

PERSONAL RECOLLECTIONS OF THE EARLY HISTORY OF THE UFFC-S

by

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1. My Introduction to the IRE-PGUE

My earliest recollections of the historical predecessors to what is now the IEEE UFFC-S go back to the fall of 1955. In October of 1955, I received a Ph. D. in Physics from Lehigh University in Bethlehem, PA., and on October 11th, the day before Columbus Day, joined the Technical Staff of Bell Telephone Laboratories at the Whippany, NJ location. In those days the Whippany Laboratory was engaged primarily in the development of military systems and hardware. The department I joined was headed by Roger Sykes, a man who had spent much of his career in the Bell System developing quartz crystal resonators. There were three supervisory groups in the department at that time; a quartz resonator group, an ultrasonic delay line group, and a ferroelectric crystal memory development group. I wound up going into the group working on ultrasonic delay lines.

How did I wind up in the delay line group? Earlier in the year, as part of the Bell Telephone Laboratories recruitment procedure, I had a two-day tour of several different departments at the Murray Hill and Whippany locations of Bell Telephone Laboratories and had the possibility of selecting one of several different activities. My doctoral dissertation at Lehigh was an experimental study of the details of transient stress wave propagation at the end of an impacted aluminum bar. I thought it would be advantageous for my career to stay in an area of development activity close to the field of my doctoral research.

The supervisor of the delay line group was Morton D. Fagen. The senior engineer in the group was John E. May, Jr. It happened that both these men were active in the founding of the Professional Group on Ultrasonics Engineering (PGUE) within the Institute of Radio Engineers (IRE). Within a few months John May became for me both a mentor and a close personal friend.



Fig. 1. Allen H. Meitzler (left) and John E. May, Jr. (right). This photograph was taken February, 1962. John May was the 4th Chairman of the IRE-PGUE AdCom and, in 1962, Allen Meitzler became the 6th Chairman.

Within less than a year after receiving my first paycheck from Bell Telephone laboratories, I joined the IRE; my official membership enrollment date is June 1, 1956. Even before I became a member of the IRE, Mort Fagen and John May invited me to join them in attending committee meetings of the PGUE, which had been formed only a year earlier and was struggling to come up to a viable membership strength. These meetings all took place in New York City (NYC). Besides John May and Mort Fagen, other men I remember meeting at these early committee meetings were Warren Mason of the Murray Hill location of BTL and Prof. Cyril Harris of Columbia University. Unfortunately I have no recollection of meeting Amor Lane, although he played a major role in the initial formation of the IRE-PGUE and surely must have been present at some of meetings I attended.

In the late 1950s and early 1960s, there were two major meetings of the IRE. One was the IRE International Convention and Exposition, which took place in NYC around the second or third week in March. The other major meeting was the IRE Western Electronic Show and Convention.; this meeting took place at a site on the west coast, usually in August. In the fall of 1955, when I joined BTL, Mort Fagen was actively involved in organizing a PGUE Session for the '56 March Convention, and he was interested in increasing the PGUE participation to two sessions for the 1956 convention¹. As part of this effort to increase the number of PGUE sessions, he persuaded me to give a report on my doctoral research at Lehigh University in one of the PGUE sessions at the 1956 IRE March Convention. That was my first paper presented at an IRE meeting. (A printed version of the paper was published in the 1956 IRE Convention Record and can be found in the UFFC Digital Archive.)

2. Early Meetings of the IRE-PGUE Administrative Committee

When I think back and try to remember the people at the earliest AdCom meetings I attended, I find that basically the attendees at these committee meetings fall into three groups. Naturally enough, the people I remember best are those I had an association with as fellow employees of Bell Telephone Laboratories. In this group, fall

¹ Sometime during the 1956-57 time period, Roger Sykes' Department was reorganized. The quartz crystal activity stayed under Roger Sykes and was transferred to Merrimack Valley, Connecticut. John Rowen was brought in as a new Department Head to manage the ultrasonic device activity that remained at Whippany, New Jersey. Morton Fagen was promoted and transferred to the Public Relations Department at Murray Hill. With this transfer, he left the field of ultrasonics. An major career accomplishment of Fagen's was to serve as the editor of the first three volumes of a massive, seven-volume set of history books entitled, "A History of Engineering and Science in the Bell System" published by Bell Telephone Laboratories, 1978.

people like Morton D. Fagen, John E. May, Jr., Warren P. Mason, and Robert N. Thurston. The group I remember next best are people who were involved in delay line, quartz resonator, and ceramic piezoelectric transducer development. This group includes people like David L. Arenberg; Don Berlincourt, Hans Jaffe, and Oskar Mattiat (Berlincourt, Jaffe, and Mattiat were all three of the Clevite Corp. in Cleveland, OH.); William F. Konig; J. J. G. McCue; Arthur Rothbart; Vincent Salmon, and Ralph Woolett.

Table 1. The Membership Composition of the Early PGUE AdComs

Explanation of Symbols: C – Chair, V- Vice Chair, S- Secretary, T- Treasurer, EM- Elected Member, XO- Ex-officio Member. The asterisk indicates members whom I remember well enough to retain a mental image.

Year(s)	1954-55	1956	1957-58	1959-60	1961	1962
C	A. L. Lane	M. D. Fagen*	C. M. Harris*	J. E. May, Jr.*	W. Roth	A. H. Meitzler*
VC	M. D. Fagen*	J. F. Herrick	L. Batchelder*	L. Batchelder*	D. L. Arenberg*	R. S. Woolett*
S	M. Kenny	J. E. May, Jr.*	F. J. Larsen	H. J. Bickel	H. J. Bickel	A. Rothbart*
T	J. Bernstein	J. Bernstein	D. L. Arenberg*	D. L. Arenberg*	H. J. Bickel	A. Rothbart*
EM	W. J. Fry	W. A. Anderson*	W. A. Anderson*	D. Berlincourt*	D. Berlincourt*	R. Bechman*
EM	J. F. Herrick	C. M. Harris*	D. Berlincourt*	M. D. Fagen*	M. D. Fagen*	W. J. Fry
EM	W. P. Mason*	T. M. Lambert	E. G. Cook*	W. J. Fry	W. J. Fry	H. Jaffe*
EM	F. Massa*	W. P. Mason*	M. D. Fagen*	C. M. Harris*	F. Massa	J. J. G. McCue*
EM	O. Mattiat*	O. E. Mattiat*	J. F. Herrick	J. F. Herrick	O. E. Mattiat*	R. L. Rod*
EM	K. S. Van Dyke	K. S. Van Dyke	O. E. Mattiat*	F. Massa*	J. E. May, Jr.*	W. F. Konig*
EM				O. E. Mattiat*	J. J. G. McCue*	R. N. Thurston*
EM				A. H. Meitzler*	A. H. Meitzler*	
EM				V. Salmon*		
XO						D. L. Arenberg*
XO						M. D. Fagen*
XO						F. Massa*
XO						O. E. Mattiat*
XO						J. E. May, Jr.*
XO						W. Roth
XO						V. Salmon*

The present-day IEEE UFFC-S AdCom and Symposium committee meetings involve people from Europe, Asia, Canada, and all over the United States. In contrast, the early IRE-PGUE AdCom and Symposium committees were made up mostly of people

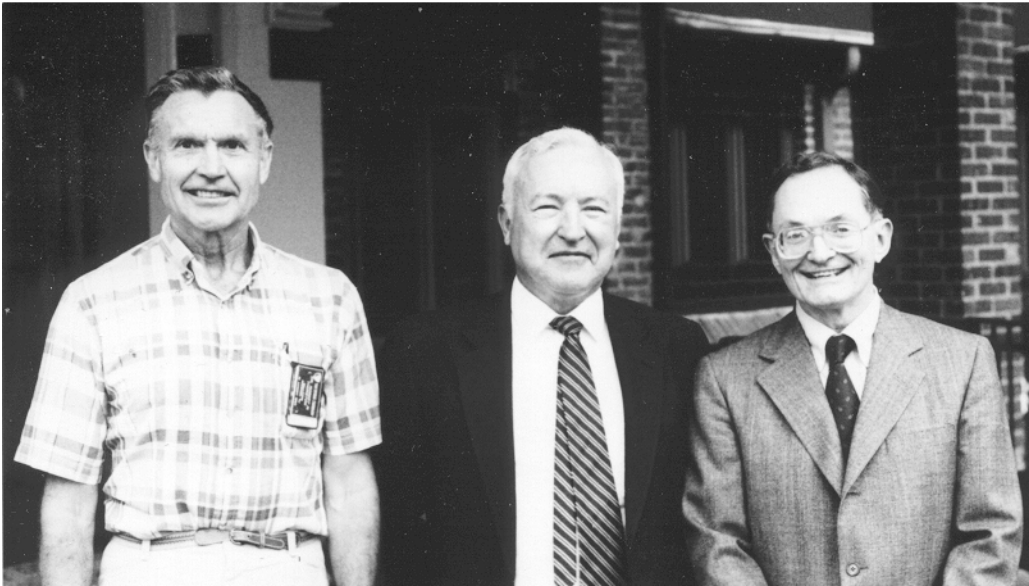


Fig. 2. Robert Thurston (left), the author (center), and Arthur Ballato (right). This photograph was taken during the summer of 1991. Bob Thurston was an early member of the IRE-PGUE . He was the Technical Program Chairman for the 2nd Ultrasonics Symposium held at Columbia University in NYC and served in 1962-63 as an elected member of the AdCom. Art Ballato was elected to the UFFC-S AdCom in 1980 and since 1981 has served as the Chairman of the UFFC-S Standards Committee.

from the eastern half of the United States and meetings were pretty much east-coast centered, New York City activities. Most of the AdCom and Symposium Committee meetings were timed to coincide with the IRE International Convention, always held in New York City around the second or third week in March. Many of these committee meetings were held in the old IRE headquarters, which was a beautiful, stately mansion at 1 East 79th St. in Manhattan. It was located at the corner of 5th Ave. and 79th St., across Fifth Ave. from the Metropolitan Art Museum. It was an architectural masterpiece with a wide, curved marble staircase, huge chandeliers, marble floors, and a large, high-ceilinged conference room with the largest mahogany conference table I have ever seen. After the IRE-IEE merged to become the IEEE, the IEEE management decided the mansion was no longer functional and sold the property. I really hated to see the mansion go.

While I can remember the mansion that served as the IRE Headquarters building well, I can only remember two meetings that took place in it. One was a meeting with a large group of people present. I suspect it was probably a meeting of something like the Technical Activities Board (TAB). The Chairman of the meeting was Bernard (Bernie) Oliver. At the time the meeting was held, Bernie Oliver held some high management position in the Hewlett Packard Corporation. There must have been at least forty people present and the meeting took place in the large conference room on the second floor. This was the room with the huge chandelier and the large mahogany table. The other meeting

that sticks in my memory was a meeting of the Program Committee for a Symposium when I was the Technical Program Chair. This meeting was held in a small corner room in the basement of the mansion, just slightly below street level, with bay windows that looked out on 79th St.. Warren Mason was there and I remember I stood at a blackboard and wrote out the abbreviated names of the submitted papers so that we could decide which papers to accept and which to reject. After the initial selection process, the accepted papers were grouped into several technical sessions and the final program was arranged.

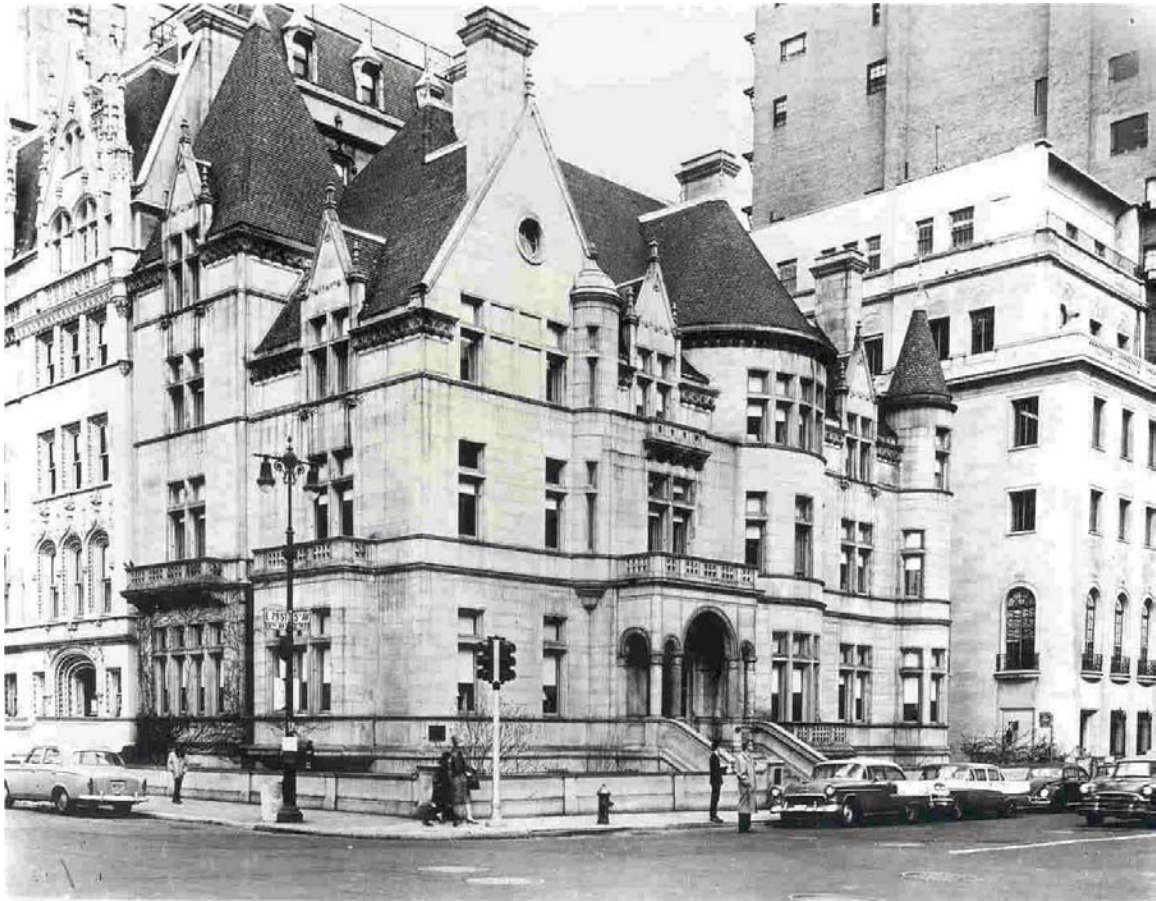


Fig. 3. The IRE Headquarters at 1 East 79th St. was the site of many committee meetings held by the early IRE-PGUE in the late 1950s. After the IRE and the AIEE merged to form the IEEE, the mansion was sold, torn down, and replaced by a modern office building. (Photograph supplied by the IEEE History Center.)

At the March, 1962 AdCom Meeting, I was elected Chairman of the AdCom and Ralph Woollett was elected Vice Chairman. The term of service was supposed to be from July 1, 1962 to June 30, 1963. I do remember I was quite thrilled to receive the recognition and honor of being elected Chairman of a national professional society. Curiously enough, writing this about 40 years later, I do not remember many of the details of my term of service as Chairman. I do remember that the newly merged IEEE

was having money problems and the great concern was to manage the affairs of the group in such a way that no financial losses were produced.

One incident related to the financial concerns of the IEEE sticks in my memory. It was the custom in those days for the AdCom to meet in the morning at the old IRE Headquarters building. When lunch time came, we would adjourn and go to a restaurant nearby on 4th Ave. and the Chairman would buy lunch for the group, sign a bill, and have the restaurant forward the bill to the IRE Headquarters for payment. About 12 to 15 AdCom members ate lunch and, following the practice that had been established by my predecessor chairmen, I signed the check for somewhere between \$200 and \$300 and told the restaurant manager to forward the bill to the IEEE. About two weeks later, I got a call from an irate woman in the IEEE Treasurer's office who gave me a severe, and especially memorable, tongue lashing for my extravagant expenditure of Group funds to buy lunch for the AdCom. (I sometimes think of this incident when I attend present UFFC-S AdCom meetings. These meetings are usually held in luxury hotels with 40 to 50 people in attendance. The AdCom meetings are all-day affairs and include breakfast and lunch served buffet style, and in the evening, full-service, sit-down dinners. The dinners are preceded by social hours with an open bar and AdCom members are allowed to bring a spouse or companion to the dinner. The total bill for providing sustenance to the AdCom members for their whole day's efforts surely runs into the thousands of dollars. As far as I know, no one at IEEE Headquarters objects to these expenditures. *Quae mutatio rerum!*)

Around the time I became the group chairman, a practice was started by the IEEE Executive Committee of having a Headquarter's representative or Group Coordinator attend the meetings of the various AdComs. The man who served in this capacity was Dr. Richard (Dick) Emberson. Dick Emberson was a pleasant fellow who really was very helpful in transmitting the concerns of the society's Executive Committee to the individual professional groups and providing a return path for the groups to express their needs and concerns to the Executive Committee. At the end of my term of service to the AdCom as chairman, Dick Emberson asked me to write him a letter summarizing the activities and accomplishments of the group during my term of office as Chairman. I remember that I did what he asked, but unbelievably, I failed to keep a copy for my records. It would be nice to be able to include a copy of this report as an appendix to this document. In the past year, I contacted the historical records department of the IEEE to see if they could locate a copy of my letter in Dr. Emberson's correspondence, but they were unable to do so. I can remember only one accomplishment of the Group that was cited in the letter. That accomplishment was the following: during my term as Chairman, the Transactions went from a photocopied typed-manuscript format to a letterpress format, giving the *IEEE Transactions on Ultrasonics Engineering* more of the appearance of a professional publication. When my term as Chairman ended, Ralph Woollett indicated he had no desire to succeed me as Chairman; and the AdCom elected, J. J. G. (Jerry) McCue of the MIT Lincoln Laboratory to succeed me to the post of Chairman.



Fig.4. Dr. Richard M. Emberson, IEEE Group Coordinator in the 1960s. He was appointed General Manager in February 1978 and served through 1978.

The last issue of the *IRE Transactions on Ultrasonics Engineering* was Volume UE-9, dated December 1962. In that issue I was listed as the AdCom Chairman and Ralph Woollett as the Vice-Chairman. The next Transactions was issued in July 1963 and was entitled *IEEE Transactions on Ultrasonics Engineering*. The inside cover of this issue listed J. J. G. McCue as the Chairman and William F. Konig as the Vice-Chairman, Arthur Rothbart was the Secretary and Treasurer. (I remember all three of these gentlemen very well.) By virtue of being a past chairman, I became an ex-officio member of the AdCom.

3. Meetings of the IEEE-GSU Administrative Committee (1962-1972)

After the formation of the IEEE by the merger of the American Institute of Electrical Engineers (AIEE) and the IRE, the AdCom and other committee meetings took place in the new IEEE office building, called the United Engineering Center (UEC), located at 345 East 47th St.. This building was a large modern office building with a number of conference rooms. The one I remember best was the conference on the top floor. This was a large room that held about 50 people and was often used as the site for AdCom meetings, Symposium Program Committee meetings, and Standards Committee meetings. The conference room had large windows that looked out over 47th St. and, if you stood up close to the windows, you could look over towards the East River and see the United Nations buildings. I often looked over at the United Nations buildings when I visited the IEEE headquarters to attend some committee meeting or other. Sometimes, when I had time to spare after the meetings, I would walk over to the United Nations Plaza and look at the architectural features of the individual buildings, the works of sculpture, and the crowds of tourists waiting in lines to go on tours of the buildings.

Around the time of the IEEE formation, there was a strong initiative to change the name of the Group and broaden its scope of activity. Jerry McCue was a strong proponent of the change in name. I remember that, among the words considered for inclusion in the



Fig. 5. The United Engineering Center at 345 East 47th St. This was the site of many GSU AdCom meetings, Technical Program Committee meetings for Ultrasonics Symposiums, and Standards Committee meetings during the 1960s. In the 1990s, the building was bought by Donald Trump, torn down, and replaced by a 91-story, luxury, residential tower. (Photograph supplied by the IEEE History Center.)

revised name of the Group, were words like “hypersonics” and “praetersonics”. These words were considered primarily to emphasize the idea that the group was interested in a wide range of scientific as well as engineering topics and to include the latest developments in high frequency devices and physical acoustics. Finally the decision was

made to simply call the Group “the Group on Sonics and Ultrasonics”; and so, until the UFFC-S was established, the organization was known as the IEEE-GSU.

At the end of 1964, when Arthur Rothbart stepped down from the position of Secretary-Treasurer, I agreed to take on the post and served in this capacity until I resigned from the AdCom at the end of 1972. My resignation was not the result of any loss of interest in the IEEE-GSU, but rather it was the result of a change in jobs. In November of 1972, I left Bell Telephone Laboratories and joined the Research Staff of the Ford Motor Company in Dearborn, MI. My career interests were of necessity shifting from ultrasonics to automotive sensors and to electronic systems for control of exhaust emissions. Although I felt I could not expect Ford Motor Co. to support my continued activity on the AdCom, I was still very much involved with the development of ANSI/IEEE Std 176-1976 and managed to stay on as the Chair of the Piezoelectric Standards Sub-committee until that standard was completed. In addition, I was able to continue my membership in the Ferroelectrics Committee of the IEEE-GSU.

In the years between 1965 and 1972, employees of Bell telephone Laboratories continued to play a major role on the AdCom. T. R. Meeker was the Chairman of the AdCom in '65 and '66. Fig. 5 shows a picture of Trig Meeker and the author.



Fig. 6. The author (on the left) and T. R. Meeker (on the right). Trig served as AdCom Chairman in '65 and '66. (The photograph was taken in August 1991 on the front lawn of Trig Meeker's house in Allentown, PA.)

Meeker's tour of service as Chairman was followed in '67 by J. H. Rowen, by D. L. White in '68, by E. K. Sittig in '69, and by W. J. Spencer in '71 and '72. All of these men were in the ultrasonic device or quartz resonator activities at Bell Telephone Laboratories, either at the location in Murray Hill, NJ, or at the location in Allentown, PA. The last chairman of the AdCom with a Bell Laboratories connection was N. F. Foster who served in 1974. A year earlier, the title of the head of the AdCom changed from Chairman to President.

The reader might think that, as a result of serving in the capacity of Secretary-Treasurer, I would have many files bulging with documents from the time period between 1965 and 1972, but I don't. When I resigned the position I wanted to clean out my files of all the accumulated papers; and consequently, I turned over all my records to my successor, William D. O'Brien, Jr. Most, if not all, of the details of what went on in the AdCom meetings from 1965 to 1972 have since faded from my memory.



Fig. 7. John H. Rowen (on the left) and the author. This photograph was taken on the New Jersey shore at John Rowen's residence on Long Beach Island, one summer day (probably in July, 1990).

Before I conclude this portion of my history of the IEEE-PGUE, there is one other person I would specifically like to include, Richard (Dick) W. Damon, who was employed by the Sperry Research Corporation. Dick Damon was elected to serve on the 1967 AdCom. The following year, when Don White was elected Chairman, Dick Damon was elected Vice-chairman. When the list of proposed candidates for the elected AdCom offices was first drawn up for the 1968 AdCom, I remember having a conversation with John Rowen, who was then Chairman, in which I asked him, "How did Dick Damon's name get on the list as a candidate for the Vice-chairman office?" (I think I felt at the time that there was a Bell Labs candidate who might be more suitable.) John Rowen replied, "Oh I don't know, I looked around one day and there was Dick Damon. The guy seems to be very energetic and good at getting into everything." John was quite right in his assessment of the capabilities of Dick Damon. Although Dick Damon did not go on to succeed Don White as the Chairman of the GSU AdCom, he went on to serve two terms as a Director in the IEEE, from '77 to '78 and '81 to '83, and as President of the IEEE in 1981. I will mention Dick Damon again later in this history when I write about the 1981 IEEE Awards Ceremony held in New York City.

4. Memories of Early Ultrasonics Symposiums

For the first few years after the formation of the IRE-PGUE, the leaders of the AdCom felt strongly that it was important, from the point of view of increasing the vitality and membership of the Group, that the Group hold its own Symposiums separate and independent of the IRE March Meeting and Wescon Convention. This objective was realized when the first National Ultrasonics Symposium was held on the campus of Stanford University, CA, on August 17 and 18, 1959. For me, it has always been one of the most memorable of all the Ultrasonics Symposiums I have attended. There were several things that contributed to making this a memorable meeting for me. First, this was the occasion of my first trip to the west coast and my first visit to San Francisco. Second, it was at this meeting that I reported my work on the shear-mode, non-dispersive, strip delay line, the device which I regard as the first important invention of my professional career. The Symposium General Chairman was Vincent Salmon of the Stanford Research Institute. Among the outstanding attendees at the meeting were Warren P. Mason and Walter G. Cady. (Cady at the time of this meeting was 85 years old.) In a conversation after the session in which I presented my paper, Cady complimented me on my presentation, an act of kindness that pleased me greatly and that made a lasting impression on my memory.

The banquet for this Ultrasonics Symposium was another memorable occasion. It was held at Ricky's Hyatt Cabanya Hotel in Palo Alto. The featured after-dinner speaker was W. G. Cady who was a famous and important man in the history of Ultrasonics. He was the inventor of the quartz-stabilized electronic oscillator, a past-President of the IRE, and the author of the famous textbook, "Piezoelectricity". In his after-dinner speech that evening, Cady reviewed the history of piezoelectricity and its application to ultrasonics and frequency control. He then went on to recount the tale of how the patent attorneys at AT&T managed to cheat him out of the credit (and royalties) for the invention of the quartz-stabilized oscillator. There was some irony in this because many of the people in the audience were employees of AT&T Bell Telephone Laboratories.

This meeting was the first and only time I saw W. G. Cady. He was a really fine old gentleman whom I remember very favorably. Not only did he compliment me on my presentation, but later he sent me a list of corrections to his textbook along with a personal note. While meeting Walter Cady was an outstanding memorable experience for me, others attending the symposium knew him well. For example, when John May was an undergraduate at Wesleyan University, he had Cady as a Professor in his physics classes.

The second Ultrasonics Symposium, according to the UFFC-S historians, was held November 28-30, 1962, at the School of Applied Science and Engineering, Columbia University, New York City. John E. May, Jr. was the Chairman, I was the Vice-Chairman, and Robert Thurston was the Chairman of the Technical Program Committee. Curiously enough, I have only the vaguest of recollections of this meeting even though I served as the Vice-Chairman. Perhaps the fact that I was Chairman of the

PGUE AdCom at this time kept the symposium from making much of an impression on me.

On the other hand, I remember a lot of things about the 1963 Ultrasonics Symposium. I was the Chairman for this symposium, Robert Thurston was the Vice-Chairman, and Thrygve (Trig) Meeker was the Chairman of the Technical Program Committee. Perhaps the reasons I remember this meeting so well were, first, because of the excitement of being the General Chairman and, second, because of the excitement of running a symposium in a glamorous place like Washington D.C. I do remember that one of the perks of being the General Chairman was to have a nice, complimentary suite of rooms in the conference hotel. (The conference hotel was the Marriott Motor Hotel also known as the “Twin Bridges Hotel”, if I remember correctly.)

Two areas associated with the 1963 Ultrasonics Symposium that I can still picture in my mind are, first, the suite of rooms I enjoyed, and second, the area where the registration desk was located. I think the reason I remember the registration area so well was because of all the time I spent there trying to resolve the hassles that go along with people registering for meetings. There was the confusion of who registered in advance and who didn't, what kind of payment to accept, the classes of registrants (member, non-member, student), and the amounts they were asked to pay. Even though in those days the registration fees were less than \$50, there were still people who complained bitterly about the size of the registration fee. I was glad when the third day of the symposium came and the rate of new registrations per hour fell off to zero. With the administrative responsibilities that went along with being the Symposium General Chairman, I did not get to spend much time in the technical sessions listening to the presentations.



Fig. 8. Fred S Hickernell (on the left) and the author. The photograph was taken September, 2001, in Ann Arbor, MI.. Fred was the President of the UFFC-S during 2001.

Another person who does have strong, vivid memories of the 1963 Ultrasonics Symposium is Fred S. Hickernell. The 1963 Ultrasonics Symposium was the first IEEE meeting that Fred ever attended. Before that, as a young engineer he had attended other meetings like APS meetings. One of the things that he says he remembers made a very favorable impression on him was that this meeting was the first meeting he ever attended where the Symposium Chairman and the Technical Program Chairman were in the lobby, at the registration desk, greeting the people who came to attend the meeting. (Fred, of course, later joined the IEEE and the UFFC-S and for many years served on the UFFC AdCom. In 2001, Fred served as President of the UFFC-S.)

Perhaps another thing that contributed to the memorability of this meeting is that it took place shortly after the assassination and burial of President John F. Kennedy. One late afternoon during the meeting, John Rowen, who was then a Department Head at Bell Telephone Laboratories and my boss, organized an informal group of people to walk over the bridge to the Arlington National Cemetery where President Kennedy was buried and pay their respects at President Kennedy's grave. Having a number of important things to do and being of a conservative Republican political persuasion, I chose not to go along.

The following year, 1964, the Ultrasonics Symposium took place in Santa Monica, CA. This is another meeting that made a big impression on me. For this meeting, Robert L. Rod was the Symposium General Chairman and I was the Technical Program Chairman. Robert L. Rod was the founder of Acoustica Associates, an industrial ultrasonics firm located on Long Island. Several years before 1964, Rod had sold his interest in Acoustica Associates and moved to the Santa Monica area, hence the reason he was interested in promoting an Ultrasonics symposium in the area and serving as its General Chairman. John Rowen, although not at the time on the IEEE-GSU AdCom, was Head of the Ultrasonic Device Department and an important, behind-the-scenes influence on the decisions that were made by the BTL members of the AdCom. Rowen was worried whether or not Rod was a good choice as General Chairman. Rod was more of a dynamic business man, a wheeler-dealer type, rather than a conservative engineer. Rowen was concerned about whether or not Rod was going to be responsible enough to carry out the duties of the symposium General Chairman. Fortunately for the reputation of the Ultrasonics Symposium and the IEEE-GSU, the meeting went off very well and was quite successful.

Again, some of the things that contributed to the memorability of this meeting were; first, it was a west-coast meeting; and second, it was located at a glamorous site with a beautiful beach, palm trees, and a picturesque view of the Pacific ocean. Most important of all, it was at this meeting at which I met Cecil E. Land. After one of the sessions, Cecil came up to me and introduced himself to me. He told me he was employed by the Sandia Corporation in Albuquerque, NM, and was working on piezoceramic transducer materials. He said that he had enjoyed reading several of my papers and wanted to meet me. We became immediate friends and this friendship became one of the deepest and most influential friendships of my professional career. Cecil Land and I were both active on the IEEE-GSU Ferroelectrics Committee from its inception and

later he became the Chairman of the Ferroelectrics Committee serving in that capacity from 1978 to 1990².

There is one other interesting historical item that happened at the 1964 Ultrasonics symposium. The last few decades have seen a tremendous growth in the area of SAW (surface acoustic wave) devices. John Rowen gave the first paper on a surface array transducer structure to produce surface waves on crystalline quartz at this meeting. The paper was included into the program as a post-deadline paper and, as such, was not included in the printed advance program for the meeting; but the title and abstract were published in the Final Program supplement for the 1964 Symposium on Sonics and Ultrasonics. (The text of the abstract is in the Digital Archive of the UFFC and can be found by simply typing J. H. Rowen into the search engine.³ Unfortunately, there never was a follow-up paper published by Rowen in a technical journal, but there was a patent application filed and a U.S. patent issued.⁴)

The following year, 1965, the Ultrasonics Symposium moved back to the east coast. The site of the symposium was Boston, MA. For me, the 1965 Ultrasonics Symposium was memorable, not so much for the events that took place during the symposium, although I am sure there must have been a number of fine papers presented, but rather for things that happened before and after the Symposium. David L. Arenberg was the General Chairman for this symposium. Dave Arenberg and John May had worked together in a Navy Research laboratory during the later days of World War II and were old friends. It was this association that launched John May on his career in ultrasonic delay lines. In any event, sometime a few months before the meeting, John May arranged for the two of us to visit Dave and check out the arrangements for the Ultrasonics Symposium. As part of the visit, Dave gave us a guided tour of Boston and MIT. Dave had a membership in the sailing club at MIT, so it was possible for him to arrange to rent a sailboat and take John and me for a sail on the Charles River. The ride in the small, open sailboat and the roast beef dinner at the famous Durgin Park restaurant are two of my fond memories of the Boston meeting.

In contrast to my fond memories, there was a notable event associated with the Boston meeting that left horrible memories for several attendees. The 1965 Ultrasonics Symposium was a three-day meeting, covering Wednesday, Thursday, and Friday. Many of the attendees, myself included, lived on the East Coast and so it was possible, if you wanted to get home Friday evening, to catch an evening airplane flight from Boston. In those days, Eastern Airlines was still in existence and flying the “Eastern Airlines Shuttle”. The shuttle had the nice feature that no advance ticket was needed. You showed up at the gate, bought a ticket, and boarded the next flight out, which is just what I did. I arrived home Friday evening without any difficulties.

² Cecil Land died in January 1998 and the UFFC-S honored him by dedicating the July 2000 issue of the *IEEE Transactions on UFFC* to him. Ahmad Safari and I shared the honor of serving as the guest editors for this special issue.

³ The paper by Rowen was listed in the supplementary program as “J6 High Frequency Dispersive Ultrasonic Delay Lines”. In the text of the abstract the words “surface wave grating delay line” are used.

⁴ Patent No. 3,289,114, “Tapped Ultrasonic Delay Line and Uses Therefor”, filed Nov. 29, 1966.

The following Saturday morning started out like any other weekend Saturday in the Fall. Sometime during the morning, I received a telephone call from Stanley Jacke. Stan lived in the New England area and worked at Branson Ultrasonics. We were good friends from our associations in IEEE activities and meetings. He reported that an Eastern Airline's shuttle, flying from Boston to Newark, had a mid-air collision and had gone down in a farmer's field somewhere in New Jersey. He was calling to find out if I was on the plane and was pleased to hear that I was not. A little while later, after I finished talking to Stan, I got another call from Friedolph Smits. Friedolph had become the head of the Ultrasonic Device Department at Murray Hill, in which I was included. He was calling to see if I was OK and if I had any information on who in our department might have been flying on the airplane that crashed. I told him that I did not know of anyone in our department who had plans to fly back from Boston on Saturday morning.

As I found out later, there were people on the plane who were returning from the Boston Ultrasonics Symposium. At the time of this writing, the two people whose names I know for sure are Warren Mason and Eric Hafner. Both men sustained injuries that required them to spend some period of time in the hospital for recovery. Warren Mason seemed to get over the accident very well, and resumed traveling to meetings in a short time, as if nothing had happened. For Eric Hafner, it was a more traumatic experience. On several occasions, years later, I tried to engage him in conversations about the accident. On one of these occasions, he told me that, after the accident, it took him two years before he was able to book an airplane flight and travel by air. On those several occasions when I talked to Eric about the accident, I would say, "Eric, why don't you write up your recollections of that flight for publication in the UFFC-S Newsletter. It would make interesting reading for a lot of the UFFC-S members." Eric's reply, was always the same, "I don't want to talk about it or write about it; I don't even want to think about it."

There is one other sad association that I have with the 1965 Ultrasonics Symposium in Boston. Dave Arenberg, who was the General Chairman, lived in Rochester, Massachusetts. A finer, more pleasant individual would be hard to imagine. He was murdered in his home six years later, on September 7, 1971⁵.

There were other memorable meetings in the late 1960s and early 1970s including meetings in Cleveland, New York City, St. Louis, Miami, and Vancouver, B.C. I will leave it to others to bring these meetings to life with their recollections.

5. Memories of Early Frequency Control Symposiums

I joined Bell Telephone Laboratories in the Fall of 1955. I think the first Frequency Control symposium I attended was in 1957. In those days, the symposiums

⁵ His obituary was published in the January 1972 issue of the *IEEE Transactions on Sonics and Ultrasonics*. Along with many details of his accomplishments during a long and productive career, the obituary reported the following: "He was living in the family's home at the moment of his untimely death. He was found brutally beaten at the hands of an unknown assailant. The world loses immeasurably in his passing. The loss of a kind, dedicated, gentle friend is made all the greater by the senselessness of the manner of his passing."

were under the sponsorship and control of the U.S. Army Signal Corps headquartered in Ft. Monmouth, New Jersey. Ft. Monmouth is close to resort communities along the NJ shore. In the late 1950s and early 1960s the Frequency Control Symposiums were held in places like Asbury Park and Atlantic City. The meetings were held in luxurious and, at one time, grand hotels on the ocean front. In Asbury Park, the hotel was the Berkeley-Cartaret Hotel, in Atlantic City it was the Shelburne Hotel.

The first Frequency Control Symposium I attended was in 1957 at the Berkeley-Cartaret Hotel in Asbury Park. I managed to get approval to attend two days of the 1957 Symposium. My wife liked very much to spend time on the beach at the NJ shore, so she decided to go along with me and arranged for a relative to care for our first son, who was then only two years old. Since we had decided rather late to attend the symposium, we wound up staying in a motel near the conference hotel, rather than in the conference hotel itself.

One of the main reasons I wanted to attend the meeting was to have a chance to meet Prof. Raymond D. Mindlin. Professor Mindlin was the leader of the dominant research activity, located at Columbia University in New York City, in the analysis of vibrations in bounded solids. He had for many years a continuing research contract with the Army Signal Corps concerned with the analysis of the vibrations of quartz plates. Prof. Mindlin was always the featured speaker at Frequency Control Symposiums, usually being the first presenter of a paper on the program. I attended the opening session and heard the paper that Prof. Mindlin presented.

During the lunch break between the morning and afternoon session, I happened to see Prof. Mindlin at the coffee shop lunch counter by himself. "Aha", I said to myself, "Here is my chance to meet him." Fortunately, there was an empty seat beside him, so I went up to the counter, sat in the empty seat, and introduced myself to him as Allen Meitzler, someone who recently joined Bell Telephone laboratories in Roger Sykes' Department. After the preliminary introduction, I began to ask him some technical questions about the modes of propagation predicted by the Rayleigh-Lamb equation for stress waves in a plate, since at the time I was particularly interested in the subject and I knew Prof. Mindlin had done some pioneering work in mapping out the general nature of these modes of propagation. I was in the middle of explaining something to him that was bothering me, when suddenly he stopped me and said, "Who are you? Where do you come from? You talk just like one of my students!" I was momentarily taken aback by this abrupt question, but I recovered and then explained to him that I did my graduate work at Lehigh University on an experimental study of transient stress wave propagation at the impacted end of a cylindrical bar and that my thesis professor was Prof. Cassius Curtis. After the mystery of my origins was cleared up, we continued on with the discussion and had a pleasant, brief conversation until it was time for him to leave. And that was my introduction to Prof. Mindlin. Of course, neither one of us knew at that time, that one of his graduate students, Harry Tiersten, would within a few years join Bell Telephone Laboratories in the Ultrasonic Device Department headed by John Rowen in which I would be working.

Meeting Prof. Mindlin was the most memorable event of the first Frequency Control Symposium that I attended. There was one other thing that impressed me about that first Frequency Control Symposium. Located on the top floor of the conference hotel was a hospitality suite. If I recall correctly, it was actually located in a large ballroom with a view overlooking the ocean. There was an open bar and a large table loaded down with all sorts of good food. The hospitality room was of course sponsored by vendors who were interested in selling equipment to the engineers and management people attending the meeting. There were a number of tables and chairs spread around the room, so that you could get a drink at the bar, load up a plate with food at the main table, and then find a smaller table at which to sit down with friends and discuss whatever subjects came to mind. The hospitality room made a big impression on me because it was the first time I had ever experienced anything like it at a technical conference. Up until then, I had attended meetings like the American Physical Society meetings or Acoustical Society meetings or the IRE meetings such as the International Conventions in New York City or the Ultrasonics Symposiums. These meetings, by comparison, were rather austere.

Between 1957 and 1965, I probably attended several of the Frequency Control Symposiums since they were close by my work locations in Whippany and Murray Hill NJ. The next Frequency Control Symposium from which I still have specific recollections was the 1965 Frequency Control Symposium held at the Shelburne Hotel in Atlantic City. What made this one memorable was a combination of circumstances. About a month before the Symposium, I bought a new 1965 Buick “Sportwagon” an intermediate size station wagon. I was able to arrange for myself and three members of my supervisory group at Murray Hill to attend the symposium and drive down to Atlantic City together in my new car. The other three people making the trip were Gerald (Jerry) Coquin, Erhard Sittig, and Harry Tiersten⁶. Of the four of us, Jerry was the only one presenting a paper. It was a paper on the use of tapped delay-line structures as filters. We all had a great time and the conversations that went on, driving down and back and at various meals together were thoroughly stimulating and enjoyable. I regret that I didn’t have the foresight to take a tape recorder along with me.

One other odd little detail that I do remember from that meeting is that on one evening, looking for some kind of entertainment, we went to see the movie “The Sound of Music”. This movie was a musical starring Julie Andrews and Christopher Plummer. It came out in 1965, a few weeks before the symposium. Being something of a Julie Andrews fan, I persuaded my three companions to go along with me to see the movie. I enjoyed the movie. After we came out of the movie, I asked my three companions what they thought of it. Harry and Jerry thought it was “all right”; Erhard didn’t like it. I asked Erhard why he didn’t like the movie. Erhard, who grew up in Germany during the 30s and 40s, replied, “The movie⁷ has all this beautiful scenery of the Austrian Alps and the Austrian buildings, and the people in Austrian costumes, but every time the actors opened

⁶ Around 1965, I was extremely fortunate, as a supervisor at Bell Telephone Laboratories in the Ultrasonic Device Department, to have three extraordinarily talented, productive people in my supervisory group: Jerry Coquin, Erhard Sittig, and Harry Tiersten.

⁷ In the last few years, the movie has become a “camp film” classic. There is a movie theater in London, England that, every year, shows the film. People come dressed in the costumes of their favorite characters and the audience sings along with the characters all of the songs in the movie.

their mouths, whether talking or singing, the words came out in English.” The incongruity of it all was more than Erhard could stomach.

The 1966 Frequency Control Symposium was another symposium with some memorable events. The meeting began on a Monday and I arrived in Atlantic City late Sunday afternoon, again driving down from Morristown NJ where I was living. After I checked into the hotel, one of the first persons I met was Prof. Morio Onoe. I knew Morio Onoe well because he had been a guest Member of Technical Staff in the Ultrasonic Device Department for a year. He was attending the symposium and was scheduled to give a paper the opening day. We sat down at a table close to the registration desk and started a conversation. Suddenly, I was alarmed to observe Morio faint and collapse in the chair in which he was sitting. His collapse lasted less than a minute and, fortunately, turned out to be nothing more serious than fatigue from the stress of travel. After we were able to resume our conversation, Morio asked me if I would listen to him as he rehearsed the paper that he was going to present the next day. The reason he wanted to do this was to improve his English pronunciation and grammar. We met in his room later that evening and went over his speech. I must admit that, at the time, I failed to appreciate the significance of the paper he was presenting at the meeting.

It turned out that this 1966 Frequency Control Symposium was the first meeting at which papers presenting the basic ideas and design theory for the monolithic crystal filters were presented. There were two competing groups working on the same basic ideas and presenting two related papers. The one group was at the Allentown location of Bell Telephone Laboratories with their work presented in a paper co-authored by R. A. Sykes and W. D. Beaver; and presented by Roger Sykes. The other group was at the University of Tokyo with their paper co-authored by M. Onoe, H. Jumonji, and N. Kobori, and presented by Morio Onoe.



Fig. 9.. Morio Onoe (on the left) and the author. This photograph was taken in February 1990, at a conference on Micro-electromechanical Systems (MEMS) in Napa Valley, CA. At the time Morio Onoe was the Vice-President of Research for the Ricoh Corporation, Japan.

The invention of the quartz, monolithic crystal filter is one of those cases of essentially independent, simultaneous invention by two different groups. Certainly, regardless of the details of the initial invention, it was one of the important developments in the field of ultrasonic devices during the 1960s, and it was an invention that spawned an intense amount of research and development and that led to the formation and growth of a major branch of the electronic components industry. Many years later, in the 1990s, a patent suit would be brought in a U.S. Federal Court by AT&T Bell Telephone Laboratories to establish the priority of Bell System patents and to enable AT&T to collect royalties from manufacturers of monolithic crystal filters, but the suit was unsuccessful.

The 1966 Frequency Control Symposium was the last Frequency Control Symposium I attended in the 60s. The department I was in at Murray Hill was undergoing a change in activity from ultrasonic devices to optical memory and display devices. (To me, it seemed clear that the management at Bell Telephone Laboratories at this time was trying to accomplish two objectives: (1) reduce the size of the ultrasonic device activity at Murray Hill and (2) shift the focus of device development from military system applications to Bell System applications.) In the late '60s my personal development work changed from piezoelectric transducers and delay line structures to transparent ferroelectric ceramics and the development of image storage and display devices. In spite of this and a few other career changes, I did manage to attend a few Frequency Control Symposiums over the years in the decades of the 70s, 80s, and 90s.

The emphasis in this history is on events that took place more than two decades ago. There is one more recent Frequency Control Symposium that I want to mention because it was a great source of pleasure to me, that is the 1995 Frequency Control Symposium that took place in San Francisco. This was the Symposium at which Arthur (Art) Warner received the UFFC-S Achievement Award. The citation that accompanied it stated: "For his nearly 60 years of pioneering and wide-ranging contributions to the design and fabrication of high-stability quartz resonators." Art Warner was certainly one of the people in the UFFC whom I knew over the longest period of time. I first met Art early in 1955 when I went on a two-day series of interviews to several different locations at Bell Telephone laboratories. Art Warner was one of the persons in Roger Sykes' department at Whippany who interviewed me. I can still remember clearly sitting in his office-laboratory, talking to him, and looking at the interesting collection of raw quartz samples and finished quartz crystal resonators that he had sitting around his laboratory. One of the things that we both shared in common from the outset was an association with Lehigh University in Bethlehem PA. Art had done a year of graduate study in the Physics Department at Lehigh before he left to join Bell. Over the years, I had a close personal friendship with Art. After I left Bell and joined Ford and moved to Ann Arbor, Art visited us several times as a house guest when he came out to Ann Arbor on personal business. In addition to Art Warner's contributions to the development of quartz resonators and the investigation of new piezoelectric materials, Art also made significant contributions to the development of IEEE Stds 176-1978 and 176-1987. Art Warner certainly well-deserved the Achievement Award and I was very pleased to be present when he received the award and to be able to congratulate him. Another close personal friend, who was

present at the 1995 FCS and helped to make it an enjoyable time, was my old friend Harry Tiersten. We had a few excellent dinners in some of San Francisco's finest restaurants, one of the dinners in the company of John Vig, the General Chairman of the meeting. After the meeting ended, Harry and I spent one day visiting nearby Muir Woods and enjoying a walk through the magnificent forest of Sequoias.

Most recently, in 2001, I attended the Frequency Symposium in Seattle. Very few of my friends from the '60s and '70s were there. Harry Tiersten was there and even gave a paper in spite of suffering from a physical problem. Eric Hafner was there. At one of the evening social events, I was pleased to meet again W. (Bill) D. Beaver, one of the people involved in the early development of the quartz monolithic crystal filter and now (in 2001) running a quartz resonator manufacturing plant in Singapore.

6. Memories of Early Ferroelectrics Committee and ISAF Meetings

From the beginning of my career at Bell Telephone Laboratories I had a strong interest on the application of ferroelectric materials to electronic devices. My primary interest in ferroelectric materials in the early stages of my career, during the period from 1955 to 1965, was as transducers for ultrasonic delay lines. A number of my early publications are on the subject of the measurement and characterization of ferroelectrics as transducer materials. Then too, the department at Bell headed by Roger Sykes, at the time I joined it in October 1955, had an activity concerned with the development of ferroelectric memory devices. Two close friends engaged in the BaTiO₃ memory device activity were Henry Stadler and Thyrgve (Trig) Meeker. It was natural enough, when Prof. Charles Pulvari of Catholic University, Washington, D.C., proposed the formation of a Ferroelectrics Committee to promote further activity in the IEEE GSU, that I became one of the individuals involved in the formation and development of the committee. During that time period, I was serving as Secretary-Treasurer of the Group and this activity also made it useful for me to be involved.

The earliest meetings of the Ferroelectrics Committee took place in a small conference room, (The conference room couldn't have been much larger than about 8 by 12 ft.) off the main office of the Department of Electrical Engineering, at Catholic University. Prof. Pulvari was the Chairman of the Department. From the outset, I believe that Prof. Pulvari had in mind as a major objective of the committee, the enhancement of the ferroelectrics effort within the GSU by building a separate meeting on ferroelectrics. Among the very early people involved in these meetings, in addition to Prof. Pulvari and myself, were people like Cecil Land of Sandia, Prof. L. Eric Cross of Pennsylvania State University, Stuart Kurtz of Philips Laboratories, and George Taylor of RCA Laboratories.

The result of this effort lead to the first "Symposium on Applications of Ferroelectrics", held sometime during 1968. This was a two day meeting (a morning and afternoon session on two days, with no parallel sessions) held at Catholic University in an auditorium in one of the engineering buildings on the campus. Prof. Pulvari was the General Chairman and Henry Stadler was the Program Chairman. I remember that I gave

a paper on the application of ferroelectric materials in ultrasonic devices operating above 100 MHz. As I recall there was a banquet and, if I remember correctly, it was held in the dining room of a nearby motel. The meeting wound up making a loss of few hundred dollars. The fact that the meeting wound up with a loss greatly distressed Prof. Pulvari; so much so, that Henry Stadler volunteered to make up the deficit by making a personal contribution. In those days, the financial situations of the GSU and the parent IEEE were precarious and budgets were tight. The next "Symposium on Applications of Ferroelectrics" was not held until 1971. This too was a low cost meeting held using the auditorium facilities at the IBM Watson Research Laboratory. A. W. Smith was the General Chairman and L. E. Cross was the Program Chairman. I was there, but I really remember very little about this meeting. The papers from this meeting were collected and published in Vol. 3 parts 2, 3, 4 of the journal "Ferroelectrics".

The record of the first ferroelectrics symposiums is incomplete and not accessible even in the UFFC Digital Archive. There is no collection of the papers from the first symposium and not even a program that I know of. The papers from the 1971 meeting and the '75, '79, and '83 meetings were published in "Ferroelectrics" and, as a result, are not in the UFFC Digital Archive. To some people looking back on this situation, this may seem as if the organizers of these early meetings were lax in making proper arrangements. My perception, as someone who attended committee meetings in those days is somewhat different. The attitude of the parent GSU AdCom towards the Ferroelectrics Committee was something like the attitude of a parent towards an unwanted stepchild. Many of the AdCom members felt that the ferroelectrics activity was not all that relevant to the main activity of the GSU, but they were willing to tolerate it as long as the ferroelectrics activity was able to conduct its meetings on a basis that did not burden the GSU with financial losses. The desire to avoid losses from publication costs was the major reason for transferring the copyright to the papers collected at several early ferroelectrics symposiums. The symposium organizing committees provided the authors of papers with an expense-free publication in exchange for the copyrights.

One indication of the low status held by the ferroelectrics activity in the GSU scheme of things can be found in searching for any mention of the Ferroelectrics Committee in issues of the GSU Newsletter. Early issues of the GSU Newsletter can be found in the UFFC Digital Archive. No mention of the existence of a Ferroelectrics Committee or of a ferroelectrics symposium can be found in the Newsletter until the June 1971 issue. In a routine listing of the committees associated with the GSU, the existence of the Ferroelectrics Committee is finally acknowledged and listed as follows:

C. F. Pulvari, Chairman

G. Burns	A. H. Meitzler
L. E. Cross	R. E. Nettleton
S. E. Cummins	A. W. Smith
H. Jaffe	H. L. Stadler
C. E. Land	G. W. Taylor
W. N. Lawless	H. H. Wieder
I. Lefkowitz	

Table 2, shown below, is a summary listing of the “International Symposiums on Applications of Ferroelectrics” from 1968 to 2004. I believe the emphasis on the growth of the meeting and the emphasis on its international nature began with the 1975 meeting. One thought that strikes me when I look at this table is that I was very fortunate, in spite of the fact that my career activities changed drastically when I went from Bell Laboratories to Ford Research in November, 1972, I was still able to attend all of the ISAF meetings from 1968 to 1998. I missed the meeting in Hawaii in 2000 and I doubt that I will make the meeting in Kyoto, Japan in 2002.

Table 2. A Summary of Information about ISAF Meetings (Prepared by L. E. Cross)

	Date	Location	General Chair/Co-Chairs	Program Chair/Co-chairs	Proceedings
1 st	1968	Catholic University,	C. Pulvari	H. Stadler	-
2 nd	June 7, 1971	IBM Watson Research Labs.	A. W. Smith	L. E. Cross	Ferroelectrics Vol. 3 parts 2,3,4 1972
3 rd	June 9, 1975	Albuquerque, NM	C. E. Land, and A. M. Glass	L. E. Cross	Ferroelectrics Vol. 10, 11 1976
4 th	June 13, 1979	Minneapolis, MN	S. T. Liu	L. E. Cross	Ferroelectrics 27, and 28, Jan. 1980
5 th	June 1, 1983	Gaithersburg, MD	R. C. Pohanka	W. N. Lawless	Ferroelectrics Vol.49, 50, and 51
6 th	June 8, 1986	Lehigh University, PA	W. A. Smith	R. E. Newnham	IEEE
7 th	June 6, 1990	University of IL at Urbana-Champaign, IL	D. Payne	S. K. Krupanidi, and S. Kurtz	IEEE
8 th	August 30, 1992	Greenville, SC	G. Haertling	A. Kingon	IEEE
9 th	August 7, 1994	Penn State University, PA	A. Bhalla	A. Bhalla and R. Guo	IEEE
10 th	August 18, 1996	Rutgers University/East Brunswick New Jersey,	A. Safari	T. ShROUT and T. R. Gururaja	IEEE
11 th	August 24, 1998	Montreux, Switzerland	N. Setter	N. Setter and D. Damjanaovic	IEEE
12 th	July 30, 2000	Honolulu, Hawaii	A. Kingon and D. Viehland	S. T. McKinstry, S. Pilgrim and N. Ichinose	IEEE
13 th	2002	Kyoto, Japan	D. Payne and T. Takenaka	-	IEEE
14 th	2004	Montreal, Quebec Ontario	S. Pilgrim and W. A. Schulze	-	IEEE

Looking back over this list of ISAF meetings, I have many pleasant memories and I won't attempt to relate, at this time, one or two stories from each of the meetings. There is, however, one meeting that I especially want to talk about and that is the 1975 ISAF held in Albuquerque NM and co-chaired by my good friend Cecil Land.

During the decade of the '60s, an important development in the field of ferroelectric ceramics was the invention, development, characterization, and application of PLZT ceramics by Gene Haertling and Cecil Land at the Sandia Corporation in Albuquerque, NM. My last few years on the staff of BTL were spent working primarily on the development of PLZT optical memory and display devices. By chance, even though I was working at Ford Motor Co. on ceramic sensors for automotive emission control systems, I was able to put together a contributed paper entitled "Structural Transformations occasioned by Crystallographic Shear in PLZT and TiO₂ Ceramics". (I believe this was the last paper that I ever gave at an ISAF meeting.) However, my reason for wanting to talk about the 1975 ISAF does not involve me, but rather Cecil Land.

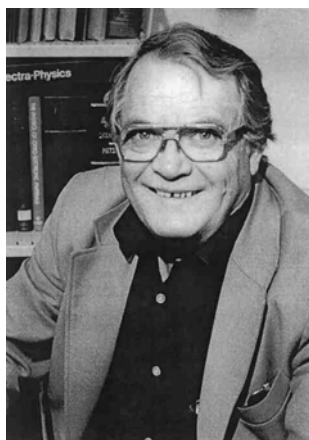


Fig. 10. Cecil E. Land. Cecil Land worked at Sandia National Laboratories for 35 years before retiring as a Distinguished Member of Technical Staff in 1991. This photograph was taken around the time of his retirement.

On one of the evenings during this meeting, Cecil Land hosted, at his own expense, for a group of about fifty people, a dinner. This banquet was co-hosted by Cecil and his wife Betty and given at their expense as an expression of their thanks to all the individuals present for their friendship and support. The people present included members of the Ferroelectrics Committee, members of the symposium committee, close associates on the staff at Sandia and even a few members of Sandia management. I always thought this was a remarkably generous, warm-hearted, and noble-spirited thing for Cecil and his wife to do

Another memorable thing that happened at this meeting, is that one evening, I don't remember which one, James (Jim) C. King invited Warren Mason and me to his house for cocktails and conversation. Jim was a member of Roger Sykes' department at the time I joined BTL and specialized in studying defect structures in single-crystal quartz. He was made the first head of the Ultrasonic Device Department set up at

Allentown to manufacture delay lines and, later, transferred with a promotion to Director to Sandia. If I recall correctly, Jim had a collection of antique rifles, which he showed to Warren mason and me; and, all in all, it was a pleasant evening of drinks and conversation.

I have many pleasant memories of all the Ferroelectrics Symposiums that I attended. It was to members of the Ferroelectrics Committee, and primarily to Cecil Land, that I am indebted for the support needed to receive the award of the IEEE Fellow Membership Grade. Over our years of association, Cecil and I formed a deep friendship. It is that fact that makes me want to say a few words about the ISAF that took place at Lehigh University. Lehigh University was the place where I attended graduate school as a Physics major and earned a Ph.D. It was a memorable meeting for several reasons. The food at the social hour and the banquet was outstanding. In addition, and what is much more important, it was the last symposium that Cecil Land attended before his illness with emphysema forced him into retirement. I do remember, one evening we sat together in a large room in the Administration building on the Lehigh campus and talked for a long time about the many experiences we had shared and the people we had known. I think Cecil sensed that this was probably going to be the last time we would see each other; and indeed, that turned out to be the case. Cecil was a fine man, a productive, creative scientist and, a great friend, and I never attend a Ferroelectrics Symposium or a Ferroelectrics Committee without thinking of him and wishing that he were still with us.

7. Memories of Piezoelectric Standards Sub-committee Meetings

Around 1964, after my term of service as Chairman of the AdCom came to an end, I became involved in an activity that was going to consume a significant amount of my time for the next 14 years; that is, I agreed to become the Chair of the Piezoelectric Standards Sub-committee and take on the task of preparing a new standard on piezoelectricity. During the decades of the 1940's and early 1950's, there was a significant IRE activity in the area of the development of standards for piezoelectric materials and devices. After I joined Bell Telephone Laboratories in October 1955, my own research activities were very much involved with the characterization and application of piezoelectric ceramic materials used as transducers for ultrasonic delay lines and for acousto-optic devices. Chairing a committee on the development of piezoelectric standards seemed to me to be very much in accord with my own career interests.

One of my associates, and a close personal friend, in the early 1960's was Harry F. Tiersten. Harry was a theoretician in the area of mechanical wave motions and piezoelectric materials. It was Harry Tiersten, more than anyone else, who made me aware of the shortcomings in the existing IRE-IEEE standards on piezoelectric materials and devices and urged me to organize an effort to develop a new standard on piezoelectricity. He volunteered to put a substantial amount of his personal effort into the drafting of a new standard. With the assurance of Tiersten's participation and with the participation of several other colleagues at Bell Telephone Laboratories, I agreed to take on the task of serving as the Chairman.



Fig. 11. The author and H. F. Tiersten (on the right). This photograph was taken on the occasion of the IEEE UFFC-S Achievement Award presented to H. F. Tiersten, Nov. 1, 1993.

The IRE-IEEE standards on piezoelectricity that were in force in the early 1960's were the creation of a number of people, mostly located at a few industrial laboratories. Among these people were men like Warren Mason, Walter Bond, Arthur Warner, Roger Sykes and Irving Fair at Bell Telephone Laboratories; Rudolph Bechman and Eduard Gerber at the U.S. Army Signal Corps Laboratory at Ft. Monmouth, NJ; and Hans Jaffe, Don Berlincourt and Hans Baerwald at the Clevite Research Laboratories in Cleveland, OH.

The main objective of the new work that the committee undertook starting around 1964 was a revision of IRE Standard 176, the IRE Standard on Piezoelectricity. Some of the generation who had worked on the standards in the '40's and '50's, particularly Roger Sykes and Eduard Gerber, were not sympathetic to the idea of embarking on the job of creating a new version of the standard on piezoelectricity. Probably, if Harry Tiersten and I had been in Roger Sykes' department at BTL, the revision would never have been undertaken. As it was, we were in an ultrasonic device department with John Rowen as the department head, and John Rowen was supportive of the undertaking. With the support and encouragement of Harry Tiersten and a few others, a PAR (Project Approval Request) was prepared, submitted to the main Standards Governing Board and approved. Among the participants at early meetings of the Piezoelectric Standards Committee, I can remember people like Harry Tiersten, Rudolph Bechman, Art Warner, and Don Berlincourt. Later, the activity was joined by other notable contributors including Jerry Coquin and Fred S. Welsh, III. .

Since many of the participants in the meetings of the Piezoelectric Standards Subcommittee were located close to New York city, it was relatively easy to call meetings at times like the main IEEE Convention in March, at the Ultrasonics Symposium, and at other times. The headquarters location of the IEEE, particularly the headquarters location on East 57th St., was frequently the location for the meetings. I do remember that some of the meetings were occasions of ferocious debate between participants who had differing opinions. I always enjoyed these debates; for me, the meetings were more often than not tremendous learning experiences.

8. The 1981 IEEE Awards Ceremony in New York City

I owe the fact that I am presently a Fellow in the IEEE, in large part, to the persistence of my good friend Cecil Land. At one point during his tenure as Chairman of the Ferroelectrics Committee, Cecil noticed that I was not a Fellow of the IEEE. He said, "Al, give me the background information and I'll take care of doing the work of preparing your nomination to the IEEE Fellow Membership Grade". I was thrilled at the idea of becoming an IEEE Fellow. However, securing the award for me turned out not to be as simple as Cecil had imagined. He submitted the nomination the first time and it was passed over. He submitted the paperwork a second time and the nomination was passed over again. After the second time, I said to Cecil, "Look Cecil, thanks for all your efforts, but you got better ways to spend your time. Let's just give up." "No-sir-uh, Al," he said, "You deserve to be a Fellow and we are not going to give up until you become one." The third time the nomination passed.

Early in 1981 there was a local IEEE Southeast Michigan Section meeting in 1981 where I actually received the Fellow Membership certificate. But there was also a national IEEE Awards Meeting that took place in New York City. Fellow award recipients were invited to participate in this meeting, which took place as part of the Awards ceremony associated with the International Convention. My wife, Joan, and I went to the ceremony. The man who was the President of the Society and officiating at the ceremony was Dick Denton, and old friend and acquaintance from the days when we served on the IEEE GSU-AdCom together. Another friend from my GSU associations was Art Ballato, who also was present and who received a Fellow award at the same time.

A memorable part of the award ceremony was the presence of the two inventors of the point-contact transistor, Walter Brattain and John Bardeen. They were made Honorary Life Members of the IEEE at this ceremony.

At the end of the ceremony Dick Damon came over to me and told me that there was going to be a special reception in honor of Bardeen and Brattain in a nearby hotel and he invited me to join the group. I was pleased to accept the invitation. At the reception I

was introduced to Bardeen and Brattain⁸ and took advantage of the opportunity to ask both of them to give me their autographs on some 3" x 5" cards that I was carrying in my pocket. They graciously did as I requested⁹

It is interesting to note that William Shockley was not a participant in the award ceremony and the reception after it. By 1981, Shockley had become such a controversial figure because of his views on the influence of race on intelligence, that he could not participate in a public gathering without drawing a group of protestors that would interfere with the order of any public meeting in which he participated.

9. Closing Comments and Philosophical Reflections

9.1. The Bell Telephone Laboratories Influence

When one looks back over the early history of the IEEE UFFC-S, it is clear that Bell Telephone Laboratories played a very large roll in supplying the talent and support needed to make the organization function and grow. It is also very clear that other people and organizations were involved and played important roles. Indeed, Amor Lane, the initial organizer, was with the U.S. Navy. The University of Illinois and Columbia University provided key people and so did commercial companies like the Clevite Corporation, and the research laboratory of Zenith Radio Corporation. The Army Signal Corps laboratory at Fort Monmouth was another source of talented, supportive people. I freely acknowledge that my account of the early history of the IEEE UFFC-S is strongly influenced by the fact the many of the people who played key roles in the founding and development of the society were both close personal friends and close professional associates through the common connection of Bell Telephone Laboratories during the years from 1955 to 1972.

9.2. The Nature of the Present-Day (year 2000) UFFC-S AdCom

In January 1996, after I retired from Ford Motor Co., I ran for election to the AdCom and served from 1997 to 2000. The nature of the AdCom had changed completely in the years that had elapsed between when I resigned as Secretary-Treasurer in 1972 and when I rejoined the AdCom as an elected member in 1997. During the three years that I served on the AdCom, there was not a single member of the AdCom who was an employee of Lucent Technologies (formerly AT&T Bell Laboratories). The international nature of the AdCom was strongly evident in the presence of AdCom members from Europe and Asia.

⁸ Actually, I had met Walter Brattain once before, 24 years earlier. On April 22, 1954, Walter Brattain gave a talk on Semiconductor Physics to a meeting of the Physics Club of the Lehigh Valley. The talk was given in the evening in a lecture room of the Physics Building of Lehigh University. I was a graduate student at the time. I sat attentively through the talk and took four pages of notes in cramped handwriting. I still have among my prized possessions the four pages of notes that I took that evening.

⁹ I took the two autographed cards home and carefully put them away in a file. Several years later, I looked for the cards and could not find them. I can't believe I threw them away, but I have not been able to find them, and I keep hoping that some day they will turn up.

During the early years from 1956 to 1972, AdCom meetings were bastions of male exclusivity. (Julia Herrick was a member of the AdCom during the first few years, but by the time I started to attend AdCom meetings in 1956, she was no longer present.) That has changed. The trend for women to be increasingly present in engineering was evident in the composition of the AdCom meetings from 1997 to 2000. After Julia Herrick, the next woman to be elected to the UFFC-S AdCom was Jan Brown; who was elected to the AdCom in 1984; she was elected Vice-President of the Society in 1988 and President in 1990. She has been a regular presence at AdCom meetings since she was first elected to serve in 1984 and has served both the UFFC-S and the IEEE national organization in various offices. Present day meetings of the AdCom usually have three or four women present serving either as elected members or ex-officio members.

Another aspect in which the present-day UFFC-S is notably different from GSU of the early days is that not a single committee meeting, AdCom, Symposium or any other kind of committee meeting, takes place in New York City. The people who are present at the AdCom meetings are people connected with universities, government research laboratories, industrial organizations, and consulting firms. The distribution seems to be fairly uniform, with no one dominant group the way in which Bell Telephone Laboratories employees dominated some of the early AdCom meetings. During the last AdCom meeting I attended as an elected member of the AdCom (held in the month of October 2000 and at the exotic location of San Juan, Puerto Rico), I looked around the room at 40 or so members sitting in the meeting. Not a single person at the meeting was, at the time of the meeting, an employee of AT&T or its subsidiaries. There was one other person there who at one time was connected to AT&T as I was. That person was Tom Cutchen, who during 2000 and 2001 serves as the Chair of the Ferroelectrics Committee and who is employed by the Sandia Corporation. Sandia is now a government laboratory; but when I first met Tom back in the 60s, while I was an employee of Bell Telephone Laboratories, Sandia Laboratories was also a part of the Bell System.

9.3 Whose UFFC-S Is It, Anyway?

When I left graduate school as a freshly minted Ph.D. in Physics in the fall of 1955 and took a position of Member of Technical Staff with Bell Telephone Laboratories, I also joined within the next year several professional societies including the IRE, the American Institute of Physics (AIP), and the Acoustical Society of America (ASA). After I was at Bell Labs for a year or so, I noticed that not all of my contemporaries on the technical staff, who were young Ph.D.s in Physics, were active in the IRE. Broadly speaking, the young Ph.D.s could be divided into three groups. There were (1) those who were members of the AIP or Sigma Xi or other scientific societies but **not** the IRE, (2) those who belonged to the IRE and one or more scientific societies, and (3) those who did not belong to any professional societies at all. The members of the first group appeared to be individuals who did not want to compromise their status as “scientists” by being involved with an engineering society. The third group had a different set of reasons for not being in the IRE. Once I asked a friend of mine who was in the third group why he didn’t join the IRE. “Why should I?” he replied. “Well”, I said, “you can subscribe to the journals and get home delivery, you can attend meetings

usually at a lower registration fee, and you can publish papers in the Institute's journals." "Yeah", he said, "But as a non-member, I can see the journals in the library, the company pays whatever the registration fee is when I go to a meeting, and the IRE journals are only too happy to accept whatever papers I submit, whether or not I am a member. So I get all the benefits without paying the dues." I must admit, at the time, I was taken aback by his arguments and had no good rebuttal to offer. Now, 45 years later, I think I could give him a good rebuttal. I firmly believe that the major rewards of membership lie in the association with other scientists and engineers, in the friendships that are made over the years, in the experiences shared, and in the stimulation that comes from interacting with some of the most intelligent, capable, and productive individuals in one's field of professional activity.

When I look back on my early association with the IRE, I think I was unusually fortunate to have opportunities that probably are not available to new members of the present-day IEEE UFFC-S. I joined the Bell Telephone Laboratories in an area of professional activity where my closest professional associates and management supervisors were active in the IRE and supportive of its activities. Most of the important technical meetings and committee meetings were in New York City, only about 25 miles or an hour's commute from where I lived and worked in New Jersey. There was never any problem about getting the approval to attend a meeting. I don't think a similar situation exists for present-day, young engineers. Nowadays, the UFFC-S AdCom meetings and the major technical meetings take place in many different countries. Many of them are held in semi-resort or holiday locations, so that management is likely to regard the trip as a boondoggle, an expense that is hard to justify to higher management. For example, in my own case, it might be noted that during the 17 years that I was employed at Bell Telephone Laboratories, I never received approval to make a trip to Europe or to Asia. Approval for that kind of trip was reserved for those who were expected to move into management and develop into department heads or directors. It was very rare for a supervisor or ordinary engineer to attend a technical meeting in a foreign country (Canada was, of course, the notable exception to this rule.).

Over the years that I have known the organization, now called the IEEE UFFC-S, there have been a number of profound changes, both in the nature of the organization and in the nature of its meetings. What started as a group of ultrasonics engineers mostly located in states clustered around New York City has become a large, multi-national professional organization with a membership that includes professionals from many countries. The meetings have changed in a manner that reflects this geographical diversity. Instead of being concentrated in the U.S., they now occasionally take place in the US, but frequently are located in attractive locations outside the U.S. This practice has resulted in meetings that not only are well attended, but in addition, are financially successful, frequently producing budget surpluses in the tens of thousands of dollars. One result of this strategy is that the UFFC-S is financially strong with financial reserves around a million dollars. The strategy of holding meetings in expensive resort hotels in attractive locations produces a large attendance of senior engineers and management types. To some extent, the potential discrimination against student engineers is lessened by providing travel support for students and for engineers from "poorer" countries. But in

spite of the good intentions of the AdCom, there are two groups that are disadvantaged. One group is the group of older, retired engineers who are interested and would like to attend but who find the high registration fees, the travel costs, and the living costs prohibitively expensive. The other group is the group of young engineers, recently hired into large companies or research organizations and without the seniority that enables them to qualify for travel support.

One thing that has disappointed me, as an older person attending present-day UFFC-S meetings, is that very few of the people I knew from the '60s and the '70s are present at these meetings. I hoped that I would be able to see these people and renew old friendships. Clearly, this hope was unrealistic. But the present-day Ultrasonics Symposiums, Frequency Control Symposiums, and Symposiums on Applications of Ferroelectricity are not intended to function as high-school or college class reunions, nor should they. The meeting strategy that has evolved satisfies successfully the primary mission of the society; that is to promote education and research in the fields of Ultrasonics, Ferroelectrics, and Frequency Control and to do this on a basis that allows the meetings to be self-supporting and ongoing. The Proceedings of the meetings and the *IEEE Trans. UFFC* provide media for the publication of research papers and the distribution of knowledge; the quality of the publications and the total number of papers published per year continue to increase as of the time of this writing.

9.4. Conclusion

I will close this history with an expression of my deep personal thanks to the IRE PGUE and the IEEE UFFC-S. The meetings, the associations, the camaraderie have provided me with friendships, memorable experiences, and opportunities for intellectual growth. The organization has all my good wishes for a prosperous continuation into the future of its basic missions to promote the profession of engineering, to educate, and to disseminate knowledge.

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¹⁰ This document is available on the IEEE-UFFC website under the History heading.

¹¹ *IEEE Transactions on Sonics and Ultrasonics*, Vol. SU-31, No. 6, November 1984, p. 536.

Center, Rutgers University, was very helpful in supplying miscellaneous information and photographs of the IRE Headquarters, of the IEEE United Engineering Center, and Dr. Emberson.