EMC Society History

Dan Hoolihan, Associate Editor, History Committee Chair

I wish a Happy New Year to all the interested history readers in the EMC Society. I hope that you enjoy the historical articles in this issue of the EMC Society Newsletter.

First, I'd like to share some general remarks and comments with you.

Mervin H. First – EMCS Founder

We heard from one of the EMC Society Founders since the last issue; Mervin H. First. On October 28th, 2008, he wrote, "I read with interest (and some chagrin) about the 50th Anniversary party in Hawaii. As one of the original Founders, I wondered why I, apparently, was never invited. I am attaching an article from the May 1984 Transactions correcting the original list, which apparently was not corrected on the invitation list."

We, of course, apologized to Mr. First for not knowing he was a Founder and that he was alive and well. We hope that there are no other Founders out there that we have missed in our research. If anyone knows of other Founders that we have not recognized, please let me know. You may reach me via the contact information on page 3 of this Newsletter.

The May 1984 issue of IEEE Transactions on Electromagnetic Compatibility did include an editorial by Richard Schulz titled "Setting the Record Straight" which added six names to the list of Founders: Robert Brook, John A. Eckert, Mervin First, Fred J. Nichols, A. T. Parker, and Jerry Rothhammer. We would also like to set the "record straight" and add those six names to the list of 326 names published in the last edition of the EMC Newsletter (Issue No. 219).

Henning Harmuth

Our re-publication of Henning Harmuth's paper on "Correction of Maxwell's Equations for Signal I" in Issue No. 219 of the EMC Newsletter brought a pleasant surprise, an e-mail from the author! We had been unable to contact Henning and were pleased to hear from him in an e-mail dated 10 December 2008.

He wrote:

"I received the EMC Society Newsletter and was very happy to see that my paper "Correction of Maxwell's Equations for Signals I" is well received after 22 years. I turned 80 in July and my last book came out in November. No more scientific activity; my short-term memory is terrible and I may have other age-related problems that I cannot diagnose myself.

I enclose two pages of my last book. In the preface, the scientific editor Peter Hawkes has something to say about Maxwell's equations. At the very end of the foreword, you will find Richard B. Schulz mentioned, who published my paper on Maxwell's equations in the *IEEE Transactions on EMC* in 1986.

How did you find out that my paper was frequently referenced? I once tried Google to search for Harmuth, H. and for Harmuth, H. F. but this did not work since apparently anybody with the name Harmuth was listed."

Now that we have the e-mail coordinates of both of these gentlemen, we will keep in touch with them.

See you in the next issue.

EMC Society Newsletter Review – 50, 25 and 10 Years Ago

50-Years Ago – Institute of Radio Engineers - Professional Group on Radio Frequency Interference (PGRFI) Newsletter, Number 4, February – 1959

The lead article was a reprint of a luncheon address at the Fourth Annual Armour Conference by Harold R. Schwenk, the chairman of the PGRFI. The title of his presentation was "An Outlook into the Future of the RF Interference Field and the Part that the PGRFI will play in the Future of the Field of RF Interference." His concluding sentence was "As you can see, the IRE Professional Group on RFI can play a very important role in the future of the RF Interference field, but it will require that we all lend a hand and work together if we are to be successful."

The membership of the PG on RFI was 497 members in January of 1959.

An interesting story in the Newsletter centered on a unique Anti-Missile device. In a book about World War II, titled 'Walker R.N.' and published by Pan Books Ltd., London, on page 135 is the following, "Against the 'Chase-me-Charlie' there was no defense until, one day in the bay, an escort was attacked by an aircraft which launched its 'glider bomb' just as a scientist aboard switched on his electric razor to test out a theory. To the amazement of the ship and the enemy aircraft, the new weapon gyrated about the sky in a fantastic exhibition of aerobatics, finally giving chase to its own 'parent.' In some inexplicable way, the 'Chase-me-Charlie' control system had been affected by the electric waves given off by the razor. This method was never officially admitted by the Admiralty as a defense measure, but the ships which sailed into the 'Chase-me-Charlie' areas found it fool-proof. In Liverpool, there was a sudden run on shops selling all makes of electric razors."

25 Years Ago – IEEE Electromagnetic Compatibility Society Newsletter, Issue No. 120, Winter 1984

The cover story was an appeal for "Nominations for Board of Directors." Petition forms could be obtained from William G. Duff at Atlantic Research Corporation.

An article internal to the Newsletter highlighted the upcoming 1984 IEEE International Symposium on EMC; it was to be the first IEEE International Symposium on EMC held outside of the USA. The Symposium was scheduled for Tokyo, Japan in October 16-18.

The EMC Personality Profile highlighted Dr. Robert J. Haislmaier, the Navy EMC Coordinator for the Chief of Naval Operations. (Note – The Chapter Angel Program of the EMC Society is named the Haislmaier Chapter Angel Program in honor of Dr. Haislmaier, an active EMC Society Board of Directors Member in the 1980s.)

Two EMC Society Members were elected to the Fellow Grade: Dr. Carl E. Baum for "pioneering the singularity expansion method and electromagnetic topology in electromagnetic theory and for development of EMP simulation and electromagnetic sensors" and Dr. Hiroshi Kikuchi for "contributions and leadership in plasma studies."

Robert D. Goldblum was the Editor of the Newsletter.

10 Years Ago – IEEE EMC Society Newsletter, Issue No. 180, Winter 1999

"Richard B. Schulz, May 21, 1920 to October 1, 1998" was the lead story on the front page of the Newsletter. Dick was a long-time member of the EMC Society and the editor of the IEEE Transactions on Electromagnetic Compatibility for 18 years. He was also a former President of the EMC Society and a Life Fellow of the IEEE. In his spare time, he chaired the 1968 IEEE International Symposium on EMC.

EMC Fellow Award winners included Stanislaw Grzybowski, Oren Byrl Kesler, Said El-Sayed Ismail El-Khamy, and Wen Xun Zhang.

Newly elected EMC Society Board of Directors members included Elya Joffe (KTM Project Engineering Ltd.), Don Bush (dBi Corporation), Ghery Pettit (Intel), David Millard (Georgia Tech Research Institute), and Doug Smith (Auspex Systems).

Janet O'Neil was the Editor of the Newsletter. **EMC**

Electromagnetic Compatibility Comes of Age

By R. M. Showers, EMC Society Founder

The science of electromagnetic compatibility has been in existence for several decades. As an art, it goes back much further, perhaps to the time of Edison when he was just beginning to experiment with practical electrical devices. I am sure that with some of his more sophisticated devices undesired interactions took place because of inadequate shielding or filtering. Certainly, with the advent of radio, incompatibility problems occurred as a result of the poor quality of transmitters and receivers. Perhaps the first formal recognition of electromagnetic compatibility problems occurred when the telephone and power companies found they had mutual coupling problems when their lines were carried on the same utility poles. Later on, the increasing use of the radio spectrum called for formal controls administered by departments in the post, telephone, and telegraph offices in many countries, or through the Federal Communications Commission in the United States.

Until recently, problems in electromagnetic compatibility were solved by specialists having familiarity with the equipments and systems which exhibited interactions and who received relatively little recognition for their accomplishments, except when their efforts failed, in which case the recognition was not particularly complimentary. Furthermore, these experts worked under extremely trying conditions, especially when called upon to solve problems that had arisen because of poor design of equipment, improper application and use of equipments, or because of sudden changes in environmental conditions which they were powerless to do anything about. In particular, they were usually called upon to solve problems "after the fact," when, if they had been called in on initial design and systems engineering stages, the problems encountered could have been entirely avoided. Except for the technical areas that have been mentioned and in the area of military electronics, where achieving electromagnetic compatibility was essential because of the high concentration of equipment and its frequently highly sophisticated nature, the EMC engineer obtained few rewards for his efforts. His accomplishments were attained through sheer dedication.

We are now on the threshold of a new era. Evidence of this fact includes the following: (a) the recent establishment of a new technical committee in the International Electrotechnical Commission on electromagnetic compatibility, TC 77, (b) interest demonstrated in the past several years by many manufacturers in determining what electromagnetic compatibility characteristics their equipment should have both from the point of view of their emission characteristics as well as their susceptibility characteristics, (c) increasing emphasis on the application of electromagnetic compatibility requirements in international trade, (d) the re-establishment of a group concerned with radio noise in Commission 8 of URSI, and finally (e) the recognition that electromagnetic characteristics of the environment must be described and controlled along with many of the other traditional characteristics such as temperature, pressure, humidity, chemical contamination, etc.

If the concept of a new era is accepted, then one might well take a few moments to reflect upon the status of the field of technology and perhaps speculate on what the future holds. In the first place, with new recognition, one should recognize new responsibility. The EMC engineer will be required to define this

area of competence clearly in relation to other areas of specialization, and to show all the potential users how his work can contribute to the solution of their problems. His services must be packaged in such a way that their value will be recognized. This may not be easy since the EMC area has so many dimensions. All types of electronic and electrical equipment are involved, and the techniques can be applied in early design stages, in development stages, in production stages, and in installation stages. Furthermore, the technology changes relatively rapidly. For example, the increased use of digital transmission techniques as compared to analog techniques requires new technology. Frequency ranges have changed, bandwidths have changed, and correspondingly methods of avoiding interference problems have changed. While much change has taken place over the last 15 years or so, we can expect more extensive application of digital techniques in the coming years.

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Dr. Ralph Showers, May 1975

It is because of examples such as this that this conference and other conferences like it are important. They are evidence of the dynamic nature of the discipline and provide opportunities for practitioners of the field to exchange notes on new problems, new methods of analysis, and new methods of solution. They also provide opportunities for persons with limited experience in the field to quickly become aware of the state of the art.

At this point, one may well ask—what is the future of the field? It lies in several areas which can be grouped into four categories: first, developments in adequate quantitative theories applicable to fundamental electromagnetic phenomena; second, development of new and improved techniques in electromagnetic compatibility control including methods of measurement of emission and susceptibility levels; third, development of components; and fourth, development of standards.

The theoretical problems include more accurate solutions of shielding properties of various configurations. Exact solutions for the shielding effects of coaxial structures are still not readily available to the practitioner. In the same general area, currently there is much effort on shielding from transient fields. Another area which still needs work is the theory of grounding. Here, the general principles are well understood but quantitative information on the optimum ground arrangements under particularly operating conditions is still not generally available.

Techniques of measurement and control of interference are needed in many areas. While the regulatory authorities have devoted much attention to the protection of radio broadcasting, control of electromagnetic compatibility in industrial operations is only beginning to get the attention that it deserves in the public market place. Undoubtedly, individual engineers working in particular companies have treated many of the problems which are likely to arise, but there does not appear to be available as general a body of knowledge as is needed. In addition, further work is needed in the development of techniques of measurement of both emission and susceptibility characteristics of all classes of equipment, especially with regard to their broadband and pulse characteristics.

In the component area, new types of wiring and cabling, including strip lines and means of protecting such lines, new methods of interference suppression, especially of the impulsive type, integrated circuits, and the development of optical waveguides can have major impacts on the field.

Finally, particular emphasis should be placed on the area of standardization. It is not appropriate to review the importance of establishing standards. Clearly, they have an important function in encouraging trade through the economies which are affected in manufacturing and in engineering. In line with the theme of this particular presentation, I should like to refer to the often quoted statement that, in fact, standards are an expression of the state of the art. Before one can write a standard, there must be a technology available which has general application. It must be based upon aspects of the science and the art which are widely understood and accepted. Until that state has been reached, standards cannot generally be written which are significant. Extensive work in standards is done at various levels within individual companies, within particular industries, and at national levels. At this conference, it is well to emphasize the international aspect. In the electromagnetic compatibility field, CISPR has been active for about 40 years. Its effectiveness in producing standards of general applicability is probably one of the more outstanding achievements of this kind of effort. The documents are highly respected and reflect work performed at a high technical level. In the past 10 years or so, the importance of the electromagnetic compatibility discipline has received broad recognition in the electro-technical field. A number of IEC technical committees have shown an interest in preparing standards related to their particular scopes. Because of the cross-disciplinary nature of the problems involved, the IEC has recognized the importance of centering this activity in a separate technical committee, and the formation of TC 77 was approved last year. This committee had its first meeting in Bucharest in September 1974.

At the present time, there is no apparent conflict in scopes between the CISPR and TC 77. TC 77 has undertaken to deal with low frequency phenomena; in particular harmonics of the power line frequency up to perhaps as high as 2500 Hz, and flicker phenomena which occur at a few cycles per second. While the phenomena involved are not new, the fact is that the problems caused by these effects are assuming increasing importance, especially in view of the development of solid-state techniques for power control. These devices, unless very carefully designed, are likely to introduce substantial harmonic and pulsing currents into the power supply system. These can react not only on sensitive equipment connected to the same power line, but can also create substantial problems in the power distribution equipment and control techniques associated with that

equipment. Solutions to these problems are necessary and can be expected to have substantial economic impact. It is therefore necessary that all of the available expertise be assembled to discuss them.

While TC 77 is concerned with some rather special problems at the moment, at the meeting in Bucharest the delegates were surveyed with regard to their general interest in other problems. The response was substantial. Included were problems in telecontrol, industrial equipment, electronic data processing control, radio communications, machine tools, medical equipment, and other areas. The spectrum of interest extended well into the megahertz range and clearly overlaps the areas of concern of CISPR in many respects. Just how this work will be developed in the future is the subject of study of a special Committee of Action working group.

It is perhaps of interest to speculate on standards developments in the immediate future. First, the need for industrial standards will be met in large measure by reference to the basic techniques used in controlling radio interference. For example, the fundamental basis for setting limits for protection of broadcasting has been levels of field strength to be protected. For the development of electromagnetic compatibility standards, clearly the criteria can be different. In industrial areas the objective is not the protection of broadcasting field strengths, but the obtaining of mutually compatible levels of emission and susceptibility. Although these may vary from industry to industry and from one location to another location in any given industry, there is surely a need for standards that can be invoked generally.

These standards cannot be set independently of those applied in broadcasting, since industrial equipment is already limited for this purpose. But, because of its location, it is permitted higher emission levels than in the home. In line with this, sensitive equipment used must have good susceptibility (immunity) characteristics, but a rational basis for establishing appropriate limits does not yet exist.

The program for this symposium contains a large number of papers which directly relate to this question of setting standards for achieving electromagnetic compatibility in various specific environments including urban, industrial and commercial areas, hospitals, aircraft and other, including pertinent measurement techniques. It is clear that rapid advances can be expected in the near future.

Practitioners in the field can look to opportunities to contribute to these efforts in the future, and they will be stimulated quite substantially by the outputs of these efforts.

Editor's Note: *This speech was the Keynote Address given by Dr. Ralph Showers at the 1st Symposium and Technical Exhibition on Electromagnetic Compatibility held in Montreux, Switzerland, from May 20-22, 1975. At the time, Dr. Showers was with the Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, PA. Dr. Showers was active as the Chair of CISPR as well as the Chair of the American National Standards Institute (ANSI) Accredited Standards Committee C63® (electromagnetic compatibility).* **EMC**