Chapter VI

Beyond 100 Meters:

Vhf and Hf Developments

From work carried on in Germany and other countries, it has become known that prolonged exposure of the human being within an ultra-short wave field will produce sterilization.

- Francis R. McCabe (1934)

Now I find out!

- Guy V. Wood (1958)[1]

Selection of a frequency range occupied a significant portion of time in Dwight Beatty's 1928 and 1929 field experiments. Selecting a frequency directly affects battery power, antenna length, signal-to-noise radio, transmission characteristics, and other diverse needs. The time of day and the terrain also must be considered before a frequency range is selected. The scarcity of commercial components for sale restricted the scope of Beatty's experiments. If "an optimum frequency exists ... which will provide the best signal/noise ratio at the receiver under a given set of conditions,"[2] then the complexity of Beatty's task, and his preoccupation with frequency, may be better understood.

To insure the effective transmission of daytime signals in timbered and mountainous terrain, Beatty narrowed his frequency criteria to three: What frequency would be the least susceptible to interference under these conditions? What frequency would result in a radio set light enough to be carried? What available components could accomplish all of this without resulting in a set too sophisticated or delicate for adverse conditions? From his consultations with NBS, NRL, commercial manufacturers, amateurs, and his own experiments, Beatty selected the region of 100 meters (between 3 and 4 MHz) as the most promising. This band was used for the SP-1930, SP, P, and M sets.[3]

A worldwide interest in the lower end of the 10-meter, very high frequency (vhf), spectrum began to occur about the time of Beatty's earliest field trials. On March 7, 1928, the 28- to 30-MHz region was reserved and authorized for both code and voice amateur use, as it still is today, more than 50 years later.[4] Almost immediately, numerous reports of trans-Atlantic broadcasts and receptions were received.[5] In spite of the success experienced by "hams," vhf was found useful for consistent transmissions only over so-called "line-of-sight" distances. Transmission of these higher frequencies over the horizon is due to radio wave reflection, or "bounce," from the ionosphere. This process is highly vulnerable to sunspot activity; it was considered erratic and resulted in fading of signals and wide variations between the quality of day transmissions (often poor) and night transmissions (usually better). Signals received hundreds of miles away might not be detectable only a few miles distant. For these reasons, the vhf spectrum at that time found little favor with users needing consistent performance. Such Government agencies as the Weather Bureau and the Navy, which relied on long-distance (DX) broadcasts, left the development of early vhf largely to radio amateurs.[6]

Early Radio Laboratory interest in vhf development was due to a combination of circumstances. Harold Lawson and Foy Squibb were aware of the advantages and peculiarities of the 10-meter band through their professional involvements, which included Lawson's membership in the American Radio Relay League.[7] Gael Simson was in a position to recognize and encourage their field experiments and to secure operating frequencies. Because other Government agencies in IRAC found no useful purpose in vhf, Simson was able to acquire an abundance of these channels for use in the Forest Service.[8] Although his motives in acquiring a large number of 10-meter frequencies are not recorded, Simson probably recognized the relationship between line-of-sight transmission and its application to Forest Service use. Because National Forests were then covered by a network of fire lookout towers, each one usually in sight of several others, line-of-sight radio transmissions had the potential for useful application.

Another benefit, and perhaps Simson's primary consideration, was that vhf was above the frequency spectrum for electrical interference during lightning storms. If vhf (10 meters) could be developed in the same manner as hf (100 meters), its ability to provide static-free transmission during lightning storms would aid forest firefighters during conditions that produced static interference and forest fires.

In addition to line-of-sight performance and static-free reception, vhf offered several other advantages. Because shorter wave lengths require shorter lengths of antenna wire, a transmitter-receiver operating at 10 meters can use an antenna about one-tenth the length required for 100 meters. This shorter wire is also relatively simple to install, especially when it became possible to incorporate an antenna of this length (approximately 7.5 feet) in the set as a telescoping rod.

Because vhf also required lower levels of power for line-of-sight transmissions, a corresponding decrease in battery weight was possible. The lower battery drain meant the operator could leave the receiver on for standby operation rather than rely on intermittent schedules of operation that often had receivers "Off" when they needed to be "On."

A final advantage of vhf low-power requirements was the possibility for duplex operation, that is, transmitting and receiving simultaneously.[9] With this feature vhf could more closely approximate telephone performance, as well as function as a relay for the immediate transfer of messages from point A to point C via point B.

A major reason for the lack of commercial development in the 30- to 40-MHz region was the relative absence of components that could operate at these shorter wave lengths. Amateurs have traditionally considered this a challenge. A ham inclined to conquer unexplored horizons will find suitable components either by combining unusual parts into a unique design or by raiding the "junk box" of a fellow ham. The end result is usually a unique product too complicated in parts and labor for profitable duplication by large-scale manufacturers.

This tendency to produce a custom design worked to the advantage of amateurs and was a logical approach for the Radio Laboratory. In fact, Beatty, Lawson, and Squibb designed Forest Service radios as if they were one-of-a-kind units intended for their own personal use. In the best of amateur traditions, their experimentation was based on a few articles read here, a conversation with other hams there, a few of their own ideas thrown in for good measure, and a lot of work. Within the limitations of space and size, they sought to package a unique concept for a specific situation--fire fighting.

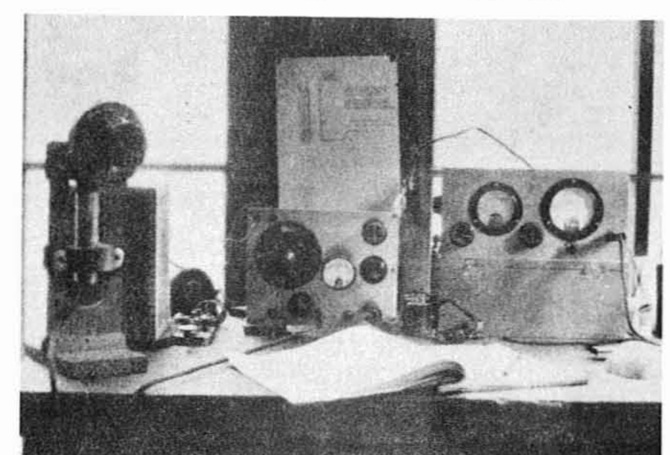
Viewed in retrospect, this approach precluded early involvement by manufacturers in the design of hf or vhf portable radios. The Forest Service market was at best to be only several thousand units. As in any new endeavor, the cost of research was considerable. The demands of consumers for other products such as broadcast radios, military transmitters and receivers, and large fixed-base communication systems was real. Major corporations are geared to mass markets; the techniques of amateur radio enthusiasts have no place in their board rooms, production lines, or sales territories. Firms like RCA, De Forest, Radio Telephone and Telegraph Co., Westinghouse Electric Corp., and Zenith Radio Corp. were hard-pressed to duplicate Forest Service units of comparable size, price, or function at a profit.

Work Begins on Vhf in 1932

The work on very high frequency (vhf) began at the Radio Laboratory in 1932, shortly after the move to Vancouver.[10] Following the successful 100-meter development plan, a high-power 10-meter transmitter was constructed for fixed-base use. A prototype portable design was installed at Wind River for field tests during 1933. These tests proved satisfactory and led to the production of a small number of portables that were distributed to selected Regional locations for intervisible communication, "one of the most intriguing uses of radio ..."[11]

A 5-meter set, designated type V (for Roman numeral five), was also completed in time for the 1934 fire season. Two units were shipped to Bill Apgar at Savenac Nursery. Apgar tested the equipment and found it lacking. "I eventually believe the equipment will be of use," he wrote of the 60-MHz set, "but in its present state of development and in view of its limitation, I should hesitate to acquire more than enough for experimental purposes."[12]

Figure 55. Photo at left shows an early version of Harold Lawson's 10-meter-band vhf portable radiophone, center, at Wind River Forest Experiment Station, Wash., 1933. Photo at right shows Harold Lawson testing a later version, also at Wind River. Note the absence of the panel meter that is on the front panel of the set in the photo at left. (Forest Service photos, History Section)



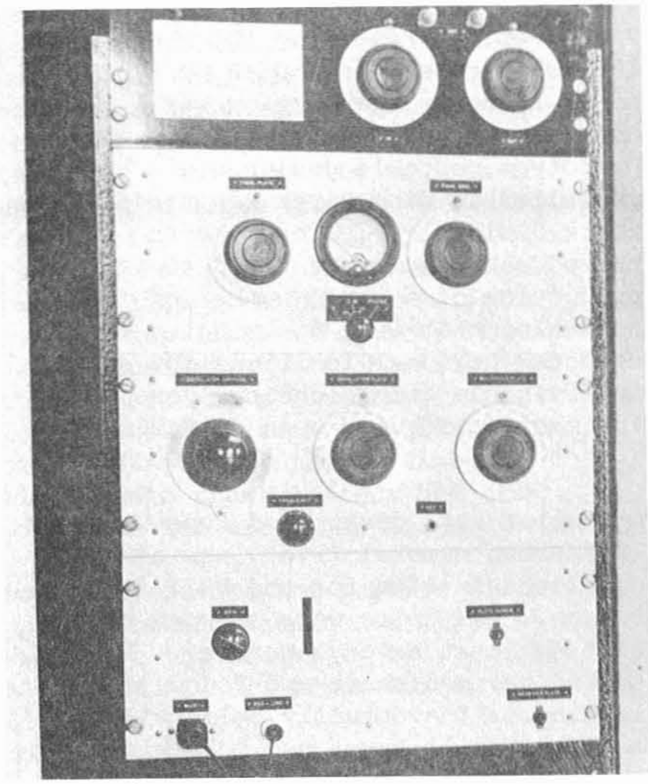


Figure 56. High-power, fixed-base vhf transmitter begun at the Radio Laboratory in Vancouver, Wash., in 1932 and installed at Wind River in 1933. (NA:95G-302664)

The type V failed to perform as expected largely because the receiver could not operate satisfactorily at 60 MHz.[13] An example of pushing components beyond their limits, it could not make the transition from test bench to field use, and the 5-meter band was abandoned for the less demanding range of 10 meters. With a triad consisting of portables, semiportables, and fixed-base radios, each phase of Forest Service vhf fire-radio needs would be met. The working plan for the 10-meter models was identical to that of the previously successful 100-meter units. By early 1934, Harold Lawson had completed the design of the portable type S set (superregenerator) and Foy Squibb, who had returned from field tests and installations, completed design of the semiportable type T sets (ten meters). Calling again for bids on working models, the Radio Laboratory had vhf units available for Regional testing by late 1934 and subsequently produced for the 1935 fire season.[14]

Like their 100-meter counterparts, these vhf units represented the best portable and semiportable design. The T set, for example, transmitted and received voice only and weighed between 30 and 100 pounds, depending on battery selection. It cost $50 to $60, was rated at a working range of 50 miles "over optical paths," designed for standby operation, and could be operated duplex.[15] While lacking the capability to operate duplex, the S set redeemed itself with a low initial price tag of $26 and a mere 10-pound weight. The set-up time of under 2 minutes provided smokechasers, scouts, and fire chiefs with an adequate tool for ranges of 50 miles "over optical paths."[16]

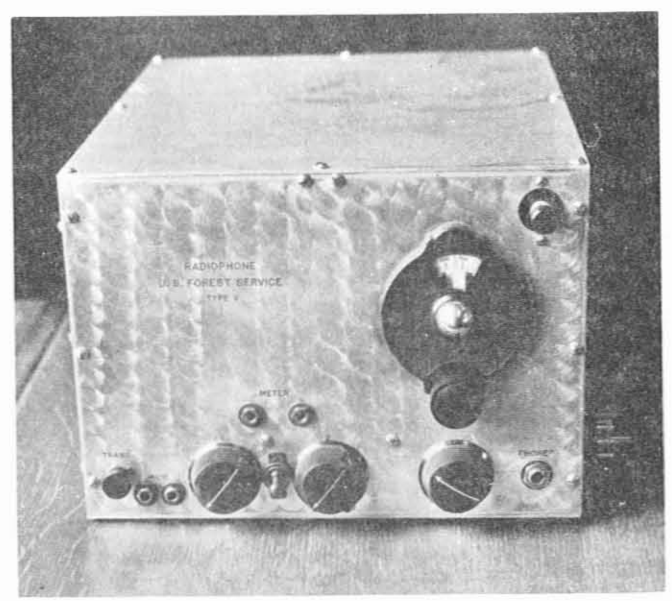


Figure 57. Experimental type V 5-meter-band radiophone field-tested during the 1934 fire season in Region 1 and found deficient because the receiver could not operate satisfactorily at 60 MHz. The 5-meter band was then abandoned for the less demanding range of 10 meters. (NA:95G-274974)

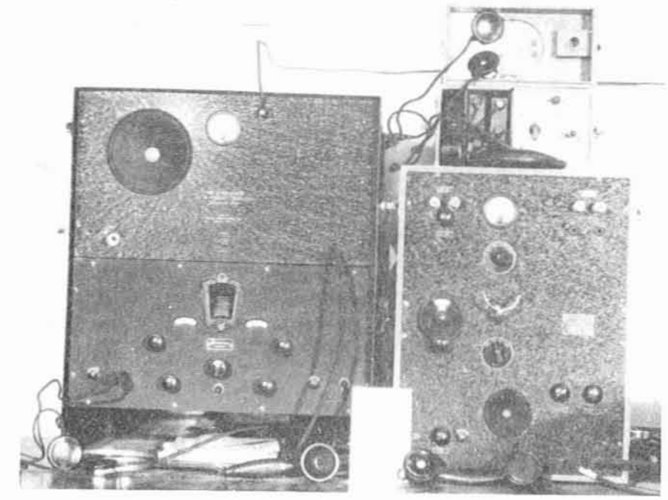


Figure 58. Type S (superregenerative) portable (10-pound) vhf set atop a later type T semiportable set, at right. Both of these 10-meter-band sets were designed and tested in the Regions in 1934. They were produced in volume for the 1935 fire season, when they received some mobile testing. Both were voice transmitter-receivers with a working range of 50 miles, line of sight. At left is a type M set mounted in a field cabinet. (NA:95G-362772).

In addition to experimenting with the S and T sets in mobile communications during 1935, the Radio Laboratory also worked to complete a vhf/lf receiver-transmitter for airplane use. The result was the type A (Airplane) designed for quick installation and capable of sending and receiving "...satisfactorily from plane to ground, even in unshielded planes."[17] It weighed about 25 pounds, and operated from a 6-volt battery that also lent itself "...to automobile installation for two-way communication from moving vehicles under favorable topographic conditions."[18]

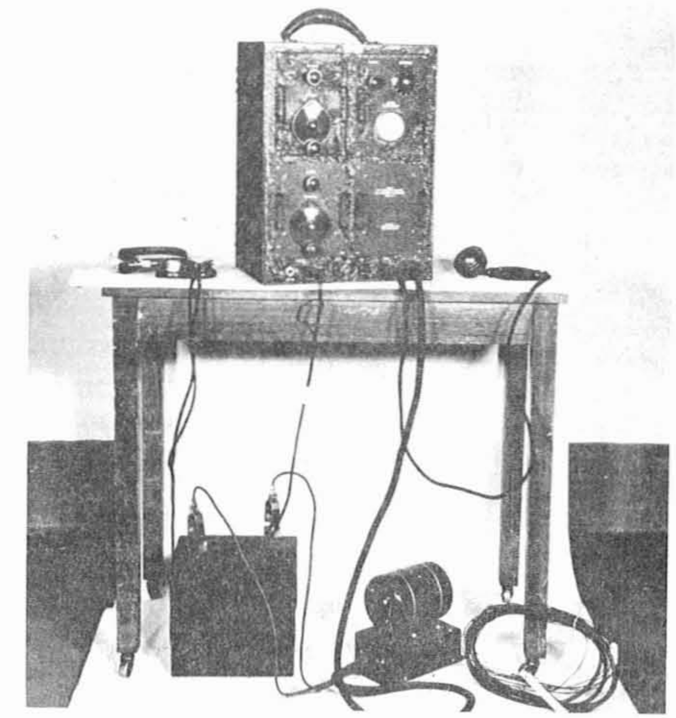


Figure 59. Type A set, a vhf receiver-transmitter, was designed for use in airplanes for air-to-ground communication, but was also operable in moving automobiles. It became available early in 1936. (Forest Service photo, History Section).

Spokane Firm Gets Contract

The workload at the Radio Laboratory was heavy, so Simson decided to have the initial model of a fixed-base, vhf transmitter constructed by an outside source. Preliminary schematic drawings had already been completed by Lawson. Spokane Radio Co. was low bidder for building the set.

SRC, of course, had "manufactured" the first eight sets of Beatty's SP--1930. The firm had also successfully bid on other units and played a significant, advisory role in the Forest Service program between 1931 and 1934.[19] Started as a local parts and repair facility for commercial radios, it had entered a wide range of electronic activities. The founder was Morris Willis. With his uncle, A. F. "Speed" Horton, and Frank Prince and Ted Young as engineers, plus a handful of regular and temporary employees that included Foy Squibb in 1930, Willis made SRC one of the more successful electronics firms in the Pacific Northwest.[20]

Working with Lawson's drawings for a moderate-power 10-meter set, Prince, Young, and a new employee, Logan Belleville, began to experiment with circuits that "...were a little bit of this and a little bit of that."[21] Belleville assumed the major share of the design, and the U set (for UHF) began to take shape.

In its final form, the type U was enclosed in a 4-foot, 9-inch console and weighed about 300 pounds. Like its hf counterpart, the M set, it used a commercial receiver, a National SW3 superregenerative. With an output power of 20 watts, the type U, priced at $400, rounded out the vhf triad.

Because of Belleville's knowledge of vhf and acceptance of the U set, Simson arranged to borrow Belleville from SRC during August 1936. He was placed temporarily as a junior radio engineer, and paid out of CCC and WPA (Civilian Conservation Corps and Works Progress Administration) funds. Belleville later achieved permanent Civil Service status.[22]

Logan Belleville had acquired radio background much as Lawson and Squibb had. As a young boy in Twin Falls, Idaho, he "was kind of a loner;" he did not get along easily with most others of his age. Instead of conventional youthful activities, he found tinkering in electronic communications exciting. With a young friend down the street, using cracked-off bottle tops for insulators,

Figure 60. Logan Belleville, who designed it at the Radio Laboratory in 1936, is at the controls of a type U-30-25 fixed-base vhf radiophone with output power of 20 watts, in the Region 6 headquarters in Portland, Ore. (Forest Service photo, History Section).

salvaged wire, and whatever parts that could be found, he devised a workable communication device between their two homes. Later, Belleville decided to attempt the same feat with wireless. He learned what parts he needed for an amateur set from library books. His product, though workable, could receive only a local amateur because the electric power lines into Twin Falls passed directly over the Belleville home.[23]

Encouraged by his father, who gave him a vacuum tube for his birthday and a set of double earphones for his success in using the tube, Belleville became an astute follower of radio developments. With the attitude that "...if it ever worked, I could make it work again," he started to repair broadcast radios for the local residents.

A year after high school graduation, Belleville caught a ride to San Francisco, where his repair experience landed him a job with a local radio company. Duties included service calls "from Chinatown to out in the ocean," but he returned to Twin Falls after becoming homesick.

Spirits refortified several weeks later, Logan decided to try his fortune in Los Angeles. His first job was as a department store technician repairing sets before they went on the shelf. Next he worked at the service desk for a major radio manufacturer, repairing sets that dealers could not fix. At his third job, identical to the one in San Francisco, he again found the lure of home irresistible.[24]

Belleville found employment as a radio announcer back in Twin Falls. Encouraged by the station owner, he obtained a commercial first-class radio license and an amateur license (W7CFX). He operated a radio repair shop during off hours. At the shop he came into contact with A. F. "Speed" Horton, who was on the road selling electronic components for SRC. Because of Belleville's demonstrated knowledge of radio, Speed put him in contact with Morris Willis who put him on the SRC customer service desk. There, Willis recognized Belleville's potential and promoted him to help develop the Forest Service type U set.[25]

Before Belleville came to the Radio Laboratory, Gael Simson had obtained authorization to add a few other employees to the staff. He hired Ralph H. Kunselman before the move to Portland. Carl B. Davis joined the staff a year later. These two technicians constructed the prototype of most Laboratory sets. About this same time, Foy Squibb was temporarily assigned to install a number of his type T sets on the Cumberland (now Daniel Boone) National Forest in Kentucky. Lack of funds prevented his return to the Radio Laboratory after the installation was complete.[26]

In an effort to overcome the inability of the M sets to perform on the Forest Service patrol boats along Alaska's southeastern coast, Harold Lawson offered Wilbur "Bill" Claypool temporary employment. Claypool accepted, and the personnel count at the Laboratory remained near six through 1936.

Bill Claypool came to the Forest Service from a job as regional service manager for a Portland firm handling Stewart-Warner refrigerators and radios.[27] He had been familiar with Lawson's radio work for some time. He had acquired his amateur license in high school (9DDV, and then 7UN, NU7UN, W7UN, 3UN, XEUN and, "hopefully," XE1UN) and had "ham sessions" with Lawson in 1931 when the PCL-1 was under test.[28] In 1936, Lawson and Claypool became closely acquainted while serving with six others on the organizing committee for the American Radio Relay League (ARRL) convention in Portland.

B2 Set Designed for Alaska

Claypool suspected that the failure of the Alaskan type M was due to the 100-meter frequency selection and a low power output. To test his theory, he drew up plans for a dual-channel transmitter that would operate above and below the 3-MHz type M. After beefing up the output by a factor of 10 and adding a Hammarlund Comet Pro receiver, Claypool dubbed the new design the type B2 (Boat) and headed for Alaska. He discovered almost immediately that the 200-watt B2's were enough to make "the sparks begin to fly."[29]

Without an effective gound system, however, everything on the patrol boats was "hot"--the power shaft, propeller, and control room. After drydocking the boats, Claypool had large copper plates installed on the bottoms and then insulated the antenna footings. This cured the problem and the B2 set, operating at 2.3 and 4.6 MHz (130 and 64 meters, respectively), provided adequate communications until a small 100-watt version was completed a few years later.[30]

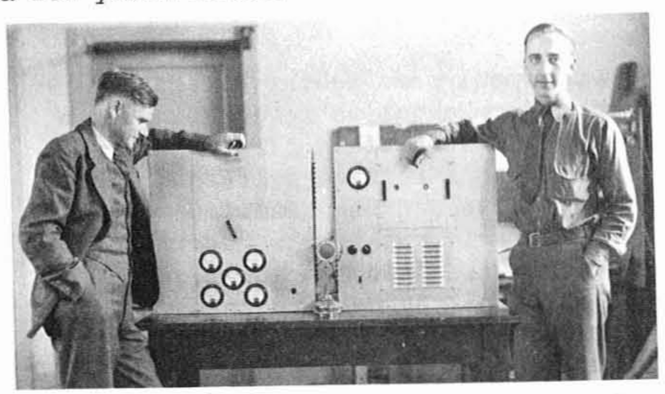


Figure 61. The B2 200-watt, dual-channel transmitter (130 and 65 meters), designed by the Radio Laboratory, worked well for forest patrol boats in the Alaska Region. Builder Wilbur Claypool of the Laboratory is shown on right and Gael Simson on left. (NA:95G-305778)

Other experiments in vhf were also conducted during this phase of Laboratory work. In an attempt to determine the relative performance of various vhf operating frequencies, Simson, long a believer in the utility of establishing a Servicewide radio network, traveled the country with the soon-familiar "Simson's Suitcase" built at the Lab. With the suitcase, he could effectively test four channels. It started on a fundamental frequency; then the press of a button would give the second, third, and fourth harmonic (the fundamental x2, x3, x4). Morning and evening, no matter where he was, he would try to contact Portland. (By 1941, Simson was up to 4.5, 9.0, 13.5, and 19.1 MHz, respectively, but he never succeeded in finding a satisfactory all-Service frequency.)[31]

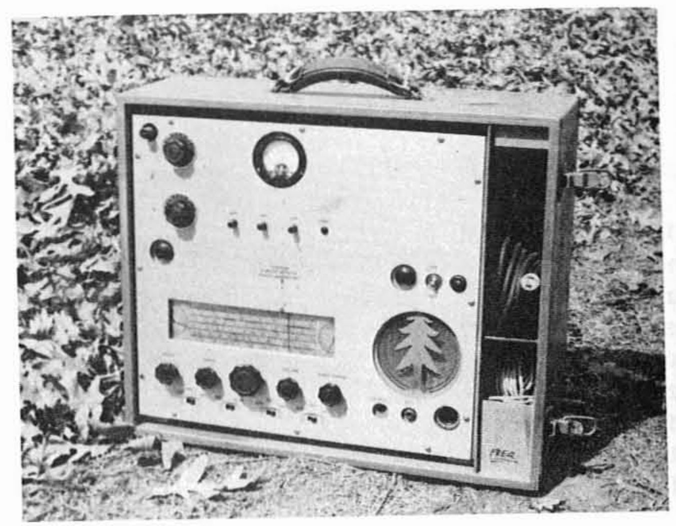


Figure 62. "Simson's Suitcase," which was carried around the country by its builder, Gael Simson of the Radio Laboratory, in an unsuccessful effort to find an optimum Servicewide frequency channel for a potential national radio network for the agency. (Forest Service photo, History Section)

The Radio Laboratory's progress in producing up-to-date radios was paralleled by physical improvements to the facilities. The brick exterior got a fresh coat of paint and a new addition put on the rear of the building. The appearance of a more modern facility was heightened inside, where the changes were equally impressive, with a separate room set off for communications. Here Logan Belleville led the group in designing a 250-watt transmitter--"a beautiful thing"--that kept KBAA at the Laboratory in contact with the men while they were on various assignments around the Pacific Northwest.[32]

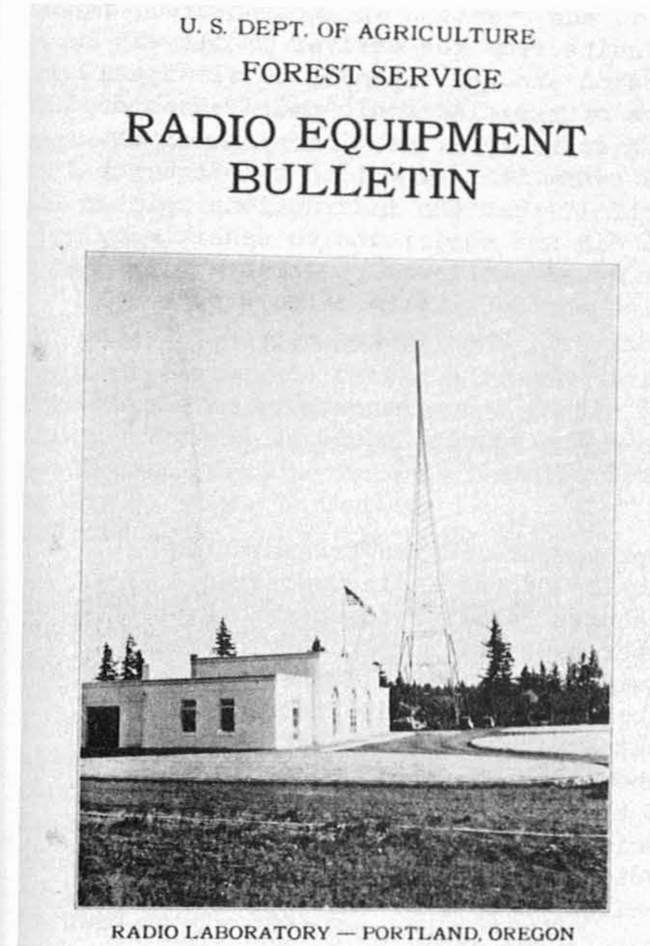


Figure 63. The Forest Service Radio Laboratory at Portland, Ore., in 1939, appeared on cover of "Radio Equipment Bulletin." (Forest Service photo, History Section)

With a full complement of vhf and hf radios in the portable, semiportable, and fixed-base classes, activities at the Radio Laboratory might have been expected to subside. This was not the case. In addition to improvements brought about "almost daily [by] new tubes, parts and technique..."[33] and the problems experienced with the commercial vhf receivers, the men recognized that their initial design efforts needed constant updating. "By modern standards," Harold Lawson was to recall, "we had some pretty sad pieces of hardware. For their day

Figure 64. Transmitting and receiving equipment at the Radio Laboratory's Station KBAA, Portland, Ore. A new 250-watt transmitter installed about 1939 kept the Laboratory in close touch with personnel on field assignments. (Forest Service photo, History Section)

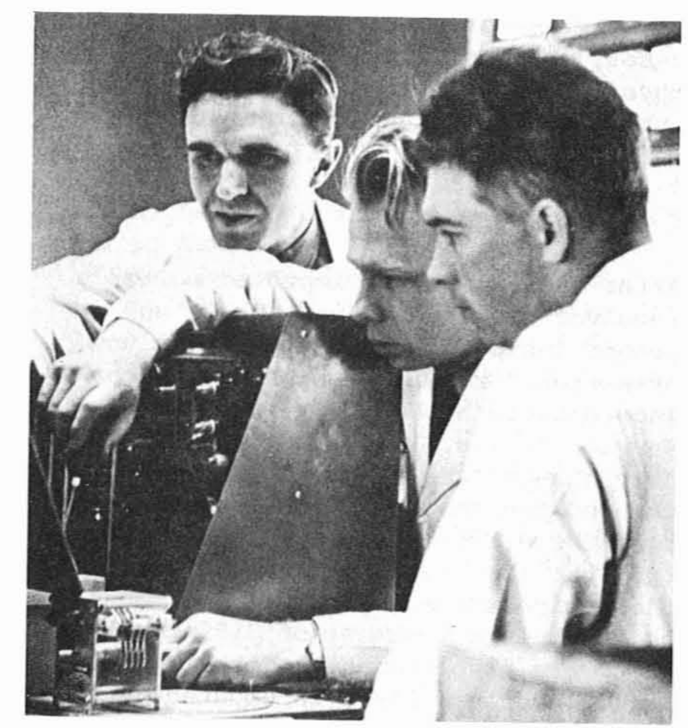


Figure 65. Checking the performance of a new vhf prototype at the Radio Laboratory. Left to right are Harold Lawson, Logan Belleville, and Carl Davis. (Forest Service photo, History Section)

most of them were pretty good, but we had a few 'dogs'..."[34]

Their desire to leave nothing to chance spurred them to tackle every identified problem. They experimented with variations that would improve the product and conducted studies on every new concept. For minor changes, a model change was made. For major changes, a new design was undertaken.

As a result, a significant number of Laboratory model changes were made before 1941. The M set, for example, went through variations that included the models B, C, and D. The T set had three model changes, the SPF and T/D each had five, the I had three, and the Relay Repeater Station (RRS) eventually had six variations.[35] Some of the changes involved only minor alterations intended as "fixes" for particular problems. In other cases, the modifications altered the physical appearance of the unit and changed the original function of the sets.

KA Model for Airplanes

After the Laboratory improved portable receiver design, the new M sets no longer included a separate Hummarlund or National receiver. Instead, each incorporated a receiver of Forest Service design. The end product not only changed the appearance but also changed the specifications so much that the M set could conceivably drop from the fixed-base class to that of the semiportable. Improvements found beneficial in a number of different sets were also grouped together with a few other new ideas in updated designs; this was reflected in the type KA (Kar-Airplane) in early 1940.

The type KA was intended to be the vhf (34.22-MHz) airplane counterpart of the S, T, and U sets. It incorporated circuits from the earlier mobile vhf version and was intended to eliminate much of the electronic noise associated with spark-type ignition systems. It had a new feature called the "squelch control" that the instructions pointed out did not contribute to sensitivity but merely relieved the constant hissing noise characteristic of this type of receiver. When it was set only to the point where the hiss disappeared, any signal strong enough to be heard above the squelch could be heard "full volume."

Improvements in the transmitting section of the KA incorporated features familiar to operators using other types of Forest Service radio equipment. Having learned through experience the tuning procedures most acceptable to operators, the Laboratory designed the front panel of the type KA to be similar "to the tuning procedures for the type M radiophone."[36] By assimilating the mobile concepts of the type K and operational features of the type M, incorporating new circuits, and designing from experience gained with the previous airplane type A, the staff was able to "invent" the new composite type KA.

With only minor staff changes between 1935 and 1941, the small Laboratory coterie was responsible for 9 entirely new types of radio equipment, some 27 model changes over the full complement of Forest Service radios, inumerable "fixes," and several types of unique hardware and test equipment. Although some may have "lacked refinements by modern standards," they had a decided effect on the adoption of electronic communications, fire-control procedures, and administrative management procedures in the Forest Service. They also affected the development and

design of radios in the military and private sectors.

The path to success, however, was marked by many trials and tribulations. As events were to indicate, the Radio Laboratory was more than a hobby shop.

Reference Notes

1. Francis R. McCabe, "The Use of Radio in Forestry," (Senior thesis, School of Forestry, Oregon State Agricultural College, 25 April 1934), p. 28; and penciled note in margin by Guy V. Wood, 28 January 1958, Gaylord A. Knight Collection.

2. Keith Henney, ed., *The Radio Engineering Handbook* (New York: McGraw-Hill, 1941), p. 538.

3. Wavelength in meters is found by dividing velocity in meters per second (300,000,000) by the frequency in cycles. Thus, 3,000,000 cycles, or 3 MHz, is effectively 100 meters. In the interest of clarity, 100 meters is used in the text to represent the general range of Forest Service frequencies below 4 MHz, and 10 meters for the range of 28.5 to 32.5 MHz actually used in this band by the Forest Service.

4. The classification of frequency ranges was shifted upward about the time of World War II. Hence, uhf was downgraded to vhf (30-300 MHz) and appears in more recent texts and articles as such. Because all Forest Service documentation prior to World War II used the older terminology of uhf for any frequency above 30 MHz, and vhf for the 10-meter band, a number of quotes in the text will not appear correct. The same confusion will appear over the later renaming of kilocycles (kc) and megacycles (mc) as kilohertz (kHz) and megahertz (MHz), respectively. However, in the interest of clarity, I have opted to use the present designations rather than expect the nontechnical reader to make a later transition. Where a quotation uses the older terminology the modern designation will be immediately braketed, e.g., /kHz/, /uhf/, etc.

5. Roland F. Spooner, "1978-Fifty Years of Ten Meters," *Ten-Ten Chapter News* 16, no. 2 (Spring 1978), p. 8.

6. L. S. Howeth, *History of Communications-Electronics in the United States Navy* (Washington, D.C.: Government Printing Office, 1963), pp. 387, 410.

7. Lawson was on the organizing committee for the ARRL convention in Portland in 1927. See Wilbur Claypool, interview with the author in San Antonio, Tex., July 1978.

8. Lawson and Squibb both agree that Simson had an "intuitive" feeling for vhf based on "inquisitiveness or foresight." Neither one recalls his own early interest, and both credit Simson with the initial impetus. See Harold K. Lawson, interview with the author in King City, Ore., May 1978, and W. Foy Squibb, interview with the author in Missoula, Mont., May 1978.

9. A. Gael Simson, "U.S. Forest Service Radio Equipment," 2 January 1935, mimeographed memorandum, p. 3, Gaylord A. Knight Collection.

10. William B. Apgar, "Report on Radio Activities at Savenac Nursery--1932," 30 November 1932, p. 9, Gaylord A. Knight Collection; and McCabe, "Radio," p. 28.

11. F. H. Brundage to the Forester, 26 January 1934, Gaylord A. Knight Collection.

12. William B. Apgar, "Radio Communications Report--1934," /nd/,

[ca. late 1934-early 1935], typed copy, p. 8, Gaylord A. Knight Collection.

13. Lawson, interview with the author.

14. W. Foy Squibb, "Diary," 4 June 1934.

15. A. G. Simson, "Radio Equipment," 2 January 1935, p. 4, Gaylord A. Knight Collection.

16. Simson, "Radio Equipment," p. 4.

17. Simson, U.S. Forest Service Radio Developments," 10 April 1936, typed copy, p. 4, Gaylord A. Knight Collection.

18. Simson, "Radio Developments," p. 4.

19. Lawson, interview with author and Logan Belleville, interview with author in Saratoga, Calif., January 1978.

20. Belleville, interview with author, and Morris Willis, interview with author in Santa Barbara, Calif., January 1978.

21. Belleville, interview with author.

22. Belleville, interview with author.

23. Belleville, interview with author.

24. Belleville, interview with author.

25. Willis, interview with author.

26. Squibb, interview with author, and Lawson, interview with author.

27. Wilbur Claypool, interview with author in San Antonio, Tex., July 1978.

28. H. K. Lawson to W7ARZ [Wally Guthrie], Salem, Ore., 29 May 1931, Gaylord A. Knight Collection.

29. Claypool, interview with author.

30. Claypool, interview with author.

31. Frequency markings on the "Suit-case" now in storage at the Electronics Center, Beltsville, Md.

32. Lawson, interview with author, and various "Field Diaries" of Laboratory personnel.

33. U.S. Department of Agriculture, Forest Service, *Radio Handbook* (Washington, D.C.: U.S. Department of Agriculture, Forest Service, Division of Operation, circa 1938), p. 7, Mimeographed.

34. Lawson, interview with author.

35. See Appendix I; also chapter 7, pp. 106-108.

36. Forest Service Radio Laboratory, "Instructions for Operating Type KA Radiophone," 15 June 1940, Gaylord A. Knight Collection.

Chapter VII
Improved Designs:
Standards for the Future

Though the newspapers--and we ourselves--may be prone to treat them with no more than an off-hand respect, these sets are, even in a purely mechanical light, one of the outstanding wonders of the radio world. Improvement must still go on, but when viewed in a utilitarian way their worth--not only to the cause of conservation, but to society as well--already can hardly be evaluated either in dollars and cents or in words.

- Forest Service *Service Bulletin*[1]

By 1935, the rapid growth of radio use by Forest Service field units was complicating the administration and control of the radio project. The 700 radios available for operation, mostly in California and the Pacific Northwest, were congesting the limited frequencies allotted.[2] Using vhf had alleviated the problem somewhat by transferring part of the load to the 10-meter allocations, but the value of 100-meter radio was still important for nonline-of-sight transmissions. At a Forest Service communications conference in Portland in early 1935, "overcrowding" on the 100-meter band was discussed at length.[3]

To eliminate part of the congestion, the committee that planned the conference suggested that the Radio Laboratory staff design an intermediate-power transmitter of about 10 watts to fit between the 5-watt SP Special and the 20-watt type M.[4] The proponents argued this change '...will remove many more costly M sets from the air as well as reduce the interference between regions and forest on shared frequencies." Although "practically divided" on this point, the committee agreed "after rather exhaustive investigations" that "low power should govern" and that an improved receiver for the SP Specials would provide "adequate communication" in the semi-portable line. If this did not prove satisfactory, the committee requested that "...a new type set should be designed, but not until after an examination has been made by the technical staff at the Laboratory."[5]

The communications committee also reiterated the Forest Service policy of avoiding radio communications for all but fire control in an effort to further reduce inter-Forest, 100-meter interference. The practice of using the 3- to 3.5-MHz band for administrative business, or point-to-point communication, despite a prohibition, had been increasing steadily and was another cause of overcrowding. The committee cautioned that, "consistent with the agreement in effect between the A. T. & T system and the Secretary of Agriculture, we cannot ethically use radio for point-to-point communications where adequate private telephone facilities are available."[6]

The Laboratory staff set out to implement the conference mandate. In an attempt to provide a radio set of intermediate size and power, they sought (1) to improve the performance of the type PF (instead of that of SP Special as suggested) and (2) to lower the power of the type M.

In the meantime, Bill Claypool returned from Alaska to learn that the Laboratory temporarily lacked the funds to keep him on the payroll. He decided to open a marine radio sales and service shop in southeastern Alaska. While Claypool was in Portland to gather equipment for this venture, the financial situation improved, and Harold Lawson won him back with an assignment to improve the PF. (Claypool went back to Alaska later as an employee of the Forest Service.)[7]