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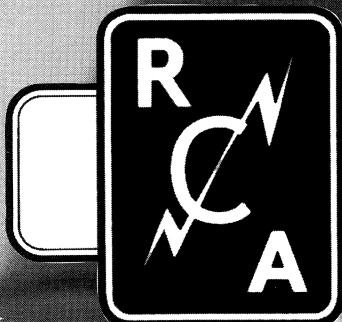
**A Tribute In  
Words And  
Pictures To  
Fred M. Link**

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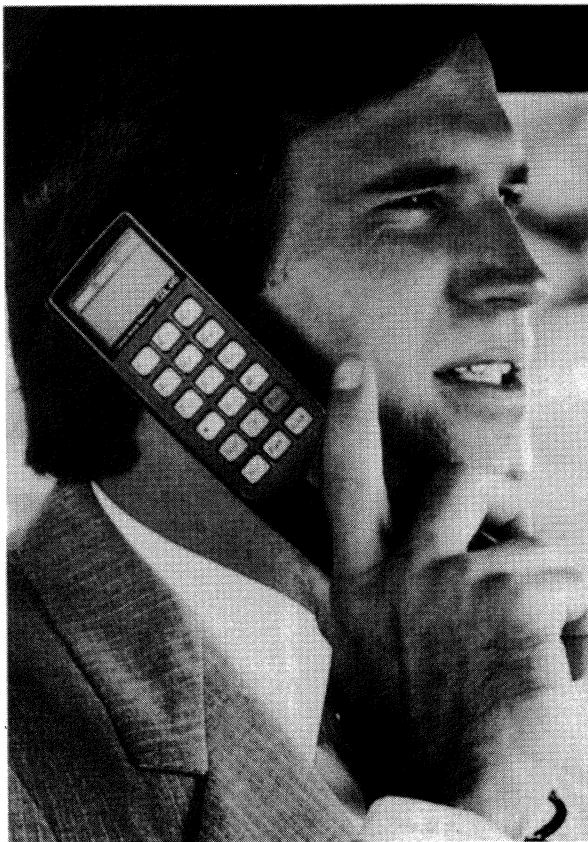
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# A Message From Mercy

**T**his year would have marked Fred Link's 100th birthday. As the celebrated "Father of Mobile Radio," Fred had such a colorful industry history, and we all have our favorite fond memories of him. Being the humble guy that he was, Fred liked to refer to himself in the third person when he received critical acclaim.

I remember how proud Fred was when he was mentioned in Kathi Ann Brown's book, *Critical Connection, the MSS Story*. He sent me a copy and wrote me a note that said, "This tells a little bit of where Fred Link had a major impact on a vital industry - Land Mobile Radio - and WW II."

Fred also highlighted some excerpts from the book regarding stalled sales in radio systems: "Stumped, Paul Galvin [of Motorola] confided his frustrations to Fred M. Link, whose small company - the Fred M. Link Company in New York City - was the recognized leader in police communications during the 1930s. Link pinpointed Galvin's problem immediately" and "Galvin wanted to know how Link's tiny operation was managing to beat the pants off the competition, including marketing powerhouses like General Electric and RCA."

The book goes on to tell how Fred helped Paul Galvin reach "the happy ending to the tale of flagging sales," which Fred also highlighted. Fred told me that the secret to his success, which he shared with Paul Galvin, was that he would never sell radios to anyone who wasn't qualified to maintain them. His customers employed their own licensed technicians. And he loved to point out that the MSS story used phrases like "Fred Link was right," "Fred Link's wise words" and other descriptive phrases about Fred Link.

My other favorite memories surround Fred Link's birthday parties. Fred's 80th birthday party was held at the Marriott Hotel in Orlando, Fla. He was soundly roasted by a group that included Ted Faust, Bob Foosaner, Mal Gurian and Loren McQueen. A "Dr. Ruth" impersonator was on hand to give Fred lots of advice. Fred had an inner-ear problem that kept him from dancing but he managed to learn the "moonwalk" that night. It was a wonderful time for Fred and for the industry that loved him.

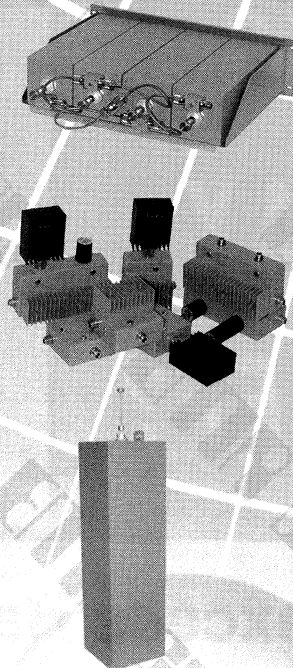
Fred's 85th birthday party was held at Union Station in Washington, D.C. This was another grand affair, sponsored by Telocator (now PCIA - The Wireless Infrastructure Association). An impressively large cake was rolled out for Fred and his guests. The U.S. Marine Band played as Don Bishop sang "Happy Birthday."

By the time his 90th birthday rolled around, Fred was beginning to slow down just a little bit. He still relished the limelight, though, and he was proud of being honored on his birthday at the PCIA convention in Seattle. PCIA presented Fred with a special award, it served birthday cake, and everyone at the banquet sang "Happy Birthday" to him. He was thrilled, and he wanted me to call Memi, his wife, and report to her about all of the attention that had been paid to him. I remember making many such calls to Memi over the years I was associated with Fred. Even though it's been six years since he has been gone, I still miss him terribly. He was truly unique, and I loved him very much.

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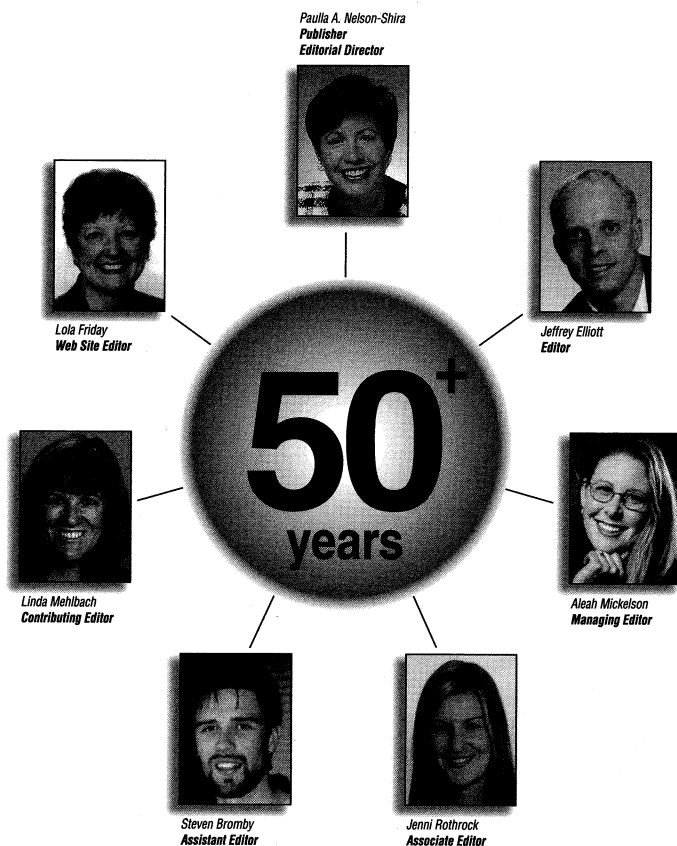
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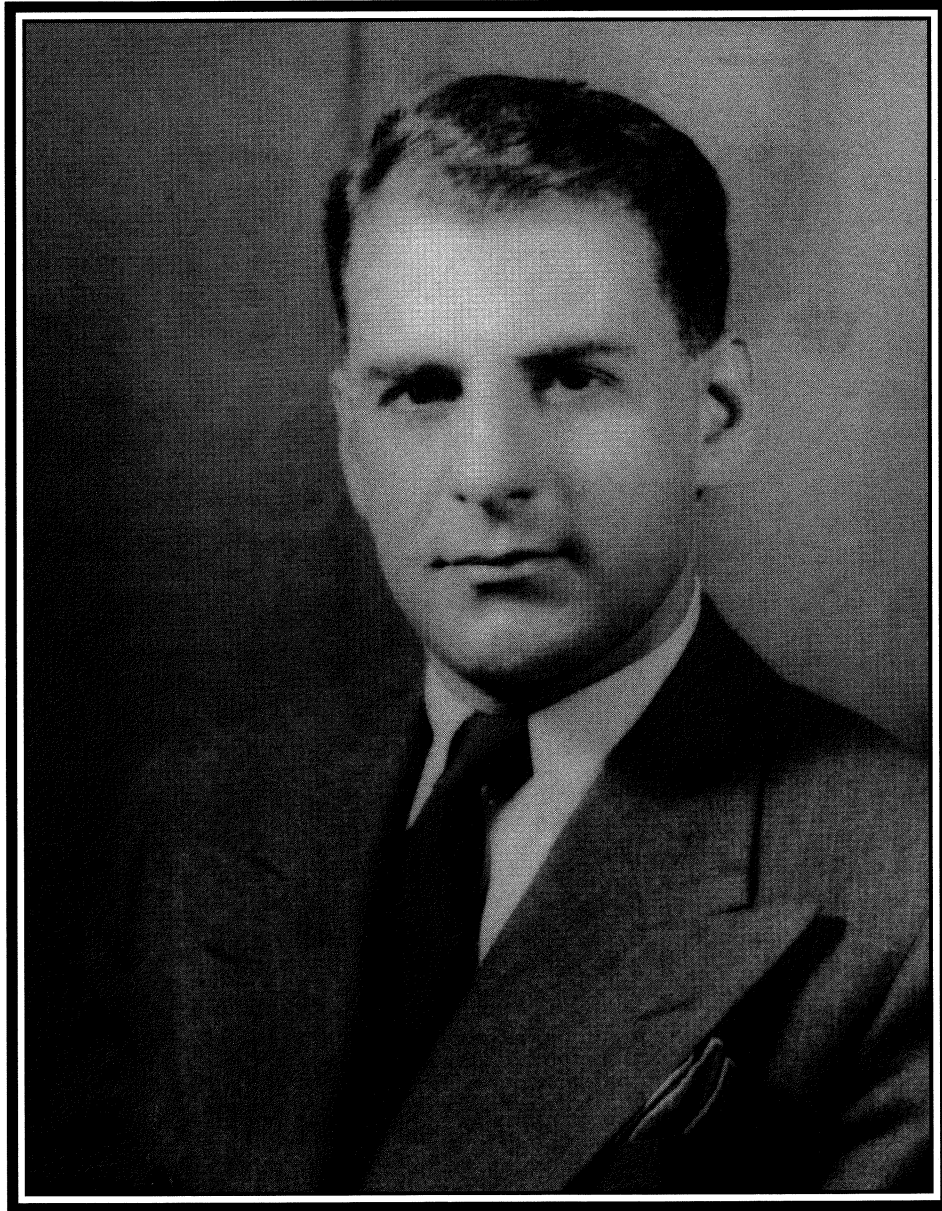
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# **Fred M. Link: 'Goodwill Ambassador'**



**During his long and distinguished career,  
Fred Link touched all of our lives in one way or another.**

*By Don Bishop*



**F**red Link was known to several generations. His fame began with amateur radio exploits, it continued with police radio innovations, it included World War II radio manufacturing, and it extended with mobile radio consulting.

I met Fred M. Link in August 1984 at the Salt Lake City APCO conference. I was *Mobile Radio Technology's* new senior editor. Phil Cook, then a co-owner of Mobile Radio Technology and its publisher, invited a group for lunch, including Fred.

"Fred, what do you do?" I asked.



*In June 1908, RF technology was not the first thing on the young Fred Link's mind.*

"Don, it's been so long since anyone asked me, I don't know how to answer," he responded.

You see, Fred was so famous in the land mobile radio industry that hardly anyone ever had to ask. What followed was about 20 minutes of Fred's resume, which sketched an amazing story.

My last visit with Fred was on June 8, 1998, when Mercy Contreras (*Mobile Radio Technology's* group publisher at the time) and I took him to lunch at Loafer's Restaurant in Frenchtown, N.J. We talked about his friends in the industry and in the Radio Club of America. He passed away in his sleep on June 18 from a rapidly advancing leukemia that had been diagnosed only a few days before. He was 93.

Fred never wanted to cooperate in the writing of his biography. He wouldn't let me print his stories

"while I'm alive," he said, "because I can't be sure what's the truth and what isn't. It might embarrass some people."

"But Fred, most of them are no longer with us," I persuaded.

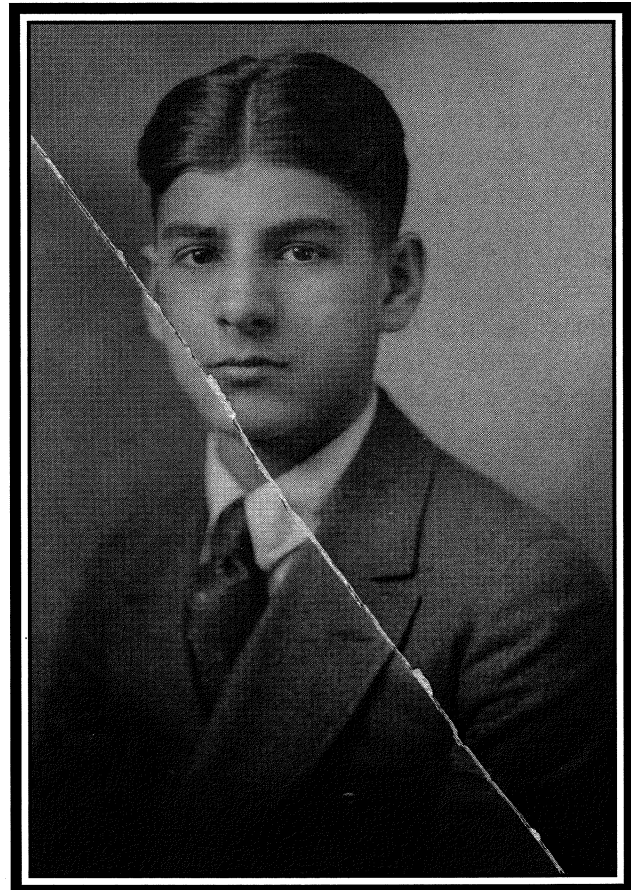
"That's true, but I still can't be sure of what I say," he insisted.

## **The Early Days**

Early on, Fred worked part-time as a telegraph operator for the railroad. He was 14. "I learned Morse code to earn a merit badge in 'wireless' to qualify as maybe the first Eagle Scout in Pennsylvania," Fred explained. "A lot of the railroad's Morse operators had left for the military in World War I, so I got some work as a relief operator."

During high school, Fred worked for his uncle, George Motter, as an apprentice electrician. "I attended school half-days and worked the other half," he said. Fred earned a Journeyman's Certificate as an electrician by the time he entered Pennsylvania State College.

He was a radio amateur, first with spark station



*Fred Link in 1921, at the tender age of 17.*



*Link Radio sponsored a company baseball team, with coach Fred Link in the middle (year unknown).*

3OV at Boy Scout Troop No. 7 in the York, Pa., YMCA, and then with his own continuous wave (CW) station, 3BVA. Access to electrical parts at his uncle's company helped Fred to build these stations. From 1927 to 1933, he and John B. Knight Jr. operated W2ALU in New York and in Passaic, N.J.

As a graduate electrical engineer in 1927, Fred went to work at New York Telephone and then, in 1929, DeForest Radio. In late 1931, Fred resigned from DeForest Radio along with a group of employees, including the man who had hired him, Allen B. DuMont.

Fred had been in charge of tube manufacturing. A U.S. Navy radio inspector, Walter Peterman, suggested that Fred consult the trustee of Duovac Radio Tube Company in Brooklyn, N.Y., to help the company to complete U.S. Navy orders for tubes. Fred did business for two years as "Fred M. Link, Consultant" with Duovac and other tube manufacturers. By 1933, Fred had become partners with R.C. Powell in the R.C. Powell Company, which manufactured remote broadcast amplifiers and radios.

Once, Fred told me he bought out Powell; another time, he said Powell became overwhelmed by the business challenges of the Depression, turned the

company over to Fred and left. Either way, Fred became sole owner, he changed the name to "Fred M. Link Company," and he went to work completing a Signal Corps contract for equipment.

## Company Man

The Link Company made a variety of electronic equipment, assisted other manufacturers (including DuMont), and provided repair services before concentrating on police radio communications equipment under a new name, Link Radio Corporation.

"Fred Budelman, our chief engineer, was brilliant," Fred said. "He could take circuit diagrams, think about them overnight and build prototypes the next day."

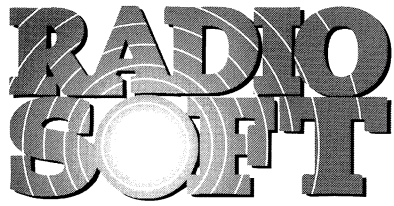
What put Link Radio in the forefront was the manufacture of frequency-modulated (FM) two-way radio equipment.

"That was the brainchild of Dan Noble, an electrical engineering professor at the University of Connecticut," Fred said. "He was consulting the state police on the design of a statewide communications network."

Noble had monitored experimental FM broadcasts from Edwin H. Armstrong's Alpine, N.J., station, and

*"My best recollection wasn't a single incident. Many times, people would ask me to introduce them to Fred. What didn't know was that Fred loved meeting new people and was always available to talk to anyone, no matter what they did or who they were."*

*Stan Reubenstein (F)*



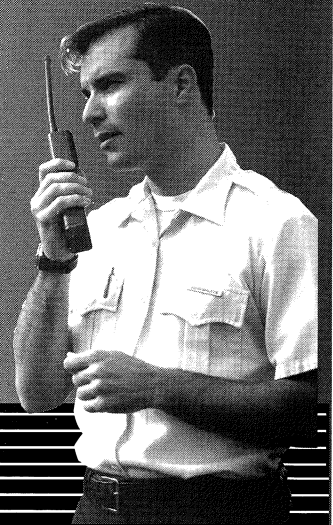
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*"I remember quite a few years back being at some industry affair at which Fred was a guest speaker. It was the first time that I heard him jokingly claim to be the father of cellular communications. It seems that, many years ago, he was involved in putting in a multiple channel radio dispatch system for, if I remember correctly, either a very large police department or taxicab company.*

*Maybe it was in Detroit?*

*Basically, the set up was one channel was used for the initial contact between the car and dispatchers back at base, and then the dispatcher would assign a different working channel to use for the actual message traffic. Fred claimed that even though it was manual and not computer based at that time, the basic principle was still the foundation of today's cellular communications.*

*It was so Fred. If you knew him, you had to love him."*

*Tony Sabino (F)*

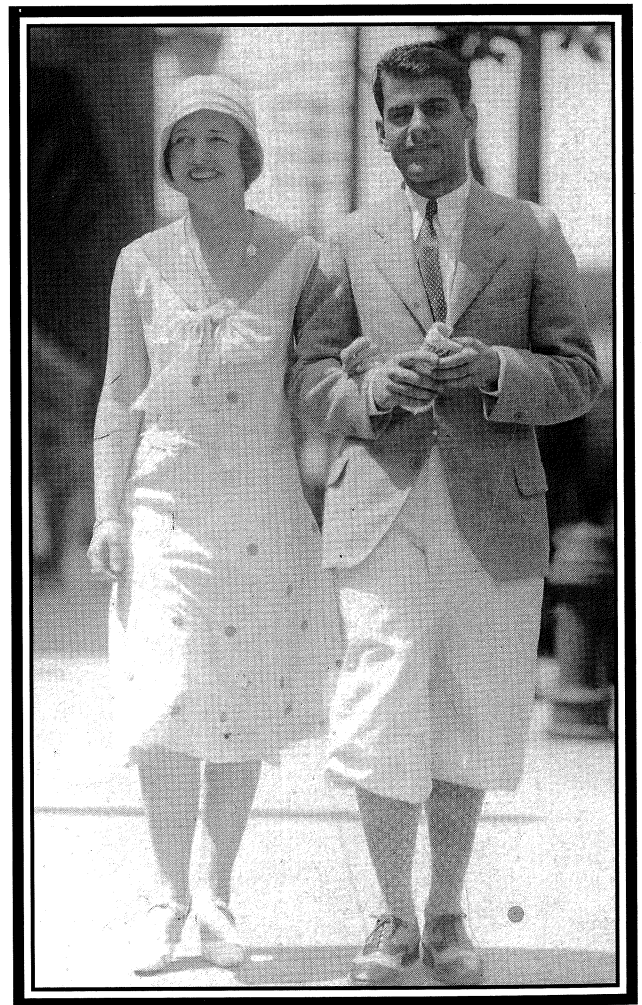


he had developed an idea for using FM for communications.

"Noble visited Link Radio with diagrams, and showed them to Budelman and me," Fred said. "The next day, Budelman had prototypes." Link Radio then built the Connecticut equipment.

With FM, Link Radio took the lead in police-radio manufacturing, and it later made equipment used by all military branches during World War II. His company earned five Army-Navy "E" awards. In 1950, Fred sold the company.

"I had been lucky many times," Fred said, but luck ran out with the sale of the business. His buyers gave him preferred (non-voting) stock. "I didn't need the cash," Fred said. His buyers came under federal indictment for reasons I never learned, and they diverted company resources to pay their legal



*Fred and Mildred Link as a young couple. The two shared many things, including a long marriage and two daughters. They were called "Dazzy" and "Memie" by their children, grandchildren and close friends. They were friends with the Sarnoffs, whom they met on a cruise ship. Sarnoff ended up hiring Fred as a consultant for his Radio Corporation of America.*

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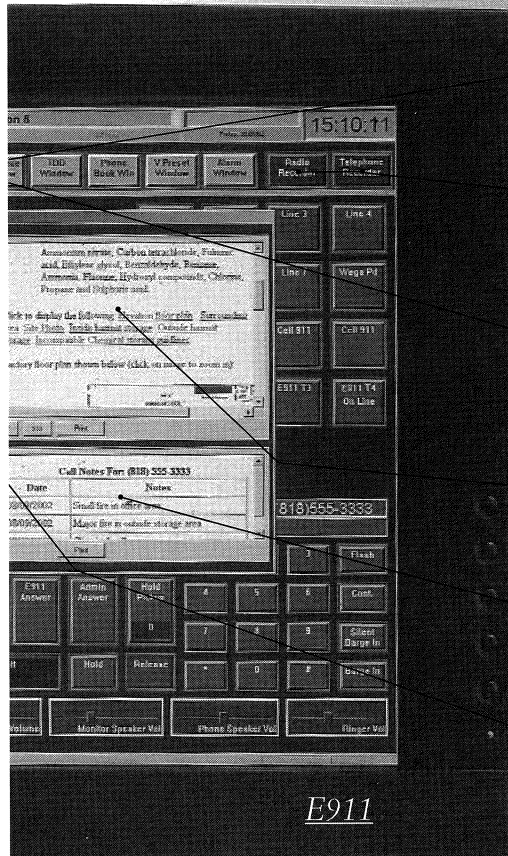
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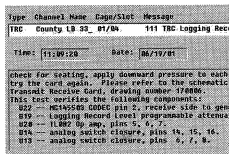
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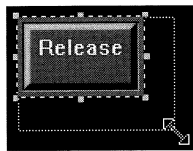
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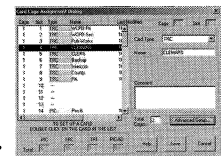
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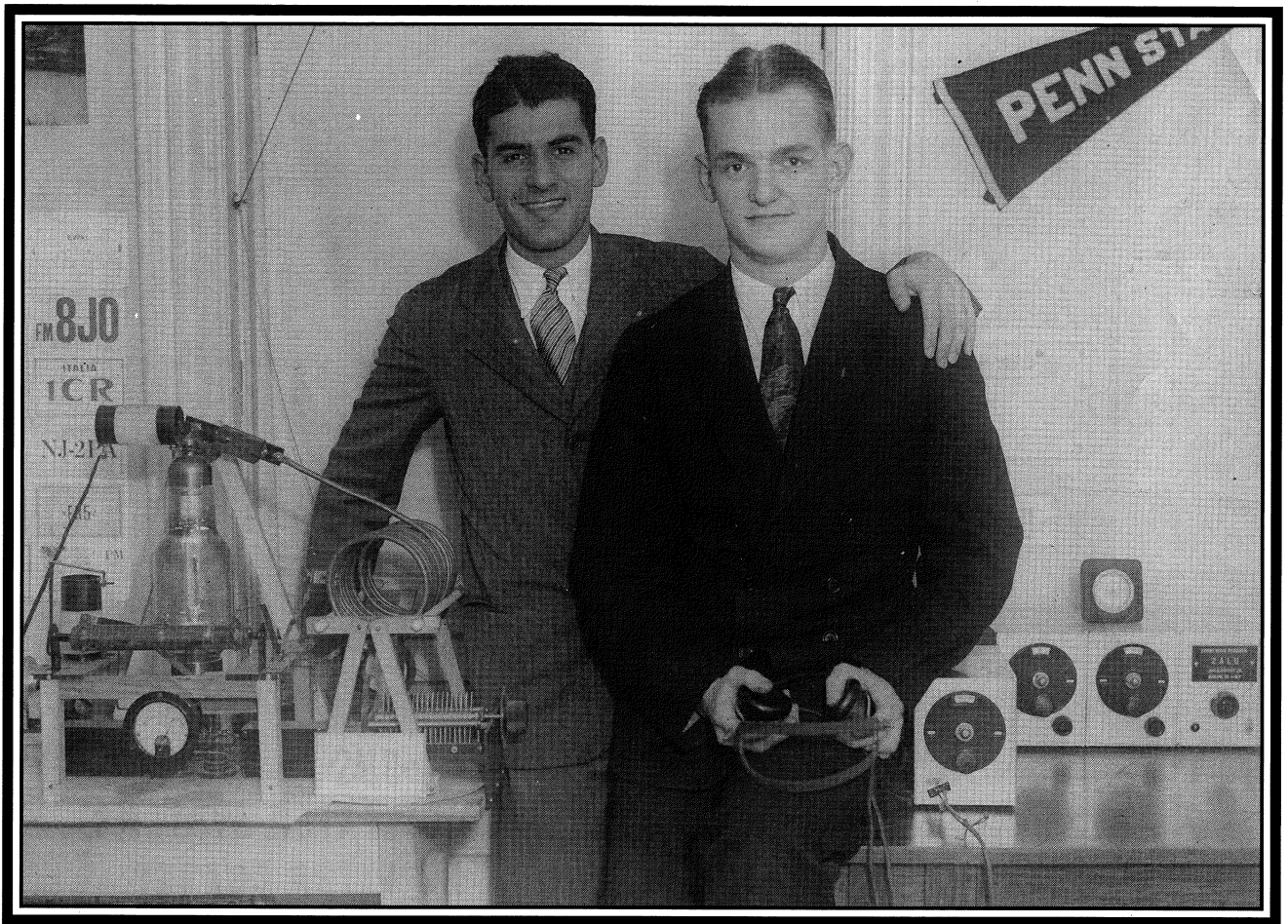


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*From 1927 to 1933, Fred Link (left) and John B. Knight Jr. (right) operated W2ALU in New York City and in Passaic, N.J. The two entered a DX contest and transmitted from their room at the New York City YMCA (this photo) with bootlegged power from an elevator.*

expenses. Link Radio was in Chapter 11 bankruptcy by 1952, and it was liquidated in 1953. Fred went back to work.

## Starting Over

In 1954, under a five-year contract with DuMont Laboratories run by his old friend Allen DuMont, Fred established a mobile radio division and hired many former Link Radio employees. The division served many former Link Radio customers that had been left without replacement equipment and service.

After the contract was up, Gen. David Sarnoff, the head of Radio Corporation of America (RCA), told one of his vice presidents to hire Fred as a consultant to resolve a problem with a RCA contract to provide police-radio equipment to the city of Philadelphia. The Sarnoffs had met the Links on a cruise ship, and Sarnoff knew Fred by reputation and because Fred had helped to prepare compelling legal exhibits in opposition to RCA in a patent dispute. More luck?

“Sarnoff told this vice president how much I was to be paid, and it was more than the vice president made. He didn’t like that very much,” Fred said. Fred’s help saved the contract, and Sarnoff kept him as a consultant from 1959 to 1965.

After 1965, Fred worked as a consultant for a variety of companies. One was Cambridge, England-based Pye Telecommunications, which became part of Philips Radio Communications Systems, now Simoco Telecommunications. Another was Communications Industries, one of whose founders, Jerry Stover, credits a Link radio with saving his life in World War II — somewhat for its communications capability and somewhat for its capacity to stop bullets, as Jerry tells the story.

Others to benefit from Fred’s expertise included Repco, E.F. Johnson, Ericsson, Trott Communications Group and...*Mobile Radio Technology*. Fred became our industry consultant in 1984. He advised us about information we should publish, and he introduced us to

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*"I remember watching Fred meet new people, my wife Susan included, in his typical friendly, enthusiastic, positive and 'feel good' manner. After talking to Fred for the first time after a NABER board meeting, Susan commented what a wonderful guy he was, and she asked what his connection to NABER was? When I explained how he sort of invented our business and all he had done, she was really impressed that such an accomplished person as Fred would never mention what he had done but would use the conversation to make the person with whom he was talking feel so comfortable and good about themselves. Susan and Fred became fast friends. That was Fred."*

*Meade Sutterfield (F)*

industry figures he thought we should know — and he knew almost everyone. In recent years, as his eyesight weakened, he wanted help at the many trade shows he attended. I accompanied him so often that people started calling me his "bodyguard." I told him he was a "people magnet" because he attracted so much attention as we walked the exhibit aisles.

"I prefer 'goodwill ambassador,' Don, if you don't mind," he said.

## **The Link Family**

Fred and his wife Mildred raised two daughters: Daryl, who died several years ago, and Joanne. They also raised American Saddlebred horses. "I can't say that horse-breeding made any money," Fred said, "but it brought me in contact with all the right people." The horses usually were ridden in competition by the Link daughters. Their home, Robin Hill Farm in Pittstown, N.J., contains countless awards and photographs from horse shows.

Fred led the Radio Club of America as president for 23 years, which also figured in the success of his consulting business.

Now you know something about Fred's life, but you shoulda heard his stories. Like the "Great Texas Antenna Shoot," wherein Fred's customer and benefactor, oilman Jim West, organized a shooting party to "remove" a base station antenna that was mounted too high. And the "Radio-Equipped, Horse-Drawn

Delivery Cart" that, thanks to a New York City ordinance, always went ahead of motorized trucks at the docks to pick up supplies for Link Radio. And the "Electric Windows That Sold the Radios," wherein foreign buyers, fascinated by electric windows on a Cadillac given to Fred by Jim West, agreed to a purchase while spending most of their time working the windows instead of watching the demonstration of radio equipment in the car.

And the "Lyndon Johnson Waiver," wherein the then-Senate Majority Leader called the FCC and obtained a waiver for Fred to install 3,000-watt VHF low-band base stations to communicate by skip with mobiles and airplanes across the United States. And Fred's travel to Havana and Mexico City to sell police radios. And many more.

Fred used to tell me, "Don, don't get old; you won't like it."

I would say, "First of all, what's the alternative? Second, if you're any example, what's wrong with it?"

"I guess you're right," he would concede. "I've been lucky."

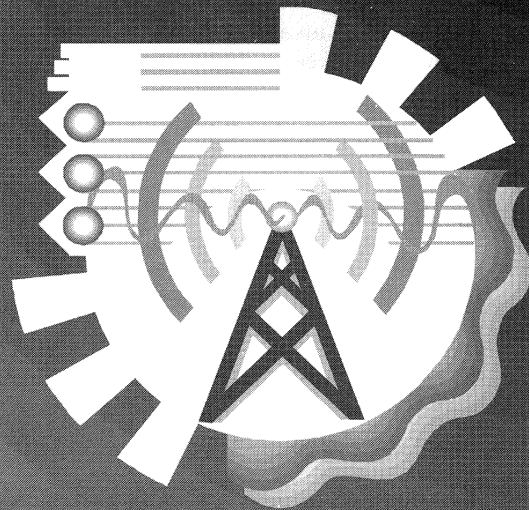
Fred was lucky, although he also was prepared to take advantage of the opportunities that good fortune



*A pensive Fred Link in his office (year unknown). Later in life, he would lead the Radio Club of America as president for 23 years.*



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brought him. He recognized those opportunities, and that made the difference. And I know I was lucky to know him. God bless you, Fred.

Fred M. Link was my mentor and my good friend. My life was enriched by his friendship, and I shall forever cherish the memories of our many wonderful times together.

Fred passed away on June 18, 1998. It was a sad day for all of us in the land mobile industry. Fred was revered as the "father of two-way radio." Hardly a person in the industry didn't know Fred personally or by reputation.

Fred was 93 when he passed away. His age, though, never stopped him from being as involved in the industry as his health would permit. As recently as the first week in June, Fred signed some letters announcing his resignation from the Radio Club banquet contributions committee. Committee? He was the committee! And until June 18, 1998, Fred was industry consultant to *MRT*.



*Mildred and Fred Link go Mexican. In the early years, Fred spent a lot of time in Havana and Mexico (year unknown)*

*"As many of you remember, Fred and I shared a room at the industry trade shows and conferences. Fred and I got along very well, so it was very easy to share the room. Because of my poor eyesight (without glasses) and Fred's hearing problem, I was the ears and Fred was the eyes. One time, while I was shaving in the bathroom, the phone rang and I answered the hair dryer. Fred snored a lot and I'm sure I did, too, but Fred took out his hearing aid and, obviously, did not hear me. Fred hummed a lot but I never could figure out what song he was humming.*

*Fred was a neatnik. Before we left the room to go to whatever function we had to, he would tidy up the desk in the room and do other cleaning functions. I told him to leave it for the maid, but it didn't do any good.*

*Fred was one of the best raconteurs I ever met. His stories were about the history of radio, and everybody loved them. Whenever we planned a Radio Club breakfast, Fred would ask me what he should talk about. I told him not to worry about it, just start talking. Well, we all know he did a great job.*

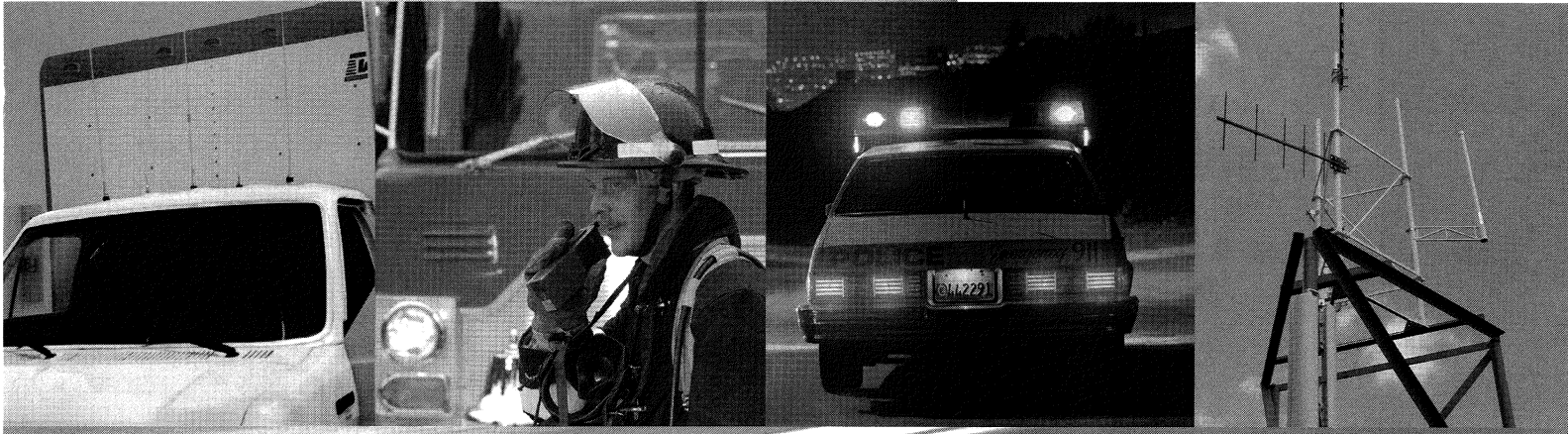
*I miss Fred - like most of you do - but it was a great experience and joy to have known him."*

*Ray Trott (F)*

### **"They Tell Me I Was Magnificent"**

I am reminded of the wonderful times I shared with Fred. He once chastised me for not being present at one of his many keynote speeches.

"They tell me I was magnificent!" he proclaimed with a straight face. And I have no doubt that he was. Fred was quite a gifted speaker. For years he was the featured speaker at the Radio Club of America breakfasts, and how we looked forward to his presentations. We sat there mesmerized by his stories about Silver Dollar Jim West or about the time he and Johnny Knight entered a DX contest and transmitted from their room at the New York City YMCA with bootlegged power from an elevator. Their operation caused so much interference to AM broadcast radio reception that authorities traced the source to their room.



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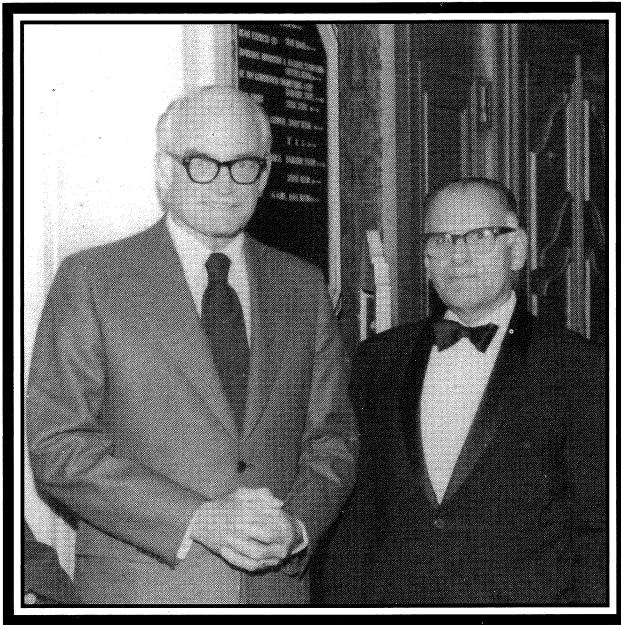
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Fred Link and former senator Barry Goldwater (R-Ariz.), an ardent amateur radio operator for whom one of the Radio Club of America's 10 scholarships is named (year unknown).

Fred had so many wonderful experiences to share. Remember his many adventures with Bill Lear, and how he met Nikola Tesla? Fred would stray from his story and maybe take two or three digressions, but he always tied everything together in the end. Part of the fun of listening was wondering how in the world he would tie what he was talking about to what he had started to talk about in the first place.

As my friendship with Fred grew, so did my relationship with his lovely wife Mildred and his daughter Joanne. Fred and Mildred are affectionately called "Dazzy" and "Memi" by their children, grandchildren and close friends. Memi and Joanne share Fred's wonderful sense of humor, his amazing energy and his ability to make you feel like you are their best friend.

I asked Memi if there was anything we could do for her. She said she would like to have a collection of Fred's "one liners." If you knew Fred, you know of his special, and sometimes not too humble, way of saying things.

In one of my last conversations with Fred, I told him that things were just not the same without his full involvement. I told him that we were

*"It was the early Eighties, and I was a relative newcomer to covering the wireless-communications industry. I was introduced to Fred Link at an industry event, and he was very kind to the 'new kid on the block.' Later that year, at Christmas, I received a box of candy at my office. It was from Fred, and I was so surprised that he had remembered me. He continued this gift-giving for many years. I still think about him, especially when speaking with other Radio Club members, and how he helped in starting my career."*

*Debra Wayne (F)*

trying to carry on like he expected us to, but that it would never be the same. His "one-liner" response was, "Well, that can't be denied, that can't be denied."

Dazzy, you were special, and we will miss you terribly. There will never be another quite like you. And that can't be denied, Dazzy. That can't be denied.

*(This article first appeared in the Aug. 1, 1998, issue of Mobile Radio Technology magazine. It is reprinted with the permission of Primedia Inc.)*



*Always the ladies' man, Fred Link poses with Geneva and Mattie Bean.*



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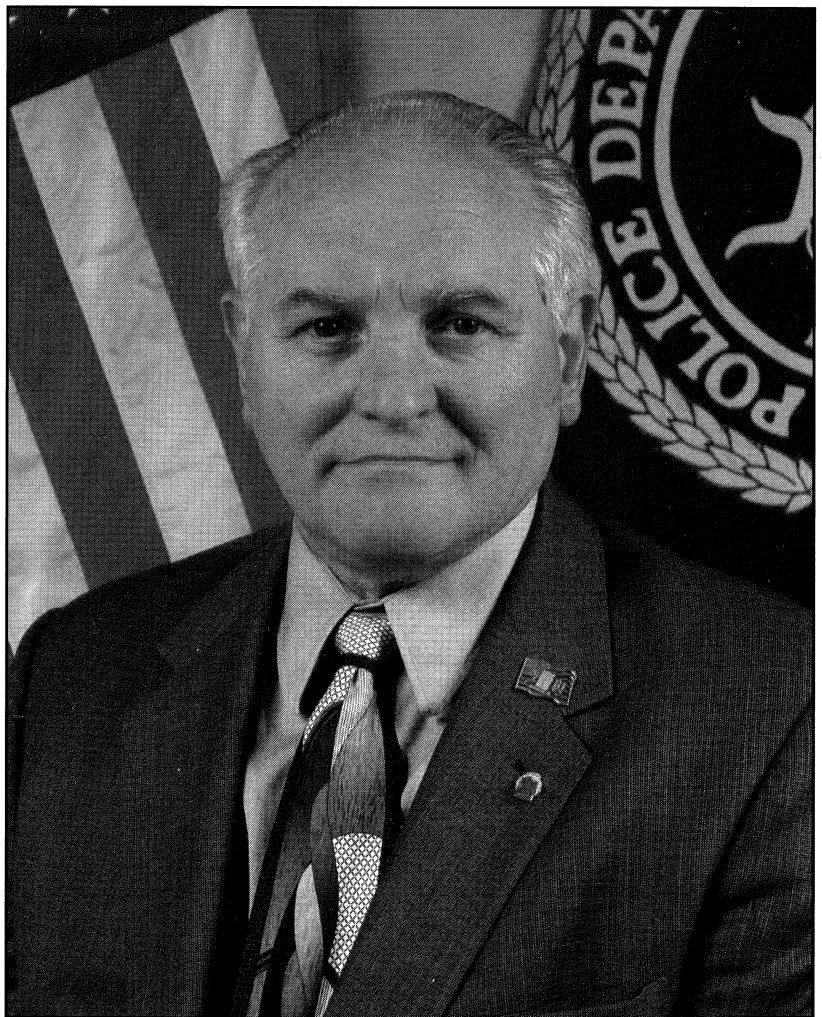
# Vincent Stile And The 800 MHz Question

**O**n Aug. 5, 2004, the Federal Communications Commission voted unanimously to adopt a plan to alleviate public-safety interference in the 800 MHz band. Vincent Stile (F, class of 2004), past president of the Association of Public Safety Communications Officials International (APCO) who currently is on staff with the Suffolk County Police in Yaphank, N.Y., was part of the group that helped get this milestone rulemaking passed. He talked about that process and his career while keynoting the Radio Club of America's Breakfast Meeting in conjunction with APCO 2004 in Montreal - a meeting that took place right after the FCC's landmark decision was announced.

**I**t's a great honor to be a guest speaker before this fine audience. I just hope I don't bore you to tears. When Mercy (Contreras) asked me to speak, I thought, 'Why me?' What could I speak about? But then I realized that, in a few days, I will be stepping down as president of a great public-safety association, and this may be my last opportunity to have a captive audience.

In considering what I would say, I thought I really had no great words of wisdom to pass on, except maybe what one past president said to me when I joined the APCO Board: "Be careful of what you wish for." Well, I got what I wished for and more. It has been a great experience, and I am happy to have been able to live it.

I remember saying to one other past president that we're all put here on this earth to do certain things, and I truly believe that there is a purpose for us for being in a certain place in life when things happen. We're put to the challenge to try to fix whatever might have been sent our way or at least try. I believe the good Lord wants us to deal with these things in order to build character.



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I have had the distinct privilege of being on the APCO Boards of Joe Hanna as a candidate, then with Lyle Gallagher, Glen Nash and Thera Bradshaw. From each board, I've learned that it is absolutely necessary to work as a team. We all have our different opinions, but when it comes to making a final decision, the board needs to speak as one. Also, the buck stops with the president, and you can't realize how extremely important and consequential that spot is until you get into that position. I was fortunate or unfortunate (depending on how one wants to look at it) to be given the opportunity of getting additional time to realize the importance of that position.

My electronic career started when I did a four-year stint in the U.S. Air Force during the Korean War. My career in radio began after the Air Force, when I went to school at the RCA Institute in New York City, where you could earn a 1st Class radio license from the FCC — back when it meant something. My first industry working experience was with North American Philips, after which I worked for Pan American Airlines when it was one of the major airlines.

I finally found my niche in public safety as a sworn police officer with the Suffolk County Police Department on Long Island. The police department allowed me to get first-hand, hands-on knowledge of radio, from the mobile and portable operation to microwave. I was and still am very fortunate to be working for this very progressive police department that allows me to stay active in this specialized career field. I say "fortunate" again, only because after 20 years in uniform as OIC of radio repair, the department hired me back as Director of Police Radio Communications after I retired in 1985. They did that because I know they felt I knew too much about their radio system.

## **The Early APCO Days**

Back in 1970, APCO came into the picture when I began doing frequency coordination for southern New York State as the APCO frequency coordinator. This became a focal point of my public-safety communications career, and spectrum management has been my career passion ever since. It opened the door for me to take part in many, many public safety radio meetings and conferences. APCO enhanced my radio career, which actually benefited the County Police. It gave me the opportunity to know and understand the public-safety wireless-communications business from the rulemaking to the field operations.

Becoming an APCO Board officer in 2000 was like putting the icing on the cake for me. What a way to cap a career in a field in which you really have a passion for. It is like getting a Masters degree in public-safety communications.

From the very beginning of my four years on the APCO Board of Officers, the 800 MHz interference problem was destined to be a legacy of mine. As a board candidate, I was asked what I intended to do about the 800 MHz interference problem that was raising havoc with public safety.

## **The 800 MHz Problem**

I had no idea what those folks in California were talking about. We had no such problem on the East Coast - or so I thought. It was a problem that was being proliferated as more and more cellular systems flourish across the country. This problem along with locating wireless telephones soon became my everyday concern while I was being introduced to Enhanced 911, the wireless carriers and their waiver requests, the PBX problem — all of which I had very little knowledge of. In my first couple of years as a board member, I got educated on how to put together a foundation, and I immediately felt the pressure of demands and politics being put onto leaders of a large international association.

However, if there's been one area that I would say that has been a focal point of my term as a Board officer and president, it has to be the 800 MHz interference problem. There are many other truly significant highlights that have occurred during my tenure that I'm very proud of, such as the opening of an APCO Washington, D.C., office; the hiring of a legal and government affairs officer for that office; and creating two other important positions in the D.C., office: the Communications Affairs Manager and the Legislative Network Manager.

All are extremely important highlights for APCO International. During my tenure, we've worked hard to improve our training curriculum and update the APCO coordination process as well as completely changing our Administrative Management System. I'm also very proud of the fact that during my tenure as president, the APCO board was responsible for putting together a competent committee to conduct a search for a new executive director, whom I hired to take the helm of APCO to steer the association into a future. Financially, I can say with a great deal of pride that APCO International has completed this past year having the highest revenue surplus we've ever had,

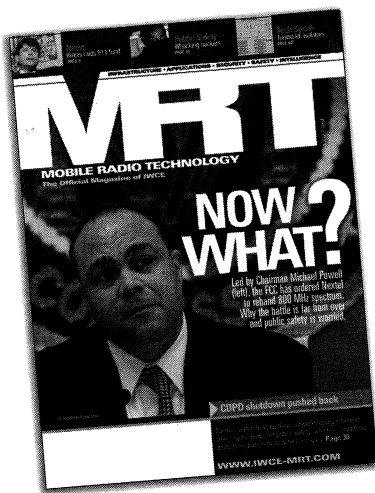


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thanks to the efforts of our CFO and Board of Officers.

Nonetheless, I still believe my record in history will only reflect the 800 MHz interference problem that happened during my time on the Board of Officers. So many others who have participated in the final solution of this critical public-safety problem — many of whom are present in this room — deserve a great deal of credit for all they have done to bring this problem to closure but, even so, I believe my term as the APCO president will have the legacy of having to deal with the 800 MHz problem.

In November of 2001, I went to a meeting in Washington, D.C., at the request of APCO President Glen Nash. Along with Harlin McEwen, Alan Caldwell and APCO's P-39 Committee Chair Roxann Brown, we were introduced to a Nextel proposal that became known as the "White Paper." It actually made me turn chalk white. I thought to myself that the 800 NPSAC system that I had fought so hard to establish in Suffolk County was now going to be pulled apart. I remember someone asking me why I was so upset, to which I said I was concerned about whether the system in Suffolk could be converted. But most of all, who was going to pay for this proposed transition?

After being assured that public safety would not have to pay a dime, I went back home to check on whether or not my department's radios could be returned. I then began to think of the kinds of problems I had been hearing about across the country that first-responders were having. I then made the announcement to my boss, Commissioner Gallagher, who asked me immediately, "Who's paying for this?" I started to tell him I was working with some great public-safety folks, one of whom he knew quite well — Chief Harlin McEwen of the International Association of Chiefs of Police (IACP) and with a fire chief, Alan Caldwell of the International Association of Fire Chiefs (IAFC). I told him we were working as a team for public safety, and our main concern was to fix a major 800 MHz interference problem that will not cost public safety a dime.

## **Solving The Problem**

Knowing who the players were, Commissioner Gallagher was satisfied with my explanation of what was to happen should the FCC adopt the proposal. He also recognized that there was a greater need on a national level for the first-responders, which has been

the driving theme of public safety throughout this entire effort.

Since then, Commissioner Gallagher has retired and my new boss is Commissioner Richard Dormer, who just happened to be my immediate boss as Chief of Support Services 14 years earlier when I began installing the County's 800 MHz trunked radio system. Dormer's continued trust in what I was doing for APCO International allowed me to fulfill my commitment to APCO and public safety. This continued commitment from the Suffolk County Police supports my earlier statement that I've been fortunate to be working for a progressive, forward-thinking police department, concerning themselves with all of public-safety's interests.

With input from a number of APCO public-safety engineers and technicians along with Bob Gurss, Harlin McEwen, Alan Caldwell, Laura Smith and her ITA group, Alan Tillis and Nextel together with Nextel's engineers, the Consensus Plan was born. After many hours of negotiating, giving and taking, the plan was submitted to the FCC. It was on Christmas Eve 2003 that APCO's Spectrum Management Committee and Nextel's engineers hammered out the "Appendix F" portion of the plan to make sure that public-safety has the best possible protection from any future possible interference.

Thereafter, it was Harlin, Alan Caldwell and I (who had, earlier in the year, formed the Coalition for Improved Public Safety Communications [CIPSC] along with Bob Gurss) who made a number of trips to the FCC to explain why the Consensus Plan was the right thing to do. CIPSC is the. It was originally formed as the triad — when Glen Nash was president of APCO International — to provide the combined input efforts of police, fire, EMS, and 911 dispatch, the first-responder local public-safety entities.

Our combined efforts — besides those of Laura Smith, Alan Tillis and Nextel — worked hard to convince the FCC that the Consensus Plan was right. Eventually, even our opponents admitted that it was the right thing to do. It was on July 8 this year that the commission, by unanimous vote, ruled that the Consensus Plan Plus was the right thing to do.

## **The Right Task, The Right Time**

"Be careful of what you wish for" and "We're put here on earth to do certain things" kind of clicks for me. Stopping to take the time to think about it, the 800 MHz interference problem was the problem, the right task, the right thing for me to do. This was my

niche in public safety to work on and stick with.

And we're almost there. The commission under Chairman Michael Powell has seen to do the best it could to help public safety and our first-responders. The July 8 announcement will basically fix the 800 MHz problem by implementing the "Consensus Plan" with additional features. My personal thanks goes out to Chairman Powell for capping my four years on the APCO Board and for doing a great thing for our public-safety first-responders.

I want to thank my two partners in this effort, Harlin McEwen and Alan Caldwell, who are two old worriers on the Washington, D.C., scene. They know the ropes around town and gave me an education — of course, contributing to my "Masters" degree.

I now pass this on to the new board to make the implementation happen, which is the part I'll truly miss. This is the part where all the fun begins: putting it all together.

I've enjoyed everything connected to this career path I chose and truly appreciate all those that I have made friends with along the way. Thank you all for listening.

***"The 800 MHz interference problem was the problem, the right task, the right thing for me to do. This was my niche in public safety to work on and stick with."***

**Vincent Stile**

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# Inaugural Spring Gathering A Big Success

Kicking off a new tradition, Radio Club members aim to make the West Coast annual meeting as much of a must-attend as is the annual banquet in New York City.

By Richard "Rich" Reichler

The Radio Club of America hosted its first annual "Spring Gathering" May 12. Envisioned a few years ago by former RCA President Steve Aldinger along with the Long-Range Planning Committee and the Board of Directors to take place in the western United States for the benefit of the many Club members located there, the new event was held in Ontario, Calif., at the Doubletree Hotel. Thanks to the efforts lead by RCA Fellow and Director Carolyn Servidio, it occurred in conjunction with the 2004 California APCO Training Conference and Exhibition for Public Safety that took place at the nearby Ontario Convention Center.

Club events occur in a number of locations, even over the air, in order to accommodate the widely spread locations of its members. This gathering now takes place in the West; the awards banquet is held in the East; and other events, such as section meetings and conference-related breakfasts, go on at various sites. As was the case in California and regardless of the locations, members and guests from all over are welcome at all of the activities in the interest of exchanging knowledge.

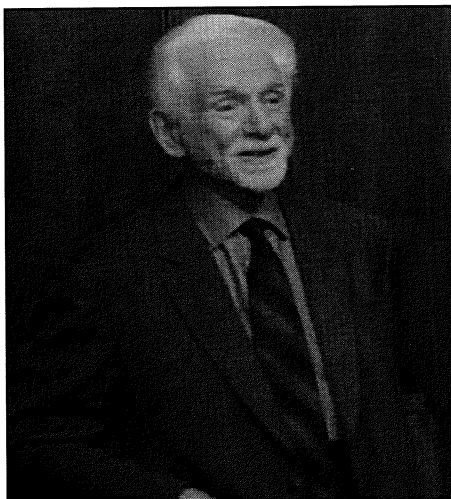
RCA President Mercy Contreras and Paul Mills (F) nicely kicked off the reception and dinner by welcoming the almost 40 attendees and introducing special guest speaker Marty Cooper (F), considered by many to be the "Father of the Cellular Phone. Those present, including many public-safety communications officials, enjoyed hearing Cooper, a longtime RCA member, tell lots of stories of interesting aspects about the development of the cellphone based on his numerous experiences over the past 30 years. His talk largely covered his years at Motorola, and he touched on the competition with AT&T.

In addition, technical and regulatory challenges were discussed by Cooper. He got a nice assist from another longtime RCA member, his ex-Motorola colleague Bill Roselle, who brought in several vintage cellular phones to share with the guests. During his talk and the question-and-answer period that followed, it was quite fascinating to hear Cooper enlighten everyone about current technical issues, including such current hardware as the state-of-the-art antennas being designed by his company, ArrayComm Inc. Learning about scientific matters is a Club mission, and the evening's presentation was an enjoyable way to do this.

With the help of many supporters, the vision is for the Spring Gathering to grow to a size comparable to the annual Banquet and Awards meeting. The program may include one or more related activities in order to make the overall experience as beneficial, interesting and cost-effective as possible for everyone involved.

Thanks go to some generous people and companies that donated their time and/or money to help make this new event happen. In addition to the speakers and organizers, appreciation goes to ARCOM Wireless, Jack Daniel, Marketing Connection, *Mobile Radio Technology* magazine, Modular Communication Systems (Moducom), Plantronics, PMC Associates, *RadioResource/Mission Critical Communications*, RadioMate, RJR Wireless and Pat Thomson.

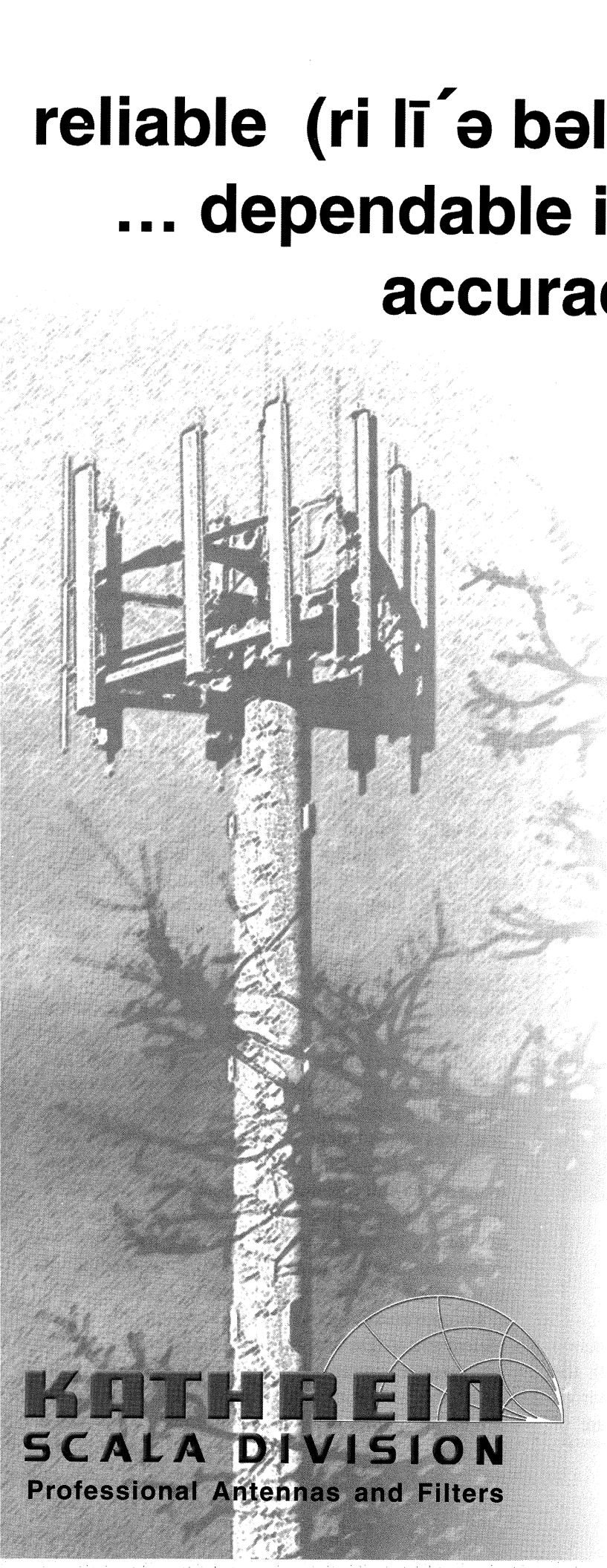
A new Radio Club tradition has been born. This was an uplifting evening, and those in attendance appreciated obtaining some interesting historical and current information, a nice dinner and some good fellowship.



Keynote speaker Marty Cooper

**reliable (ri lī'ə bəl), adj.**

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From these hypotheses, Reber constructed a 9.4-meter (31 feet)-diameter parabola in his back yard. The surface of the reflector consisted of 45 pieces of 26-gauge galvanized iron sheet screwed into 72 wooden rafters cut into the shape of a parabola. He did all the work himself, completing the job in four months between June and September 1937.

In terms of cost, Reber spent about \$1,300 (in 1937 dollars!). He constructed the receivers at home — a true amateur! First, he used a crystal detector followed by audio amplification at a wavelength of 9 centimeters (3.3 GHz) with no luck — no obvious noise increase from the Sun, the moon, planets, and brightest stars. He moved to 33 centimeters (900 MHz), changing the receiver to an acorn triode followed by audio amplification. Again, he had no luck observing the same objects. At this time, Reber concluded that extraterrestrial noise signals did not obey Planck's blackbody law.

A new feed antenna and receiver were constructed for 1.87 meters (160 MHz). At this new frequency, Reber began observing increased noise levels as the Milky Way galaxy rotated across his antenna beam. One surely has to marvel at his tenacity; measurements were made from midnight to early morning by recording output signals from a voltmeter as a function of time. He ate breakfast, drove to his work in Chicago as a radio engineer, came home, slept until midnight and repeated the procedure.

The calculated beam width of his parabola at 1.87 meters was approximately 12 degrees, and yet he was able to produce maps of radio intensity of the plane of our galaxy. These maps clearly show the peaks at the galactic center near Sagittarius along with secondary peaks near Cygnus and Cassiopeia.<sup>4</sup> Note that both Cygnus and Cassiopeia are strong radio sources, and both are the result of supernova explosions.

## Enter The Professionals

The Second World War put a damper on radio astronomical studies. Radio and radar investigations were undertaken to support the war effort. The end result of these investigations after the war provided a better understanding of microwave electronics as well as yielding a wealth of sensitive microwave receivers — just what the new field of radio astronomy needed if it was to progress into a quantitative branch of astronomy. There was one particular incident that occurred during the war that related to radio astronomy but it was kept classified for obvious reasons.

On Jan. 12, 1942, two German ships — the *Scharnhorst* and the *Gneisenau* — sailed through the English Channel undetected by British coastal radars. These British radars were heavily jammed by German stations across the Channel along the French coast. The British physicist J.S. Hey was assigned the task of examining ways of dealing with German jamming efforts. Late in February 1942, during daytime, reports of jamming were received all over Britain. The British anti-aircraft radars operating at 4- and 8-meter wavelengths were rendered unusable for hours at a time.

Hey's investigations into this new type of jamming led him to observe that the principal direction of the jamming source was not toward Europe. An analysis of the radar operator's reports showed that the jamming "signals" appeared to follow the path of the Sun across Britain. When Hey wrote his report of the incident, several prominent radio and communications scientists were quite skeptical.<sup>5</sup>

The decade of the 1940s was a time of dramatic change in radio astronomy, for example, observation of the Sun at radio wavelengths and the discovery of the 21-centimeter radiation from neutral hydrogen. Using Max Planck's radiation law, G.C. Southworth of Bell Telephone Laboratories hypothesized that the Sun should radiate in the microwave spectrum. During June 1941, Southworth and his associates were able to detect the Sun at a wavelength of 3.2 centimeters (9.4 GHz). Although the Netherlands was under military occupation during the World War II, copies of Grote Reber's *Astrophysical Journal* articles were read by the astronomers at the observatory at the University of Leiden.

J.H. Oort and H.C. van de Hulst considered the possibility of detecting the microwave emission line of neutral hydrogen at a wavelength of 21 centimeters. This prediction turned out to be one of the most important ever made in the new science. The 21-centimeter emission line of neutral hydrogen was detected first by H.I. Ewen and E.M. Purcell of Harvard in 1951, just six weeks before Oort's group. The detection was made possible using a clever receiving technique developed by R.H. Dicke at MIT.

The Dicke radiometer used a rapid switching system such that the receiver input was switched rapidly between the antenna and a thermostatically controlled noise source. The output of the detector measured the difference in noise voltage between the astronomical source and the noise source. With this basic system, Dicke measured the noise temperature of the Sun, and he went on to measure the celestial background radiation.

Toward the end of the next decade after the war, radio astronomy had developed into an acceptable part of astronomy and radio engineering. The entire January 1958 issue of the *Proceedings of the IRE*<sup>6</sup> was devoted to radio astronomy. It is interesting to note that of the 70 contributors to that issue, almost one-third held degrees in electrical engineering while the remainder held degrees in physics or astronomy.

## Radio Astronomy Today

My introduction to the world of radio astronomy began while I was employed by the Communications Research Laboratory, Moore School of Electrical Engineering at the University of Pennsylvania. Several projects were developed at their Valley Forge Research Center: construction of a 400 MHz spectroheliograph for monitoring solar activity and monitoring the 20 MHz radio emissions of Jupiter as the iron-core satellite Io orbited within Jupiter's strong magnetic field. As one educated in radio engineering and active as an amateur radio operator, I found the mixture of radio and astronomy to be fascinating. I pursued neither further studies nor work in this field until many years later.

After a decade of radio engineering, I became a high-school physics teacher. I participated in a number of summer opportunities for teacher enhancement offered by the National Science Foundation. The first of these was a program designed to acquaint teachers with radio astronomy and science research in the classroom. This program took place at the National Radio Astronomy Observatory.

I spent part of two summers as both a student-participant and then a mentor for new participants. The teacher-participants used a 12-meter (40 feet) diameter parabolic reflector antenna with a low-noise pre-amplifier at the focal point<sup>7</sup>. This receiving system is designed to operate at the frequency where the hydrogen atom randomly flips: 21 centimeters or 1.42 GHz. The 12-meter radio telescope is designed to move in declination only (similar to an elevation axis). The other axis motion, right ascension, is obtained by the motion of the Earth itself, thus simplifying the steering of the reflector.

Because hydrogen is the most common chemical element in the universe, mapping hydrogen is an important tool used by radio astronomers. Clouds of hydrogen exist throughout our galaxy, and these clouds are prime locations for star formation to occur. My mapping project was of the region Sagittarius,

near the center of our galaxy. This region is radio-bright due to the presence of an enormous black hole at the galactic center.

Using the 40-foot radio telescope as a model, note the following characteristics of a well-designed radio telescope:

1. Low-noise front end, such that system noise figure is as low as possible, consistent with good engineering practice. Cooling an amplifier increases its gain and improves the noise figure.
2. Wide bandwidth, because radio astronomers are interested in radio "noise" from extra-terrestrial sources as opposed to the narrower bandwidths required for communications of intelligent signals.
3. No AGC loops. While AGC loops are important in maintaining a constant output if the input varies in a communications receiver, variations of radio noise from extra-terrestrial sources indicate differing physical processes creating that radio noise.
4. All parts of the system are held to as stable a physical temperature as possible, thus precluding ambient temperature changes from being recorded as source temperature changes.
5. Some form of post-detection signal analysis. Many of the modern radio telescopes in use today analyze the spectrum of the received radio noise, spectral analysis being one of the most important tools for understanding physical and chemical processes.

Additionally, the received signal strength, known as flux density, is measured in watts per meter squared per Hertz (now accepted as 1.0 watts per meter squared per Hertz equals 1.0 Jansky). The more meters squared of antenna, the weaker the source can be and still give the same receiver temperature (if the source fills the beam). Radio astronomers use conversion factors that take into account the antenna efficiency to relate the flux density to antenna temperature.

During the summer of 2000, I was accepted as a Research Experience Teacher (RET) assigned to one of the staff astronomers at NRAO-Green Bank. During my eight-week employment, I assisted in mapping the plane of the Milky Way galaxy at two frequencies simultaneously: 8.35 GHz and 14.35 GHz. The purpose of this survey was to identify known radio sources in our galaxy for future comparison to objects that may increase or decrease their flux density over time as well as to locate objects that appear at a time later than the survey<sup>8</sup>.

## Creating A Map

Given the enormous size of our galaxy, I observed only a small quadrant in the region of the object Cygnus-A bounded by Galactic Longitude +74 degrees to +86 degrees and Galactic Latitude -04 to +06 degrees. From my observations, I created a map based on location (Galactic longitude and latitude) and flux density using a Linux-based software package (single-dish FITS image using AIPS) written by NRAO personnel<sup>9</sup>.

The radio telescope used for this project has a 13.7-meter (45 feet) primary reflector on an azimuth-elevation mount. A 2-meter secondary reflector is mounted 5.08 meters from the vertex of the primary mirror. The 8- and 14 GHz feed horns are mounted behind an opening at the vertex of the primary reflector. Multiple reflections of the 14 GHz signal are performed through the use of a frequency selective surface.

The front end for each band is from a design used by the Very Long Baseline Array at Socorro, N.M. The front ends consist of cryogenically cooled HFET amplifiers having system noise temperatures less than 60 Kelvin. The angular resolution of this radio telescope is fewer than 10 minutes of arc measured Full Width Half Maximum; compare this value to the beam widths used in the Jansky and Reber antenna systems.

Data samples are taken by four channels for total intensity. In each of the two frequency bands, both right- and left-circular polarized signals are measured. Square-law detectors measure total power in each channel over a bandwidth of 500 MHz with an integration constant of 0.1 seconds. Prior to each observing run, the total gain of the RF and IF sections was estimated using a calibration signal of known noise temperature that was injected into the front ends of both receivers. The known calibration signal's measured value was converted from total power into noise temperature measured in Kelvin units.

Post-calibration was performed on each set of measurements; the Sun, moon and planets were removed if the Sun was 50 degrees from the image center and if the moon was within 10 degrees of the observed section. Additional filtering removed the effects of the background sky radio noise and the system temperature (internal noise) contributions. I hoped the only signal remaining would be that from sources within the region being mapped. From the data collected and analyzed, I was able to confirm the distance to within a few percent for the planetary nebula NGC 7027 within our galaxy.

## The Newest Radio Telescope

Before I close this discussion, mention must be made of the newest radio telescope at Green Bank. Dubbed the Green Bank Telescope (GBT), it is a parabola of diameter 100 meters by 110 meters (330 feet by 363 feet); the surface area of the reflector is 7,853 square meters. It is of altitude-azimuth design with an offset feed system. The offset feed system improves system sensitivity in that no supporting structure blocks the incoming signals; thus, there are lower side lobes and reduced standing wave ratio.

The reflector surface is made of hundreds of individual-, computer- and laser-controlled panels. As the reflector is steered toward different celestial objects, the motor-driven panels continuously adjust to maintain a perfect parabolic shape, thus defying gravity's effects on the massive reflector. The usable frequency range is from 100 MHz to 100 GHz — VHF to millimeter waves in one instrument. The receivers are mounted in a movable "house" at either the prime focus or a secondary focus covering UHF, L band, S band, C band, X band, Ku band, K band, Ka band, Q band and W band. A bolometer "camera" is planned for the 3-millimeter band.

Much of the GBT's current and planned observations are spectroscopic for analysis of astrochemistry and astrophysical molecular structures of heavy molecules, including those of importance in astrobiology. At this time, the GBT is the largest moveable structure on Earth.

From Karl Jansky's serendipitous discovery of radio waves in our galaxy to the GBT, radio astronomy continues to push the outer envelope of radio engineering. Super-sensitive, internally quiet receivers and enormous antenna systems daily scan the sky for radio signals. Professional astronomers, radio engineers and amateur radio operators contribute to a better understanding of a complex and fascinating universe.

*Robert H. Welsh is a fellow in the Radio Club of America.*

### Sources:

1. Misha Schwartz, *Information Transmission, Modulation and Noise*, McGraw-Hill, 1980.
2. Karl G. Jansky, "Directional Studies of the Atmosphere at High Frequencies." *Proceedings of the IRE*, Vol. 20, 1932.
3. Karl G. Jansky, "Electrical Disturbances Apparently of Extraterrestrial Origin." *Proceedings of the IRE*, Vol. 21, 1933.
4. Grote Reber, "Cosmic Static", *Proceedings of the IRE*, Vol. 28, 1940.
5. J.S. Hey, *The Evolution of Radio Astronomy*, Watson Academic Publications, 1973.
6. *Proceedings of the IRE*, Vol. 46, January 1958.
7. see 40 Foot Radio Telescope block diagram
8. Glen Langston, et al, *The First Galactic Plane Survey at 8.35 and 14.35 GHz*. *The Astronomical Journal*, Vol. 119, 2000.
9. image of quadrant mapped



# Strategies For Passing The GROL Examination

By Russell V. Carstensen, PE, NCE

A General Radiotelephone Operator License (GROL) is required to adjust, maintain or internally repair FCC licensed radiotelephone transmitters in the aviation, maritime and international fixed public radio services. It is also required to operate the following:

- Any maritime land radio station or compulsorily equipped ship
- A radiotelephone station operating with more than 1,500 watts of peak envelope power
- A voluntarily equipped ship and aeronautical (including aircraft) stations with more than 1,000 watts of peak envelope power.

Holding an FCC GROL is an important step in an electronics/communications career. Positions requiring the GROL include:

- Radio systems specialist
- Microwave technician
- Telecom bench technician
- Aviation radio technician
- RF engineer
- Two-way radio technician
- Satellite systems engineer
- Avionics technician
- TV broadcast maintenance
- Communications specialist
- Field technician
- Radio operator

Graduation from a recognized course of electronics training accompanied by a general radiotelephone operators license are power credentials for an entry-level technician to present to a prospective employer. Topics covered in the GROL examination include:

- Operating procedures
- Radio wave propagation
- Radio practice
- Electrical principles
- Circuit components
- Practical circuits, signals and emissions
- Antennas and feed lines

## Getting Prepared

The GROL exam is a closed-book examination. Closed-book examinations are the most challenging style because there are no "lifelines" available after the examination begins. Closed-book examinations are conquerable. Careful preparation and a definite strategy will overcome not having text materials to which you can refer during the examination. So what's next?

■ **Know your material.** It is important that you know radio-operating procedures and have sufficient training in electronics. The GROL examination covers two elements: Element 1 and Element 3. Element 1 is the basic radio law and operating practice with which every maritime radio operator should be familiar (see

the Code of Federal Regulations Title 47, Part 80). Element 3 covers the electronic fundamentals and techniques required to adjust, repair and maintain radio transmitters and receivers. Subjects covered include operating procedures, radio wave propagation, radio practice, electrical principles, circuit components, practical circuits, signals and emissions, and antennas and feed lines.

■ **Work with the material.** Cramming is a surefire way to bomb out. The best approach is to work with the subject material.

- Work problems and sample tests. Using the concepts and formulas presented in study guides and applying them to sample questions reinforces your knowledge.

- Making flash cards or copying text can conquer questions on rules and regulations.

- The National Association of Radio and Telecommunications Engineers (NARTE) has put together what it calls the Shaker Test. It is an excellent study aid if run under the same conditions as the actual exam.

Once you have done all your studying and feel confident enough that you know most of the material, it's time to go in there and tackle that exam. Just remember, on the day of the exam:

- Be well-rested. Research has shown that a good night's sleep before exams will allow you to receive better marks than if you spent the entire night cramming.

- Show up early. Don't rush. Allowing time to arrive at the examination site with a period for last-minute review will reduce anxiety and stress, and it will enhance your confidence.

## ■ And when you begin the exam:

- Pace yourself. Read through all the questions carefully. Divide the number of questions by the time available to determine how many questions per hour you should complete.

- Don't dwell. If you're having trouble with one of the questions, leave and move on to the next one. You can then come back to this difficult question toward the end.

- Go with your first answer. Because you do not have any reference materials, go with your first response. Only change an answer if you have found a different way to confirm it.

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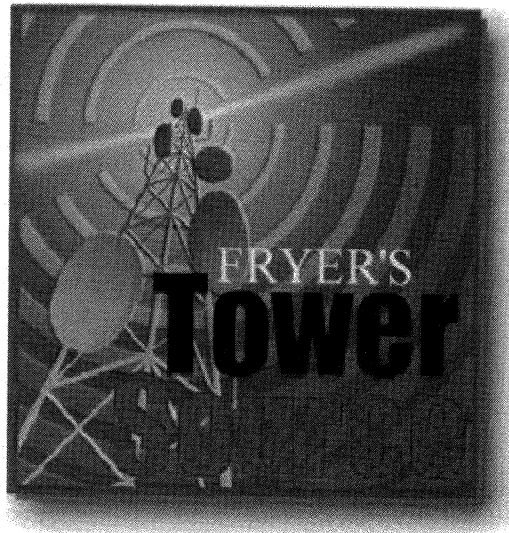
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The Radio Club of America, Inc.  
Awards Committee  
**Fellow Nomination Form**

The Club annually elevates worthy Club members to the grade of Fellow in recognition of outstanding achievement, and to provide inspiration for many people, both currently and in the future. As a member of the Club, your help in nominating and sponsoring candidates is appreciated. This form is provided to assist you in this process. In order to complete the elevation process in time for the annual Awards Banquet in November, the Awards Committee prefers to receive nominations prior to April of the year of the proposed elevation.

Article I of the Club's By-Laws states the following:

- Section 6: Elevation or transfer to the grade of Fellow shall be by a majority vote of the Board of Directors.
- Section 7: A Fellow shall have been a member of the Club for at least five (5) years and/or a Senior Member for at least two (2) years and one whose contributions have been outstanding with extraordinary qualifications in the art and science of radio and electronics. The five and two years referenced above may be waived by a majority vote of the Board of Directors.
- Section 8: Elevation to the status of Fellow is by invitation only. If such person is not a Senior Member, his/her sponsor must submit a Senior Member form to the Executive Committee for recommendation to the Board of Directors

To nominate an RCA member, please **legibly provide the information below** to the Club's Awards Committee in care of the Club's Executive Secretary in any of the following ways:

Fax: (732) 219-1938  
E-mail: ExSec@Radio-Club-of-America.org  
U.S.P.S. mail: 10 Drs. James Parker Blvd., Suite 103, Red Bank, NJ 07701-1500

**A. Full name of candidate:** \_\_\_\_\_

**B. Proposed citation (between 5 and 25 words), based on why it is felt that this candidate should be considered: (to be announced at the presentation of the award)**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**C. Attach supporting material such as an expanded explanation, a biography, a resume, and any significant published articles: (please list your attachments below)**

\_\_\_\_\_  
\_\_\_\_\_

**Sponsor submitting this nomination:**

**Full name:** \_\_\_\_\_ **Phone number:** \_\_\_\_\_

**E-mail address:** \_\_\_\_\_ **Fax number:** \_\_\_\_\_

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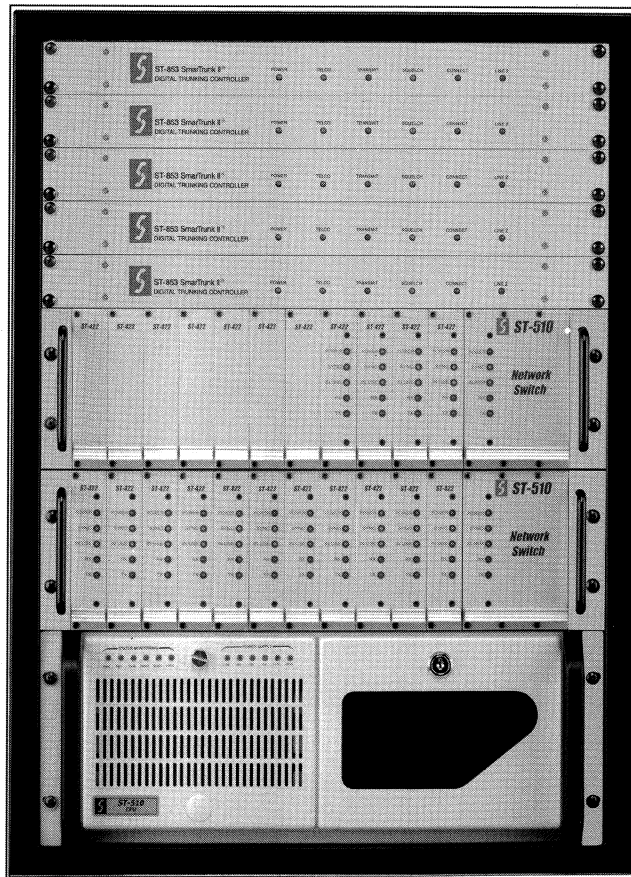


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