/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 "Suitcase" 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]

The major problem with the type PF was its regenerative type receiver. It operated best when finely tuned to the point of breaking into oscillation. This made it a delight for experienced operators but proved difficult for the scarred and battered hands of a firefighter. Lacking the comfort and quiet of a lab or office, the harried men on the fireline had neither the time nor the patience to deftly locate the critical telltale hiss indicating regeneration.

Claypool set about designing a more acceptable receiver, assisted primarily by Lawson. For several months, he made many trips between books, drafting table, and workbench, attempting to master the fundamentals of superheterodynes. At one point, when neither Claypool nor Lawson could figure out the mathematics for a tracking oscillator in the 455-*if* stage, a traveling salesman came by. Learning of their problem, this graduate of "a prestigious school in the East" sat down and "whipped out" the answer for them.[8] The other circuitry was completed in due time and the newly designated SPF (Semi-portable phone) was ready for the 1936 fire season.

SPF Is Big Success

The success of the 2 1/4-watt SPF was immediate and it went on to become a legend. About one-half again as large as its predecessor, and weighing an intermediate 21 pounds, 6 pounds more, it was still light enough for smoke-chasers. With the kitbox, it was also hefty enough for temporary fire camps. Rugged in appearance and construction, it provided adequate service, amazingly, for 20 years after production stopped.

New Forest Service communication technicians continued to "cut their teeth" on the venerable SPF into the 1960's. Known on the fireline as the "short-peckered friend," it gained the respect of all who had to depend on it. Even Bill Apgar in Region 1, who found much to complain about, remembered that "those SPF's were a dream."[9]

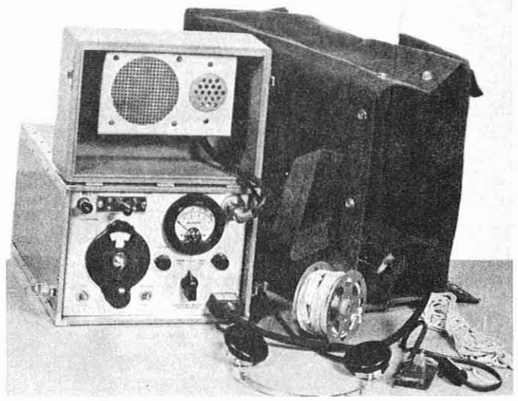

Figure 66. Front view of SPF model set up for portable use. (Forest Service photo, History Section)

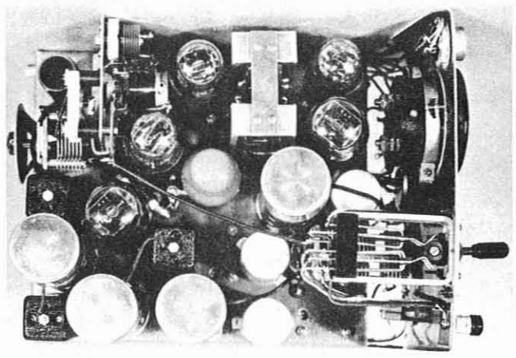

Figure 67. Interior view of SPF model. (Forest Service photo, History Section)

Figure 68. Smokechaser with SPF model set up for portable use on the Spud Hill fire, Columbia (now Gifford Pinchot) National Forest, Wash., 1937. (NA:95G-354925)

Figure 69. SPF model set up for semi-portable use at a Region 6 temporary base camp. (Forest Service photo, History Section)

The design of an intermediate-power, fixed-base, 100-meter unit followed that of the SPF. Based on the suggestions of the 1935 communications conference, the Radio Laboratory worked on altering the type M, now in its third modification, after abandoning the Hammarlund Comet Pro for the superheterodyne receiver of Claypool's SPF. Starting with the type M model D, the lower-powered version became the type I (Intermediate power). Virtually identical in appearance to the M, the type I weighed 66 pounds with all accessories, had a nominal output of 9 1/2 watts, and operated from batteries. Although the communications conference recommended it to reduce frequency crowding, its 20-watt predecessor outsold it 4 to 1.

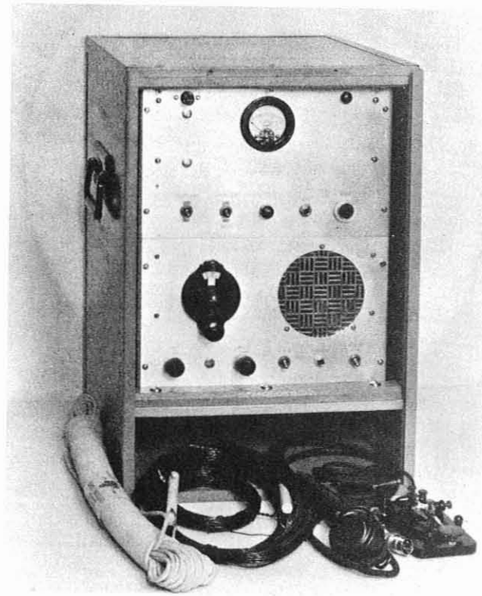

Figure 70. The type M, model D. The type I, model D, with the exception of a few switches, was identical in appearance. (Forest Service photo, History Section)

Improvements in the existing line of equipment followed a similar pattern. Criticisms had been leveled at the type S for its low power and frequently spurious signals, making it a prime candidate for replacement. Earlier changes in the type S model B had alleviated some of the problems of this 0.1-watt set, but even though over 780 sets were purchased by the Regions, the Laboratory decided to discontinue production. An updated version, the type SV (Superregenerative Variable frequency), with its output increased to 1-watt and separate oscillator circuits and tubes for both the transmitter and receiver, did not overcome all previous objections, however.

Figure 71. Type SV set at Mt. Hood, Ore., February 1941. (NA:95G-405143)

At an interregional radio meeting in Portland, January 4 to 12, 1938, a thorough review and analysis of Forest Service radio was again undertaken. Each set was evaluated on every aspect of construction and operation. Minor changes were recommended for most sets, but the type T set was subjected to major criticism. Over 35 changes were proposed. In addition to the need for greater receiver sensitivity, the conference requested crystal control for the transmitter, the use of a push-to-talk microphone, and a host of mechanical improvements.[10]

The Radio Laboratory had periodically subjected type T to model changes even before the conference. Early in its reconstruction, the T set was divided into two separate cabinets for duplex operation. With separate circuits for reception and transmission, the TH/TL (Ten-meter High frequency/ Ten-meter Low frequency) included many improvements.[11] But these modifications did not bring the type T up to the performance standards of the more successful Forest Service sets. It was "considered obsolete" following the 1938 communications conference, and was not included in later Radio Laboratory catalogs.[12] It was soon to be replaced by an improved model.

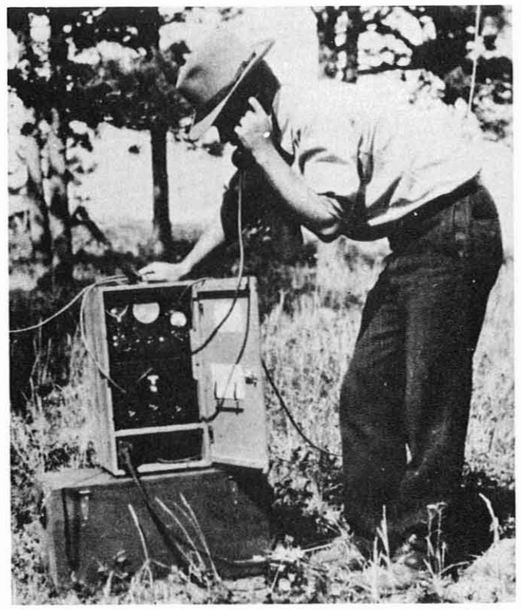

Figure 72. Type TH/TL in semiportable configuration for field use. See figure 97. (NA:95G-316855)

The naming of the type T, model D (T/D), was somewhat misleading. It was radically improved over the old type T. The type T/D incorporated "...the latest developments in ultra-high frequency /vhf/ parts and material with a view to extending the usefulness of the ultrahigh frequency /vhf/ spectrum..."[13] The major change in the T/D was in the receiver. The superregeneratives in the previous type T's were inherently noisy, making continuous standby nerve-wracking for the operators. This problem was eliminated by incorporating the superheterodyne in the T/D.

The T/D illustrates the number of complexities associated with the introduction of new Radio Laboratory ideas. Many older S and SV portables in the field faced obsolescence because the transmitters could not tune to the exact frequencies of the T/D. If a forest purchased the new units for lookout towers and sent smokechasers into the field with SV sets, there would certainly be many complaints. The master oscillators in the SV's simply could not hit the exact receiving location of the crystal-controlled T/D's--at least not without a number of frustrating failures.

T/D and SX/SXA Sets Are Versatile

The Laboratory staff was aware of this problem before completing the T/D design. To overcome objections, the men incorporated a bell into the circuitry of the new sets. This adaptation permitted S and SV operators to tune the dial of their sets across the full range of the T/D receiver while transmitting. When the two frequencies matched, the T/D alarm bell would sound. Returning to transmitting frequency, the S or SV operator would then continue to transmit until the type T/D operator located the calling station.

This strategy silenced charges of "planned obsolescence" against the Laboratory. But the staff went even one better. They saw the bell already in each T/D as presenting an option for a unique call system. If several T/D sets were ordered for a National Forest, the sender could activate the bell of a single receiver by using a code signal for that particular receiver in the system. This not only provided a degree of privacy but also meant that every lookout did not have to be disturbed when a message was relayed in the middle of the night.

The introduction of the T/D speaks well for the forethought and planning of the Radio Laboratory staff. In addition to extending the usefulness of the S and SV sets, the staff also made the T/D a less demanding tool. It could be left on, tuned to "standby" when necessary. With the set on standby, the lookouts or fire bosses could go about their other duties knowing that "the entirely foolproof" bell would notify them of incoming communications.[14]

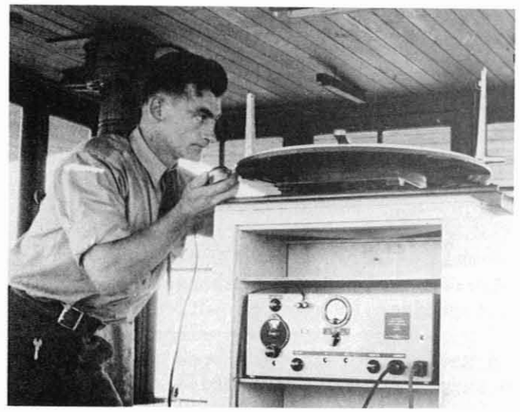

Figure 73. Type T, model D, located in base of fire finder, Pepper Lookout, Mt. Hood National Forest, Ore., July 1940. (NA:95G-397920)

Development of a mobile set for use in Forest Service vehicles proved to be a more demanding job for the Laboratory than expected. The lack of adequate commercial sets, the bumpy roads, and the ignition problems made early development of mobile radio impractical. "I am afraid," wrote Gael Simson in early 1936, that, "the day when the Forest Supervisor can ride around in his car and listen to all his radio stations will have to be deferred for a long, long time. The Forests are too big, our transmitters too small, and roads too noisy."[15]

The Radio Laboratory's first mobile radio was an adaptation of the type I transmitter, with a commercial pushbutton receiver, in late 1938. This type I-Mobile found only limited acceptance. It was then modified and renamed the type K (Kar).[16] The type K was supplied in three packages --a receiver, transmitter, and power supply. It had an output of 9 1/2 watts and operated on 100 meters.[17]

To be successful, the type I would have to provide consistent performance under adverse conditions. Almost immediately, it was learned that this second-generation mobile was unsatisfactory because of the unstable commercial receiver. Having failed to wed an available product with a modified transmitter of its own design, the Laboratory staff was "forced to begin development" of its own mobile receiver.[18] Logan Belleville received the primary responsibility for this project.

The Radio Laboratory dropped its plan to supply a 100-meter mobile and instead considered a 10-meter model. Basing the transmitter on a scaled-down version of the original type U, the staff was successful in late 1941 in providing an acceptable mobile transmitter--the KU-T (Kar uhf-Transmitter).

The task of designing a mobile receiver was much more complex. There was, as always, the problem of automobile noise, and there was no existing set to provide a starting point. Undaunted, Belleville sought his answers in the Laboratory tradition. Using books, drafting table, and workbench, his solution some months later was both unique and extremely successful.

Belleville overcame the problem without spark-plug noise suppressors or other forms of common ignition noise treatment. He accomplished this by using a variation of the "Lamb Silencer," first outlined in a 1936 *QST* magazine article.[19] This technique was similar to today's squelch control that keeps the receiver off in the absence of a strong signal. Only transmissions above the squelch setting are heard by the operator.[20]

Lawson and Belleville believed this adaptation allowed the KU-R (Kar uhf-Receiver) to compete favorably with the newly developed, commercial frequency-modulated (FM) mobile sets, which were static-free. In addition, it extended the life of other amplitude-modulated (AM) mobile sets. In an article for *Electronics* magazine, they wrote that the modification was "...good enough so that many [AM] communication systems now being discarded can be made to serve adequately."[21] Most important, the KT-T/KU-R had passed the tests which its predecessors had failed; its operation under adverse conditions far exceeded expectations. At the request of the Regions, the techniques used by Belleville were later applied to a vhf semiportable set--the U-T/U-R. While never substantiated, the word got around the National Forests that Motorola Inc. said they would have been "hard pressed" to equal the KU-R performance in the AM mobile field.[22]

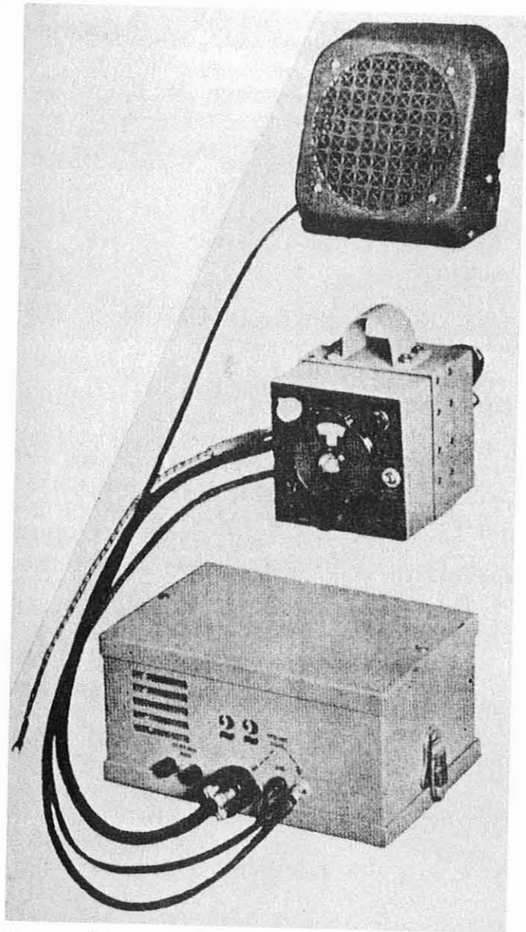

Figure 74. Type KU-R AM receiver, the Radio Laboratory's first fully successful mobile receiver. With its companion, the KU-T transmitter, it gave a high level of performance under adverse conditions. Receiver performance was assisted by a squelch control. The set competed favorably with new commercial FM sets of the time. See photo of combined unit in appendix I. (Forest Service photo, History Section)

Regional requests for an improved vhf portable/semiportable also led the Radio Laboratory to undertake a major modification of the type S/SV in 1940. The new type SX (Super-regenerative Crystals)[23] used three crystal-controlled frequencies in the 10-meter band at 1/4-watt power each. These were selected either by a switch or push buttons. With the purchase of a separate attachment (SXA), the unit could replace either the S or SV. The popularity of the SX led the smokejumper's school in Missoula to request an ultralight version. The type SJ (Smokejumper) represented the ultimate in size reduction; at 6 pounds, the compact set could fit in a special leg pocket of the smokejumper's outfit.[24]

Figure 75. Type SX (superregenerative, crystal-controlled frequency) lower set, shown here interconnected for operation with the SXA, top. The SXA was an audio amplifier used as a standby speaker with the SX transceiver. The SX proved a very popular, light, portable set. It was a successor to the S and SV sets. See circuit diagram in appendix I. (NA:95G-407251)

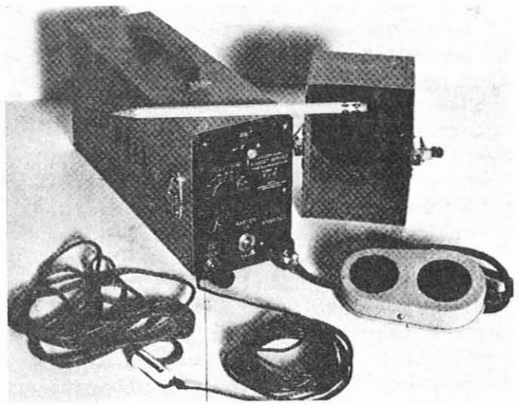

Figure 76. Type SJ set, developed as an ultralightweight model for smokejumpers, fitting into a special leg pocket and weighing only 6 pounds. Pencil gives an idea of its size. (Forest Service photo, History Section)

By early 1938, the staff at the Radio Laboratory was thinking of extending the effective operating range of the vhf semiportables.[25] In principle, vhf sets were limited to line-of-sight transmissions, but this could be extended if a third party relayed a message between two points not visible to each other. This concept might be thought of as a communication between a smokechaser and National Forest headquarters, with a lookout within sight of both parties retransmitting the smokechaser's message. The logical next step was to devise an "automatic relay."

First Radio Relay Station

In July 1941, a battery-operated radio relay design was completed at the Laboratory and readied for installation on Mt. Diablo, near Oakland, Calif.[26] The RRS was a composite of earlier vhf sets operating on standby until a carrier frequency turned on both the receiver and

Figure 77. The RRS (Radio Relay Station) installation atop Mt. Diablo, Calif., first field setup of the Forest Service, July 1941. It allowed the nearby Regional headquarters in San Francisco to establish point-to-point communication with any outlying vhf radio within visible range of the repeater. Esthetics required the RRS to be placed in a plain building that minimized environmental impact. (Forest Service photo, History Section)

Figure 78. Logan Belleville, standing, and Carl Davis, of the Radio Laboratory, at the RRS installation on Mt. Shasta, Calif. (Forest Service photo, History Section)

transmitter. Its introduction heralded a new era in Forest Service communication planning.

The selection of Mt. Diablo was significant. Located within communication range of Region 5 headquarters in San Francisco, the mountain gave the Regional office an opportunity to establish point-to-point communication with any outlying vhf radio within visible range of the repeater. If a system of strategically located repeaters could be placed throughout the State, it would eventually be possible for the Regional office to make contact with anyone in sight of a repeater. The Sequoia National Forest headquarters at Porterville, for example, might locate a repeater link on a point also visible to Mt. Diablo, bringing that office into direct contact with San Francisco. Similarly, if the Inyo National Forest could situate a repeater in line with the Porterville repeater, a 3-way link would be established between Bishop and the Regional office. The length of this daisy-chain communication system was limited only by an insufficient number of "intervisible" locations.

The RRS also had a significant impact on radio for the fireline aside from the inherent possibilities of vhf repeaters for administrative use. One criticism of vhf portable radio had been its inability to overcome the limits of intervisibility. A smokechaser who happened on a fire in a location where mountain ridges and the absence of a visible lookout tower hampered vhf communication was no better off than earlier smokechasers who had to rely on the telephone. To make contact, both had to leave the site. But with one or more vhf repeaters at strategic locations throughout a Forest, the smokechaser could now get his message out by sending his communication via the RRS link. This possibility was recognized by the Laboratory staff, who made plans to take full advantage of the technology.

Portable and semiportable sets were then designed with at least two transmitting channels. The first channel could be used on a Forest network when intervisible transmission was possible. The second channel would be the RRS link. Thus the anomalies of transmission would not keep fire crews, smokechasers, work crews, mobile units, or lookouts from establishing communications through one of the frequencies. This design virtually eliminated the last major objection to vhf use.

Two further advantages of the RRS are worthy of note. Its reliability made frequent maintenance inspections unnecessary; trips once or twice a year for adjustments and the replacement of batteries were usually the only attention required. This was in contrast to the annual chore of maintaining telephone lines and then repairing them after high wind, ice, and snow. The RRS also relieved overcrowding on the 100-meter channels for long-distance communication.

The way the Radio Laboratory staff coped with perceived objections provides insight into some of the guidelines they established for radio design. To be competitive with the telephone, the Radio Laboratory had to at least match the telephone's advantages, including ease of use, and relative simplicity. The simply constructed wooden box housing a Ranger's telephone was never shut off at the end of working hours; it always provided a silent communication hookup even if the many party line calls, which rang every bell on the party

line, proved unnerving. Maintenance was inexpensive, and there was no battery drain during periods of standby.

On the a.c.-powered central station type U, the concept of standby, or 24-hour service, was touted as the "outstanding feature." The *Radio Equipment* bulletin pointed out that "when a call is received on the stand-by loudspeaker, it is only necessary to pick up the /telephone/ handset to answer."[27] This feature, matching one of the telephone's advantages, was improved in the battery-operated type T model D. The T/D, of course, incorporated a "silent stand-by calling system" that relieved the operator of the incessant background noise associated with the earlier receivers and "advised of incoming calls without the necessity of a loudspeaker in constant operation."[28] The relatively low battery drain of the T/D, like the telephone, made continuous 24-hour use possible.

Similarly, the duplex feature in Forest Service radio made it possible to interrupt conversations to ask questions. It also protected the communication system against inadvertent breakdowns. During the era of simplex operation, a radio operator under stress of an emergency, especially a fire fight, could neglect to throw the switch from "Transmit" to "Receive;" as a result, important incoming messages could be lost. By providing radio with duplex capability, the Radio Laboratory effectively silenced one more criticism.

A review of Laboratory literature also conveys an awareness of the need to provide a rundown of comparative costs by including an estimate of annual radio maintenance expenses in its catalog. A Supervisor could then easily calculate that if the initial cost of a semiportable set was listed as $100 and annual maintenance at approximately $20, the price of installing and maintaining a new 5-mile telephone line was much more.

Many Advantages Over Telephone

A number of other features extended the application of radio beyond that of the telephone; for example, the RRS repeater for long-distance transmissions; the Garco generator for extended, heavy-duty use in the interior; the quieter operation of vhf during electrical storms; and the mobile operation of KU-R/KU-T. Less apparent advantages over the telephone included comparatively private conversations as contrasted to multi-party lines made up of the Forest Service and numerous cooperators, elimination of the frequent delays caused by a backlog of calls at the local central, and freedom from the umbilical cord of the telephone. Thus radio was not only a supplement to the telephone, but also an electronic, primary communication device that eventually equaled and then surpassed the performance of its predecessor. The telephone spurred on the Laboratory staff to improve the radio.

Meanwhile, the administration of the Radio Laboratory continued along the lines established in 1932. Portland continued to determine the technical aspects of radio application, while the Washington Office "rubber-stamped" them into policy. As Regional interest in radio use grew, Earl Loveridge began to give serious consideration to the need for a separate radio section under the Division of Operation. Concerned that this would take time for approval, he once again turned to Jack Horton and the Radio Laboratory. "At present," he wrote in mid-1937, "the Section exists only in the formative stage,

hence I have to depend on you and Simson for considerable assistance in the radio activities of this office."[29]

By the end of the 1940 fire season, nearly 4,000 radios had been ordered by the Regions. Some 90 percent were in the portable class (under 21 pounds), and 2,000, or one-half, were vhf sets with only 1 percent over 2-watt output.[30] These figures reflect the successful accomplishments of the Radio Laboratory in its effort to design lightweight portables for the fireline during the relatively short period, 1933 to 1940.

By this time, it was also apparent that the SPF was "probably the backbone of the high-frequency /100-meter/ communication system."[31] In 1947, for example, it continued to lead the popular 10-meter SX by some 400 sets--1,200 to 800, respectively.[32] The development of vhf, originally accompanied by almost immediate obsolescence, had found considerable favor on the National Forests and was promising to become more popular as technological improvements tended to level off. "Within the last year or two," Simson wrote the Regions, "this process has slowed up markedly and it is not anticipated that the obsolescence factor will again be nearly so severe as it has in the past."[33]

The lack of adequate frequencies continued to limit the extension of radio into the National Forests. Because of Simson's IRAC activities, the Forest Service had a relative abundance of frequencies, at least when compared to the U.S. Weather Bureau which had to borrow a frequency from the Forest Service to get on the air.[34] The Forest Service authorization to use 25 frequencies in the 2,000 to 3,000 kHz band (100 to 150 meters) and 75 frequencies in the 30,000 to 40,000 kHz band (roughly 10 meters, actually 7.5 to 10.0 meters)[35] was not a significant allocation--given the promixity of Regions to each other, the number of National Forests, and the score of tasks that might have to be handled on any given day.

All the accomplishments of the Radio Laboratory staff were conducted despite a lack of adequate manpower. Before World War II, the Laboratory never had more than eight employees. Allowing for Lawson's contract employment, and Belleville's rather late appointment in 1936, the accomplishments appear even more staggering.

Similarly, at no time did the budget for the Laboratory go over $30,000. In fact, considering the benefits returned to the Forest Service, the allotments for fiscal year 1939 reflect rather miserly expenditures, with Belleville's weekly salary of $31.15 less than that paid the stenographer and draftsman. A breakdown follows in table 1.

Figure 79. Radio Laboratory personnel, ca. 1939. Left to right, Earl Schoenfeld, Gael Simson, Harold Lawson, Logan Belleville, Ralph Kunselman, and Carl Davis. (Forest Service photo, History Section)

Table 1.--Allotment estimate, Radio Laboratory, FY 1939[36]

Item	Amount	Total
Salaries:		
A. G. Simson, Radio Engineer	$4,600	
H. K. Lawson, Associate Radio Engineer	3,200	
Earl Schoenfeld, Assistant Radio Engineer	2,600	
L. M. Belleville, Radio Electrician	1,620	
Ralph Kunselman, Radio Electrician	1,620	
Carl Davis, Radio Electrician	1,620	
P. W. Snapp, Draftsman	1,800	
A. Pedersen, Stenographer	1,800	$18,860
Travel:		
A. G. Simson	1,500	
Other radio personnel	1,000	2,500
Miscellaneous Expenses:		
Fuel, electricity, water, telephone and telegraph, freight, and express		1,030
Parts and equipment		4,300
Complete house on tower		400
Total, all items		$27,090

In retrospect, the radio design accomplishments in Portland deserve very high marks. Only one decade had elapsed between Beatty's SP-1930 and the Laboratory RRS. Perhaps only those who have struggled with developing a single idea can appreciate the scope of this endeavor. It is no mean accomplishment to master the fundamentals of a design, test the innumerable variations, struggle with the gremlins that work their way into the circuitry, and then overcome the common "wisdom" that says if the prototype works, the final product won't. Though rewarding, the process is a highly personal endeavor that takes its toll, but it was repeated at the Radio Laboratory perhaps 100 times in a 10-year period.

In addition, the Radio Laboratory had responsibility for implementing a smooth transfer of this technology. Special projects, cooperation with other Government agencies, a great deal of travel and the expected bureaucratic administrative chores all combined to place additional demands on an already limited staff.

Reference Notes

1. U.S. Department of Agriculture, Forest Service, "Review Your Radio," *Service Bulletin* (1939): 6, p. 6, Gaylord A. Knight Collection.

2. U.S. Department of Agriculture, Forest Service, "Forest Service Communications Conference," Portland, Ore., 20 February to 3 March 1935, mimeographed summary, Gaylord A. Knight Collection.

3. The attendees of record were the personnel from the Radio Laboratory, William Apgar (R-1), Francis Woods (R-4), Fred Funk (R-5), and Leonard Blodgett and W. Holtz (R-6). Forest Service, "Communications Conference."

4. The SP Special (or SSP) was a "beefed up" 5-watt SP.

5. Forest Service, "Communications Conference," p. 2.

6. Forest Service, "Communications Conference," p. 3.

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

8. Harold K. Lawson, interview with the author in King City, Ore., May 1978.

9. William Apgar, interview with the author in Sun City, Ariz., January 1978.

10. U.S. Department of Agriculture, Forest Service, Radio Laboratory, "Technical Notes accumulated January 4 to January 12, 1938, at the Forest Service Radio Laboratory InterRegional Radio Meeting," typed copy, Gaylord A. Knight Collection.

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

12. A. G. Simson, "Radio as a National Forest Protection Tool," *Journal of Forestry* 36, no. 4 (April 1938): 367.

13. A. G. Simson, "U.S. Forest Service Radio Developments," 10 April 1938, historical paper, including expected design changes, Gaylord A. Knight Collection.

14. Harold Lawson, "Memorandum for Mr. Simson," 26 October 1938, Gaylord A. Knight Collection.

15. A. G. Simson, "The Role of Radio in National Forest Communication," 11 April 1936, mimeographed copy, Gaylord A. Knight Collection.

16. The designation "type K" for "Kar" is only an educated guess, based on the method used to select other radio types. Neither Lawson, Belleville, nor Claypool could recall specifically why this letter designation was selected. Kar was considered an appropriate designation even though there was a commercial mobile radio produced by the Kaar Company at about this time.

17. U.S. Department of Agriculture, Forest Service, Radio Laboratory, *Radio Equipment Bulletin* (1939): 10.

18. A. G. Simson, "Memorandum," 27 January 1939, Gaylord A. Knight Collection.

19. H. K. Lawson and L. M. Belleville, "Mobile 30-40 Receiver for the U.S. Forest Service," *Electronics*, January 1942, p. 23.

20. Logan Belleville, interview with the author in Saratoga, Calif., January 1978.

21. Lawson and Belleville, "Mobile 30-40 Mc Receiver," p. 24.

22. Gaylord A. Knight, interview with the author in Atlanta, Ga., November 1977, February 1978, and April 1979.

23. In amateur radio parlance the word "crystal" is written "xtal," hence the SX designation.

24. S. R. Winters, "Radio Equipped Smoke Jumpers," *Radio News*, April 1942, p. 6.

25. Lawson and Belleville, "Mobile 30-40 Mc Receiver," p. 24.

26. Logan Belleville, "Field Diary, No. 4," July 1941 to December 1941, Gaylord A. Knight Collection, 7 July 1941.

27. U.S. Department of Agriculture, Forest Service, Radio Laboratory,

Radio Equipment Bulletin, October 1939. Looseleaf. Lifting the handset automatically turned on the transmitter.

28. Forest Service, Radio Laboratory, *Radio Equipment Bulletin*, October 1939.

29. Earl Loveridge to the Regional Forester, Portland, 29 April 1937, Gaylord A. Knight Collection.

30. Lawson and Belleville, "Mobile 30-40 Mc Receiver," p. 24.

31. Simson, "Memorandum," 27 January 1939, p. 3, Gaylord A. Knight Collection.

32. D. S. Nordwall, "Memorandum for the Record--Radio Laboratory Inspection," 24 March 1947, p. 14, Gaylord A. Knight Collection.

33. A. G. Simson, "Memorandum," 27 January 1939, p. 3, Gaylord A. Knight Collection.

34. William P. Kramer, "Office Memorandum to Region 1," 29 July 1948, Gaylord A. Knight Collection.

35. Simson, "Memorandum," p. 5. In the 10-meter band the Forest Service actually used only the 28,200- to 32,500-KHz (28.5- to 32.5-MHz) range, or 9.23 to 10.53 meters.

36. Simson, "Memorandum," p. 5 (slightly edited).

Chapter VIII

Eat, Sleep, and Drink Radio:

Administration, Cooperation, and Special Tasks

(The radio operator) will guard his health and keep as physically fit as the job permits so that he will not fail in emergencies. By example, he will show that he can take it and come up smiling.

- Forest Service *Radio Handbook*[1]

Men like Simson, Lawson, Squibb, Claypool, and Belleville came to radio development with a natural inclination, talent, and respect for the subject matter. By teaching themselves the basics and keeping pace with technological developments, they grew up with the subject while increasing their own self-confidence. As time progressed, the subject and individual merged into one. Logan Belleville willingly "ate, drank, and slept radio."[2] The net result was that the Radio Laboratory achieved its mission relatively quickly. It was staffed by highly creative men dedicated to their profession because of enthusiasm and free choice. The Washington Office could ask for an inch, expect a foot, and receive a mile.

Gael Simson quietly set the example for total commitment to the radio development program. As the principal administrator, his Portland location often placed him several thousand miles from many of his duties. He served both the Chief of the Forest Service and the Regional Forester of Region 6. His tasks, culled below from a memorandum from Earl Loveridge, encompassed a wide range of administrative functions and made him a well-traveled man.[3]

One of Simson's most important duties was his assignment to the IRAC. This assignment became his through a series of delegations, from the Secretary of Agriculture to the Chief Forester to Assistant Forester Loveridge to the Regional Forester in Portland, who passed it onto him. Each agency of

Chief, Forest Service	Regional Forester, R-6
(Simson's responsibilities through the Washington Office)	(Simson's and Lawson's responsibilities through the Radio Laboratory)
1. Formulate national policy.	1. Technical advice and recommendations in policy; technical application and administration of radio policies.
2. All Washington, D.C. contacts.	2. All field contacts, including technical and procurement.
3. Frequency allocations.	3. Technical assistance in frequency assignments.
4. Cooperation with State and Federal Agencies.	4. Cooperation with Regions.
5. Normal administrative management.	5. Administrative supervision of Radio Laboratory unit.
6. Field inspections.	6. Field inspections.