually etch materials leaving signatures that are almost impossible to remove by normal cleaning procedures.

Industry has recognized this problem and taken steps to protect contamination sensitive products from being adulterated by human hands and fingers. In many cases the materials chosen for gloves perform well in preventing contamination, but unfortunately are very good accumulators of static charge and maybe also very good static charge generators.

Electrostatic discharge (ESD) protective gloves and finger cots are made of various materials. These materials may include textiles, such as cotton, with metallic fibers woven into the fabric, Nylon®, pink poly and many other types of synthetics such as vinyl and nitrile. They are used in many applications for the handling of ESD sensitive items where contamination is an important issue.

With so many types of gloves and finger cots available, how does the ESD Coordinator know which type or style is acceptable to use? As the ESD Coordinator, you also need to be a good detective. One that researches, asks the right questions, and digs for verifiable data. Don't just trust your manufacturer, but measure the materials yourself.

ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) does not specifically address the use of gloves or finger cots but the standard does require that any product (i.e. materials) used in an EPA must be qualified for use. (See Section 7.3 Product Qualification Plan). Any one of three methods can accomplish this qualification:

- Product specification review (review of the manufactures test results),
- Independent laboratory evaluation or
- Internal laboratory evaluation.

While the first two options of the S20.20 requirement are pretty straight forward (and maybe expensive), how can the ESD coordinator perform an internal assessment of the glove or finger cot, especially if they don't have an in-house laboratory?

The ESD Association document TR20.20 Handbook for the Development of an Electrostatic Discharge Control Program for the Protection of Electronic Parts, Assemblies, and Equipment, provides the following guidance:

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Perform a Measurement of the Intrinsic Resistance of ESD Gloves and Finger Cots

The intrinsic surface resistance of ESD gloves can be measured using the probe as defined in ANSI/ESD STM11.11. The intrinsic volume resistance of ESD gloves can be measured using the probe as defined in ANSI/ESD STM11.12. The intrinsic surface or volume resistance of finger cots (or gloves) can be measured using the probe as defined in ANSI/ESD STM11.13.

Perform an In-Use Resistance of ESD Gloves or Finger Cots

The in-use resistance of ESD gloves or finger cots can be measured using ANSI/ESD SP15.1. The constant area and force electrode (CAFE) is specifically designed for resistance measurements at the thumb and finger-tips.

The user of the CAFE test method should note that the resistance of the glove or finger cot can be much lower than its intrinsic resistance as measured by ANSI/ESD STM11.11, STM11.12, or STM11.13. In addition, once a glove or finger cot is put on and then removed, it cannot be measured again because the glove or finger cot will be contaminated by the person's skin emissions.

This contamination will affect the accuracy and reproducibility of further measurements on a particular glove or finger cot. It is suggested, for the best reproducibility for a test group, that gloves or finger cots be selected from the same lot. In the case of testing for lot-to-lot product auditing, compliance verification, or variation, gloves or finger cots should be selected from multiple lots.

****Note:** The ESD Association is currently performing work on the 15.1 document to establish the document as a standard test method. Round robin testing was performed by 4 different independent laboratories and the results were found to be repeatable and reproducible. This new Standard Test Method (STM) is expected to be released later in 2019.

Perform a Charge Generation Test of the ESD Gloves and Finger Cots

Electrical resistance is one property that can be used to evaluate the electrostatic characteristics of gloves. While electrical resistance is the best method to measure how well the glove/finger cot will dissipate charge, resistance does not fully characterize these materials.

An additional property to be considered in the selection and use of gloves and finger cots includes charge generation (tribocharging). There is no correlation between a glove resistance and tribocharging. A common source of electrostatic charge in a work environment is the separation of gloves from the items being picked-up or released, resulting in the generation of electrostatic charge that can accumulate on personnel, gloves, or finger cots and induced into items.

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The effect of this generation and accumulation of electrostatic charge can be minimized with appropriate selection of glove or finger cots.

Following are some suggested test methods to measure charge generation and accumulation of gloves and finger cots:

Contact and Separation of Materials Handled by a Factory Operator

One method to measure charge on items being handled by a gloved person is to have the person pick up the item while wearing a glove and drop it into a Faraday Cup, instead of placing into its normal assembly. Any charge accumulated by the item during contact and separation can be recorded by a Coulombmeter attached to the Faraday cup. The magnitude of charge can suggest the risk of damage to devices or assemblies from handling procedures.

General Contact and Separation of Materials Handled

Qualitative estimates of charge accumulation on items can be made using various materials that might be handled by a gloved person. Such items might be Kapton® flexible printed circuits or insulators, epoxy printed circuit assemblies, Plexiglas®, glass, nylon®, or Teflon® insulators and small metal parts. Samples such as thin sticks of these items, or thin insulated sticks covered with the test material, can be rubbed between the thumb and forefinger of a gloved person and dropped into a Faraday Cup and accumulated charge measured using the Coulombmeter.

Choose the glove material that accumulates the least amount of charge with the item under test while still meeting the application requirements.

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When selecting a glove or finger cot for use in your manufacturing process many factors need to be considered. Becoming an ESD detective is paramount to ensuring that you don't introduce an EOS/ESD problem while trying to solve a contamination problem.

All of the documents referenced in this article are available either as a free download or for purchase through the ESD Association. Please visit the ESD Association website at www.esda.org to obtain your copy.

For Further Reference

ANSI/ESD STM11.11, Surface Resistance

ANSI/ESD STM11.12, Volume Resistance

ANSI/ESD STM11.13, Two-Point Probe

ANSI/ESD SP15.1, Gloves and Finger Cots

ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

ESD TR20.20 Handbook for the Development of an Electrostatic Discharge Control Program for the Protection of Electronic Parts, Assemblies, and Equipment

The views and opinions expressed in this article are those of the author and do not reflect views or opinions of EOS/ESD Association, Inc. EOS/ESD Association, Inc., neither endorses or recommends any products, materials, or devices.

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Standards Referenced in Article

ANSI/ESD STM11.11-2015 Revision of ANSI/ESD STM11.11-2006 ESD Association Standard Test Method <i>for the Protection of Electrostatic Discharge Susceptible Items –</i> <i>Surface Resistance Measurement of Static Dissipative Planar Materials</i> Electrostatic Discharge Association 7900 Tustin Road, Bldg. 3 Rancho, CA 92669 An American National Standard Approved July 8, 2015 ANSI/ESD STM11.11, Surface Resistance	ANSI/ESD STM11.12-2015 Revision of ANSI/ESD STM11.12-2007 ESD Association Standard Test Method <i>For the Protection of Electrostatic Discharge Susceptible Items</i> <i>Volume Resistance Measurements of Static Dissipative Planar Materials</i> Electrostatic Discharge Association 7900 Tustin Road, Bldg. 3 Rancho, CA 92669 An American National Standard Approved May 28, 2015 ANSI/ESD STM11.12, Volume Resistance	ANSI/ESD STM11.13-2015 Revision of ANSI/ESD STM11.13-2004 ESD Association Standard Test Method <i>For the Protection of Electrostatic Discharge Susceptible Items</i> <i>Two-Point Resistance Measurement</i> Electrostatic Discharge Association 7900 Tustin Road, Bldg. 3 Rancho, CA 92669 An American National Standard Approved June 16, 2015 ANSI/ESD STM11.13, Two-Point Probe
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Standards Referenced in Article

ANSI/ESD SP15.1-2011 ESD Association Standard Practice For the Protection of Electrostatic Discharge Susceptible Items In-Use Resistance Testing of Gloves and Finger Cots ESD Association	ANSI/ESD S20.20-2014 Revision of ANSI/ESD S20.20-2007 ESD Association Standard For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) ESD Association	ESD TR20.20-2016 Revision of ESD TR20.20-2008 ESD Association Technical Report For the Protection of Electrostatic Discharge Susceptible Items Handbook for the Development of an Electrostatic Discharge Control Program for the Protection of Electronic Parts, Assemblies, and Equipment ESD Association
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ANSI/ESD SP15.1, Gloves and Finger Cots	ANSI/ESD S20.20	ESD TR20.20

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From the desk of the editor.



Nick Pimpinella configuring software

EOS/ESD Association, Inc. takes education seriously. As a central pillar of our mission, education is of vital importance as we strive to provide the industry with the best training and classes possible. A part of this effort is an overhaul of our online classes. We are in the process of converting our online academy classes to a new platform that gives users a script of the presentation in addition to the audio recording.

As a volunteer-run organization powered by six staff who keep the operations of the organization running efficiently day-to-day, we continually look for ways to improve products and services we provide to the industry. If you have not had the opportunity to view our online academy classes do not delay, take a look - <https://esda.org/training-and-education/online-training/>

Our class conversion efforts started last year. If you have taken one of the new courses, you will hear, Nicholas Pimpinella, the voice of ESDA, narrating the class. We began our focus on certification classes, and you can see and hear the changes in classes like Standards, Packaging, Ionization, Cleanrooms, and others. As we regularly convert classes to a new online format for ease of access and completion, the quality in these productions has taken a step into the future. We recently added a new recording studio. This provides a clear, crisp recording and eliminates sound disruptions and distortion. The next set of classes targeted for conversion to this new format are the Device Stress Testing classes.

EOS/ESD Association, Inc. has a strong international flavor, and our members come from more than 30 countries throughout the world. With clearer audio recordings that provide a script, you can read and hear improves everyone's experience with our online training program.

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Development and sales of ESD Testers



Please excuse the dust. Over the next few issues of Threshold, you will see many changes take place.

We are working to bring more content to our readers, and volunteers.

We hope to turn Threshold into something bigger and better. We appreciate your patience during this process.

For any suggestions on what you would like to see in a bi-monthly news letter, if you have come across an interesting article you wish to share or have written an article yourself, please send an email to brennanp@esda.org.

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For Bees, Static Electricity Is Information

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Three years ago, we reported on the “shocking” discovery that flowers decorate their petals with negative charges that bumblebees can detect. The patterns of charge are species-specific, as if to tell the positively charged insects to come on in for a treat. At the time, the methods bees use to detect the charges were unknown, but the news created quite a buzz in the media (see [National Geographic](#)). Now, the organs of electrical sensing in insects are coming to light.

In a recent open-access paper in the [Proceedings of the National Academy of Sciences](#) (PNAS), Sutton *et al.* locate the sensing in the tiny hairs, called filiform hairs, that cover the bumblebee’s body. It was known that the hairs respond to motion and sound, and that they are innervated at the base for transmission of information to the brain. The new findings add another function to these multipurpose sensors:

Electroreception in terrestrial animals is poorly understood. In bumblebees, the mechanical response of filiform hairs in the presence of electric fields provides key evidence for electrosensitivity to ecologically relevant electric fields. Mechanosensory hairs in arthropods have been shown to function as fluid flow or sound particle velocity receivers. The present work provides direct evidence for additional, nonexclusive functionality involving electrical Coulomb-force coupling between distant charged objects and mechanosensory hairs. Thus, the sensory mechanism is proposed to rely on electromechanical coupling, whereby many light thin hairs serve the detection of the electrical fields surrounding a bumblebee approaching a flower. [Emphasis added.]

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The “electromechanical coupling” means that the hairs respond to the presence of static electricity by moving toward or away from one another. That motion among “many light thin hairs” creates patterns in the nerve endings that the bee can use for information on the nectar quality in the flower. Apparently the antennae are less sensitive to electrical movement than the body hairs, for bumblebees at least. Honeybees may make more use of antennal deflections.

If another positively charged pollinator visited recently, the flower will have fewer negative ions due to charge cancellation. It will take a few minutes for the flower to recharge itself. In the meantime, the pollinator can move on to better sources, not wasting time where the nectar has already been taken.

Commenting on this discovery in [PNAS](#), Harold H. Zakon finds it intriguing that insects get information from static “noise.” We humans feel static electricity (also called triboelectricity) primarily when we touch a doorknob after scuffing our shoes on the carpet; otherwise we are not aware of it (unless it gets strong enough to make our hair stand on end). That brief shock on the fingertip is noise to us, not information. It’s just an epiphenomenon to us, Zakon says. Imagine, though, if sensors on our body hairs detected patterns of charge in a candy store, leading us directly to the best-advertised treats? What if our friends could read and interpret our electrical charge patterns without our having to say a word about where we have been?

Whatever differences may exist between honeybees and bumblebees, Zakon says, “the bigger take-home message of all of these studies is that **insects have a triboelectric sense mediated by mechanoreceptors.**” Note, however, that having hairs that deflect in the presence of static electricity is not enough. The nerves have to know the difference between electrically-induced motions and wind or sound motions. The brain has to be able to interpret the patterns of sensations coming in. Then, the brain has to activate instinctive responses, with muscles and nerves, to make use of the information. Unless the whole system works together, static electricity is useless as a signal.

Most of us have watched bees pollinating flowers all our lives without knowing there’s a hidden communication system going on between plant and insect using invisible forces. That’s fascinating enough, but the case of bumblebees hints at widespread electrical signaling in the biosphere. Sutton *et al.* remark, “This finding **prompts the possibility that other terrestrial animals use such sensory hairsto detect and respond to electric fields.**”

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What other animals might use static information? Zakon offers some possibilities.

*Is there a triboelectric sense in other insects? If accumulation of charge on an insect's body is as **widespread** as appears **likely**, is it an epiphenomenon or even a nuisance in some species — perhaps even suppressed centrally as noise — but used in others? Have other insect pollinators — such as **wasps, moths, butterflies, flies, and beetles** — also **evolved** to interact electrically with their flowers? It has been known for over 100 y that charge is held on the **hair of mammals and feathers of birds**. Similar to bees, pollen may be electrostatically attracted to approaching **hummingbirds**. Might **hummingbirds and other nectarivorous pollinating birds**, or perhaps some **pollinating mammals such as bats**, have **evolved** a similar triboelectric sense?*

We're used to hearing that all kinds of complex systems "have evolved." But how sensible is that when a triboelectric sense requires detectors, nerves, brains, and muscles to utilize an information source? How much less sensible to say they "have evolved" multiple times in unrelated animals as diverse as birds, butterflies, and fish? How did members of the plant kingdom get involved?

A phenomenon is not a "signal" unless it is detected by a creature looking for it, equipped with an appropriate receiver. A signal is not "information" unless a creature can use it for a function. Mars has static electricity, but the only ones who care are humans who sent intelligently designed rovers there to measure it when dust devils passed by. The moon has static electricity, too; it was a nuisance to Apollo astronauts when it made dust cling to everything. It only became "information" when scientists investigated its properties to gain insight into the origin of the lunar regolith, partly to plan for dealing with it in case a lunar base is ever built.

We've pointed to other invisible sources of information used by animals, including the earth's magnetic field. Earlier this month we reported how [deer are magnetically equipped](#); now we can add another mammal: the wart hog. No kidding; scientists from Uppsala University reporting in [Mammal Review](#) now say that "wild boars and wart hogs may have an internal compass."

*"The fascinating findings add on to a well growing body of evidence for a magnetic sense in mammals. The interesting questions that arise now are **how they are able to sense the magnetic field and whether they really use it for navigation**" said Dr. Pascal Malkemper, senior author of the Mammal Review study.*

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A Practical Approach

In [*Living Waters*](#), Illustra Media showed sea turtles using the magnetic field for information, salmon using odor molecules for information, and dolphins using sound for information. In each case, the animals are equipped with extremely sophisticated machines to detect, transmit, interpret, and utilize the information. In each case, furthermore, the mechanisms appear irreducibly complex — incapable of explanation by blind, unguided processes.

Now we can add static electricity to the growing list of information sources utilized by living things. Without well-designed receivers and interpreters, static electricity is a mere epiphenomenon of no functional consequence. In short, it's noise. Only intelligence knows how to extract signal out of noise and use it to get things done.

Photo credit: Alvesgaspar [[GFDL](#) or [CC BY-SA 3.0](#)], [via Wikimedia Commons](#).

If you have come across an interesting article you wish to share or have written an article yourself, please send an email to brennanp@esda.org.

ESDA and Advanced Static Control Consulting (ASCC) offer ESD Technician Certification Training

Ensure standardized excellence and advanced knowledge for your technicians with TR53 Technician Certification for ESD compliance verification of ANSI/ ESD S20.20, the globally recognized standard for the development and management of an ESD control programs. The EOS/ESD Association, the global leader in ESD Control Standards partnered with ASCC for ESD Technician Certification training.

Advanced Static Control Consulting (ASCC) has been endorsed by the ESD Association as an official, third-party, service provider for training that can lead to attendee certification as an “ESDA Certified TR53 Technician”. Attendees that pass the optional exam will be provided with certification credentials by ASCC. ASCC will also register all successful candidates with the ESD Association.

Upcoming events

March 12-14, 2019

TR53 Certified ESD Technician Training provided by ASCC in cooperation with Prostat

Hyatt Place Chicago/Itasca

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Register by credit card by calling Prostat at: +1 (855) STATIC1 (782-8421) or +1-630-238-8883

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International ESD Workshop

March 31-April 4, 2019 at Hyatt Regency Monterey, One Old Golf Course Road,
Monterey CA, USA
Co-located with IRPS!



Now in its 13th year, the IEW continues to provide a relaxed, invigorating atmosphere to present new work and engage in discussions about the latest issues confronting the ESD and EOS communities. This year, IEW will co-locate with the International Reliability Physics Symposium (IRPS). In addition to everything IEW provides, IEW registrants can also attend the IRPS technical sessions on ESD and latch-up as well as a joint evening poster reception showcasing works from both conferences. Thus, submissions to IEW will receive exposure to a much broader audience. IEW attendees will also be exposed to

work on a wider range of reliability topics from IRPS and will have access to IRPS keynotes. IRPS registrants will have access to IEW keynote and invited talks (but not the other unique elements of IEW). IEW will retain those elements which make it the unique experience it is: invited speakers & seminars, discussion groups, and some down time to network and explore the area.

Experience the uniquely interactive program of the IEW Workshop.

- Listen to viewpoints of industry experts
- Share your ideas and opinions on EOS/ESD topics
- Explore industry best practices and give your inputs
- Interact and network with high-level EOS/ESD industry experts
- A highly rewarding experience and engaging experience for all!

At the IEW you will find a tutorial track, discussion groups, seminars, keynote, and invited talks.

EVERY IEW attendee get complimentary access to the following IRPS sessions :

Tuesday AM Keynotes

Wednesday IRPS ESD technical sessions

Wednesday IRPS Poster Session and dinner where all IEW and IRPS posters are displayed



International ESD Workshop Registration Form

March 31-April 4, 2019 at Hyatt Regency Monterey, One Old Golf Course Road,
Monterey CA, USA

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Company: _____

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City: _____ State: _____ Zip: _____ Country: _____

Phone: () _____ E-mail: _____

Address is: (Please check one) ☐ home or ☐ office

☐ Please check here if you would like a printed set of notes. ☐ Check if, under the Americans with Disabilities Act, you require any auxiliary aids or services.

Please indicate any special dietary needs: _____

Hyatt group code for industry room rate - G-IR03

<https://irps.org/onsite-registration-center/hotel-information/>.

Registration Fee \$1,495

Discount before February 15, 2019: members \$1,295 / non-members \$1,395

The registration fee includes full workshop attendance and handout materials, breakfast and lunch.

Cancellation & refund requests will be considered if received in writing no later than February 15th 2019, and are subject to a \$50 fee.

Any other approved dispositions will also be assessed a \$50 fee.

* Students wishing to apply for a 50% discount on their registration must contact EOS/ESD Association, Inc. prior to registering. No refunds will be issued if discount is not applied at time of original registration.

* Register 5 or more people from one company at the same time and save \$100 per person. Please contact EOS/ESD Association, Inc. prior to registering.

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Discussion Groups

I am interested in the following discussion group(s)

- ☐ DG System ESD Device Modeling ☐ DG Future CDM Testing: Problems and Solution Options
☐ DG Empirical ESD Modeling ☐ DG Electrical Overstress (EOS) - Identifying Damage Mechanisms

Register Online at: <http://www.cvent.com/d/gbq2zk>

Posters

Will you be bringing a poster to the open poster session? ☐ Yes ☐ No

If yes, what is the title of your poster? _____



Special Interest Groups

Would you like to form a new SIG? ☐ Yes ☐ No

If yes, what is the proposed topic for your group? _____

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NEW EOS/ESD ASSOCIATION, INC. ONLINE ACADEMY COURSE

April 24-25, 2019 11:00AM-12:30PM EST

FC220: Device Technology & Failure Analysis for the Program Manager

Terry Welscher, Dangelmayer Associates, LLC

Certification: PFM

This tutorial provides an overview of the device technology used to provide ESD protection, ESD protection techniques, and Failure Analysis (FA) techniques to debug non-working ESD protection. This class does not go into the depth necessary to equip the student to be an ESD Protection Designer or an ESD Failure Analysis Engineer. It does familiarize the student with the terms and concepts of ESD protection and FA to allow the student to interact and understand the work being done by the Designer or Failure Analyst. After completing this tutorial the student should be able to understand the basics of device ESD protection design and some of the trade-offs inherent in that process. The student should also be familiar with the most commonly used failure analysis techniques and tools used to identify the root cause of an ESD failure. The topics covered include: the three most common ESD Models: HBM, CDM and System Level (IEC); characteristics of ideal ESD protection; ESD failure analysis schemes; key characteristics of real ESD protection; failure analysis flow; failure analysis tools and how they are applied to ESD failures.



Dr. Terry L. Welscher retired from Lucent Technologies-Bell Laboratories Engineering Research Center in 2001, as the director of the quality, test, & reliability department. He began his career in Bell Labs in 1978, where he worked on electrical conduction mechanisms in insulating polymers and electrolytic corrosion failure mechanisms in electrical interconnection materials. In 1984, he was appointed distinguished member of technical staff for his work in these fields. In 1988, he was promoted to technical manager to re-constitute the Bell Laboratories core expertise in electrostatic discharge (ESD). The newly formed group proceeded to produce a string of ground-breaking contributions to the field and played a key role in advancing industry standards. In 1994, he broadened his group's activities to all aspects of hardware reliability for Lucent Technologies with special emphasis in environmental stress testing (EST) and product reliability prediction and planning. In 1997, he was promoted to director of the quality, test & reliability center of excellence where he directed the development and deployment of product quality, test and reliability assurance practices for Lucent Technologies business units. This work included design for testability of integrated circuits, board and system level test and diagnosis and special techniques for testing of RF and optoelectronic systems and components. After leaving Lucent, he became reliability director for LaserSharp Corporation, an optical fiber laser amplifier company, where he was responsible for product quality, reliability, and compliance. Since 2004, he has been senior vice president of Dangelmayer Associates, LLC, an EOS/ESD consulting firm. Dr. Welscher was chairman of the ESD Association standards committee 1988-1989. He was technical program chair in 1991, vice general chair in 1992, and general chair in 1993 of the EOS/ESD Symposium. He served as member of the Symposium board of directors 1993-1995. He has also been active in quality standards and road mapping activities with Sematech, the EOS/ESD Association, and the JEDEC 14 quality and reliability committee. He served on the board of directors of JEDEC 1999-2001. He is currently co-chair of the joint JEDEC/ESDA HBM and CDM ESD working groups, and member of the Board of Directors and Past President of the EOS/ESD Association. Recently, he has led the effort to harmonize and merge JEDEC and ESDA device testing standards. He holds a BS in chemistry from Florida State University and a PhD in chemical physics from the University of Texas at Austin. He is author or co-author of fifty papers in solid state physics, applied mathematics, organic chemistry, electronics reliability, and electrostatic discharge. For his contributions to the ESD Association, Terry was presented with the Outstanding Contribution award in September 2018.

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NEW COURSES

✓	Dates	Course Title	Cert.	#Credits
	April 30-31, 2019	FC220: Device Technology & Failure Analysis for the Program Manager	PM	3

RECORDED ON-DEMAND COURSES

✓	#	Course Title	Cert.	#Credits
		3D Integration with Through-Silicon Via (TSV)		1
	FC263	Advanced ESD/EMI Auditing Techniques		1
	DT300	Advanced HBM – Dealing with Tester Parameters, High Pin Count and Two Pin Testing	D	1
	DT200	CDM Testing Essentials	D	1
	FC171	Changes to ANSI/ESD S20.20 from the 2007 version to the 2014 version		1
	GP250	Charged Board Events: A Growing Industry Concern		1
	DD280	Charged Device Model Phenomena, Design and Modeling	DD	3
	FC110	Cleanroom Considerations for the Program Manager	PM	3
	FC211	Compliance Verification: Pillars of Auditing		1
	FC180	Controlling ESD in Automated Equipment by Proper Grounding		1
	FC241	Developing a Compliance Verification Program		1
	DT202	Device Stress Testing Standards Update	D-R	1
	FC215	Device Technology & Failure Analysis Overview	PM	3
	DT230	Device Testing Correlation to Root Cause Failure Analysis		1
	FC261	Electric Fields: Practical Considerations		1
	FC260	Electrical Overshoot (EOS) in Manufacturing and Test		3
	FC260	Electrostatic Attraction		1
	FC280	Electrostatic Calculations for the Program Manager (4 Hrs)	PM	3
	DD184	Electrostatic Discharge Effects in Integrated Circuit Technologies	DD	1
	GP250	EOS-A Big Challenge in Today's Handling of Customer Rejects		1
		EOS: A New Focus		1
	DD110	ESD from Basics to Advanced Protection Design	DD	
	DT140	ESD Fundamentals I for Stress Testing	D	1
	DT141	ESD Fundamentals II for Stress Testing	D	1
	GP331	ESD Problem Solving		1

✓	#	Course Title	Cert.	#Credits
	DD201	ESD Protection and IO Design		3
	FC210	ESD Standards Overview for the Program Manager	PM	3
	DD220	ESD Test Simplification with Approved Sampling Methods in HBM	D-E	1
	DT145	Essentials for Controlling the ESD Work Area	D	1
	DT142	Fundamentals of Failure Analysis	D	1
	DT130	Fundamentals of System Level Testing	D-E	1
	FC231	Grounding in an Electrostatic Protected Area Classroom		
	FC231	Grounding in an Electrostatic Protected Area		1
	DT180	HBM & MM Testing Essentials	D	1
	DT211	High Speed Digital Oscilloscope Fundamentals	D	1
	FC181	Highlights and key concepts of Footwear/Flooring Standards		1
	FC181	Highlights and key concepts of Footwear/Flooring Standards Korean		1
	FC181	Highlights and key concepts of Footwear/Flooring Standards THAI		1
	DT131	HBM – System Level Testing of Components	D-E	1
	DD103	Integrated Circuit ESD Fundamentals		3
	DD231	Integrated ESD Device and Board Level Design		2
	FC120	Ionization Issues and Awareness for the Program Manager	PM	3
	DD112	Latch-up Fundamentals	DD	1
	DT281	Latch-up Testing and Troubleshooting	D-E	1
	DD102	On-Chip Protection in RF Technologies	DD	1
	GP330	Overview on Efficient and Reliable System-Level ESD		1
	FC280	Packaging Principles for the PM	PM	3
	DD222	Practical Aspects of Latch-Up for Low Voltage CMOS: Design Rules, Layout Floor Planning, and Test		1
	DD132 FC132	Susceptibility Testing of Devices and Systems		1
	DD138 FC130	System Level ESD/EMI Testing IEC & Other Standards	PM DD	3
	DD117	TCAD Fundamentals		1
	DD205	TCAD Methodologies for Industrial ESD Design		1
	DD218	TUP Fundamentals-Understanding the Equipment Options	D-E	1
	FC361	Ultra-sensitive (Class Q) Devices: ESD Controls and Auditing Measurements		3

(PM) (DD) Taking this online class will fulfill the requirement for the full length material that is a requirement of the ESDA Certification Program curriculum. Details on the Professional Certification Program offered by ESDA are on our website at www.esda.org/certification.html.

(D) Core class (D-E) Elective (D-R) Renewal class - Device Stress Testing Certification Course required and elective courses of the ESDA Device Stress Testing Certification curriculum. Details on the Professional Certification Program offered by ESDA are on our website at www.esda.org/certification.html.

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EOS/ESD ASSOCIATION TUTORIALS

ESD Auditing Essentials for Successful S20.20 Programs and Beyond!

May 7-9, 2019

**Teradyne Conference Center 600 Riverpark Drive, North Reading, MA 01864 USA
Lunch and refreshments provided**

May 7, 2019

ESD Myths that Impact ESD Auditing

8:30 a.m. - 12:00 p.m.

Instructor: Ted Dangelmayer, Dangelmayer Associates, LLC.



There are a number of common misunderstandings and controversies about electrostatic discharge (ESD) program management that can have significant impact on the implementation and maintenance of the ESD program. These misunderstandings or "myths" result in unnecessary expenditures and/or result in a compromise of the program integrity. These myths and controversies, such as latency are often cited by skeptics not wanting to adhere to certain standard ESD procedures. As a consequence, it is important to identify and dispel the myths as well as to understand the potential impact of latent failures.

This tutorial highlights 10 common myths and supporting success studies as well as a success study on latency. The myths and success studies presented here were chosen to provide real-world examples of how an ESD program can be strengthened by understanding the fallacy in each of the myths. This understanding will result in more reliable products that are also more cost competitive. Although not a myth, latency it is a significant reliability consideration that is surrounded with controversy. Some experts will argue that latency is virtually non-existent and others will claim that it is the dominant failure mode. Reality lies somewhere in between. The Latency study cites irrefutable evidence of latent failures in alarming proportions that must be factored into ESD programs and product design.

Co-sponsored by the Northeast Chapter ESD Association <http://www.nechapter-esda.org>

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EOS/ESD ASSOCIATION TUTORIALS

May 7-9, 2019

Teradyne Conference Center 600 Riverpark Drive, North Reading, MA 01864 USA
Lunch and refreshments provided

May 7, 2019 1:00 p.m. - 4:30 p.m.
(continued) May 8, 2019 8:30 a.m. - 12:00 p.m.
FC101:How To's of In-Plant ESD Auditing and
Evaluation Measurements



Instructors: Ted Dangelmayer, Ginger Hansel, Dangelmayer Associates, LLC.

This program reviews the evaluation and periodic verification (audit) measurement procedures for the technical requirements specified in the ANSI/ESD S20.20 ESD program development standard. Detailed explanation of instruments, fixtures, and accessories function and usage are provided. Then, the details of "How to" measure are explained and demonstrated. Measurements include those listed in Table 1: Grounding/Equipotential Bonding Requirements; Table 2: Personnel Grounding Requirements; and Table 3: EPA/ESD Control Items. These recommended measurement procedures confirm the proper operation and use of ESD control products and materials selected as part of a facility's S20.20 ESD control program.

Some sample topics covered in this course are:

- ANSI/ESD S20.20 Technical Control Requirements
- Program Manager's Approach to Instrumentation and Applications
- Testing Ground Circuits and Assessing Connections
- Essential Resistance Measurement Procedures and Concerns
- Electrostatic Field and Voltage Measurements
- Personnel Grounding Considerations vs. ESD Control Points
- Product Installation Baseline Measurements
- Evaluation, Acceptance, and Audit Procedures for: Ground Systems, Floors, Worksurfaces, Equipment, Personnel Grounding, Garments, Materials, Production Aids, Packaging, and Ionization Devices
- Electrostatic Analysis Measurements including Worksurface Suppression, Footwear/Flooring, and Ionization Decay

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EOS/ESD ASSOCIATION TUTORIALS

May 7-9, 2019

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Lunch and refreshments provided

May 8th, 2019

Hands-on ESD Measurements & Auditing Pitfalls

1:00 p.m. - 4:30 p.m.

Instructors: Ted Dangelmayer, Ginger Hansel, Dangelmayer Associates, LLC.



Accurate data is the foundation of effective ESD program management. This hands-on tutorial will explain and demonstrate the proper use of ESD test equipment such as static locators, resistance meters, charge plate monitors, and event detectors. We will examine pitfalls of using these common instruments that can result in an incorrect representation of the ESD risk. For example, static locators can give misleading readings if the effects of voltage suppression are not taken into account. We will also discuss the effective use of ionization since ionizers that are not measured, maintained, and located correctly may contribute ESD hazards to the work area. Each student will participate in class exercises to perform these tests. The hands-on experience is the best way to understand the seriousness of the pitfalls and the benefits to taking the proper precautions. What you learn will help you avoid frequent auditing problems and improve your compliance verification program.

May 9th, 2019

FC170: ESD Training for Internal Auditors and Supplier Quality Engineers

8:30 a.m. - 4:30 p.m.

Instructor: John T. Kinnear, IBM Corporation



This class has been designed specifically for those individuals who are responsible for:

- Performing internal company ESD assessments based on ANSI/ESD S20.20
- Conducting a pre-assessment of their facility prior to an external 3rd party assessment
- Assessing the ESD control programs of their suppliers

This course will use the checklist used by ESDA certified auditors as the basis for the class. However, this class will delve into the meaning behind each of the audit checklist questions in greater detail than is currently found in either the ESD Association registrar certification training or the ANSI/ESD S20.20 ESD program design seminar. After taking this class the student will be able assess a process and determine whether or not it meets the requirements of ANSI/ESD S20.20-2007.

Note: Familiarity with performing assessments is recommended for anyone planning on taking this course.

Co-sponsored by the Northeast Chapter ESD Association <http://www.nechapter-esda.org>

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- ☐ **May 7-8** **\$1,420**
Register before March 22nd, 2019 member: \$1,020/ non-member \$1,220

- ☐ **May 9** **\$710**
Register before March 22nd, 2019 member: \$510/ non-member \$610

- ☐ **All three days** **\$2,130**
Register before March 22nd, 2019 member: \$1,530/ non-member \$1,830

Cancellation & refund requests will be honored only if received in writing no later than March, 22nd 2019, and are subject to a \$50 fee. Any other approved dispositions will also be assessed a \$50 fee.

Payment Information:

Register Online at <http://www.cvent.com/d/hbqg3p>

Other forms of payment Contact:

EOS/ESD Association, Inc.

info@esda.org

Phone: +1 (315) 339-6937

Accommodations

Residence Inn by Marriott Woburn
300 Presidential Way, Woburn, MA 01801
(781) 376-4000

Courtyard Boston Woburn
240 Michamum Road, Woburn, MA 01801
(781) 932-3200

Co-sponsored by the Northeast Chapter ESD Association <http://www.nechapter-esda.org>

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Phone +1 315-339-6937 • info@esda.org • www.esda.org



EOS/ESD Manufacturing Symposium in China

Hilton Garden Inn, Shanghai, China
May 21-24, 2019



CALL FOR PRESENTATIONS

The EOS/ESD Association is organizing the EOS/ESD Manufacturing Symposium China. The EOS/ESD Manufacturing Symposium in China is focused on discussing issues and providing answers to electrostatic discharge in electronic production and assembly.

Call For Presentations

Abstract Submission Deadline March 15, 2019

Submission Instructions

Your presentation abstract (two slides including reasonably sized figures) must clearly present the data and the significance of the results. Please e-mail your presentation abstract including title, author affiliation, and e-mail address to info@esda.org by March 15, 2019 (Friday) deadline. Notification of acceptance will occur by March 20, 2019. Final, full presentations for EOS/ESD Manufacturing Symposium in MS PowerPoint® format must be received by **May 6, 2019**. These MS PowerPoint® slides will be included in the presentation handout that will be distributed during the Symposium. There will be no published proceedings of the Symposium. Technical papers that have been previously published may be considered.

For more information and registration please visit the ESDA website at www.esda.org/manufacturingsymposium/

Please visit the web page at <http://www.esda.org/manufacturingsymposium/> for regular updates on the Symposium. As it becomes available, we will post information on the full technical program including tutorials, seminars, technical sessions, discussions, workshops, and exhibits.

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Co-Sponsored by:



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Shanghai SHENHUA Technology Corporation



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Local Chair:

Tay, Chin Siang, Canmax



Mark
Your
Calendar!

If you are interested in sponsoring this event please contact: EOS/ESD Association Inc., Phone +1-315-339-6937, info@esda.org

Setting the Global Standards for Static Control

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EOS/ESD Manufacturing Symposium in China Registration

First Name: _____ Last Name: _____

Company Name: _____

Street: _____ City: _____

State/Province: _____ Country: _____ Zip/Postal Code: _____

Address is (please circle the one that applies) Home or Company

Phone: _____ E-mail: _____

Symposium

☐ May 21,22 Technical Presentation, Talk, and Exhibits \$800

Tutorial Selection

☐ May 23 ESD Basics for the Program Manager \$510/ non-member \$610

☐ May 24 How To's of In-Plant ESD Auditing and Evaluation Measurements \$510/ non-member \$610

☐ May 23,24 ESD Program Development & Assessment (ANSI/ESD S20.20) \$1,510

Exam

☐ Professional Program Manager Certification Exam \$80
(Optional May 25, 2019)

NOTE: You must initiate an official file in your name at EOS/ESD Association, Inc. headquarters, and complete all pre- requisite courses to be eligible to take the exam.

Register Online at: <http://www.cvent.com/d/kbqgfs>



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March 5, 2019 10:57 AM



EOS/ESD Manufacturing Symposium in China Exhibitor Registration Only

EXHIBITS OPEN 9:00 – 5:00 MAY, 21-22, 2019

APPLICATION FOR EXHIBIT SPACE

Name of Company: _____

Street Address: _____

City, State, Postal Code: _____

Country: _____

Telephone: _____

Contact: _____ Email: _____

Please provide web address to be used for your link on ESDA website: _____

We will exhibit and demonstrate the following products or services: _____

We are Manufacturers Other (please specify) _____

**Exhibit Space Rental: \$1,000.00 USD
FULL PAYMENT DUE WITH REGISTRATION**

Requested Booth Space _____ Second choice _____ Third Choice _____

Amount enclosed \$ _____ ☐ Check ☐ Visa® ☐ MasterCard® ☐ American Express® ☐ Discover®

Credit card number: _____ Expiration date: _____

Name on card: _____ Security code: _____

Cardholder's signature: _____

Billing Address: _____

City: _____ State: _____ Zip/Postal Code: _____

THE UNDERSIGNED HAS READ AND AGREES TO ABIDE BY THE TERMS ON BOTH SIDES OF THIS APPLICATION.

Application By: _____ Date: _____

(Signature)

NOTES:

1. Each exhibitor receives one (1) symposium registration package for each booth rented.
2. SPACE WILL BE ASSIGNED IN THE ORDER OF RECEIPT OF REGISTRATION
3. Management reserves the right to relocate exhibit space, as necessary, to conform to show regulations.

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EOS/ESD Manufacturing Symposium in China

EXHIBIT RULES – EOS/ESD Manufacturing Symposium

CONTRACT

This application, properly executed by the applicant, shall, upon written acceptance and notification of exhibit space assigned by the EOS/ESD Association, Inc., constitute a valid and binding contract.

QUALIFICATIONS FOR EXHIBITING

Exhibitors must be manufacturers or representatives of manufacturers that produce products or perform services which conform to the subject matter covered by the symposium technical program. Management reserves the right to accept or reject any exhibitor.

PRODUCT PRESENTATION

Audio-Visual presentations and operational equipment demonstrations will be permitted only at intensity levels that will not interfere with neighboring exhibitors. Product and service demonstrations may be given by professional presenters or models, who must dress and conduct themselves in an appropriate manner. Exposition management shall determine the suitability of all presentations and/or demonstrations.

EXHIBIT SPACE CHARGES AND CANCELLATIONS

All exhibit space will be rented at the rate described on the front of this Application for Exhibit Space. Full payment of \$1,000.00 per booth must accompany the application for space. Checks should be made payable to EOS/ESD Association, Inc., and sent to EOS/ESD Association, Inc., 7800 Turin Rd., Bldg. 3, Rome, NY 13440-2069. No refunds will be given for cancellation.

ANCILLARY EVENTS

Exhibitors ARE NOT allowed to schedule events, for Association/Symposium attendees that are in direct conflict with the Association/Symposium event schedule.

SUBLETTING OF SPACE

The exhibitor shall not assign, sublet, or apportion the whole or any part of the space assigned or have representatives, equipment, or materials from other firms than his own in the exhibit space without written consent of the Management. Only one company shall be considered as the exhibitor; any other company or unit in the space shall be considered a subsidiary or affiliate.

ADVERTISING

All literature, sales brochures, or other advertising or promotional media shall be displayed ONLY within the space rented by the exhibitor.

Exhibit Space MATERIALS PROVIDED BY THE SYMPOSIUM

1 Table & 2 Chairs

CONSTRUCTION OF EXHIBITS

Exhibits shall be constructed and arranged so that they do not obstruct the general view, nor hide the exhibits or others. All booth equipment must fit within the space rented, and must not extend into aisles or corridors.

SUITABILITY OF EXHIBITS

All exhibits are expected to be educational in nature and should describe products and/or services available from the exhibiting company.

COMPLIANCE WITH LOCAL RULES

Exhibitors assume responsibility for compliance with pertinent ordinances, regulations, and codes of duly authorized local, state and federal governing bodies concerning fire safety and health, and the rules and regulations of operators and owners of the property in which the exhibit is held.

UNION JURISDICTION

The exhibitors will abide by and comply with rules and regulations concerning local unions having jurisdiction over the facility in which the exhibit is held, and specifically in the exhibit area and loading docks.

LOSS OR DAMAGE

In the event that the premises in which the Symposium is conducted shall become unfit for occupancy or substantially interfered with by reason of any cause or causes not reasonably within the control of the EOS/ESD Association, Inc., this agreement may be terminated by the EOS/ESD Association, Inc. For this purpose, the term "cause or causes" shall include, but not by way of limitation, fire, flood, epidemic, earthquake, explosion, acts of terrorism, accident, blockage, embargo, inclement weather, government restrictions, strikes, lockouts, boycotts, lack of adequate transportation services, or acts of God other than those named. Should the Committee terminate this agreement pursuant to the provisions of this paragraph, the exhibitor waives any and all claims of damage and agrees that the EOS/ESD Association, Inc., after computing the total amount refundable to all exhibitors, shall make appropriate refunds. The amount refundable to exhibitors shall be the amount by which the total amount of fees paid by all exhibitors exceeds the total amount of the EOS/ESD Association's costs and expenses in connection with its preparation for conducting the Symposium and exhibits including a reasonable reserve for claims and other contingencies.

LIABILITY WAIVER

The ESD Association, its committees, agents or sponsors, shall not be liable for any damage to property or for any injury to persons during the terms of this agreement from any cause whatsoever, by reasons of use, occupancy and enjoyment of exhibit space by exhibitors or any person thereon with the consent of the exhibitor. The exhibitor will indemnify and save harmless the EOS/ESD Association, Inc., its committees, agents or sponsors from all liability on account of any such damage or injury. Please see enclosed insurance form.

ADDITIONAL INFORMATION

Contact:

EOS/ESD Association, Inc.

7800 Turin Rd., Bldg. 3, Rome, NY 13440

Phone: +1-315-339-6937; E-Mail: info@esda.org

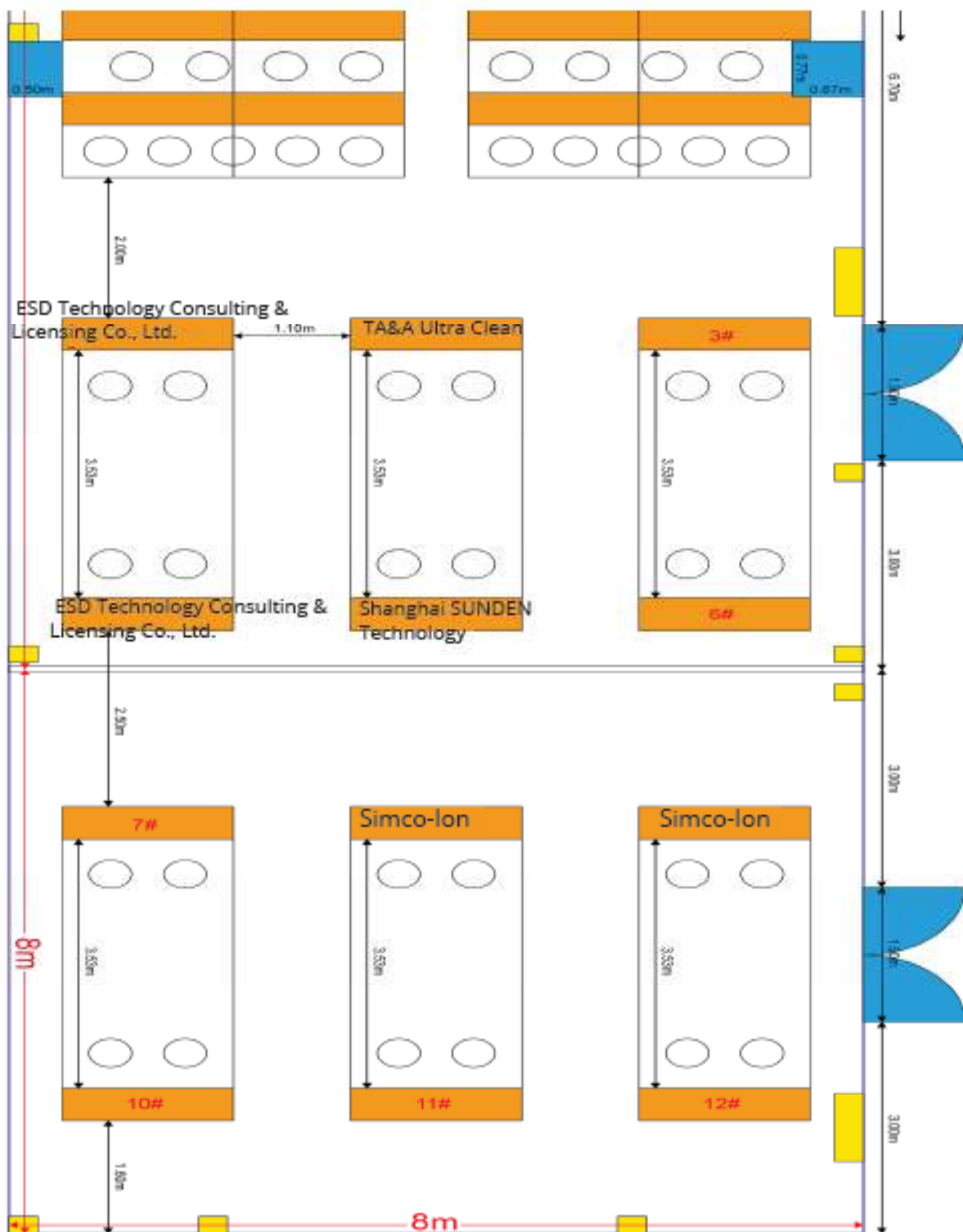
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EOS/ESD Manufacturing Symposium in China



41st EOS/ESD Symposium and Exhibits

September 15 - 20, 2019

Riverside Convention Center
3637 5th St
Riverside, CA 92501 USA

Technical Sessions
Tutorials
Manufacturing Track
IoT workshop

EXPLORE



NETWORK.

Industry Professionals
Social Receptions
Contests



Co-sponsored by IEEE, EMC Society, The Electron Devices Society, and Reliability Society.

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41st EOS/ESD Symposium and Exhibits

September 15 - 20, 2019

Riverside Convention Center
3637 5th St
Riverside, CA 92501 USA

EOS/ESD Symposium is the leading conference in the field of electrostatic discharge and electrical overstress. It offers the unique possibility to get a wide scope understanding of the challenges ahead to safeguard IC design, Manufacturing and handling in the field. Influencing standards, creating best practices, and technical direction setting requires personal attendance at this premier event to connect with industry leaders. Expert meetings and state-of-the-art technical papers set direction for Industry such as defining relevant IC sensitivity design targets.

The trend towards extreme ESD sensitivities has reached a critical stage that requires a deeper understanding of manufacturing controls and designed in protection strategies. This event features topics like the field threat for IoT systems, manufacturing controls for 3D ICs, and the vanishing ESD design window in downscaled technologies. EOS/ESD Symposium 2019 will address these topics through dedicated tracks and focused discussion groups.

- **RETURN of the MANUFACTURING TRACK:** EOS/ESD in Manufacturing - Control Materials, Technologies, and Techniques. This manufacturing track focuses on a combination of full technical papers, short papers, poster presentations, invited papers, discussion groups and workshops, hands-on demonstration sessions, and expanded practical demonstrations of equipment by current exhibitors.
- Featured keynote presentation provides the latest discoveries in EOS/ESD control.
- Workshops allow you to discuss your companies unique challenges with industry professionals and peers.
- Networking opportunities to get answers from industry experts on important technical questions.
- Tutorials and seminars for valuable training to keep you at the top of your field.



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EOS/ESD Manufacturing Symposium in Malaysia

Penang Skills Development Centre

1 Jalan Sultan Azlan Shah, 11900 Bayan Lepas, Pulau Pinang, Malaysia

October 14th-17th 2019

October 18th Program Manager Exam (optional)



The EOS/ESD Association is organizing the EOS/ESD Manufacturing Symposium Malaysia. The EOS/ESD Manufacturing Symposium in Malaysia is focused on discussing issues and providing answers to electrostatic discharge in electronic production and assembly.



Call For Presentations

Abstract Submission Deadline July 12, 2019

Submission Instructions

Your presentation abstract (two slides including reasonably sized figures) must clearly present the data and the significance of the results. Please e-mail your presentation abstract including title, author affiliation, and e-mail address to info@esda.org by July 12, 2019 (Friday) deadline. Notification of acceptance will occur by July 20, 2019. Final, full presentations for EOS/ESD Manufacturing Symposium in MS PowerPoint® format must be received by **October 4, 2019**. These MS PowerPoint® slides will be included in the presentation handout that will be distributed during the Symposium. There will be no published proceedings of the Symposium. Technical papers that have been previously published may be considered.

For more information and registration please visit the ESDA website at www.esda.org/manufacturingsymposium/

<https://www.everfeed.com.sg/penang-2019>

<https://www.esda-asian.com/featured-news>

Please visit the web page at <http://www.esda.org/manufacturingsymposium/> for regular updates on the Symposium. As it becomes available, we will post information on the full technical program including tutorials, seminars, technical sessions, discussions, workshops, and exhibits.

EOS/ESD Manufacturing Symposium would like you to consider presentation abstract submission topics such as:

I. EOS/ESD Factory Level and Materials Technology

- Packaging and Handling
- Case Studies, Reviews and Analysis
- Test Methods and Procedures
- Troubleshooting Techniques
- Air Ionization and Uses
- Facility Design
- ESD Shunting Packaging Technology
- ESD Control Materials
- ESD Detection and Measurement Techniques
- Management Issues (cost/benefit analysis etc.)

II. EOS/ESD Standards – Components, Systems, Factory, & Materials

- Test Methods and Procedures
- Standards – Comparisons and Analysis
- ESD Control Program Development
- Case Studies
- Round-Robin Testing, Results, and Analysis

Sponsored by:



Management Chair:

Junjun Li, IBM Corporation

Local Chair:

Marcus Koh, Everized Technology Pte Ltd



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February 27, 2019 3:15 PM



EOS/ESD Manufacturing Symposium in Malaysia

Penang Skills Development Centre

October 14th-17th 2019

October 18th Program Manager Exam (optional)

First Name: _____ Last Name: _____

Company Name: _____

Street: _____ City: _____

State/Province: _____ Country: _____ Zip/Postal Code: _____

Address is (please circle the one that applies) Home or Company

Phone: _____ E-mail: _____

Tutorial Selection

- ☐ Day 1 ESD Basics for the Program Manager \$510 USD/ non-member \$610 USD
- ☐ Day 2 How To's of In-Plant ESD Auditing and Evaluation Measurements \$510 USD/ non-member \$610 USD
- ☐ Day 3 & 4 ESD Program Development & Assessment (ANSI/ESD S20.20) \$1,510 USD
- ☐ Day 5 Professional Program Manager Certification Exam \$80 USD
(Optional October 18, 2019)

NOTE: You must initiate an official file in your name at EOS/ESD Association, Inc., pay the \$50 USD filing fee, and complete all pre-requisite courses to be eligible to take the exam.

Symposium

- ☐ Day 3 & 4 Symposium: Technical Presentation, Talk, and Exhibits \$800 USD

The EOS/ESD Association, Inc. offers a fifty percent discount for full-time students. Proof of enrollment required. Student fees apply only to symposium or tutorial registration and do not apply to exclusive 10 course bundle for Malaysia event.

Exclusive 10 course bundle for Malaysia event

Certified Program Manager Certification

For the exclusive bundle price, payment MUST be made before September 15th, 2019.

- ☐ 3 face to face courses: ESD Basics, How To's and S20.20 (Days 1, 2, & 3) \$5,000 USD
- 7 Online courses: (Class links provided upon payment)
 - Cleanroom Considerations for the Program Manager
 - Ionization Issues and Answers for the Program Manager
 - System Level for the Program Manager
 - Packaging Principles for the Program Manager
 - ESD Association Standards Overview
 - Device Technology and FA Overview
 - Electrostatic Calculations for the Program Manager



Register Online at: <http://www.cvent.com/d/m6qjyt>

Alternative payment: contact Everfeed Phone: +65 6863 1488 E-Mail: info@everfeed.com.sg

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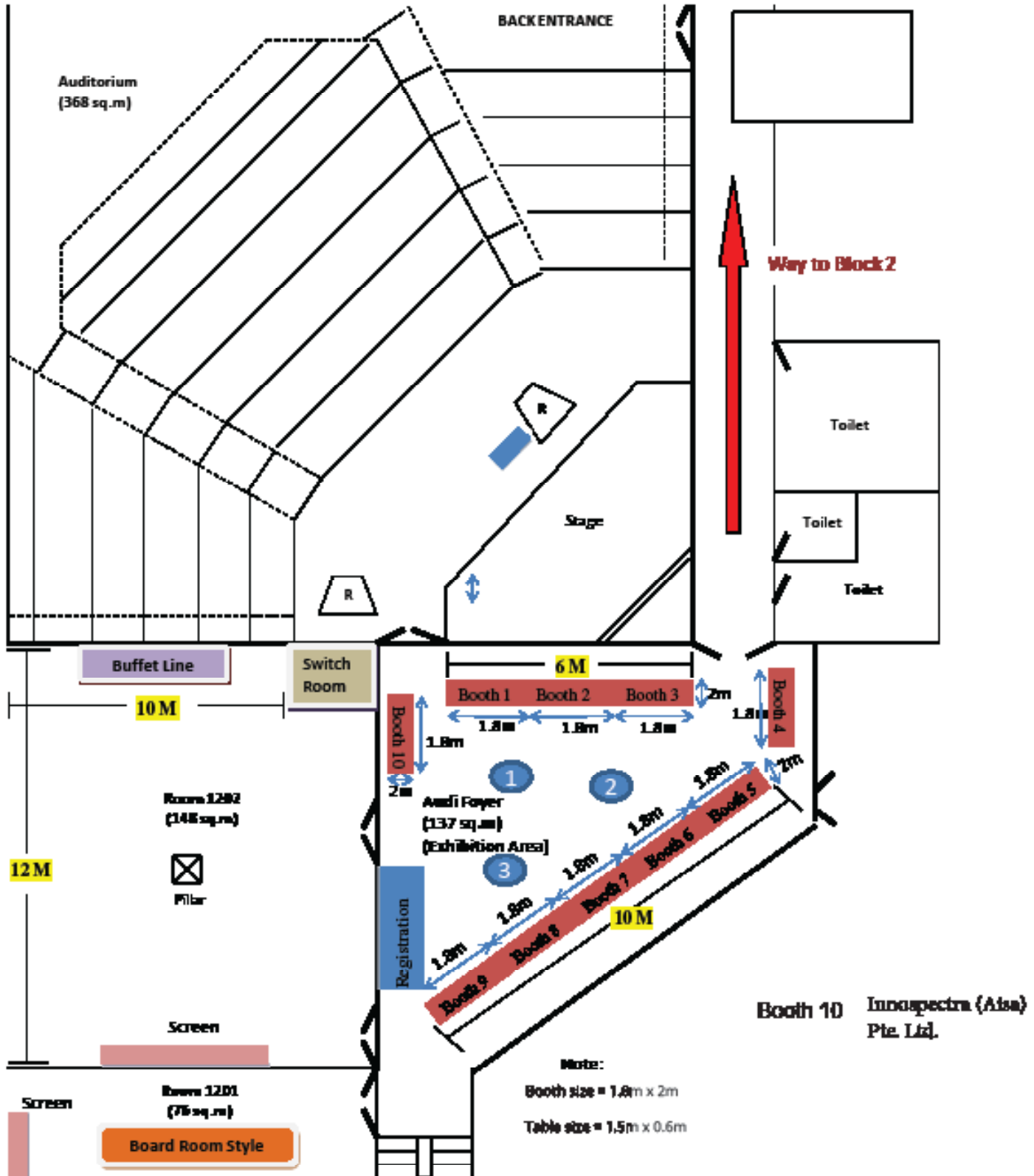
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February 27, 2019 2:15 PM



EOS/ESD Manufacturing Symposium in Malaysia



EOS/ESD Manufacturing Symposium in Malaysia Exhibitor Registration Only

APPLICATION FOR EXHIBIT SPACE

Name of Company: _____

Street Address: _____

City, State, Postal Code: _____

Country: _____

Telephone: _____

Contact: _____ Email: _____

Please provide web address to be used for your link on ESDA website: _____

We will exhibit and demonstrate the following products or services: _____

We are _____ Manufacturers _____ Other (please specify) _____

**Exhibit Space Rental: \$1,000.00 USD
FULL PAYMENT DUE WITH REGISTRATION**

Requested Booth Space _____ Second choice _____ Third Choice _____

Amount enclosed \$ _____ ☐ Check ☐ Visa® ☐ MasterCard® ☐ American Express® ☐ Discover®

Credit card number: _____ Expiration date: _____

Name on card: _____ Security code: _____

Cardholder's signature: _____

Billing Address: _____

City: _____ State: _____ Zip/Postal Code: _____

THE UNDERSIGNED HAS READ AND AGREES TO ABIDE BY THE TERMS ON BOTH SIDES OF THIS APPLICATION.

Application By: _____ Date: _____

(Signature)

NOTES:

1. Each exhibitor receives one (1) symposium registration package for each booth rented.
2. SPACE WILL BE ASSIGNED IN THE ORDER OF RECEIPT OF REGISTRATION
3. Management reserves the right to relocate exhibit space, as necessary, to conform to show regulations.

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Q) Please provide direction about where we should look into regarding norms or standards about the limits on Temperature and HR% for an ESD electronic assembly facility

Temperature and humidity controls are not listed as a requirement in the modern ESD control standards such as ANSI/ESD S20.20 and IEC61340-5-1. The reason for this is all of the ESD control items used in a facility have to function to their specifications when tested after conditioning at 12+/-3% RH at 23+/-3C. Older standards, predominantly from the US Military, listed 30-60% RH at room temperature for ESD control. Today, humidity is mainly controlled for personnel comfort and on the high side for solderability issues. MIL HDBK 263(B) has the discussion about humidity and that is referenced in MIL STD 1686. If you want to control humidity in your facility, that is acceptable but you may not want to include it as a requirement in your ESD control program. If it becomes an ESD control program requirement, then you can be audited against it and cited if you have any excursions outside of the range.

Q) We are installing a new ESD floor. It is a painted on surface. According to the USAF Technical Order 00-25-234, para 7.8.3(d)(1) the specification is:

A total of 16 equally spaced resistance measurements shall be taken for every 10,000 square foot area of flooring. For floors with less than 10,000 square feet one resistance measurement shall be taken for each 400 square feet of flooring (equally spaced). The average of the total surface to ground resistance measurements shall be between 1×10^6 and 1×10^9 ohms with no individual measurement being above 5×10^9 or below 1×10^6 ohms.

What I need to know is, does this specification match the spec in ANSI/ESD STM7.1-2013?

Thank you for your inquiry. The AF Tech Order section on flooring and our test method ANSI/ESD STM7.1 are similar in scope and purpose. There are variations in the number of measurements made and our STM7.1 does not have limits. The limits for flooring are in ANSI/ESD S20.20. STM7.1 has "a minimum" of 5 measurements per contiguous 5000 square feet. Most of the time, at least for qualification purposes, practitioners make many more measurements during qualification to get a good map of the floor resistance after installation. This helps in the future to monitor changes. S20.20 does not have a lower limit for flooring so that very conductive flooring can be used if it is needed. The upper limit is the same as in the TO at $< 1 \times 10^9$ ohms. Most companies set the lower limit at 5×10^5 ohms for current limiting with 120 volt AC systems. The lower limit needs to be set depending on facility requirements.

The response given is a service to industry; EOS/ESD Association, Inc. is not responsible for content. The users of this information need to determine the suitability of the response.

Have a question to ask? Send an email to info@esda.org with your question (be as descriptive as possible).

Your company could be here!

Contact info@esda.org to find out how to advertise your company in the Bi monthly Threshold.

Your company could be here!

Contact info@esda.org to find out how to advertise your company in the Bi monthly Threshold.



EOS/ESD Association Event Schedule

Setting the Global Standards for Static Control!

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2019

March 31-April 4, 2019

International ESD Workshop (IEW)

Hyatt Regency Monterey

One Old Golf Course Road

Monterey CA, USA

April 8-14, 2019

EOS/ESD Association Meeting Series

Riverside Convention Center, Riverside, CA

Marriott Riverside at the Convention Center

(Room Rate \$141/night)

April 8-10, 2019

Electrostatics 2019

Manchester Conference Centre (Pendulum Hotel)

Manchester, UK

April 24-25, 2019

FC220: Device Technology & Failure for the

Program Manager

EOS/ESD Association, Inc. Online Seminar

May 7th-9th, 2019 North East Local Chapter and

EOS/ESD Association, Inc. Tutorials

May 7 (½ Day) ESD Myths that Impact ESD

Auditing

(½ Day) FC101: How To's of In-Plant ESD

Auditing and Evaluation Measurements

May 8 (½ Day) Cont'd FC101: How To's of In-Plant

ESD Auditing and Evaluation Measurements

(½ Day) Hands-on ESD Measurements &

Auditing Pitfalls

May 9

FC170: ESD Training for Internal Auditors and

Supplier Quality Engineers

May 21-24, 2019

Manufacturing Symposium in China

The Hilton Garden Inn

Shanghai China

June 10-21, 2019

Summer Virtual Meeting Series

June 18-19, 2019

June 18 FC100: ESD Basics for the Program

Manager

June 19 FC101: How To's of In-Plant ESD Auditing

and Evaluation Measurements

September 9-20, 2019

EOS/ESD Association Meeting Series

EOS/ESD Symposium and Exhibits

Riverside Convention Center, Riverside, CA

Marriott Riverside at the Convention Center, Riverside, CA

(Room Rate \$140/night)

The Mission Inn Hotel & Spa, Riverside, CA (Room Rate

\$140/night)

October 14-18, 2019

Manufacturing Symposium in Penang

Penang, Malaysia

November 27-28, 2019

RCJ Symposium

Japan

Do you know a Working Group Chair/member and would like to be featured in the Threshold? Send an email to info@esda.org for information on how to be in the spotlight!

Do you have something you would like to publish in Threshold? Send an email to brennanp@esda.org for information.

Editorial Deadlines

Threshold™ is published six times a year by the ESD Association, a not-for-profit corporation. It strives for the advancement of theory and practice of electrical overstress avoidance and of allied arts and sciences and the maintenance of a high professional standing among its members and others.

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Threshold™ Publication Schedule

Issue	Deadlines
January/February	December 1
March/April	February 1
May/June	April 1
July/August	June 1
September/October	August 1
November/December	October 1

Threshold Institutional Listings

Space in the Threshold Institutional Listings, which appear at the bottom of newsletter pages, can be purchased for \$600.00 for six consecutive issues. Larger contributions are welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the EOS/ESD Association, Inc. should be sent to:
EOS/ESD Association, Inc., 7900 Turin Rd., Bldg. 3, Rome, NY 13440-2069 Tel: (315) 339-6937, e-mail: info@esda.org.

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