EMC Society History

Dan Hoolihan, Associate Editor, History Committee Chair

Stories from 50-25-10 Years Ago in the EMC Society Newsletter

50 - Years Ago - Fall 1958
No Newsletter was published in the fall of 1958. Issue Number 3 of the Professional Group on Radio Frequency Interference Newsletter was published in August of 1958 and the next Newsletter (Issue Number 4) wasn't published until February of 1959.

25 - Years Ago - Issue No. 119 - Fall 1983 - IEEE Electromagnetic Compatibility Society Newsletter
The cover stories of this issue included: (1) - Future EMC-S International Symposia Schedule [1984-1987] and (2) - The IEEE EMC Society Board of Directors Election [Directors elected for a three-year term beginning 1 January 1984 included Edwin Bronaugh, Robert Goldblum, Donald Heirman, Henry Ott, Richard Schulz and Art Wall].The internal stories included an Education Committee News report by Henry Ott where he reported the Committee was going to "put together a book of EMC related Experiments and Demonstrations." The Newsletter also reported that William C. Green, a Founding member of the Society, had passed away. Two pages of the forty-page Newsletter were devoted to results of the EMCS/BoD meeting held on 22 August 1983. Bill Duff was President of the Society, President-Elect for 1984 was Gene Knowles, and Bob Goldblum was the Editor of the Newsletter.

10 - Years Ago - Issue No.179 - Fall 1998 - IEEE EMC Society Newsletter
The cover story was "Past Presidents of the EMC Society" which included a picture of Past Presidents taken at the 1998 IEEE International EMC Symposium in Denver, Colorado. Represented in the picture were Ralph Showers (1960-61), Richard Schulz (1968), Gene Cory (1974-75), Don Heirman (1980-81), Bill Duff (1982-83), Len Carlson (1986-87), Don Clark (1988-89), Ed Bronaugh (1990-91), Bob Hofmann (1992-93), Warren Kesselman (1994-95), Bill Gjertson (1996-97), and Dan Hoolihan (1998-99). Internal Newsletter stories included the highlights of the Board of Directors attending the "EMC '98 ROMA" EMC Symposium, an Education Committee Report by Associate Editor Maqsood Mohd, a report by Andy Drozd on "EMC Experiment Demonstrations", and a Chapter Chatter column by Todd Hubing which included "EMC Limericks." An example of one of the limericks is shown below:

"There once was a man from Nantucket
Who slept in a very large bucket
'Twas lucky for him
He grounded the rim
For one stormy night lightning struck it!"

Janet O'Neil was the Editor of the Newsletter.

EMC War Stories

By Milton Kant, EMC Society Founder

I'll go back pretty much to the beginning of my career in EMC which was at the Sperry Gyroscope Company. In those years, Sperry was an equipment manufacturer that made all types of equipment from complete airborne systems to airborne systems including control systems for drones. They made navigation systems for aircrafts; they made ground equipment; they made high powered radar for ground systems and ship-boards; and they made submarine equipment. They were the subcontractor for the Polaris submarine navigation system so our RFI lab started out as a measurement facility.

Once you start making EMC/RFI measurements, you end up also helping to fix any problems that you uncover for the equipment that is out of specification. You end up learning how to filter EMI, suppress emissions, and shield equipment. This lab/troubleshooting experience led in turn to trying to educate the design engineers that they should design the EMI suppression and shielding requirements into their equipment as part of the equipment design.

We used to hold classes for design engineers to try to teach them the basics of EMI design. Not only was it important to do the design correctly but it was also economical. To try to fix a piece of equipment after it's been designed and in pre-production equipment, built and gone through tests - to try to change the design after that effort is much more expensive than the effort that is taken during the design to make sure that you analyze the equipment and put the fixes in at the beginning. Most of the design and circuit engineers at Sperry would only be interested in getting the equipment to work in terms of performance characteristics. The requirements for interference, reliability and all the other environmental regulations were usually just an afterthought. That attitude was prevalent throughout the industry.

One of the reasons for forming the EMC Society, or Professional Group on RFI as it was known then, was to try to

educate design engineers. By education, we didn't mean educating ourselves, which was part of it, but educating the people who designed the equipment, the equipment designers. At the time we started, one of the missions of the EMC Society would be to hold sessions during other Society symposiums to try to put this concept forth. A good part of my work at Sperry was trying to educate the equipment designers.

One of the examples I can recall, among the many, dealt with submarines. The Aegis system had a computer, which at that time was still a tube-computer because it used electronic tubes. They were using a clock bus in the megahertz range, two to four megahertz, around it. That bus was running around all the equipment. Naturally, when they tried to meet the spec, the signal was radiating all over the place. A good effort was made to try to contain clock frequencies within the computers and not let them radiate. Once again, the designers weren't interested in that. They just knew they needed the clock frequencies to be sent all around their system and how to use them in operation of the computer.

Another facet of this, another example that people didn't understand and still have problems with today, is the difference between when equipment is being interfered with and the interference is the desired radiation from a transmitter which interferes with equipment. We were building high powered radars which were being sited across the country as part of the early warning system. There was a site out at Mantioch, Long Island. They were getting complaints that they were picking up the radar on the radio and hi-fi systems out there. A second site in Michigan was interfering with a control tower at an airport nearby. We would go out and check the radiated characteristics of the signal to make sure that it met the requirements or that the harmonic levels were low. We made field measurements to validate that they were within the allowable limits. Then, we had to convince people that it's not the problem of the transmitter, rather, the design of the audio equipment was such that it was susceptible to these high-powered radars which supposedly indicated that no equipment was tested for susceptibility characteristics, especially commercial equipment. This is being remedied these days; I think there is much more awareness of the fact that all of the new electronic equipment is susceptible to high-powered radiation.

My work at Sperry was a good education for me. When I left Sperry, I went to RCA to work on the Aegis system. My experience at Sperry, of course, contributed to my work I was doing there. This led to RCA finally being given the Ship Integration responsibility for the Aegis systems, which included the topside design of the whole system - the entire ship! With EMC being an important part of that, EMC engineers were given a lot of that responsibility to locate antennas and for the design of the ship. The Aegis Destroyer not only had EMC requirements, it had for the basic systems very high-powered radar. It was a challenge to make sure all of the other systems on the ship could operate when the radar was operating. The ship also had all kinds of survivability requirements and low radar cross-section requirements. So my RF experience as an EMC engineer helped in doing Othello locations, in the ship design characteristics because even at the beginning, when I think back to my work at Sperry, EMC engineers were considered magicians. It was an art, black art to a lot of people. They just didn't know about it. Part of our development included being able to get more of an engineering approach to the subject. This led to the development of all the miracle codes and everything they used for antenna location and ship hull design.

I ended up in a position where, due to my EMC background, I could really contribute to the whole top side design of the Aegis ships there. The culmination of that work was attending the commissioning of the first DD51 Cruiser in 1991, which was just before I retired. I worked on the Aegis for about 22 years and applied much of the knowledge that I learned at Sperry.

Leonard Keeps Giving: Another Dig into The Past

By Mike Violette, Washington Labs

About thirty minutes from the US National Archives is a humble storage complex at Tyson's Corner, an architectural inversion of the federalist-style granite building that cradles the scriptures from the founding of our country. For the EMC Society, this humble Virginia facility holds the recovered scrolls from our early summer trip to Leonard Thomas' inner sanctum, a critical link to the history of our Society's founding.

As summer reluctantly left the stage to fall on a brilliant blue-sky Friday, Dan Hoolihan, EMC Society Historian, continued his hunt for the near-legendary, possibly mythical list of the names of the original EMC Founders. Words have been whispered, theories proposed and emails exchanged: somewhere in the first secretary's earthly possessions was that fabled list. That morning, fortified by a life-shortening, but delicious egg, sausage and Swiss cheese breakfast sandwich, lovingly assembled on a fresh multi-grain brioche and washed down with a

truly above average cup of coffee, we advanced like knights in search of the Holy Grail, but with maybe less ecclesiastical fervor and certainly less clunking, and not on steeds, but in four

cylinder sedans.

As traffic in Tyson's wound up to its usual frenetic and loathsome neck-muscle tightening swirl, we set forth off to find it: The List.

Once again, we found much more.

Dan's reverent guidance was simple and direct, I posit not unlike Lewis Leakey's gentle words to his staff as the first indications of the fossilized bones of *Australopithecus afarensis* or *Lucy* were swept clean of eons of limbo. "Careful lads," I imagine him saying. "The smallest scrap might hold the biggest clue."

Maybe we would be as lucky and our Lucy would be brought to light.

It was with measured optimism that we pulled into a cookie-cutter orange storage company where people keep their treasures that they rarely visit and have mostly forgotten: toys they no longer play with and clothes that don't fit and appliances that will never again feel a crackling glow in their electrical circulatory system.

Not unlike Howard Carter's feeling of elation upon discovering the resting place of Tutankhamen (ok, ok it's a stretch), we gently coaxed the cipher lock open.

With a soft click the door yielded and we entered the climate-controlled tomb of unloved prized possessions.

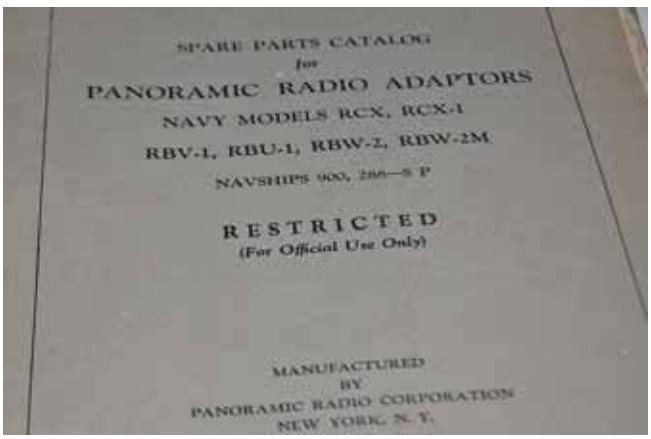
With a clattering rattle, the overhead metal door was flung open and light bathed a wondrous scene. We had to pause and catch our breath, brows wet, despite the conditioned air of the place. My nostrils filled with the sweet smell of timeless nostalgia; the air swirled mysteriously overhead as a motor kicked to life someplace (did I catch a whiff of mimeograph ink?). I reeled for a moment. In those lovely white cardboard sarcophagi was the march of time, possibly five decades or more: pencil, pen, carbon paper, Xerox, thermal facsimile, so many ways of communicating.

Again back to Carter: I imagined him studying the cuneiform and hieroglyphs under flickering lights. If only we could douse the glaring incandescent lights and hold torches to our treasure, we might then understand fully that thrill. Unfortunately, the Fairfax County Fire Department generally frowns upon the possession and burning of kerosene-soaked torches in enclosed spaces.

The Forties

We set to work, opening the boxed files as hundreds of voices of EMC past fairly chattered. We searched each and every file in pursuit of the List. At another time, with more leisure, each set of documents could entertain and inform for hours. But time was against us.

Did we fear that the precious documents would crumble to dust? Or was there a meticulous but benign spirit whose essence shadowed the fifty years of carefully-typed minutes and meetings? Did the engineers who invented the devices in the catalogs and specifications cry out in haunting voices: "Remember My Oscillator. I Have Created It!"? Or did we feel the ghost of a WWII Navy Technician, forever bound to the Earth, hopelessly searching for the Spare Parts Catalog for Panoramic Radio Receivers, published nineteen forty five? No, no--No such thing, all imagined. Dan had to hop a plane at noon.



BELL TELEPHONE LABORATORIES

463 West Street New York 14 March 18, 1949

1690-JCS-SJD

MR. LEONARD W. THOMAS
Electronics Design & Development Div.
Bureau of Ships
Dept. of the Navy
Washington, D.C.

Bell Telephone Labs.
Deal, N. J.

Dear Mr. Thomas:

I am glad to inform you that your paper "Interference Reduction" has been accepted for presentation at meeting sponsored by Commission 4 of the URSI in Washington on May 2-3. You will be informed of detailed arrangements later.

I note with interest another paper at the same session which seems to be closely related to your subject, "Radio Interference Problems of Aircraft Design", by C.F.W. Anderson. One thought which has been in the mind of the committee planning these meetings has been that it is desirable to conduct them more as symposia than has been done in past years, with the idea of encouraging discussion. Perhaps if both you and Mr. Anderson

Our Plutarch remained steady at his task and muttered quietly, reading off the names of the Founders and followers of the EMC Soceity, lost in a certain reverie as he scanned minutes of years of meetings and various correspondences, reading the names:

Fisher, O'Neill, Nichols, Kesselman, White, Showers, Heirman, Schlicke, so many others.

We must be close to finding the Keystone.

Meanwhile, I had the good fortune to sift through some of the collection: correspondence, professional and semi-personal collections of articles, standards and publications.

The first ANSI C95.1 was about five pages long. Ten milliwatts per cm squared.

Curiously, a letter written to a young Mr. Thomas slipped from a manila folder and floated to the floor. Dated March 18, 1949 on Bell Telephone Laboratories letterhead, carefully typed on a Remington or Smith-Corona manual, it read, in part. (I imagine Leonard's thrill: Ah, publication!).

"Dear Mr. Thomas,

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Interference? Back in 1949? The transistor was still in swaddling clothes! But, I am reminded: The more things change, etc. And as to the pursuit of the paper: "Interference Reduction", truthfully, I am not unhappy that Mr. Thomas' paper did not reduce all of the interference, for, lo it is often a lonely and painful pursuit, were it not for interference, we would not be slabbing words on a page for the EMC Society's Newsletter.

The Fifties

Advancing my search a decade and more than slightly off-task, I marveled at the deft innovation of the motor-operated "Mechanical Sweep Drive" from the General Radio Catalog which "attaches to knobs, dials or shafts" to speed EMC tests. Even in its infancy, a certain tedium accompanied our work. Confession: It has not been too long since we rigged an electric drill to our venerable HP 8672 signal generator to accomplish the same thing. (And a paper clip jammed in the frequency increment button does the trick on an 8656.) As to the frequency standard, I can't imagine calculating the uncertainty accompanying a calibration on the four hundred pound, seven foot rack of wire, knobs and tubes.

A third box produced a yellowing Kraft-paper envelope which granted us some more gold, complete with black and white photographs. Locale: off the coast of California. Maybe a studied propeller-head reader of this article can weigh in on the

Mechanical Sweep Drives

adapt Manually-Operated Equipment to Automatic Sweep Applications

Type 1750-A Sweep Drive . . . $510

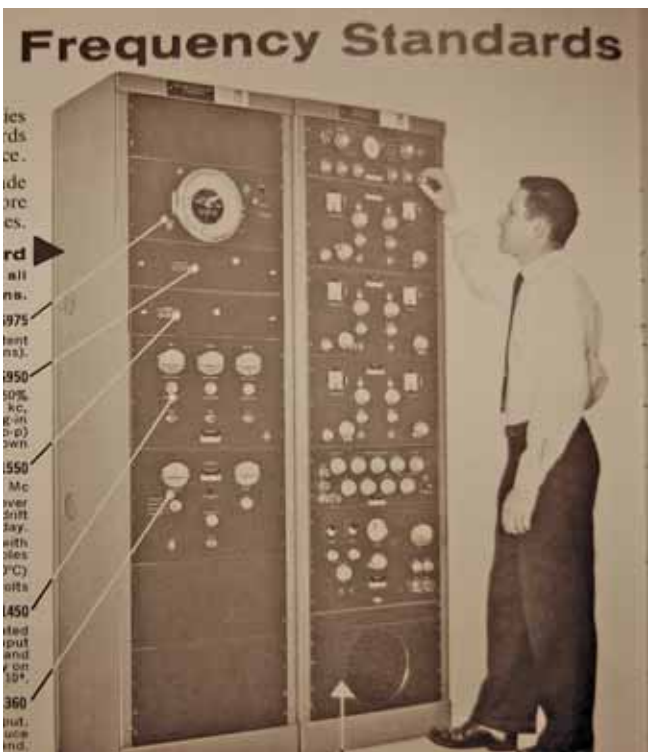
Attaches to knobs, dials or shafts for automatic sweeping of oscillators and other equipment. Sweep arc, speed, and center frequency are all continuously variable, even while the Sweep is in motion. Speed is adjustable from 0.5 to 5 cps — a CRO sweep voltage proportional to shaft-angular position is supplied, permitting calibration of CRO horizontal axis — limit switch, universal coupling system and many other features.

The Type 1263-B Regulated Power Supply is designed to power the Unit Oscillator as well as to keep the oscillator's output constant over wide ranges of frequency. It does this by comparing the rectified r-f output of the oscillator against an internal reference voltage, and applying any necessary corrections to the oscillator through its plate voltage supply. With this setup, output is maintained within 2% over the oscillator's entire frequency range.

1263-B

874-VQ

Unit Oscillator



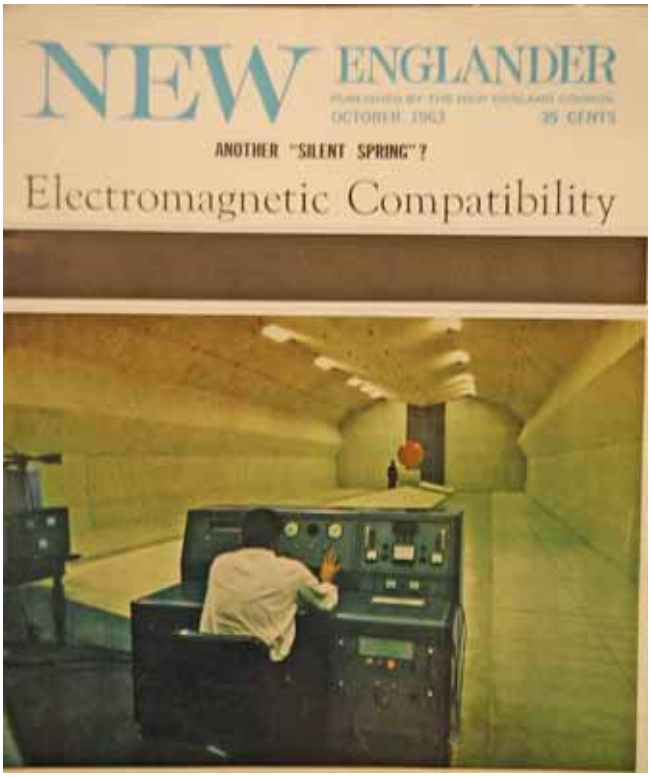
make and model of the airplane while the rest of us can marvel at the RF rig that this young engineer is using to do his EMC thing. Check out the "graphical interface": pre-pan display; pre-Polaroid; post-papyrus.

We're not sure who this pioneer is (Leonard, himself, perhaps?), but the caption of the above photo reads "ambient test" and this particular project looked like a site survey or RF system performance measurement of some kind; in the envelope were multiple aerial photos taken through the window of the small tail-dragger in the background.

The Sixties

The US was firmly in the grip of the hysteria of the Cold War and apocalyptical fear gripped the pen of the author of the article on EMC in the New Englander, a general-interest publication. In the October 1963 edition it carried an ominous article on EMC, likening the problem of RF Interference to that unveiled in Rachel Carson's book of that time on the environment: Silent Spring. The bent of the article was that the uncontrolled growth in radio frequency emissions was going to leave the spectrum a hostile and toxic place. There are some amusing snippets in the piece, including likening RF propagation to nuclear 'fissing', to wit:

"...when the static energy travels and snowballs, picking up more energy and gathering strength as it goes, ending up miles from its original source, that can be dangerous..." Hmmm.



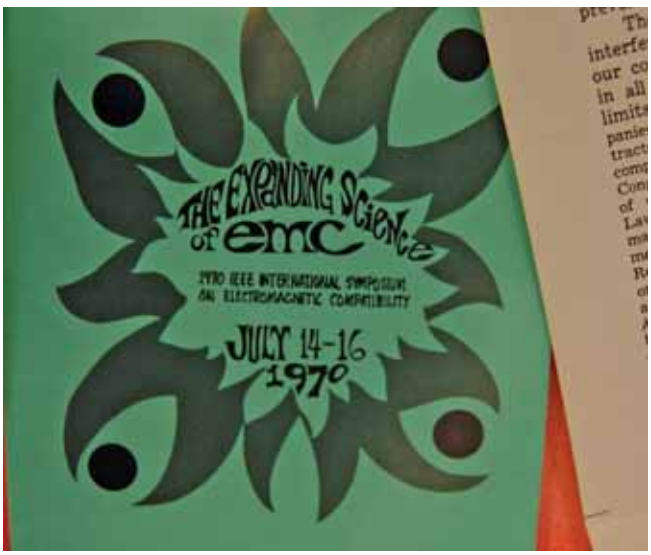
And "Another Silent Spring may be in the making." Yikes! The article goes on its exposé of the various levels of interest, ignorance and denial that are the human condition, and again, the more things change..."As a result of man's inventiveness and passion for miniaturization, products emitting electrical energy have been made even smaller and smaller--and packed closer to other sources of spurious emission."

And finally, a time-proven statement: "The FCC staff is overworked and understaffed."

In the fine but faulty rhetoric of the Post-McCarthy era, it speaks of "an EMC-riddled atmosphere."

If that were true, we'd all be looking for jobs. Too much EMC? Let us pray not!

But smug observations aside, it's an interesting read, for sure, and talks about the origins of the Electromagnetic Compatibility Analysis Center (ECAC) in Annapolis. One interesting paragraph harkens to the early formation of the EMC Soci-



ety. "...in 1957 the Professional Group on Radio Frequency Interference of the Institute of Radio Engineering was formed and has now changed its name to the Professional Technical Group on Electromagnetic Compatibility (PTGEMC) in order to include the entire interference field."

Aha! Another click of the Rubik's Cube. We can't be far-off...

The Seventies

But before we advance to the present, we have to pay homage to one more decade. Tripping along through the sixties we welcomed the engineering community to the summer of love and the groovy EMC Society with the "1970 International Symposium on EMC." That is some Aquarius cool, the Expanding Science of EMC. WOW! Let's jump in the hot tub, celebrate the next few decades of discovery (and hope there's no leakage current).

Engineers in bell-bottoms. Far out!

List Ho!?

At this point, our time was running out and we hadn't found what we were looking for and the effects of the morning's coffee had worn off. We decided to stop after one more box and leave the rest to another time when fortuitously a folder with the title: "EMC History" was pulled from the fourth box. Dan's hands trembled as his eyes fell to handwritten sign-in sheets and finally, perhaps, the Grail itself--a transcribed list of names on graph paper.

"I think we may have it," Dan said, his laconic mid-western manner thinly and insufficiently covering his excitement. "I'll write this down and see if our members recognize these names."

Buoyed, but cautious, we re-sealed the tomb and left, vowing to return and sift through the archives once more, should our mission not be complete.

Dan made his plane.

Thanks again Mr. Thomas.

Epilogue

Well, is it the list? Dan, what did you find?

Bibliography

The Leonard Thomas Archives. 1940s-2006

The New Englander. The New England Council for Economic Development. October 1963.

Dan Hoolihan (left) and Mike Violette used a self-timer camera to document the historic moment when they discovered what may be the petition to form the Professional Group on Radio Frequency Interference (PGRFI).

Dan Hoolihan (back row center) organized a special lunch to honor EMC Society Founders and Past Presidents, including (front row from left) Joe Fischer of Fischer Custom Communications, Founders Ralph Showers and Tony Zimbalatti, Todd Hubing of Clemson University, (back row from left) Bill Gjertson of Boeing and Joe Butler of Parker Chomerics.