Mar/Apr 2019 • No. 250

ESA Newsletter
Electrostatics Society of America - The Friendly Society

President's Message

Naming just a few of the many applications of electrostatics: xerography used in photocopying and laser printing, spray painting used heavily in the automobile industry, precipitation of contaminants used in air cleaning, etc. --- wow, what an exciting field! When it comes to the basics of many phenomena, electrostatics exists everywhere, in living cells, molecules, atoms, and at subatomic levels. The chemists say "Everything is Chemistry". We can be proud to say "Electrostatics exists Everywhere". Without electrostatics life does not exist. We are lucky to choose electrostatics and its applications as our practicing field, as a teacher, scientist, engineer, mentor, or simply a volunteer. In this regard, I would like to draw your attention to our annual meeting in Rochester, NY, from June 10th-12th. You will have a wonderful time learning about electrostatics at the meeting in Rochester.

Here is a brief glimpse into the technical program: you will find papers on electrostatics induced flows and composite materials used as electrical insulation (Monday), electroporation and its applications in medicine and biotechnology, contact charging and triboelectricity, with a keynote given by Prof. David Dean from University of Rochester (Tuesday), and electrostatics applied to aerospace and atmosphere, with another keynote by Prof. Steven Barrett from MIT (Wednesday). A mix of all these topics are presented in a poster session on Wednesday afternoon, giving the audience an opportunity to interact with authors in a leisurely environment. As always, papers are presented both by our rising stars, the students who are pursuing electrostatics studies, and our experts. Do not miss out on all the fun and learning during the meeting, whether in a technical session or outside.

After an exciting and memorable period as President of the ESA, it is time for me to step down and invite others to continue the legacy of serving the society. I would like to take a moment to remember and cherish the time together, which has been great. I truly have enjoyed serving the society and working with the executives and conference organizers. Also, I've greatly enjoyed interacting with conference attendees, especially the students, during our annual and joint meetings. Finally, I would like to thank the members of the other three societies, the Institute of Electrostatic Japan (IEJ), the IEEE Industry Applications Society (IAS) Electrostatic Processes Committee (EPC), and La Societé Francaise d'Electrostatique (SFE), for their cooperation during our joint meetings. We are expanding this cooperation by inviting the Chinese Electrostatic Society to participate in the next joint meeting to be held on Price Edward Island (PEI, Canada) in June 2020.

This is my last message as President of the ESA. Thank you - I am grateful for all the support you have provided, whether through serving on a committee, attending the annual meeting, and/or donating to the future success of the Society. This is not a goodbye, only a change to my designation, and I am always there to serve the society and the field of electrostatics.

So long,
For the Friendly Society
Shesha Jayaram, *shesha.jayaram@uwaterloo.ca*
President, Electrostatics Society of America

Calendar

- Electrostatics 2019, April 8-11, 2019, and Dielectrics 2019, April 11-12, 2019, Manchester Conf. Hall, Manchester, UK, http: *http://electrostatics2019.iopconfs.org/home* & *http://dielectrics2019.iopconfs.org/home*
- 2019 ESA Annual Meeting, June 10-12, 2019, Rochester Riverside Hotel, Rochester, NY, USA, Contact: Kelly Robinson, *kelly.robinson@electrostaticanswers.com*, *http://www.electrostatics.org/annualmeeting.html*
- EIC 2019, Elec Insul Conf, June 16-19, 2019, Hyatt Regency Calgary, Calgary, Alberta, Canada, Further info: *http: http://ieee-eic.org*
- ICDL 2019, IEEE Int'l. Conf. on Dielectric Liquids, June 23-27, 2019, Univ. of Roma, Rome, Italy, Contact: Massimo Pompili or Luigi Calcara, *icdl2019@uniroma1.it*, *https://www.icdl2019.org*
- 4th ISNPEDADM 2019, Oct. 7-10, 2019, Bonifacio, Corsica Island, France. Contact: Eric Moreau, *eric.moreau@univ-poitiers.fr*

ESA Officers

President:
Shesha Jayaram, Univ. of Waterloo
Vice President and Awards Chair:
Maciej Noras, Univ. of North Carolina
Executive Council:
David Go, Univ. of Notre Dame
Poupak Mehrani, Univ. of Ottawa
Rajeswari Sundararajan, Purdue Univ.

Election of ESA Council Members

The ESA Bylaws provide for the election of officers every two years. Members vote for a complete slate of candidates at the annual meeting, and anyone is eligible to nominate or be part of a slate.

At this time, we have one nominated slate of candidates for this years election:

Slate of ESA Officers for 2019-2021
President
David Go, Univ. of Notre Dame
Vice President
Maciej Noras, Univ. of North Carolina
Executive Council
Shesha Jayaram, Univ. of Waterloo
N.K. Kishore, Indian Inst. of Tech., Kharagpur
Poupak Mehrani, Univ. of Ottawa

If anyone would like to nominate an alternate slate, please inform me well before the June conference so that we can prepare election materials for the business meeting.

Absent an alternate slate, we will likely approve the current nominated slate by acclamation.

Shesha Jayaram, ESA President
shesha.jayaram@uwaterloo.ca

ESA Elections By-Laws - New Council Slates Are Sought

Based on Article 4 of the ESA Constitution, the term of the present ESA Council ends on June 30, 2019 and the new Council term of office begins on July 1, 2019. It is now time for the Secretary (address found on back page of this ESA Newsletter) to receive slates of nominees for the upcoming (7/1/19 - 6/30/21) term.

Since the Council shall be nominated as a full slate, the presenter of that slate is responsible for checking with all the members of that slate to insure each nominee is willing to serve. A slate consists of five members: the President, the Vice-President and three Council Members.

If more than one slate is presented to the Secretary, a ballot will be mailed out about May 15 (or as soon as reasonably possible) with the deadline for receipt of the ballots by the Secretary being June 2, 2019. If only one slate is presented (then as tradition has held) no ballots will be mailed, and the Membership present at the ESA Annual Meeting will be asked to vote on the slate. If no slates are presented, then, as Article 4b states, "If extraordinary circumstances prevent the election of a new Council, the existing Council shall continue in office, year by year, until an election can be held."

2019 Annual Meeting of the Electrostatics Society of America

Rochester Riverside Hotel, Rochester, NY

June 10-12, 2019

The Electrostatics Society of America (ESA) 2019 Annual Meeting Technical Program includes presentations in scientific and technical areas involving electrostatics. Contributions range from fundamental physics and new developments in electrostatics to applications in industry, atmospheric and space sciences, medicine, energy and other fields.

Scheduled Technical Sessions

- Materials and Gas discharges
- Safety and hazards
- Measurements and instrumenation
- Biological and medical applications
- Contact charging and triboelectric effects
- Atmospheric and space applications
- Electrically-induced flows & electrokinetics

Keynote Speakers	Affiliation
Prof. Steven Barrett	Dept. of Aeronautics and Astronautics Massachusetts Institute of Technology
David A. Dean, Ph.D.	Dept. of Pediatrics, Biomedical Engineering, and Pharmacology & Physiology University of Rochester

Conference information is available at: http://www.electrostatics.org.

Student Presentation Competition: Presentations by undergraduate & graduate students are eligible for the *Student Presentation Competition*.

Important Dates

May 31, 2019 *Final manuscript deadline*
June 10, 2019 *ESA 2019 Informal Reception Luncheon, 11:30AM, Monday, 10 June 2019*
June 10-12, 2019 *ESA Annual Meeting begins at 1:00PM, Monday 10 June 2019*

Organizing Committee

N. K.	Kishore	Indian Institute of Technology Kharagpur, India	kishore@ee.iitkgp.ac.in
Kelly	Robinson	Electrostatic Answers	kelly.robinson@electrostaticanswers.com
Bill	Vosteen	Monroe Electronics	billv@monroe-electronics.com
Mark	Zaretsky	Eastman Kodak	mark.c.zaretsky@gmail.com

Technical Chair

Mark Zaretsky, Eastman Kodak Company, mark.c.zaretsky@gmail.com

About Rochester NY: On the southern shore of Lake Ontario in Western New York, Rochester (metro area population of just over 1 million) is New York's third most populous city. The University of Rochester and Rochester Institute of Technology have renowned research programs. Many important inventions and innovations originated in the Rochester area, and is the birthplace of Kodak, Xerox, Bausch & Lomb, Gleason, and Western Union.

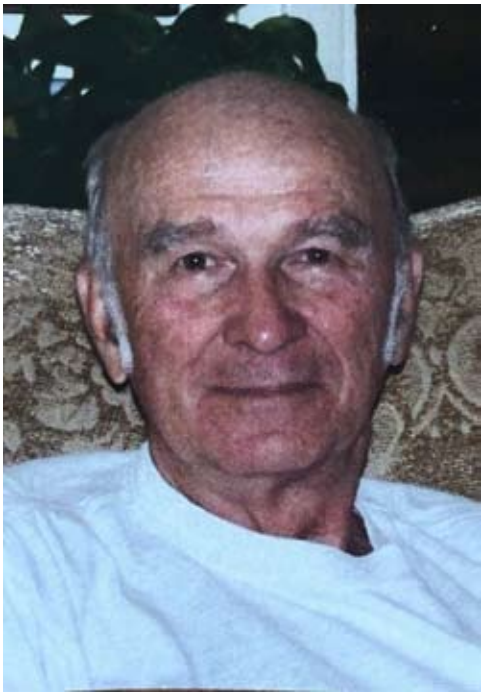
Obituary - Richard F. Bergen

Al Seaver

It is with a saddened heart that I must report the passing of long time ESA member Dick Bergen. The ESA is known as "*The Friendly Society*" and Dick was a master in putting that description into practice. I remember my first ESA Meeting in 1989 at Lake Placid, New York. Dick came over to me, introduced himself, and asked if this was my first meeting. After admitting it was my first meeting, he proceeded to tell me the many reasons why I would enjoy the ESA event. Then he introduced me to some other members and later sat down beside me during the first lecture series. Near the end of the event he gave me his definition of a successful meeting. He said he considered a conference successful if he met at least one new person and learned at least two new things. Such was Dick's ability to clearly describe the personal essence of a great meeting. By the end of the meeting I realized I was the "one new person" on his "successful meeting list" for that year. Every year before the start of the conference Dick would see the Conference Chair and ask if there was anything he could help with during the meeting. He was never the one to head a program but always one of the ones who made the event successful through his behind the scenes work. He also served as ESA Vice President under two ESA Presidents: Glenn Schmieg (1989 – 1991) and Joe Crowley (1992 – 1995). During the time I served as ESA President, Dick was an invaluable source of information on any topic involving the ESA. He had a great ability to break down any subject into its pros and cons. This ability was consistent with the way he did his technical research and is reflected in his many patents. All who knew him realize the ESA lost a little of its friendly magic with Dick's passing. Fortunately, others are carrying on his tradition.
– Respectfully submitted, Al Seaver

Richard F. Bergen

November 15, 1935 ~ January 31, 2019 (age 83)



Richard F. Bergen

Richard F. Bergen – Ontario, New York.
Richard (aka Dick) passed away on January 31, 2019 at age 83. He was born on November 15, 1935 in Webster, NY to Louis and Helen Bergen. Dick was also predeceased by his granddaughter, Rachel Bergen and 5 siblings. He is survived by his wife, Arlena (aka Missie) Bergen; sons, Richard, Gene (Pam) and Tom Bergen; daughters, Arlena (Eric) Zlatin and Jenifer (Randal) Calus; grandchildren, sister, Betty Furmage.

Dick graduated from the Rochester Institute of Technology in 1955, with a degree in Graphic Arts and Photography. He proudly served his country in the United States Army from 1955-1957 as a radar man. Dick was employed for Eastman Kodak for 10 years, and for over 30 years, he worked for Xerox as a physicist and inventor. During his professional career and after in retirement Dick was a prolific inventor and accrued a total of 47 United States Patents.

Dick was an outdoorsman, enjoying hunting, fishing, hiking and also had an interest in stain glass, magic and sailing. Above all, Dick loved his family and loved being with them. He will be dearly missed.

Dick was a great believer in humanitarian causes. Contributions in memory of Richard F. Bergen may be directed to Smile Train, at: my.smiletrain.org.

MIT engineers fly first-ever plane with no moving parts

Jennifer Chu

Since the first airplane took flight over 100 years ago, virtually every aircraft in the sky has flown with the help of moving parts such as propellers, turbine blades, or fans that produce a persistent, whining buzz.

Now MIT engineers have built and flown the first-ever plane with no moving parts. Instead of propellers or turbines, the light aircraft is powered by an "ionic wind" — a silent but mighty flow of ions that is produced aboard the plane, and that generates enough thrust to propel the plane over a sustained, steady flight. Unlike turbine-powered planes, the aircraft does not depend on fossil fuels to fly. And unlike propeller-driven drones, the new design is completely silent.

"This is the first-ever sustained flight of a plane with no moving parts in the propulsion system," says Steven Barrett, associate professor of aeronautics and astronautics at MIT. "This has potentially opened new and unexplored possibilities for aircraft which are quieter, mechanically simpler, and do not emit combustion emissions."

He expects that in the near-term, such ion wind propulsion systems could be used to fly less noisy drones. Further out, he envisions ion propulsion paired with more conventional combustion systems to create more fuel-efficient, hybrid passenger planes and other large aircraft.

Barrett says the inspiration for the team's ion plane comes partly from the movie and television series, "Star Trek," which he watched avidly as a kid. He was particularly drawn to the futuristic shuttlecrafts that effortlessly skimmed through the air, with seemingly no moving parts and hardly any noise or exhaust. "This made me think, in the long-term future, planes shouldn't have propellers and turbines," Barrett says. "They should be more like the shuttles in 'Star Trek,' that have just a blue glow and silently glide."

About nine years ago, Barrett started looking for ways to design a propulsion system for planes with no moving parts. He eventually came upon "ionic wind," also known as electroaerodynamic thrust — a physical principle that was first identified in the 1920s and describes a wind, or thrust, that can be produced when a current is passed between a thin and a thick electrode. If enough voltage is applied, the air in between the electrodes can produce enough thrust to propel a small aircraft.

For years, electroaerodynamic thrust has mostly been a hobbyist's project, and designs have for the most part been limited to small, desktop "lifters" tethered to large voltage supplies that create just enough wind for a small craft to hover briefly in the air. It was largely assumed that it would be impossible to produce enough ionic wind to propel a larger aircraft over a sustained flight.

"It was a sleepless night in a hotel when I was jet-lagged, and I was thinking about this and started searching for ways it could be done," he recalls. "I did some back-of-the-envelope calculations and found that, yes, it might become a viable propulsion system," Barrett says. "And it turned out it needed many years of work to get from that to a first test flight."

The team's final design resembles a large, lightweight glider. The aircraft, which weighs about 5 pounds and has a 5-meter wingspan, carries an array of thin wires, which are strung like horizontal fencing along and beneath the front end of the plane's wing. The wires act as positively charged electrodes, while similarly arranged thicker wires, running along the back end of the plane's wing, serve as negative electrodes.

The fuselage of the plane holds a stack of lithium-polymer batteries. Barrett's ion plane team included members of Professor David Perreault's Power Electronics Research Group in the Research Laboratory of Electronics, who designed a power supply that would convert the batteries' output to a sufficiently high voltage to propel the plane. In this way, the batteries supply electricity at 40,000 volts to positively charge the wires via a lightweight power converter.

Once the wires are energized, they act to attract and strip away negatively charged electrons from the surrounding air molecules, like a giant magnet attracting iron filings. The air molecules that are left behind are newly ionized, and are in turn attracted to the negatively charged electrodes at the back of the plane.

As the newly formed cloud of ions flows toward the negatively charged wires, each ion collides millions of

times with other air molecules, creating a thrust that propels the aircraft forward.

The team, which also included Lincoln Laboratory staff Thomas Sebastian and Mark Woolston, flew the plane in multiple test flights across the gymnasium in MIT's duPont Athletic Center — the largest indoor space they could find to perform their experiments. The team flew the plane a distance of 60 meters (the maximum distance within the gym) and found the plane produced enough ionic thrust to sustain flight the entire time. They repeated the flight 10 times, with similar performance.

"This was the simplest possible plane we could design that could prove the concept that an ion plane could fly," Barrett says. "It's still some way away from an aircraft that could perform a useful mission. It needs to be more efficient, fly for longer, and fly outside."

The new design is a "big step" toward demonstrating the feasibility of ion wind propulsion, according to Franck Plouraboue, senior researcher at the Institute of Fluid Mechanics in Toulouse, France, who notes that researchers previously weren't able to fly anything heavier than a few grams.

"The strength of the results are a direct proof that steady flight of a drone with ionic wind is sustainable," says Plouraboue, who was not involved in the research. "[Outside of drone applications], it is difficult to infer how much it could influence aircraft propulsion in the future. Nevertheless, this is not really a weakness but rather an opening for future progress, in a field which is now going to burst."

Barrett's team is working on increasing the efficiency of their design, to produce more ionic wind with less voltage. The researchers are also hoping to increase the design's thrust density — the amount of thrust generated per unit area. Currently, flying the team's lightweight plane requires a large area of electrodes, which essentially makes up the plane's propulsion system. Ideally, Barrett would like to design an aircraft with no visible propulsion system or separate controls surfaces such as rudders and elevators.

"It took a long time to get here," Barrett says. "Going from the basic principle to something that actually flies was a long journey of characterizing the physics, then coming up with the design and making it work. Now the possibilities for this kind of propulsion system are viable.".

(from *http://news.mit.edu/2018/first-ionic-wind-plane-no-moving-parts-1121*)

Researchers capture an image of negative capacitance in action

Linda Vu

For the first time ever, an international team of researchers imaged the microscopic state of negative capacitance. This novel result provides researchers with fundamental, atomistic insight into the physics of negative capacitance, which could have far-reaching consequences for energy-efficient electronics.

Capacitors are simple devices that can store an electrical charge. Their capacitance, or ability to store electrical energy, is determined by how much the capacitor's charge changes when it is connected to a voltage source, like a battery. Negative capacitance occurs when a change in charge causes the net voltage across a material to change in the opposite direction; so that a decrease in voltage leads to an increase in charge.

"The upshot is that the opposite relation between charge and voltage could locally enhance the voltage across the common dielectric material," said Sayeef Salahuddin, professor of electrical engineering and computer sciences, who led the overall effort. "The voltage 'amplification' gained could be used to reduce the supply voltage requirement in a transistor, thus making computers and other electronic devices more energy-efficient."

As we increasingly rely on computers for daily tasks, the energy needed to run these systems is becoming substantial. Studies show that the total electricity consumption by the world's data centers is equivalent to 10 percent of all electricity used in the United States. "This is where a new physical phenomenon such as negative capacitance could provide a completely new set of tools to improve the energy efficiency of our computers," said Salahuddin.

In 2008, Salahuddin theoretically predicted that the state of negative capacitance can be locally stabilized in a ferroelectric material by placing it together with another common dielectric, or insulating material. But until recently, this phenomenon could only be

Current Events (cont'd.)

detected indirectly.

The work in this paper directly captured negative capacitance in an atomically perfect superlattice of ferroelectric-dielectric heterostructure, synthesized by the group of Ramamoorthy Ramesh, professor of physics and of material science and engineering. Using state-of-the-art imaging techniques, the researchers mapped out the polarization as well as the electric field with atomic resolution. This allowed them to estimate the local energy density, which clearly showed regions where the curvature of the energy density is negative, indicating stabilization of the steady-state negative capacitance.

The same results were also obtained from state-of-the-art modeling techniques. Salahuddin notes that the confluence of experimental observation and theoretical calculation provides a concrete validation of the negative capacitance concept as well as an atomistic picture of a material in this state.

(from *https://engineering.berkeley.edu/2019/01/researchers-capture-image-negative-capacitance-action*)

Getting A Charge Out Of It

A.D. Moore Retrospective

A.D. Moore and the early days of the Electrostatics Society of America (ESA)

G.S. Peter Castle, Charter Member

In the previous issue I outlined the story of A.D.'s early career and the events leading up to the formation of ESA in 1970. In this and subsequent issues it is appropriate to let A.D. continue the story in his own words through sharing a few of his commentaries as provided in the early versions of the News Letter which he wrote for a number of years. This current issue of the ESA Newsletter is #250 and previous issues starting in Jan/Feb 2003 at #164 are currently available through the online archives accessible from the home page of the ESA web site. Copies of earlier issues should soon be available.

Attached below is a copy of ESA News Letter Number One, the first ever, as written and typed by A.D.

Of particular interest is his comment "Let us hope that our Society will continue, as far as possible, to avoid the rigidities that plague large organizations". To this day this is certainly one of the endearing characteristics of ESA.

Also of interest, the "dues" referred to amounted to $15/year. Currently they have risen to $20/year. Not many organizations can claim to have an annual dues inflation rate of only .577% per year over a 50 year period. For comparison, in this time span the cumulative CPI in the USA increased over 552% which would amount to a suggested level for annual dues of $98.

Number One ESA NEWS LETTER November 16, 1970

ELECTROSTATICS SOCIETY OF AMERICA

The ESA, founded three months ago on August 17, is still so young that it has no forms and no letterhead. Until now it had no NEWS LETTER. Even this issue is unofficial, since the Executive Council has not authorized it. However, being very young, we are still delightfully informal. Let us hope that our Society will continue, as far as possible, to avoid the rigidities that plague large organizations.

OUR BEGINNINGS are not familiar to all of our members. On July 14, 1970, I sent a letter to 32 people interested in electrostatics, and proposed that the ESA be founded. The response was encouraging. I then framed a Constitution, an Enabling Act, and a Ballot sheet, and sent copies to the same list.

Those who sent in ballots would thereby adopt the Constitution and the Act, and also vote for a five-member Interim Executive Council. The ballots were sent to an impartial receiver, Associate Dean H. W. Farris, College of Engineering, U. of M., for him to make the count and report on it. Seventeen came in by the deadline, and the Society was founded.

The 17 became the Charter Members. By Item 2 of the Act, others on the list could also become such, by way of request within a reasonable time. We now have 23 Charter Members. At this date, others who have joined bring the total membership to 37. Since all this has happened only through personal contacts and correspondence, we would seem to be doing quite all right. Membership will take a jump later, when national announcements are made in various journals.

Our membership is a mixed bag, with representation in meteorology, management, consulting, basic and applied research, manufacturing, and education. There are three international memberships, with more to come.

The INTERIM EXECUTIVE COUNCIL makeup as elected is: President, A. D. Moore; Vice President, Bernard Vonnegut; Members, Charles D. Hendricks, Emery P. Miller, Vincent J. Schaefer.

The ALBANY CONFERENCE ON ELECTROSTATICS will be held at Albany on June 8-11, 1971, with SUNYA (State University of New York at Albany) and General Electric as hosts. It is being sponsored by IEEE, AMS (American Meteorological Society) and ESA. Its General Committee is headed by Myron Robinson of the AEC (formerly, Research-Cottrell). The General Committee met at SUNYA on September 28-29 for planning. I learned today from Robinson by telephone, that we are getting excellent co-operation from IEEE and AMS. At the meeting the Committee fixed the nature of the program and selected the invited speakers. They asked me to round up the speakers. This has largely been done. They include Prof. N. J. Felici of Grenoble, France, and Dr. Masuda of Tokyo. Interest in the Conference is running high, even though here again, no national notice has as yet been given.

COUNCIL ACTIONS. Since there is an overlap in membership between the above General Committee and the ESA Executive Council, I called the first Council meeting for the same period as above, at Albany. The Council appointed Emery P. Miller as Secretary, and Duncan C. Blanchard as Treasurer. Annual dues were set at $15.00 per year.

The Conference General Committee requested ESA sponsorship for the Conference, and this was granted.

The ESA CONVENTION. Any new society has a lot to do to shake itself down into reasonably permanent form. We need a Convention, at which certain measures can be considered and acted upon. Bylaws are needed. Routines must be set up for nomination and election of the national officers (and the first such election will replace the present Interim Council). Having an ESA NEWS or NEWS LETTER or the equivalent should be discussed and settled. The very important matter of eventually having a professional ESA JOURNAL demands attention. Presumably, the ESA will take over the calling of electrostatic conferences of broad scope. For instance, should the next be an international conference, and if so, when? Another matter: should we appoint some leaders abroad, as correspondents or representatives, to establish rapport with like groups in other countries? And so on.

Therefore, your Council has called our first Convention, to be held in connection with the Albany Conference on Electrostatics: to take place, as a business session, on the last morning, Friday, June 11.

The ESA will be whatever our members will make it to be. Come to the Convention and "help make." Before that, we will welcome suggestions from any and all on any phase of our makeup and operation.

NEW MEMBERS. Those wishing to join ESA should write to me, Prof. A. D. Moore, Electrical Engineering, University of Michigan, Ann Arbor, Michigan 48104, giving name, title, connection, address, and interest in electrostatics.

DUES. If your dues check for the year 1971 has not come in, please mail it to our Treasurer, Dr. Duncan C. Blanchard, Department of Atmospheric Sciences, SUNYA, 1400 Washington Avenue, Albany, N. Y. 12203.

Cordially yours,

A. D. Moore

A. D. Moore, President ESA

(All who attended the Adirondack Conference on Electrostatics in October, 1968, will be saddened to learn that J. Hall Carpenter, President of CARPCO, Jacksonville, Florida, died about one month ago.)

Electrostatics
Society of America

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ESA Information

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2019 ESA Annual Meeting
June 10-12, 2019
Rochester Riverside Hotel
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