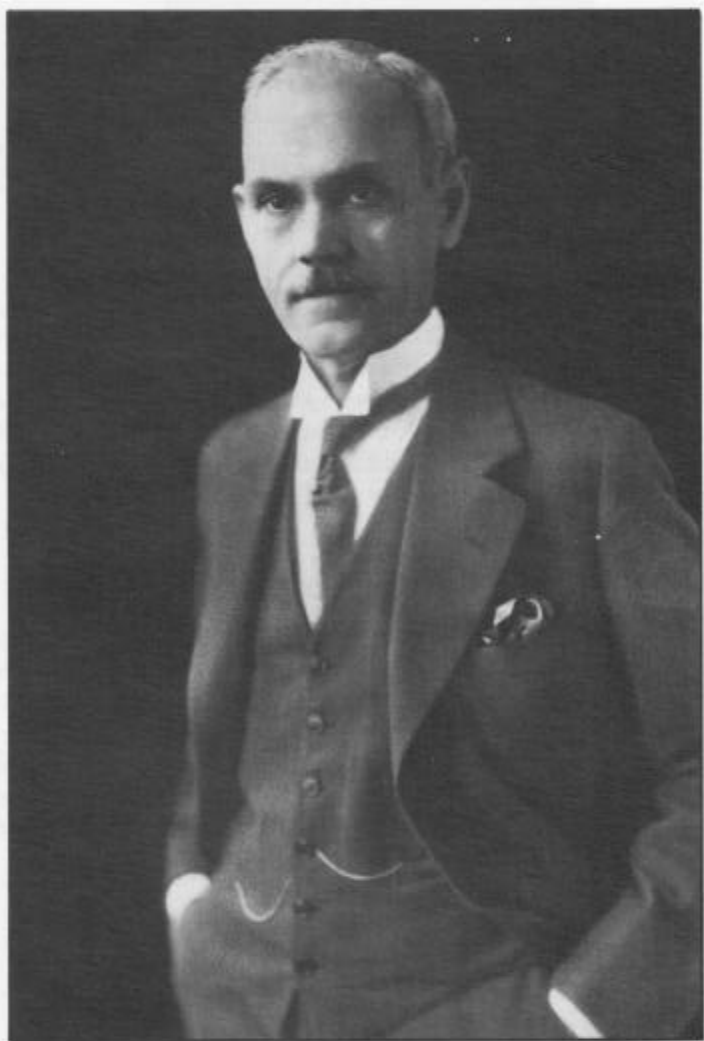




OSCAR HAMMARLUND

FOUNDER AND PRESIDENT

THE HAMMARLUND MANUFACTURING CO., INC.

New York

HAMMARLUND RADIO

By Stuart Meyer, W2GHK
Vienna, Virginia

Editor's Note: Stuart Meyer, W2GHK, joined the Hammarlund Manufacturing Co. in 1960 as Chief Engineer, subsequently rising to Vice-President of Engineering, Senior Vice-President, and President. He retired from Hammarlund in 1966.

While there he was predominantly responsible for broadening the product line to include land mobile two-way radio and high frequency single-side-band fixed point-to-point equipment. This story of Hammarlund Radio follows his personal appearance before the Antique Wireless Association's annual meeting at Canandaigua, N.Y., in September, 1986, and his presentation, "Hammarlund Radio—The Man and the Equipment".

R.M.M.

The founder of the Hammarlund Manufacturing Co., Oscar Hammarlund, was born in 1861 in Stockholm, Sweden. As a student he won the admiration of his classmates as well as high honors for his engineering ability. After completing technical college he went to work as a special tool designer and inspector of electrical instruments for the L.M. Erickson Co. of Stockholm, a leading manufacturer and the originator of the french-type telephone. Shortly after taking this job, he received an offer for a similar position with the Elgin Watch Company in the United States, and accepted the opportunity to come to this country. He arrived in 1882.

His outstanding engineering achievements at Elgin attracted the attention of Western Electric Co. officials, and in 1886 he joined W.E. as superintendent of their Chicago plant. Six years later he left W.E. to go with the Gray National Telautograph Co. (later known as the Telautograph Corporation) which was then engaged in the development of the Telautograph. As the design engineer and plant superintendent, he spent many years with Elisha Gray, the co-inventor of the telephone, and was able to follow the early history of wireless development.

The "Telautograph" was a device designed to electrically transmit writing by varying a DC current over a wire. However, many problems were encountered by Gray in the designing and building of this unique instrument. After working out most of the details, he found that the frequent failures and dulling of the stylus or pencil at the remote end seriously handicapped the entire system.

Oscar Hammarlund received the assignment to design a means of overcoming the handicap of the troublesome stylus. He solved the problem by developing a propelling pencil, and in so doing invented the present-day automatic lead pencil. At the time he didn't realize the ultimate possibilities of his invention. It was one of the first of many important items that he eventually was to create and see become highly successful products.

Mr. Hammarlund's interest in the advance of wireless communications was keen enough that in 1910 he decided to organize a company for the purpose of developing his own ideas. The initial success of the Hammarlund Manufacturing Co. was due solely to his painstaking research and struggle during the early days, but it was not until 1919, when radio broadcasting was about to become a reality, that Oscar Hammarlund had the opportunity to put the results of his early experiments to practical use.

From that time forward the Hammarlund Manufacturing Co. had a sensational series of "firsts". Included among these was the first mid-line capacitor, standard in receivers for many years; the first "MC" and "APC" type variable capacitors, built originally for the small group of radio experimenters of the 1920's; the first commercially-produced superheterodyne short-wave receiver; the first band-spread dial with the amateur-band calibrations; the first beat-frequency oscillator with the front panel adjustment calibrated in kc. Literally dozens of innovations and advances were incorporated in the company's communication receivers, ranging from the early models to the famous SP-600 which was designed to be the finest receiver of its type available.



Fig. 1. The famous Hammarlund APC capacitor, originally designed in 1925.

For many years, before most of the present day radio and electronic manufacturers even existed, every wireless enthusiast and dabbler in electricity knew of Hammarlund, and amateur radio operators and experimenters turned to this organization for many of their needs. Based on several generations of experience and know-how, the Hammarlund Manufacturing Co. reached high levels of achievement during its lifetime.

A scan back through the years discloses a history of tremendous growth and advancement. Unfortunately, much of it was never completely recorded and has been lost. The last facility of the Hammarlund Manufacturing Co., with its production line manufacturing capabilities and its bright modern offices, would seem unbelievable to Oscar Hammarlund in the early years after his founding of the company in 1910.

The company was originally located in a loft on Fulton St. in Manhattan. In order to provide work for his small group of skilled people, Hammarlund built a weird assortment of products, ranging from the "Anti-Window Rattler" which was merely slipped in between a window frame and the window to hold it tight after the wood had shrunk, to the "Bango", a protection device inserted in windows so that if it were disturbed during the night by an intruder, a blank cartridge would be set off to awaken the household.

Other items manufactured in those days include twin liquor decanters, a finger gauge for use by jewelers, precision metal measuring rules, mechanical widow displays, and metal watch cases. At one time they turned out air alarms for installation in ceilings as fire protection devices. This apparatus consisted

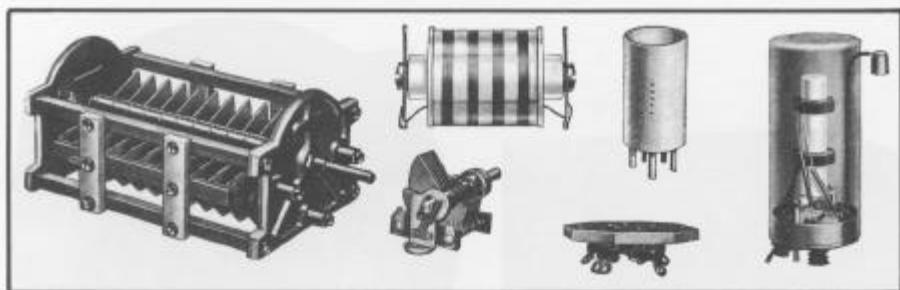


Fig. 2. Typical Hammarlund wireless components as shown in the 1932 catalog.

of a metal bulb in which was installed a diaphragm; when the bulb became overheated, the diaphragm expanded and set off an alarm at a distant location.

Another early product, the "Armagraph", was used to train radio operators in Morse code. It consisted of a rotating disc in which notches were cut and over which glided a platinum tip contact. As the disc rotated, the needle hit each of the holes in turn and produced the sounds of the dots and dashes. During the same time period, they were also producing a centrifuge used by medical laboratories for urine analysis.

The first Hammarlund electronic-related product was the variable air capacitor developed in 1916, not as a product for a specific application but as a construction item for the experimenter who furnished the plans. Actually, the company executives had only a slight concept of its actual use.

In 1920 Hammarlund moved the company to 18th St. in New York City; there were about 50 employees on the payroll. At the time he developed a new automatic machine for making spring clips to go into the tops of Christmas decorations. The clip expanded to provide a support for the decoration, and today, as a result, this style of clip permits easier decoration of our Christmas trees.

The company became well known in the 1920's for its Western Union call boxes which it manufactured by the hundreds of thousands. These small fixtures were a part of nearly every business office. When someone wanted to



Fig. 3. This 1925 Hammarlund-Roberts Kit Radio sold for \$60.85, per advertisement in October, 1925 *QST*. The cabinet was extra.

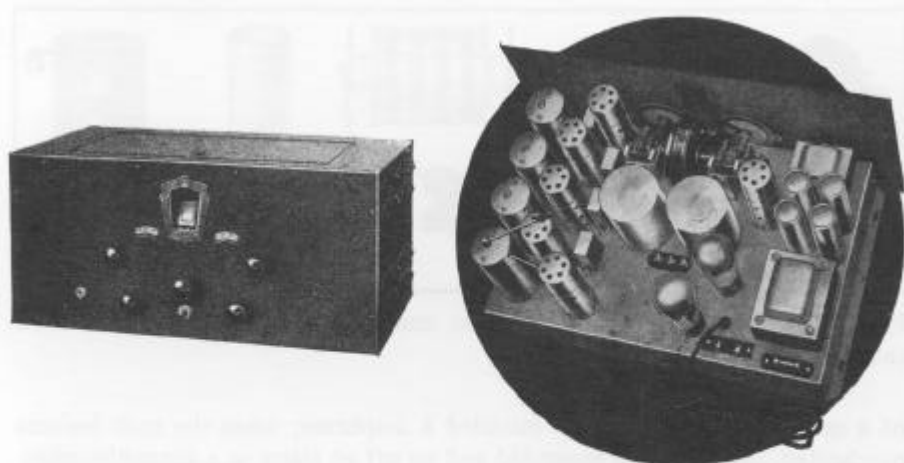


Fig. 4. The early Comet-Pro superheterodyne. Range was 15-250 meters; it sold in 1933 for \$88.20, less tubes, but with built-in power supply.

send a message, he would turn the crank on the call box, which would send a signal to the nearest Western Union office; a messenger would be sent over immediately to pick up the message. There were also double-throw knife switches as well as cordless table jacks for telephone systems, all of which marked the beginning of the definite swing to electrical products.

In 1925 the company moved to 424 West 34th St. in Manhattan, where the first Hammarlund-Roberts Radio kits were built. These kits, designed for construction and broadcast listening by experimenters, incorporated capacitors, coils and other related items manufactured by Hammarlund. They were generally considered to be the finest and most successful kit-type radio receivers of the time, with the circuit technique ahead of nearly all ready-made receivers.

Also in 1925, the famous "mid-line" variable condenser, an innovation by Oscar and his son Lloyd, was developed as the most practical solution to the tuning problem at the high end of the dial. This design became standard in almost all home entertainment receivers, and remained in use until the advent of electronic tuning.

The first commercially produced short-wave superheterodyne, the Comet-

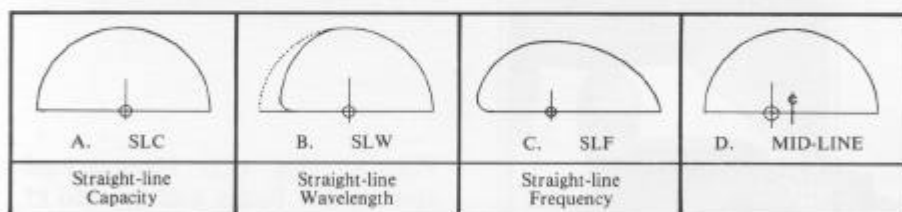


Fig. 5. Hammarlund Midline Capacitors. A. With the 550 to 1500 kHz broadcast band of 1925, the dial was very open at the low end, and too crowded to read above 1000 kHz. B. Wavelength was used more than frequency in the

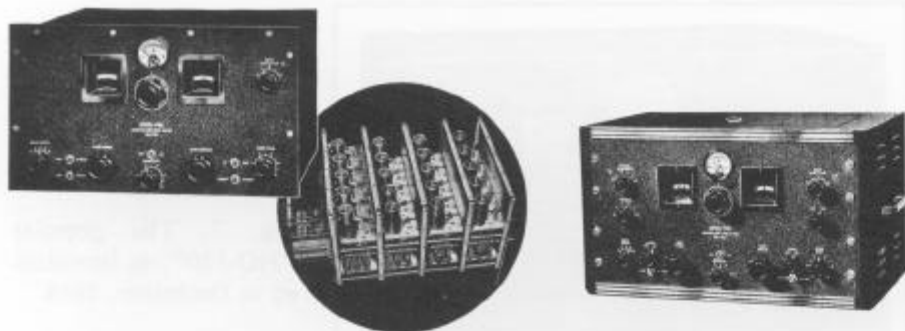


Fig. 6. The legendary "Super-Pro", on the left as the pre-war 10-meter version in 1937, and on the right as one of the several WWII military versions. The tuning unit is in the center.

Pro, was a Hammarlund pioneered product. It was introduced in April of 1932, and was designed as an eight-tube receiver covering the range of 14-200 meters with four sets of two coils each. By 1936 the Comet Pro was in use all over the world by thousands of commercial operators, in broadcast stations and by many amateur radio operators. All the important expeditions included one as a part of their standard gear.

In 1936 the first of the "Super-Pro" line was introduced after more than four years of planning and engineering. It featured two stages of tuned radio-frequency amplification, electrostatically shielded antenna coils, an improved "Lamb" type crystal filter useable on both phone and single-signal cw, and a front-panel calibrated beat-frequency oscillator pitch control. Amplified automatic gain control of the IF amplifier and RF stages provided an exceptionally flat audio output over a wide range of input signal levels. Initially, two versions were manufactured. One tuned from the low end of the broadcast band to 20 MHz, and the other started at 1250 kHz and went up to 40 MHz. Each band position had a frequency tuning range of 2:1. The variable bandwidth IF amplifier, another Hammarlund "first", and the high-quality audio amplifier provided exceptional performance for the music lover. The separate power supply, as many a ham and former military operator can testify, was a challenge to the muscles of the user.

Numerous articles have been published over the years in the various amateur magazines depicting modifications and improvements to the original Super-

early days, and some manufacturers used straight-line wavelength tuning with negligible benefit to the user. C. As broadcast stations are separated by the same 10 kHz over the whole dial, the SLF capacitor gave the user uniform dial calibration. Unfortunately, the SLF capacitors were very microphonic and expensive to make. D. Midline: A compromise between SLW and SLF. Dies are easy to make as the outline is a true radius. The shaft position is displaced to give an acceptable dial-frequency distribution. The microphonic problem is moderate to low.



Fig. 7. The popular "HQ-120", as introduced in December, 1938.

Pro and its military versions. Some of these went so far as to eliminate the external power supply, characteristic of the SP-100 through the SP-400, and replace it with a smaller version on the main chassis. Some years after World War II, a company in the far East built a substantial business by selling reworked BC-779 and BC-1004 military versions of the receiver. A large number of the original receivers, including the BC-794, were made available through the War Assets Administration in 1946 for \$101.00 each.

Because the company had specialized in high-frequency capacitors for use in commercial and military equipment, nearly 90 percent of all American electronic military gear produced during the early part of World War II incorporated Hammarlund variable capacitors, until the other manufacturers could be taught the Hammarlund techniques and begin making them. At the peak of wartime production the famous Hammarlund "APC" variable was produced at the rate of one million a month by ten different manufacturers.

During the early post-WWII years, Hammarlund developed a product line designated "Centralized Operation Control", or "COC". This was a basic system designed to control various devices from remote locations. The widest application was in wireline, microwave and land-mobile radio. This product enjoyed considerable popularity until the early 1960's, when it was overtaken by the more advanced digital systems.

One of the most notable short-wave/amateur receivers of all time was the Hammarlund HQ-120/129 series. The HQ-120 was truly ahead of its time when first introduced in December, 1938. It featured coverage from 540 kHz



Fig. 8. The 1952 Super-Pro 600 20-tube, double conversion, high-performance receiver. This is the JX model.

to 30 MHz with calibrated amateur bandspread. This feature of calibrated bandspread, including a 300-degree readout scale, was an industry first. Other innovations pioneered by Hammarlund included a front-panel adjustable antenna trimmer, calibrated front-panel beat-frequency oscillator, and the famous multi-bandwidth crystal filter. The noise limiter was particularly useful on the higher frequencies. A special version of the receiver, designated the RBG, was built for the U.S. Navy.

After the war, the HQ-120 was reintroduced as the HQ-129 and sold for \$129.00, but the company lost money on the product and it did not stay at this bargain price for long. The receiver was basically the HQ-120 with a modest styling change and a greatly improved series-gate noise limiter. Both versions of the receiver were truly pace-setting units at their inception, and a considerable number still remain in use.

The SP-600, introduced in 1952, was an enhanced Super Pro covering the frequency range of 540 kHz to 60 MHz with a 0-100 arbitrarily calibrated mechanical bandspread. The receiver provided for optional crystal control of frequency, and included a design feature which made it possible to use two receivers for diversity reception, tuned by the local oscillator of one receiver. A lower-frequency version covered 15 kHz to 540 kHz, and both models were widely used throughout the world for military, laboratory and commercial applications. The SP-600 was not designed to be a ham receiver and therefore lacked calibrated amateur bandspread. However, many of these receivers have been used very successfully in the amateur radio service.



Fig. 9. The HQ-145, showing the new cabinet styling. It sold for \$269.00.

In about 1950 the basic cabinet styling of the Hammarlund receivers aimed at the amateur and short-wave-listener market was changed by using an extruded rib around the outside of the front panel. Electrically, the single-conversion concept of the HQ-120/129 series continued in production through about 1960, with a series of receivers designated the HQ-140, the HQ-150, and the HQ-160. These used the same basic tuning assembly which provided the fully calibrated bandspread of the 10-through 80-meter amateur bands. The HQ-150 and HQ-160, in addition, employed a "Q" multiplier sub-assembly with front panel adjustments appearing above the tuning dials. In 1956 the company introduced a lower-cost general coverage receiver, the HQ-100, with calibrated



Fig. 10. The 1955 PRO-310 receiver with matching speaker.

amateur bandsread. This was supplemented with the HQ-110, basically the same receiver, except that it covered only the amateur bands from 160 through 6 meters.

Another receiver, the HQ-145, was intended to be an updated replacement of the models 120, 129, 140, 150, and 160 series. These were all single-conversion designs and thus suffered from image responses on the higher frequencies. To counter this problem, the HQ-145 used single conversion up to 7 MHz, and double conversion above that. It retained the six-bandwidth selection crystal filter along with a series-gate noise limiter, calibrated amateur bandsread and the front panel antenna trimmer, all of which did much to make its predecessors popular. This receiver had modest success in the market place, but never did capture the hearts of the hams and SWLs as did the 120 and the 129.

Unlike the 120 and 129, the HQ-145 had a built-in "Q" multiplier, and a later version, the HQ-145X, provided for optional crystal control of the first (local) oscillator stage.

The first Hammarlund product to use printed-circuit-board construction was the PRO-310, introduced in 1955. It covered from 550 kHz to 35.5 MHz, and featured double-conversion and a constant-calibration band spread. Unfortunately, the life of the PRO-310 was short with only one production run of 1000 units, and it was last advertised in July, 1956.

In the 1960's, Hammarlund produced the basic FAA airport tower control VHF AM receiver, designed for the 108-132 MHz portion of the spectrum.

The HQ-180 and HQ-170 receivers were introduced in 1959. These were considerably more sophisticated than prior models and incorporated a product detector and multi-bandwidth upper and lower-sideband selection with selectivity settings of 0.5, 1, 2, and 3 kHz bandwidths. The 180 model was a general coverage receiver while the 170 was a bandsread-only unit covering the 160-through 6-meter amateur bands. With the advent of this multi-bandwidth IF system, the company departed from the use of its multi-band crystal filter, with the sole exception of the one in the HQ-145 series.

In 1964 the HQ-110 and the HQ-170 receivers were equipped with a built-in

two-meter converter and a six-meter nuvistor preamplifier (designed by Frank Jones, W6AJF). The bandspread dial was changed to include the calibration for the two-meter band.

The Hammarlund receiver line of the HQ-100, 110, 145, 160, 170, and 180 vintage had provisions for the installation of an optional clock to turn on and preheat the unit. This was popular in the days before the general trend to crystal-controlled-first-oscillator receivers, and helped considerably to reduce warm-up drift. Another step in this direction was used in the "A" versions of the HQ-170 and 180 receivers, which incorporated a stand-by filament transformer to keep the oscillator and first mixer tubes on continuously. The "A" models, in addition to having 110-120 volt power transformers as standard equipment and dual audio outputs (3.2 and 500 ohms), also had a system socket so that a harness cable could coordinate them with the HX-150 single-sideband transmitter.

Several years after the introduction of the HQ-170 and 180 receivers, the company produced a single-sideband adapter for use with earlier receivers of almost any manufacture. This consisted of the sideband-selectable multibandwidth IF circuitry of the 170/180, together with a variable threshold limiter and an audio amplifier and built-in power supply. Two versions were offered; a compact desk-top unit for the amateur market and a rack-mounted version for use with the SP-600. The latter was bought by the FAA in modest quantities.

Following through on improvements to the HQ-170/180 receiver line, in 1960 Hammarlund introduced a "Lamb" type noise blanker. This device worked on Jim Lamb's original principal of punching a hole in the signal to virtually eliminate the effect of ignition-noise interference. A special version of this noise silencer, which was also marketed as a "noise immunizer", was developed for the Coast Guard for use with their numerous National HRO type receivers in the vicinity of LORAN stations. The device was extremely effective in reducing LORAN pulse interference in the 160-meter band.

Some miscellaneous products produced during the 1960's included a direction finder, the RDF-10, aimed at the small pleasure boat market, and an electronic keyer designated the HK1B. This solid-state unit offered straight keying, a "bug" mode of operation, and fully automatic dots and dashes.

The HQ-125, the first and only solid-state receiver produced by Hammarlund, was designed in the mid-1960's by Lester Earnshaw, ZL1AAX, but did not go into production until 1967. This amateur-band receiver was compatible with the Collins "S" line units which employed the same frequency generating scheme, thus making it capable of functioning in the transceive mode with the Collins transmitter. This receiver was produced in only limited quantities.

A number of transmitters were produced. These saw only limited use until Hammarlund entered the market with single-sideband equipment. In 1960 the HX-500 was introduced; this was a table-top, 100-watt output, single-sideband transmitter which also had FM and FSK transmission capability. This unit was probably too sophisticated and too expensive for the market at the time, and



Fig. 11. HX-500 SSB transmitter



Fig. 12. HX-50 SSB transmitter

the HX-50 was introduced in 1962. It featured bandpass coupling of the driver stages, simplifying the tuning and band changing. The HX-50 had provisions for accepting a 160-meter kit, which also could be ordered installed at the factory. This modestly priced unit used a crystal filter to eliminate the unwanted sideband.

In 1964 the company produced a table-top linear amplifier, the HXL-1, a 1500-watt unit with a built-in power supply for the 10-80 meter amateur bands. It basically matched the HX-50 in appearance and size, and its control circuitry was compatible with most of the exciters and transceivers then on the market, including the Collins "S" line.

Hammarlund entered the land-mobile two-way radio market in 1960, producing many units under the name "Outercom". The first one to go into production was designated the FM-50, a 35-watt unit covering the 150-170 MHz band. This was followed by the FM-60 with a frequency range of 25-54 MHz and a rated power output of 50 watts. The company also produced a high-band (150-174 MHz) 100-watt desk-top booster amplifier designed to increase the power output of the FM-50.

The "Outercom" land-mobile units featured a cascode receiver front end with high-frequency crystal lattice filtering. They had unusually high sensitivity coupled with improved adjacent-channel signal rejection, and were relatively immune to desensitization. The receiver section of the Outercom was also used as a high-performance monitor receiver with crystal-controlled channel selection for the Public Safety, Industrial, and Land Transportation Radio Services in both the 25-50 MHz and 150-174 MHz bands.

The FM-50 was made for the Coast Guard in a special version, designated the AN/URC-45, with six-channels and with a second receiver for continuous monitoring of the marine VHF emergency channel.

Hammarlund built a substantial quantity of VHF FM "Village Radios" for the U.S. Agency for International Development (AID) for use in Viet Nam. Several versions of these radios were produced under contract and were later made available as land-mobile units for the commercial domestic market.

The Citizens' Band (27 MHz) radio market was entered in the early 1960's,



Lloyd A. Hammarlund



Fig. 14. Hammarlund plant at Mars Hill, N.C. in 1965.

Photo: S. Meyer

and Hammarlund was one of the first companies to offer a synthesized 23-channel transceiver, also produced under private label for Lafayette, Allied Radio, and Radio Shack. In addition, the HQ-100 general coverage receiver was redesigned to include a one-tube transmitter modulated by the receiver audio section. This unit, designated the HWQ-105TR, was intended for single-channel transceiving in the 10-and 11-meter bands. A six-channel crystal-controlled unit was also produced for Business Radio and Industrial Radio use in the CB band.

For forty years all of Hammarlund's activities were centered in New York City, but in the early 1950's a phased move to western North Carolina was begun. The first manufacturing at the new Mars Hill, N.C., plant built in 1951 involved the variable air capacitor line. With additional space provided by an expansion in 1959, the manufacture of receivers and other accessories was transferred, leaving engineering, accounting and general management in New York until 1965, when the remaining company functions were moved south.

This major addition to the Hammarlund manufacturing facility brought the production space up to approximately 100,000 square feet. The plant was fairly self-sufficient, producing a number of screw machine parts and mechanical components. A complete plating facility, a paint shop, and a silk-screen capability for panels minimized dependency on outside vendors.

Oscar Hammarlund's management style was "family-like"; he frequently visited the production lines and knew every person who worked for him by name. He passed away in 1945. The company, however, continued to flourish under the direction of Lloyd Hammarlund, his son.

In the late 1950's Hammarlund was sold to Telechrome, which several years later sold out to Giannini Scientific. In the latter 60's the company was again sold, to the Electronic Assistance Corporation. But this sale was final. The product line was sold off in parts or phased out. Thus ended the golden years of one of the most respected names of the Electronic Communications Industries.

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