A Collection of Radio Memories

by

Bob Thomas, W3NE

Preface

I saved Bob's articles as he wrote and shared them, but realize in putting this collection together that not all were sent to me. If you have old issues of The Blurb with articles that are missing here, please send me them and I will update the collection. I live too far to be a Phil-Mont member and have no issues myself. In one article Bob mentions having written 57 so far, and at that point I have 47 so there are many missing.

Thanks and 73!

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Some Radio Stores of Philadelphia

A Memoir

Bob Thomas, W3NE

PROLOGUE

The radio stores that I, along with an ever-diminishing number of Phil-Monters "of a certain age" grew up with, were vastly different from those few around today. Stores of the 'forties and 'fifties each had a unique character of their own, unlike sterile cookie-cutter Radio Shacks or an HRO megastore in the hinterland. What seemed in those days to be no more than everyday routine occurrences, now evoke distinct memories of each emporium, their sales counters, products they carried, personalities of sales staff, lighting, distinct scents, and even the creaks in their floors. Perhaps by relating some personal recollections of those venerable institutions of long ago, our younger members will have a better understanding why Phil-Monters who lived through those times talk, act, and think the way we do now. It's a long story that will take several chapters to tell, but if the Editor has empty space in the *Blurb* he is willing to fill, and is not driven out of office for malfeasance, we'll give it a go. There are two caveats: Not every radio store in the city and environs will be covered; the articles will be only about the ones with which I was personally acquainted. Also, since these stories are written from memory of events occurring sixty-plus years ago there might be an occasional factual error. However, I will do my best to recall experiences just as they happened.

RADIO 437

My introduction to a lifelong career in electronics and broadcasting began at age thirteen with an article by Stanley Johnson on "Experimenters 'Special' One Tuber" regenerative receiver in July 1942 *Popular Mechanics*. I hadn't a clue what "regenerative" meant or anything else about radio, but with eight(!) detailed drawings, six photographs, and a pictorial wiring diagram for those of us who couldn't read a schematic, it seemed a simple enough thing to build. Obtaining a tube in the first year of our entry in the war could have been a problem, but Mr. Johnson specified a 1Q5GT, which was still readily available for replacement in portable radios. Knowing nothing about radio stores, I selected RADIO 437 – miraculously located at 437 Market Street – as my source of parts, mainly because they had an impressive show window and ran flashy newspaper ads for radio sets and appliances. So you might as well start at the top … I thought.

From the store entrance you passed through a show room laden with imposing wood console AM broadcast and shortwave radios, many sporting Magic Eye indicators in their big tuning dials, then it was down a narrow stairway to a stuffy cramped basement. The heady aroma of bakelite, wax, curing enamel, solder flux and stale cigar smoke permeated the atmosphere. Floor-to-ceiling shelves along the basement walls were crammed with crystal sets, "Broadcast Through Your Radio" carbon mikes, "Wonder" antennas, glitzy multimeters, and myriad components. One shelf had a stack of (as I naively said in those days) "3–6–5–m–m–f–d" variable condensers. I selected a genuine Philmore in a neat orange box, and then pawed through bins of carbon resistors and capacitors to get the required small parts, all the while wishing I knew the color code. I learned later that the resistors they were selling were an obsolete style made with a wire lead wrapped around each end of a 1/8" carbon rod then dipped in paint. Oh, well. My final selections were a small spool of No. 30 plain enameled wire (most of it still in my junk box!) and the tube, an Arcturus, which I thought at the time was a cheap off-brand, only to learn fifty years later that they were highly revered by anybody who knew anything about radio! 437 also stocked a variety of plug-in coil forms, but none was needed as instructions in the article called for the tuning coil to be wound on a cardboard sleeve from a D-cell. Later on I wound coils for the receiver on old tube bases so I could change bands. The radio worked great for listening to all sorts of foreign languages and for war reports from England, but there were no stirrings toward amateur radio at that time, as hams were off the air for the duration.

Radio 437 was an interesting store for a 14-year-old newbie, but as I gradually learned "what was what", it became apparent their stock was at the low end of the quality scale and at prices geared to the ignorance of the customer. Still, it was a magical place for a first foray in a radio parts store and continued on as a Philadelphia institution that survived for many years after the war with a higher-end product line as respectable radio/TV store on Chestnut Street. Stores of increasing potential gradually revealed themselves as my horizons widened, eventually leading to *the* Ultimate Ham Radio Store of Philadelphia, if not the world! Stay tuned.

Mr. Herbach and Maury Rademan

A fond remembrance, by Bob Thomas, W3NE
December 2008

Until recently moved to its present location in Independence Mall, the Liberty Bell stood almost exactly on the former site of 522 Market Street. That was the address of Herbach and Rademan Co., a radio store like no other. It was not a ham radio store, or a radio serviceman's Mecca, and it certainly was no Radio Shack, but I hope this short memoir will enable the hams of today understand what that store and its proprietors meant to me, and the influence they had on a naive kid just getting into the radio game.

Mr. Herbach's first name is lost in the sands of time, but that doesn't really matter because, by his very stature, one never referred to him as other than "Mister" Herbach. A first-generation product of the old country, he was a gentleman above all, as well as accomplished businessman, always impeccably dressed, even to wearing spats*. Rumor had it that, after initially being a partner with a Mr. Moskovitz in store called M&H, which sold sporting goods and electronic equipment at 514 Market Street, Mr. Herbach suddenly departed in 1934 due to Moskovitz's involvement in an arms deal. Is that true? Who knows? The result was, Mr. Herbach subsequently joined with his perfect complement, Maury Rademan, to establish H&R.

Entering the H&R store, one first encountered a spacious section of floor models and show cases devoted to an array of eclectic products. For example, there were microscopes and telescopes, motion picture cameras and projectors, drafting instruments, high fidelity and public address sound equipment, Erector, chemistry, and scientific kits, model train sets, model airplane kits and gas engines, and a few quirky amateur receivers. That was Mr. Herbach's domain. He glided around, schmoozing customers and making sales, handing over final paperwork to a counter clerk to complete transactions.

Beyond that area was the radio store. It had a long counter behind which Maury Rademan, thinning black hair, bow tie and sleeves of his white shirt always rolled up, flitted like a nervous bird from customer-to-customer, to a gigantic rotary catalog file, to the stock room and to the Bell telephone or the Keystone phone. In those days, the independent Keystone Telephone Company served a large segment of the Philadelphia business community with alternative telephones and lines between commercial users. In fact their motto was, "When the 'Keystone' rings, it means Business!" Anyway, it was not unusual to see Maury getting information for a customer and placing an order with simultaneous calls on both company's phones at once! Another common implement of the day was the Western Union call box – an elliptical blue box about five inches high with a bar knob on the front. Turning the knob through 90-degrees sent your unique address code to the WU central office, informing them you wanted to send a telegram. They would then dispatch a messenger boy on a bike to pick up your written message and return it to the office for transmission. This was obviously before email!

Whatever H&R might have lacked in commercial ham equipment, they more than compensated with a fantastic stock of material for builders, such as chassis and cabinets by Par-Metal, Bud and Premier; variable condensers from Cardwell, Hammarlund, Millen, National and Bud; every kind of transformer imaginable from Kenyon, Thordarson, UTC, Chicago, Stancor, Triad, and Acme; tubes made by RCA, GE, Amperex, Raytheon, Hytron, and Tungsol. These names might sound like a foreign language today, but at a time before QST construction articles were supported by the author's sale of pre-programmed PIC chips and etched circuit boards, those early components were the literal foundation of amateur radio. Even with such an immense variety of products, however, Maury Rademan seldom had to consult an inventory list to know if a certain part was in stock or what it cost – it was all in his head. More importantly, beyond that efficient customer service, he treated everybody, regular big-time customer or walk-in dumb kid, with the same kindness, respect and dispatch. How else would this rare gentleman be so indelibly etched in my memory after all these years?

There was an interesting pricing structure in those days. Before politicians intruded with their MSRP mandates, manufacturers established their own "List" for their product's retail price. At H&R and most other radio stores, marked prices were usually followed by "/L" to designate List Price. When Joe Schmo walked in with a dud tube in his hand and asked for a replacement, he got it in a box marked "/L" and paid full List. But when a radio serviceman or ham bought the same tube they automatically got it for "Net", designated "/N" on the box, which was 1/3 off List. Store wholesale cost was typically 40% off list, so the business was quite orderly and well understood.

H&R was an innovator in the radio/electronics field with distribution of a free monthly illustrated newsletter that advertised new, overstock and specialized products. Appropriately titled *This Month,* it showcased a variety of items unavailable through mainstream distribution channels, including government surplus, small motors, pumps, relays, optical equipment, and unusual commercial products manufactured by H&R. It typically ran twenty pages or more, all produced in-house, and was very popular among small manufacturers and hobbyists.

The Independence Mall project resulted in all the stores in the 500-block of Market Street being demolished, so H&R moved to the new (but short-lived) "Radio Row" on the 1200-block of Arch Street for a few years until new owners moved an unrecognizable shadow of the original company to Bristol and most recently to Cherry Hill, where products typical of the old *This Month* are still offered through an on-line catalog for delivery by mail.

In addition to looking after his section of the store, Mr. Herbach established a modest manufacturing facility on the second floor where custom electronic equipment was designed and built to support special needs of store customers. Later, the shop responded to urgent requirements of the armed forces during WW-II. It was during my employment by the Manufacturing Division of H&R that I received a priceless education in the way electronic equipment should be built, in short, with superior quality unmatched anywhere, until the advent of Tektronix. But that's a story for another time.

* Spats are fabric covers worn around the ankle and over the top of the shoe. They are typically made of felt-like material with buttons down one side. Spats were popular with dapper gentlemen until the Second World War. Surprisingly, they are beginning to come back in vogue among best dressed men and women. This fashion note courtesy of the *Blurb*.

RADIO ELECTRIC SERVICE COMPANY

The rise and fall of a giant
By Bob Thomas, W3NE
February 2009

Attitudes toward replacing things that stopped working have changed drastically since the depression and ensuing war and recovery years. When a radio or other appliance failed in the 'thirties and 'forties there was never a thought of simply throwing it away and buying a new one, as is common today. Of course, "times have changed", and for good reason. Contrary to the situation now, when repairing something can cost almost as much as a brand new item, in those far off years when there was no such thing as "discretionary spending", there was widespread support from a network of local service companies and neighborhood moonlighters. They could set things right with a failed radio or broken appliance for a fraction of its replacement cost. That not only enabled impecunious folk to save their limited funds for mundane expenses like coal, shoes, or a college education, it spawned a thriving manufacturing and sales industry that supplied parts to local service companies and, incidentally, to hobbyists interested in making their own electronic equipment.

Radio Electric Service Company, known in early days simply as "Radio Electric", and later as "RESCO", was a large store on the northwest corner of 7th and Arch Streets. The interior of the store was foreboding, with a stark sales area having no resemblance to a showroom. Although bare and nondescript, in its heyday, Radio Electric had the most comprehensive stock of radio components and small household appliance replacement parts of any store in the city, so that's where you went! On the downside, if you were a student, or a working stiff who couldn't get time off to shop during the week, or perhaps a radio service man who encountered an unexpected Friday Afternoon Emergency, you had no choice but to endure "Saturday Morning Hell" at Radio Electric. The closest thing to that experience today is the trading floor of the New York Stock Exchange!

Saturday morning saw swarms of customers, sometimes jostling two-deep, at the long sales counter. Standing on one side of you might be a "civilian" looking for "one of these", waving a cruddy tube with the type number worn off, and on the other side maybe a prosperous service business proprietor buying ten vibrators for 1938 Packard auto radios and two dozen filter condensers. Guess who got the most attention! Everyone would be served in due time by a counterman who might be either sympathetic and helpful or, more than likely, diffident and impatient. After a few visits you learned which type each salesman was, and looked the other way if one of the latter approached. Sometimes exotic gear like a communications receiver or a PA amplifier with record player on top would be bought by an excited enthusiast next to you who would be only too glad to open the carton so all could see his new prize.

When you had everything you wanted and a sales slip was written-up, the clerk took your money and stuffed it with the receipt into a brass cylinder about two-inches in diameter and eight-inches long. After closing an end cap on the cylinder, it was pushed into a tube that extended down from the ceiling and then, with a "thup," it was sucked away on a trip through a complex vacuum pipe system to a cashier out of sight on the second floor. In a few minutes, there would be a "thunk" as the carrier dropped out of the tube with your change and receipt. Such technology! Finally out on Arch Street, you drew a deep breath, not only thankful that you could now go home and start building that latest 10 meter preamp, but especially for having once again survived Saturday Morning Hell.

Nothing lasts forever and as years went on, the replacement parts market declined and competitors siphoned away much of the remaining small parts business enjoyed by RESCO during and immediately after the war. The store responded by reorganizing to feature high fidelity audio equipment just as that hobby began to flourish in the ‘fifties, first with monophonic and later stereo gear. Austin Gutman, who had been one of the friendlier countermen, was promoted to Manager of the HiFi Department. Most of the old sales counter was removed, to be replaced by attractive displays of major components and complete high fidelity systems with elaborate demonstration facilities.

With his affable personality, Austin made a lot of audio sales, rapidly gained recognition throughout the city and within the company, and finally was promoted to Store Manager. He was a ham (W3FOG) and in later years joined Phil-Mont, sometimes entertaining us with stories and programs about his exploits flying RC aircraft at Valley Forge Park. Eventually the high fidelity market migrated to upper end specialist stores, so Austin modified the sales floor once again, this time with self-serve display stands and a supermarket-type of checkout counter. That was not enough though, so in what was to be a final attempt to counteract continued declining revenue during the ‘sixties, RESCO embarked on an ambitious expansion program with establishment of branch stores in the extremities of the city and in the suburbs. That was a fleeting and unsuccessful strategy. Unable to compete against the mushrooming incursion of chain stores specializing in imported products, the once vibrant Radio Electric Service Company finally went out of business. As bad as it might have seemed at the time, Saturday Morning Hell has become a wistful memory!

Eugene G. Wile

Uptown convenience – Less than cordial

By Bob Thomas, W3NE

March 2009

The Eugene Wile radio store was located in the central business district of Philadelphia, in the vicinity of 11th and Walnut Streets. It had been founded by Mr. Wile before the war and due to its handy location it attracted customers who worked in the many nearby office buildings. Show floor displays and inventory at Wile's reflected the customers' interests. They liked to browse through radio and electronics books, a variety of which were displayed on rotating racks, and look at shortwave receivers and amateur products placed around the store. After Mr. Wile passed away, the store continued operation under the management of his wife, perhaps not exactly a stern individual, but certainly a less than congenial one.

You almost *expected* to be insulted when shopping at Wile's. That tense atmosphere is exemplified by a situation involving former Phil-Mont member, the late and likeable Charles Andrews, W3IRS, popularly known as "Frenchy". Frenchy was a control room engineer at WPEN, located around 19th Street, so it was only natural when he decided to buy his first microphone, an Astatic D-104, *the* standard communications mike of the era, that he would go to the nearby Eugene Wile store.

Before continuing, time out has to be taken here to explain that Frenchy had grown up in a bi-lingual household, so an occasional mis-interpretation of an unusual word would be understandable. Anyway, he walked into Wile's on his lunch hour one day and told to Mrs. Wile that he would like to buy "an *Asiatic* D-104". She exploded and replied to Frenchy in no uncertain terms that, "What you really want is an *Astatic* microphone, not *Asiatic,*" with a tone that clearly implied, "you imbecile". Well, Frenchy was a sensitive fellow, and even decades later as he related that story to me, it was obvious he had been crushed to be rebuffed in such a manner. My own experience with the store was quite limited but certainly not traumatic, having gone there perhaps two times within memory, once to buy a book on oscilloscope patterns and again for a reel of audio tape. So far as all of the oldtime radio stores in the city are concerned, I'm afraid Wile's, everything considered, was little more than a footnote, thus this brief description.

Epilogue

After writing the above account, and just before forwarding the manuscript to Editor Rick, I received the following comments in an email from Gene Pressler, W3ZXV. Inasmuch as Gene had not seen my remarks, it is interesting that his experiences at Wile's resulted in the somewhat different viewpoint of a satisfied customer.

> "Wile was the store closest to where I worked. Mrs. Wile was a piece of work but she knew her business. I was a young 'know-nothing' at the time but for whatever reason, she seemed to like me and took me under her wing. The counter guy's name was Bert, I think, and he was always dressed in a suit and tie – very unusual in those days. Mrs. Wile was always on his case and he must have been related (only a relative would have taken the verbal abuse the poor guy was subjected to). I may be one of the few people who have fond memories of her."
> – Gene

ALMO RADIO

New Kid on the Block
by Bob Thomas, W3NE
March 2009

What does a politician do when asked to comment on a subject he knows nothing about? He changes the subject! While I am not a politician, in the interest of full disclosure I have to admit I remember almost nothing about the Almo Radio store in Philadelphia. However, there was a unique event that directly linked Almo with the Phil-Mont Mobile Radio Club, and I do have a good recollection of that. Read on.

Almo Radio didn't come to Philadelphia until the late 'fifties, but they hit the ground running. Their main store was on Arch Street near twelfth, a generic radio store of the day featuring high fidelity components, test equipment, amateur and SWL gear, repair parts and the first vestige of the Japanese electronics onslaught. Although new, they lost no time focusing on the local amateur market, and what better way to publicize interest in hams than to sponsor an exhibition involving participation by ham radio clubs? The *Almo Show,* as it became known, was held in a West Philadelphia convention facility – I don't remember exactly where, although it was somewhere near the University of Pennsylvania.

The first show was announced with plenty of fanfare and it attracted all the region's major amateur radio clubs as well as suppliers and manufacturers of electronic components and amateur equipment. Each club was allotted space along the sides of a spacious room for a booth to display their specialty, and these were interspersed with booths for manufacturers of ham radio equipment and components. Phil-Mont received an invitation to participate which we eagerly accepted. As luck would have it, our assigned space was by itself at one end of the room. It was only natural that our exhibit should be put in the hands of Jay Gaul, W3IM, a window dresser and commercial artist of exceptional talent. It was left up to Jay to design and build an exhibit with a mobile radio theme. Nobody in the club could have had an inkling, though, of the blockbuster display Jay would come up with!

Although unrelated to this story, W3IM was a well known mobile *CW* operator who used to tool around his Lehigh Valley sales territory during the day between client calls making mobile contacts on 40 meter CW with a homemade "sideswiper" key mounted on a clipboard strapped to his right leg. A sideswiper is best described as a horizontal key, something like a bug without automatic dots, not too much different than a simplified $400 paddle of today, except Jay's prosaic lashup used a plain kitchen knife as its basic part. It looked like the dickens, but he sure had fun and lots of success making mobile CW QSOs!

Not long after the meeting authorizing Phil-Mont participation in the Almo Show, I got a call from Jay asking me to come over to his house. When I arrived at Jay's, I could hardly believe my eyes, for there, lying on his front lawn, was the entire center section of a Crosley automobile, from the fire wall back to the windshield "A" posts and a 9" section of the roof. All the miscellaneous parts were there too: dashboard, speedometer and gauges, steering column and steering wheel, and glove box, all scattered around the body.

The Crosley was the first American minicar, the first in the U.S. to use an overhead camshaft and disc bakes. It had an 80” wheelbase, ran on 12” tires, had a 38 HP engine, could barely make 65 mph, but it got 50 mpg. The car had ardent fans, and is still a collector’s car. Crosley: where are you now when we need you? -- even though the U.S. Congress would not approve of you.

Jay took the body section to a repair shop where it was sandblasted and painted Sexy Red. We then made side supports from two 2x2 wood poles that held the car body so the windshield was at just the right height for someone standing at the steering wheel to look ahead as if sitting in the car. Behind the posts, we constructed a light weight box, closed on the floor and open at the top. It was about 6-ft wide at the back and had 6-ft high sides that were about 8-ft deep (understand, this is all from a fading memory). Jay then painted a street scene inside the box with perspective so, from the driver’s standing position, there was a road leading into the distance ahead with curbs, sidewalks, street lights and a variety of stores along each side. A flood light at the top of each front post illuminated the scene for stark realism. Jay painted people strolling along the sidewalks, but his *piece de resistance* – a typical W3IM masterpiece of humor – was a fireplug at the curb with a small dog, hind leg raised, ready to do the needful.

Many hands helped move the exhibit from Jay’s home to the convention room and prepare it for the opening. The whole operation went without a hitch – this was Phil-Mont, after all! A complete battery-powered mobile ham station was installed in the Crosley body and an 8-ft whip on spring mount was bolted prominently on the car’s cowl. For the life of me I cannot remember what equipment we used, but it was probably an early Elmac AM transmitter and a Gonset converter feeding the car radio. A QQH Motorola hand mike hung from the dashboard. The receiver sprang to life, and W3RQZ/Exhibit Mobile was in business!

As judging was about to start, I left the exhibit and drove a few blocks away, to wait for a CQ on 29.493 Mc., the PMRC net frequency. When the time came, we had a solid QSO that, along with the authentic operational mobile rig and fantastic street panorama, clearly set the judges on their ears. It goes without saying that Phil-Mont won the $100 First Prize hands-down for the best exhibit in the show. In fact, we did it again the next year and the year after that, by which time Almo management must have concluded there was not much more to be gained from contests.

Their shows did help to achieve Almo’s objective in terms of establishing a ham customer base and putting Almo on the map as a major amateur radio dealer. Having said that, however, there still was one David among the city’s radio store Goliaths: It was a store where flash and pizzazz were, to say the very least, totally absent; a memorable place that was the ultimate destination of just about every active ham in the region. That’s for next time.

CONSOLIDATED RADIO

Ham Nirvana

by Bob Thomas, W3NE

April 2009

The full name of the store in this narrative was probably Consolidated Radio Company, but nobody called it that – it was just "Consolidated" to everybody who went there. Situated in the 600-block of Arch Street, the store was a short walk from the 5th Street PRT Market Street subway station, accessible from most parts of the city for a 7½¢ fare and a free transfer. Outside, Consolidated was anything but inviting: drab paint, smudged show window, and motley display of disparate radio items, typically a faded License Manual, 10,000-volt variable condenser, dud 304TL, and a decrepit McElroy bug (of which more later).

Anticipation escalated as you approached the front door, entering into a serene, dimly lit world of unadulterated amateur radio. In keeping with the dolorous exterior, the dusty floor boards creaked quietly with every step. Behind the sales counter, nine times out of ten Jerry Mathis would be found either on the telephone discussing the last (or next) DXSS or sitting at a small bench assembling one of his famous Cool Kilowatt finals for a client. Depending on the seriousness of Jerry's preoccupation and the DX status of the customer, Jerry would either wait on new arrivals or ignore them.

In the latter case it was left to George Hall, W3BMS, proprietor of Consolidated, to leave his mysterious lair at the back of the store. George always sauntered behind the counter toward his customer, each black hair combed-down precisely in place and wearing his perennial blue wool sweater, half-buttoned closed in front. There was always a friendly greeting – in my case "Hello Bobby, what can we do for you"? Casual conversation always followed for several minutes, then eventually the "want list" was produced and George would disappear back to the stockroom to pick out the items required.

In the meantime, Jerry might be rousted from his preoccupation to continue the conversation, perhaps with an intimation that Frankford Radio Club was always on the lookout for DX contestors to strengthen their rivalry with Potomac Valley RC. Jerry was an uberpersonality in W3-land: SCM, top or near-top in the DXCC standings, and always knowledgeable of the latest local, ARRL and FCC news. His fame extended back well before a 1938 RCA Tube Department advertisement in *QST* and *Radio* magazines featured a photo of the young W3BES with a glowing testimonial by Jerry for RCA's then-new 813 tube, which he had employed in a contest winning final amp.

When George returned, usually with every part required – no matter how obscure – he would begin writing up the sales slip, allowing the customer an opportunity to browse among juicy sale items. These were stored on a table in dusty gray plywood bins about eight inches on a side, each containing things you wanted but didn't necessarily need (at least at the time). I was able to pick up two gorgeous National AN Velvet Vernier dials for only $1.50, one going immediately into a two meter tunable converter the other, forty years later, on the panel of a 1929 TPTG 80M breadboard transmitter for bandspread control. At one time those bins yielded small split-stator variable condensers with a ratchet shaft detent at 35¢ each; a lucky buy of a handful wound up in a VHF wavemeter, a push-push 2M transmitter doubler, and various other transmitters. There could be ceramic sockets, antenna relays, mica transmitting condensers and an assortment of transformers of both known and unknown heritage. One that still comes to mind was a nifty brand new in-the-box Thordarson 35-watt modulation transformer (fondled but never used).

A few weeks after graduating from college in 1950, I was able to save enough money from my $55/week first job to buy a Hallicrafters S-40 receiver, a rehash of their prewar S-20R. I placed an order with Consolidated, but the country still had not fully recovered from the war, and with the model change, delivery time for my receiver was quoted as "three to five weeks". This was definitely not a "click your mouse and enter your credit card number" instant purchase of today. I eventually got a call from George letting me know the receiver had arrived, so on my way home from work on Howard Street (when you could walk there without being mugged or shot), I picked up the S-40. Riding home with it on the subway, I could hardly contain myself, and after a hurried dinner it was unpacked and on the air, receiving code practice transmissions from W1AW on 3555 kc. By the end of that summer I was able to pass the FCC test for a Class B (13 WPM) license, and from then on I finally felt I really belonged at Consolidated!

An earlier reference to the McElroy bug in the show window illustrated George Hall's flexibility toward young hams. Our own Dick Moll, then W3PDJ, had his eye on that key for a long time before finally mustering the courage to ask George if he could get it for a lowball price. Now, at that time T.R. McElroy was famous as a super high-speed code operator, having won his last national contest in 1939, copying at 77 wpm, so there was a certain cache associated with his commercial products. Undaunted by that fame, the young Richard asked George if he would sell the bug for $5.00. George acceded, so one more ham became a hot CW operator and Consolidated garnered another lifetime supporter. Incidentally, Dick still has that venerable key, now possibly valued at near 100 times what he paid George.

A valuable perk for shopping at Consolidated was consistent availability of the latest free issue of GE *Ham News,* published semimonthly by the GE Tube Department. Each issue ran eight to twelve pages with construction topics like SSB adaptors, VHF equipment and high power HF linears as well as little gadgets and tutorials, like how to test a transmitting tube. An early issue described the *R-9er,* a wideband preamp for upper HF bands that was just the thing to pep up my S-40 on 10M. Another interesting unit I made was a 6-Meter transceiver in a 5x6x9 box. Of course Consolidated benefited from the selling parts needed by builders of *Ham News* gear.

Like all the stores catering to builders, Consolidated faced a shrinking market as turnkey Asian products infiltrated amateur radio and most hams either lost interest in making their own equipment or were new to the game and didn't know how. For better or worse I was not around when George closed the store, probably some time in the late 'sixties. Would I buy a receiver today at full list price and then wait two months for delivery if I were able to recapture the ethos of those old radio stores of Philadelphia? To quote a well known female politician from Alaska, "You betcha"!

Sic transit gloria mundi.

LEECE-NEVILLE

The revolution begins
by Bob Thomas, W3NE
May 2009

Prior to 1960, American automobiles had 6-volt electrical systems – with *positive* ground, yet! Nearly all European cars, in contrast, had superior 12-volt negative-ground systems. Eventually, as more and more electrical accessories were stuffed into U.S. cars, our manufacturers were finally forced to change over to today's 12-volt negative-ground system, but that didn't do hams any good back in the 1950s. It was bad enough without amateur equipment in the car, but if you ran 50-watts AM, creating a total primary load current of around 20-Amps at 6-volts, every time the car came to a stop voltage sagged, headlights dimmed, and a feeling of uneasiness descended whenever the engine idled for very long.

As so often happened every time there was a potential bonanza in the offing for Phil-Monters, Jim Spencer, then W3QQH, got wind of availability of several Leece-Neville 6-volt alternator systems[1] that had been removed from Parks Department vehicles. This was at a time when hardly anybody had heard of alternator-based electrical systems, but after we learned what the advantages were – nearly full output even at cranking speed, low electrical noise due to absence of a high current commutator and brushes, and superb regulation – several of us jumped at the opportunity to buy one of the used systems Jim had dickered for.

With faded memory, about $40 seems to be what we most likely paid for a Leece-Neville system, which was considered a bargain at the time. For that price we got a 3-phase alternator with a mounting bracket, a special old style "buzzer" voltage regulator, a bunch of cables, and a separate 3-phase selenium rectifier, everything covered in a dense layer of fine dust from their former field service. In modern practice rectifiers are integral with the alternator, but compact silicon rectifiers had not been invented then, so we had to be content with a bulky selenium bridge rectifier made with a stack of cooling fins no less than 10-inches long and 4-inches square! Fortunately cars of that era had a lot of spare room up front under the hood, so there was no problem mounting the rectifier stack in the cooling air stream.

The point of no return was approached with considerable trepidation as I removed the standard 6-volt generator and regulator from my '53 Ford. Installation of the Leece-Neville system went without a hitch; when I turned the ignition key, Eureka – it worked! That set the stage for installing a 50-watt 6146 AM rig powered by an unused surplus PE-103 dynamotor in the trunk. A dynamotor is a combination motor and generator on one shaft. The motor ran on 6V. from the car and the generator put out 500-volts dc at about 160 ma. It was controlled by a relay actuated from the push-to-talk switch, so every time I transmitted, a short duration, muted "o-i-i-nk" emanated from the trunk as the PE-103 jumped to operating speed.

Thanks to Jim, a new era in reliable mobile radio operation had begun!

[1] *Leece-Neville is still in business today. Their system is now the basis of the electrical systems in nearly all vehicles in the world. It is based on an alternator with a magnetic rotor comprised of three finger-like permanent magnets interleaved with three other magnets of opposite polarity. The rotor is driven by the vehicle's engine to create a three-phase rotating field that induces*

voltages in three stator (stationary) windings made of heavy wire. Voltages from the stator windings have a three-phase relationship with 120 degrees between each phase, contributing to relatively smooth dc after rectification by a 3-phase rectifier. Output voltage is regulated by a small feedback current fed through slip rings to an auxiliary field winding on the rotor.

WIDE WIDE WORLD

Phil-Mont on Network TV
by Bob Thomas
June 2009

Pat Weaver was a television program innovator at NBC who conceived the *Today* show, later on produced the NBC "color specials" that finally got color television off the ground, and along the way managed to be father of Sigorney Weaver (a factoid having nothing to do with this story). In 1955 Weaver developed a Sunday afternoon program called *Wide Wide World* that featured live events of popular interest – all television was live in those halcyon days before video recording. Dave Garroway was the host for the program in New York while a vast NBC field crew manned forty cameras and twelve equipment and production vans were deployed around the country to originate a variety of interesting segments from different remote venues every week.

Once again Jim Spencer got wind that something was up in our area, either by virtue of his own sleuthing or because he was widely known as the "go-to guy" when radio support was needed. The producers of *WWW* had scheduled a segment of the show for a Sunday in 1956 to cover a gas balloon ascension featuring Connie Wolf, an internationally-known female balloonist. Phil-Mont already had a solid reputation participating in that activity from tracking local balloon flights with our mobile units, so we were included in the program. Now the balloon we are talking about here did not incorporate a relatively safe propane burner to generate hot air for buoyancy; it used gas: that is, flammable, explosive natural gas, right out of the pipe. We were familiar with the filling process, which had to take place in a field on Egypt Road to get where a high pressure gas main was accessible.

When I arrived at the field the balloon was half-inflated. Jim was already there with Phil-Mont's first mobile unit, a small enclosed two-wheel yellow trailer with the club call, W3RQZ/3, emblazoned on each side in tall red letters, and equipped with basic communications gear inside. NBC had planned an introductory segment at the field for an interview Connie and to show the balloon being inflated with the RQZ/3 trailer in the background. Then they planned to cut away to other parts of the program, returning later for the ascension after the balloon had been fully inflated. What was not planned, however, was a ferocious wind that not only complicated the inflation process, but ruled out any possibility that an ascension would be made on that afternoon! Although the high wind had not been planned, its possibility had been foreseen by NBC's veteran field producer who had rented a crane with an 80-foot boom. Suspended from the crane's cable, but now resting on the ground, was a wood platform just large enough for an RCA TK-30 Field Camera and a cameraman.

When it came time for the program to return to our site, the fully inflated balloon was buffeted mercilessly by the gale as a dozen or so ground crew tried their best to keep it under control. We had a portable TV receiver in the trailer so we were able to watch the off-air program. Back in New York, Garroway announced with regret that the writhing balloon could not be safely released but, in the interest of full disclosure, they would now *simulate* what an actual ascension looks like to the flight crew in the balloon's basket. With that, the crane operator was cued, he threw the cable drum into gear and, with the roar of the crane's engine, the camera platform leapt into the air. As we watched the broadcast on our receiver, the scene depicted by the rapidly ascending wide-angle camera shot was just as though the viewer was in the rising balloon basket.

That concluded our segment of the show. The TV crew began knocking down their setup, all that expensive gas was released from the balloon into the atmosphere, and Jim and I were off for home. So ended Phil-Mont's debut on network TV!

A CONVENIENT COAX PUSH-ON CONNECTOR

by Bob Thomas, W3NE
July 2009

Sometimes having to change a coax cable connection repeatedly can be a real pain. For instance, let's say you have one transceiver that you use at the fixed station, but also like to take along when you're out mobiling. At other times, it might be necessary to transfer the rig's output coax from an antenna to a dummy load for some tests and then and back again to the antenna. Changing the transceiver from one antenna to another can also be annoying with all the putting-on and taking-off of standard PL-259 threaded coax connectors. Finally, some of us like to completely disconnect the shack from the antennas to avoid lightening damage but a coax switch just doesn't cut it, so that means unscrewing the transmission line outside and then remembering to put it back again before operating.

The easiest way to simplify all the "ons-" and "offs-" of coax changes is to use a "threadless" push-on connector like the ones in the photo. The push-on connector is permanently screwed on the standard PL259 male connector at the end of the coax lead from the rig or any other cable that is frequently changed. After that all that's necessary is to shove it on or pull it off the destination SO-259 female connector. The slip-on sleeve is smooth inside with four thin slots around its periphery that apply just the right amount of friction to the external threads of the mating connector to hold it in place, but not so much that it damages the threads. It is, as they say on Interstate highway signs, "Easy On-Off"!

Push-on connectors are often available in one of the bins of connectors frequently displayed by dealers at hamfests. The ones shown here are Workman Model KC-259. They are well made with Teflon insulation and bright nickel plated brass. They can be obtained on eBay from CRS Communications for $2.35 each plus shipping. Two connectors cost $7.79 including shipping. Life doesn't have to be complicated; start saving your wrist now from Carpal Tunnel Syndrome!

CHANNEL 1

Life Before Repeaters
by Bob Thomas, W3NE
August 2009

Believe-It-Or-Not™ there was a time when hams in this region communicated locally without the “benefit” of a repeater! Foremost among them were the hundred or so members of – you guessed it – the Phil-Mont Mobile Radio Club! We all used AM equipment for our fixed and mobile stations, operating on the common communicating frequency of 29.493 Mc, universally known as *Channel-1*. That specific frequency resulted from availability of cheap surplus FT-243 crystals on 7333.33 kc, using their fourth harmonic to generate a net frequency in the upper end of the 10-meter band. Many Phil-Monters monitored Channel-1 with wideband crystal-controlled receivers with squelch, and some even had remote operating positions around the house enabling them to answer calls almost instantly from wherever they were. One in particular, Brad Martin, W3QV (whose call now graces our 2M repeater) pretty regularly monitored Channel-1 twenty-four hours a day, not unlike the current practice of W3RM. That intense monitoring, supplemented by timely response in emergencies, rightfully led to the club slogan, “Phil-Mont is ready…Every Single Minute”. You could count on an answer to a request for a routine contact or a distress call – and there occasionally were some – at almost any time of the day or night.

You might think the range of our mobile stations was limited for direct communications compared to relaying through today’s high-altitude centrally-located repeater, but not so. For one thing 10-meter ground wave propagation is inherently better than VHF. Flutter and fading are not as prominent, we all used decent antennas and reasonable power, and we did not have to contend with marginal signals from flea power HTs. Furthermore, when the band was open, DX stations would frequently relay during QSOs between mobiles that were at far ends of the service area, unable to hear each other directly. One Denver ham often provided that service on a daily basis whenever the band was open. At other times regular denizens of “the frequency” in England and in Germany livened the frequency, all without computer intervention (which thankfully had not yet been invented). Of course another benefit of 10-meters during band openings was solid domestic and foreign DX QSOs for mobiles. A secondary club net frequency of 29.626 Mc. (known as Channel-2) was established for use when Channel-1 was busy, and there also was a National Calling Frequency at 29.640 Mc. for initiating DX contacts worldwide.

Fixed station antennas were typically a vertical coaxial type that employed a ¼-wave radiator above a ¼-wave coaxial matching section fed with 75-ohm coax. One of the club members built several of that type in his shop for early Phil-Monters and when they ran out we reverted to one manufactured by Kreco, a local antenna manufacturer. Coax antennas had a sleek appearance because they were made to screw on top of a ¾” threaded pipe mast with the transmission line running up inside the pipe, through the 8-ft. coaxial matching section made of 2” diameter brass or aluminum tube, to a connector at the bottom of the radiator. Mobile antennas were sometimes multi-band verticals, but generally they were simply an 8-foot whip with spring mount on the rear bumper. W3CNO had a droll sense of humor; George connected a pilot light bulb across a couple of inches of his whip near its center so the bulb was illuminated by RF current whenever he transmitted, no doubt to the wonderment of following motorists.

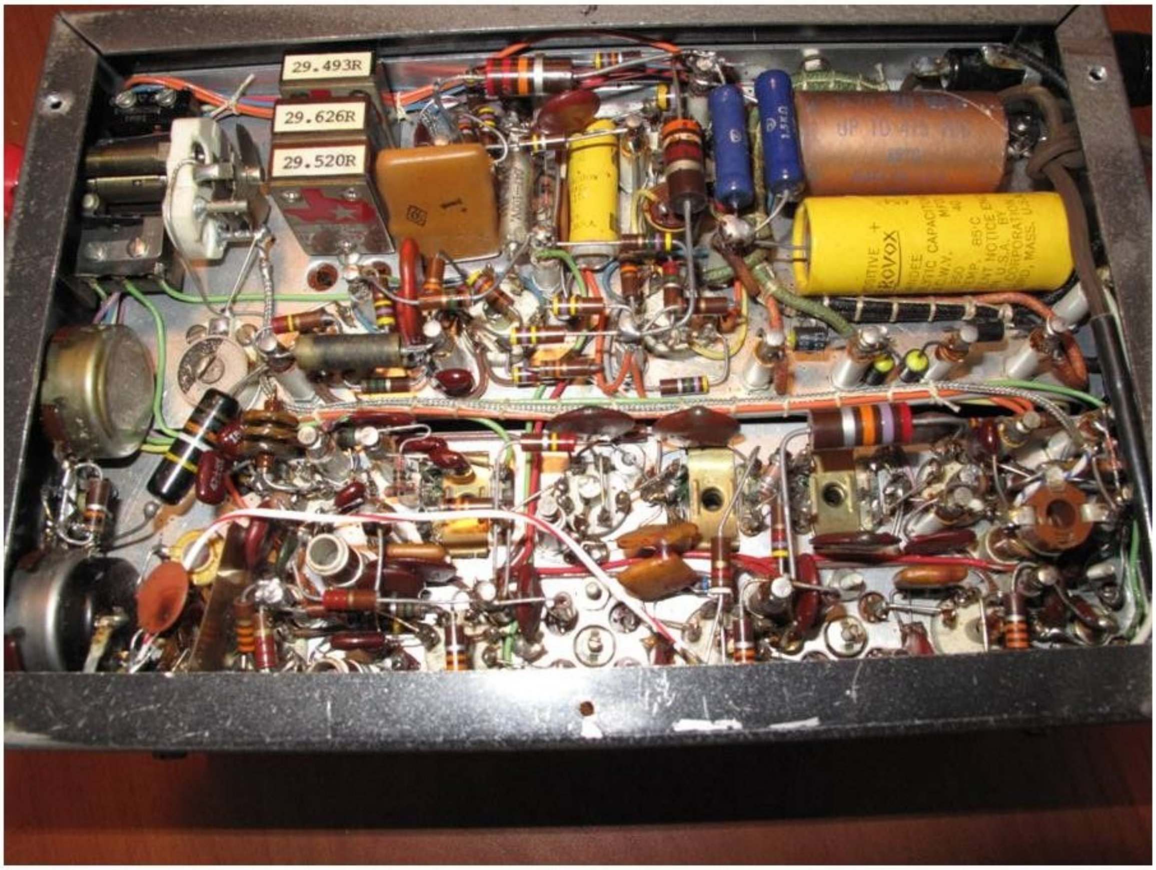
Occupancy of Channel-1 was consistently high beginning with morning drive time when W3JGB parked on in Fairmount Park before going to his office at IRC. He conducted the “Scrambled

Egg Net" for late risers and several members driving to work. The "10-on-10 Net", forerunner of today's less disciplined Sunday morning net, attracted up to sixty stations, many of which also populated the frequency well before net time and continued with contacts long after the net closed. Even when 10M was dead, there were lots of mobile and fixed QSOs going on during the day. Noontime usually saw a rise in activity on Channel-1 from several members who went out to their cars in the parking lot for a brown Bag lunch and still more operation.

It didn't used to be a crime to call CQ, so there were seldom any instances, so common on the repeater where a station will slur his call once, doesn't get an instant reply, and immediately moves off, sometimes just missing a contact. Additionally, QSOs were generally substantive and seldom brief, perhaps because most users of the frequency were Phil-Mont members who knew each other pretty well and had a lot of common interests to discuss. This came about because a high percentage of club members regularly attended monthly Membership and open Mid-Month (Directors) meetings where everyone took an active part in discussions and policy making. There was wide participation in hidden transmitter hunts, exchange visits with the Washington Radio Club, annual club banquets and dinner-dances, frequent public service events and CD drills, and consistent operation on the net frequency in the evenings. That was the way we got to know each other, and it also resulted in a commendably high level of participation which typically brought out two or more candidates for every elected office.

Another difference in operation between the 10-meter AM days and what we (don't) experience now, was activity during evenings and weekends. It typically began around 7 PM and continued, more on than off, until after 10 PM. Sometimes it was serious, but often took a light hearted turn, like the famous "Barrel Modulation Incident". One Friday evening, the most active night of the week on the frequency, somebody made a transmission with a wastebasket over his head and, with booming hollow audio, asked for an audio quality report. The first to reply (either in cahoots, or having an insightful assessment of the impending gag) told the enquiring station his audio quality was excellent, "Sounds just like you – don't change a thing". Another station confirmed that report, and then another. Finally, some poor innocent schlub (the mark) who had been monitoring all along could not keep quiet any longer. With utmost temerity he offered the apologetic opinion that the offensive audio might have just a little too much bass and possibly a slight hollow sound. Of course it was all of that in spades! By then several other stations had caught on and heaped on even more praise for the barrel modulation, all to the embarrassment of the mark. Eventually the mark caught on and everybody had a good laugh.

A reason often offered to explain periods of low occupancy on 147.03 is that today's hams are much busier than those of fifty years ago. That just doesn't hold water. Many members who were consistently active on Channel-1 and in club events during the first two decades of Phil-Mont's existence were simultaneously raising young families, perhaps taking care of a relative, establishing a small business, and pursuing other aspects of ham radio, just like now. Maybe the answer is simply that hams are not as enthusiastic today or more likely, fascination with other interests, especially computers, leaves less time for amateur operation. Whatever the reason, we undeniably have an incredible resource in the W3QV repeater – it just needs to be used!



Monitor Receiver Component Side

First Conversion crystal-controlled oscillator circuit is at upper right. Microswitches adjacent to variable condenser select Wide- or Narrow-Bandwidth. Variable condenser tunes Second Conversion oscillator in Narrow BW mode. To right of oscillator are squelch, audio amplifiers, and power supply rectifier/filters. IF amplifiers are at bottom of photo. Yes, that's a Sprague *Black Beauty* condenser; how were we to know they would fail after thirty years?

W3QZO (W3NE) PMRC Channel 1 Monitor Receiver

The red knob activates Microswitches so when the knob is pulled out, a 1500 kc. IF with 20 kc. bandwidth is selected. When the knob is pushed in, the Microswitch inserts a Second IF of 262 kc with 6 kc B.W. Rotating the knob then tunes the second conversion oscillator to shift the narrow IF inside the WB IF — Passband Tuning!

13 Tube 10 Meter Monitor Receiver—Top of Chassis

The IF strip is at the top, with the 1500 kc IF at the very top and 262 kc IF below, with double-tuned transformers right of center. The two left-most tubes are mixers (RF Amplifier is out of sight under electrolytic condensers). Tubes next to power transformer are for squelch, and audio amplifiers. Horizontal tube is a voltage regulator. The tube under VR is a

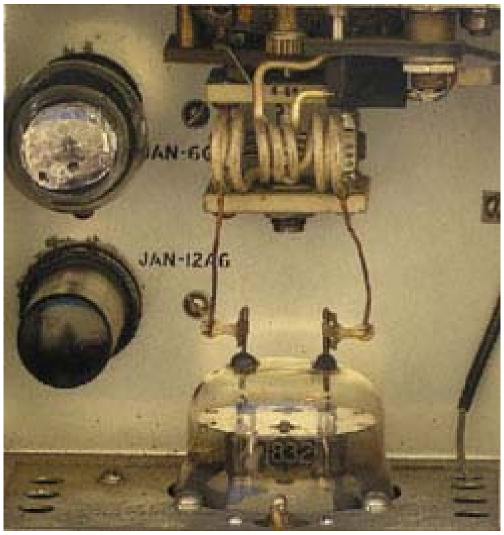
THE "522"

VHF on the cheap
by Bob Thomas, W3NE
September 2009

The title of this article does not refer to the Doylestown local departing Suburban Station at 5:22 in the evening. Rather, it is the shortened designation for the SCR-522, a VHF aircraft communications package that was on every airplane shipped to Europe during WW-II. The 522 was essentially copied from an existing British product designated TR-1143. The U.S. version consisted of an aluminum cabinet about 17" wide, 23" high and 10" deep. Inside were two subassemblies, a 12-tube VHF receiver and a matching transmitter with a frequency range of 112-151 Mc. Although the Tx and Rx were not strictly "autotuned" by servos as some Collins equipment, interstage tuning capacitors were ganged together by a linear cam mechanism for optimum tuning on any of four spot frequencies within the overall range.

The 522 was the foundation for early post war 2-meter operation at many ham stations. I paid $14 for mine, used but in excellent condition. Tuning the receiver across the 2M band posed a problem because the oscillator control covered ten times the range needed by hams. Fred Shaw, W3ADV, was my mentor and he had developed a very simple tuning method that was an adaptation of a 1930s invention for bandspread tuning by that paragon of receiver designers, McMurdo Silver. [As an aside, McMurdo Sound in Antarctica was named in honor of Silver for his contribution to Adm. Perry's first expedition, for which Silver designed and built a radio receiver crucial to the success of the venture.]

As Silver's scheme was applied to the 522 receiver by Freddy, a lever about ten inches long was attached to the shaft of the oscillator tuning condenser. The other end of the lever was spring-loaded against an eccentric cam fitted to the shaft of a vernier control knob. The cam was simply a short piece of round brass rod drilled off-center by about 1/8". Then, as the tuning knob was rotated through its range, the cam offset moved the end of the lever 1/8" up and down with a corresponding small angular rotation of the 522 oscillator condenser shaft. By fiddling with the amount of cam offset and the locking position of the lever on the tuning condenser, the receiver tuning range could be adjusted to just cover the new 2M band of 144 to 148 Mc. (Prior to the war our VHF allocation was 112-116 Mc, known as the 2½ meter band.)



The transmitter was conservatively designed for 6 watts output with an 832 twin-tetrode push-pull power amplifier in the final, preceded by another 832 tripler to ensure plenty of grid drive for the final amplifier. That was fine for wartime aircraft over Europe, but in Philadelphia it meant the driver not only multiplied 48 Mc. to 144 Mc. – no problem in itself – but also generated a *fourth* harmonic of 48Mc. that fell right on Channel 10's audio carrier at 216 Mc. Oi*!* There was trouble in the neighborhood! However, when W3VVS, one of the TVI Committee's Field Investigators observed that there was no TVI on my own TV set, which was right in the shack, Paul delicately explained the situation to an irate neighbor who grudgingly accepted circumstances and stopped telephoning me every time I went on the air.

My receiver and the transmitter were mounted with their power supplies in a standard 19" rack cabinet, making a compact (for its time) 2-meter AM station. Many happy hours of ragchewing into early morning hours were enjoyed with that system, but when I decided to try the ARRL VHF Sweepstakes Contest in January 1952, an improvement in operating style was needed. In those pre-repeater days on 2-meter AM, stations were scattered all over the band. The only way to make an unscheduled QSO was to call a CQ, which typically ran *two minutes long!* To simplify establishing a contact with a CQ, the calling station would often announce at the end, "Tuning from the low end up", or, ". . . high end down". That gave receiving ops an opportunity to rapidly shift their Tx frequency and thus be closer to where the calling station would be listening. That was fine for hams with VFO control, but with my rock-bound 522, something had to be done.

Fortunately, the military SCR-522 package also included a rapid tuning system. It consisted of an accessory ratchet motor that mounted on the face of the transmitter to manipulate its tuning control rods, and a BC-602 push-button remote control box that caused the motor to home on one of four pre-set positions. Thus, with a few crystal frequencies strategically located across the band, one could appropriately respond to a CQ by rapidly selecting a transmit frequency at the low- or high-end of the band to snag a contact while the other poor sods were in the wrong place.

The contest was great fun at first, with that ratchet motor emitting a raucous BRA-A-A-CK every time I would QSY from one part of the band or another in reply to a CQ. But even my "frequency agile" 522 and a five element beam couldn't compete against sophisticated high power stations, big beams and high altitude locations like Mt. Airy and Roxborough, which were the hotbed of local VHF activity in those days. Nevertheless, the second life of my SCR-522 provided a cheap and educational entry to the world of VHF. I sometimes wish I still had it!

The "Other" Morse Code

by Bob Thomas, W3NE
September 2009

Hams who have passed a code test when they obtained their license go on to enjoy the hobby, either enthusiastically embracing CW or steadfastly ignoring it. In either case, many do not realize the code we learned is but one of two versions of "Morse Code". Morse-coded messages initially used dot-dash combinations to represent whole *words*, rather than individual letters and numbers, requiring a lookup table, thus precluding its use for the extensive vocabulary of general communications. Morse (or more likely his associate, Alfred Vail) recognized and overcame that limitation by assigning a unique combination of dots, dashes, *and their spacing* to each letter, number and punctuation mark, optimized specifically for the English language. The Germans later devised another code, optimized for German that exhibits superior reliability under adverse conditions encountered in wireless and undersea cable. The German code became known as "International" or "Continental" Morse, and is the code used today in ham radio. The "other" Morse code, "American Morse," continued to be used in the U.S. by railroads and landline telegraph companies. In addition to being as much as twenty percent more efficient for the English language, American Morse possesses a much richer character set for punctuation, accented letters, and special characters like the dollar sign, making it the one best suited for domestic personal messages and press transmissions.

Eleven of the twenty-six letters are different in International and American Morse codes, e.g., di-dah-dit, is ***R*** in International, but ***F*** in American Morse. While International Morse always has the same width of spaces between elements in a character (equal to the width of one dot), American Morse element spacing can be anywhere from one-half to two times a dot width! For example, American Morse letters ***I*** and ***O*** are both represented by dit-dit, but one letter is distinguished from the other only by virtue of ***O*** having a space between its two dots three times as long as in the ***I.*** It is not easy to be bilingual in the two codes, especially when one depends on the click-clack of a sounder, but coastal station operators relayed traffic from Western Union (American) landlines to ships at sea (International). American Morse is more difficult to learn than International, but good operators can handle 35 wpm.

The need for telegraph initially was greatest on railroads. Schools specializing in telegraphy proliferated, but a more common entry path was tutoring by a relative or sympathetic railroad station agent. Upon gaining sufficient proficiency, the railroad gave a newly-minted Morse operator a one-way ticket to a station down the line where there was an opening. If they were hired, fine; if not, they had a long walk back home. Note the lack of reference to the gender of the new hopefuls; women and girls were almost as likely to be attracted to the field as men and boys. Most telegraph operators remained on the job for life or were gradually promoted through railroad ranks, even as high as President in some cases. Some prominent exceptions who left the field for fame in other pursuits were Gene Autry, Andrew Carnegie, Richard W. Sears (…Roebuck & Co.), Thomas Edison, and Chet Huntley.

The advent of teletype and centralized traffic control on railroad systems eliminated opportunities for American Morse operators just as new developments have relegated International Morse to obsolescence. Many ex-American Morse operators now satisfy a craving for their old passion with membership in the Morse Telegraph Club (MTC). The MTC quarterly news letter publishes lengthy articles and vignettes by old time American Morse operators about significant historical events, and biographies of legendary personalities. But members of MTC do not only live in the past; they have organized a world-wide system of dialup American Morse telegraphy by establishing telephone nodes that can be accessed over residential telephone lines. Over two hundred dialup nodes are maintained in the U.S. and Canada. Local key/sounder dc loops in members' homes are converted to tones by obsolete 300-baud modems that are connected by phone line to the nearest dialup node, similar to an internet connection. A landline "telegraph" conversation can then be conducted between one or more distant enthusiasts. In addition to casual contacts and nets, low- and high-speed code instruction is conducted every week. Programs and interface circuits are available for computer-generated American Morse instruction on a sounder.

Both Morse codes have made significant, if not crucial, contributions to society. As we witness the gradual fading of interest in "our" code, we can take heart in the likelihood of its continued existence, as exemplified by the success of American Morse enthusiasts in preserving the "other" code.

<u>*Author's Note:*</u> *This article was originally written for the Delmont Radio Club. It is based on material from* Dots and Dashes, *newsletter of Morse Telegraph Club,*
http://members.tripod.com/morse_telegraph_club/, *and from Morsum Magnificat,*
http//www.morsum.demon.co.uk/

AMELIA EARHART – Part One

What if she had been a ham?

by Bob Thomas, W3NE

October 2009

Amelia Earhart was a foremost American icon of the ‘twenties and ‘thirties. She was a tomboy as a youngster, a life style that convinced her there was nothing a man could do that couldn't also be done as well or better by a woman. She became an advocate for woman’s rights and, with her short-cropped hair and sporty dress, created a fashion widely adopted by young women of the era eager to express their own self-determination.

Flying became Amelia’s passion following a short ride with a barnstormer in 1920. She qualified for a pilot’s license after six months of lessons, bought a used biplane and proceeded to fly it to 14,000 feet for the first world altitude record by a woman pilot! Other accomplishments followed in quick order: First woman to fly solo across the Atlantic; Altitude record in a Pitcairn autogiro; Air race competitor; Aeronautics Editor of *Cosmopolitan*; and regular newspaper columnist popularizing commercial air travel.

Despite her impressive credentials, A.E. was regarded by leading aviators as a below-average pilot, but that didn’t deter her from setting sights on the Ultimate Adventure – a flight around the world. This would be no wimpy Northern Hemisphere flight; it would be the hard way around the equator, with long segments over open water, unstable weather, and poor equatorial radio propagation. A key figure in that undertaking would be her husband, George Putnam, who enthusiastically obtained influential sponsors, raised funds and directed high profile publicity.

Amelia was befriended by Eleanor Roosevelt, who shared many of her views and championed her cause within the labyrinth of the Federal Government after FDR’s 1932 election. The State Department negotiated landing credentials with governments of stopover countries on the trans-global flight, and the government funded construction of special runways on Howland Island, a refueling point between Indonesia and Hawaii. Additionally, executive “persuasion” was applied to the U.S. Navy, Coast Guard, and Bureau of Air Commerce (FAA of the day) to assist Earhart.

Purdue University provided a Lockheed Electra for the flight. The Electra was a twin-engine transport widely used in commercial aviation, but Model 10-E was extensively modified by removal of cabin windows and seats. Nearly the entire cabin was occupied by fuel tanks, leaving only a small passageway in the center for crew to crawl on hands and knees to the rear of the plane to the navigator’s plotting table and latrine.

A change in leadership at the Bureau of Commerce eroded government support for Amelia’s mission just as it was about to commence. Days before scheduled departure from Oakland for Hawaii, she was notified by the new chief of the Air Commerce Bureau that she had failed to renew the instrument rating section of her transport license and could not proceed until she had been recertified. A three part test was required, consisting of a written examination, a flight test flying blind with instruments, and *demonstration of proficiency in use of radio navigation*. The regulators eventually relented somewhat and allowed her to recertify by taking only the flight test. With that technicality out of the way, the epoch flight was ready to begin, however, as we shall see later, she received no favor by elimination of the radio navigation element!

The Electra had a crew of four when it took off from Oakland for the start of its trans-global marathon. Amelia Earhart was pilot. Harry Manning was scheduled to be navigator on the first three long over-water segments to Hawaii and New Guinea. Manning was a private pilot and an amateur radio enthusiast with extensive experience as a shipboard navigator, having served at sea for years as a ship captain in the Navy. There was some concern, however, that he might have difficulty coping with the rapidly changing conditions in flight, so a second navigator, Fred Noonan, was added to the team. Noonan was former ace Pan American Airways navigator, a key figure in planning PanAm's Clipper routes to the Orient and South Pacific. He had recently left the company with a sterling reputation as a celestial navigator. The fourth member of the team was Paul Mantz, the country's most competent aviator, brought on board as technical advisor.

The Electra lifted its four occupants from the Oakland airport at 4:37 PM March 17, 1937 for the 2410 mile flight to Hawaii. PanAm ground stations used Adcock direction finders to make position measurements from the plane's transmissions on 3105 kc, returning the information to Manning by CW on 2986 kc. Additional guidance was obtained as they neared Hawaii using the plane's DF loop to home on a beacon at 290 kc. With radio navigation aids supplementing Noonan's dead reckoning, the plane landed safely at the Army's Wheeler field the next morning.

Mantz discovered improper lubrication had caused damage to prop pitch gears, requiring repairs that delayed onward flight to Howland Island as originally scheduled for later in the day. After prop hub repairs were completed several days later, Mantz gave the plane a rigorous flight check, then landed at Luke Field, Pearl Harbor, where a 3000 foot paved runway would be ideal for subsequent takeoff by the heavily loaded Electra on the next leg of the trip.

Takeoff from Luke for Howland Island was initiated at 5:30 AM on April 20. Amelia ran up the engines of the Electra. Manning and Noonan were in their places at the rear of the aircraft. The plane rolled down the smooth runway for 1200 feet, but then veered to the left in an uncontrolled ground loop (like to an automobile spinout), collapsing its landing gear before coming to an abrupt stop. No one was injured and the engines did not sustain damage, but both propellers were mangled and the airframe was severely damaged. An Army investigating board was unable to determine the exact cause of the crash, although many, including Paul Mantz, seemed to attribute it to pilot error.

Plans for the world flight had come to an ignominious end, at least temporarily, while the Electra was returned to Lockheed for extensive repairs. Paul Mantz, who was scheduled to leave the team anyway, went on to other ventures, and Captain Manning returned to active duty in the Navy. (He later had a distinguished war record and became the first captain of the *USS United States*.) Putnam mortgaged his house to finance repairs and Earhart contributed a considerable sum of her own money. Her resolve did not suffer, however! Three months later the Electra was repaired and ready once again for an epoch journey in which radio communications were to play a pivotal role. That will be our topic next month.

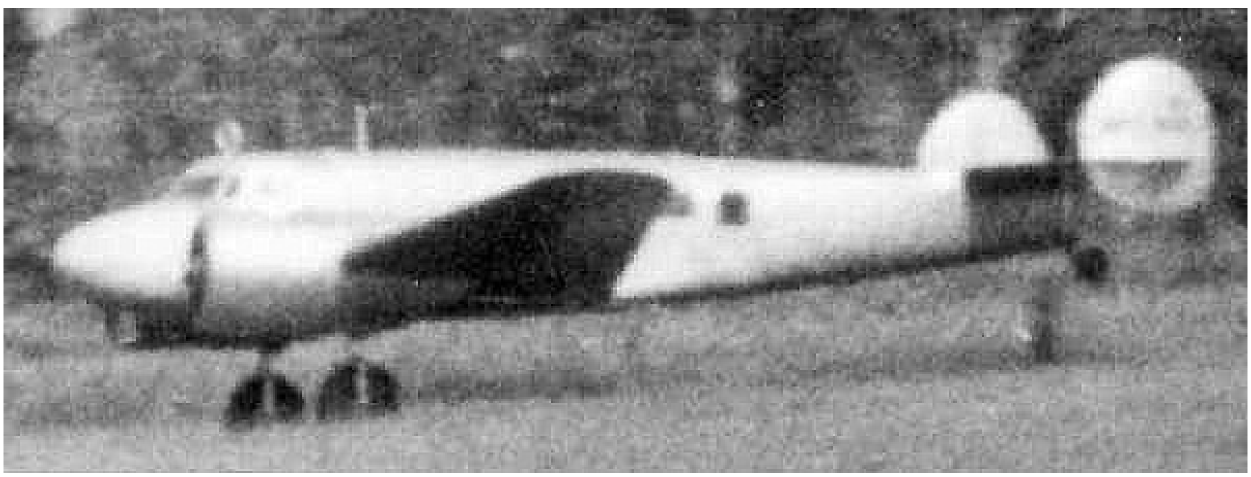
AMELIA EARHART – Part Two

What if she had been a ham?

by Bob Thomas, W3NE

November 2009

Amelia's second attempt at trans-global flight began with takeoff of her repaired Electra from Burbank on May 20th. Notable aspects of that event were the secrecy with which the journey was resumed, and a hurried reversal in direction from its originally planned route to a new, west-to-east path. Having suffered the indignity of a takeoff crash three months earlier, Earhart and Putnam uncharacteristically downplayed the flight's re-start, billing the new attempt as a "test flight" in case there was another pilot gaff. A.E explained the reversal of direction as taking advantage of better weather in the tropics. That disingenuous excuse obscured a more likely reason – to conform to demands of the Bureau of Air Commerce. In the event, headwinds and unsettled weather on the final leg of the flight contributed to its ultimate failure. The beginning of the new attempt was blemished by a near-disastrous engine fire as Miss Earhart attempted to restart the engines after a stopover in Tucson. Then she landed at the wrong airport in Miami!



The Electra was equipped with a Western Electric 20B receiver and 13A transmitter. The receiver had one input for 188-1200 kc. direction-finding and second one for 1.5-10 Mc. phone. [There are contradictory anecdotal reports of another receiver, a pre-production Bendix RA-1 which, in reality, may have been only a DF antenna coupler.] The transmitter was similar to the SCR-274N (ARC-5) of WW-II fame. It put out 50-watts screen-modulated AM on crystal-controlled aircraft frequencies of 3105 and 6210 Mc., and CW on the 500 kc. international distress frequency (considered by Earhart to be next to useless, as noted below).

There were four antennas on the Electra when it arrived at Miami: 1) a prototype Bendix MN-20 DF loop above the cockpit, rotatable by a knob above the pilot. 2) a short "sense" antenna between stubby masts under the fuselage, to resolve the inherent 180º ambiguity of the DF loop; 3) an HF "V" with 54 ft. legs from a dorsal mast behind the cockpit to each rudder; 4) a 150 ft. wire that could be reeled out from the rear of the fuselage for 500 kc. This antenna and its deployment apparatus was removed at A.E.'s insistence to save weight. S*he failed to appreciate* *the crucial importance of using low frequencies for accurate direction finding*. There is doubt about when the trailing wire was removed, but it was not present when the Electra left Miami.

A public announcement that the world flight had already resumed was not made until May 23, at Miami. On June 2, Earhart and Noonan took off for Puerto Rico, then across the Equator to South America, across the Equator again and 1961 miles over the Atlantic Ocean to West Africa, across the African Continent to Ethiopia, then India, across the Equator for the third time to Indonesia, then Australia, and finally to Lae, New Guinea. They had flown 28,585 miles from their start at Burbank on a two month journey that was a remarkable feat of skill and endurance!

Amelia spent an inordinate portion of time when not flying to write accounts of the trip for the *New York Herald Tribune*. That was a top priority, and it made access to her very difficult for Coast Guard officials attempting to coordinate communications for the risky 2550 mile over-water segment from Lae to Howland Island. Howland is a low lying coral outcropping, a mere speck in the Pacific, just large enough to accommodate runways specially built for Earhart by Roosevelt's WPA. The Coast Guard ship *Itasca* would lie off-shore for radio communications.

After a series of frustrating delays, Richard Black, Commander of the *Itasca*, finally received a message from A.E. in which she inexplicably specified homing transmissions on 7.50 *Mc*. Such a high frequency would be useless to her for radio location with available equipment! It was contrary to recommendations for 333 or 545 *kilocycles,* received earlier by Black from Coast Guard Headquarters but never forwarded to Earhart. Furthermore, it was inconsistent with an eminently logical 400 kc. homing frequency that she had previously requested for transmission by the Coast Guard ship *Ontario*, stationed midway between Lae and Howland Island. There is speculation that Earhart was confused about *frequency* and *wavelength,* and that she intended *Itasca* to transmit on 750 *meters,* corresponding to a frequency of 400 kc. Regardless, Black was not motivated to contradict Amelia Earhart, whom he considered, right or wrong, to be in charge of a mission in which it was his responsibility to simply respond as requested.

At 10 AM on July 2. Amelia's Electra 10E Special trundled down the runway at Lae for takeoff tortured by a load of 1100 gallons of gasoline. All but 40 gallons was 87 octane, the best available at Lae, but far below 100 octane fuel for which the engines were optimized. The plane used every inch of runway, dipped slightly as it left the island, and headed over the Pacific in a cloud of spray for a mile before it began a steady climb on its last flight.

Excitement in *Itasca's* radio room rose as the first weak signals from the Electra were heard by Chief Radioman Leo Belarts at 2:45 AM. [Local time as observed on *Itasca* in a peculiar system of 1.5 hour time zones used by the Navy and Coast Guard. It was a constant source of confusion with Earhart's use of GMT.] The signal strength steadily increased, but when *Itasca* responded to her requests for transmission of DF beacons 500 and 6210 kc., there was no acknowlinedgement. She was not receiving the ship's transmissions! Of course she couldn't hear signals on 500 kc because the necessary trailing wire antenna had been removed. and she could not copy Morse, further rendering that frequency useless – another thing *Itasca's* radiomen were unaware of.

Amelia's voice grew louder as carrier strength reached QSA5 (comparable to today's S9+30dB). In fact, her transmissions were so strong by about 7:30 AM, that Belarts went out on deck with the expectation of hearing the Electra's twin engines. It was nowhere to be seen. Tension in the radio room was palpable. Her transmissions continued as plaintiff one-way requests for position and reports of ever lower fuel level. Finally, the *Itasca* radio log entry at 7:40 AM reported the last transmission logged: "Running out of gas. Only ½ hour left." Amelia Earhart was lost.

EPILOGUE

The subtitle of this article poses the question, "What if she had been a ham?" If she had been, she would have (in that era) been proficient in Morse and that would have led her to appreciate CW on 500 kc. The trailing antenna would have remained. She would have understood the necessity of using a medium frequency direction finding beacon, not the wildly inappropriate 7.5 Mc. she specified. She no doubt would have checked out her radio gear before leaving Miami and all along the route so it would be at peak performance on the arduous final segments of the journey. If, if, if . . .

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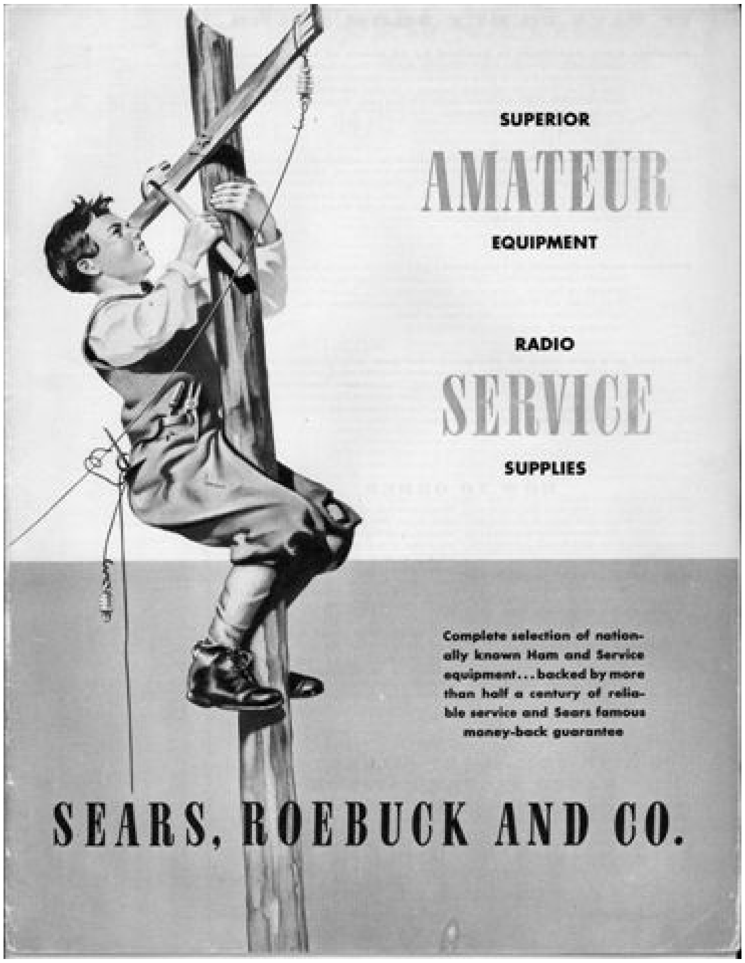
The Joy of Catalogs

Youthful reading and dreaming

Bob Thomas, W3NE

December 2009



We all are probably familiar with the catalogs of huge national discount houses HRO, AES and Texas Towers. These slick publications are essentially collections of print ads for products of Asian descent (and MFJ), with some comparison tables and brief descriptions of minor products. Bland sameness has not always existed. There was a time, before the Japanese captured commercial and amateur markets, when many national and regional U.S. suppliers of radio parts and equipment issued a new catalog about this time every year. Although they included many of the same products, they possessed individuality in product lines and the markets they addressed.

For a youngster or avid ham, arrival of a mail order catalog was met with instant excitement, followed by hours poring over every fascinating page of receivers, transmitters, test gear, and parts. Perusing their pages provided a foundation for understanding the physical nature of radio. Young hams or SWL fans could never hope to afford commercial equipment on meager income from a paper route or gardening chores, but availability of inexpensive components and a few kits enabled them to construct satisfying substitutes. As time went on after the war, more elaborate kits were introduced that could be assembled by just about anybody for radio gear almost as good as exotic commercial products – but that's a story for a later time. Meanwhile, here are brief descriptions of a just a few prominent, and less prominent, catalogues "of the day".

The foremost national mail order supplier was **Allied Radio**, founded during the radio craze in 1921. My first Allied catalog was 178 pages of awesome inspiration, published in 1939 when I was twelve. Major products were broadcast receivers sold under the *Knight* house brand. Forty models were offered, from a 4-tube ac-dc set to an imposing 16-tube 3-band wood console model at $83.50 ($1253 in 2009 inflated currency). There were few factory-built transmitters and most were expensive. That was good reason for hams to build their own from what today would be an unimaginable variety of components. Amateur receivers were offered as commercial models and in kits for simple 1-tube battery sets up to those approaching commercial capabilities.

The 1950 Allied catalog introduced table and console television receivers with a 12.5" picture! Some ham receivers were double-superhets for improved image rejection. HiFi was becoming prominent as tape began to supplant disk recordings, and FM gained a foothold. Those new technologies competed with sales amateur radio had formerly enjoyed, leading to a decline in space allotted to ham components. By 1969 the Allied catalog had grown to 536 pages, including more audio equipment than ever, CB gear, and Drake ham equipment but, except for Hallicrafters, traditional amateur products were gone. Over 70 pages were devoted to Knightkits, a significant competitor to Heathkit. The end was near, however. In 1970 Tandy, owner of RadioShack, acquired Allied for its industrial products only, assigning radio equipment to RS.

Walter Ashe Radio Company began as a regional supplier of general radio parts and equipment in St. Louis, but their 1950 catalog is evidence of ambitious pursuit of hams. All major Collins AM gear was featured in two pages packed with technical details: 75A-1 revolutionary receiver, 32V-2 transmitter, two exciters, and the 30K-1, a 1kW rack-mounted AM transmitter priced at $1450, presently going on eBay for $15,000! Full lines of National, RME, Hallicrafters and Hammarlund receivers, now coveted by collectors, were shown along with Stancor and Meissner equipment. They carried few non-amateur products in comparison to other mail order houses, but they offered all the parts a ham could desire, even QSL cards (what are those?). Ashe came into prominence about this time with a liberal trade-in policy that encouraged hams with aging or unwanted gear to upgrade to latest technology with a generous allowance for their old equipment. Their catalog reveals Walter Ashe as one of the great ham radio mail order dealers.
Lafayette Radio was the popular name for "Wholesale Radio Service Company", headquartered in New York with branches in Chicago and Atlanta. Before succumbing to the Japanese juggernaut, Lafayette, through its annual catalogs, was widely respected for a comprehensive stock of well known domestic manufacturers. Pre-war catalogs typically ran more than 200 pages, devoted primarily to parts for amateurs, test equipment, and ham communications gear. The "civilian" side of the catalogs featured over thirty-five pages of house-brand broadcast receivers, making them favorites for reading and dreaming on a snowy night.

Wholesale Radio Laboratories was founded in 1935 by Leo Meyerson, W0GFQ, with a $1000 loan from his father. His company was principal supplier of quartz crystals to the U.S. war effort. After hostilities, the company name was changed to **World Radio Laboratories.** They stocked a complete lines of ham radio parts and equipment for sale through annual mail order catalogs and a retail store in Council Bluffs, Iowa. What really distinguished WRL was Leo's introduction of four moderately-priced transmitters manufactured in-house. They ranged in power levels from the 65-watt *Globe Scout* CW transmitter up to the 500-watt *Globe King,* self-contained with VFO and modulator, in a 31" rack cabinet. Luscious! The 200-page 1957 catalog describes those rigs in great detail along with CW/AM/SSB equipment from Collins, Johnson, B&W, Eldico, Harvey-Wells, Millen, Elmac, and Central Electronics. Every receiver available at the time is covered in similar detail, making this one of the best amateur radio catalogs of them all.

What will come as a surprise to most readers is an amateur radio catalog issued pre-war by none other than **Sears, Roebuck and Company**! What did he say?! *Sears???* Quite true. A 1940 Sears 48-page catalog of ham equipment described twelve transmitters from Hallicrafters, National and Stancor, and fourteen receivers manufactured by National, Hallicrafters, and Hammarlund. Test equipment, builder's parts, antenna supplies, and even transmitting tubes, were also sold by Sears through the mail. They even offered an easy installment plan for a small down payment and monthly payments spread over a year. It says something about the size of the amateur market in those days when Sears (and competitor Montgomery Ward to a lesser extent) would devote an entire catalog to our hobby. How times have changed! Take at look at the front cover of the 1940 Edition, reproduced here. Nothing could capture the exuberance of a young ham in those days better than that kid, barely clinging to the pole while nailing-on a crossarm, an insulator and feedline dangling from the pocket of his knickers – perhaps a long-lost ancestor of WU3I!

THE RADIO PROXIMITY FUSE

Second best-kept secret of WW-II
Bob Thomas, W3NE
January 2010

In the fall of 1944, Japanese armed forces were decimated. U.S. Marines were winning viscous battles along the island chain leading to an invasion of Japan itself. In a desperate attempt to deploy their limited remaining resources, the Japanese resorted to attacks on our Pacific Fleet with waves of suicide bombers, known as *Kamikaze.* These planes, loaded with explosives, were crashed directly into our ships, causing thousands of casualties and loss of ships, sometimes from a single strategically-aimed or lucky enemy aircraft. Conventional anti-aircraft defense had only limited effect against the devastating low flying, or diving *Kamikaze*. Something had to be done!

Anti-aircraft fire is not necessarily intended to score a direct hit, a highly unlikely possibility considering the size and speed of airplanes. Rather, it creates an expanding cloud of shrapnel, high velocity metal fragments, that spray out *near* the target to inflict damage. This is accomplish in ordinary anti-aircraft ordnance by an onboard altimeter or mechanical timer that is preset just before firing to activate the shell's detonating fuse within the field of enemy aircraft. With *Kamikaze* coming in fast and furious, that was no mean feat! Fortunately, a lengthy development program culminated just in time to respond to this new threat with a device to automatically detonate the shell at optimum distance from the target. The new invention was designated VT (Variable Time) Fuse, popularly known as the "Radio Proximity Fuse."

The same British group that had invented the magnetron had begun working on the VT Fuse concept, but it was decided in 1940 to transfer further development to the U.S. National Defense Research Committee. The most viable approach was soon determined to be a miniature radar system housed in the nose cone of the projectiles. The system depended on subminiature vacuum tubes (it would be more than two decades before suitable semiconductors would be developed). However, there were serious reservations among scientists whether a tube could be made to withstand the tremendous effects of acceleration as the shell was fired. Tubes would be subjected to 20,000 G as the shell accelerates to required muzzle velocity, plus an additional 5,000 G from rotational acceleration while spinning at 250 rps due to the barrel's rifling!

Fortunately for the Allies, the prospect of making a tube that could withstand such treatment appeared so daunting to the Germans, they did not pursue VT fuse development. Not so in the U.S.! Tests immediately began with Raytheon hearing aid subminiature tubes. They were embedded in carrier blocks and dropped on concrete or armor plate, examined and then modified for improved ruggedness. More sophisticated tubes were fired from a home-made vertical gun. Final versions were used in RF oscillators mounted in projectile nose cones shot from 37 mm guns while RF output stability was monitored. Three ruggedized tube types emerged from the development program: a triode, a pentode and a thyratron – a gas-filled tube analogue of an SCR. Other key components were developed while tube designs continued to be perfected, and by February 1942 a pilot production line started making VT Fuses for 5-inch anti-aircraft guns.

A wet-type battery with a built-in safety feature was designed by National Carbon Co. It had a cylindrical shape with a thin glass ampule filled with electrolyte in the center. The battery was normally dead without electrolyte, so the VT Fuse was disabled. Centrifugal force broke the glass ampule when the shell was spun by the gun's rifling during firing, diffusing electrolyte through the battery to arm the fuse by the time the shell exited the barrel. Other safety features prevented premature activation of the fuse in case the shell was accidentally dropped on the deck, and until the shell was out of the barrel and a safe distance away from the ship. Initial cost of a fuse was $732, but by 1945 it had declined to $17. Over 22 million Proximity Fuses were produced by the end of the war.

The VT Fuse employed a triode regenerative detector circuit exactly like the receivers used by amateurs and BCLs in the 1920s. It was coupled to an antenna in the tip of the nose cone, the body of the shell providing a ground plane. Regen receivers oscillate in one of their operating modes, radiating RF from the antenna. [That caused bedlam on ham bands and in neighborhoods when hundreds of radio fans were tuning around in the evening.] The regenerative circuit in a VT Fuse operated simultaneously as a transmitter and receiver, *sending* RF out as a transmitter, and *receiving* RF reflected from the target as the shell approached. The frequency of reflected RF was shifted up, due to Doppler effect, relative to RF radiated from the fuse. At a closing speed of 500 mph and radiated frequency of 160 MHz, the shift was about 240 Hz, appearing as an audio beat in the output of the regen circuit. Amplitude of the beat increased as the shell approached its target, and when it reached a preset value corresponding to a distance of about thirty feet, a thyratron was triggered to initiate detonation of the shell. *Sayonara, Kamikaze!*

The Proximity Fuse was a rousing success in the Pacific Theatre. It scored three times as many hits as conventional defenses in its first year of deployment. Military leaders considered it of such importance that using over land was forbidden to avoid any possibility a dud might be captured and used to develop counter measures. That policy was abandoned when the Nazi's V1 pulse-jet "Buzz Bomb" was used against civilian population centers in England, so any duds would fall back on friendly ground. Conventional countermeasures were ineffective against the V1, but after introduction of the VT Fuse, only four of 104 Buzz Bombs reached their targets.

In mid-December 1946, the Germans launched a surprise major counter offense and several secondary counter attacks in Western Europe, known collectively as "The Battle of the Bulge." Fighting became so intense there was no alternative to equipping bombs and Howitzer shells with Proximity Fuses. The effect was immediate and decisive. Bombs and shells exploded thirty feet above the ground, spraying shrapnel in a downward cone. German soldiers were totally exposed in fox holes or behind natural barriers that would have formerly provided protection. So fearsome was the effect generated by the Proximity Fuse, that whole squads of German soldiers deserted or refused to go into the field and fight.

A superbly organized cooperative effort among scientists, commercial manufacturers, and military forces produced a product of elegant simplicity. There is no doubt that protection of civilians and support of our troops with ordnance equipped with the VT Fuse was a major factor in victory in the Pacific and Europe. The importance of the Proximity Fuse, and the secrecy with which it was brought to fruition, was exceeded only by the Atomic Bomb.

General Radio

Camden's Gem

Bob Thomas, W3NE

February 2010

Even with a large bright red sign proclaiming its identity, few motorists, hams or otherwise, noticed a white store situated just past the toll booths on the right side of the Ben Franklin Bridge Plaza in Camden. That was General Radio Supply, known to regular customers as "Walt's". The store was owned and operated by Walter Beringer, a forty-something gentleman when I started going there in 1951. A large segment of Walt's business was the Radio/TV service trade, which flourished before throw-away electronics became prevalent. For the ham builder, however, the selection of off-the-shelf items at Walt's was an incredible resource; there was hardly a component, chassis, meter, cabinet, test instrument, coax or multi-conductor cable that was not stocked by Walt. Imagine being able to buy seven feet of cut-to-length 5-conductor cable (shielded or unshielded), any receiving or small transmitting tube, Millen, National or Meissner product, chokes, power, interstage or modulation transformers, or …

I was a regular customer of Walt's for over thirty years until my retirement from RCA in 1982. The store was only six blocks from the plant, so all the hams at RCA patronized the store during lunch hour, often several times a week, depending on what we were building. The austere sales area had a long metal-top counter behind which were shelves of high-demand radio and TV service components, and out in front, some racks displaying a few magazines and books, and a complete file of Sams *Photofacts* service data.

Walt was on hand most of the time to personally serve his customers. His regular counter assistant was Aldo, who shuffled about staring into space, as though dreaming of life on Mars. Aldo had a knack for routinely botching the most elementary request. If asked for ten 51-ohm resistors, he would disappear into the stock room, saunter back five minutes later with a blank look and the realization that, "Oh, I thought you wanted fifty-one 10-ohm resistors." About 1970 Walt Junior began working in the store. He was bright, energetic and efficient, but had an indefinable air of detachment. With choices like that, regular customers would naturally hang back until it looked like Walt, Sr. would be available!

As the years went by, it gradually became apparent that Walt's health was declining. It didn't deter him from being in the store almost every day, but he began to move slower and acquire the appearance of someone in physical distress. That's the way he was during my last visit to his store in 1982 when I retired early from RCA to take a new job in another city. I don't know how long General Radio could possibly have survived after that in view of Walt's fragile health, the precipitous decline in customers interested in buying radio parts, and the redevelopment of Camden. At any rate, it was great while it lasted. In retrospect, it was just as well for the customers of that extraordinary source of every radio part imaginable during those halcyon years that we had no inkling of how really bad it was going to get. Goodbye Walt . . . hello 2010.

PHONENETICS

Complicated is good?
Bob Thomas, W3NE
April 2010

[Names and station call letters in this narrative are fictitious. Any resemblance to specific amateur stations or their operators is strictly coincidental. Names and call signs have been changed to protect the guilty.]

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Phonetics, words spoken in place of individual letters of the alphabet they represent, were introduced in WW-I. Hams and even the general public became conversant with standard phonetics during WW-II, when the system designated "1945 Allied Services" was used. Those phonetic equivalents were logical, easily memorized, and mostly monosyllable words that were recognized by all the Allies. Although good enough to win a war, 1945 phonetics were found wanting by new age global experts of the ICAO (International Civil Aviation Organization).

ICAO preferred more complex words than those proven in battle, in many cases adopting phonetics with three syllables where one had been adequate. Inexplicably, many of the words they chose for phonetics do not even sound like the letter they represented, e.g., **I = *I*ndia** rather than **I =*I*tem,** and **O =*O*scar** instead of **O =*O*boe**. And, they also ignored ARRL's admonition to avoid geographic names for phonetics because of their obvious potential to create confusion.

ICAO justified tampering with WW-II Allied phonetics because those were considered to be inappropriate for use in some languages, even though – get this – *all international voice communications are conducted in English!* To make matters worse, some of these "universal" ICAO phonetics are required, by decree, to be spoken with weird pronunciations, as in "kilo", which must be pronounced by "communicators" as *KEE-loh*. Does any nationality actually refer to weight in *KEE-loh*-grams? Have you ever been asked to, "QSY up three KEE-loh hertz"? We've sure come a long way since 1945 in the name of "international solidarity".

Amateurs embraced ICAO phonetics, now with the imprimatur of NATO, no less. Hardly a QSO goes by that trivial ham communications are not *declarified* by gratuitous over-use of phonetics. For example, even in QSA5, Rock-Solid, Zero-QRM conditions, many hams feel compelled to repeat their name phonetically**:** "The name here is Leonard: *Lima-Echo-Oscar-November-Alfa-Romeo-Delta"*. Oi! As if anybody would confuse Lenny's name with Bruce, Eric or anyone else! And is there a ham, anywhere, who finds *Whiskey* more understandable than plain old ***W?***

Excess phonetics are frequently used during 2-meter repeater nets in DFQ conditions. The NCS is flummoxed by a torrent of long phonetics thrown from several stations at once, so fast – *and unnecessarily* – they actually create confusion compared to short transmission of well-enunciated call *letters*. But that wouldn't sound "official" like an F-18 pilot or orbiting astronaut. The most ironic, if not hilarious, frivolous use of phonetics is when an insecure ham recites his call first as, *KEE-loh, thu-REE, Whiskey, Alpha, Lima,* only to repeat it rationally as plain "K3WAL" in an admission that the first pretentious version was really unnecessary and probably misunderstood.

It's not the intent of this article to discourage use of phonetics by amateurs ***when appropriate***. It is an attempt to highlight some of many circumstances when they are counterproductive. If clarity is enhanced by phonetics, they certainly should be used. But when interjected just as a mindless habit, or to satisfy a giant ego, they get tiresome and impede accurate communications.

All is not lost, however! On April 1 of this year, representatives from 387 nations convened in Geneva, Switzerland, traditional birthplace of International Standards. The *Committee Radiodiffusïon á Phonêtiqué* (CRAP) approved a report from its PLENARY WORKING GROUP B, ANNEX IVXX, whose members have labored tirelessly for advancement of CRAP. Their new Table of Phoneynetics is reproduced below. This development vaults the flawed concepts of ICAO/NATO phonetics to their absurd limit. They are certain to be so repugnant that they will cause total abandonment of phone operation as they incite a wild scramble to adopt more modern keyboard-based digital communications where the human voice is neither needed nor tolerated…
. . . or even to CW from a hand key!

The CRAP Table of Phoneynetic Equivalents

A	Are	**N**	New
B	Bee	**O**	Ouch
C	Cue	**P**	Pea
D	Duh	**Q**	Queue
E	Eye	**R**	Repeat
F	For	**S**	Sea
G	Gnu	**T**	Tea
H	Herb	**U**	Undo
I	Idiot	**V**	Venezuela
J	José	**W**	Why
K	Knew	**X**	Xerxes
L	Lieu	**Y**	Yew
M	Moishe	**Z**	Zero

NOTE: Some of the phonynetics above are based upon a list published in *REMARCS,* newsletter of the Midatlantic Amateur Radio Club. The editor then was a former Phil-Mont member – none other than the newly elected President of ARRL, Kay Craigie, K3KN, *Knew-Three-Knew-New.*

H&R MANUFACTURING – Part 1

A practical education . . . with pay!

Bob Thomas

April 2010

In an earlier article on Philadelphia radio stores, I mentioned a manufacturing facility located on the floor above the Herbach and Rademan retail store. The Manufacturing Division of H&R was established by Mr. Herbach in the late 'thirties to custom build products for store customers requiring something beyond the standard product lines of mainstream manufacturers. For example, design and construction of an auditorium lighting control panel for a high school, a radio dispatching system, special public address equipment, or a one-off measuring instrument for a medical lab. An early association with a talented scientist also positioned H&R to exploit the emerging field of nuclear radiation measurement and, with the entry of the U.S. in WW-II, numerous contracts became available for electronic equipment that was an exact fit for H&R's modest production capabilities.

I began working at H&R for 35¢ an hour in the late spring of 1944, after completing eleventh grade at high school. Until that time my best wage was 25¢ after school for incidental yard work or for hour upon hour drilling holes in a concrete floor with a hammer and star drill at a local plastics factory. H&R was a step up from that but it was not always a dream job and there were commuting expenses that meant there was really no gain in wages. However, it was an entry to the field I longed to be in and more importantly, it enabled me to observe the very definition of high quality electronic equipment construction. It couldn't have been too bad, because after that first summer I continued on Saturdays and two afternoons a week when school resumed, and went back again for a second summer in 1945.

H&R, like all the other stores along lower Market Street, occupied a narrow three story building that extended from Market all the way back to Commerce Street in the rear. The store and its stock room were on the ground floor. Offices were up a flight of stairs at the front of the second floor. The manufacturing section behind the offices consisted of an enclosed room for running final tests, a small office for the Chief Engineer, and then a large open shop. The shop had benches on each side for three or four technicians and several production assembly people, mostly women. A lathe, drill press, foot-operated metal shear, and spot welder were in the back of the shop. Rest rooms and a stock room were at the very back of the building, next to an ancient freight elevator. That elevator was a man-eating monster with a manually-operated gate and small square hole at elbow height in one side. Two cables ran past the hole between the elevator and the wall of the shaft. There were lead blobs on the cables at each floor for the operator to grab by reaching through the hole and pulling up or down to Start and Stop the elevator and change its direction. The trick was to pull on the appropriate lead blob to stop the elevator within a few inches of the outside floor level. This was only one of many risky situations where there was absence of an OSHA in 1944!

The floor of the shop was a menace too. Oiled southern pine floor boards from 1880 ran lengthwise through the whole building. They were fastened to joists with old fashioned cut nails which, because they were stamped out of flat material and tapered on two sides, tended to work upward out of the board. In addition, corners of the old pine boards often split part way off, so they also stuck up slightly above the rest of the floor. Now, in those wartime years of leather shortages, half the population was walking around with holes in the soles of their shoes so, if you weren't careful you might trip over a high nail head caught in your shoe, or suddenly feel a pain in your foot and see 9-inch splinter sticking out the front of your shoe! It was always good for a laugh if somebody was watching.

Jack Wagenseller, W3GS, was the jolly, unflappable, remarkably competent Chief Engineer. Jack had been the ARRL Eastern Pennsylvania SCM (Section Communications Manager) around 1935, at a time when the League and its field organization were much more engaged with local amateur affairs than they are today. In addition to keeping things moving smoothly in the shop, Jack prepared bids for new jobs, did any engineering necessary to convert contract specs into drawings, and divided work among the most appropriate people in the shop. He had a grand sense of humor and the most even temperament of anyone I ever knew. No matter how complex or disastrous a problem might be, or what stupid stunt someone had pulled, Jack would take a long draw on his ever-present pipe and say in the quietest of tones, "Well now, let's see." Then he would come up with a solution regardless of how hard he personally had to bite the bullet.

Jack told an interesting story about the origin of his call. He had been a resident student at the George School in Newtown. He became interested in ham radio, built a transmitter and began making contacts without the "benefit" of a license, using the school's initials for his call letters. He bootlegged as W3GS for a while until he became proficient enough to pass the FCC test for a Class B license. Just as they are now, calls were assigned strictly in alphabetical order but, to his astonishment, when his license arrived, it was for the very call he had been using for bootleg operation! That was a clear message from the FCC's RI (Radio Inspector) that Jack had been monitored all along and the FCC knew he had been bootlegging. Uncharacteristically, the RI went along anyway with just a subtle tweak to let him know he had not gotten away with anything. Jack claimed that story is true and if so, we should all be so lucky!

On my first day at work I was paired as assistant with Jake Mayer, a technician whose electronic construction was exquisite. On this project, however, Jake's versatility was put to the test with something entirely different. H&R had secured a contract to build thirty-three production test stations for the International Resistance Company (IRC), the nation's Second Banana resistor manufacturer (after Allen Bradley). IRC needed to rapidly expand production capacity to meet increasing demands of the military. Each test station had a large plywood hopper into which resistors were dumped by the thousands. An operator opened a shutter at the bottom of the hopper to let one or two resistors drop down. The operator then pressed a resistor's leads across a pair of contacts connected to an automatic resistance bridge that classified it into a tolerance range of 5- 10- or 20-percent. The resistor would subsequently be color coded in another operation. The hoppers, made of 3/8" plywood, were about 18" tall, open about 15"x9" at the top, narrowing down to 3"x2" at the bottom where the shutter was located. While others were building the measuring equipment, Jake and I made the hoppers – not exactly the electronics experience I had hope for!

Resigned to our fate, Jake and I began moving the plywood on that arm-amputating elevator to a loft on the third floor. There was a table saw there, but nothing else except rows of fire buckets full of water hanging from brackets along the brick walls, as required by City fire regulations. Jake laid out the 4x8 sheets to minimize waste, and we were making pretty good progress sawing, stacking, coughing and going deaf from the noise. Then, as we were handling one of the plywood sheets, it just clipped a fire bucket, which fell off its bracket onto the floor. As I looked around for something to wipe up the spilled water, Jake yelled, "Forget that, come with me, quick!" We ran to the elevator for the floor below, and rushed through the shop to the business office right under the spot where the bucket had fallen. The office staff had gone for the day, and Jake told me to grab newspapers and spread them over the all desks while he gathered up important looking papers. We had no sooner finished when streams of water began raining down from the ceiling. Remember those 1880 plank floors? They were like sieves, and Jake was wise enough to realize it would not be long before the water in that spilled bucket would be on the office below.

Eventually, after all the wood parts had been cut out, we nailed and glued the hoppers together, sanded them and sprayed shellac on them to finish our part of the job. It was a relief to both of us. Jake returned to laying out and wiring complex circuits and I began working on other projects. Some of those were interesting and instructional, and others, well . . . More about that next time.

H&R MANUFACTURING – Part 2

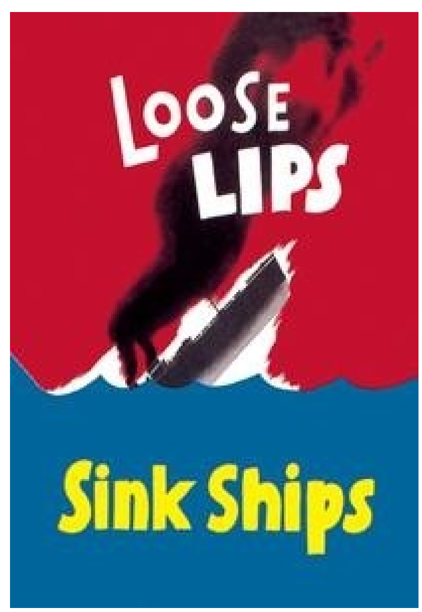
A practical education . . . with pay!

Bob Thomas

May 2010

A contract for a large number of BFO adaptors was awarded to H&R by the Navy in the summer of 1944. This BFO (Beat Frequency Oscillator) was a one-tube plug-in accessory for adapting a phone receiver for CW code reception. It was built in a small L-shaped box with a socket for the tube in the top of the foot of the L, and circuitry in the vertical leg. An octal (8-pin) plug in the bottom of the foot enabled the BFO to be plugged into an accessory socket on the receiver. The case was constructed of several sheet metal parts spot welded together. One side was left open to facilitate assembly and for access to wiring; a cover was fastened over the open side after final test.

My job was to do the spot welding. A fixture to hold all the parts in position during welding had been made by an ingenious Hawaiian named Frank, who also swaged, bent and filed copper welding electrodes so they could navigate around the fixture to reach inside the tight confines of the box. The welder was as basic as they get. It consisted of a cabinet about five feet high with little more than a transformer and tap switch inside Frank's electrodes were bolted to massive upper and lower horizontal copper conductor arms extending out from the front of the cabinet. The upper conductor arm was hinged at the back and connected to a foot pedal so it could be brought down, pressing the welding electrodes together with BFO case parts in between. The pedal also operated a switch at the end of its stroke to send transformer secondary current from one electrode, through the workpieces, to the other electrode. The current was so high it melted the parts together in a small round spot, forming a weld. Although the current was adjustable with the tap switch, this elementary welder had no control over the *duration* of current flow; that depended on how long the pedal was held down. As we all know, the foot is not our most dexterous limb, so it was very difficult to depress the pedal just long enough to obtain a good weld, say for six cycles of a-c (1/10 second), but not as long as twenty cycles (1/3 second), which would cause pieces of case metal to burn right through between the electrodes, making a hole and spattering molten steel in all directions! But that is what we had to work with then, and eventually my reject rate dropped to an acceptable level, permitting reasonable output over the several weeks it took to finish the job. An unappreciated side effect after the job was finished, was dozens of tiny steel droplets splashed out from bad welds that permanently embed themselves in the lenses of my glasses, ruining them. Still no OSHA! To my horror, the next summer another order of BFOs had been secured, but by then H&R had acquired a new spot welder with a timer that could be set for precise control of weld duration, so the job went smoothly.



A welcome change occurred when I was given a small part in production of the AN/PRC-5 Transmitter/Receiver, known around the shop as "The Spy Radio." This set consisted of a two-tube shortwave CW transmitter, a superhet CW/phone receiver and a 115/230V a-c power supply, packaged with crystals, transmitter coils, a key, headphones and antenna wire, all in a civilian-style suitcase. Suitcases of that era were typically made of plywood covered by varnished tan fabric with a few chocolate-brown stripes. That was a nearly universal style, so a spy set inside would not generally draw attention to its presence. A recent internet search revealed these radios were made for the OSS (Office of Strategic Services), predecessor to the CIA, and had a Secret classification. No mention of secrecy was made to us in 1944, although people who dealt with military equipment of any type generally complied with the admonition to keep quiet about their job. "Loose lips sink ships," was a highly publicized patriotic motto of the time. We all fantasized about the exotic uses the sets might see behind the lines in the hands of spies or covert resistance fighters. However, little has ever been revealed about their actual deployment, and only one or two PRC-5s are known to still be in existence, saved by military radio collectors.

The receiver was continuously tunable in two bands from 4.5 to 16 Mc. The transmitter covered 4- to 16-Mc. in four bands. It would have been a great Field Day CW rig! Band changing was accomplished with plug-in coils, but the 6V6 oscillator and 6L6 final coils were identical to minimize parts count and simplify field operation by unskilled personnel. The coils were wound on phenolic forms mounted with spacers on small ceramic jack bars. Square holes in the radio's front panel, were just big enough to pass the coil assemblies for changing bands without removing the set from its suitcase. As previously mentioned, I had a small part – a *very* small part – in production of the PRC-5, that being to cut grooves in the coil forms to hold windings rigidly in place in adverse field conditions. The grooves were cut on one of those ubiquitous South Bend 9" lathes with automatic-feed gears setup for required turns pitch. My job consisted only of slipping a blank coil form over a cylindrical mandrel held in the lathe chuck, then feeding-in the tool at the appropriate point for cutting a groove of the required depth and length. Even though it was repetitive, it was clean, interesting work involving a number of different operations, and it wasn't long before all the coil forms were finished.

Later, I also was responsible for final assembly of the PRC-5 in its case. We bought custom built suitcases from Barnett Brothers, who had a factory on Arch Street (how can trivia like that be recalled when it's impossible to remember where I left a pencil three minutes ago?). The suitcases came with an inside wood frame that supported the radio panel, which was held down with several woodscrews. There was a bit of amusement in the shop when one of the cases was unwrapped, revealing a note inside from a girl on the Barnett production line. She obviously thought the cases were going directly overseas because the note said something like, "Lonely at home waiting to hear from a handsome soldier. Call Marcy at Mayfair–xxxx." Sorry, Marcy.

There was a variety of other small jobs during that first stint at H&R, all of them instructive in some way, if not always enjoyable. Summer ended all too soon and it suddenly became time to go back to school. However, Jack Wagenseller asked me to continue working two afternoons a week after school and Saturdays. It seemed like a good opportunity, so I accepted. There were several jobs of much great interest in store for me, but also one more task I could have done without. More about that next time.


ANT. COUPLING
MFP-4-52
OFF
REC.
SEND
CRYSTAL
AMP. TUNING
110
220
AMP.
COIL
OSC. TUNING
OSC. COIL
OSC.
AMP.
KEY
RECEIVER
TUNING
VOLUME
OFF
ON
PHONES

H&R MANUFACTURING – Part 3

Interesting work and farewell

Bob Thomas, W3NE

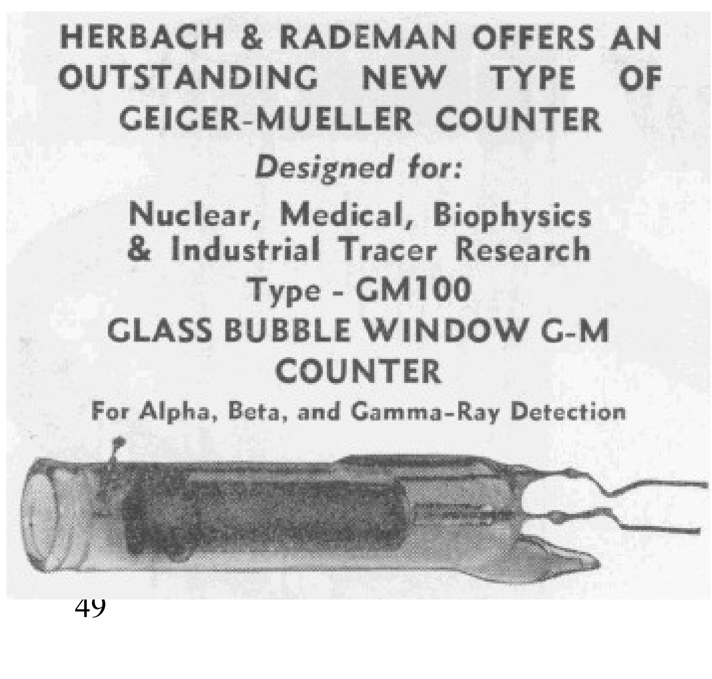
August 2010

By September 1944 the Allies were moving toward victory in Europe, still to be confronted by unexpected German resistance in the Battle of the Bulge. In the Pacific, the Marines had captured Guadalcanal and were launching what would be an inconceivably bitter offensive on Peleliu, memorialized in the recent HBO *Pacific* series. With that backdrop, and safe at home, I began my final year at high school and returned to part time work at H&R.

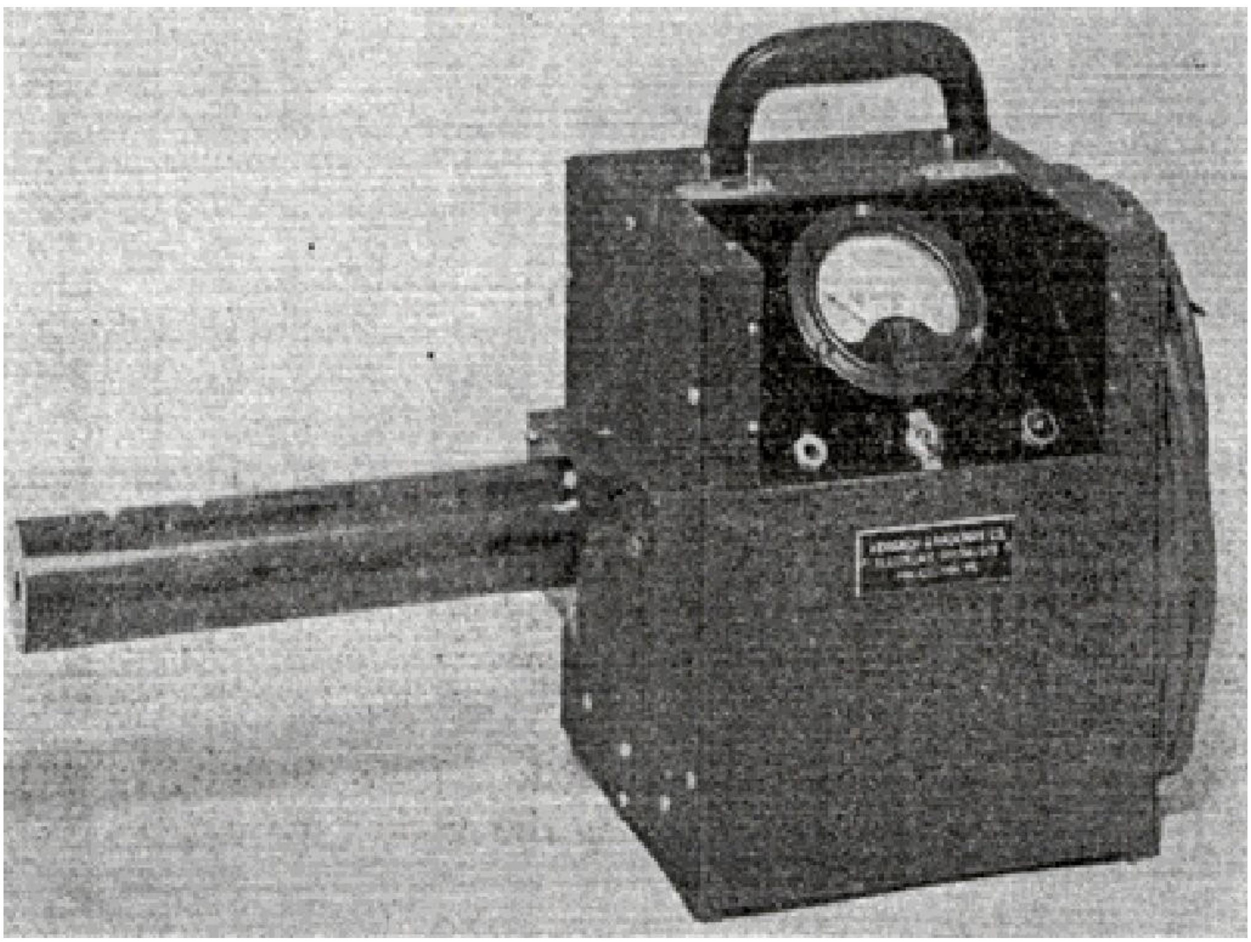
On the first day back I was taken to the third floor, an open loft, bare except for an air compressor, spray gun, and a small table. My job for the next six months would be mostly to spray Moisture Fungus Proofing compound (MFP) on Allen-Bradley potentiometers. MFP, as its name implies, was intended to inhibit growth of fungus on military electronic equipment. It was a brown varnish-like compound that dried rapidly. The compound was typically sprayed all over everything on completely assembled equipment or on selected components if they would be inaccessible for MFP application after final assembly. Although MFP was required only for gear destined for the South Pacific, it came into general use on anything that could go either to the Pacific or European theatres. Inspectors examined MFP coverage and would stamp "MFP" and date of application, if approved. It protected components and wiring alright, but it created havoc for service personnel when joints had to be unsoldered and new components or wires reconnected. Hams found that out when they converted dirt-cheap surplus gear to amateur use after the war, often by making extensive circuit modifications.

The "details" of my job were to place about 200 potentiometers at a time in an 18"x24" sheet aluminum mask that had holes punched in to shield the pot's solder lugs while MFP was sprayed on its phenolic insulator and rear shell. A mask would be loaded, MFP sprayed on in a uniform layer, and then set aside while another mask was loaded and sprayed. The compound dried fast enough that a steady production rate could be maintained with three masks. In those days nobody thought about what MFP vapor might do to the lungs, so there was no respirator. I'll have to admit though, in 65 years I never had fungus on my lungs. The loft was unheated so I wore a wool sweater when the weather got cold, but it eventually became stiff as a board from MFP overspray and had to be thrown away. Well, that went on for several months, but having finally paid my dues, I began to get some interesting work.

One of the good jobs was to install Geiger-Müller tubes in H&R GLR-200 portable radiation detectors. The tube was about a half-inch in diameter and three inches long, with an electrode on one side, two leads from one end and a thin Nonex glass window sealed on the other. The Nonex was only .005" thick, so the



expensive tubes had to be handled very carefully. The G-M tube was held by two fuse clips wrapped with lacing cord, and coated with melted bees wax. That subassembly was wiggled inside a 1.5” diameter Bakelite tube and held in place with a couple of short screws through the fuse holders. A Bakelite plug with a ¼” hole in its center was fitted in the end of the tube facing the Nonex window and the whole assembly was mounted on the side of a portable cabinet. Radiation in the vicinity entered the hole in the end plug, passed through the Nonex window, and ionized a weak gas mixture in the G-M tube. Pulses generated by the tube were amplified and applied to a meter circuit to display strength of the radiation. A standard gamma ray source was used to calibrate the instrument but preliminary testing was done simply by holding a match in front of the hole. Alpha radiation emitted by the flame produced a full scale indication and the familiar buzzing noise from an internal monitor speaker. A single sheet of paper between the flame and instrument would stop the alpha radiation, but not the gamma rays from the standard. Great fun.



About a dozen of these meters were lined up, waiting for installation of the G-M tubes and final tests. I made a fixture to hold the tubes in their fuse clip mountings while they were wrapped with lacing cord. A small paint brush was used to coat the wrappings with melted bees wax. When the wax solidified, the completed assembly was wiggled into the Bakelite tube and fastened in place, being careful of that thin glass window. Wires from the detector circuit were soldered to G-M tube leads, and after the Bakelite tube was mounted on the side of the cabinet, the instrument was ready for test and calibration.

Everything went well except for one unit which did not display any output from gamma radiation. There was nothing to do but disassemble it and inspect the G-M tube connections. The end plug had to be removed to access the G-M tube. This particular plug had a tight fit and couldn't be pulled straight out, so I put a small screwdriver into the plug's hole to slightly tilt it so it could be withdrawn. As the screwdriver passed through the hole there was a barely audible "tink." – it had had gone in too far and went right through the Nonex window of the G-M tube!

I mentioned previously that Jack Wagenseller, the Chief Engineer, had an even temperament, but I didn't know how he was going to react when told I had just destroyed a thirty dollar tube. He took the signature long draw on his pipe and said the anticipated, "Well now, let's see." Then he frowned and said he would have to dock my salary for the cost of a new tube – two weeks pay at my rate. With that, he broke into a hearty laugh, handed me a new tube to install. No pay cut and he didn't even mention to be more careful next time. What a great boss!

Another good job came along, this time one without risks. Merchant ships often carried broadcast receivers for crew morale. Superheterodyne receivers, as would normally be used for civilian BC reception, were banned on ships at sea during the war because radiation from the local oscillator could be detected by German submarines with disastrous loss of a ship or even several ships in a convoy. One solution was to incorporate exceptional shielding of the oscillator circuitry, as in the high quality Scott RCH receiver, but that was too costly for mass-produced morale receivers. Instead, most shipboard BC sets avoided a local oscillator by using direct amplification of broadcast RF signals without conversion to an intermediate frequency. In the TRF (Tuned Radio Frequency) receivers built by H&R there were three stages of RF amplification, with interstage resonant circuits tuned by a four-gang variable condenser to cover the broadcast band. Each Miller high-Q interstage transformer was housed in a shield two and a half inches in diameter. The variable condenser was a work of art. The TRF principle was not new; all early radios were high performance TRFs prior to invention of the superhet. In fact, a TRF receiver will produce near-FM quality from good AM stations, but with today's AM programming, who needs it? Our production TRFs had to be tested and repaired if necessary, then they were aligned, which could be tedious due to the number of tuned circuits that had to track across the broadcast band. This was a terrific learning opportunity, gave me a great sense of accomplishment, and turned out to be the most enjoyable job I had at H&R.

In the spring of 1945 I thought about enlisting in the Navy's electronics training program for radar operators. Applicants for the training had to pass the Eddy Test, an electronics aptitude exam, named for Captain William C. Eddy, who conceived the test and coordinated the training program. Some high school pals talked me into going to the recruiting office and taking the test on the spur of the moment one afternoon while we were wandering around downtown. Before the test would be administered, however, it was necessary to pass an eye exam which, with my 20/800 vision, I failed miserably. That was that, I thought, but later in the summer an acquaintance who knew a Chief at the recruiting station arranged with him to give me the Eddy Test before the eye exam. The theory was, I would do so well in the Eddy Test (what youthful ego!) that the Navy would *have* to take me even with poor eyesight. I took the morning of August 6^{th} off from work, reported to the recruiting office as scheduled, and asked to see the Chief who was going to pull off this miracle. "Oh, he transferred out of here Friday, but you can still take the Eddy Test. Just step over here first for an eye exam." That did it, so after failing the eye test again I walked dejected down Market Street to H&R.

Entering the manufacturing area, I was astonished to see all work that had been in progress the day before now covered with brown wrapping paper and the employees sitting around chatting with each other. When I asked what was going on, one of the girls replied, "Haven't you heard? We dropped a new kind of bomb on Japan, so powerful it destroyed a whole city. *The war is over!"* Management immediately assured everybody our military contracts wouldn't be cancelled, but by afternoon telegrams arrived from Washington to do just that. There wasn't enough commercial work to keep many on the payroll, so my days at H&R came to a sudden, dramatic end.

Next time, some final thoughts and how experience at H&R shaped my future in engineering and ham radio.

DR. GEORGE H. BROWN

Mathematician, Engineer, Inventor

Bob Thomas, W3NE

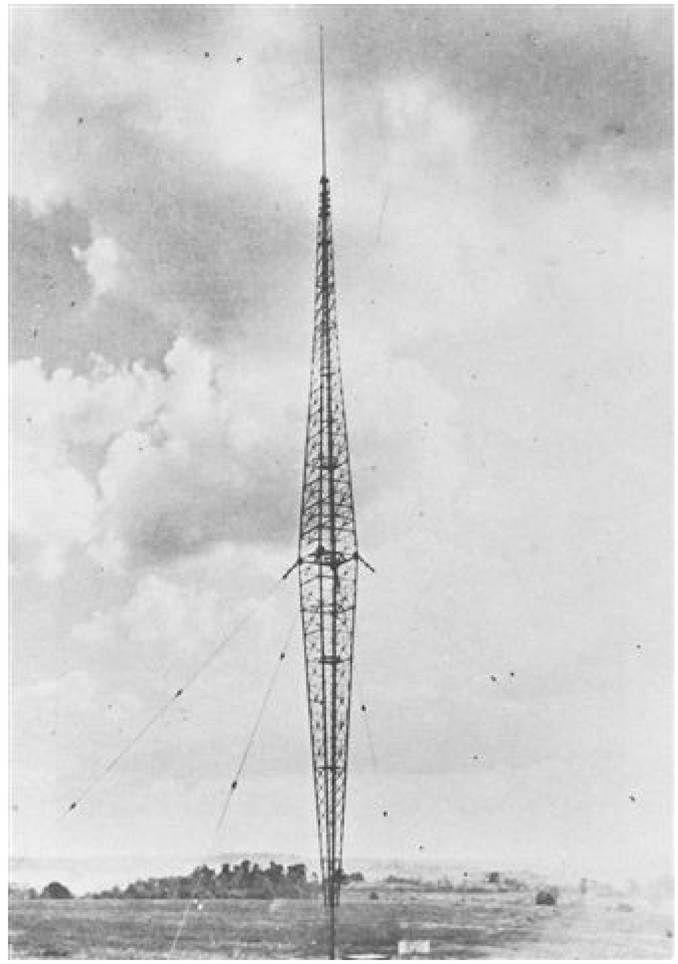
June 2010

I'm taking a break from the account of my H&R days to relate a few notable achievements in radio from a man you probably never heard of. From the article's title, an easy guess is that I refer to Dr. George H. Brown. Before going any further, it has to be stated that this article is based almost entirely on Dr. Brown's autobiography with the unlikely title, *and part of which I was*. That unique title reveals the unconventional nature of this brilliant scientist.

George acquired an interest in radio as a youngster from a ham friend around 1921 in Portage, Wisconsin. He graduated from the University of Wisconsin with a Ph.D. in theory of RF field analysis, broadcast radio antennas and ground systems. Dr. Brown was hired by the RCA Research Department, Camden, in 1934 – an event immediately rewarding, for both Brown and the Radio Corporation of America.

WCAU was a major Philadelphia radio station with a new RCA 50,000 Watt transmitter and elaborate antenna near Newtown Square. The antenna, like those of most leading stations of the day, was manufactured by the Blaw-Knox Tower Company. It was an expensive, complex structure of "classic" proportions, consisting of a lower inverted-pyramid of square crossection 187-feet high, but only a foot wide at the base, where it rested on a (big!) insulator. It expanded outward to twenty-six feet on a side at the top. On top of that was an upper pyramid, which narrowed to two-feet at the top, and above that was a pipe mast, giving the tower a total height of 500-feet. All well and good except for one detail: *WCAU could barely be heard in Philadelphia!*

Dr. Brown was assigned by RCA to investigate the abysmal performance of the WCAU antenna and design corrective modifications. He conducted extensive field strength measurements that supported observed weak metropolitan reception but revealed nothing useful for making improvements. For that, Brown decided to employ "modeling," a technique he and a classmate had perfected as graduate students at Wisconsin University. "Modeling" involves construction of an exact scale model of an antenna, say 1/100 full size and testing it at 100 *times* the normal operating frequency. The model antenna is rotated on a turntable while field strength measurement are made at various distances. Using experimental data from several tower configurations at the university, they developed complex mathematical equations that could accurately predict performance of almost any kind of antenna tower.



For the WCAU antenna modeling project, Brown selected a scaling factor of 1/64 full-size, resulting in a model about 8ft. high and .406 in. wide at the center. The RF field around the model antenna was then accurately measured at a frequency of 74.88 Mc. (64 times WCAU's 1934 carrier frequency of 1170 kc.). Test data enabled Brown to calculate the characteristics of the full-size Blaw-Knox tower which showed the central bulge to be the cause of its aberrant behavior. Since replacement of the tower would have been prohibitively expensive, Brown had to design a modification to compensate for the improper shape of the B-K tower. His calculations showed the best approach was to remove the pipe extension mast and add a large ring around the top of the tower, but insulated from it. The ring was connected to the top of the tower through a variable inductance to trim the radiated RF pattern. That enabled the station to broadcast with good coverage for several years it was moved to Cinnaminson, N.J.

Dr. Brown's calculations showed the optimum shape of a broadcast antenna to be a nothing more than a simple, slim constant-crossection tower used singly or with additional towers if directivity was required. In a stroke, he revolutionized broadcasting with mathematical equations for calculating antenna physical characteristics and their radiation patterns. This significantly reduced cost and complexity of antenna towers and enabled many stations to operate on the same frequency at night without mutual interference, vastly expanding the number of stations that can be accommodated in the limited number of channels. In 1937 Dr. Brown published a paper describing his design methods for directional antennas and ground systems that was so comprehensive it was adopted in whole as an FCC recommendation. Closer to our hobby, radio telescope pioneer John Kraus, W8JK, wrote in his book *Big Ear,* that he had based his "8JK" close-spaced beam antenna, very popular before the war, on design principles for directional antennas Brown had published in a 1938 article.

For all the mathematical power in Brown's equations for analyzing a known antenna system, they would not work in reverse – to design a system of towers that would radiate a specified directional radiation pattern. Initially that involved a cut-and-try process beginning with an educated guess to get close to the desired directional pattern, then making successive minor changes in the figures to arrive at the desired pattern. A solution could take several days to calculate. The problem eventually was eliminated by an analog computer employing 52 vacuum tubes, called an *Antennalyzer,* which was capable of solving eight simultaneous equations that predicted antenna directivity. The instrument incorporated a cathode ray tube on which desired patterns were drawn with a crayon. Several knobs were then adjusted, randomly at first, to obtain a CRT trace that approximated the required pattern. Minor adjustments were then made to achieve exact coincidence between the drawn pattern and the CRT trace. The simplicity of this ingenious instrument was demonstrated when Dr. Brown's secretary was able to twiddle the knobs to determiner all the parameters for a complex directional antenna array in fifteen minutes!

Dr. Brown's focus changed in the spring of 1938 – you might say it "downsized" – from mammoth broadcast arrays to a new challenge: To design a simple antenna for base stations of mobile communications systems, such as used by police, fire, taxi, and delivery companies. He and two colleagues came up with a new kind of antenna consisting of a quarter-wave vertical radiator above four quarter-wave horizontal rods spaced at ninety degrees to each other. Sound familiar? They called the new creation a *Ground Plane* antenna. The first ground plane antenna was installed for police communications atop the Haddonfield, N.J. firehouse. Not only did it eliminate spotty coverage previously encountered, it began to cause interference with police radio in Philadelphia! The designers continued with refined tests of the antenna and found that it performed just as well with only two ground plane rods as with four. However, when some of the RCA Sales Department saw the two-element ground plane, those self-professed "technical experts" expressed doubt that it would radiate equally in all directions despite evidence to the contrary. Quoting Dr. Brown, "*To quiet them we used four ground [plane] rods for a while, stilling the criticism. When the antenna became really popular, we did not dare confess to our ruse."* Later, ground plane antennas in the 35 Mc. band were ordered for use on New York Harbor fire boats. Because of concern that transverse radials would not clear dockside obstacles regularly encountered by the boats, only two ground rods, running fore and aft, were used with complete success. Despite every assurance of the inventor to the contrary, ground planes became destined, to this day, to be made with four radials, whether needed or not. The ground plane antenna became so widely adopted that by the end of WW-II, RCA had sold over 50,000!

The next challenge for George Brown came from the new television broadcasting service in New York City by RCA's subsidiary, NBC. A non-directional antenna with gain was needed for TV transmission from the top of the Empire State Building. He designed another new antenna configuration consisting of four horizontal rods extending from a central mast. It was dubbed a "turnstile" antenna from its similarity to the common device of that name. Each element was driven with an appropriate RF phase shift, and gain was achieved by vertically stacking several sets of turnstiles. Later the plain rods morphed into wide bandwidth pipe elements that looked like bat wings, which became the moniker of that form of turnstile for television transmission.

Doc Brown was a versatile engineer who, in addition to his far reaching antenna designs, was also involved with RF heating applications for drying penicillin, welding plastic sheet, detonating explosive rivets used at inaccessible places on aircraft, and heat treating metal surfaces. He was deeply involved in international color television standards. Although I only encountered him twice at RCA, it was obvious he was "a man apart," not only in his rigorous scientific thinking, but as a philosopher. A pity more people in radio are not aware of this remarkable man.

H. T. E. R. N.

Haverford Township Emergency Radio Net
Bob Thomas, W3NE
September 2010

The Haverford Township Emergency Radio Net (HTERN) was formed during WW-II within the War Emergency Radio Service to provide civil defense communications for the township. WERS, precursor to postwar RACES, was the only avenue open to amateurs for operating during the war. Transmissions were confined to the 2½ meter band (112-116 Mc.). By the time I got my Class B ticket and joined the net in 1950, the band had been moved to the present 144-148 Mc. allocation and ham operation had returned to normal.

We conducted simulated emergency drills on 146.8 Mc. AM with mobile units and net control from a base station permanently located in the police station on Manoa Road. Other than that, we operated pretty much as an informal amateur club with occasional meetings, an evening net, transmitter hunts, and even Field Day – of which more later.

An expansion of activity occurred when one of our members, Laurence LePage, W3QCV, became Executive V.P. of the Franklin Institute. One of Laurence's early objectives was to introduce amateur radio to the public by means of a ham station at the Institute. It materialized in 1952 as W3TKQ when Fred Shaw, W3ADV installed 10M and 2M AM stations. Some net members operated TKQ occasionally, but it got off to a slow start and didn't really amount to much until Phil-Mont became involved some years later.

Bill Burton, W3ADF was another HTERN member who eventually joined Phil-Mont. He was humorously "memorialized" by Jim Spencer as *Able-Dable-Fable* (Phonetic Space Cadets, take note). Bill made a notable contribution to amateurs throughout Pennsylvania that is still being enjoyed today. He was well connected in Harrisburg as lobbyist for a beer industry trade association. Bill began a campaign in the mid 'fifties for introduction of legislation to authorize call letter license plates for Commonwealth amateurs. It was an arduous process, as are all processes in Harrisburg, but he persevered through the legislative labyrinth to eventually pull off passage of the enabling statute. Of course the whole PMRC gang applied immediately for new plates and after we received them we gathered on a windy Sunday afternoon for a group photo, each of us holding the coveted plate. There was one disappointment, however. Either a Harrisburg drone or perhaps a prisoner-employee at the Graterford License Plate Stamping Factory, erroneously substituted the *number* "1" for the *letter* "I" on one plate. As a result Bob Feree, W3IW got his license plate stamped "W31W". Poor Bob. He had to live with that weird plate and endless kidding about 31W for a whole year until they issued him a correct one.


PROF. THOMAS A. BENHAM of Haverford College uses three closely spaced photocells (sketch above) to gauge the distance of obstacles in his version of the electronic eye. Professor Benham, too, is blind. Both his and Dr. Witcher's projects are supported by Government grants.

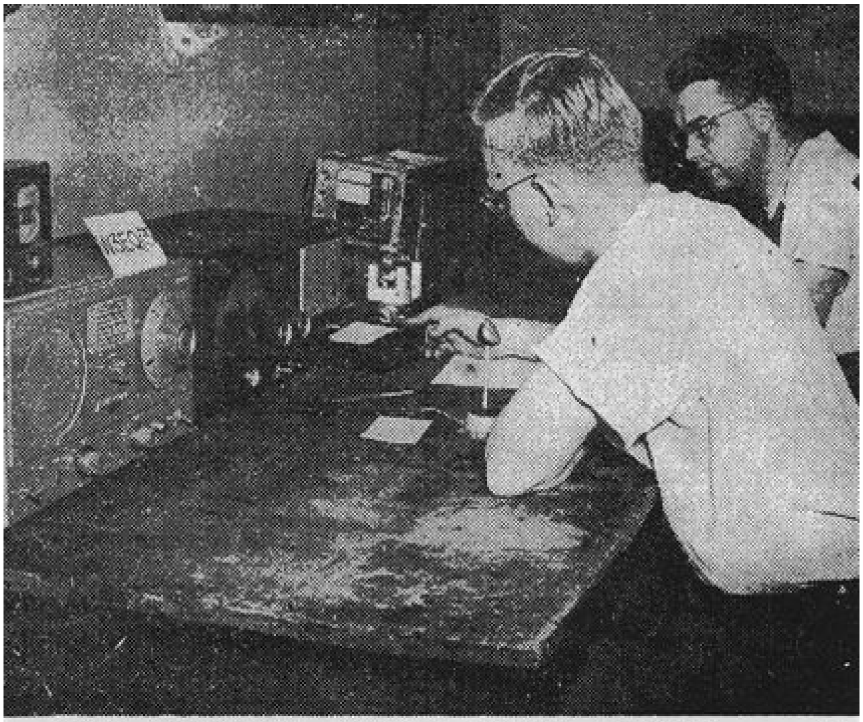
Many other hams who were originally HTERN members and later joined Phil-Mont might still be remembered by a few present members "of a certain age": W3HQJ was

Dean of Penn Dental College; Tom Consalvi, W3EOZ, was Sales Manager of B&W; Tom Benham, W3DD, was an inventor and Physics Professor at Haverford College; W3PBR, Mason Frakenfield, became a guide who operated W3TKQ and operated the lightning machine at the Institute; W3DOU, W3LNQ, W3GRY, W3HFY and the writer all "graduated" from HTERN to Phil-Mont.

Transmitter hunts, mentioned above, were very popular and attracted enthusiastic participation, including several technically savvy hams from the SJRA who always were tough competitors. All the hunts were on 146.8 AM. The antenna of choice was a two-element cubical quad, lashed to the side of the car with makeshift brackets and crude means for rotation. The quads had compact diamond-shaped wire radiators on a wood frame 19 inches on a side, fed for vertical polarization. Receivers ranged from a home-built superhet to a converter feeding an HF ham band receiver, down to the lowest of the low: an Abbott TR-4 transceiver. The TR-4, so named because it was a had four tubes, began life in the old 2½ meter band before the war, and was resurrected after the war for 2 meters. It could hardly have been cruder, with its one-tube superregenerative receiver, one-tube modulated oscillator transmitter, and two audio tubes. It had separate dials for transmitter and receiver tuning. Superregen receivers are very sensitive but they are known as "rush boxes" because of the soft rushing sound they make unless quieted by a strong signal.

The hunts were usually held on Saturday afternoons, when jovial competitors gathered at a field to show off their equipment and deride the rudimentary setup of Ed Kay, W3DQE, who simply propped up a TR-4 on the dashboard. Ed was a painter/paper hanger with limited theoretical background, but loaded with intuition and patience. He took the ribbing for his obsolete TR-4 with good nature as we chatted before the start of every hunt. I didn't have a car, so I always rode along with Ed, my valued mentor. It was an education to watch him manipulate his beam while listening with cocked ear to subtle changes in rushing noise from the TR-4. All of those cues, combined with familiarity of local roads, a keen sense of terrain, and a knack for shrewd guessing of possible hidden transmitter locations, made him winner over the wise guys in more than half the contests. So much for technology!

We decided the net should participate in the 1951 Field Day competition. Tom Benham offered space to set up our station in the Physics Lab at Haverford College, so one night Freddy and I went to see Tom at the college to make a survey for equipment and antenna installations. While we were climbing the staircase to the roof, Tom, who was blind, got a laugh by offering to turn on a light so *we* could see where we were going. Incidentally, he later took us to the wood shop where he was building bass reflex speaker cabinets. We were astonished to see pieces of plywood on a bench near the shop's circular saw and we asked if he had any assistance while cutting the material. He nonchalantly replied, "No, I feel where the blade is before I turn on the saw, then just make sure to keep my fingers away from it when I make the cut!" We operated FD on 40M and 2M for a very low pressure event, managing to get a whopping 143 contacts for a big-big score of 1476 points. But, as with all HTERN activities, it was fun!



BOB THOMAS, ABOVE LEFT, SENDS, as Al Spencer, right, records contacts for Havertown Radio Emergency Net during the nationwide, 'round-the-clock field day test last weekend in which the local net contacted 143 other operators for a total of 1476 points. They operated from Haverford College campus. (Bill Harris photo.)

HEATHKITS

A Lost Resource
Bob Thomas, W3NE
September 2010

You arrive home, worn down from an exasperating day at work, then you spy that box on the table with other mail. *It's your new Heathkit!* Cares of the day fade away, you eat dinner, then it's back to that box and into the shack where it is opened to reveal a new addition to your station – almost. First, though, it is necessary to assemble all those parts in the kit and then wire it, welcome tasks taking two to forty hours, depending on the equipment's complexity. They are not really "tasks" at all; building a kit is a satisfying, educational journey from first inspection of each component to checking-off assembly steps as they are completed, and then finally bringing your new device to life as it is tested and adjusted, all of that laced with visions of how it will bring new enjoyment to your hobby.

Sadly, that experience, so common for almost forty years, occurs no more. Kit building was shoved aside by the opiate of two-meter HTs and Asian transceivers so cheap "it doesn't pay" to make your own. But what is sacrificed for instant gratification? For one thing it is the inner the satisfaction that comes from creating something with your own hands, a valuable experience that seldom enriches the lives of young people today. In a more practical sense you do not acquire the faintest notion of how that Wundergadget works or what to do when it stops working. With kit-built gear on the other hand, some knowledge of its operation is absorbed during construction, so the builder will not be reluctant to dive inside when it needs servicing. Those are all moot considerations today because, except for Elecraft, kits are no longer on the market. Here are some reflections on what once was available from Heathkit, the principal kit manufacturer. Products of other notable companies will be covered in a subsequent article.

The E.B. Heath Aerial Vehicle Company, a 1913 distributor of airplane supplies, was the unlikely progenitor of latter day Heathkits. Mr. Heath was famous in the late 'twenties for his "Parasol" full-size airplane kit. The company was purchased in 1935 by Howard Anthony after it had entered bankruptcy After WW-II Mr. Anthony conceived a plan to buy huge quantities of radio parts at distress prices on the war surplus market and then package them for resale in the form of assembly kits for amateurs, experimenters and servicemen. Heathkit was born!

The first Heathkit was the Model O-1 5” oscilloscope introduced in 1947 for only $39.95. Five months later the V-1 Vacuum Tube Voltmeter hit the market for $24.50, and the following month Heath advertised the A-1 24-watt audio amplifier. Heath continually upgraded their kits to reflect improved technology and rising customer expectations, for example, oscilloscope kits eventually included dual-trace models with 60 MHz bandwidth. Generators advanced from the $19.95 G-1 of 1948 to near-laboratory grade RF signal generators. Waveform generators, and everything needed for TV receiver alignment were introduced. The lowly V-1 VTVM graduated to ever-improved models, some with digital displays and versions for audio measurements at the millivolt level. In short, there was virtually nothing the home builder or experimenter could wish for that was not available in a Heathkit. Then came automotive instruments that were very popular until cars became too complex to be serviced at home. Audio amplifiers were lucrative for the company and even today Heath tube amps command sky-high prices on eBay. Every one of those items provided their builders with a feeling of personal accomplishment and enabled them to acquire home instrumentation and entertainment facilities at a fraction of the cost of assembled commercial products.

Earliest Heathkits did not have detailed step-by-step wiring instructions. Mr. Anthony quickly realized, however, that inexperienced builders would have to be taken by the hand during construction to fulfill the company motto: “We will not let you fail.” Each explicit instruction step soon included a small square block where the builder placed a check mark after that step had been completed. Lengths and colors of every wire were specified.. Connections to terminals were designated “S” if the joint was to be soldered immediately, or “NS” to indicate a wire should be crimped on the terminal but not soldered until additional wires were added. Mechanical layouts, pictorial wiring diagrams, and schematics were furnished on oversize pull-out sheets with the manual to aid the builder.

Heath certainly made their mark in the amateur radio community! Somewhat stodgy at first, but then with a burst of development and styling, their amateur gear eventually matched or exceeded many commercial products of the day. The first transmitter was the 1953 AT-1, a 35-watt two-tube bandswitching CW rig with built-in power supply. Comments on *eham.com* and other websites reveal how profoundly that basic little rig influenced young hams of the day. The "DX" transmitter line began in June 1955 with the DX-100, a self-contained 100-watt 80-10M CW/AM transmitter kit selling for $189.50. For impecunious hams, a series of simpler models in the DX-series culminated in 1962 with the DX-60, a 90-watt CW/AM transmitter for around $80 that even a modern amateur would do well to have in his shack. The VF-1 VFO kit, at only $19.95, enabled frequency agility with those basic transmitters.

Heath's first receiver was the 1948 K-1, an elementary regenerative set with limited performance aimed at SWLs. The next series of receivers, AR-1, -2, and -3 were rudimentary superhets but still marginal for ham use. It was not until the HR-10, an all-band superhet with crystal lattice filter was introduced in 1961 to complement the DX-60 that receiver development finally caught up with transmitters. From then on, Heath amateur products really soared.

Following success of the DX-100, Heath made one last big effort with "classic" AM equipment before the arrival of SSB. The TX-1*Apache* 150-watt transmitter and RX-1 *Mohawk* receiver had matching appearance and sold together from 1958 to 1964 for $505. Again, this was far below comparable ready-built equipment. Both units were full-featured with slide rule dials that indicated only the band (80-10M) in use. They were big and heavy with rugged steel cabinets and chassis, and high grade Chicago transformers potted in sexy formed-steel cases. SSB began taking over amateur phone operations, so in 1961 Heath introduced the SB-10 Sideband Adaptor for use with the TX-1 which had provision from its inception for easy conversion to the new mode. The TX-1 was redesigned to incorporate integral SSB generation as the HX-1 *Marauder* in 1962. Hams yearning for more power had their needs satisfied with the KL-1 *Chippewa* amplifier in the styling of the TX/RX/HX series incorporating two 4-400 final grounded grid tubes operating Class C for CW/FM/RTTY and AB-2 for SSB. High power VHF AM requirements were fulfilled in 1958 by the VHF-1 *Seneca* transmitter, also packaged in the TX-1 style, with about 100-watts on 6 and 2 meters. That transmitter was a far cry from the first foray by Heath in 1960 into VHF with their quirky "Lunchbox" transceivers, so named because of their appearance, for 2- and 6-meters (as well as 10M). They were pretty basic, but they helped populate the bands and they introduced thousands of Novices to VHF operation.

That brings us to compact SSB transmitters, receivers and transceivers. Collins had set the pace with their innovative base station and mobile designs and Heath, never bashful about copying, exploited the trend with a gaggle lookalike products too numerous to cover here in detail. Suffice it to say, the company was in the game in a big way. Ever mindful of the younger element in amateur radio, in 1963 Heath offered very low cost single-band 200-watt SSB transceivers with sweep tube finals for 75, 40 and 20 meters – their famous HW, or "Hot Water" line, as well as low power entry level multiband transceivers. When the QRP operation gained traction, they responded in 1972 with a new product line, culminating in the HW-7 4-watt SSB/CW all-band transceiver of 1984. Premium SSB models included high performance receivers, transmitters and transceivers, notably the SB-101, based on Collins products. Power gain for those rigs was realized through a succession of linear amplifiers, ultimately the SB-220 with two grounded grid 3-500Z tubes for 1 kW PEP output, a hot item on eBay even today.

Finally, and it was *final,* Heath matched the most advanced Japanese equipment of 1982 with their SS-9000 transceiver – but it was supplied assembled, not as a kit, signaling the end of a rich epoch when anyone wanting to make fascinating things with their own hands had access to over 400 kits of all kinds. The breadth of Heath products during the existence of the company was truly astounding, ranging from amateur products only touched upon above, to clocks, weather stations, garage door openers, computers, and color television receivers. There were several changes in Heathkit's ownership and management over the life of the company, but those of us who were fortunate to be around during those splendid times will never forget first sight of that carton just arrived from Benton Harbor – *my new Heathkit!*

The "Other" Kits

PAST AND PRESENT
Bob Thomas, W3NE
November 2010

Heath was, without doubt, the premier manufacturer of electronics-based kits. But many others offered a narrower, though notable, scope of products that flourished until less taxing pastimes were discovered. Here are some, of them along with two entries that, even today, buck the popular trend. In fact, one U.S. company manufactures ham equipment kits that even exceed the performance of the most expensive Asian products.

ALLIED RADIO was no stranger to the kit market, having sold broadcast receiver kits to nontechnical men and women in the early days of radio. In the 1940s, they sold breadboard crystal receivers actually built on a wood board included with the kit. After the war Allied introduced Knight-Kits, in competition with Heath. Perhaps the most popular Knight-Kit was the *Ocean Hopper* regenerative receiver covering 165 kc. to 35 Mc. with five plug-in coils. It started thousands of new amateurs in their hobby, first receiving W1AW code practice transmissions, then as the station receiver, and it has remained popular with today's collectors, many of whom used one as a Novice. A wide range of Knight receiver kits over the years culminated in the R100-A, with a Q-multiplier and other important features. A humble 6AG7/807 Model T50 was first in the Knight-Kit transmitter line that eventually included VHF rigs and the T150 (150 Watt) rig running a pair of 6146s. The T150 had cheapo screen modulation but connections for an external plate modulator. Allied didn't come close to the sophistication of the Heath DX-100 and SSB equipment or overall quality of construction, but they did serve a customer base having limited finances. Far beyond amateur gear, Knight-Kits were produced for all manner of test equipment, a full line of hi-fi audio amplifiers, preamps, tuners and accessories, automotive and household electronics, CB transceivers, a comprehensive range of training kits, and even an ambitious electronic organ. Maybe not the best quality, Knight-Kits had many features at low prices that sometimes filled-in gaps in the Heathkit product line.

EICO was another major supplier of postwar kits but again, nowhere near matching Heath's breadth of products, especially in the amateur line. Once they became established, however, Eico kits did not convey the aura of borderline cheapness that characterized Heath components. Eico offered a complete line of audio and video test equipment and hi-fi products but their amateur line was rather sparse. Their transmitter products consisted of the 60-watt Model 723 80-10 Meter CW transmitter, using a dreaded sweep tube in the final, and a 90 watt 80-10 Meter Model 720 with a 6146 final. Both were CW-only transmitters, but Eico offered a well designed 50-watt modulator for running either Tx on AM. In contrast to the cheesy Heathkit standalone VFO, Eico Model 722, was built on a copper plated chassis with an internal power supply, and sported an expansive slide rule dial. Their sole SSB rig covered three bands with 200-watts PEP SSB built with an attractive brushed aluminum panel and separate matching power supply.

E.F. JOHNSON produced kits exclusively for ham radio beginning in 1949 with the 160-10M *Viking* AM/CW transmitter kit for $209.50 *(less tubes!).* The final tube was a Raytheon 4D32 dual tetrode with Pi network plate tuning for a very conservative rating of 100-watts input on phone and 115-wats CW. It was housed in a custom desktop rack cabinet but no particular attention had been given to prevention of television interference. It wasn't long before hams who put one on the air became unpopular with neighbors just when TV was getting started and receivers were wide open to RF interference. Johnson responded by introducing the *Viking II,* incorporating latest TVI suppression methods and a new final amp with two readily available 6146 tubes in parallel. The *Viking II* kit was a rousing success soon followed by a kit for a smaller version with internal VFO, called *Ranger,* in a kit for $179.50. Today *Rangers* command twice their 1960 kit price largely due to their solid design and high quality components. In all, Johnson turned out thirteen kits for transmitters from 50 to 500-watts as well as a VHF transmitter and 1 kW linear amplifier.

WORLD RADIO LABS was the creation of Leo Meyerson, W0GFQ, a wireless pioneer from 1920 who established a large electronics distribution company in Council Bluffs, Iowa. WRL distributed a full range of electronics parts and equipment, and under Leo's tutelage, developed more than thirty amateur transmitter kits with ratings from 40- to 500-watts between 1948 and 1959. Some of these rigs were described in a previous article, so not much more will be said here, except to comment that the top WRL kit was for the *Globe King 500C*, of 1958. It ran 500 watts input to an amplitude modulated 4-400, and 540 watts on SSB with an external exciter. It was constructed in classic style on three separate units for Power Supply/VFO, Modulator, and RF Section at a total cost of $795.. This was the ultimate Boatanchor, and best of all, you could build it yourself.

MORE KIT MANUFACTURERS. In addition to the major sources just described, transmitter kits were available from the well known transformer manufacturers Stancor and Thordarson.. Lafayette Radio introduced the 6-tube *All-Star* superhet receiver kit in 1934 (W3VVS had one) to meet the requirements of amateurs and advanced SWLs. Meissner issued kits for several BC/SW receivers and their famous *Signal Shifter* VFO. Even well known Hallicrafters got into the act with kits for two shortwave receivers and several types of test equipment. More recently (fifty years ago?), Central Electronics led the migration to SSB with their 10A and 20A exciters and *Slicer* receiver sideband adaptor kits.

The kit saga could go on and on about minor kit suppliers that have become a dim memory. Several suppliers offer single PC board kits now but they are a far cry from old time elaborate kits. But if you think you have missed out on a rewarding, educational and useful pastime, think again! Here are two sources of ham radio kits that furnish all the rewards of the past with new products of modern design and construction:

TEN-TEC supplies kits for four single-band CW QRP transceivers running 3 watts for any 50 kc. segment of 80, 40, 30 or 20 meters. These compact rigs incorporate a single conversion superhet receiver with RIT and a VFO-controlled transmitter with side tone generator, full QSK and built-in T/R switching, all for $119. Ten-Tec also manufactures Model 1254 AM/CW/SSB double conversion superhet receiver that covers 100 kc. to 30 Mc. It employs a microprocessor-controlled frequency synthesizer with digital readout and can be aligned with a volt-ohm meter and its built-in signal generator. For $195 and 15 to 20 hours of well spent time, you will wind up with a great all-band receiver. Somewhat lower in complexity, but still a good performer, the $89 Ten-Tec Model 1253 9-band regenerative receiver can be assembled by any raw beginner with his/her own hands for an instructive self-satisfying introduction to amateur radio.

ELECRAFT was founded in 1998 by N6KR and WA6HHQ to manufacture a range of kits to suit modern operating conditions.. Their K1 transceiver kit covers two or four bands for $300 or $400, respectively. Both models have a VFO-controlled 5-watt CW transmitter with QSK, XIT, and a memory keyer. The receiver is a superhet with three programmable crystal filter bandwidths, RIT and digital frequency readout. The completed transceiver is only 5.2”x2.2”x5.6”. Next step up is the K2, a CW transceiver kit with mid/high-level features and 15-watt input for $700 and 100 watts for $1100. The K1 and K2 are made with conventional components that you can get your fingers around and see without a magnifier. The K3 is the company’s most recent product. It covers 160 to 6 meters but it employs surface-mount components, so the kit consists of pre-manufactured and tested PC boards that the builder wires into a main assembly. K3 capabilities are far too extensive to describe here, suffice it to say its performance measured by independent labs surpasses that of every other amateur transceiver on today’s market. Price class is $1500 to $2000. Most recently, Elecraft has introduced a matching DSP Panadaptor for the K3 as well as a plug-in 2M transverter. Kits for a wide range of related equipment and plug-in accessory modules are offered for all Elecraft transceivers to expand their capabilities. Elecraft has acquired near cult status among their users who share hardware and software hacks, some of which are even incorporated in product updates by the manufacturer. That has to be the ultimate involvement by kit builders and the products they love!

Bringing Home WW-II MIAs

Bob Thomas, W3NE
November 2010

The following article has nothing to do with amateur radio; it is related to Veterans Day, which will be observed on the 11th of this month. It describes the efforts of small group of private citizens dedicated to finding U.S. airmen lost in the South Pacific during WW-II and seeing that they, or their final resting place, is honored by a grateful nation in the presence of their survivors.

The story begins in August, 1993. A scandalous article was scheduled for publication in the next issue of *Harpers* magazine, in which a very prominent politician, who had been a Navy pilot in WW-II, would be accused of committing crimes of war for sinking an allegedly unarmed 150-foot Japanese fishing trawler in an island grouping known as Palau. The politician's supporters, outraged by that preposterous accusation, recognized that indisputable proof of his innocence could be obtained only by an actual examination of the sunken ship. An exploratory team of experts was quickly assembled for travel to Palau, where the wrecked vessel would have be located and physical evidence obtained to discredit the ruinous article. The team was comprised of a diver/historian experienced in documenting ship wrecks, another diver who was a magnetometer expert, two adventurous dive shop operators, and a medical doctor and his wife, who happened to be a dive instructor with deep sea experience.

After arrival at Palau the exploratory team quickly located the trawler's wreckage under forty feet of water. Among the items found by divers on and near the wrecked ship were a mount for a large gun, munitions boxes filled with 75mm anti-aircraft shells, boxes of machine gun ammunition, and thousands of rounds of small arms ammo. This had been no innocent fishing trawler! Evidence was collected and photographs made for a press release. The politician was indisputably cleared of the false accusations and the impending *Harpers* article summarily quashed. Having completed their mission, all the members of the team returned home except for the physician and his wife, who were so fascinated by islanders' descriptions of crashed

American aircraft throughout Palau, they stayed on to inspect some of the crash sites. The physician was Patrick Scannon, M.D., PhD, who became so consumed by the unknown fate of missing crewmen, he became committed to returning to Palau to document crash sites that had been long forgotten by our government. The *Bent Prop Project* was born.

Looking back to the spring of 1944, the U.S. 1st Marine Division had captured Guadalcanal, and would soon move on to the hellish battle on Iwo Jima. But before that, they had to be diverted to capture the island of Peleliu, part of the Palau group, 300 nautical miles north of New Guinea and 500 miles east of the Philippines. The Japanese had a heavily fortified airfield on Peleliu that threatened the flank of General MacArthur's retake of the Philippines.

An attack on Palau from the air began on the last day of March 1944 and continued for six months until the Peleliu airfield had been captured by the 1st Marine Division after one of the bitterest battles of the war. Even so, pockets of Japanese remained active on the island until the last day of the war, prolonging exposure of our planes and ground forces to intermittent attack. Carrier-based *Corsairs* and TBM *Avengers* initially combined with B-24 bombers from New Guinea in coordinated attacks on enemy aircraft, naval and maritime ships and land fortifications, as well as laying mines to prevent escape of Japanese ships. Resistance from the air defenses was limited; losses to our aircraft resulted mainly from anti-aircraft fire. Nevertheless, in five months of action over Palau, more than two hundred American aviators were lost – declared "Missing in Action." The missing men perished when their planes went down at sea or were killed on impact or captured and subsequently executed by beheading if they had the misfortune to crash on land. Today, after 65 years of exposure to tropical weather or immersion in deep salt water, most traces of the planes and their heroic crews have vanished, but enough sometimes remains to identify the aircraft, enabling crew members to be traced from government records. That's where Pat Scannon and the *Bent Prop Project* come in.

Pat Scannon returned alone to Palau a year after the "Trawler Affair" to explore the island aided by a talented Palauan guide and translator. They interviewed elder residents who had been alive during the war and still remembered where airplanes crashed. Wreckage of a Marine Corsair was found and they made cursory explorations of other crash sites that held possibilities for further investigation, which Pat began by himself the following year. It became obvious to Scannon, however, that the necessarily meticulous investigations required to eventually identify missing crewmen, and discovery of the more obscure crash sites, would require exploration by experts in several fields. That is when the *Bent Prop Project* came to fruition. The idea received immediate, enthusiastic support from a group of West Coast explorers, divers, and adventurers. The first organized trip to Palau was made by Scannon and four eager cohorts in 1997. Slogging through chest-deep black muck in swamps, hacking their way in mangrove jungles, and scuba diving in shallow waterways protected by barrier reefs, they discovered airplane wreckage at four crash sites – one in shallow water – but were unable to locate a B-24 known to have crashed at sea.

Bent Prop explorers do not disturb anything at a crash out of respect for the crewmen, but clues retrieved at each site, from faded registration marks, manufacturers' identification data, serial numbers, and even a "bent prop" found scattered in the debris field, are used for researching official records. Information judged potentially useful is forwarded to the Joint POW/MIA Accounting Command (JPAC) who conduct exacting forensic investigations to determine identities and recover human remains associated with the crash. JPAC goes to great lengths to accomplish this: On land they divide the crash field into a grid, then meticulously place earth and debris from each segment in numbered pails for subsequent screening to separate anything that might lead to identifying the airmen. At sea they literally vacuum the ocean floor into containers that are later examined for evidence, such as part of a flight jacket, a dog tag, bone fragments or personal jewelry.

JPAC's underwater investigative methods were crucial to the successful return of missing crewmen from a B-24 that had been shot down over waters near Palau. Wreckage of the plane had been found in 40-feet of water after an exhaustive search extending over ten years by *Bent Prop* teams. Comingled remains of seven crew who went down with their plane were recovered by JPAC and returned to the U.S. for positive identification. Finally, just last April, a horse-drawn caisson carried a flag-draped casket containing those hallowed remains to a military funeral at Arlington Cemetery. Present among the families of the former MIA flyers, was Charles Goulding, Jr. of Buckingham of Bucks County and his mother, who were son and wife of the B-24 radioman.

Eight airmen, shot down near Palau on September 1, 1944, are laid to rest at Arlington National Cemetery on April 29, 2010.

Bent Prop has conducted twenty-nine expeditions on Palau and its waters since 1994. When wreckage is definitely established, but there is no possibility of recovering human remains, the team gathers at the crash site holding a flag. The flag and a photograph of the ceremony are later presented to surviving kin who can at last come to terms with the final resting place of loved ones missing for so long. In more conclusive situations, remains identified by JPAC are returned and honored as was done for the B-24 crew. This is the best that can be done today to fulfill the motto, "Leave no man behind."

It appears that the *Bent Prop Project* is funded largely by an anonymous donor supplemented by donations from individuals close to the participants and proceeds from sale of a riveting DVD documenting their many successes. Volumes of fascinating information about this vital volunteer effort are available on the *Bent Prop Project* website at

http://www.bentprop.org/

Oh, there is just one final detail to wrap-up this story: That politician who was at the root of Bent Prop's formation? He was Navy Ensign George H.W. Bush, 41st President of the United States.

Jack Binns

Wireless Hero
by Bob Thomas
December 2010

John Robinson Binns was born to his unwed mother in the Union Poorhouse, Lancashire, England, in 1884. He completed school at age 13 and went to work in a telegraph office of the Great Eastern Railway. Tragedy struck as he was taking a short cut to deliver a message by ducking under a stopped railway car. The train moved before he could escape and both legs were crushed. Doctors decided not to amputate because infection had developed and he was near death anyway. Instead, they put Jack in traction, a new treatment then, and he remained bedridden for an entire year! This boy might have been poor, but he was ambitious with a thirst for knowledge, so while he was recuperating he learned everything he could about electricity, wireless and emerging electronics. Jack returned to the railway as chief of a major telegraph office after he healed, but he decided to leave for work with a more opportunities. He secured employment with the Marconi Company, and after three months training in the company school, he went to sea as wireless operator on German ships. Three years later the Reichstag required all wireless operators on their ships to be German nationals, so in January 1909, Jack Binns became the wireless operator on the White Star Line's palatial *RMS Republic*, sister ship of the *Titanic,* then under construction at Belfast.

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Warm water from the Gulf of Mexico flows around Florida, then northward near the East Coast at nearly six miles per hour. Vapor from the warm turbulent Gulf Stream mixes with cold North Atlantic air off Nantucket Island to form a dense fog in cold weather, sometimes so thick that visibility beyond 10 feet is impossible. Those were the conditions at 4 AM on January 23, 1909 as the 450-passenger *Republic* was creeping its way from New York toward Liverpool. Nearby, another ship, the *SS Florida,* was headed toward New York with 841 Italian immigrants who had recently survived a devastating earth quake at Messina. The two vessels were dangerously close, each able to hear the other's fog horn, yet invisible to the other. The *Florida* had no wireless facilities so the two ships were communicating by siren signals when suddenly, and inexplicably, *Florida's* bow crashed directly into the port side of *Republic*. Casualties were light, however, the *Republic's* boilers were disabled, causing loss of steam pressure, failure of electric power, and loss of rudder control. The *Republic* was adrift and taking on water in total darkness.

Jack Binns was off duty and asleep in his tiny room adjacent to the *Republic's* wireless room when the collision occurred. Both rooms were in a wood shack added as an afterthought outside on a deck when wireless was installed on the *Republic*. Jolted awake by the impact, Binns rushed into the wireless room to assess the condition of the apparatus and get it on the air. In those days the frequency of spark transmitters was determined mainly by the antenna's resonant frequency, not an independent tuned circuit. Jack had no way of knowing in total darkness if his aerial was up and intact, or if it had been damaged by the impact. The only way to find out would be to fire-up the transmitter and see how it loaded. He changed over from now-dead ship's power to storage batteries, known in that era as "accumulators," which were always kept fully charged in case of emergency. He pressed the key tentatively and the loud raucous sound of the 1.5 kW spark indicated the set was operating properly. Whew! Lower voltage from use of battery power caused the spark's note to be lower in pitch than normal, which would make reception difficult. Even worse, transmitter power output on batteries was much lower than normal so its range would be sixty miles at most, just about the distance from the foundering ship to the nearest Marconi land station at Siasconsett on Nantucket Island, Massachusetts.

Binns negotiated an arduous route through wreckage in black of night to the bridge where he reported readiness of his wireless gear to Captain Sealby. Sealby gave his best estimate of the ship's position to Jack, who returned to the shack and immediately began sending, "CQD" (the distress signal of the time) followed by the *Republic's* call letters, "MKC." His signals were barely readable by Siasconsett operator Jack Irwin, requiring Binns to send slowly, but Irwin replied that he had copied Binns and was relaying his position to other ships. The *RMS Baltic* and other nearby ships changed course and began steaming toward the stricken *Republic* as fast as visibility would permit.

Conditions in the radio shack through all this turmoil were inhospitable, to say the least. First, an entire wall on one side had been demolished in the collision, allowing raw, frigid sea air to blow in constantly. The transmit/receive switch had broken, requiring Jack to hold it closed with one hand the whole time he was sending with the other. Accumulators do not provide full current instantaneously like a modern storage battery, so he had to send slowly enough for transmitter supply voltage to build up. And finally, crowds of passengers attracted by the flashing arc, pushed their way into the wireless shack, making it almost impossible for Jack to do his job until he chased them all out. The latter problem was completely resolved at10 AM the next morning when the *Florida,* which had rammed the *Republic* but was not fatally damaged itself, returned and lay nearby while crews of both ships worked relentlessly to ferry passengers in lifeboats from the slowly sinking *Republic* to the Italian ship.

Captain Sealby gave periodic updates on the position of his drifting ship to Jack for transmission to the *Baltic* when it became near enough for direct wireless contact. Sealby obtained the coordinates from bearings on a Submarine Bell at Nantucket. It was one of several submerged bells deployed at lightships and various coastal stations made to ring in a unique sequence that identified each bell and its location. Sound waves propagated underwater from the bell were picked up as a navigation aid from as far away as 30 miles by appropriately equipped ships. Those ships had a water-filled chamber on each side of the bow. A microphone in each chamber detected the bell's sound waves and fed separate receivers on the ship's bridge. By comparing relative audio levels from each mike, the navigator was able to determine the ship's position relative to the Submarine Bell.

Darkness fell and heavy fog closed in as the *Baltic* slowly approached the *Republic*. Binns reported to Captain Sealby that *Baltic's* signal strength had become abnormally high, indicating they were very close indeed. Both ships then began using conventional marine "bombs," rockets and fog horns to facilitate the final approach, which concluded when the *Baltic* arrived alongside at 7 PM. The next morning, Jack and a few crew remained onboard the *Republic* as it was towed toward New York by a U.S. Revenue Cutter, but by nightfall it was listing so badly all hands were ordered to abandon ship. Captain Sealby and the First Mate remained onboard while Jack and the remaining crew were ferried to an escort ship. Not long afterward, the majestic *Republic* slipped to its watery grave. The Captain and Mate abandoned at the last second and were rescued.

Binns received the adulation that only Manhattan can bestow on a hero and he wrote a series of articles describing his adventure for *The New York Times*. The required legal inquiry into the accident was never held; Britain and the United States held cursory reviews but their outcomes were inconsequential, neither assigning responsibility for the collision nor issuing recommendations for improved safety at sea. The U.S. Senate held substantive hearings during which Jack Binns testified that all ships at sea should have two wireless operators to ensure 24-hour monitoring for possible disasters. Although he was complimented for his testimony, his suggestion was ignored. Two years later the *Californian* was only fourteen miles from the sinking *Titanic,* and could have saved 1400 lives had its sole wireless operator not closed down the ship's wireless station after completing his scheduled day watch.

In 1911 Binns was scheduled to join another Marconi operator to man the wireless station of the *Titanic* on its inaugural voyage the following year. However, the head of the White Star line was concerned that Binns would bring bad luck and unfavorable publicity to the new vessel, so Jack was assigned to other ships instead. He was later made Travelling Inspector in a position created especially for him. His interest and talent in writing, coupled with the desire of his new wife that he leave the sea, resulted in Jack's departure from Marconi for a job with a newspaper. Jack joined the Flying Corps of Canada during the First World War, learned to fly, and became an instructor for the Corps and later for the RAF. He returned to civilian life as Editor of Aviation and Radio for the New York Tribune. In 1924 Binns became Assistant Treasurer for the prestigious Hazeltine electronics development company where he rose to President from 1942 to 1955 when Hazeltine was at the forefront of developments in military electronics and color television. Jack Binns passed away in 1959.

Who is NEMO?

And where did he go?

by Bob Thomas, W3NE

January 2011

From its inception and through WW-II, ordinary radio broadcasting captured public interest with vibrant first-hand reporting of events *as* they were happening from *where* they were happening. Sports, cultural, political and battlefield events that occurred beyond the confines of cozy studios were transported directly into the homes of an audience that craved the vicarious participation this medium brought them. Of course today we have television "Team Coverage," with idiot field correspondents standing in ocean surf bringing us superficial accounts of trivial events and interviews with drunks at sports bars. Not so with radio remotes; they enabled listeners to "see with their minds" what was happening through colorful, graphic audio reports of Real News.

Remote pickups became such crucial components of radio programming that early broadcasters soon dedicated telephone lines exclusively to handling originations from the field. According to the late Bob Morris,W2LV, veteran employee of NBC, around 1923-24 Westinghouse applied the quite logical term "Remote" to those lines and associated broadcasts. This apparently caused apoplexy among the management of NBC, who were loath to use the same terminology as an arch competitor. So, as befits corporate micromanagement, it was decreed that within the NBC Red Network, programs originating outside the studio and their related facilities would be referred to *only* as (get this) *"Wire Telephony as an Adjunct to Radio Broadcasting."* This meddling naturally did not sit well with the more practical operators, who immediately began to discuss among themselves alternatives to the ridiculous legislated terminology. A member of the engineering staff named George Stewart, suggested *Nemo* as NBC's substitute for "Remote." *Nemo* had a quirky appeal to the engineers, who accepted it by acclimation! The new term stuck, and soon began appearing everywhere within NBC – patch panel labels, switcher nomenclature, program logs, and even in high level technical papers. Although initially an industry buzzword, *Nemo* soon became known even to the early broadcast audiences, who were made to feel like "insiders" by the many broadcast fan magazines that covered personalities and inner workings of the business until the early fifties.

It's not clear today what prompted George Stewart (assumed spelling) to suggest *Nemo*. One possibility is the contemporary *Little Nemo In Slumberland* comic strip – the first realistically-drawn cartoon with quality color printing – which chronicled young Nemo's adventures with dragons, monsters and trips to Mars. Another possibility is "Captain Nemo" in Jules Verne's *Twenty Thousand Leagues Under the Sea*, certainly a remote if there ever was one. In more recent times various meanings were attached to the NEMO acronym, and Disney/Pixar released the animated film, "Finding Nemo," but they all postdated original NBC terminology.

Nemo remained well understood and widely used as the "in" synonym for a remote broadcast until some years after WW-II. By the late 'fifties, however, its use had begun to decline. Perhaps that was due to a new generation of engineers and operators who were entering the broadcast field, especially television, with no ties to tradition, and a public that no longer cared about what was behind the mike and camera. Certainly at RCA, there was no inclination to employ the term on studio or portable equipment, despite the association with our NBC subsidiary. Oldtimers at NBC continued to use the term until recently, but even there, they have finally reverted to the more rational term “Remote,” eschewed so many years ago by earlier white tower executives. About the only place *Nemo* will be encountered today is on the 75-Meter SSB “Nemo Net,” an informal gathering of broadcast pioneers. For the most part, however, our old friend *Nemo* has passed from the broadcast scene, gone but not forgotten!

But wait – as the infomercial says –*That’s not all*. After initially writing this article in 1996 for a local antique radio club newsletter, I was contacted by fellow Phil-Monter, N3QMH, who was free lancing installation of digital audio studio equipment at several Philadelphia radio stations. Bill said a Broadcast Engineering Airtrak-90 digital console he recently installed came with a sheet of labels for customizing control nomenclature with titles like STUDIO-A, MIC-1, and MASTER, and that two of them were marked *NEMO!*

Maybe our old friend has not completely disappeared after all.

Comments about NEMO

JANUARY 2011

The following remarks have been received from various sources in response to my Nemo article:

Oh those were the days. Got my 1st Phone, June 1951 and started at WILM ABC in Wilmington same month. We did use "nemo" . Remember a pick up at Dela Park, which we fed ABC Radio, one Sat afternoon.

Dick, W3ORU

- -

Wow, I sure learned something new from the latest W3NE article! Even though the term was thought to be forgotten, it shows hope may be around the corner with BE's use of the term! Lost, but certainly not forgotten.

Joe, W3GMS

- -

My Albuquerque friend, Mike Langner, K5MGR, is the recently retired chief engineer for Citadel Broadcasting out here. He has been a radio engineer and sometimes station owner for his entire career. You can see that "Nemo" made it to Albuquerque.

Jim Hanlon, W8KGI [See below]

Hi Jim!
Yep, I ran across Nemo as a legacy term in the early '60's -- after about '62 I never heard the word again, but did come across it in this context in some older books about radio broadcasting. .

Which, I suppose, makes me a part of living history.

I think I just aged further!

And yes, we had a patchbay labelled "Nemo!"

Mike, K5MGR

- -

The term "Nemo" is not in the least unfamiliar to me. Some older equipment had the term Nemo engraved upon it. My understanding was that the term still existed on patch boards at Bell Tel. I think our Remler gear had that term and possibly it was used at WFIL when I worked there? Good story.

Charlie, W3CAU

- -

Via W3CAU:

When I worked at WPEN in the 1960s, we had patch panel labels that said NEMO. The station also did a Sunday morning church broadcast with an OP6 and OP7 that was logged as Nemo.

Doug, K3KW

The Vanishing

Tales of Horror and Intrigue
Bob Thomas, W3NE
March 2011

This article is in two parts: It begins with a fictional story, told in many forms by film and literature, of mysterious events that took place over a hundred years ago. The second part is a true account of something that happened with chilling similarity just last month.

Kay, a young English woman, arrived with her mother in Paris while the 1889 *Exposition Universelle* was in progress. The city overflowed with tourists who were there to attend the exhibition. Only two single rooms were still available when the English ladies registered at their hotel, so Kay took the plainest one, allowing her mother to enjoy the more elaborate room with rose-patterned silk wall covering and rich, plumb-colored velvet drapes at the windows.

They went out for dinner and when they returned Kay's mother went directly to bed because she felt ill. When Kay looked in on her later, her mother was in serious distress so a doctor was summoned. The doctor arrived with the hotel manager, and after his examination, the doctor and manager had an animated conversation in French, which neither English lady understood. The doctor said Kay's mother was gravely ill, but there was proper medicine at his office on the other side of the city. He wrote a note in French and gave it to Kay, telling her it had instructions to his nurse for the medicine and directions for a cab driver to find his office. Kay rushed to a horse-drawn cab and handed the doctor's note to the driver. He studied the note at length before starting his horses on an ambling journey. Kay was upset by their leisurely pace and became more agitated when she realized they frequently changed direction rather than following a direct path. She finally reached the doctor's office, and handed his note to his nurse. The nurse disappeared and didn't return with the medicine for over an hour. By then Kay was a wreck but, with medicine in hand, she took the cab for another long trek back to the hotel.

At the front desk she asked the manager about her mother, but he denied knowing anything about her, stating that Kay had come into the hotel alone. The doctor also appeared confused and disclaimed any knowledge of her mother. Composing herself, Kay asked to see the hotel register, since that would show she and her mother had signed-in together. The bound register book was opened and her signature was there next to her room number, but there was a man's signature opposite her mother's room number! Frantic, Kay demanded to go to her mother's room. The manager reluctantly agreed just to be rid of her. As she stepped into the room and looked around, she turned ashen and gasped. Walls that had been rose-patterned silk were now light blue with yellow daisies; white cotton curtains hung where she knew there had been plumb velvet drapes. Kay demanded an explanation. All she got was blank stares and shrugged shoulders.

What Kay was not told was that her mother had bubonic plague, the scourge of Europe. The doctor and hotel manager immediately realized that if the public learned there was a case of the plague in Paris, the city would be vacated in a flash, the Exposition would collapse and the hotel ruined forever. The only recourse they saw was to invent an elaborate ruse to cover up reality. What became of Kay's mother? That depends on which version of the tale you read.

Now leap ahead to the last week of January 2011. I had decided to upgrade my computing with a new Dell Vostro machine running Windows 7. Computers in the Dell Vostro product line are intended for small business users, so they offer a broader selection of hardware and software than general-purpose consumer models. Vostro 430 computers have been available for a few years and they are quite good, but while perusing them, I discovered a new model, the 460, that uses Intel's brand new "Sandy Bridge" processor and Cougar Point chip set for performance well beyond the storied Pentium.
Dell's presentation of available options is so convenient to use I added an icon to the desktop of my current computer that enabled going directly to Vostro 460 descriptions with a simple double click of the mouse. Over the next several days I visited the site frequently, each time reviewing options and making printouts of various configurations for further consideration. By the end of the month final decisions had been made in the twenty-five categories of choices offered. On the morning of Monday January 31st I double-clicked the desktop 460 icon and placed an order.

Although my order had been confirmed I decided in the afternoon of the following day to review promotional material for the Vostro 460. I double-clicked the trusty 460 desktop icon but, instead of being directed to the 460 page, this terse message appeared: *"Dell has removed this page."* Taken aback, I then went to Google and searched for <dell 460 computer> but that only yielded specs for an Alienware gaming computer being marketed by Dell. Next it was to the Dell Home Page, where I entered "Vostro 460" in the Search window That took me to Vostro 430 computers. *Nothing I tried would bring up the 460 page!* By now I was beginning to feel like Kay when she returned to the hotel to find all trace of her mother eradicated**.** I had to face reality: ***Dell had thoroughly scrubbed away every vestige of their new Vostro 460 from their website!***

The only recourse was to navigate a dreaded phone menu to Dell Customer Service. After getting bounced between four different reps, each speaking a barely decipherable dialect, I was finally transferred to Kirk in the sales department. Kirk told me to do exactly what I had already done a dozen times. When he finally tried it himself and also failed to find the Vostro 460 page, he put me on hold while he conferred with his manager (but not until I got his number in case the line dropped – I've been there before). Kirk returned with the vague report that yes, the Vostro 460 products had indeed been withdrawn, but he did not know why. Later that evening I went back Google and searched <intel sandy bridge problem> . That returned an Intel Press Release, dated earlier that very day, which explained there was a problem with a Sandy Bridge support chip and production was halted, not to be resumed until the end of February, with full production in April. The veil was finally lifted.

Post Script: Five days later the Vostro 460 surfaced once again on a Dell web page, but although pictures of it were shown, a prominent notice stated, "The 460 is temporarily unavailable." One can only imagine the chaos and forehead slapping that took place at Dell and other OEMs, not to mention Intel, when they realized the magnitude of the problems confronting them to rework products in the field and correct the defective chip. Estimated cost to Intel alone is $900 million!
I have to admit that their problems make my inconvenience seem somewhat insignificant.

At the end of February, Dell finally began listing the Vostro 460 for sale again, but at a higher price – for obvious reasons!

CSSC Amplitude Modulation

Super Power Ham Rigs Now Legal

by Bob Thomas

April 1, 2011

Dr. Irving O'Reilly, Chief Research Scientist at the Sandia National Laboratories in New Mexico, described an astonishing new development in the April *Proceedings of the IEEE* that is destined to revolutionize radiotelephone transmission technology and open a new frontier in amateur radio. Fifteen years of intensive research by Dr. O'Reilly and his team has resulted in the invention of Cancelled Sideband Suppressed Carrier (CSSC) amplitude modulation. CSSC is the culmination of 102 years of progress in improved efficiency of amplitude modulation transmission and reception. A brief history of the development of earlier forms of AM will set the stage for a detailed explanation of this incredible new advance in communications.

Although the dawn of radio sound transmission is often assumed to have been an era of groping cut-and-try, that was hardly the situation. Reginald Fessenden transmitted conventional amplitude modulated high power RF in 1909. By 1918, Bell Telephone engineers understood the fundamentals of single sideband modulation (SSB), which they developed to increase channel capacity of under-sea cable circuits. Successful use of SSB for short wave radio transmissions was delayed until 1930 due to stability issues, but thereafter it became the mode of preference for commercial users. A few hams had SSB rigs on the air in the 1930s, but it was not until the late 60s that SSB began its domination of amateur radio. Early "Modulation Wars" were interesting and full of disparaging remarks about Donald Duck on one side and the futility of "transmitting a whistle" on the other. None of that matters now with CSSC – partisans of both camps will have their way!

A brief review of amplitude modulation will help to understand the subsequent explanation of CSSC. Amplitude modulation of a radio frequency by an audio signal produces three output frequencies: The original frequency (carrier) and two sidebands. The sidebands are offset above and below the carrier by a frequency equal to the audio frequency. In a basic AM system, audio is recovered in a receiver by heterodyning the sidebands with the carrier in a nonlinear detector. Except for their frequency displacement from the carrier, both sidebands contain precisely the same information. The carrier contains no information – it is present only for use as a reference for detection of sideband information, and therein lies the basic advantage of SSB: If the carrier does not contain any information, why transmit it? Simply transmit one sideband and generate a pseudo-carrier in the receiver to detect it. The total power in both sidebands at 100% modulation is one-half the power in the carrier, or one-third of the *total* power transmitted. Thus, if only one sideband is transmitted (1/6th of the total power), SSB advocates claim an 8dB] improvement in efficiency ($10\mathrm{Log}_{10}\ 6 = 7.78$dB). On the other hand, AM enthusiasts counter that the presumed 8dB advantage does not consider effects of noise on the lower amplitude of one sideband. Those divergent positions are in exact agreement with Kozanowski's Theorem which states, "Figures don't lie but liars can figure."

Signal processing in a CSSC transmitter begins the same as in a conventional SSB rig. Audio amplitude-modulates a carrier in a singly-balanced ring modulator, resulting in upper and lower sidebands without the carrier. In a conventional SSB Tx one of those sidebands is selected by a filter, amplified, and transmitted. In DSSC, however the two sidebands are fed to separate inputs of a digital signal processor. The DSP outputs a new pair of analog upper- and lower-sidebands, each with a passband extending outward from the original carrier frequency. The new sidebands, now identical in all respects, each containing a zero frequency reference corresponding to the carrier frequency, are fed through buffer amplifiers to inverting and non-inverting inputs of a Differential Class B power amplifier. Since both sidebands contain identical information and now occupy exactly the same frequency spectrum, they appear to cancel each other in the differential final amp. In fact, a meter in the transmission line from the final amplifier to an antenna or dummy load will indicate zero RF current regardless of modulation level.

Although the sidebands are nominally cancelled within the final amplifier, Irving O'Reilly's research has shown they continue to exist as *virtual sidebands* that can be radiated by an antenna, reflected by the ionosphere, picked up by a suitable receiver, and converted back to the original audio! For the ham operator, this means transmitters can be operated at almost unlimited high power and still comply with Part 97 of FCC regulations for maximum PEP *output* power from an amateur transmitter of 1500 watts, which, according to Part 97, can be measured only with an RF ammeter or calibrated wattmeter. With CSSC, those instruments will read zero power at full modulation even if the differential linear amplifier is operated with 20kW d-c into the final. There is a practical limit to amateur power input, however, because spurious modulation products are generated that can be measured by conventional instruments. Nevertheless, we can look forward to solid DX contacts while running legal superpower. Two W6 hams on Irving O'Reilly's development team are upgrading their domestic electrical service to 440 volts/50 Amps 3-phase in anticipation of being the first 20kW CSSC superpower stations on the amateur bands

Detection of this new signal format involves technology as radically new as its transmission. Looking back for a moment, when only one sideband is transmitted with suppressed carrier, all that is required for detection of the audio is a locally-generated carrier, e.g., BFO in a normal AM receiver or VFO-derived local carrier in a typical SSB transceiver. That local carrier need only have a frequency exactly the same as the original carrier; its phase relative to the original carrier doesn't matter. However, double sideband suppressed carrier systems require means in the receiver to generate a new local carrier that is in phase with the original carrier. To synthesize an in-phase local carrier in a DSSC receiver, the two virtual sidebands are first recovered by a standard diode detector. Then, since the sidebands have a specific relationship with their carrier back in the transmitter, they contain information that can be extracted to generate a new local carrier identical to the original in both frequency and phase. That complex feat is accomplished elegantly in a single LSI chip using a Fast Fourier Transform. The FFT chip separates the combined sidebands then applies an algorithm to each of them to synthesize a new carrier with correct frequency and phase.

Several practical efforts are underway to ensure acceptance of CSSC. The International Telecommunications Union (ITU) has established *A3W* as the worldwide designation for CSSC phone transmissions (A3E is the designation for normal AM). Also, because the high power advantage now makes the new format attractive for modulated-code (MCW), the ITU has established *A2X* to designate CSSC for MCW transmission. For its part, the ARRL is aggressively modifying contest and award rules to incorporate CSSC operation in an equitable manner along with legacy modes, such as AM, SSB and CW that are expected to survive for several more years. And finally, a consortium of IBM, Intel and MFJ is readying software, LSI chips, and circuit design, respectively, to ensure interchangeability of CSSC signals among all users.

At one time high power AM stations came on the air with the dull *Thunk!* of the antenna relay. Background noise, splatter, and heterodynes disappeared, and there was complete silence except maybe for a ticking clock, water dripping from a leaky faucet, or termites chomping on the floor joists. When the operator spoke, his voice boomed forth with deep resonant base and clear wideband highs. That all went down the drain when SSB came in with its draconian low- and high-frequency cutoffs and excessive processing. In the near future though, CSSC will deliver 20 Hz – 15 kHz audio so hams will finally sound like humans again, not a synthesizer in a computer. Receiver tuning will be precise and automatic; no more audio spectrum shifting in nets by stations that just can’t seem to get on the same frequency as everybody else.

Virtual sideband transmission by CSSC will usher in a new era in ham radio. The only downside will be DX hogs and the moron that transmits without listening!

Bob's Shack, Mid-'fifties

June 2009

I just came across this photo of my mid-'fifties ham station.

At upper left are a 2-meter 40W AM transmitter and 2M tunable converter on top of my first receiver - Hallicrafters S-40. To right of them are a Jones Micro SWR meter, Johnson Match Box, VFO, and Viking-II and a Collins speaker. Lower right (l.-r.) Heath 3" scope (partially hidden behind mike stand, Collins 75A-3, early 10M crystal-controlled intercom receiver for Phil-Mont; Heath VTVM; QZO-designed Conelrad receiver; 6M transceiver from GE Ham Tips. Turner 99 mike. Them was the days!

Bob – NE

The ARRL Guide to Antenna Tuners

A Book Review
Bob Thomas, W3NE
July 1, 2011

The American Radio Relay League has been a vital part of my amateur life ever since purchase of my first *QST* in 1946. That led to awareness of annual editions of the (then) venerable *Radio Amateur's Handbook*, which sold for a paltry $1.00. Those gold mines of information were eventually supplemented by other invaluable ARRL books, including *How to Become a Radio Amateur, Learning the Radiotelegraph Code,* and seldom noticed *Understanding Amateur Radio,* by George Grammer – a down-to-earth study guide of basic electrical and RF theory. Building the Lecher Lines[1] and performing experiments with them at UHF as described by GG imbued a life-long appreciation of the fundamental nature of standing waves. Reading the ink off those books eventually led me to copy W1AW nightly code practice transmissions on 3555 kc. in the summer of 1950. Without the ARRL publications and W1AW, I would not have obtained a ticket, so it's obvious how much they, and the ARRL in general, are cherished at W3NE. Having said all that, however, we come to this book review. Sorry, ARRL, but it isn't entirely pretty.

For the last couple of years I have been experimenting with various 80- and 40-meter antennas for operation at my noise-ridden third floor apartment. A key factor in all systems tried so far has been proper matching of the antenna to the transmitter. Short wire antennas used with or without loading contrivances often present weird complex impedances requiring an unconventional matching network that results in squirley tuning. Therefore, I was elated to learn that ARRL just introduced a new book: *The ARRL Guide to Antenna Tuners*, by Joel Harris, W1ZR. Mr. Harris is Technical Editor of *QST,* writes "The Doctor Is In" monthly column of practical advice in that magazine, and is a prolific author of technical articles and ARRL books. Here, I thought, will be practical answers to what I need, so I immediately ordered a copy sight unseen from Amazon with free shipping, avoiding the additional $10.50 charged for shipping by ARRL – a dubious benefit of membership.

I'm afraid I got off to a bad start after reading this book's sophomoric opening paragraph. W1ZR likens an antenna tuner to a power supply that "matches" a 120 V ac power line to the 13.8 V dc input of a transceiver. Really! So, for all you dummies out there, an antenna tuner is like a power supply for RF. There is already enough dumbing down in ham radio without this sort of drivel. That is followed by an entire page devoted to three simple block diagrams depicting a) tuner between a transmitter and a long wire antenna, b) tuner connected to a 50-ohm coax transmission line feeding an antenna and, c) tuner remotely located at an antenna. The text then explains various unbalanced tuner circuits, including untuned transformer-coupled, L-network, highpass and lowpass T-networks, and Pi-network. However, the author incorrectly appends the comment that all "provide equivalent performance" without noting that while *lowpass*-T and Pi networks inherently attenuate transmitter harmonics, highpass networks so often appearing in amateur literature and commercial products, provide no such benefit for harmonic reduction.

Helpful plots of typical SWR response for 80- and 40-meter antennas illustrate why a tuner is needed for covering an entire band, and this is supplemented with a clear, concise sidebar explanation of SWR and its relationship with antenna impedance. Use of tuner controls is described, noting that if multiple minimum-SWR adjustments are found, the one with the least inductance will produce best performance. The author opines lack of an RF ammeter in the output of today's tuners, a point well taken in view of the crucial importance of antenna *current* for optimum results regardless of what is indicated by the highly revered SWR meter. Photos of several commercial tuners, are shown including a vintage Johnson Matchbox, which still finds favor among hams. W1ZR thankfully explodes the myth of the "perfect" antenna whose SWR is claimed to be unity over an entire band when, in reality, it's fed with a transmission line so long that line losses mask what is actually going on at the antenna.

Continuing with transmission lines, W1ZR explores the advantages and disadvantages of coaxial cable, open wire line, and "window line" (Newspeak for *ladder line*). This section is preceded by a description of a program on a CD included with the *ARRL Antenna Book*, known as "TLW for Transmission Lines for Windows," that enables rapid calculation of transmission line performance. (A similar program by AC6LW called "TLDetails" is available with other useful antenna software free at: http://www.ac6la.com/) Thank goodness W1ZR lays out all the disadvantages of feeding a balanced antenna with coax, inviting stray RF issues that are widely ignored by many hams who could at least ameliorate those problems with ferrite-bead chokes, particularly for multi-band dipole antennas.

Co-located and remote tuners are treated in depth with a practical example that shows power delivered to an antenna can be increased more than six times, under high SWR conditions, even with low-loss coax, by using a tuner located directly under an antenna rather than at the transmitter. This is followed by a chapter describing various types of baluns, their basic design, advantages and disadvantages, and how they are applied. In that regard, the next section, which describes balanced antenna tuner circuits, there is an illuminating discussion on unbalanced tuners with a balun in contrast to a more complex dedicated balanced tuner. By the way, the title page of this chapter is illustrated with a second picture of our old friend, the Johnson Matchbox!
Chapter 14 is a rehash of *QST* product reviews for high power unbalanced antenna tuners from Ameritron, MFJ, Ten-Tec, and Palstar, and a gaggle of automatic tuners. This is followed by a very short discussion of balanced- T highpass network tuners and one with an unbalanced L-network. Once again, there is no mention that all the highpass tuners (series-C/shunt L) described here lack the harmonic suppression of lowpass (shunt-C/series-L) circuits. Alas, the late W2OBJ, outspoken champion of the latter configuration, must be spinning in his grave over this omission! Of course the excuse for resorting to highpass circuits is that they can be realized with two variable capacitors, whereas, a lowpass tuner requires two expensive variable inductors, something not many hams will stand for today. The history, basic concept, and specifications of the Johnson Matchbox are presented in accurate detail at the close of this chapter. Speaking of the Matchbox, however, it is illustrated *two more times(!)* in this chapter, once on the title page along with three modern tuners, and again in an identical illustration twenty-five pages later.

The last chapter is primarily devoted to reprints of two QST articles describing tuners to match a 43-foot vertical antenna, which has come in vogue recently. And finally, there is exactly what I bought this book for: A short (very short) section on building your own HF tuner that includes suggested component values and photos of typical construction for highpass, pi, and L-networks, illustrated with photographs showing actual construction. The final section briefly covers hairpin loops for tuners covering 10 meters through 70 cm, again lifted from a *QST* article.

Despite my minor criticisms, W1ZR has done a quite creditable job with fresh, illuminating editorial content. As a builder I would have preferred more emphasis on home construction, but ARRL and its authors cannot dismiss the trend for instant gratification that has swept all hobbies that were once the province of individual achievement. So the overall content of the book is what it is. What the book is not, however, is an example of the best that can be done with desktop publishing; it is the antithesis of that! Photographs are muddy, without detail, and completely lacking in gray scale. I reviewed photographs in a 1934 ARRL *Handbook,* and they all were all much clearer with excellent contrast and abundant detail. Perhaps the photos in the review book are so bad because they are printed on the rough surface of cheap, thick paper. The book's sloppy editing is still another matter. Thirty of the book's measly 157 pages are completely blank or have less than a quarter of a page of text. There is no excuse for repeating an illustration *four* times. Slap-dash production necessitated inclusion with the First Edition an Errata Sheet listing six corrections; a completely new Index: and a totally omitted Appendix in which W1ZR takes the mystery out of logarithms and decibels, and explains how to use Windows Calculator for dB computation. On an encouraging note, the current *ARRL Letter* lists a personnel advertisement for a Book Editor, so maybe there is hope for the future!

One last comment. We all know shipping costs have skyrocketed in recent years. However, there is no reason a book purchased directly from ARRL should be saddled with a shipping charge of nearly half the book's price. The ARRL is imposing a flat rate on all its customers for the convenience of the ARRL Mail Room. For example, shipping the review book anywhere in the U.S. would cost $4.95 by USPS Priority Mail, and only $2.82 by Media Mail. Allowing a dollar for handling. Media Mail would still cost one-third the current charge. Why should U.S. hams be penalized by a world-wide flat rate set by the *American* Radio Relay League? It's high time the League stopped over-charging for printed matter shipped to U.S. customers, especially its supportive domestic members.

[1] Lecher Lines are comprised of two parallel conductors on an insulated frame. The line is excited by a UHF generator through a coupling loop. The frame design permits a shorting bar to be slid along the transmission lines to change their physical, hence electrical, length. An RF field strength detector is also arranged to slide along the frame. Moving the detector along the transmission line reveals rising and falling field strength – standing waves. By changing test frequency, line length, and termination, variations in standing waves may be observed. Lecher Lines are an ideal tool for studying the character of RF intensity along a transmission line.

Remembering Shallcross – Part 1

Good experience and enjoyable work, but . . .

Bob Thomas, W3NE

July 31, 2011

Drexel University was a pioneer in "Cooperative Education," whereby students alternate at three- or six-month intervals between formal classes and regular employment in industry. Outside jobs help with college expenses but more importantly, they provide a practical view of what lies ahead after graduation. Because of the co-op program, I had nine memorable months of instructive, personally rewarding experiences at the Shallcross Manufacturing Company during my Junior and Senior years in the late '40s. Perhaps the few vignettes related here will offer some insight on industrial life in America when companies still made things.

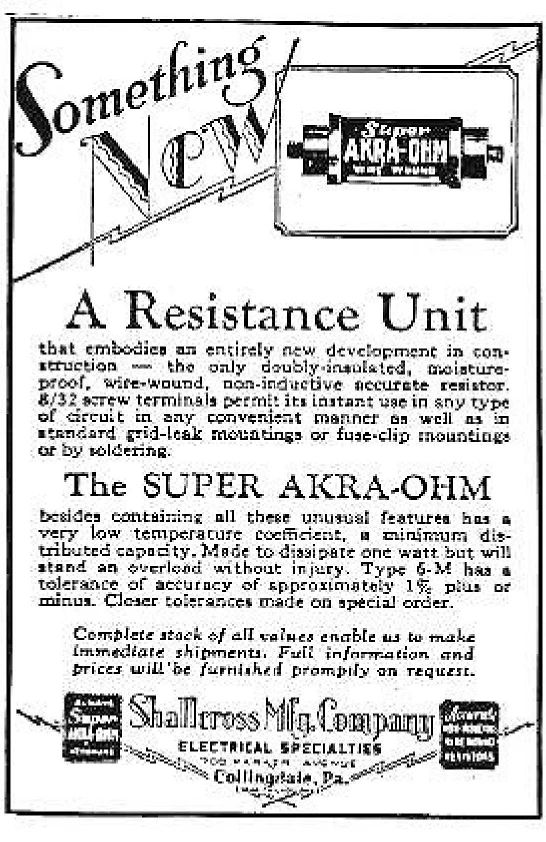
John Shallcross founded his company in a former bakery in Collingdale, a suburb of Philadelphia, in the mid-'twenties to make precision wire wound resistors. The first advertisement I have seen for Shallcross Akra-Ohm resistors was in *QST* for September 1929. That was decades before thin film technology was developed, when the only means for making accurate resistors was by winding insulated resistance wire on ceramic bobbins. The bobbins were typically about a half-inch in diameter and an inch long with buss wire or staked-on terminals. Some of the first versions were made with fuse-type ends so they could be plugged into holders commonly used for grid leak resistors in early radio sets. Resistors in the megohm range required hundreds of turns of silk-insulated wire as small as 1/1000" diameter! The wire was usually made of Manganin, an alloy of copper, manganese and nickel, formulated for high resistance, low temperature coefficient, and good long term stability. After winding, the resistors were soaked in varnish, baked in an oven, and operated under load for several hours to stabilize their resistance.

When I worked at Shallcross the company had expanded into a modern one- and two-story building complex at 520 Pusey Avenue in Collingdale. The plant consisted of a large manufacturing building where 160 women operated resistor-winding machines, an adjacent machine shop, engineering lab, and second floor business office. There also were separate areas for assembly and testing of a variety of Wheatstone and Kelvin bridges, decade resistance boxes, telephone test equipment, and audio attenuators. All instrument switches and their component parts were built in-house, as were all the parts for the attenuators. The company suffered the stigma of running second best to Leeds and Northrup in the instrument field and Daven in the attenuator line, an image unfortunately reinforced by Shallcross's propensity to copy innovations of those industry leaders rather than invest in advanced development of new products. But that was over sixty years ago; today those venerable companies exist in name only.

By the time I joined it for my first co-op assignment, the company was well established under tight general management of John Shallcross, Sr. (popularly known as "Pappy") and his three sons. John Jr. had the most responsible position (under domination of his father), as manager of Sales and Marketing. Younger son "Spike" was Production Manager in a job well suited for him, given the large number of females in his domain. Dewees, a feckless fellow with personal issues, was in charge of the Engineering Lab where I worked, although I reported to Fred Mitchell, the Chief Engineer.

The company was obviously very much under family control, a point well taken by older employees who seemed to accept the minimal likelihood of ever rising very far in management. It was also a paternal organization with a company-subsidized "Sunshine Club" in lieu of a union. However, it was generally acknowledged that "Pappy" personally took care of faithful employees if they had health or financial problems. Even as a temporary employee, I was well treated, once being taken with the "regulars" to the IRE Show in New York, an extravaganza of electronic wares displayed by virtually every manufacturer in the business. What an enriching experience that was, and on top of it all, they gave me $5 (over half a day's pay then) for spending money.

After introductions on my first day at work, I was assigned by an officious chap to prepare an environmental chamber for his use. He was going to test a new type of power resistor over a wide range of temperatures to investigate performance in extreme operating conditions. The chamber cabinet was about four feet square and eight feet high. Instead of a modern mechanical refrigeration system for the cold cycle, however, cooling was accomplished by circulating cold alcohol through coils in the test chamber. The alcohol was super-cooled by dry ice in a large reservoir at the top of the unit. He pointed to the chamber and said, "Get it going." then departed. There was a 25-pound block of dry ice and an axe on the floor next to the chamber, so I chopped-up about a quarter of the block into small pieces, put them in a cardboard box, and climbed up a step ladder so I could dump the dry ice lumps into the warm alcohol. By the time I had climbed down the ladder, alcohol foam was gushing over the top of the tank and streaming down the sides of the cabinet onto the floor. My "advisor" reappeared and without batting an eye said, "Oh yeah, I meant to tell you to put the dry ice in a very small amount at a time or the alcohol will boil violently." Although I had to occasionally tend the environmental chamber after that dismal introduction, it soon became routine and there was plenty of time left for more interesting work with friendlier people.



The first job I had where I was left alone was to test a number of resistor networks from the Harvard Computation Laboratory (a heady title in that age!). Actual measurement was a cinch using a Shallcross "Percent Limit Bridge," which measured a particular resistance value within a preset tolerance range. There were enough networks involved to justify making a fixture to switch between individual resistors, which were mounted on an octal plug, so there was not a lot of connecting and disconnecting of leads. When all the out-of-tolerance resistors had been found and replaced, I had my own chance to use that dreaded environmental chamber to put the assemblies through temperature cycling before making one last measurement and sending the networks on their way.

The next project was, literally, a big one: help design and construct two 2000-volt 800-ma. dc power supplies – a ham's delight. More on that next time.

Remembering Shallcross – Part 2

Interesting projects and some contention

Bob Thomas, W3NE

July 31, 2011

A new high-voltage, high-current rotary switch was in development at Shallcross about the time I was completing my first minor job assignments at the company. The next phase in the switch development program would be a life test where sample switches would be continuously rotated through each position while switching a high voltage to various load resistors. A power supply capable of providing 2000 volts at 800 ma. dc was required to stress switch contacts to their maximum rating during the life test.

Lucky me: I was to work with a Technician to design and build two of the power supplies. The Tech was John Perchalski, W3DLR who knew what was what. He was an avid 40 meter CW op (the entire 40M band was CW-only in those days!) who arrived every morning with tales of DX exploits the previous night. For us the project was like two kids in a candy shop, deciding on the schematic, selecting components, and laying-out the chassis and front panel. Each supply was built in a roll-around dolly with a luscious black Bakelite panel. Cutouts in the panel revealed the dials of four Simpson 4” rectangular meters for monitoring line voltage, rectifier tube filament voltage, dc output voltage, and output current. Output voltage was controlled by a 1 kW Variac in the primary of a UTC Commercial Grade plate transformer. A pair of 872 mercury vapor rectifiers, with filament voltage adjusted by a small Variac, were protected by a time delay relay in the HV transformer primary. A Millen HV so-called “safety” connector was used for HV dc output. Wow! This was great stuff and we both had a ball making them. Not only that, there was a later requirement for two more smaller supplies and I got to design and build them by myself.

One afternoon two visitors took a big instrument into the Chief Engineer’s office. A few minutes later C.E. Fred Mitchell and the men brought the instrument out and put it on a lab table so we could all look it over. It was strange thing, something like an oscilloscope except the CRT was in the upper left corner rather than the center of the front panel where it should be. Even stranger, the horizontal sweep was calibrated in *time,* not frequency like scopes were supposed to be. The visitors explained their new product, but it was far more advanced than anything Shallcross needed, so they departed. It wasn’t until a few years later I realized I had seen a Tektronix 511, the first of what would become *the standard* oscilloscopes of the World.

Shallcross manufactured a full line of fixed and variable audio attenuators for the broadcasting and recording industries. Variable attenuators act like a conventional “volume control” potentiometer. However, rather than a simple continuous resistance tapped by a sliding contact, a variable attenuator is a multi-pole switch of forty or more small contacts with a precision attenuator of 1 dB or less connected between adjacent pairs of contacts. Attenuation changes in small increments as the control shaft is turned, producing a smooth, noiseless change of signal level in the accurately defined steps required for audio production..

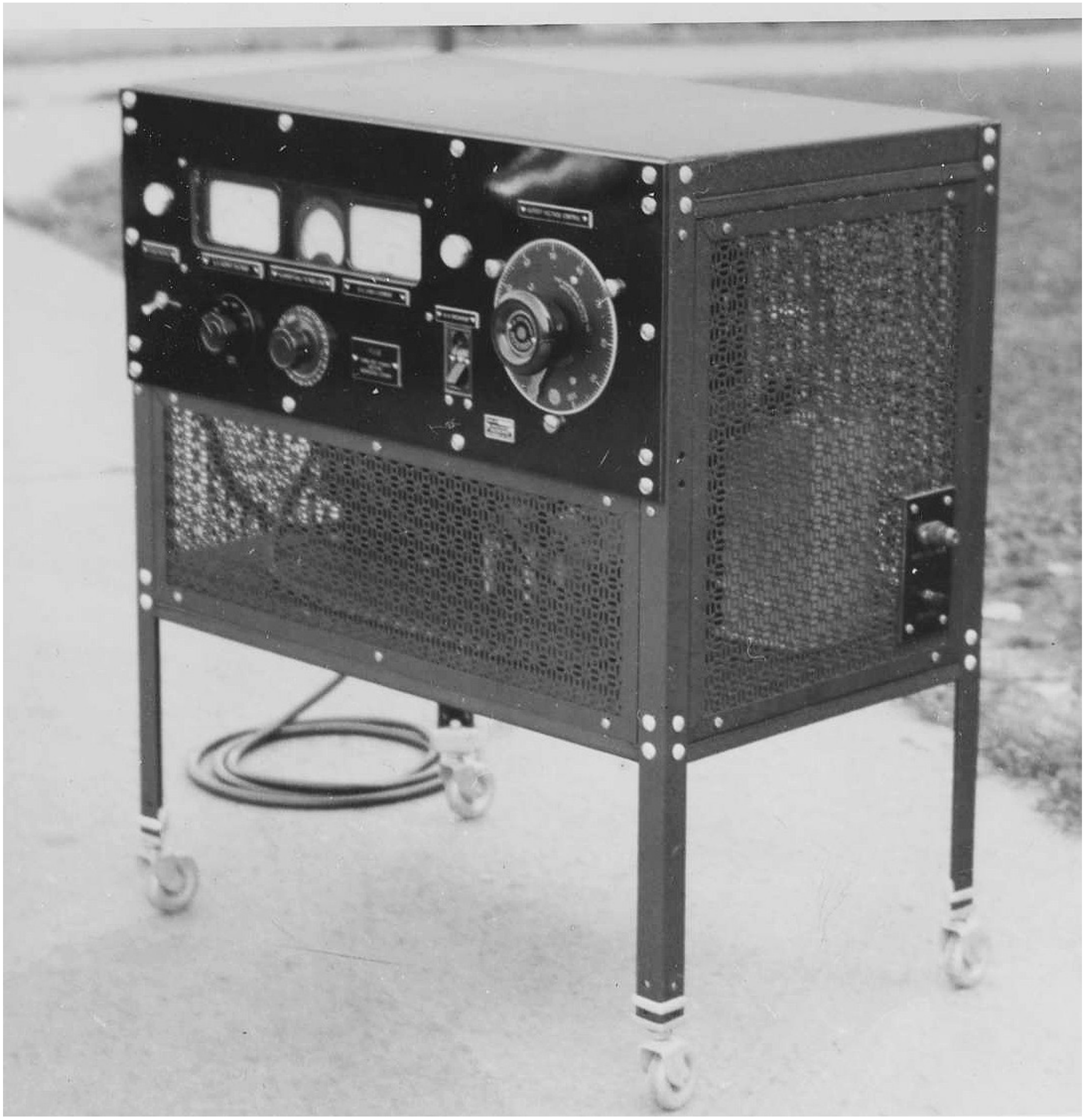
The original attenuator factory test fixture was outdated and becoming unreliable so Charlie Fritz, engineer in charge of attenuators, designed a new circuit to simplify testing and improve product throughput. Charlie’s schematic was turned over to me for design of a new test fixture. After making a control panel layout, I ordered new impedance matching transformers, telephone-type key switches, reference attenuators and mechanical parts for the new test set. A Tech wired up the unit while I wrote a new test procedure to go along with it. I went in on a Sunday to avoid interrupting production with installation of our new test station. I checked it out to make sure it was working properly and taped a note right across the VU meter to let the test foreman know the fixture was new and he should follow the attached revised test procedure.

Monday morning I went right to the test room to see how things were going. The brand new test set was partially disassembled and Pappy Shallcross was getting an earful from a hysterical foreman about the disaster caused by the smartass engineers and their new test system. When I asked if he had followed the new procedure as noted in the prominent sign, the foreman boasted he didn't need to follow it because he always did it "his way" and saw no reason to change. Instead he had taken a soldering iron to the new test circuit and butchered it without knowing what he was doing. When everything was finally restored to its original design configuration and the new procedure followed properly, attenuator tests were completed faster and more accurately than ever before. Later that day when Pappy saw me he said, "Things got pretty hot this morning, didn't they?" I replied, yes they had, and he said, "You did good, keep it up." He made my day!

Pappy had tight hold on operation of his company and when things didn't go his way, everybody knew it. Someone would duck into the Lab to warn, "He's on the warpath!" If you listened carefully, you could hear muffled shouts emanating from the resistor production room. Then there would be a *blam* when he slammed the door going into the machine shop, which was next door to us. Now the shouting was louder and partly understandable. A few minutes of that and a *kablam!* as Pappy blustered from the shop, through the Lab right into Fred Mitchell's office with another bang as that door slammed shut. After Fred got chewed-out Pappy emerged glowering, and stamped out of the Lab to the seclusion of his own office. That cleared the air and it was all done without resorting to a single memo or, as we currently suffer, a flurry of e-mails. As far as I know, Pappy never reprimanded an ordinary employee; he held his managers responsible for running their operation, but always maintained good relations with the troops.

Good employee relations were important, but they didn't put food on the table, so shortly after I returned to Drexel for the last term before graduation in 1950, the employees voted to form a union. The man who founded the company and always ran it his way could not swallow that. John Shallcross closed his venerable company in Collingdale and moved it to North Carolina to begin anew. Times had changed though, and many of the company's bread-and-butter products no longer had a place in modern electronics. After some corporate juggling the company became part of IRC-Shallcross, a combination of two old Philadelphia resistor manufacturers. Separately in 1967, Pappy's son John Jr. founded *Shallco* which continues to make power switches and, in an ironic twist, audio attenuators to the designs of former arch competitor, Daven!

And in a coincidence that could only occur in Phil-Mont, Al Tribble, W3STW, just told me he immediately noticed the street address of the old Shallcross plant mentioned in Part-1. It seems that years later, Al worked in the very same building as I had while he was employed by GE during the mid-'sixties in setting up manufacture of innovative extremely high power diodes.



David Sarnoff – Part 1

Self-made Radio and TV Visionary

Bob Thomas, W3NE

September 8, 2011

David Sarnoff was arguably the most powerful, successful leader in the electronics industry during the heyday of America's superiority in innovation and manufacture of consumer and commercial electronics equipment. He rose through the ranks from Morse operator to President of the Radio Corporation of America for 35 years until he retired in 1965. Unlike today's executives, often seen by employees and the public as overpaid, incompetent, self-serving products of university business schools, General Sarnoff garnered the highest respect and loyalty of virtually everyone in the Corporation (as we called ourselves). His success was not easily achieved, however, as we shall see.

The Sarnoff family lived in a remote shetl in the Russian province of Minsk. Their primitive village had no public conveniences, nevertheless, the Czar's tax collectors made regular visits and the Jewish minority was subjected to continual discrimination. Thus in 1900, when he was nine years old, David emigrated with his family to the promise of the United States. Their first home was a three-room flat on the fourth floor of a tenement in a lower east side Manhattan ghetto. There was one bathroom for the twenty residents on their floor! Still, it was a far better than the place they had left, and young David immediately thrived. He began every day at 4 AM delivering Yiddish newspapers in the tenements then he attended a neighborhood Alliance School where he learned to read English in six months. He worked the rest of the day at a newsstand, saving enough money in four years to buy his own newsstand in Hell's Kitchen at 46th Street and 10th Avenue. David was main financial provider of his family from the time they arrived here because his father was unable to find steady work due to a chronic respiratory disease.

David got a job as messenger delivering telegrams for the Commerciall Cable Company, a major telegraph company of the day. It was there that he got his first glimpse of men copying Morse code and he was so attracted to the profession he bought a $2.00 key and taught himself the code. When he asked for time off to observe the Jewish Holidays and was fired on the spot, but in a few days he got a better position at the American Marconi Telegraph Company. Sarnoff's first job at Marconi was file clerk, where he became acquainted with details of the company's operation from correspondence, including directives from Marconi himself. He had a voracious appetite for knowledge which he satisfied in off hours studying technical subjects at Marconi and New York City libraries. He also had occasional opportunities to talk with operators and to continue on his own to become proficient with code. This initiative was not lost on Management; he gradually was assigned more office responsibilities and occasionally filled-in for Morse operators at shore stations. A big break came when Sr. Marconi arrived in New York and D.S. became acquainted with the great inventor, who was his hero. They had much in common as ambitious immigrants and visions for the future of wireless. Before long David became Marconi's personal messenger, an association that gave him access to company files, and a raise in salary that enabled him to move his family to better accomodations.

As Sarnoff steadily rose in the esteem of his supervisors, he was given more and more responsibility. He became a regular operator at a succession of Marconi shore stations and then a supervisor of one station after another as he consistently increased volume of message traffic and improved station efficiency. He was photographed at one of those assignments, sitting in a pensive mood, key at hand, in a moment that depicts the seriousness of his dedication. The next step upward was a prime assignment at the Marconi station at the top of the Wannamaker store in Manhattan. It was there, when off duty, that David was able to chat in person with radio enthusiasts and amateur operators who visited the store, learning what they needed and encouraging them in their new field. It also was there that he gained prominence in April 1912, when he remained on duty to handle health and welfare traffic from families and survivors of the *Titanic* disaster. The effectiveness of wireless aboard the rescue ship *Carpathia* (and tragic consequences of closer ships without wireless *not* responding) caused the U.S. Navy to initiate total control of all radio in the United States, a policy that would intimately involve David Sarnoff in the future.

D.S. continued to advance, rising to Chief Inspector in charge of all Marconi gear on ships in New York Harbor. To David it was an opportunity to literally get inside Marconi products. He visited radio rooms of ships where he was able to talk operator-to-operator with the crew to obtain frank assessments of Marconi equipment. He did the same on ships using competitive gear, where he gained the candor of operators as only another operator could. His information was forwarded to the engineering department for improvement of Marconi gear, and to the sales department, where the strengths of Marconi equipment, and weaknesses of competitors could be exploited. By now David Sarnoff was acknowledged as the one person who knew more about Marconi America than anyone else!

Sarnoff and three Marconi engineers visited a Columbia University laboratory in December 1913. They were shown a receiver incorporating a new principle invented by Edwin Armstrong, known as *regeneration*. Sarnoff was awed by its phenomenal sensitivity, which far exceeded that of any currently-available detectors. He and Armstrong immediately struck up a friendship and arranged to take the receiver to the Marconi wireless station at Belmar, NJ. They shivered in a cold hut for two days listening to DX from spark stations around the world like they had never been heard before. David, wild with enthusiasm, tried to impress his superiors with the importance of Armstrong's invention, but the company was having financial difficulties and had always taken a conservative approach toward new technology. Upper management saw no need for haste to adopt the new receiver regardless of its merits.

Meanwhile, developments in amplitude modulation over the next few years enabled transmission of sound with Alexanderson alternators and Paulsen continuous-arc transmitters. Sarnoff recognized the potential of this new technology when combined with regenerative receivers as the key to broadcasting directly to households. In 1916 he wrote what was to become a landmark memo to Marconi executives describing his ideas for a "Radio Music Box" to bring entertainment and cultural programs to the homes of all Americans. This was no vague suggestion; the memo included realistic estimates of costs, market penetration and realizable profits. However, his memo was ill-timed. War was looming in Europe and the U.S. Navy was again moving to totally control radio in the United States. David received no a reply to his memo so he set his plan aside until there would be more favorable circumstances.

The Secretary of the Navy got his chance to control wireless, including commandeering amateur and commercial stations, when the U.S. entered the war in 1917. German and British-owned wireless installations were confiscated by the Navy. Edwin Armstrong received a commission and was sent on active duty to France. At home, industry leaders were given virtually automatic commissions in the navy to facilitate participation in the war effort but David Sarnoff, then powerful Commercial Manager of the entire Marconi America Company, was ignored by Washington. It was a hurtful anti-Semitic snub to a man compelled to repay his country for the opportunities it had given him.

Momentous effects of war upon the wireless industry included government edicts terminating all patent litigation and a moratorium on issuance of new patents, which would be held by the government for use by any manufacturer for the duration of the war. That policy created a large "patent pool" that was destined to play a pivotal role in postwar reorganization of the radio industry, as we shall see next time.

David Sarnoff – Part 2

Self-made Radio and TV Visionary

Bob Thomas, W3NE

September 19, 2011

Near the end of the First World War, Congress proposed legislation to usurp total control of wireless by the U.S. government, just as the Navy had done at the start of the war. If politicians succeeded in their grab for power, it would be the end of amateur radio, commercial wireless, and free broadcasting. Justification for exercising unilateral federal power over wireless was the fear that foreign countries, already in control of all undersea cables, would similarly dominate the new medium. After all, Marconi America was a division of the British Marconi Company and took its orders from London so it, in particular, was looked upon with suspicion on Capitol Hill. The threat was finally diverted by an agreement reached privately between Marconi America and General Electric to form a new totally American company, the *Radio Corporation.* The new U.S. firm would hold patents of both companies. GE patents included rights to the Alexanderson alternator that generated high power (200kW) continuous wave RF, and Marconi America patents covered transmitter and receiver hardware and promising future developments. The two company's combined patent resources enabled the Radio Corporation to conduct domestic and foreign wireless communications free of foreign influence. David Sarnoff became Commercial Manager and the new company was incorporated in the fall of 1919 as the Radio Corporation of America. An unnoticed key provision inserted in the charter of the corporation by D.S. allowed RCA to conduct one-way transmissions – broadcasting! David Sarnoff alone had seen the future.

Having secured the confidence of GE upper management, David was again in a position to promote his ideas for a Radio Music Box. After receiving approval for his three-year business plan to produce and market radios by RCA, he went to see Alfred Goldsmith at the former Marconi laboratory at CCNY. Dr. Goldsmith had anticipated the need for a simple receiver and had already completed a design with one knob for tuning and one for volume. He called it a *radiola,* a name that would become famous in later years.

Intricacies of organization required by the government did not end with the simple formation of the Radio Corporation of America. The U.S. Navy had concerns about potential conflict between RCA wireless transmissions and AT&T landline telegraphy. There was also a tangle of vacuum tube patents held by RCA and Western Electric that had to be resolved. And finally, Westinghouse held critical patents for broadcast equipment as well as Armstrong's regenerative and superheterodyne receivers. Those issues were finally resolved in 1921 when RCA gave stock to the outside companies in exchange for cross licensing agreements and promising Westinghouse that forty percent of products sold by RCA would be manufactured by Westinghouse and sixty percent by GE.

Uppermost on David Sarnoff's agenda as he took over RCA operations was to introduce the public to broadcasting on a grand scale. Westinghouse had already pioneered the new medium with KDKA in 1920 and was making good headway with WJZ in Newark, KYW in Chicago and WBZ near Boston to establish a customer base for their radios, a concept D.S had proposed at Marconi years before only to be ignored. Even so, radio still had not captured the public acclaim David knew it could, so he decided to vault RCA, and radio, into public prominence by broadcasting an event of intense national interest. There was no better opportunity for that than the highly publicized boxing match between Jack Dempsey and Georges Carpentier on July 2, 1921. Sarnoff had RCA engineers set up a transmitter and antenna right at the scene of the fight, where a blow-by-blow account was broadcast to a large New York audience and relayed by landline to enthralled listeners along the entire east coast. Radio instantly became a national craze, for which Sarnoff was rewarded with promotion to Executive Vice President of RCA.

His new position enabled David to move RCA rapidly ahead with high power broadcast stations in major cities, however, a potentially disastrous rift developed between RCA and AT&T. AT&T owned powerful WEAF in Newark and had begun broadcasting commercials. Sarnoff's philosophy all along had been that broadcasting should be a free, non-commercial cultural public service to supply programming for the benefit of its Radiola customers. Westinghouse echoed that philosophy. AT&T had no such ties to the audience of WEAF and had begun inserting commercials in their programs, opening the door to what we have today. More important, however, was AT&T's refusal to continue leasing their high quality landlines to RCA for distribution of programs to cities beyond New York. After a bitter court fight and threatening regulatory moves by the Federal Trade Commission, the two companies compromised in 1926. AT&T divested its broadcast interests by selling WEAF to RCA and agreed to again lease their landlines without discrimination to all broadcasting companies. Sarnoff had to agree to establish a separate and self-supporting, revenue-producing broadcasting subsidiary, the National Broadcasting Company, to produce and distribute programs. From its inception, NBC became wildly successful as it expanded its range of programs and acquired new affiliate stations all the way to west coast. The network had become so big by 1927 it divided into two separate feeds, the Red Network and the Blue Network, each with its own programs and affiliates.

Sarnoff guided RCA into the motion picture business around 1929 to manufacture sound equipment for film production and theatrical display. And by the end of the 'twenties the Corporation had acquired the Victor Talking Machine Company to begin manufacture of RCA-Victor phonograph records. David Sarnoff was on a roll and on January 1, 1930 he was made President of the Radio Corporation of America at age 39.

Even before his ascent to the head of RCA, Sarnoff had set his sights on a technology he predicted would be the next major advancement in communications: *Television*. We will continue with that next time, and take a side glance to see how he elevated the cultural level of radio with a revolutionary initiative at NBC.

David Sarnoff – Part 3

Self-made Radio and TV Visionary

Bob Thomas, W3NE

September 28, 2011

Radio broadcasters of the early 'thirties were not delivering the cultural programming envisioned two decades earlier by David Sarnoff. Even after the FCC was created by the Communications Act of 1934 there was negligible intervention by the government affecting program content. D.S. might have controlled RCA's subsidiary NBC but he was helpless to stem the public's craving for vapid programs. He did however, bring culture to his network, and in a big way. He employed Artur Rodzinski to organize the NBC Symphony Orchestra, which was initially conducted by Pierre Monteux until Sarnoff persuaded the renowned Italian conductor Arturo Toscanini to take the baton in 1937. Toscanini conducted the orchestra for the next seventeen years in NBC studio 8H, on numerous international tours, and for RCA-Victor records. Saturday afternoon broadcasts of the Metropolitan Opera were also inaugurated by Sarnoff.

The early 'thirties also marked an era when D.S. provided material assistance to Major Edwin Armstrong to field test his cutting-edge FM radio system by allowing him to install a 200-watt FM transmitter and VHF antenna at NBC's site on the Empire State Building. In addition, an RCA engineer was assigned to conduct extensive FM reception measurements at his home in Haddonfield, NJ. Despite that boost, FM still failed to gain industry recognition and Armstrong had to remove his transmitter from Empire State to make room for an RCA transmitter to be used for television field tests. The Major, rebuffed by his old friend, sold his RCA stock to fund an elaborate FM station at Alpine, N.J. where the spectacular technical quality of his broadcasts finally dispelled any doubt about the superiority of FM over AM.

Sarnoff was eventually forced to negotiate with Armstrong for an FM system license even though the last thing he wanted was a new development that would impact sales of RCA AM radios and broadcast equipment. The two sides were tantalizingly close to agreement but when Armstrong insisted on the same royalties he was getting from other manufacturers, Sarnoff and company walked away, determined to devote RCA resources to television. Going their separate ways, Armstrong's FM system began to be adopted for public service mobile communications and numerous military applications. The FCC released its backlog of applications for FM station construction permits, and FM was selected for the sound channel of U.S. television broadcasting when new TV standards were issued in 1941. RCA accelerated development of television in anticipation of the 1939 World's Fair where it received an encouraging response from the public. However, the plans of everyone in the electronics field were put on hold after December 7, 1941.

David Sarnoff had been in the Army Reserves since 1925, serving for two weeks most years. After war was declared he was called to duty as head of the Signal Corps Advisory Board until 1944, when he was assigned as personal advisor to General Eisenhower in London. He was given unusual flexibility under Ike to bypass channels to requisition any material and personnel needed to build and staff a broadcast facility for transmitting programs to troops in the European and the Mediterranean theatres. Another task was to investigate and cure inadequate throughput of Command communications. Drawing on his experience at Marconi wireless stations, D.S. found existing Command Network capacity to be only one-third of requirements and instituted sweeping changes to handle anticipated invasion traffic. Sarnoff also was ordered to improve the deficient CW skills of Signal Corps operators. He discovered that although CW operators had to copy 25 wpm, their instructors could typically only copy 10 wpm! "Appropriate" changes were made and by D-Day we had a solid reservoir of qualified radio operators. Sarnoff was discharged after the war as a Brigadier General, one of the proudest achievements of his life.

Back at RCA after the war, Sarnoff oversaw inauguration of regularly scheduled television broadcasting by NBC, manufacture of TV station technical equipment, and introduction of the TS630 TV receiver (194***6, 30*** tubes) for $435. The 630 was a fabulous success, manufactured in huge quantities by RCA and sold as kits or complete chassis to innumerable other companies that had yet to establish their own designs. Television was a cash cow for the corporation until 1953 when the market had matured and competition increased. In anticipation of that, D.S. had pushed development of an all-electronic compatible color TV system that would that would not make existing monochrome receivers obsolete. The FCC approved the NTSC (National Television System Committee) standards for the RCA color television system on December 23, 1953.

Approval of the color system was one thing, but public acceptance was something else. Color receivers were expensive, difficult for an average person to adjust, and broadcasters had a lot to learn about making color uniform from one station to another, even from one camera to another! But the biggest impediment to acceptance was lack of programs in color. By 1959 color TV was faltering and David Sarnoff was in deep trouble with his Board of Directors. The company had already pumped over $100 million into development and Sarnoff wanted another $40 million to put color over the top. He finally prevailed, and devoted much of the new funding to a bold expansion of programming by NBC, culminating in all prime time programs in color in 1964. That sparked sales just as D.S. had predicted, and his company was once again on solid ground.

With the success of compatible color television, D.S. had accomplished the last of his major goals, but he continued to press his scientists and engineers for developments in new frontiers of electronics until he retired in 1965 at age 74. After enjoying a short retirement, General Sarnoff passed away following a long and painful illness on December 12, 1971.

David Sarnoff

Self-made Radio and TV Visionary
Bob Thomas, W3NE
September 28, 2011

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The TVI Battles

They weren't pretty
Bob Thomas, W3NE
December 6, 2011

Mention of television interference (TVI) at the November meeting dredged up memories of the early history of Phil-Mont when the term "mobile radio" acquired new significance. It (TVI) began about a year after the war ended, as the first post war TV receivers began to appear. They were expensive and highly prized by adventurous first-adopters who had shelled out upwards of $400 for a 10" black and white set. At that same time hams were beginning to get back on the air, many using the rigs they had left behind when they entered the service. It didn't take long for the two events to collide, as some owners of those expensive TV sets began to have their viewing pleasure ruined by black bars or herring-bone patterns floating across the screen and sometimes total loss of pictures for their favorite programs. *TVI was born!*

Most transmitters at that time, if they were not old pre-war vintage, were new ones constructed the same way as they were before the war. They typically were built on an open chassis (or even on a wood board) or at best, as rack-and-panel modular units mounted in an open relay rack or ordinary metal cabinet. Phone transmitters used amplitude modulation so viewers sometimes got a good clue about the source of picture disturbances when they were accompanied by a voice. A common reaction was, "It's that confounded amateur radio ham up the street again, Betsy!" Confrontations took place, like the time I received a telephone call while operating in contest on a Saturday afternoon. The unidentified caller simply shouted, "Shut up!" and then hung up.

In the beginning of the TVI debacle, hams didn't think they were doing anything wrong, and all the viewers knew was that their blissful pastime was being ruined by that d_ _ _ ham down the block. In reality there were two fundamental problems: 1) early TV receivers usually had "wide open" RF front ends that could not discriminate against out-of-band signals and, 2) amateur rigs radiated harmonics directly from the transmitter. At first the problems were simply too overwhelming for many hams to "process" so they looked for an escape route that avoided a situation that was growing to overwhelming proportions.

If you ask a politician what to do when confronted by a tough question, his reply will be, "Change the conversation." That's what many hams around Philadelphia did; they avoided TVI by going to mobile operation, a principle motivation for establishing PMRC. By agreeing on use of a single frequency in the ten meter band, the club concentrated operation at one spot that could easily be monitored by fixed stations so mobiles could usually count on making a contact. Before long several dozen cars in the region were sporting an 8-foot whip on the rear bumper and fixed station receivers were monitoring The Frequency, Channel 1 on 29.493.2 Mc. Cost was modest for a mobile transmitter and a receiving converter feeding the car BC radio. Best of all, when you were on the road there was no TVI. Well, not exactly – there might be TVI, but it was fleeting as the mobile drove past. That phenomenon gave rise to a new sport among mischievous hams who delighted in driving along a suburban street so they could look into living rooms where images of TV programs flipped and rolled while they transmitted in motion. Not nice, maybe, but amusing and completely immune from that dreaded phone call. The new freedom gave birth to the name of the club newsletter, *TVI Retreat,* edited by George King, W3PXY. The name gradually morphed to the present title of our bulletin as it became commonly referred to as "the blurb."

Reputable TV receiver manufacturers finally acknowledged their error ignoring the importance of shielding and adequate front end filtering. They improved new models and offered upgrade kits for field installation by dealers. The FCC entered the fray with the proclamation that an amateur having a TV receiver in his house that was not affected by his own transmissions was absolved from responsibility for interference caused to neighbors' sets. Nevertheless, in cases of acute interference the ham might be forced by the Commission to observe quiet hours, say from 4PM to midnight – a draconian limitation that didn't go over very well. In any event, those actions put the ball squarely in the amateur's court.

The challenge to eliminate amateur radio's contribution to TVI was met on several fronts. Articles in *QST* and new designs published in the ARRL *Handbook* stressed the necessity for thoroughly shielding transmitters and bypassing all connections entering and leaving the Tx. Articles showed liberal use of metal window screen covering ventilation openings, techniques for sealing physical gaps in the panels and doors of cabinets, and gave advice on design of power line and interface lead filtering. Traditional push-pull finals with link coupling were abandoned in favor of a single-ended configuration that lent itself to load matching with a pi-network, which also acted as a low pass filter to minimize harmonic output.

One of the most useful aids to amateurs for TVI reduction was a book published and distributed free by Phil Rand, W1DBM. It was a compilation of some *QST* articles and several chapters written by Phil describing all the techniques for elimination of TVI. Equipment manufacturers also responded with new products incorporating features that eliminated causes of TVI. For example, the Johnson *Viking II* 100 watt AM transmitter was housed in a copper plated cabinet with a tight fitting lid bonded to the case with beryllium copper finger stock. The back of the meter was shielded by a metal shield cup and every input and output lead was filtered with a series air-wound inductor and ceramic bypass capacitor. Complex coax low pass filters with very high attenuation above a 30 Mc. became available from several manufacturers at reasonable prices for harmonic suppression in the transmitter output.

Finally, the ARRL established local TVI Committees made up of amateurs and private citizens to diplomatically resolve stubborn cases of TVI. The procedure generally followed was for a member of the TVI Committee to first visit the amateur. If the ham was unable to transmit without causing TVI in own set, the case was put on hold until a subsequent visit from the committee showed the ham had eliminated his own TVI. On the other hand, if the amateur was able operate his transmitter without interference to his own TV set the committee member went to the home where TVI had been reported. If a test transmission resulted in TVI, the committee representative had the difficult task of convincing the complainant that their receiver was at fault, and they were responsible for obtaining a service technician to cure it. Similar problems also occurred with broadcast radios and telephones, for which the same procedure was followed.

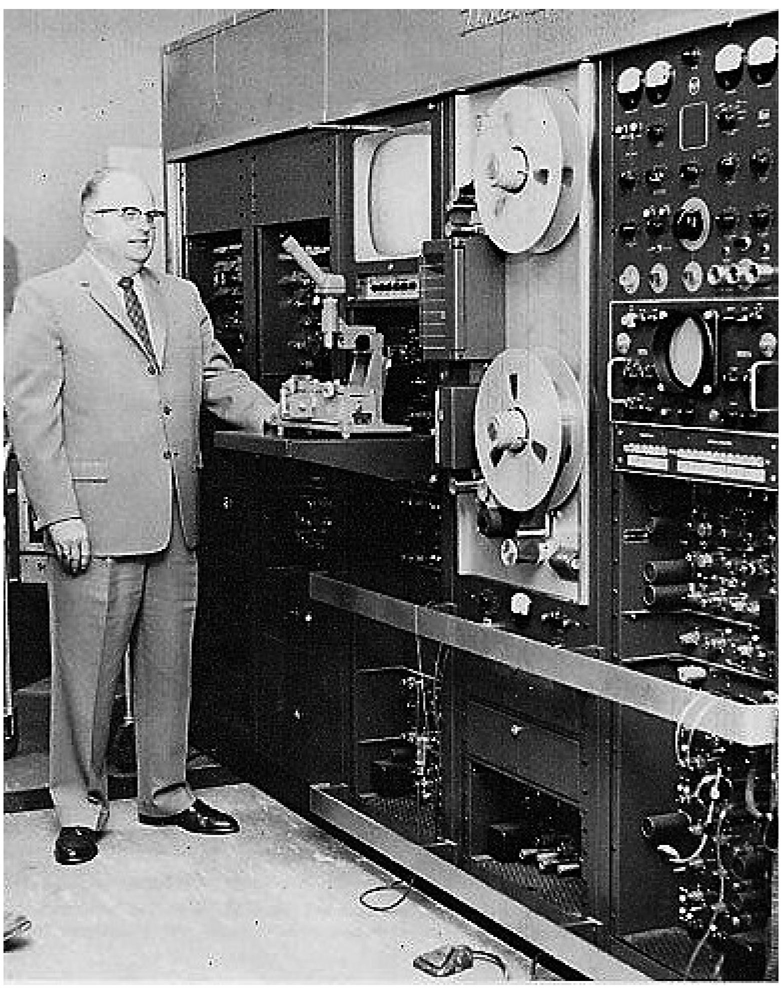
TVI complaints gradually became manageable and when cable distribution eventually dominated off-air TV reception they practically disappeared. For several critical years, however, TVI was the bane of amateur radio, not to mention enjoyable TV viewing.

Arrival of Transistors

It was sink or swim
Bob Thomas, W3NE
December 17, 2011

Disruptive Technology is a term that has been appearing in recent financial and technical articles. It refers to a new development that is so revolutionary it causes a total break with the past and initiates radical societal changes. Depending on how far back you want to go, examples of that are fire and the wheel. The most spectacular example of disruptive technology in modern times is developments in atomic physics that have been applied to military weapons and peaceful products for medicine and industry. Less dramatic but still far-reaching disruptive technologies occurred in transportation (the automobile and mass production methods) and communications (telegraph, wireless, and radio). The latter eventually opened the door to advances in solid state physics, leading to the most recent disruptive technology – invention of the transistor.

If you think introduction of transistors was not disruptive, think again. At the RCA Broadcast Systems Division we had been going merrily along introducing new tube-based equipment at a furious rate for cameras, monitors and processing equipment. We knew all about tubes and how to use them, and manufacturers continually provided us with improved types. In 1958 my section introduced a tube-based video tape recorder (VTR) for television based on an Ampex invention. That VTR occupied three 7-foot racks and consumed 3.5kW. If you wanted to record and playback color, that took another three racks! Four years later transistors were developed sufficiently to enable us to design the first solid state VTR housed in a console about the size of a large upright piano. What happened in the interval between the first tube VTR and the solid state machine was a disruptive technology with a profound impact that is the topic of this article.


Tube-based VTR

The first brush with transistors in our lab occurred in the early 'fifties when Bob Dennison, W2HBE took home a couple of 1N34 germanium diodes. Those diodes are made with a tiny pointed wire ("cat whisker") that presses against a pellet of germanium; one diode lead goes to the pellet and the other to the cat whisker. Rectification occurs at the point of contact. That evening Bob broke open two diodes. He removed the cat whisker from one of them and arranged it to press against the germanium pellet of the other diode only a few thousandths of an inch away from that diode's original c/w. The new assembly became a point contact transistor where the original c/w performed as the emitter, the added c/w acted as the collector, and the germanium pellet as the base. Although crude, Bob's kitchen table transistor exhibited a gain of 2, which wasn't bad considering its origin and era.

We were certainly aware of the eventual value of solid state devices for broadcast equipment, but for many years transistors suffered from large variations in characteristics, limited bandwidth, power limitations, and unreliability. Before long, point contact transistors were supplanted by junction devices that not only improved uniformity and reliability, they enabled manufacture of both PNP and NPN transistors to lend great flexibility in circuit design. Bandwidth was increased to hundreds of megacycles for some types, and use of hermetically sealed metal cases improved reliability of premium transistors by preventing contamination after manufacture. By 1956 those efforts elevated transistors from an experimenter's curiosity to a viable contender for application in commercial equipment.

First solid-state VTR

Many of the innovations described above were pioneered at the new RCA semiconductor research and production facility in Sommerville, NJ. Because of its major role in the new field of semiconductors, the Corporation had a compelling interest in rapid deployment of its latest products, so the Broadcast Systems Division in Camden was charged with immediately implementing the technology in all new designs. In preparation for our task, Bell Labs was contracted to supply a crash course in solid state technology for all our engineers. Night classes were held for lectures that concentrated on solid-state physics. Each class was supplemented by voluminous notes on related topics that had to be learned between classes to avoid falling hopelessly behind. Of course all that had to be fitted within normal work, family responsibilities and sleep. Even so, that highly theoretical education hardly equipped us to begin designing circuits with transistors that would be viable in an already sophisticated, demanding market. For that, a few of our talented engineers presented another in-house after hours training seminar, this time emphasizing the practical, real life aspects of solid-state circuit design. Classes were held two nights a week for several months until a high degree of confidence pervaded the entire engineering department to ensure we were ready for task ahead.

This would be no gradual, evolutionary segue from tubes to transistors; it was a wrenching, instantaneous, and permanent departure from our association with vacuum tube circuit design into the new culture of solid-state. One of the biggest changes was the total break from reliance on published characteristic curves, which had been so essential for tube-based circuit design, but were utterly misleading for design of transistor circuits. Another concept seldom considered with tubes was emphasis on temperature stability. On the other hand, we no longer had to be concerned about getting knocked on the can by a 280-volt half-Ampere regulated power supply!

It wasn't easy going – in fact it was *disruptive* – but almost overnight an all-new studio and field broadcast equipment product line appeared for audio (of course), VTRs, switchers, monitors, transition generators, cameras and video processors. Integrated circuits were taken in stride and we never looked back, well almost never; some of us continue our interest in restoring and using ham radio boat anchors that still rely on ancient hollow-state technology that glows in the dark.

NVIS Communication

Learn how and when to use it

Bob Thomas, W3NE

Match 24, 2012

To get right to the point, NVIS stands for *Near Vertical Incidence Skywave*. NVIS is a method of communicating with high reliability by radio using an antenna positioned close to the ground. RF from the transmit antenna is radiated *nearly vertically* toward the ionosphere which reflects it downward as a *skywave*. The skywave covers the surface of the earth in a circular pattern with a radius of about 300 miles around the point of origination. This article will show how and when NVIS can be used to advantage in various amateur situations.

Hams are fortunate that there is an ionosphere surrounding the earth because without it, HF DX would be impossible. The ionosphere consists of free electrons, ions, and plasma clouds extending from 30 to 300 miles above the earth's surface. Its actual makeup depends mainly on the sun, so it varies with time of day, with the seasons, and with conditions on the sun, i.e., ultra violet and x-ray radiation, sunspots, flares and other solar phenomena. DX is possible when radio waves from an antenna are reflected by the ionosphere back to the earth at some distance from their source. Multiple ionosphere-to-earth reflections can carry a radio signal around the globe for phenomenal DX contacts, depending on conditions in the ionosphere.

The ionosphere is generally considered to be divided by altitude into three main layers. The lowest, called the D-layer, absorbs radio waves with frequencies below 1500 kc. (200 meters). It is dependent on the sun to produce ionization for its existence so the D-layer is present only in daytime and disappears at night. It absorbs RF energy when present in daylight, preventing upper layers of the ionosphere from reflecting RF back to the ground. That's why there is no broadcast-band DX during the day, although distant BC stations pound through at night when upper layers of the ionosphere bend their signals back to earth. The next higher layer, the E-layer, ordinarily does not reflect RF above about 10 Mc. so it is the reason 6-meter DX is uncommon except during "sporadic-E" events during which floating clouds of ionization are present for intervals lasting from a few minutes to several hours, especially during the summer.

The highest-altitude layer of the ionosphere is the F-layer. It is so dense it reflects radio waves back toward earth, depending on their frequency and angle (*incidence*) at which they approach the F-layer off of vertical. For example, RF from an NVIS antenna directly below the F-layer (*Vertical Incidence*) will be totally reflected straight back to earth as long as it is below the *"critical frequency."* If it is above the critical frequency vertical beams of RF continue going right through the F-layer into space. Signals arriving at an angle of incidence off of vertical are reflected back to earth as a *skywave* returning at some "skip distance" from their source for what we call "DX." The original skywave is often reflected back and forth between the ionosphere and surface of the earth several times for amazing communications around the globe. All of this was not recognized by the U.S. Congress in 1912 when, responding to pressure from the Navy and commercial interests, they relegated all amateur activity to frequencies above 1500 kc. Ha, ha! Hams then showed the world the value of short wave communications!

The critical frequency that determines reflective properties of the F-layer for NVIS varies constantly, but is usually below 10 Mc. It should be checked prior to attempting NVIS because it could be so low that even the 40-meter band might be marginal; you can always count on 160

and 80 meters, however. Although the critical frequency is the upper limit for Vertical Incidence RF to be returned to earth, don't let it discourage you for non-NVIS operation. Skip can occur at frequencies much higher than the critical frequency.[1] A map depicting current critical frequencies around the world is available at: http://www.spacew.com/www/fof2.html
Near-vertical radiation and reception is attained by locating antennas, preferably at both ends of the circuit, very close to the ground – anywhere from 0.15λ (18 ft. for 40M), to as close as two feet or even laying the wire right on the ground! The earth then reflects transmit RF directly upward and only the *vertical* returning skywave is effective at the receive end. That has two advantages to ensure solid, reliable communications: 1) Only very stable vertical-incident waves are utilized, and 2) QRM from long-path DX, and atmospheric noise, which primarily originates from distant lightening and man-made sources, arrive nearly horizontally where a low receiving antenna is very insensitive. A compromise of antenna height and performance has to be reached of course. Transmit and receive efficiency requires antennas to be as high as possible, but QRM and noise attenuation is enhanced when the receive antenna is as low as possible. A loss of only 6 dB occurs when an antenna is as low as .05λ (6 ft. on 40M, 12 ft. on 80M). That loss can be compensated with additional receiver gain and there will still be an overall improvement in signal-to-noise ratio! It is not necessary for both ends of a communications circuit to incorporate NVIS antennas, but performance is doubled when they do.

We have been conditioned to believe that best HF communications results only when antennas are as high as possible. That is true when earth/ionosphere reflections, or "skip," are relied upon to bounce signals over one or more long distance hops but then we also have to accept inevitable gaps in local coverage and possible fading and high noise levels. NVIS is appropriate when solid communications within 300 miles is paramount.

NVIS antennas are uncomplicated and can be easily stored, ready for hasty deployment. Once the antennas are up on low masts (or even traffic cones) emergency traffic can be handled in low-interference conditions. NVIS is perfect for hilly or mountainous regions where its vertically-oriented signals are unaffected by high terrain and deep valleys. They are popular along the California coast where continuous coverage around the barren mountains and into deep canyons is essential. In fact, an ideal location for an NVIS station is at the bottom of a valley where surrounding hills provide a noise shield and the moist earth an excellent ground reflector! Typical uses for NVIS in our area would include regional emergency nets, say involving Philadelphia and Harrisburg or Washington-Philadelphia-New York. It is also well suited for informal round tables. NVIS offers great potential for hikers and QRP operators as well as relaxed rag chewing from home with attenuation of interference that might make a QSO by standard means unpleasant. And finally, with Field Day around the corner, a simple NVIS antenna for 80M or 40M thrown up at the last minute (no high-power launcher required) could re-open a 280.000 square mile surrounding area for new contacts that might have been previously missed due to skip associated with traditional high-mounted antennas.

NVIS is such a broad and expanding amateur activity that its full potential cannot possibly be covered in a short article. The internet abounds with information and advice on how to get started and make this unique mode of operation work for you.

[1] Critical frequency should not be confused with *Maximum Useable Frequency* (MUF) which is a determining factor for useful DX conditions. MUF *is* related to critical frequency, however, by the off-vertical angle at which signals approach the ionosphere. It is calculated as follows:
$MUF = f_c \div (\text{secant } \theta)$, where **$\theta$ =** off-vertical angle that incident RF makes with the ionosphere
MUF typically is 2 to 4 times the critical frequency, depending on path length and season.

This and That

Miscellaneous Ramblings
Bob Thomas, W3NE
June 22, 2012

Rather than focus on a single topic this month, an opportunity will be taken to cover a few miscellaneous items worthy of reporting, some recent, some vintage.

Clearing the Record. The title of this section has been stolen directly from the pages of the Philadelphia *Inquirer* therefore it epitomizes journalistic integrity and excellence. The *Inky* never makes a mistake so they have no need for a column called "Corrections." Instead, their headline terminology is "Clearing the Record," where they publish *corrections*. Go figger. Anyway, in the May *Blurb* article about Phil-Mont's first Field Day, the year that it occurred and the score we attained were miss-stated. See, there is no admission that anything in the article was wrong, so the following is simply a clarification, not a correction.

Recent acquisition of some old *QST*s opened a window onto what actually occurred. The year of our first FD was 1955, not 1952. Furthermore, and of greater significance, we did very well on that first attempt: W3RQZ/3 made 635 contacts in Class AB (we ran 15 Watts on 2M, and 100 W. on two HF transmitters) for a score of 4710 points. That placed us in the upper 11 percent of all 3-transmitter entries, in contradiction to "much closer to the bottom than the top" as stated in the article. I just wanted to clarify that.

A few statistics. Average age of U.S. hams in 1938 was 29.5, less than half of today's ageing appliance operators. There were only about 50,000 licensed amateurs then compared to over 750,000 today, so why were the bands seething with QSOs then but half-empty today? We now represent only 0.24 percent of the U.S. population compared to Japan, where 3,5000,000 hams account for over 2 percent of their country's population. A surprising factoid is that Thailand is third after the U.S. in licensed amateurs! A 1939 survey revealed that 94.5% of ARRL members built their own transmitters and 24% made their receivers.

The Copying Bee. The ARRL conducted an annual CW receiving competition known as the "Copying Bee" for several years prior to WW-II. International Morse text was sent automatically at 25 words per minute from several amateur stations across the country to make them equally accessible to everyone. Messages were equivalent to 60 words of plain language with intentional cunning spelling errors, character groups with confusing code combinations, call signs, and punctuation. Because of the devious spelling errors, receiving operators had to write down exactly what they heard, with no possibility of anticipating or guessing. For example, part of a message might be sent as: **HE WHO LAUGHS LAST LAUGHH BEST HIHARD AND TEME (GILA) CQ IS THE GENERAL CALR.** Received copy was sent exactly as originally written down to ARRL for evaluation and scoring; copy that had been corrected was disqualified. This was an era when CW operating was prevalent so it was not uncommon for several hundred hams to participate, of which only a half-dozen might score 100%. All scores were listed in QST and winners received a bronze medallion for an honorable activity in amateur radio that has been lost in the dust.

Phone operation on 40 Meters. Various circumstances determine how and when changes are made in amateur-band mode assignments. For example the rise of the Novice Class, as well as recent variants on relaxation of FCC qualifications for amateur radio operator licenses have resulted in population of HF and VHF bands by new hams of varied knowledge and skill levels. The 40 meter band, 7000 to 7300 kc., had been reserved exclusively for amateur CW operation as agreed at a world-wide conference in 1929. Those rules were then changed following a bitter dispute at the 1938 Cairo International Conference when short wave broadcasting from non-American regions was permitted to intermingle with ham communications from 7200 to 7300 kc. Those newly authorized high power SW transmissions might have originated far from North America, but they were beamed to an audience right here and right among amateur CW QSOs.

The adoption of that imprudent change caused apoplexy at ARRL like nothing else seen since! ARRL General Manager Ken Warner wrote scathing editorials in QST advocating outright interference to SW stations by hams, who he encouraged to intentionally QRM SW broadcasts at every opportunity! When a powerful French SW station went on the air he wrote, “Well, what are little transmitters for? We’ve got a right to work on 7280 kc. too. As one seagull said to the other seagulls, ‘What’re we waiting for?’” There was concern that CW ops would take the easy way and stay in 7000-7200 kc., surrendering the upper end of the band to foreign broadcasting. It was widely thought that occupancy of the upper 100 kc. could be contested more effectively if that segment of the band were opened to amateur phone operation. Brad Martin, W3QV, whose call now distinguishes our repeater, was ARRL Atlantic Division Director. During the 1939 Board of Directors meeting Brad successfully introduced a motion to poll North American amateurs on the desirability of obtaining FCC authorization of A3 modulation from 7200 to 7300kc. However, while the poll was in progress Europe became enmeshed in war so the issue was dropped. Phone in 40 meters was not considered again until the mid-‘fifties, when it was approved, more because of increased popularity of phone operation and the ascension of SSB than vindictiveness over marauding SW broadcasts, most of which continued to occupy the 40 meter band until recently.

The Magnetic Loop Antenna

A Magic (almost) aerial

Bob Thomas, W3NE

August 5, 2012

Some hams are hobbled by a local noise level so high that only signals S8 and stronger are able to blast through the background cacophony for pleasurable reception. Believe it, I'm one of them, and from what we hear on the air I'm not the only one! Even some who have a beam or "ideal" wire antenna, high and in the clear, experience noise from a nearby commercial district or distant power line fault like a leaking circuit breaker a mile or more away. Others are afflicted by strictly local (in-house) noise sources but do not have the real estate to erect a half-wave wire between 80 foot poles in an open field, as antenna manuals so glibly suggest; that's me too. Still others are severely limited by restrictions on outdoor antennas. In short, many radio amateurs have been struggling in a severe noise environment with little possibility for acceptable receiving conditions. That situation might be improved with an antenna based on principles developed 46 years ago but only recently incorporated in a commercial product.

In the early 1960s, at the height of the Cold War with the USSR it became vitally important for the U.S to detect the EMP (Electro-Magnetic Pulse) that accompanies the explosion of an atomic bomb. While an EMP is incredibly destructive to electronic equipment in certain circumstances it also can be quite weak when it emanates from an underground explosion or detonation of a small device at a considerable distance. The latter situation required sensing apparatus relatively immune to local noise sources in order to detect a weak EMP. Furthermore, it was crucial not only to detect weak EMPs, but to localize their source based on bearings at the receive location. First Lieutenant Carl E. Baum, of the Air Force Weapons Laboratory, made a rigorous mathematical analysis of loop antennas to determine the best approach.

Lt. Baum's 1964 study compared conventional split-shielded loops having a long history of success in radio direction finding, against a relatively unknown type called a *Moebius Strip Loop.* What Baum's analysis revealed was that a moebius loop antenna has <u>twice</u> the sensitivity to the *magnetic* field of an electromagnetic (radio) wave as a conventional shielded loop while simultaneously exhibiting lower sensitivity to the *electric* component of the wave. Those two characteristics of a moebius "magnetic" loop make it an ideal receiving antenna because its superior sensitivity to the magnetic field of desired signals and its insensitivity to the electric field, which is predominantly associated with local "man-made" noise. In short, a moebius loop antenna enhances the signal-to-noise ratio of desired signals. Baum's insightful analysis was not declassified for release to the public until 1994.

Let's look into what a moebius really is. It is a German term (pronounced "mee-bius") describing an object that has only one surface and one edge. That might seem impossible but an easily made example reveals exactly what a moebius is: Take a strip of paper, say ½" wide and a 10" long, give it a half-twist, then paste the two ends together. The strip now fulfills the two-part definition of a moebius. If you don't believe it, start at the joint in the strip and run a finger along an edge. After traversing the edge for its entire 20-inch length you come right back where you started without going around any corners, proving there is only *one* edge. Similarly, starting at the joint, run a finger along the surface and you will travel over the full surface of the strip to come back where you started; your moebius strip has only *one* surface!

A moebius strip loop antenna is constructed inside a tube typically formed into a circle with an opening at the bottom. Individual coaxes are threaded through each half of the loop from bottom to top, where the center conductor of each coax is connected to the shield of the other coax, forming a *moebius* circuit in which there is a single continuous path through center conductors and shields of both coaxes. That moebius configuration endows loops with twice the sensitivity of a conventional loop. The coaxes are completely insulated from the tube and the tube does not have a gap at the top like many loop antennas. Received signals are extracted from the center conductors of each coax at the bottom of the loop.

Compact loop antennas unfortunately suffer from the disadvantage of their small physical size compared to the wavelength of signals they are receiving so they intercept less energy and produce lower signal levels than conventional full-size antennas with large apertures. Another limitation of moebius loops results from response primarily to the magnetic field of signals, which is only one-fifth the amplitude of the electric field picked up by a wire antenna mainly picks up. Those effects cause the output of a magnetic loop to be much lower than conventional aerials but they discriminate against noise and the lower output level can be easily compensated by a high gain amplifier between the loop and receiver.

A useful characteristic of a moebius loop is its figure-8 sensitivity pattern which exhibits maximum pickup in-line with the plane of the loop, and nulls broadside to the loop. The shape of its pattern is similar to a half-wave wire but since loops are small they can be easily rotated to take advantage of their directivity. Thus a loop can be turned to peak a desired signal or, alternatively to null interference. Noise sources at W3NE are nearby and diffuse so the loop's null seldom helps here, but when a station is bothered by a concentrated distant noise, like that utility company leaking lightning arrestor, it might be more beneficial to overall SNR to null the noise rather than peak the desired signal.

Lt. Baum's findings are the basis for Pixel Technologies' RF PRO-1 Magnetic Loop, introduced in 2010 and subsequently upgraded to current version -1B. Some PMRC members have this loop including W3AOK, KB3RIZ, NC3U and the writer. It covers the entire range from 50 kHz to 30 MHz. The Pixel loop is made of two semi-circles of ¾" aluminum tube connected to conduit junction boxes at top and bottom, where internal connections are made. An aluminum plate bolted to the bottom conduit box supports a rugged diecast preamp housing and has holes for mounting the loop on a mast with supplied U-bolts. I was concerned about the loop's wind velocity rating in case the owner of my apartment made an issue of it. When the question was e-mailed to Doug Talley, an affable fellow who seems to be the knowledgeable Chief Cook & Bottle Washer at Pixel he replied, "The loop is very conservatively rated at 100 mph." Wel-l-l-l, maybe, but in any case it is mechanically robust.

As previously discussed, the output level from a loop is substantially lower than most antennas. To compensate for its low output the PRO-1B package includes a 37 dB broadband low noise preamplifier. Even so, signal levels at the W3NE receiver are at least two S-units lower than a "normal" antenna, but that does not seem to cause any detrimental effects. Preamp output from an F connector goes through RG-6U Quad-Shield coax to a junction box inside the shack. The junction box incorporates connectors for: 1) coax feed from the antenna; 2) coax to a receiver or transceiver; 3) 20 volts d-c from a supplied wall wart for preamp power, which is multiplexed on the preamp transmission line; and 4) T/R logic level input from the transceiver or station T/R control system to disable the preamp when transmitting.

The PRO-1B is a *receive only* antenna that requires special precautions to avoid damage from high level RF during transmissions. These are all spelled out in the User Manual (available on-line) but in general, unless the loop is used with a transceiver having a dedicated Receive-Only Input, some means for external rapid T/R antenna switching has to be provided. Even with a dedicated Rx Input, the transceiver must supply a ground-on-transmit T/R control signal (the same as for linear amplifier control) to an RCA jack on the antenna junction box for disabling the preamp. If a dedicated Rx-Only Input is not available, or if the PRO-1B is used with a standalone transmitter, a fast antenna T/R switch or relay has to be provided. The DX Engineering RTR-1 supplies all the functions to do that with safety interlocks in a compact unit that also enables easy comparison of incoming signals from the loop or main antenna.

The PRO-1B can be mounted in a fixed position but it has to be rotatable for optimal performance to peak desired signals or null interference. There is a difference in signal strength of about three S-units on 40 meters depending on loop orientation; the same should apply to nulling noise if it is coming from a distance. One illustration here shows the rotator installation at W3NE (transmissions are from a Hamstick dipole visible at the center of that photo). The other photo is a view of the loop high above my third floor balcony; the preamp is in the box directly below the loop. I get a two to three S-unit improvement in SNR with this loop compared to any other antenna tried. Anyone interested in performance of the PRO-1B should check user reviews posted on eHam.com reporting performance in a wide variety of installations. While the moebius Magnetic Loop isn't a "magic" antenna, it might be the best way for some hams to cope with a high-noise environment or space constraints.

Illustration 1: Rotator installation

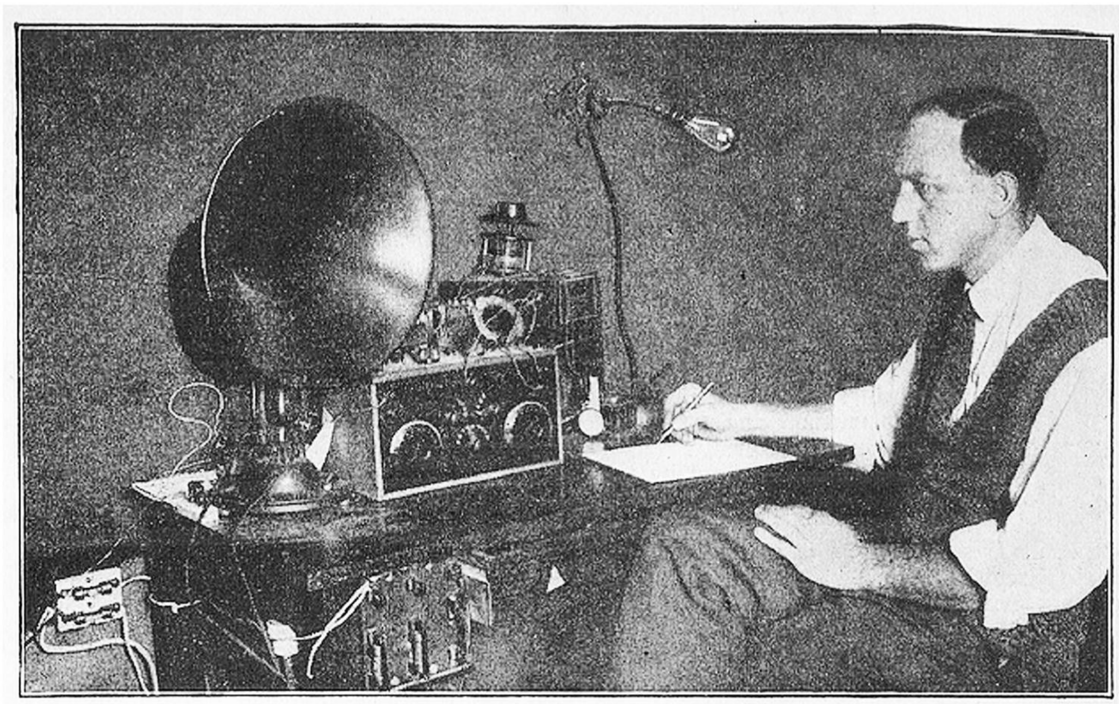
Illustration 2: Loop installation

John L. Reinartz

". . . on whose shoulders we stand"

Bob Thomas, W3NE

September 7, 2012



John Reinartz, 1QP at his 1924 station . Reinartz Tuner is on desk.

The subtitle of this article alludes to a phrase often heard in reference to pioneers who led the way in years gone by with developments of such fundamental importance they continue to enrich our lives even today. They become the foundation upon which successors have built today's technology. A prominent early innovator in the field of radio communications was John Leo Reinartz who came to this country with his family from Germany in 1904 at the age of 10. Although his name is virtually unrecognized today, Reinartz made such profound contributions to the art and science of communications he has justifiably been called "The Father of Short Wave Radio" . . . and for very good reasons, as we shall see.

The young Reinartz became captivated by radio only two years after his arrival here. He assembled a station with a low power spark transmitter and a primitive receiver using a coherer detector. The impecunious boy made his coherer by mixing particles of nickel and iron obtained by filing a Buffalo Nickel and a nail. The particle mixture was placed loosely in a glass tube with end terminals connected in series with an antenna tuner, a battery, and a pair of headphones. A spark signal picked up by the antenna caused the metal particles to clump together (cohere) to produce audio in the 'phones. The tube was then tapped by a "decoherer" to loosen the particles in preparation for receiving the next spark signal. As crude as they were, coherer and crystal detectors were state-of-the-art until the triode vacuum tube was introduced, leading to invention of the regenerative receiver by Edwin Armstrong.

The basic regenerative receiver utilizes a simple circuit that is sensitive, reasonably selective, and easy to construct, attributes that caused them to be immediately embraced by commercial wireless companies and amateur operators. Early regens were not without their faults, however. Tuning was affected by incidental variations of antenna characteristics caused by wind and climate effects, adjustment of regeneration and several auxiliary circuits was required each time the receiver was tuned to a new frequency, receiver tuning range was quite narrow, and hand capacity made them tricky to tune. John Reinartz, by then 1QP, designed a new receiver circumventing all those disadvantages that was described in the January 1921 QST. His tuner had one circuit dedicated to tuning the antenna. Another section did the actual tuning to the desired signal frequency, and a third circuit was devoted to control of regeneration. Attention to parts layout substantially reduced hand-capacity effects. After initial permanent adjustments had been made, the Reinartz Tuner permitted one-knob control for tuning – a first for receivers until then. Furthermore, the Reinartz tuner covered 200 meters to 28 meters, a previously unheard of range and far beyond the 200 meter wavelength where amateurs were permitted to operate then.

The Reinartz tuner took the radio world by storm! Correspondence flooded in to its inventor and QST, which ran a follow-up article by Reinartz two months later describing a simplified version. That and successive improvements by Reinartz prompted the editor of QST to comment, "It is impossible to keep up with this Reinartz man. Since preparing the foregoing [article] he has dropped around with another 'trigger circuit' that knocks its predecessors cold." For the next several years QST ran one or more articles every month on 1QP's tuner with praise-laden observations and suggestions from users.

Like most inventive individuals 1QP's expertise surfaced in many areas. His design for a CW transmitter with unique features was published in the June 1922 issue of QST. The following year the Technical Editor of QST, described what Reinartz called his Modulascope. In the early days of CW, transmitter output often was anything but Continuous Wave; it was more like a carrier modulated by inadequately filtered a-c riding on the transmitter plate supply. It gave a so-called CW transmitter's output a raucous, wideband signal which, on the new RST scale, returned reports of T3 (pretty bad) or worse. The Reinartz Modulascope was comprised of a pickle jar with a small Tesla coil inside that was coupled to the plate coil of a CW transmitter. A wire whisker attached to the Tesla coil whirled around in a circle, generating a circular arc discharge modulated by bright and dark spots if there was a-c on the transmitter carrier. The display could be visually observed and even photographed – a clever forerunner of the oscilloscope.

Reinartz met 8AB, a French amateur, at the 1923 ARRL national convention in Chicago. Together with ARRL Traffic Manager, 1MO the three men agreed to attempt two-way transatlantic QSOs later in the year. All three were using the latest Reinartz Tuner on 100 meters (3.0 Mc.) on the night of November 27, when they copied a long message from 8AB in Nice, France. 1MO replied first, then Reinartz using the call 1XAM. The barrier had been broken: Amateur Radio had spanned the Atlantic!

John Reinartz' most influential intellectual achievement, even more significant than his famous tuner (but inexplicably virtually unrecognized by professionals) was his explanation of the effect of the Heaviside Layer (ionosphere) on short wave radio propagation to cause what we now call "skip." His sweeping conclusions in that article were based on 5000 signal reports recorded from contacts during 1924 with five cooperating stations in Europe and 18 in the U.S. Reinartz conducted those two-way QSOs between 20- and 60-meters at various times of day and all seasons throughout 1924. His insightful explanations for short wave propagation were published in a landmark article in April 1925 QST, "The Reflection of Short Waves." That article, ladies and gentlemen, established the foundation for the DX propagation predictions we use today, and it all came from the fertile mind and experimental efforts of John Leo Reinartz.

Far more than a theoretician, Reinartz put his knowledge of propagation to practical use in 1925 when he made a schedule with 6TS in Santa Monica for a 20 meter contact at high noon. They established the first daylight amateur transcontinental QSO. He then went on to design equipment and take charge of communications onboard Lt. Cdr. Byrd's schooner Bowdoin during Byrd's first attempt to fly over the North Pole. It was the first time daily communications had been held with an Arctic station, influencing a high school kid in Cedar Rapids named Art Collins to play hooky so he could get in on the action. After the expedition Reinartz was commissioned a Lieutenant in the Naval Reserve where he did experimental work for the Navy in the next few years.

In 1933 John Reinartz joined RCA where he conducted research on radio propagation and short waves. Possibly borrowing from those experiences, he wrote an in-depth article on how to control the radiation pattern of amateur antennas, published in February 1935 QST. He was called to active duty in 1938 as a Naval Personnel Officer with the assignment to assemble a group of experienced radiomen for training and research. By Pearl Harbor he had compiled a list of 720 reserve officers and 3,500 enlisted men who were ready for Navy communications duties. He then moved on to head the Naval Research Laboratory until he was assigned to manage modification of airborne radar sets. Captain Reinartz was discharged in 1946. He returned to RCA for three years until he retired to take a new position with Eimac in California. Reinartz was manager of the Eimac Amateur Service Department, where he was the company's good will ambassador to the amateur community at the time Eimac tubes were beginning to penetrate the ham market. Reinartz was quite active in local amateur activities as a member of the Santa Cruz County ARC; his last call letters, K6BJ, now identify the club's memorial station

John L. Reinartz acquired 28 U.S. patents and earned the admiration of hams the world over. He was the first recipient of the Hiram Percy Maxim Medal in recognition of his singular achievements. The medal was presented at bedside by ARRL President Herbert Hoover, Jr. only three weeks before John Reinartz passed away on October 5, 1964.

The next time you flip-on your fancy Yaecomwood rice box, press the mike button and feel so proud of yourself when you work some exotic DX, take a moment to reflect on John Reinartz and the other innovative pioneers that came before and after him. It is their broad shoulders on which you are now privileged to stand.

A Direct-Digital VFO Kit

Into the 21st Century!

Bob Thomas, W3NE

October 27, 2012

Despite all the moaning over the demise of Heathkit, the amateur community is currently blessed with an abundance of new sources for kits that can be built into useful ham radio equipment. The abundance of QRP kits comes to mind of course, but there also is a variety of kits on the market for other gear ranging from SDRs (software-defined radios) and full-featured HF transceivers to simple operating aids. Somewhere in the middle of that pack are kits for advanced digital-based VFOs, of which one model in particular is the subject of this article.

I have a Harvey-Wells TBS-50 classic boat anchor transmitter from the '50s that needs a VFO for frequency agility on today's bands. A matching VFO made by H-W exclusively for their transmitter is occasionally available on eBay and less often at hamfests, but due to its rarity it costs as much or more than the whole transmitter! Aside from that, the matching VFO has somewhat clunky tuning and excessive drift. While contemplating what to do, I saw a DDS (Direct Digital Synthesis) VFO made by W3HWT from a kit of parts supplied by N3ZI, who is located in Las Vegas, NV.

The N3ZI Model DDS-2012 generates a pure sine wave from 100 kc. to over 30 mc. It is based on Analog Devices' AD9834 Numerically-controlled Oscillator, a 20-pin surface mount package that came already soldered to the PC board in the kit I purchased. It includes a crystal-controlled clock oscillator (80 Mc.), a D/A converter that changes digitally-generated RF to a sine wave, and eleven non-volatile memories that store discrete frequencies set by the user. An Amtel microcontroller converts input from a panel-mounted rotary encoder to a serial data stream to adjust 9834 RF output frequency. The microcontroller also selects AD9834 memories where discrete frequencies are stored, and additionally controls a 10-digit LCD readout of VFO frequency and two additional digits assigned to programming and frequency memory addresses. All of that power resides in just two chips and support circuitry on a PC board only 3" long and 1.75" wide. As Dorothy observed, "Toto, I've a feeling we're not in Kansas anymore."

Illustration 3: DDS PCB and display

User-programmable memories are accessed through Up/Down buttons. Nine of the memories can be used to store specific frequencies, such as band edges or frequently used net frequencies. One of the additional memories can be assigned to RIT or A/B VFO, activated from an external logic bus. The second special memory is for storing an IF offset that allows the DDS VFO to be used as a local oscillator of a receiver with the LCD displaying actual tuned input frequency; the VFO would then be switched between standard transmitter control to receiver tuning by the station T-R relay. If neither of those functions is required, both special memories can be devoted to additional user-selected frequencies, bringing the total of those to eleven (enough for storing a band edge of every HF amateur band). In addition to all that, the DDS VFO will generate RTTY and PSK output directly from logic levels without use of intermediate audio tones.

Precise tuning in increments as small as one cycle can be made as the rotary encoder knob is turned, so for all practical purposes, tuning is continuous but very slow! However, other tuning steps of 10, 25, 100, and 1000 cycles can be selected by simply tapping the encoder knob. Tuning rate accelerates as the tuning knob is turned so there's no problem moving rapidly from one end of a band to the other. Tuning characteristics depend a lot upon the type of rotary encoder used. The encoder supplied with the kit employs mechanical switches not known for longevity and it is limited to four steps per revolution. An alternative optical encoder is available with 64 steps per revolution for much smoother frequency control and essentially infinite life.
The DDS-2012 is not a beginner's kit. The manual provides a few suggestions for assembly sequence but there are no step-by-step instructions. Some descriptions of circuit modifications to accommodate LCD substitutions are a little vague but can be deciphered by carefully reading the

manual. The LCD supplied with the kit has a single row of twelve 0.5” characters of excellent contrast in normal viewing conditions. Alternative LCDs are offered with the kits at a modest price differential for two-line displays of smaller characters and adjustable backlight intensity and contrast. I have severely limited vision but have found the large characters on the standard LCD to be quite readable without adjustable contrast or a backlight. To illustrate how prices of this sort of item have tumbled, serial input LCD displays exactly like the one supplied in the kit are available from a domestic eBay source for less than one dollar!

Illustration 4: DDS enclosure

N3ZI supplies VFO kits in four levels of completeness to satisfy builders’ skills and facilities at prices ranging from $45 for a basic kit of parts without a PC board or LCD, $74.50 for the kit described here, and up to $84.95 for a full kit with a 2-line color display. My completed kit is housed in a Hammond 6.5”-wide sloping-panel enclosure with two pushbuttons to select frequency memory locations and a third P.B. for programming. Low- and High-Level RF Output BNC connectors are mounted on the back along with a coaxial 12V power input jack and a DB9 connector for computer programming via an RS-232 serial bus.

WA1FFL (Hagerty Radio Co.) markets a DDS VFO kit with performance somewhat better than the N3ZI product but costing almost twice as much. The improved performance might be advantageous on VHF and HF digital modes but the less expensive N3ZI product is adequate for typical operation on HF bands and meets my needs. WA1FFL also sells an excellent wideband amplifier kit to increase output level of either VFO (typically 350 mv.) to the several volts required by vintage tube transmitters, so I bought one to supplement the 3ZI VFO. Presentation of the WA1FFL amplifier kit is superior to N3DZI's VFO and if that also applies to the Hagerty VFO it would be further justification for its higher price.

DDS VFO construction has been personally very instructive and resulted in a valuable addition to the shack. It is the first major digital device I have built at home since assembling the W3QV repeater voter kit fifteen years ago, but having enjoyed making the VFO so much, it will not be my last modern kit. In addition to its intended use for driving tube transmitters, I plan to apply the VFO's capability for one-cycle resolution to measuring the Q of antenna loading coils where precision frequency control is required for coils with Q in the 300-range (a topic for another article). Once you get started, there is no end to interesting, informative and useful equipment that can be made from the wealth of kits available today. Ham radio is more than two-minute QSOs using an Asian HT through a repeater. Consider searching the internet for kits of interest that will reward you with a useful device and a better understanding of what radio is all about.

Midwest Radios

Unique radio marketing

Bob Thomas, W3NE

November 25, 2012

One of the delights of fourth grade at Brookline Elementary School in 1938 was our weekly period scheduled for browsing in the school's Library. We could read anything that appealed to our individual interests so I always headed to the magazine rack for latest editions of *Popular Mechanics* and *Popular Science.* Both 6"x9" small format magazines then had fascinating articles of real substance in contrast to superficial digests and glitzy graphics of current editions. Aside from articles on scientific and practical developments, the magazines carried fascinating advertisements on every imaginable product and service. One regular advertisement that captured the imagination of this eleven-year-old was for Midwest radios.

Midwest Radio Company was founded in Cincinnati around 1920 by E.G. Hoffman, a radio amateur who turned his hobby of designing and building radios into a thriving mail order business. Hoffman sold his early radios and a short wave converter under the *Miraco* brand name, advertising in radio enthusiasts' magazines of the day, including *QST*. As sales increased he moved production to successively larger factories (referred to as "Laboratories") eventually occupying a block-long building at 909 Broadway, Cincinnati. All major components of Midwest radios, including RF, audio and power transformers, fabricated assemblies, and wood cabinets were manufactured in-house. Sales of Midwest radios soared so that by 1938, when I became captivated by them, over 20,000 sets had been sold – all by mail order!

Several factors made Midwest radios stand apart from major brands like RCA, Philco and Zenith. Most obvious was total reliance on "Factory-to-You" mail order, which the company was quick to point out eliminated profits associated with distributors and local retail dealers. Of course the delivery cost (substantial for a 96-pound console model) was never mentioned. There were liberal payment options, a generous return policy, and one year warranty. The principle attraction of Midwest radios though, was the large number of tubes compared to major brands. American public equated a radio's performance to the number of tubes it had; "more was better." Seizing on that widely-held perception, Hoffman's 1938 radios boasted as many as twenty tubes – even more than the best communications receivers of the day! That was a good marketing ploy but it opened Midwest to accusations (all false) that some tube sockets were not wired at all, or some tubes had only their filament connected. In fact, all tubes in Midwest radios performed a function, although in many instances two tubes were used where one multiple-section tube would have been appropriate. None of that mattered though; Midwest radios sold!

High end models were loaded with features unmatched by most competitors. One was motorized tuning: the touch of a button turned on the set, a motor turned the tuning shaft to the selected station then Automatic Frequency Control ensured precise tuning. Volume expansion made loud music passages even louder compensate to compression in recordings. A "Mystic Movie Dial" (wow!) eliminated dial clutter by projecting short wave scales on the main dial only when SW had been selected. Tuned frequency was indicated by a spot of light dubbed "Travelling Coloray Bull's-Eye" (double wow!) Chassis and major components were often chrome plated. All those features were described and illustrated in the 20-page 1938 catalog that included glowing customer testimonials from common folk, dance band leaders and movie stars. One of those 20-tube marvels could be purchased in chassis form with three speakers for the price of an 8-tube table model from a conventional competitor. In addition, complete console models were offered in several styles and various tube counts at a fraction of the cost of mainstream products.

How did Hoffman do it? Mainly by direct sales. But there were other factors, not the least of which was cost cutting in cabinets that were cheaply constructed and poorly finished. Obsolete stock of last year's chassis or cabinets was often combined into special models for a sale price to clear old inventory. Another was by advertisements featuring the price of a bare chassis without tubes or cabinet as a come-on to hook potential buyers. Despite those criticisms, Midwest radios were a good fit for depression years when radio fans yearned for an impressive broadcast/short wave receiver at rock bottom price. That market was satisfied until the start of WW-II, when Midwest ceased civilian production to support the war effort.

If you were you were an Italian, German or Japanese alien at the start of the war – no matter how long you had lived here or even if you were born in the U.S. – you were out of luck with your Midwest or any make radio. The equivalent of "Homeland Security" had a blanket policy of confiscating radio receivers from those ill-fated residents whether or not their loyalty was in question. Of course the government promised to return the sets after the war but you can guess how many times that actually happened.

Midwest resumed manufacture of radios after the war but mechanical design was significantly simplified and standardized across all model lines. Nevertheless, Midwest radios had become a cut above the others with new sophisticated design, particularly in the RF section. Postwar models would have been a credit to any communications receiver in terms of component quality, circuit design, and robust mechanical construction. Emphasis on number of tubes in top models declined from twenty to sixteen, including circuits for the new FM band. Furthermore, perhaps in response to earlier criticism of inefficient tube use, the 1947 catalog contained a section illustrating each tube with a technical description of its function.

Midwest recognized the potential of the television receiver market but old habits die hard. Every one of their TV receiver chassis was combined with an elaborate BC/FM/SW receiver, making them costly at a time when public interest in short wave had waned. A basic package with receiver chassis and separate power supply, speaker and CRT in its own compact cabinet was offered in addition to complete console models in numerous configurations. Eventually the company was unable to keep pace with the introduction of color TV and rapid innovations by domestic and foreign manufacturers. Midwest Radio ceased operations in the mid-'fifties. The site of their factory became a parking lot and those enchanting advertisements became a memory.

20 TUBES!

Model No. VT-20 . . . 20-Tube Super DeLuxe Giant Chassis . . . Motorized Electric Touch-Button Tuning . . . Mystic Movie Dial . . . Traveling Coloray Bull's Eye . . . Electronic Volume Expansion . . . Automatic Frequency Control . . . Giant Theatre-Sonic Three-Speaker Combination . . . Built-in Antenna . . . 6 Bands, Range: 125 to 20,000 KC (15 to 2,400 Meters).

Only by Buying Direct from Midwest Factory Can You Match the MIRACLE Performance of this Powerful Motorized 20-Tube Automatic Radio!

30 DAYS TRIAL

A built-in electric motor speeds the dial—in a fraction of a second—to your favorite station. Touch the button of the station you desire to tune in and . . . zip! . . . the motor hums . . . the dial spins . . . then, for an instant, "hunts" back and forth, until it finds the exact center of the station and stops right on it . . . automatically!

The tubes used include: 4 R. F. Super Control Screen Grid Pentodes; 1 Multi Electrode Mixer; 4 Super Triodes; 2 Duo Diode Detectors; 1 High Gain Variable Inductance Control; 4 High Efficiency Beam Power Output Amplifiers; 1 Duplex Duo Diode Super Triode; 2 Full Wave Power Rectifiers; 1 Duplex Duo Diode Triode.

THREE SPEAKERS

THIS AUTOMATIC UNIT CAN BE EASILY MOUNTED IN YOUR PRESENT CABINET

This chassis is used in Models WW-20, XX-20, and YY-20, and measures 20″ wide, 12¾″ deep, 9¾″ high.

THE true aristocrat of the radio world, this giant motor driven chassis heralds a new radio tuning era. It offers everything obtainable on any other chassis available, today, even at twice the price, and goes so much farther in its presentation of truly automatic reception features and exclusive advantages. Conceived three years ago, and since then secretly developed, it is acknowledged by radio authorities, as being five years ahead of the rest of the world.

Order this Midwest—at its low factory-to-you price . . . and you'll own a radio that will thrill you every time you put it through its paces.

The 20-tube Midwest DeLuxe radios are equipped with Giant Trio-Sonic, Unlimited Scope, True Fidelity, Full Expression Reproducers. The Low Frequency reproducer is 12″ in diameter, is fully capable of taking the entire output of this giant radio—and is fully coordinated with the two 6″ full scope, High Fidelity Tenor Speakers. This speaker combination makes possible the achievement of a glorious new acousti-tone . . . assures real life-like crystal-clear "concert" tone realism . . . secures Full-Scope High Fidelity. While a single speaker will give very satisfactory performance, we highly recommend the use of three speakers to obtain the startling realism and vividness of tone this powerful 20-tube radio is capable of delivering.

WITH ONE 10″ SPEAKER

Note: This SPECIAL chassis, with only a 10″ speaker, does not have as fine an audio system as the Super DeLuxe chassis—nor does it incorporate as many features. Note that the SPECIAL 10″ speaker will handle only up to 16 watts of power—and cannot equal the super 25-watt performance secured with the Trio-Sonic Speaker Combination.

WITHOUT TUBES

(Order Model No. V10-20)

Consisting of SPECIAL 20-Tube Motorized Electric Touch-Button Tuning Chassis . . . and one 10″ Speaker.

YOUR CASH PRICE $49.95

Shipping Weight, 43 pounds

WITH TUBES

(Order Model No. T10-20)

Complete with SPECIAL 20-Tube Motorized Electric Touch-Button Tuning Chassis . . . 20 Tested Tubes . . . and one 10″ Speaker.

YOUR CASH PRICE $69.85

U. S. Excise Tax Paid

Shipping Weight, 44½ lbs.

WITH THREE SPEAKERS

REGULAR RETAIL VALUE $164.50

If you have room in your cabinet and want the better performance obtainable only with a finer, heavier audio system, then order this Super DeLuxe Giant Chassis. It offers many features not found in the "V10-20" chassis, and its Trio-Sonic Speaker Combination handles the full 25 watts of undistorted power.

WITHOUT TUBES

Order Model VV-20

Consisting of 20-tube Super DeLuxe Giant Chassis . . . Motorized Electric Touch-Button Tuning . . . Giant Trio-Sonic Speaker Combination (one 12″ Bass Reproducer, one 6″ Tenor Speaker, and one 6″ High Frequency Reproducer).

YOUR CASH PRICE $64.85

Shipping Weight, 52 pounds

WITH TUBES

Order Model VT-20

Complete with Super DeLuxe, Giant Chassis with Motorized Electric Touch-Button Tuning . . . 20 Laboratory Tested Tubes . . . Giant Trio-Sonic Speaker Combination (one 12″ Bass Reproducer, one 6″ Tenor Speaker, and one 6″ High Frequency Reproducer) . . . ready to place in your cabinet and play.

YOUR CASH PRICE COMPLETE $84.75

U. S. Excise Tax Paid

Shipping Weight, 53½ pounds

EASY CREDIT PRICE $94.84

$10.00 Down, $7.07 per month for 12 months

NOTE—This radio operates on 50-60 cycles AC, 100 to 125 volts, other voltages and frequencies $4.20 additional.

Julius Barnathan

A diamond in the rough

Bob Thomas, W3NE

January 3, 2013

Exactly thirty years ago this month I retired from RCA to take a job with Broadcast Operations and Engineering (BO&E) at the ABC Television Network. Julius Barnathan, known to everyone as "Julie" was President of BO&E. He was a larger-than-life dynamic man who led engineers and union operators alike with vigor, an open mind and unbounded but passionate authority. He grew up in the Bronx where his immigrant father supported the family as a street peddler and rug merchant. After serving two years in the Navy Julie attended Brooklyn College, graduated with degrees in mathematics and statistics, then went to Columbia University for an M.A. degree in statistics. He joined ABC in 1954 as a manager in audience research – not bad for a Bronx street kid, but it illustrates a native intelligence that Julies often masked with his earthy approach to business.

Julie was "stocky," not too tall but solidly built with ample girth. That lent him a formidable advantage when he wanted to impress a deeply held conviction on someone or chew-out an underperforming subordinate. He thundered toward his target, index finger punching the victim's chest, finally bumping him backward a half-step at a time with his well-developed physique as he expressed himself in explicit terminology. The encounter became known as a Full Barnathan, an event to be avoided if at all possible. By the same token, an offhand compliment from Julie could raise spirits immeasurably.

Julie retained some of the rough edges he acquired growing up. Although he understood and processed arcane technical issues, he had difficulty verbally expressing complex thoughts. His sentences often were disjointed and incomplete, but those who knew him could fill-in the missing parts to make sense of what he meant. An example of that "editing" occurred one morning when Julie called me to his office where he was explaining ABC's policies on HDTV to the head of the Canadian Broadcasting Company. After the meeting, as the Canadian and I headed toward the lobby he asked me in desperation, "What did he say in there?" I translated and he finally understood, albeit bemused by his strange encounter with J.B.

That was the man, but what did Julie accomplish? In a word: plenty. He collaborated with Roone Arledge, innovative head of ABC Sports, on enhancements to Monday Night Football and other events pioneered by ABC in the '80s. Under Julie's direction ABC engineers and contractors developed instant replay, designed miniature "Point of View" cameras for unique scenes from unlikely places like skis of downhill racers, cameras remotely controlled through RF links in NASCAR race cars, ultra-long focal length lenses that revealed details from hundreds of yards away, and Super Slow Motion true slow motion HD video recording. He pushed ABC to be one of the first networks to utilize audio and video "synchronizers" that enabled split-screen pictures of local sources alongside satellite feeds from around the world. In another vein he made ABC the first commercial network to fund and broadcast closed captions so hearing- impaired viewers could follow dialog by means of print captions at the bottom of the screen.

Julie championed start-up enterprises by young entrepreneurs. One was Abekas, founded by three bright engineers who left Ampex after their vision for advanced products were ignored. A manager and I travelled to the Bay Area to visit Abekas and learn about their new device for storing individual television frames (still pictures). Their lab was the dining room of a split-level home in a residential area! We were ushered into the dining room where they had the largest breadboard kluge I had ever seen, assembled on two circuit boards, each about 18”x 24” with haywire everywhere. Despite its appearance, they demonstrated how their device could rapidly store or retrieve a single TV frame by entering an appropriate memory address on a keypad. Video was stored in digital form on portable hard disk drives – a revolutionary concept at the time. Based on our favorable report Julie promised Abekas a substantial minimum purchase of their first production run and gave them advance funds to help get them up and running. The first units were used to record sports team members’ pictures so they could be called up later to accompany commentary; many other applications followed. The success of Abekas soared after introduction of that first product due in part to the initial boost Julie had given them.

All the networks in New York fed programs to their affiliates from Teleport, a satellite uplink facility on Staten Island. Julie was convinced that it could be accomplished more economically from our own dishes on the roof of our headquarters building at West 66th Street. First, the building structure had to be reinforced to withstand the additional weight of two stearable 11 ft. parabolas. RFI emanating from sources throughout Manhattan was a major problem finally solved by increasing the height of the parapet surrounding the roof and applying RF-absorbing tiles to its inner wall. When the job was completed we had a highly reliable means for program distribution system at far lower cost than the competition.

A few weeks before a scheduled ABC Super Bowl broadcast, Julie called some of us to his office for a presentation by a visitor claiming he had a method to make ordinary TV pictures appear in 3D. The visitor played a VHS cassette tape of several scenes to demonstrate his results. We wore glasses with gray filters of different densities for right and left eyes, but there was no other apparatus required. His demo tape had scenes with race cars, groups of men running, and various other activities all of which were portrayed with depth and in true color. He had obtained agreement from Coca Cola, principal sponsor of that years’ half-time show, to underwrite an act in 3D using his system, which he would produce using what he called “special camera techniques.” Coke would distribute the filter-glasses through retail outlets in advance and promote the show with a heavy advertising campaign. The question we had was what was his gimmick to create 3D in scenes where there was none to begin with?

The promoter refused to discuss his technique unless Julie and all the engineers present signed a non-disclosure agreement. Well! That was like waving a red flag in front of Julius Barnathan who never, ever signed a non-disclosure agreement with anyone because, as he put it, “If I give you my word and you don’t believe me, what good is my signature?” We were at a stalemate; the man packed up and left. It wasn’t the end of the affair however. ABC attorney’s consulted ophthalmologists about the effects on eyes of children if they wore the filter glasses during extended periods of play and were informed vision could be adversely affected, at least temporarily. That was enough for ABC to nix the deal (although NBC did run it at the next Super Bowl). Subsequent research revealed a well-known physiological effect causing simulation of depth when objects are moving but that is beyond the scope of this article except to say constant motion is required to prevent the quasi-3D effect from disappearing.

ABC was purchased in 1985 by Capital Cities under a deal financed with junk bonds by Warren Buffett. Our new owners were regional station operators one-fourth the size of the network. Expected mass layoffs materialized but Julie continued to be a dominant force in the company and throughout broadcasting. Trouble was inevitable, however, because Julie was a rugged frontiersman compared to the gentrified straight-laced Cap Cities executives. He didn’t fit in with their management style, and by 1990 he was forced into retirement, replaced by a clueless former news producer who only understood budgets. Julie operated as a consultant but he had been a heavy smoker and he passed after only a few years.

These recollections represent only a few of my happy associations with Julie Barnathan – a genuine diamond in the rough. Perhaps the best thing I can say about him is that I am sorry I had not joined ABC twenty years sooner!

Lincoln and the Telegraph

Technology comes to Washington

Bob Thomas, W3NE

February 12, 2013

Telegraph communication had been invented twenty years before Abraham Lincoln became President in 1861. Although immediately embraced by newspapers, financial organizations and railroads, telegraphy was relatively uncommon in most industries and essentially nonexistent in the federal government. When government officials needed to send a telegram they dispatched a messenger to a public telegraph office to wait in line with everyone else. The White House had no telegraph terminal and only one was installed, under control of the Army, in Washington. With numerous demands on the new President's attention, particularly with his political initiative to abolish slavery, there was scant time for Lincoln to be concerned with "lightening messages," as telegrams were popularly known. Within a year of onset of the Civil War, however, the critical importance of instant communication between the Union government and its field commanders was abundantly clear to President Lincoln.

The government commandeered all telegraph lines around Washington at the beginning of the war and immediately began restoring lines damaged by Cessionist sympathizers. That work largely fell to Andrew Carnegie, formerly a telegraph operator for the Pennsylvania Railroad who had risen to Pittsburgh Division Manager. He drafted some of the best telegraph operators from the PRR and they were joined by several of the railroad's upper managers to form the new Military Telegraph Corps. Carnegie led members of the Corps in repairing and erecting lines, and trained field crews who later laid new wire right into the battlefields. By the end of the war the Corps had over 15,000 miles of telegraph lines available while the Confederates, with no facilities for manufacturing battery acid and copper wire, had only 500 miles.

Lincoln immediately realized the value of the telegraph system but he used it only casually until an incident late in the first year of his presidency brought it to his attention, dramatically altering the way Union armies would be directed. The incident began at a cabinet meeting when a messenger handed General George McClellan a dispatch. The General read it, but didn't share it with the President or cabinet. Lincoln's curiosity was aroused so after the meeting he went to the Army telegraph room outside McClellan's office and asked operator Eckert if any dispatches had been arrived from the front. Eckert replied, "There are none in the file." Lincoln, still wary of what was going on went into McClellan's office where he saw a copy of the message reporting a disastrous Federal defeat and the death of a cherished friend. He stormed back to the telegraph room where Eckert admitted taking the dispatch from the file at McClellan's order and hid it in his desk drawer. He had not lied; the message was not in the file, but the affair precipitated moving the telegraph room from Army control to the War Department, where it would be close to the White House and under civilian control. After that Lincoln went to the telegraph room every day to sift through the files of all dispatches, a practice that soon gave him powerful insight to the progress of the war.

General McClellan, who was General in Chief of the Army, took 70,000 Union soldiers down the Potomac and into Virginia where they assembled with plans to attack the Confederate capital of Richmond from the south. Days turned into weeks with no action by McClellan's troops. Lincoln's first telegraphed McClellan with obtuse suggestions that he begin to advance toward Richmond. But the General replied in long rambling messages with a litany of excuses for inaction. The tone of the President's messages turned sharper, explicitly demanding that McClellan go on the offensive. The General continued to complain and stall until finally, Confederate General Robert E. Lee attacked McClellan! Even when McClellan's Union troops were victorious in the field, he would withdraw them after battles, allowing the Rebels to regroup to mount another attack. Lincoln recognized the cold fact that only way to bring the war to a conclusion war was to annihilate the enemy and it was obvious from his daily telegraph conversations with McClellan that the General was incapable of accomplishing that. He finally ordered McClellan and his troops redeployed and appointed a new General in Chief. He also telegraphed General Ulysses S. Grant to come east from the western theatre to join in the attack against Robert E. Lee and other highly competent Confederate generals.

Lincoln had a kindred spirit in Grant and, while he became even more involved in directing some Union armies, he left Grant to fight his own aggressive war. There were still some reticent generals in the field and when Lincoln's telegraphed exhortations to them went unfulfilled, he replaced them – by telegraph – with vigorous military men who could get the job done. Such hands-on command did not come without constant attention by the President, however. To achieve his purpose he spent most of every day in the telegraph room and devoted so much time there at night he had a cot installed. When he wasn't writing or reading dispatches, Lincoln frequently sought the solitude of the telegraph cipher room, where he was able to concentrate on his thoughts. The first draft of the Emancipation Proclamation was written there.

Mention of the cipher room highlights the supremacy of the North in communicating secretly. All Union strategic messages were secured by encryption based on a code book that was frequently changed so messages were kept secret from the Confederates for the entire war. The system was so ingenious some Southern newspapers resorted to publishing captured Union encrypted messages, pleading with readers to discover what they contained. By contrast Rebel encryption was weak and easily decoded. President Lincoln wrote-out all his messages by hand before they were enciphered. The National Archives subsequently recovered all his original manuscripts from Telegraph Room files and preserved them, enabling reconstruction of the President's personal direction of the war through his nearly 1000 telegrams.

The American Civil war was the first time armed forces were deployed from a central post in response to changing conditions at the front. Lincoln, sitting in Washington, could follow the progress of two Union armies, one on each of the enemy's flanks, and direct them to squeeze and split the opposition. Abraham Lincoln was in fact *the* Commander in Chief; No "Security Council," no "Situation Room," and no flock of advisors. Abraham Lincoln was totally in charge of the war through the medium of telegraph.

In a final, somber link between Abraham Lincoln and the telegraph, progress of the assassinated leader's funeral train was flashed along railroad lines to stations in cities and towns along its route from Washington to Springfield, Illinois. Mourning common folk turned out in droves on bridges, at road crossings and in fields as the train passed by to pay their last respects to the president who had led their army into a new era of command tactics and the nation to victory in the Civil War.

AUTHOR'S NOTE: A comprehensive account of Lincoln's use of telegraph in the Civil War is given in the book *Mr. Lincoln's T-Mail*, by Tom Wheeler (Harper-Collins 2006), which was the principal reference for this article.

The Raid on Bruneval ...and the rest of the story

Bob Thomas, W3NE

Reginald V. Jones was a brilliant British scientist and wartime strategist. His insightful analyses and clever application of information from decoded German Enigma messages utterly neutralized the Luftwaffe's elaborate system of radio beams that had guided Nazi bombers with deadly accuracy in early years of WW II. Following that success, Jones turned his attention to dramatic advancements in German radar. French and Belgian Resistance operatives had reported construction of large rotatable parabolic reflectors and, at great risk, provided British intelligence with sketches and even photographs of the installations. This evidence contradicted a naïve RAF supposition that those structures were nothing more than gigantic searchlights. In fact, they were steerable UHF antennas, subsequently identified as such in aerial photographs taken on RAF reconnaissance flights by skilled Spitfire pilots diving at 300 mph through intense low-level anti-aircraft fire to an altitude of only 50 feet for oblique photography.

Recognizing that the antennas were frequently located in pairs near German airfields, Jones correctly deduced that they worked together in two radar systems – one that precisely located the position of incoming British bombers, the other tracking Luftwaffe interceptors who were guided to the marauding bombers by ground-based operators using voice transmission. That degree of accuracy demanded superb aiming precision, as even minute errors of azimuth or elevation in either half of the system would result in misdirection of the interceptors.

The German code name for the radar system with a parabolic antenna was "Wurzburg." Monitoring stations in England determined the wavelength of transmissions to be 55 cm (imagine stable 545 MHz transmitters and receivers in l94l!). In contrast, the RAF used a *single* transmitter and receiver in a PPM (Pulse Position Modulation) system that displayed the target and interceptor simultaneously as pips on a circular CRT display. Thus, instabilities and orientation errors affected both targets equally, and "all" that was necessary was for the pilot of the interceptor to close the gap between the pip representing his position with that of the bomber. KISS was alive and well 60 years ago!

A Wurzburg installation of particular interest was identified in one aerial photo at the top a 100-foot chalk cliff in southern France, near the village of Bruneval. British High Command planned a daring raid on the Bruneval installation to seize the radar equipment and deliver it to England for analysis. An attack force of 120 was assembled, consisting of the King's Own Scottish Borderers and the Black Watch (both highly disciplined, rugged Scots commandos and paratroopers), a Navy security officer, and Flight Sergeant C.W.H. Cox, an RAF radar specialist who volunteered for the mission.

To minimize risk of "forceful interrogation" should any of the team be captured and identified as a specialist with knowledge of strategic information, all personnel were given temporary false Army serial numbers and Army uniforms ... all, that is, except Sgt. Cox, whose intractable RAF brass would not permit him to wear a non-RAF uniform despite inevitable tragic consequences from being singled out as a unique technical expert. No amount of logic could convince the RAF that Cox's distinctive identity would tag him as a person of special interest, placing him in grave jeopardy if caught by the Nazis during the raid. Cox was, quite literally, "a marked man."

In the afternoon of February 27, 1942, Navy evacuation ships embarked with a Marine landing party for the French coast near Bruneval. Later, in the frosty moonlight early the next morning, 10 airplanes carried the paratroopers and Cox to their drop into enemy territory. They immediately divided into three groups: one attacked the German garrison stationed nearby for defense of the Wurzburg installation; another engaged a small contingent at the radar site while Cox dismantled the equipment; and the third began a sweep to clear the beach where evacuation ships, by then waiting offshore, would land. With bullets whizzing around them, Cox and the naval officer hurriedly disconnected cables from the radar equipment mounted directly on the back of the parabola, unbolted critical equipment boxes from the antenna, then trundled their prizes down a steep slope through a foot of snow to the beach, which by then had been secured by the third arm of the force.

At the last minute, commandos who had been engaging the main German garrison in a vicious firefight initiated "a tactical advance toward the rear," joining the others in the boats – just landed at the beach – for return to England ... reluctantly leaving behind two men killed and six missing.

Although it had been planned to study the equipment in the presence of a German radar operator captured and brought back from Bruneval, it was soon learned he was a former convict who had been conscripted into the army and had little useful knowledge of the equipment itself. That was a common situation throughout German technical operations where lack of operator expertise was compensated by sophisticated (read: "complicated") equipment with minimal operational adjustments. Interestingly, from our perspective, when the top Nazi technical officer was debriefed by Allied intelligence officers after the war, he opined that German equipment had to minimize reliance on operator skill because Hitler's ban on amateur radio in years prior to the war had so withered the reservoir of technically oriented young men that equipment had to be "foolproof."

In any case, examination of the captured radar yielded a mine of crucial information for countermeasures and, quite likely, some "reverse engineering" that benefited British radar. A secondary benefit was that it gave Jones enough stature among the RAF establishment to insist on initiating use of *window* (*chaff*, in U.S. terminology). By either term, the principle was to drop millions of fine aluminum threads – each a half-wavelength long – from an airplane to create a phantom decoy that appeared on radar as an armada of bombers, causing a diversion of enemy fighter planes from real bombing missions.

"And now ...," as former ABC radio personality Paul Harvey was fond of saying,"... for the rest of the story."

The survivors of the Bruneval raid gathered for a reunion in 1947 to commemorate the 25th anniversary of their heroic operation. During the reception, Sgt. Cox chatted with one of the Scottish paratroopers. He mentioned how apprehensive he had been because of his vulnerability for being singled out if captured in his RAF uniform while everyone else was in Army dress. The ruddy Scott replied coldly, "That needn't have troubled ye, laddie. If it appeared ye were about to be captured, we all had orders to shoot you!"

And *that* is the rest of the story!

[Summarized from R.V. Jones' account in his book, *Most Secret War*, Hamish Hamilton, 1978]

Total Station Automation

The ultimate amateur radio station

Bob Thomas, W3NE

April 1, 2013

An innovative product has been announced that is destined to revolutionize amateur radio operation, especially DXing. Two hams, formerly lead researchers at Strayer University's acclaimed Department of Imitation Intelligence, issued a press release this week describing an integrated hardware/software package that will be shown publicly for the first time at the Dayton Hamvention in May. Their product has been thoroughly beta-tested and optimized over the past year at internationally known DX stations in the U.S., Finland, and Japan.

Dubbed *AutoStation*™ the package literally takes control of your station's HF transceiver, beam, and logging program. In its most elementary configuration, *AutoStation* continually scans a band (or several bands), listening for potential contacts. If desired, the beam will be rotated at five degrees per second over a selected azimuth range to ensure optimum coverage of all geographic directions. When the system detects an opportunity for initiating a QSO, receiver scanning and antenna rotation stop, the station log is checked to avoid duplicate contacts, and then the transmitter is activated in the same mode as the received signal to make an automated return call. Several user presets are available, as described later, to select preferences for prioritizing contacts and beam orientation. If contact is established, applicable information is transmitted and the contents of subsequent replies are stored in flash memory for analysis by an imitation intelligence algorithm that then synthesizes an appropriate reply for each return transmissions. At the conclusion of the QSO, log entries are recorded and a QSL card is printed and addressed.

Systems will be manufactured in modular form so the most ambitious hams will be able to simultaneously scan several of the nine available HF ham bands. Of course individual antennas are required for each band and consideration has to be given to avoidance of cross-band interference by appropriate filtering and time-sharing of reception and transmission; embedded software automatically takes care of that.

Operation of a preprogrammed *AutoStation* is initiated by pressing a single START button. In a multi-band system, a separate SDR then scans its assigned band, watching for preset criteria. Those criteria might be a prefix not yet worked or more specifically, for call signs needed to achieve worked all continents, countries, states, islands, zones or whatever other award is being sought. Furthermore, each one of those searches can be further weighted according to the station owner's priorities, such as obtaining a DXCC award or special events certificates. The system will continue to run for a preset time or indefinitely, completely unattended, while the owner sleeps, travels, or works at his job.

Effectiveness of *AutoStation* was demonstrated dramatically during beta testing in Finland by Jukka Mäkäläinen, OH4JM whose rig, running under *AutoStation* control, acquired a four-band DXCC on 40, 20, 15 and 17 meter CW in only eleven hours using the system's multiband priority mode. In that mode OH4JM's single SDR and antennas rapidly switched for a single scan of all nine HF ham bands to determine relative activity. Then the most active bands were scrutinized for unworked call signs to fulfill Jukka's DXCC criteria. The feat could have been accomplished in even less time had Jukka's station been equipped with more than one SDR. Similar beta operation in the U.S. and Japan obtained comparable results for WAS (in four hours by WF6FF on 80, 40, and 20 SSB) and WAZ (in five hours by JA7T on 40, 30, and 20 CW).

As powerful as *AutoStation* may be for control functions, the heart of the system's versatility is its multi-language voice synthesizer/translator which enables automatic worldwide phone contacts in the language of the called station! In a one-time setup routine, the operator clearly enunciates 178 training words in his native language for voice analysis. He then reads three short paragraphs in one of the twelve languages that can be displayed on a monitor to support accurate synthesis of his personal vocalization traits, word spacing and end-of-paragraph intonation. After the user's unique characteristic parameters have been stored, the program will reproduce the operator's speech with uncanny realism, totally devoid of the typical artificial "computer voice" associated with synthesizers until now. The system responds equally well for YL operators.

The speech synthesizer is essentially non-language specific, i.e., a person of any nationality may speak the training words and paragraphs in one of the supported languages, and after they have been learned by the computer, the operator's voice may later be automatically translated into any one of the other languages to reply in the language of a calling station. Logs are kept in English by default, although there is an option for six other languages and character sets if desired. Twelve available languages, implemented in software by *Rosetta Stone* on a subcontract, include English, French, Italian, German, Russian, Spanish, Japanese, Korean, Mandarin, Cantonese, Mandarin and Farsi. Any of those languages can be translated to any other by *AutoStation!* Latency (delay) in the translation process is less than 20 milliseconds. The synthesizer/translator will be marketed as a standalone product for use in conventional amateur radio applications and in international commerce.

Four CW "fists" can be preset in one of five characteristics: Perfect, Average, Extra Dots, Banana Boat Swing, and Great Lakes Swing. Transmitted CW Speed automatically mimics the contacted station or it may be preset for a CQ or other blind transmission to any speed from 5 to 65 wpm. Correct prosigns are automatically inserted and reply messages are automatically composed by a complex algorithm based on information received from the station worked. *AutoStation's* CW message synthesis is so realistic that several CW QSOs made during beta testing ran totally automated for five minutes before the operator on the other end realized there was no human operator at our key!

Only salient capabilities of *AutoStation* can be been described in the space available here. Photos of the system are not currently available because the design has not been finalized. By the time the product is released in June several refinements and over sixteen additional features will have been incorporated. Formal announcement will be by a 10-page ad campaign in the June issue of QST. It will be interesting to see how fully automated QSOs finally displace what are now very often little more than "human-automated" contacts, where exaggerated signal reports, bland chit-chat, and boring repetitions have become the mindless time killers we all tolerate.

RCA Radio Central - Part 1

World's greatest SW station
Bob Thomas, W3NE
May 5, 2013

All U.S. wireless communications were commandeered by the Navy during the First World War and when hostilities ended there was overwhelming advocacy by the Navy and certain members of Congress to maintain that exclusive control. Their reason was concern that foreign-owned companies, British in particular, would again dominate North American communications as they had prior to the war. The undersea cable from North America to Europe had been laid by a British company and English sources controlled the supply of gutta-percha, the only effective insulation material available then that could be used in a competing cable. British-held American Marconi Company had been principal supplier of marine and point-to-point communications before the war, and they were poised to assume that role again with a pending purchase of ten 200kW long wave Alexanderson alternators from General Electric.

When the possibility of a naval takeover of wireless eventually waned, Navy officials, including Assistant Secretary Franklin D. Roosevelt, influenced the president of General Electric to consider formation of a new American-controlled company that would hold patents owned by the Navy and GE, and operate new world-wide communications services. As formation of the Radio Corporation of America got under way British management and stockholders immediately recognized the futility of attempting to compete, and readily agreed to sell their patents to the RCA and allow American Marconi staff, including David Sarnoff, to operate the new company. The scope of patents held by RCA was later enlarged to encompass key holdings of Westinghouse Electric, AT&T, Western Electric and United Fruit Company.

First order of business was to establish wireless facilities for world-wide government, marine, and commercial communications. Two sites were selected for the new RCA Radio Central short wave station in open terrain at the eastern tip of Long Island, eighty miles from Manhattan. A receiving site was established at Riverhead, while transmitters were located 16 miles to the east at Rocky Point. Separation of the two sites was sufficient to permit simultaneous transmission and reception without interference. We will begin with a description of the Rocky Point installation; Riverhead reception facilities will be described Part 2 of this article.

The Rocky Point transmission facility of Radio Central was situated on 6,400 acres of a former farm. It was initially planned to erect twelve antennas, each 1.5 miles long(!) spaced radially at 30 degree intervals, like spokes in a wheel, for transmissions in any direction. The reason for the extraordinary length was that wireless communications at that time were conducted at very low frequencies, typically 15 to 22 *kilocycles* (~1500 meters), necessitating comparably long aerials. Each antenna would be driven by a 200 kW Alexanderson Alternator, a rotary a-c generator with 600 poles to produce very low frequency RF by the most efficient method known at that time.[1] The possibility of DX propagation by reflection from the ionosphere back to earth still had not been recognized. It would be largely left to amateurs to discover that bonanza by 1923 after "banishment" by our government to wavelengths shorter than 200 meters (1500 kc and higher).

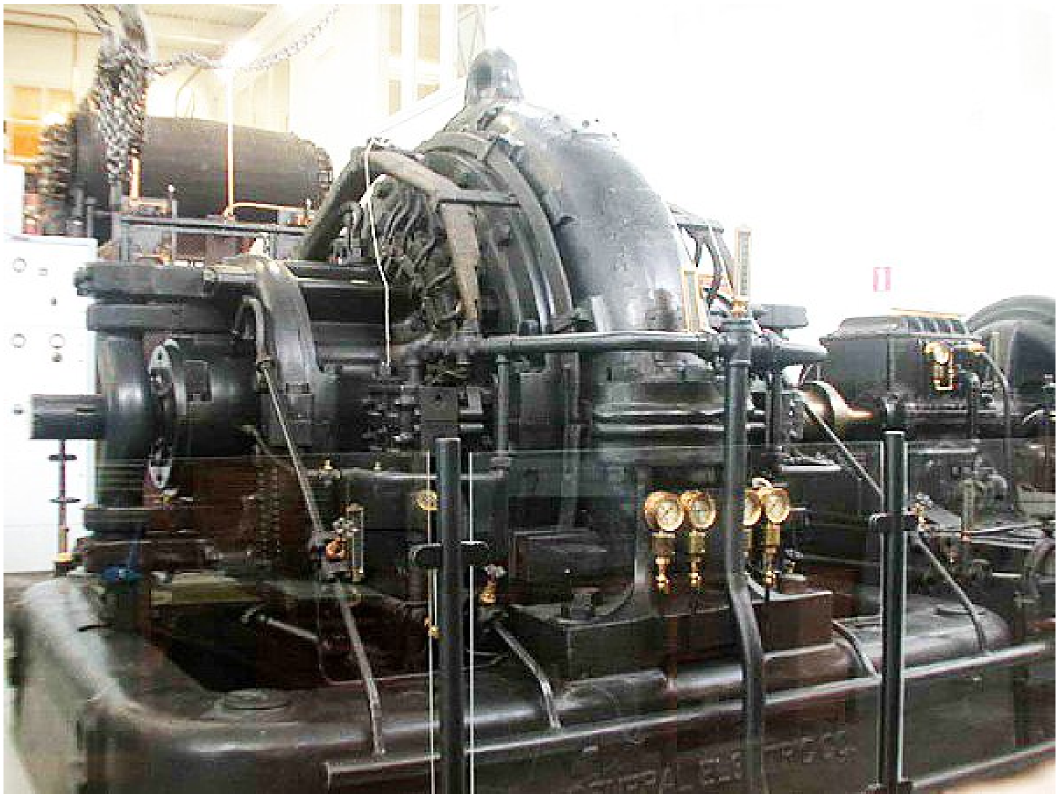


Illustration 5: Alexanderson Alternator at SAQ

Taking a conservative approach, only two of the twelve planned antennas were initially erected. The antennas were massive affairs. Each one used sixteen silicon-bronze wire conductors suspended from 150-foot cross arms on top of twelve towers 410 feet high. Towers were spaced 1260 feet apart for an effective radiator length of 4224 meters, about three wavelengths. Large air core inductors under the first six towers supplied uniform drive along the radiators for what was known as a "multiple-tuned" antenna. As we all know, "a good ground is important," thus a ground system for each antenna was made of 225 *miles* of buried copper wire!

First transmissions from WQK and WQL at Rocky Point were made in October 1921 with Morse code at 200 words per minute (faster than even W3RM can copy) from punched tape readers in the RCA traffic center at 64 Broad Street, New York. Transmissions were also made in Morse by hand keys and later teletype messages were sent with carrier On/Off for Mark/Space and subsequently for experimental purposes by FSK, with the Mark frequency transmitted by Rocky Point and Space frequency from RCA at Tuckahoe, N.J. – what a lash-up that must have been!

The conservative decision by RCA management to initially build only two of the planned twelve long wave antennas paid off almost immediately. In 1922, just months after Radio Central went into operation, radio amateurs and scientists were at the threshold of discovering high frequency radio waves are reflected back to earth by the ionosphere. Hams suddenly began making DX QSOs on 20 meters with comparatively low power that required 200 kW on low frequencies. That period also coincided with development of transmitting-type vacuum tubes capable of generating considerable power output.

RCA transmitter engineers soon produced designs for two similar transmitters: one was rated for 40 kW input of 6.6-10 Mc. the other with 20 kW on 10-21 Mc.[2] The final amplifier used four water-cooled 207s in push-pull parallel with 10 kV plate voltage at low frequencies or 7.5 kV at the high end. The finals were driven by an exciter with temperature-controlled crystal oscillators on 1.5 to 3 Mc., depending on day or nighttime operation, followed by multipliers and buffers driving two 861s in push-pull. Over thirty of those transmitters were eventually in operation at Rocky Point, so business must have been pretty good.

Keying of the exciter was unconventional, to say the least. Plate voltage of the 861 first doubler was fed through a dropping resistor – obviously one capable of very high dissipation. The plates of two parallel-connected 211 keying tubes were also connected to the dropping resistor so on key-down, doubler plate voltage was shunted to ground through the 211s, interrupting RF drive. Strange as that scheme seems, it was found to be the most effective for keying up to 400 wpm. Subsequent transmitters were operated at frequencies up 32 Mc. Self-contained roll-around Heising amplitude modulators with 849 output tubes could be plugged into any transmitter when AM was required. Transmission to England by SSB was conducted in January 1923, and VHF experimental transmitters and antennas were designed and operated for investigations of FM and television. RCA Communications' Radio Central operated over forty short wave transmitters to handle the volume of traffic originating and passing through Rocky Point.

HF antenna systems consisted of long wire directional arrays, e.g., Rhombics, and complex horizontal and vertical broadside arrays, all of them a maze of radiators, guys and support poles, and were widely separated to avoid interaction. An elaborate switching system used parallel lines made of ¼" copper wire, often longer than a half-mile, to enable connection of any transmitter to any antenna.

During WW-II Rocky Point facilities supported the armed forces and in post war years the Voice of America. However, the world of communications was changing rapidly, and it was no favor to Rocky Point that RCA Americom was formed as a vigorous competitor in the satellite industry. The last of the original 410-foot towers had been taken down at the end of 1977 and Rocky Point was closed a year later. The land was sold for one silver dollar to the State of New York for conservation as the Rocky Point Natural Management Area.

Parallel development of the Radio Central Riverhead receiving station will be described next month in Part-2 of this article, which will also be my final regular article for the *Blurb*.

NOTES

[1] Swedish scientist Ernst Alexanderson invented an alternator in 1904 capable of generating high power alternating current at frequencies as high as 100 kc. The alternator employs a thin laminated iron rotor with slots in its periphery to create rotating poles. That slotted rotor passes between 600 fixed poles of an iron stator wound with two coils. A d-c field current is passed through one of the stator coils. A voltage is induced in the other stator coil as rotor slots alternately interrupt the magnetic flux from the field. Alexanderson alternators had a long life; several were moved by the Navy to the Pacific theatre of WW-II and one was in service by the U.S. Air Force until 1951. The last one in operation was at SAQ in Sweden until 1996, when it was removed from service and preserved for periodic demonstrations. An SAQ demo held last July can be seen on YouTube at: http://www.youtube.com/watch?v=neJeIxaMqF0

[2] "QST Visit Riverhead and Rocky Point" *QST.* 9/40, pp 8-14

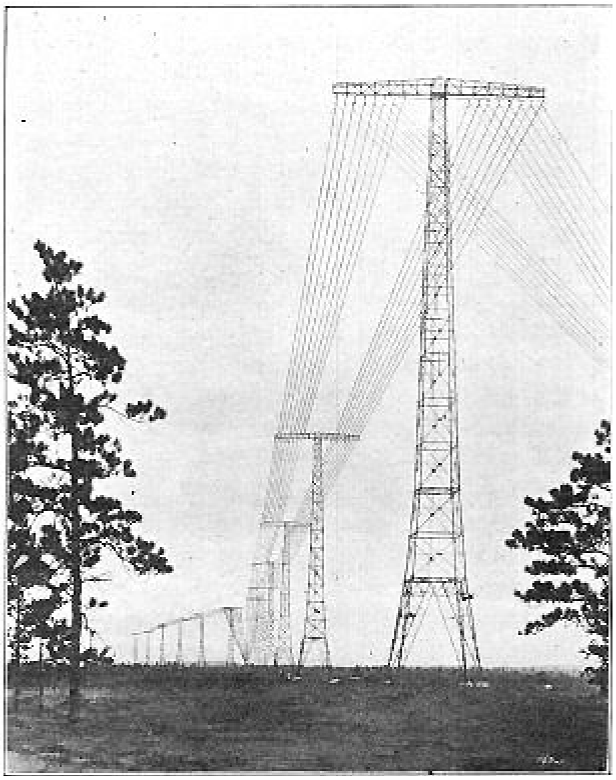


Illustration 6: Rocky Point VLF Antenna

Illustration 7: Rocky Point Postcard

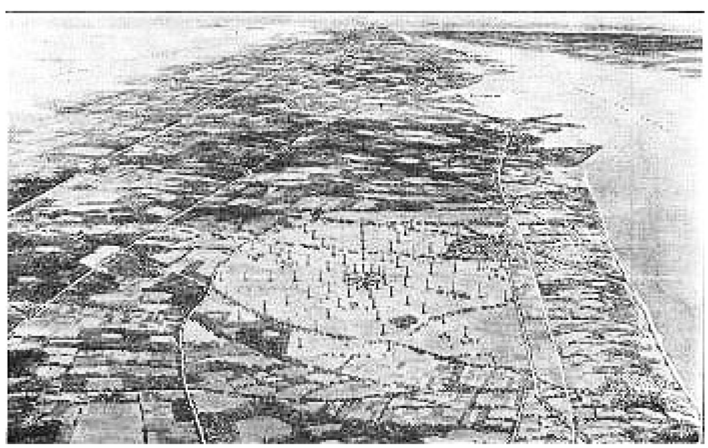


Illustration 8: Aerial View of Rocky Point, L.I.

RCA Radio Central –Part 2

World’s greatest SW station

Bob Thomas, W3NE

May 22, 2013

The first part this article described facilities established by RCA Communications for their new Radio Central transmission station on the north shore of Long Island at Rocky Point. A complementary receiving station and research laboratory were constructed in pine barrens sixteen miles to the southeast at Riverhead. The first Riverhead “laboratory” was, in fact, nothing more than a tent used during the autumn of 1919 by Philip Carter and Dr. Harold. H. Beverage, 2BML, as their headquarters for investigations of radio reception. Carter was a mathematician and antenna expert, and Beverage had developed a highly successful long wave directional receiving antenna – still widely used today – that bears his name.[1]

Those were indeed days of the radio pioneer. Beverage and Carter went about constructing the first receiving antenna for Radio Central by laying down a wire, right on the ground, along a sand road for several *miles* from Riverhead in a northeast direction toward Europe. A terminating resistor was connected to a good ground near a river at the east end of the wire, forming what Beverage termed his “wave” antenna. It proved successful so they erected a more permanent wave antenna at a height of 30 feet on utility poles. The principle of operation of his antenna is explained by Beverage in his own inimitable words as follows: [2]

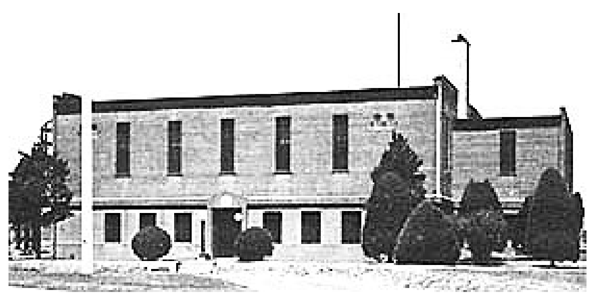


Illustration 9: Riverhead Main Building

“The wave drags its feet [due to high ground losses] it tips over a little bit and that tipping over means there’s a little component that will induce a voltage in the wire. As the signal travels along at the velocity of light it induces a little signal that keeps building up and building up until at the far end it’s quite strong. As a matter of fact if you wanted to receive a signal as strong as you got with the wave antenna, you would have to put up a tower at least 1000 feet high. . . . To prevent reflection, to make it unidirectional, because losses are low on the wire on the pole, you place a damping resistance at the end nearest the transmitting station. That stops the reflection just like the high velocities did on the wire on the ground. The beauty of the wave antenna is that it is not tuned to anything periodic and it receives a wide band of wavelengths equally well.”

Riverside went into operation with long wave reception just as the superiority of shortwave propagation was being recognized, so most overseas traffic initially was still on long waves at about 20 kc. Two Beverage antennas were used, each 9 miles long, spaced 5 miles (about $\lambda/2$) apart. The wires were terminated at the far end to make them unidirectional and a phasing network at the receiving end of one wire enabled electrically steering their combined directive patterns. Sixteen LF receivers were eventually connected to the combined Beverage array, each tuned to a different incoming signal. Rather than single-knob gang tuning, those receivers had three stages of individually-tuned RF amplifiers; however, since most long wave circuits seldom changed, retuning was not required very often. Amplified RF was rectified to drive pen recorders at the control center in Manhattan for CW above 30 wpm. A heterodyne detector generated tone output for copy by operators at lower speeds or when there was severe QRN.

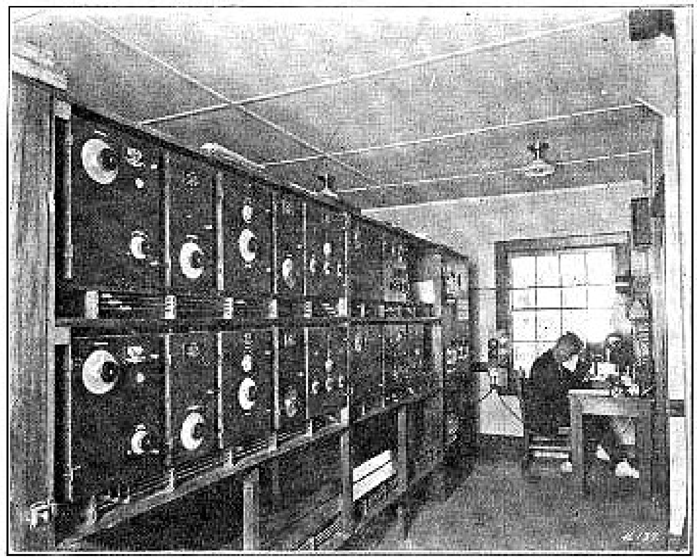


Illustration 10: Receivers at Riverhead

Conversion of Radio Central transmitting and receiving facilities got underway immediately after the DX advantages of high frequency radio (above 1500 kc.) were verified. However, a serious problem with HF reception, not encountered at long wavelengths, is fading. It is caused by changes in the ionosphere that rapidly shift the arrival time of the sky wave at a receive antenna. Experiments by Dr. Beverage and H.O. Peterson were made with simultaneous observations of the same signal received at locations three miles apart. They found that entirely different distortions due to fading occurred at the two places. They later discovered that separate receivers connected to two antennas as close as 300 feet produced vastly different output distortion during fades. That led them to invention of *diversity reception.*[3]

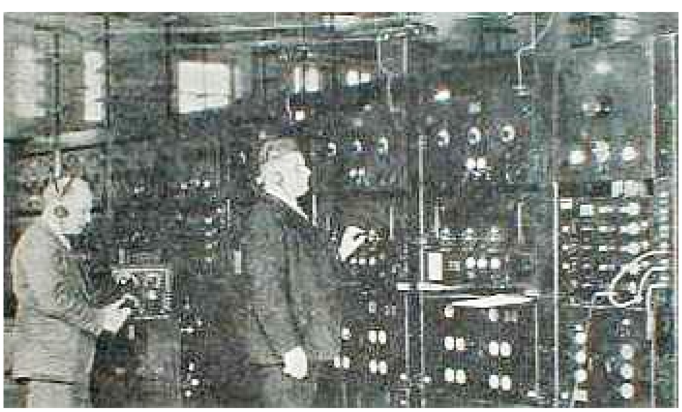


Illustration 11: Peterson & Beverage Diversity Receivers

A typical space diversity receiving system at Riverhead consisted of three widely separated antennas each feeding it's a separate receiver. Receiver outputs were combined to produce a signal that was essentially free of fading artifacts. The antennas were variations of the original Beverage but known as "fishbone" antennas because they had loosely-coupled right angle extensions placed at intervals along the main wires. The space diversity antennas had a bandwidth with a 2:1 frequency range, so several receivers tuned to different frequencies could be fed by one antenna system. Numerous sets of diversity antennas were individually aligned in the direction of transmissions from around the world.

HF receivers covered from 3 to 24 Mc. in three bands. They were superhets with a 300 kc. first IF and 50 kc. second IF. Bandwidth was selectable from 1 to 10 kc., depending on type of service. Instead of a BFO for CW detection, the 50 kc. second IF was rectified and used to drive a pen recorder or Wheatstone perforator for high speed CW or to key an audio oscillator for manual copy below 30 wpm. Keyed tones were sent by telephone line to the New York Control Center where operators heard pure tones completely devoid of noise, QRM and amplitude fluctuations for solid copy. A 1940 ARRL visitor described the effect as sounding, “just like a code practice oscillator.” By the late 1920s RCA had installed 41 of these triple-diversity receivers for reception from 26 different countries. An interesting sidelight is that all the receivers at Riverhead were powered from a massive bank of storage batteries to ensure reliability independent of public utility failure. Total d-c load current was over 1000 Amperes!

Introduction of diversity reception yielded enormous improvements in quality and reliability of short wave AM broadcasts. By the late 1940s RCA Communications had regular short wave circuits to over forty countries. Services included program relays, ship-to-shore messages, commercial traffic, press reports, RTTY and facsimile transmission and reception of photographs and documents. Domination of marine communications had been assured when David Sarnoff, through his earlier personal association shipboard operators, flipped 900 ship owners from competitive services to RCA. An agreement between RCA and Western Union extended the range of domestic telegrams originating at local telegraph offices to world-wide destinations. A frequency-measuring service was available to broadcasters and scientific labs. Radio Central laboratories were deeply involved with investigations of VHF, UHF, and microwave propagation, antennas, and relay equipment. Lessons learned at the two Long Island facilities were forwarded to the other RCA Communications centers at Point Reyes, CA and Koko Head Hawaii.

Radio Central facilities were devoted exclusively to military and government communications and strategic research during WW-II. Commercial operations resumed immediately after the war and the Riverhead laboratory continued its pre-war development programs, particularly those associated with TTY multiplexing, SSB, and TV relay systems. But earthbound communications were becoming obsolete as geostationary satellite technology developed. As put so poignantly by Bob McGraw, W2LYH, a Riverhead technician, “Like blacksmiths watching the first automobiles coming down the road, we knew the end was near every time a few more of our circuits got transferred to satellites.”

The last Station Manager at Riverhead was Marshall Etter, W2ER, who had worked alongside Harold Beverage after joining RCA in 1937. It was left to Marshall to literally turn off the light and shut the door for the last time at the historic receiving site. He and a few remaining Riverside personnel transferred to the Rocky Point transmitting station which itself was closed in 1977, ending 56 years of excellence in commercial radio communications. Marshall saved many records and historic relics. Fortunately, he attended annual Antique Wireless Association conference/flea markets for many years where it was always a treat to listen to the tales of a ham who had been intimately involved with RCA Radio Central.

REFERENCES:
[1] U.S. Patent 1,381,089 (H.H. Beverage)
Radio Receiving System
[2] Interview with Dr. Harold H. Beverage
http://www.qsl.net/aa3px/1968.html
[3] U.S. Patent 1,874,866 (Beverage/Peterson)
Method for Eliminating Fading

This marks the 57th article in the monthly series published by the *Blurb* in the last five years. The time has come for a break so, in keeping with last month's concluding comment, I am going to sign-off for a while. I hope the articles have been as interesting for readers as they were a stimulating exercise for me!

I cannot close without expressing my deep appreciation for Editor Rick who formatted the manuscripts and illustrations so skillfully. This is not my total retirement – just a vacation. "I'll be bock."
73, NE

The RCA Factory

It wasn't pretty!

Bob Thomas, W3NE

The factory where RCA manufactured and tested television studio equipment evolved from 1930-era mass production of home radio sets. Unfortunately, most of the primitive methods and attitudes of those ancient days were inherited along with the factory floor space. Production and test facilities for broadcast equipment were adjacent to each other on 17-2, RCA jargon for second floor of Building 17. That venerable building, with a tall tower topped by an illuminated stained glass tableau of Nipper in the iconic "His Master's Voice," is one of the few RCA buildings still standing in Camden. It was converted several years ago to residential lofts by developer Carl Dranoff.

Most television studio equipment was constructed on steel "bathtub" chassis like the one in the illustration. They were horizontal frames in the shape of a shallow **U**, with tubes plugged into the open front of the **U**, and circuit components on the back. Chassis were 19" wide and made in multiples of $1^3/_4$" high, with slots for mounting screws to match tapped holes in racks regardless of where the chassis was positioned. A rack full of chassis had a well-ventilated neat appearance in the front, where tubes, controls and test points were accessible. Components and terminal boards were exposed for service at the rear.

Production started by mounting all mechanical parts on the front of the chassis and terminal boards and connectors on the rear. This work was divided into small stages, each described in detailed assembly instructions that specified type of hardware and orientation of every component. Women completed an individual assembly stage then passed the chassis to the next operator. Each small assembly stage took about the same time to accomplish to maintain a smooth flow. Chassis with completed mechanical assemblies were transferred to another area for wiring with pre-cut and stripped wires or cables, and addition of small components. This was also divided into small stages with explicit instructions for each.

The RCA wiring production line was an appalling eye-opener for anyone with “normal” experience building electronic equipment. All soldering was done with 100-Watt American Beauty irons operating on 220 Volts! The high line voltage was necessary because of the load from so many soldering irons in one place, but maybe it wasn’t exciting when there was a short in an iron or its cord! Even more stunning to the uninitiated was the way the ladies had been trained to hold their soldering iron: with the hand and fingers wrapped around the handle and forearm raised as if intending to stab someone in the back! How they were able to obtain precise control of the iron’s tip with that illogical grip was beyond me, but they all did it and their work was not too bad in spite of the awkward appearance.

Completed chassis were sent to Quality Control for mechanical inspection prior to electrical test. An inspector examined each soldered joint individually, and if it was sound, a dab of red paint was applied to verify the joint was made correctly. Well and good, but boredom apparently took its toll so it was embarrassing, to say the least, to receive a phone call from an irate Chief Engineer complaining that his brand new RCA product was inoperative because of an intermittent joint with no solder, but held together with red inspection paint. All you could do in those situations was take a deep breath, swallow and punt.

Chassis that passed mechanical inspection were sent to another area for electrical performance testing. Each test position was equipped with a custom fixture to hold the product, and all the test equipment needed to verify its operation in conformance with a step-by-step test procedure. That document, prepared in consultation with the design engineer, ranged in length from two to a hundred pages, depending on the product’s complexity. Each test in the procedure had space for recording actual measurement results for the unit under evaluation; nevertheless, customers received units that obviously had not passed certain tests. As with assembly slipups, stifling work rules and indifferent attitudes of factory management made it impossible to eliminate those self-destructive lapses in quality.
Tom McIntyre was supervisor of the electrical test department. He worked under the Camden Plant Production Manager A. L. Malcarney who, to be charitable, had difficulty with anger management. A Management-by-Fear philosophy pervaded the entire factory so each supervisor acted, not in the best interest interests of the Corporation, but to protect his job, which could be terminated in an instant by the volatile Production Manager. Today we call it PYA. To survive in that that atmosphere, Tom prioritized everything that went on in the Test Department on the basis of two numbers: his mandated monthly production quota and the date of last day in the month. As his production goals converged with that fateful last day, relations became very tense on the test floor; it was not a good time for an engineer to be in the area investigating performance problems. Even at other times, presence of an engineer spelled interruption to Tom, We were barely tolerated when a performance issue required our help, but we were never accepted gladly, especially in the dreaded last week of the month.

That all changed for me by a peculiar circumstance. One afternoon while going over some results with a Test Technician, Tom took me aside to say he needed a favor. It seems he was unable to meet his production quota the previous month for an audio/video switcher I had designed. To avoid the wrath of the tyrannical Malcarney Tom had resorted to a desperate ruse. He delivered the correct number of shipping cartons to Inventory to satisfy his production quota, but some were empty because their "phantom" switchers had not yet passed through final test. The paperwork looked good, but now he had to retrieve the cartons from Inventory so the empty ones could be properly filled with switchers that had, by then, been completed. Tom asked me to write a change order that would require returning the entire production run from Inventory for installation of "official" revisions. He was basically a good guy so I went along with him, and wrote an Engineering Change Notice to unnecessarily increase the power rating of one resistor from ½-watt to 1-watt. That was risky for me because costs to move, unpack, revise, and re-pack all the switchers would be charged to Engineering. Fortunately nobody noticed, Tom was off the hook, and I had a new friend in the factory! After that episode my projects always got the best test technicians and work rules that might have caused friction with the union mysteriously vanished.

RCA was selling our new solid state video tape recorder in large numbers during the '60s. One afternoon I made a routine visit to the Test Room when, to my surprise, I spotted fellow Phil-Monter Roland Madera, W3PWG, wearing his trademark wide suspenders. Rollie had just been hired to take up slack in final testing of the machines. He had only recently joined Phil-Mont so I didn't know him very well at first but over the next several weeks we always took a few moments to chat whenever I was in the area. A month or so later Rollie was nowhere to be seen. There had been a layoff that affected Rollie because of his low seniority. He was back again several months later when he told me finding a job in the interim had been difficult because prospective employers were reluctant to hire victims of RCA layoffs who usually would return to higher wages at RCA when hiring picked up again. He was laid off a second time, opted for longevity and stability in his new job, and never returned to RCA.

Old bad habits and intractable management – in Engineering and Marketing as well as Production – eventually took their toll. The Broadcast Division could no longer compete against the superior quality and advanced design of products from forward-looking domestic companies and Japan. I took early retirement and started a new job with ABC at the beginning of 1983. Shortly afterward, in a last-gasp effort, RCA Broadcast moved from Camden to a new facility in Deptford that extended the life of the division for a few months, but it was too late. Within several months the end of a long and honorable contribution to broadcast technology came to a sudden end when RCA was purchased by General Electric and the French firm Thomson CSF. Stanford University temporarily acquired the Princeton Laboratories. RCA ceased to exists except as a Trademark.

In the Beginning . . .

Georg Simon Ohm

Bob Thomas, W3NE

The Ohm family of Erlangen, Germany, was quite unlike families of today, and even in their own time for that matter. The father was a locksmith, but despite that rather ordinary occupation and with no formal education whatever, he had such a thirst for knowledge that he educated himself to a remarkably high level. When his sons, Georg and Martin reached an appropriate age he taught them advanced mathematics, physics, chemistry and philosophy well beyond the level they might have learned at a typical school of the day.

In 1805, when he was eleven, Georg was reluctantly enrolled with his brother in the Erlangen Gymnasium for additional education. That turned out to be a disastrous, frustrating experience because "teaching" was by rote and by simply subjecting students to numbing, uninspiring books they were expected to interpret themselves. George eventually escaped that stultifying environment to enroll at the University of Erlangen where he overcompensated into a life of partying and good times. It didn't take long for his father to yank him out of there and send him to Switzerland, where worked as a mathematics teacher and later a private tutor. Ohm then returned to Erlangen where he received a doctorate in mathematics and became a lecturer. Prospects were limited at Erlangen and his salary was only sufficient to support a pauper's existence, so Ohm left and taught at various low quality state-run schools until he finally secured a decent position as lecturer at the Jesuit Gymnasium in Cologne in 1817. That was when he really began to flourish.

Georg Ohm published his mathematical discoveries that defined the precise relationships of voltage, current and resistance in an electric circuit, known today as *Ohm's Law,* in his 1827 book, *Die galvanische Kette: mathematisch bearbeitet* (The Galvanic Circuit Investigated Mathematically). It was the first example of *circuit analysis* – the mainstay of modern electronic equipment design. Ohm's monumental work, surprisingly, was universally dismissed by the German scientific establishment which, contrary to what you might think today, discounted the value of theoretical analyses in favor of practical laboratory experimentation. On the other hand, there had been no success among scientists using laboratory experimentation to correlate the relationships that exist between voltage applied to a resistive circuit, current flowing in the circuit, and resistance in the circuit. Results varied from lab to lab and many researchers could not even duplicate their own measurements! Therefore no one, except Ohm, who had proved them mathematically with his circuit analysis, was able to precisely define conditions in an electric circuit.

Ohm was able to have his own laboratory at Cologne but before beginning his lab tests in support of his calculations, he analyzed procedures that had been used by others in their failed attempts to achieve meaningful results. One-by-one he identified each of the careless methods used by experimental physicists in their vaunted laboratories. First, he recognized that one of the largest uncontrolled variables was the change in voltage applied to a resistive load when the resistance was varied. It previously had been improperly accounted for by many laboratory investigators and was completely ignored by others. Ohm understood the reason for the effect; it was the first time anyone had identified what is known today as the *internal resistance* of a voltage source. To eliminate the variability of applied voltage from batteries in his experiments, the resourceful Ohm employed heated thermocouples, which exhibit essentially zero internal resistance, to generate a constant voltage unaffected by variations in load current.

Another variable that had been unaccounted for or ignored in earlier experiments was presence in the circuit of a galvanometer used to measure voltage or current. Consisting basically of a compass inside a coil of wire, a galvanometer was the only instrument available in that era capable of measuring current. They were usually custom made by the experimenter or an assistant, each was different from the others, but worst of all the effect of their resistance in the circuit they were measuring was often ignored. Ohm was meticulous in the way he used galvanometers to ensure the effects on measurements by their presence were either eliminated or properly accounted for.

Laboratory experimenters often had to make their own wire conductors in short lengths as a second thought to the main objective of conducting an experiment. That resulted in reliance on conductors with uncontrolled variations in cross-section and possibly made of material with unknown resistance, both of which contributed to uncertainty in measurements. Ohm carefully made his wire of silver strips with constant cross-section and in lengths sufficient to obviate need for joints except at reliable terminals. His laboratory measurements were highly accurate and proved beyond doubt that his calculations were correct**:** In an electric circuit with a direct (d-c) voltage source and resistance, current is directly proportional to applied voltage and inversely proportional to the circuit resistance, expressed mathematically as, **I≈E/R**. After defined units were adopted that proportionality was subsequently changed to the now familiar **I=E/R**.

Unfortunately, Georg Ohm was an unhappy man for much of his life. None of his teaching jobs were particularly fulfilling, many were plain drudgery at low quality schools, and he was so underpaid at some colleges he often lived in poverty. He was an inward-looking person who never married or made many friends. Several influential German scientists at high levels blocked his advancement and downgraded his achievements causing them to be largely ignored within Germany. It was not until 1841, that the genius of this man was internationally recognized with award of the Copley medal by the prestigious Royal Society – *of England, yet!* It took another four years before he finally acquired the stature he deserved in his own country, when he was finally made a full member of the Bavarian Academy. He received an even higher honor in 1852 with appointment as Experimental Professor of Physics at Munich University, just two years before his death.

Any Port in a Storm – Part 1

It was El-Tronics . . . and just in time!
Bob Thomas, W3NE

This is another chapter in the saga of my working years. There was a temporary decline in employment opportunities for new electrical engineers in May of 1950. About a third of my Drexel Electrical Engineering class, including me, had no job prospects when we graduated. It was a time for downward adjustment of career aspirations and salary expectations! Philco, RCA and other large electronics companies had signed-up all the new engineers they needed six months earlier. I had an opportunity to return to Shallcross, manufacturer of precision instruments, where I had worked as a co-op student, but it was a family-owned and operated firm with no prospect whatever for significant advancement by an outsider. A last ditch possibility was to apply for a job at El-Tronics, a small manufacturing operation that grew out of the former Manufacturing Division of the Herbach and Rademan radio store where I had worked part-time while in high school during the war.

H&R had to vacate its original Market Street site to make room for Federal development of the new Independence Mall. The retail store was relocated to 1204 Arch Street in the new "Radio Row" of Philadelphia but the manufacturing division of H&R, which had occupied the second floor at the old Market Street address, did not follow. That enterprise, including equipment and most personnel, was acquired by the Ellis Company, prominent in the automatic garage door market and still in business at 7456 Limekiln Pike. Mr. Ellis called his new electronics sideline *El-Tronics* (get it???!). He established his newly acquired custom electronics development and manufacturing job shop in a disused factory building at 2647 North Howard Street, just below Lehigh Avenue in Kensington. Jack Wagenseller, W3GS, former SCM for the ARRL EPa Section and Chief Engineer at H&R, headed the new El-Tronics business on Howard Street, where he had the same title.

Concurrently with acquisition of H&R Manufacturing, a lucrative opportunity opened for El-Tronics in addressing the burgeoning market for Geiger-Muller and scintillation radiation detectors. It was the beginning of the craze for wildcat uranium prospecting throughout the West. Casual tourists in western states regularly saw hopeful prospectors, Geiger counter in hand, crawling over baron mountainsides in search of uranium deposits during the U.S. build-up of nuclear armament prior to the Cold War. El-Tronics marketed a full line of prospecting and research instruments for which demand was so high that the mighty Sears Roebuck sold them under their *Tower* brand name. Those high volume products, however, were made at a facility completely independent of the Howard Street operation. That was the situation with the company when I swallowed hard and called Jack Wagenseller to ask for a job

I must have hit Jack at a fortuitous moment; he invited me to visit the El-Tronics facilities and talk employment. The next day I got off the El at the Huntingdon Station and took the pleasant seven block walk to 2647 N. Howard. We chatted for a while then Jack took me around the single-floor facility, introducing various technicians and engineers along the way. Some of the projects in progress were a developmental set-up to measure the velocity of projectiles under a contract from Aberdeen Proving Grounds; Marty Brownstein was designing a low cost triggered-sweep wideband oscilloscope intended to compete with Tektronix; and a pulse counter for a

CAA contract was in the breadboard stage. When we were done I felt comfortable with the prospect of working there and accepted Jack's offer for a job at $55 a week.

When I reported for work the following Monday I was assigned to assist another engineer who was designing the pulse counter for the CAA (Civil Aeronautics Authority), predecessor to today's FAA. A new navigation system for radiolocation of aircraft, known as Distance Measuring Equipment (DME) had just been put into service by the CAA and the pulse counter was required for maintenance of ground-based stations. The counter had a range (by fading memory) of 20 Hz to 20 kHz, selectable in three ranges. That would not ordinarily pose a problem for a conventional frequency counter with pulses occurring at a uniform rate. However, the CAA instrument had to count pulses that occurred in pairs of two pulses separated by only 4 microseconds. The task is particularly difficult to accomplish when the rate of *pulse pairs* is very low. For example at 20 pulses per second, spacing between pulse pairs is 100,000 µsec, but the CAA instrument had to recognize *pairs* of pulses not only coming at that low rate but still counting each individual pulse separated from another by only 4 µsec.

It was in vacuum tube days, and processing pulses with those characteristics was at the limit of technology. Nevertheless, the El-Tronics engineer, Conrad somebody, approached the problem by first designing a test generator to produce pulse pairs over the required frequency range. After that he was well on the way to completion of a breadboard model for the counter that fulfilled performance requirements of the final product. It had been a taxing assignment for high-strung Conrad. He continuously complained about how challenging it was and that he was the only one in the company who fully realized the difficulty of the task. The mounting stress became too much for him and Conrad suddenly resigned after ironically completing most of the hard work, leaving me responsible for completion of the CAA contract.

It took a couple of weeks to iron out the remaining bugs then, with a leap of faith, I made the final product layout for a 7" rack-mounted unit. A common method of construction of rack equipment at that time was for components to be wired by their leads between turret terminals on a circuit board with connections from those terminals by short leads to associated tube sockets, which were mounted separately on a sheet metal chassis. Sketches for terminal boards, component silk screen identification, chassis and panel, were turned over to our machine shop. Everything was completed in a short time so I was able to stake terminals on the component board; then assemble and wire a prototype model. After the prototype was checked out and working properly on the bench it was time for testing in an environmental chamber over the brutal range of temperature and humidity specified by CAA.

Our contract required the counter to meet performance specifications over an ambient temperature range of -20˚C to +50˚C with 95% relative humidity at the high temperature. Testing had to begin at the low temperature. After -20˚C (-4˚F) was reached the counter was required to "soak" with power off for two hours, then meet all specs within two minutes after application of power. Yippee! It passed. Now for the hard part: With power off, the ambient temperature had to be rapidly increased to +50˚C (122˚F) and relative humidity increased to 95%. Power was required to be turned on again and testing resumed two minutes after reaching +50˚C. Do you have any idea what happens when a cold object is suddenly exposed to hot, humid air? There is water covering everything because the vapor in hot, moist air condenses on all the still-cold surfaces. I had to get special permission from the CAA to open the chamber door to wipe he meter glass clear of dripping water so readings could be made! Even in those hostile conditions the counter performed within spec except on the lowest range, where pulse-rate readings were low.

I eventually traced the cause of the measurement anomaly to a vacuum tube voltmeter circuit that measured the charge on a capacitor that should have been proportional to the number of pulses per second. The VTVM tube was a nine-pin miniature type and moisture was evidently causing leakage between its pins to partially discharge the capacitor between incoming pulse pairs at low duty cycles. Long story short, I changed the tube to an octal type that presented a longer leakage path and that, by the grace of God, cured the problem and enabled the prototype to pass all performance tests.

The next step was for our draftsman to make a formal schematic diagram and convert my sketches to production drawings for fabricated parts. The front panel was to be painted in a gray crackle finish to match a CAA color chip, and engraved for control identification. Pulse count was displayed on a beautiful 4-inch Weston 1% mirror-scale meter. Drawings were sent out with purchase orders to vendors for standard electrical components and to various local shops for fabrication of mechanical parts. The wait for material to come in left time for writing the instruction manual. All the parts arrived in a reasonable time except the terminal boards. After bugging our purchasing agent almost daily for three weeks about the missing boards, he finally confided in me that they were finished and ready to be shipped but the vendor was holding them until overdue bills were paid for previous work. Wow! Bells and sirens went off when I heard that. *EL-Tronics was in perilous financial condition!*

This was not the time to ruminate over the company's financial health; with all parts in hand I got on with building the first production model of the counter. There was a lot of breath-holding but the final production version of the counter performed as well as the prototype. The CAA was contacted and they sent in an inspector to examine the unit and observe its performance in their rigorous environmental tests. By some marvelous stroke of good fortune the counter sailed through the CAA inspection process and was approved for production.

Assembly of production units was handled by "Bunny" an extremely competent and versatile lady who supervised the all-female assembly workers. They made a talented team capable of high quality electronic assembly on a par with Tektronix. Production test was handled without my intervention by a very knowledgeable technician, leaving me free to go on to a new project. That, and my concern about the future viability of the company that gave me a start when I needed it will be covered in Part-2, next month.