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 physicall 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 Hand

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

Chief, Forest Service

(Simson's responsibilities through the Washington Office)

1. Formulate national policy.

- 2. All Washington, D.C. contacts.
- 3. Frequency allocations.
- 4. Cooperation with State and Federal Agencies.
- 5. Normal administrative management
- 6. Field inspections.

y e y n	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.
book ¹	Gael Simson quietly set the example for total commitment to the radio develop- ment 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 administra- tive functions and made him a well- traveled man. ³
•	One of Simson's most important duties
d	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
	Regional Forester, R-6
	(Simson's and Lawson's responsibilities through the Radio Laboratory)
	 Technical advice and recommendations in policy; technical application and administration of radio policies. All field contacts, including technical and procurement. Technical assistance in frequency assignments. Cooperation with Regions.
t.	 Administrative supervision of Radio Laboratory unit. Field inspections.

the Federal government, including the Armed Forces, was assigned a seat in IRAC. Along with E. C. Wagner, an attorney, Simson was responsible for respresenting the entire U.S. Department of Agriculture.⁴ Because IRAC met as often as once a month, Simson frequently had to leave the Laboratory to attend meetings.

Cooperation with other Federal agencies and State departments of forestry also kept Simson on the road. One such activity was a three-point program to obtain whf and hf frequencies for the States; another was the modification of IRAC regulations as applied to non-Federal forestry.⁵ When the application and use of radio had to be demonstrated to State or Federal agencies, or sets had to be inspected, at locations where radio could be effectively used, Simson would travel to appropriate Forest Service Regional headquarters, pick up the Regional communication officer, and then go to the site.

The Laboratory would also inspect sets before delivery. Sales were made to such diverse agencies as the Navy; the Indian Service, National Park Service, Reclamation Service, and Grazing Service, all in the U.S. Department of the Interior; the Biological Survey and Weather Bureau in the U.S. Department of Agriculture; and the Bureau of Lighthouses in the Department of Commerce. So Simson's time was often at a premium.⁶

The Weather Bureau used the Laboratory more than the others did. The Forest Service began in the 1930's to prepare daily fire-weather summaries as indicators of forest fire danger in each Region. For this purpose, it depended largely on the Weather Bureau to supply it with data at frequent intervals at many locations --on temperature, humidity, wind direction and velocity, lightning, rainfall, atmospheric pressure, etc. The Forest Service combined such data with its own local observations and its measurements of the fluctuating moisture content of forest litter and dead branches and tree trunks to estimate the fire hazard from day to day during the fire season in its major forest areas, and later to calculate numerical fire danger ratings. The Laboratory, therefore, provided radio frequencies for joint use, sold sets to the Weather Bureau, and helped the Bureau develop mobile radio vehicles.

The success of the Radio Laboratory and the proliferation of Forest Service radios brought a measure of national renown to the work. At least once a year, an article had to be prepared for publication in a leading magazine or journal. Visits from news people and dignitaries took up additional staff time. One time,



Figure 80. Gael Simson in Arkansas for State forestry demonstration. (Forest Service photo, History Section)



Figure 81. U.S. Weather Bureau mobile radio van, 1938. (NA:95G-364875)

the National Broadcasting Co. (NBC) developed a radio script closely following the sequence of a real forest fire control operation. NBC requested that actual sites and equipment be used rather than duplicated in the studio. Under normal circumstances, this request was no problem, but a timed script required a great deal of advance preparation. Up until a few moments before the program went on the air, the telephone company was still frantically attempting to remove 60-cycle noise from the telephone line. Taking part at their posts were a smokechaser, two lookouts, a fire camp dispatcher, and Logan Belleville riding around in a pickup equipped with mobile radio. To the relief of all, the broadcast came off without a hitch. In the closing moments, the announcer asked Gael Simson if fire emergency work was the only use made of the radio system. The answer, which might have been predicted by those aware of the Forest Service's agreements with A. T. & T., was "Yes." Then Simson carefully added, "We do not use it as a substitute for our telephone system, but merely as an emergency device "

President Roosevelt's Visit

The visit of President Franklin D. Roosevelt to the Pacific Northwest in 1939, concerning the expansion of Olympic National Park in Washington at the expense of Olympic National Forest, also required a temporary diversion from the usual Laboratory duties. At the request of John Bruckart, supervisor of the Olympic National Forest, Simson and Belleville motored up to Tacoma to install a public address system for the scheduled speeches. After the program, Simson and Belleville quickly disassembled the equipment, loaded the Chevrolet panel truck, and hurried back to beat the traffic. As they sped along, crowds waved flags at them and the highway patrol motorcycle officers pulled out in pairs to escort them. Believing the Presidential party was just behind him, Simson did his best to keep out in front. Several miles later, the two men stopped for lunch and learned that the President was indeed some distance behind, led by an identical vehicle, and that the Washington State police had been confused.8

Further examples of cooperation with State and Federal agencies ranged from the simple to the complex. One particularly unique request for assistance came from the Portland Civil Service Board. The Board asked for a written examination that would test the skills and knowledge of applicants for radio operator and radio technician jobs. Lawson and Belleville put together a comprehensive exam and were subsequently thanked by the Board for their efforts. "We found," wrote the chief examiner, "that the radio sections of the examination had a remarkably high degree of reliability..."9

Special requests for electronic equipment to suit unusual applications also found their way to Portland. In the fall of 1938 a violent hurricane hit the coast of New England, with loss of life, property, and shattering of immense stands of timber. In response to numerous requests, the Forest Service was authorized to organize and operate the emergency Northeastern Timber Salvage Administration (NETSA) to reduce hazard of fire, insects, and disease, as well as to recover as much as possible of the great potential value of the lumber. 10 But the numerous nails, bolts, and spikes in the logs were raising havoc with the saw blades. Having attended a radio short course at the Lab, Leonard Blodgett, a timber specialist who was transferred from Region 6 to become a District Supervisor of the NETSA project, knew exactly where to turn. He wrote to Gael Simson to request that the Laboratory try to develop a metal detector.1

The Laboratory was unenthusiastic. Horton informed NETSA that "from a technical standpoint the problem you present is extremely difficult."12 Blodgett, however, was not put off. Following consultations with Simson, who happened to be in Boston at the time, and Foy Squibb in the Eastern Region (R-7, now part of R-9), he prevailed upon Lawson to look into the matter further. For some months until September 1939, Logan Belleville struggled with a prototype.¹³ He eventually completed the type X (Experimental) metal detector after devising an electronic bridge arrangement that became unbalanced in the presence of metal and, thereby, changed the frequency of an audible 1,000-Hz tone. The device was sent to NETSA. Judging from the queries on other possible uses, which ranged from ore exploration to the detection of metal in a cow's stomach, it received much interest from the general public. However, it was cumbersome and proved impractical, and there was no time to refine it further.14

A similar project evolved shortly after the beginning of World War II. The Army's request for an acute listening device to detect the approach of enemy bombers led the Radio Laboratory to build the type TE (Tin Ear). When preliminary tests demonstrated that "detection time by unaided ear /was/...30 seconds ahead of the simple 'Tin Ear,'" the project was abandoned.

Regional assistance and cooperation also consumed a significant portion



Figure 82. Ralph Kunselman demonstrates the experimental type X metal detector developed by the Radio Laboratory, while Harold Lawson looks on. The gadget was designed to warn sawyers of nails, bolts, spikes, wire, etc., in logs they were processing after the New England hurricane of 1938. The work came under the timber salvage program of the Forest Service and cooperating States. (Forest Service photo, History Section)



Figure 83. Interior layout of type X radio metal detector, an experimental prototype developed by the Radio Laboratory in 1939 to warn of metal in logs. (Forest Service photo, History Section)



Figure 84. The "Tin Ear," type TE, a listening device created by the Radio Laboratory, at the request of the Army to detect approach of enemy bombers. (Forest Service photo, History Section)

of Laboratory time. Harold Lawson always had a backlog of Regional correspondence relating to technical problems, design improvements, and procurement, so Lawson and the staff spent a number of months accumulating materials and putting together an all-Service radio manual. Before then, a small pocket-size instruction book for the operators and working schematic drawings for the technicians had been inserted with each radio set shipped out. This practice had become a clerical problem for the Regions which struggled to keep pace with the paperwork for the many model changes and new products. When the Radio Handbook was published in 1938, it relieved the clerical situation greatly.

The Radio Handbook, bound in the traditional dark green of the Forest Service, dealt with all aspects of radio on the fireline. It gave the historical background of the program and went into the organization and policies of radio in the Service, use of radio in planning and application, and use of communication networks on large fires. It also outlined the proper Forest Service operating procedures and basic radio fundamentals. Several hundred pages of schematics, parts lists, circuit descriptions, and pictures were included to aid in servicing the sets. The 500 pages were removable and were frequently updated and circulated by the Laboratory.

The Radio Handbook was not only an organized compendium of Forest Service radio facts, but also an instructional device for technician training. It still left much to be desired, but now, theoretically, a person with previous experience in radio and assigned to a forest, could take the Handbook and one or two other recommended texts, and be successful in his job.



Figure 85. Suggested plan for radio network on "conflagration" fires, from the Forest Service <u>Radio Handbook</u>. (Forest Service photo, History Section)

Trips to Assist the Regions

From time to time, the Radio Laboratory staff had to travel to adjacent Regions to make technical inspections and installations. This experience often provided them with firsthand knowledge of Regional communication problems and allowed them to answer specific questions. The men went by automobile, boat, airplane, and horse, doing their best to smooth the transition of Forest Service personnel from telephone to radio. One entry in Foy Squibb's diary reflects the effort and time required. On a trip through Oregon, he spent Friday, July 21, 1933, traveling to and from an installation on Pearsol Peak. That night he recounted the day's work that had taken him 30 miles by car and 14 miles on horseback:

Left 7:00 am with Blair for Pearsol Peak--arrived 10:30--changed directions of antenna to get feeder at right angle to it. Checked set and found oscillator condenser out of adjustment so set wasn't putting out a signal. Contacted Stove Gulch, Bald Mtn., Tennessee Mtn., and Bolan Mtn. for check on set. Results not so good at distance of 10 miles but fine for distances greater or less than 10 mi.

Left Pearsol 1:00 pm--arrived Anderson Ranch 3:15 pm--Rode with Blair in govt. truck to Redwood R. S. /Ranger Station/--arrived at 6:00 pm¹⁶

Regional trips also gave the staff an opportunity to attend communication meetings and to discuss particular Laboratory design problems with authorities in the electronics field. Logan Belleville once logged a 12-day automobile round trip between Portland and Los Angeles. The diary entries, summarized below, reflect the value and the pace of such ventures away from the Radio Laboratory:

Oct. 11, 1939

Left Portland in company of H. K. Lawson in government car at 7:30 a.m. Arrived at Yreka, Calif., at 5 p.m. and contacted "Windy" Miller, forest radioman, and discussed general radio matters.

Oct. 12, 1939

Left Mt. Shasta in a.m., arrived in Vellejo, Calif., in p.m. After dinner went with Lawson and Squibb to A.I.E.E. /American Institute of Electronics Engineers/ meeting in San Francisco. F. E. Terman discussed directive antennas.

Oct. 14, 1939

Saturday. Visited Government Island. In p.m. visited /undecipherable/ and returned to Vallejo where visited with Squibb. Oct. 15, 1939

Sunday. Traveled from Vallejo to San Francisco.

Oct. 16, 1939

Met Fred Funke at Regional Office. Visited Bud Baine at Technical Radio. Visited Eimac tube plant. Visited Stanford University where saw F. E. Terman--discussed S set problems with him, saw Klystron working and met Morgan with whom discussed mobile antenna report of Dept. of Interior.

Oct. 17, 1939

Met Fred Funke in Oakland with whom started trip south. Went through Yosemite. Visited North Fork supervisor's headquarters on Sierra and discussed general radio problems. Continued on through Fresno and visited Bakersfield.

Oct. 18, 1939

Arrived at Pasedena USFS office. On to USFS radio shop in Arcadia where went over specific radio problems. Visited Monitor Piezo Products Co. to discuss several problems with crystal oscillators.

Oct. 19, 1939

Made transmission tests at Arcadia. Left about noon on way north. Stopped at Santa Barbara to look at antenna problem. Continued north to San Luis Obispo.

Oct. 20, 1939

Continued north looking over topography and making transmission tests. Arrived in Oakland. Oct. 21, 1939

Saturday. Government Island. Talked with Hanney, Funke and Crabb. Left for Modoc National Forest.

Oct. 22, 1939

Drove through Lassen National Forest. Visited Ranger station at Fall River Mills. Drove on to Klammath [sic] Falls, Oregon.

Oct. 23, 1939

Arrived back in Portland. 17

During the years immediately preceding World War II, the Portland staff personally handled a number of requests from the Regions, including special one-of-a-kind projects dealing with unique communication applications. Because Region 6 was close to the Laboratory, its requests ranged from modifications of communication sets to the construction of a radio trailer.18 In search of a package that would allow smokejumpers to parachute radios to the fireline, Region 1 asked the Laboratory to experiment with various shockproof devices, including loaves of bread.

Installation of Regional systems and the inspection of communication applications also took the staff away from Portland. Perhaps the most extended trip was made by Bill Claypool in 1936 to the Caribbean National Forest in Puerto Rico. Claypool first traveled by rail to New York City to board the ship. He detailed the New York experience for Harold and Bee Lawson in a lengthy letter from Rio Piedras. A short excerpt from his letter reflects the interests of the men associated with the Portland Radio Laboratory:



Figure 86. Parachute experiment with radio package. Note the loaves of bread on top of the package. One of a series of experiments conducted for Region 1 in the late 1930's to find a way of shock-proofing radios parachuted to smokejumpers on a fire. (Forest Service photo, History Section)



Figure 87. Radio trailer of Pacific Northwest Region (R-6) in 1939. (Forest Service photo, History Section)

Radio City held so many attractions that I could not see the previous day that I returned the next morning early and spent several hours in the New York Museum of Science and Industry. And there, Harold, you would find things that would interest you so you would never want to

leave. For example every sort of electrical principle such as capacitive, inductive, and resistive reactance and combinations are displayed in working form so simple that the layman can even understand the underlying facts. All sorts of electrical gadgets that perform unusual tricks with explanations of all. Every kind of scientific subject was displayed even to working models of wind tunnels that showed the effects of streamlining and aircraft construction and design. The Holland tunnel in miniature complete even to the automatic gas content analyzer ...

Designing a Testing Set

The Radio Laboratory staff always tried to keep radio costs to a minimum because the cost of a communications system was a financial burden for the Regions. They designed alternatives less costly than commercial test equipment. One of these, the type A test set, became a Laboratory catalog product. It served many functions: a grid-dip oscillator, a modulated oscillator, and a rectifier wavemeter. It was originally conceived by Logan Belleville for use in his Twin Falls radio shop. Along with the type D test set (for supplying a frequencymodulated test signal in visual alinement of wideband if amplifiers), it served as a functional, economical testing device in many Forest Service radio repair shops.²⁰

Annual meetings furthered interregional cooperation. Radio Laboratory staff and the Regional communications personnel would discuss and analyze each set in detail and suggest improvements and modifications. Sometimes these recommendations involved entirely new projects. Because of



Figure 88. "Plumber's Delight" antenna, a creation of the Radio Laboratory. Photo at left shows details of the radial supports. Photo at right shows an installation on a Forest Service lookout station in Region 6, covered with rime ice. (Forest Service photos, History Section)

concerns voiced over the inability of the requirement. Antennae, which may deterground-return Forest Service telephone mine the success or failure of any radio, lines to handle additional traffic, the were important factors in set-up time, 1938 conference suggested that the Radio reception, transmission, and maintenance. Laboratory look into carrier telephones, On interregional trips, the staff would that is, telephone wires used for the often find time to stop at manufacturers' transmitting medium; several test sets plants and universities to review recent were constructed in Portland. In techdevelopments in tubes and components, and nical terms, the project was unsuccessful to discuss the intricacies of particular because of the inability to predict the configurations of antenna construction. transmission distance over any given line Sometimes this brought them into disand the rather low-grade performance of a agreement with F. E. Terman, now commonly ground-return system.²¹ Belleville, who referred to as the "Father of Silicon looked back on it with a smile, thought /transistor/ Valley, " and his staff at the project was unofficially dropped Stanford University.23 because the staff had completely overlooked the fact that "...the unbalanced Antenna design, however, was not telephone line made a very effective always so well-studied or esoteric. antenna for lon-wave radio from as far as After RCA came out with a particularly the East coast, and the interference was effective vhf rod-type antenna at what R9 /perfect7."22 Forest Service circles considered a very high price, Belleville suggested Continual improvement and updating of they "turn it inside out" for their antenna design was another Laboratory production and use.²⁴ The result was



a collection of pipes that could withstand the vagaries of wind, snow, and ice. Known as the type PD (Plumber's Delight), it served admirably at many remote Forest Service locations.

The most time taken from radio design was for the model-bid-construction practice. The Radio Laboratory had adopted the procedure because the staff lacked the test equipment to specify precisely the exact electrical performance of their designs. Potential bidders could determine production expenses by costing out the parts and labor necessary to duplicate the laboratory model. This practice was usually very successful, and awards went to manufacturers willing to work closely with the Laboratory.



Figure 89. Inspecting incoming SV sets from the manufacturer at the Radio Laboratory, before reshipment to the Regions. Left to right, Charles McPherson, Carl Davis, and Ralph Kunselman. (Forest Service photo, History Section)

Actually, one staff member always seemed to be on temporary detail for preliminary acceptance tests of the sets at a manufacturer's plant, where any needed minor modifications were to be identified as sets came off the production line. This usually involved substitution of a resistor or capacitor--a practice that often left the Laboratory with an abundance of short-lead components --and greatly facilitated the final inspection process in Portland before filling the Region orders.

Some Problems with Suppliers

Sometimes, however, this procedure did not work, especially when the Forest Service rushed to get additional units into the field in time for a fire season. Once, when contracts for some type T sets were awarded, the Laboratory hastily provided a model that lacked cabinet, antenna, instruction manual, and nameplates --exclusions covered either as exceptions or as special items that were to be identified after the contract award; the potential bidder could set a cost for the items based on previous experience, go ahead with the other tasks, and then call for the specifications at an appropriate point in the construction.

The Laboratory expected contractors to order parts as soon as verbal notification was received so that construction could start quickly after written notification, Western Wireless, Ltd. of San Francisco was awarded such a contract for 130 type T sets when it was already "strapped" for adequate personnel on a contract for Forest Service type M and S sets. Charles Watson received a telephone call in June 1936 that his company had won the bid, but he did not proceed to order parts in advance. A newcomer to this volume of business and lacking adequate labor or physical plant and financial resources, he later said, "...it was thoroughly inadvisable for us to borrow the necessary money on the strength of an order which, in fact, was not [yet] an order.26

This hesitancy, though technically legal, placed additional pressure on Western Wireless. Because he could not move into production quickly, Watson used up any grace period that might have been extended to the company if legitimate problems arose during the 45-day contract schedule.

The problems of Western Wireless soon began to snowball. When the September 2 contract deadline passed, Watson asked Gael Simson for an extension based on a number of "unforeseen circumstances" due to not receiving Kellogg handsets, the inevitable (and from the Laboratory's point of view, predictable) failure of suppliers to deliver parts on schedule, as well as some "problems" created by the Radio Laboratory. These last alleged problems were as diverse as failure to specify nomenclature on nameplates and to authorize the substitution of a five-position rotary meter switch for a double pole-double throw switch, failure of the original sample to work properly, and need to rewire the receiver decks because of a change 27 in the hook-up of the guench coil.

Harold Lawson responded to Watson's complaints with an onsite inspection. He found Watson's complaints unjustified. Receiver and transmitter decks were not yet completed. Panels, brackets, and shield cases were not drilled, tapped, or mounted. Watson's contention that the lack of handsets and nameplates was holding up production was specious. Even if they were on hand, they could not be used until construction was complete. "It would appear that a large part of this delay is due to the use of insufficient labor and the employment of unskilled men, Lawson concluded.28

Lawson also dismissed the complaints that the Radio Laboratory had not

supplied a draft of the instruction manual and antenna specifications. Western had previous contracts with the Forest Service requiring the company to supply these items. Irritated by what he viewed as intentional delays, Lawson charged that the "...failure on the part of Western Wireless to call for antenna specifications or instruction manual copy was merely a method of evasion or an attempt to obtain contract time extension from the Forest Service on the basis of failure to supply /a/ complete model."²⁹

By this time, Watson realized that his relationship with the Radio Laboratory was suffering. He wrote Regional Forester C. J. Buck in Region 6 in expectation of sympathy for his campaign from higher echelons. He recounted his original complaints and charged that additional delays were warranted because the Radio Laboratory sample, on which his bid was based, "was far from complete." But if Watson thought the Regional office was not aware of the unique bid status of the contract or would be swayed by a divide-and-conquer approach, he did not understand the Regional administrative structure or the relationship between the Radio Laboratory and a Regional office. Rather than a willing ear, Watson received a onesentence reply from M. L. Merritt, Acting Regional Forester. He bluntly called Watson's attention to a memorandum from Lawson in October that he attached to his reply. It outlined Laboratory criticism after a preliminary inspection of set TL-100 sent to Portland by Western Wireless.³¹

In the normal chain of events, Forest Service contractors shipped a preliminary sample radio set to the Laboratory for approval before an inspector visited the contractor to certify compliance of the remaining sets. In this way, minor necessary modifications could be identified before the Laboratory spent money on an onsite inspection; the contractor, in turn, would be certain that modifications would have a minimal impact on final production costs. The financially pressed Watson had ignored the Laboratory evaluation.

The required modifications were minor, but time-consuming. New meter faces at 50-mA scale rather than 25-30 mA, and additional shunting of the meter grid current were necessary to keep from driving the meter off scale. Other modifications were less timeconsuming, e.g., clarification of labels, switching of two leads, soldering, cabinet stenciling, and comments on the panel hinges.³²

Perhaps of less concern to Watson, but more important, was that the T sets were no longer needed. Unintentionally, this made for further delays. No longer pressed to get the T sets on the fireline and involved with other assignments for the upcoming 1937 fire season, the Radio Laboratory was not about to drop everything in order to accommodate Mr. Watson. Believing Watson had brought the problem upon himself and constrained by limited staff and an ever-present scheduling problem, Simson and Lawson simply let the matter fit into whenever time was available.

Watson corresponded regularly with Simson and Buck during October. He made very plaintive and frequent pleas for payment, even partial payment, never wavering from his position that outside vendors and the Radio Laboratory were responsible for his plight.³³ The Region 6 office steadfastly supported the Laboratory and replied that it would "...arrange to have the type 'T' sets inspected when all are complete."³⁴ This, of course, included all antennae, hand-sets, and modifications to the original.

Watson then sent separate letters to Simson and Buck. By this time, he was walking the thin line between contract concellation for noncompliance and Western Wireless's need for some financial assistance to complete the modifications. Although still holding to his original argument, Watson did admit that modifications from the original sample were not yet complete, coming as close to demanding an inspection as possible.35 Simson responded with the following radio message: "BELLEVILLE WILL ARRIVE IN SAN FRANCISCO NOVEMBER THIRD ONE FIFTY PM TO INSPECT T SETS."36

Watson met Logan Belleville at the San Francisco airport on the appointed date. By November 11, eight days later, Belleville had made little progress. While this was primarily due to a mixup by the express company in shipping test equipment, Belleville had also found several variations in the T sets. These included lack of. adjustment in RF coils, a shortage of handsets, absence of switches, no cabinets, and incomplete testing.³⁷ He told Watson that the sets had to be completed for inspection.

Meanwhile, for lack of work and the frequent absence of Watson, Belleville took most of the next day to visit Fred Funke who supervised radio in Region 5. Returning to Western Wireless in late afternoon, he found "much activity towards getting /the/ sets ready.³⁸ The following day Belleville also noted the "place cleaned up and work progressing satisfactorily," but very few sets were being completed.³⁹ With this in mind, the possibility of having to wait 2 more weeks for all sets to be completed, plus a telegram from Simson suggesting, "IF INSPECTION BEING DELAYED ACCOUNT SETS NOT READY SUGGEST RETURN PORTLAND YOUR JUDGEMENT /sic/ SATISFACTORY,⁴⁰ Belleville confronted Watson and "Gil" Gilbertson, the radio engineer for Western Wireless. Realizing that it might take a supreme effort to arrange another inspection, Watson secured telephone permission from Lawson to continue work through the following week.⁴¹ Three days later, but still facing 100 incomplete sets, Belleville's frustration was reflected in his field diary. "Whoopee!" was his final comment for that day.⁴²

Belleville continued to run into problems with adjustments and component substitutions that commonly occurred between Laboratory prototype and finished product. Such delays were usually worked out after consultation with Lawson over KBAA, telegram, or telephone. But these problems were complicated at Western Wireless by Watson's attempts to economize. Belleville had to reject units several times because tacks were substituted for screws, even the best cabinets were substandard, and not all components were available.43 The most frustrating problem, however, was Western's inability to cut the antennae to the proper length. After Belleville discovered that the wires were considerably too long, Watson apologized and placed another man on the job. A few days later, Belleville learned to his dismay that the antennae were still too long. Checking further, he discovered that the measurements were made on a pattern maker's shrink rule, which was 3/16 inch longer per foot than standard.44 After a third attempt, each wire was cut to the proper frequency.

On November 26, after putting in double time for several days,

Belleville completed the inspection of the last T set and departed for Portland. He left behind a very relieved Charles Watson and the impression that the Radio Laboratory would expect strict contract compliance in future dealings.

Thus, throughout the 1930's the Radio Laboratory staff were involved in a number of activities that speak well for their work. But the success of the radio development program cannot be measured solely by their effort and output. Radios were intended for the fireline. Their acceptance in remote areas of the National Forests is the final measure of the Radio Laboratory's accomplishments.

Reference Notes

1. "Operators and Operating Practices," Radio Handbook (Washington, D.C.: U.S. Department of Agriculture, Forest Service, Division of Operation, ca. 1938), sect. B7.1, pp. 14-22.

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

 Loveridge to Regional Forester (R-6), 29 April 1937, Gaylord A. Knight Collection.

4. Simson's brother was the representative for the Department of Commerce.

5. Simson, "Memorandum," 27 January 1939, Gaylord A. Knight Collection, p. 5.

6. Simson, "Memorandum," p. 3. The Weather Bureau was transferred to the Department of Commerce June 30, 1940.

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 May 1939, mimeographed, Gaylord A. Knight Collection; Harold K. Lawson, interview with the author in King City, Ore., May 1978; and Logan Belleville, interview with the author in Saratoga, Calif., January 1978.

8. Belleville, interview with author.

Roger W. Reynolds to Harold Lawson,
 July 1939, Gaylord A. Knight
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10. Walter Wesselius, "Experience from the New England Hurricane," Electrical Engineering 58, no. 3 (March 1939): 99-101. See also Earl E. Peirce, Salvage Programs Following the 1939 Hurricane (Berkeley: University of California, Bancroft Library, 1968).

11. L. D. Blodgett to A. G. Simpson
/sic/, 25 March 1939, Gaylord A. Knight
Collection.

F. V. Horton to Director, NETSA,
 April 1939, Gaylord A. Knight
 Collection.

13. Belleville, interview with author.

14. Belleville, interview with author, and George Vitas, telephone conversation with Frank Harmon, History Section, Forest Service, 25 March 1981.

15. F. H. Brundage to Regional Forester (R-5) 23 April 1942, Gaylord A. Knight Collection.

16. W. F. Squibb, "Diary-June 23, to Sept. 29, 1933," Gaylord A. Knight Collection.

17. Belleville, "Diary #3,"
October 1939, Gaylord A. Knight
Collection.

 W. S. Claypool, "Memorandum for Mr. L. K. Mays," 28 September 1939, Gaylord A. Knight Collection. This memo describes the major Forest Service radio equipment included in the trailer. 19. Bill Claypool to Harold and Bee /Lawson/, 19 October 1936, Gaylord A. Knight Collection.

20. See Appendix I for details on the types A and D test sets.

21. H. K. Lawson, "Memorandum for Files," 15 November 1938, Gaylord A. Knight Collection.

22. Belleville, interview with author.

23. Belleville, interview with author, and "Field Diaries," *passim*, Gaylord A. Knight Collection. Other visits were frequently made to such manufacturers as Hewlett-Packard and Eimac (Eitel-McCullough).

24. Belleville, interview with author.

25. Logan Belleville to Harold Lawson, 13 June 1939, Gaylord A. Knight Collection.

26. Charles L. Watson to Gael Simpson /sic/, 12 August 1936, Gaylord A. Knight Collection.

27. Charles L. Watson to Gael Simpson /sic/, 4 September 1936, Gaylord A. Knight Collection.

28. "Memorandum for the Files," Harold K. Lawson, 14 September 1936, Gaylord A. Knight Collection.

29. Lawson, "Memorandum for the Files," 14 September 1936.

30. Charles L. Watson to Shirley Buck, 21 September 1936, Gaylord A. Knight Collection.

31. M. L. Merritt to Western Wireless, Ltd., 3 October 1936, Gaylord A. Knight Collection.

32. Harold K. Lawson, memorandum, per A. G. Simson to Mr. B.

Gilbertson, Western Wireless, /n.d./, Gaylord A. Knight Collection.

33. See Charles L. Watson to Gael
Simson, 5 October 1936; M. L. Merritt
to Charles L. Watson, 8 October 1936;
A. G. Simson to Charles L. Watson,
10 October 1936; Charles L. Watson
to C. J. Buck, 13 October 1936;
Charles L. Watson to A. G. Simson,
23 October 1936; and F. H. Brundage
to Western Wireless, Ltd., 26 October
1936--all Gaylord A. Knight Collection.

34. *Ibid.* and F. H. Brundage to Charles L. Watson, 26 October 1936, Gaylord A. Knight Collection.

35. Charles L. Watson to C. J. Buck, 27 October 1936, Gaylord A. Knight Collection, and Charles L. Watson to "Gael" /Simson/, 27 October 1936, Gaylord A. Knight Collection.

36. A. G. Simson to Western Wireless,2 November 1936, radiogram, GaylordA. Knight Collection.

37. Logan Belleville, "Field Diary and Travel Record," 11 November 1936, Gaylord A. Knight Collection.

38. Belleville, "Diary," 12 November 1936.

39. Belleville, "Diary," 13 November 1936.

40. A. G. Simson to Logan Belleville, 13 November 1936, telegram, Gaylord A. Knight Collection.

41. Belleville, "Diary," 13 November 1936.

42. Belleville, "Diary," 16 November 1936.

43. Belleville later learned that the supposed shortage of Kellogg handsets was due to the express office's refusal

to release them to Watson, as they were shipped C.O.D. It was also Belleville's understanding that Watson got these out of hock after a phone call to Herbert Hoover, Jr., his brother-in-law. Belleville, interview with author.

44. Belleville, "Diary," 19 November 1936.