

# Radio and Television Regulation

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in the United States,  
1920–1960

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## Engineering Public Policy for Radio

Herbert Hoover, the Department of Commerce,  
and the Broadcast Boom, 1900–1927

I do not believe any other generation in history has had the privilege of witnessing the progress from birth to adolescence of a discovery so profoundly affecting the social and economic life of the peoples of the world. . . . No other invention in all time invaded the home so rapidly and entrenched itself so securely as radio, and though it is still far from maturity, we see great advances every year.

*Secretary of Commerce Herbert Hoover,  
September 12, 1925*

During the months soon after the Westinghouse Company's establishment of KDKA in Pittsburgh, a boom in radio swept the nation. At the beginning of 1922, 28 licensed stations were broadcasting in the United States to the public; by 1923 the total had risen to more than 550.<sup>1</sup> Earlier, a number of amateur stations had attempted to use radio for public broadcasting, but the first transmissions of KDKA in November 1920, announcing the presidential election returns, proved to be a dramatic new development.

The enthusiasm for radio led many commentators to predict a utopian future for the new public technology. They believed radio broadcasting would raise the cultural standards of the nation and help forge new social and political bonds. As one observer declared: "How fine is the texture of the web that radio is even now spinning! It is achieving the task of making us feel together, think together, live together." Secretary of Commerce Herbert Hoover praised radio's "dawn glowing with the promise of profound influence on public education and public welfare."<sup>2</sup> But to ensure the full beneficial impact of this "profound influence," the country had to address a number of important questions. What would be the

relationship between the new use for radio and the established traditions of wireless telegraphy (transmission of coded signals) and telephony (transmission of voice), which private companies and government institutions, especially the U.S. Navy, mainly controlled? How would the country evaluate competing claims of access to the radio spectrum? How would radio broadcasting be supported economically and what role would government—especially the federal government—have in the new industry? The need to attempt to answer these and related questions became more pressing as interference among a growing number of stations broadcasting on a limited range of frequencies threatened to create chaos on the airwaves.

During the early 1920s, the Department of Commerce, under Herbert Hoover's leadership, stepped in to try to manage radio and maximize its potential benefits. Congress had previously placed authority over the regulation of wireless telegraphy and telephony in the hands of the secretary of commerce. Unlike these earlier uses of wireless—or *radio*, the term that became dominant by the early 1920s—transmissions from radio broadcasters were not directed from one point to another (for instance, private messages from a coastal station to a ship at sea) but were specifically broadcast to all appropriate receivers owned by the general public. Despite this difference, Hoover based his efforts to regulate the new technology on earlier legal precedents. He also pointed out that the Department of Commerce was not attempting to impose regulation on the industry, but was responding to demands made by the users themselves. According to Hoover, "this is indeed the only industry I know of which has generally with one acclaim welcomed and prayed for Government control."<sup>3</sup>

Hoover further emphasized that because the regulation of radio broadcasting involved highly technical issues dependent on complex engineering and scientific principles, it presented the federal government with a unique set of difficulties. "The problems involved in Government regulation of radio," he declared, "are the most complex and technical that have yet confronted Congress." Not surprisingly, then, during the 1920s public policy on radio was not simply formulated by politicians and bureaucrats; radio engineers, especially employees of the federal government and members of the Institute of Radio Engineers, played an essential role. This chapter analyzes their involvement and explores that theme in the context of the major tension that emerged between technocratic and nontechnocratic perspectives. Understanding the important

role of this tension in the negotiations among the different individuals and institutions working to shape radio broadcasting is fundamentally important. Before pursuing this analysis for the period of the 1920s, however, we first need to recognize that important precedents were established during the decades before KDKA and the rise of radio broadcasting.<sup>4</sup>

### The Early History of Wireless

The major technical development that provided a foundation for radio broadcasting was Heinrich Hertz's experimental verification in 1887 of the wave structure of electromagnetic radiation as predicted by James Clerk Maxwell's mathematical equations. The Italian inventor Marchese Guglielmo Marconi most fully explored the commercial possibilities of Hertz's discovery beginning in the 1890s. By developing and improving transmitters, receivers, and antennas, Marconi created a complete system for long-distance wireless communication. After moving to England, Marconi helped set up a private wireless company, which used his system to specialize in point-to-point communication for the shipping industry. He first successfully transmitted wireless telegraph signals across the Atlantic in 1901. Marconi's company soon gained a near monopoly in wireless communications. By 1912, the U.S. subsidiary of the Marconi Wireless Telegraph Company, the Marconi Company of America, controlled nearly all civilian maritime wireless communications from shore stations in the United States and handled most of the nation's other commercial wireless traffic.<sup>5</sup>

During the half dozen years before World War I, two major trends worked against the Marconi Company. Perhaps most important, company officials held to the older "spark technology," while other companies—notably American Telephone and Telegraph (AT&T) and General Electric (GE)—were developing and gaining control of key patents for "continuous-wave technology." Spark transmitters generated radio frequency signals as byproducts of electromagnetic sparking across induction coils. The resulting transmissions, however, produced damped electromagnetic waves of different frequencies. Tuning to one frequency was difficult, interference among transmitters was a major problem, and the technology was not entirely satisfactory for voice transmission, or telephony. AT&T and GE acquired control of two new inventions that became the basis for continuous-wave transmissions: the alternator and the audion (or triode vacuum tube). AT&T secured patent rights to the

audion from the inventor Lee de Forest; GE gained control of patents on the alternator developed by its employee Ernst Alexanderson. Continuous-wave technology produced high-power signals of constant frequency, which stations could more easily use to transmit the human voice.

The second trend working against the Marconi Company was the growing influence of the military, especially the navy, on the wireless business in the United States. Key navy officials—especially Josephus Daniels, secretary of the navy from 1913 to 1921—advocated complete naval control of wireless. Daniels was especially interested in keeping U.S. technology out of the hands of foreign companies. Key officers worked closely with American companies to integrate the new continuous-wave technology into all aspects of naval operations.<sup>6</sup>

During World War I, the military services did succeed in assuming control over wireless, in the name of national defense. In this case, the record of government control was generally good: military demands for improved apparatus and a government-supported patent moratorium that promoted innovation supported new research and development. The great potential of the vacuum tube as both a detector and a generator of radio waves was realized during wartime. However, other cases of government control during the war, especially of public utilities and the railroads, were far less successful. Because of these experiences, the public was not prepared to support Secretary Daniels's request that Congress authorize a continuation of naval control of wireless after the war. The newly elected Republican Congress exploited this public sentiment against a continuation of a wartime policy sponsored by a Democratic Congress. Although Daniels was forced to give up on his primary goal, he continued to pursue a secondary goal of preventing foreign control of American wireless technology during the postwar period. The navy had confiscated American Marconi's long-distance shore stations during the war and was anxious to find a way to avoid returning them. The navy was also concerned about GE's arrangement after the war that would have given American Marconi *de facto* exclusive rights to its alternators. In response, during the summer of 1919, the navy convinced GE to help establish a new American company, the Radio Corporation of America (RCA), formed from the acquisition of American Marconi. Using apparatus produced by GE and other U.S. manufacturers, the new all-American company retained American Marconi's monopoly of long-distance point-to-point service.<sup>7</sup>

RCA also supported the expansion of radio broadcasting during the 1920s. But the military influence on the institution was fundamental. The wartime experience had demonstrated the benefits of both monopolistic control and the suspension of competing and contentious patent claims. Within two years after the establishment of RCA, a series of agreements was worked out among RCA and the other major companies involved in radio. No one business controlled patents to a complete technological system of continuous-wave transmission and reception. As a result, the companies holding major patents—RCA, AT&T, GE, Westinghouse, and the United Fruit Company—agreed to extensive cross-licensing arrangements. The companies also consented to divide all aspects of the radio business. RCA retained exclusive rights to international wireless telegraphy and nonexclusive rights to international telephony. AT&T retained its control of most wireless telephony. GE and Westinghouse would manufacture radio receivers and radiotelegraphic equipment; AT&T (through its subsidiary Western Electric) would control the manufacture of wireless-telephone transmitters. RCA also agreed to buy from GE 60 percent of the radio apparatus it sold; the other 40 percent would come from Westinghouse. GE, Westinghouse, and AT&T had representatives on the board of directors of RCA and owned stock in the company. As Hugh Aitken pointed out, after the final agreement with Westinghouse in 1921, RCA controlled, "directly or through its affiliated companies, every American patent of importance in the field of continuous wave radio."<sup>8</sup>

Some of the same forces that had come together to help create RCA also shaped the early efforts by the federal government to regulate wireless. Why did the regulation of wireless seem necessary in the United States and in other countries? Originally, the major reason for government intervention was to ensure safety at sea. Distress calls would be ineffective if ships did not carry wireless equipment or maintained incompatible systems using different frequencies, especially in emergency situations. Nations using radio held international conferences at the beginning of the century to deal with these issues. In most countries, the central government assumed complete control over the radio spectrum. Government ownership seemed necessary because of the crucial military and civil uses for radio. The United States lacked the same traditions of government control, but public opinion also did not favor private ownership of the radio spectrum. This area might be a new continent for exploration, but officials questioned whether the government could



divide up something as intangible as the airwaves—they came to be known as “the ether”—into sections of private property the same way it had parceled out land. During the nineteenth century, federal land policy had encouraged citizens to claim public land at minimal or no cost and transform it into private property. But Progressive-era politicians concerned with the public interest argued that the spectrum was different; they feared that if the government allowed property rights, one group might end up with a monopoly of ideas and information and the ability profoundly to shape public opinion. Thus, radio policy in the United States was grounded in the conviction that the spectrum belonged to the public. Everyone should have a right to obtain a license and use the spectrum. However, especially after the rise of radio broadcasting during the 1920s, policy makers increasingly viewed the radio spectrum as a finite resource. At any one time, only a limited band of frequencies was available for wireless, and interference among stations (often using poorly tuned equipment) limited the number that could transmit at any one time. All citizens might own the ether, but if everyone tried to use it its value would be destroyed. Throughout the early history of radio (at least until 1927), radio policy in the United States had to deal with a potential contradiction. Decision makers wanted everyone to have a right to use the spectrum, but they increasingly came to the conclusion that the government would have to place limits on access to the radio spectrum to avoid overexploitation or, in other words, destructive interference.<sup>9</sup>

Congress was not convinced of the need for legislation until a ship-ping accident in 1909 demonstrated the value of wireless for safety at sea in a spectacular way. Maritime officials praised a single wireless operator for saving the lives of twelve hundred people. The 1910 Wireless Ship Act mandated that the government give priority of access to the spectrum to operations aimed at ensuring public safety. The law required that most oceangoing steamers have a skilled wireless officer and a wireless apparatus capable of communicating with any other system located within a radius of one hundred miles.<sup>10</sup>

But the 1910 law did not help alleviate the problem of interference; in fact, by expanding the number of users of the spectrum, Congress probably inadvertently made things worse. Most interference was unintentional, caused by a large number of closely spaced stations, many using “dirty” transmitters producing spurious signals. Some interference, however, was intentional—and when it occurred, amateur operators

were usually blamed. In addition to the navy and private companies, the amateurs were the third major group using wireless before 1920. Amateur operators included a large number of boys and young men who shared a hobby of communicating using homemade equipment. The introduction of the crystal detector in 1906 helped support this democratization of wireless. Amateur operators provided an important early audience for radio broadcasting; they also made important experimental broadcasts of music and entertainment, many years before the establishment of KDKA by Westinghouse. The number of amateur stations operating in the United States before World War I is unclear; in 1912 the *New York Times* estimated that several hundred thousand existed. The amateurs tended to view the spectrum as a new, wide-open frontier, akin to the American West, where men could pursue individual interests free from repressive authoritarian and hierarchical institutions. They resented attempts by the navy and private companies to monopolize the spectrum for commercial or military gain. This antiauthoritarian sentiment led a few amateurs to intentionally transmit false or obscene messages, especially to naval stations. The U.S. Navy complained bitterly about amateurs sending out fake distress calls or posing as naval commanders and sending ships on fraudulent missions. Josephus Daniels and other naval officers used this threat to national security and safety as a justification for seeking total naval control of wireless.<sup>11</sup>

The perceived need to discipline amateurs in order to reduce interference led Congress to begin to consider legislation more sweeping than the 1910 Wireless Act. During that same year, Congress considered six different proposals for new legislation. But it took a new tragedy, in April 1912, involving both issues of public safety and interference caused by amateurs to convince Congress to pass comprehensive legislation. The event was the sinking of the *Titanic*, with the loss of more than fifteen hundred lives. Citizens were horrified to learn that two of the ships closest to the *Titanic* had not been able to respond to the radio distress call; in one ship, the wireless operator was asleep; in the other, no wireless equipment had ever been issued. Politicians responded to the public outcry by condemning the 1910 Wireless Ship Act as inadequate. Even more shocking was the revelation that constant interference and false messages from malicious operators had hampered the rescue effort dispatched to help the *Titanic*. The press blamed the amateurs, who lost even more credibility.<sup>12</sup>

Four months after the *Titanic* disaster and in order to comply with an

international convention enacted that same year in London, Congress passed comprehensive legislation regulating the use of radio, the Radio Act of 1912. It remained the only law of its kind in the United States, despite more than thirty attempts to introduce new legislation, until it was revised in 1927. The 1912 act required that the Department of Commerce license all radio operators. The department, which already had limited authority under the 1910 act, was authorized to make necessary frequency changes when private stations interfered with military transmissions. The law also established stringent requirements that ships have at least two radio operators and maintain superior "clean" wireless equipment that would not cause spurious interference. Radio operators had to give any station making a distress call priority of use of the spectrum; interference had to be avoided. Following international agreement, U.S. citizens were required to set aside the 300-meter (999.4 kHz) band for emergency transmissions. In the event of war, the statute authorized the military services to take control of all private stations. Finally, the legislation divided up the use of the spectrum by assigning specific frequencies to different groups.<sup>13</sup>

The new allocation scheme was consistent with international agreements already being followed in Europe. It reserved frequencies between 187.4 and 499.7 kHz for the federal government, mainly the U.S. Navy. Private stations were given the use of frequencies above 499.7 kHz and below 187.4 kHz. The allocation relocated the amateurs to the shortwave region above 1,500 kHz, a band not considered usable at that time. Thus, the 1912 Radio Act implicitly clarified the criteria that the federal government would use in judging which users of radio should have priority of access to the spectrum. As Susan Douglas argued, "what established merit in 1912 was capital investment or military defense, coupled with language that justified custodial claims based on invaluable service to humanity." The act did not give authority to the secretary of commerce to deny a license to any individual; it therefore upheld the conviction that since the spectrum belonged to the people, everyone should have a right to obtain a license. But some parts of the spectrum were more desirable than others; by placing amateurs in an undesirable section, Congress was effectively making a decision about limiting access to the use of radio. A decision that seemed to be purely technical in nature had significant economic and social dimensions.<sup>14</sup>

In the public debates over national radio policy that occurred before the first broadcasts of KDKA, an important theme emerged that would

play a crucial role in the efforts by Hoover and others to interpret and administer the 1912 Radio Act for public broadcasting. A number of individuals, especially engineers and business leaders, argued that national radio policy be guided by technical considerations evaluated by technical experts. This technocratic position seemed appropriate since the regulation of radio was driven by the technical problem of interference, which in turn partly resulted from the technical limitation of a finite spectrum.

Some congressmen were convinced by the testimony of engineers and scientists that new radio legislation was unnecessary because engineering solutions to interference were just around the corner. Specifically, they promised that the radio industry was on the verge of developing "clean" transmitters and other new apparatus that would produce sharply defined signals and allow a growing number of stations to fit into the band of available radio frequencies. During congressional hearings in 1917, Alfred Goldsmith—professor of physics at the College of the City of New York—testified against a bill that proposed naval control of wireless as a naval solution to interference, by assuring members of Congress that "the problem of interference is sure to be solved in the near future by technical means now under development by the companies." Michael Pupin, professor of physics at Columbia University and an important inventor of components for electrical communications, also reassured Congress that "things are being done today by well organized industrial research laboratories which will undoubtedly lead to wonderful results so far as preventing interference produced by the acts of man are concerned." The engineers and scientists who testified against a naval monopoly believed that legislation or government control would only stifle research. Pupin even went so far as to argue that the technical problem of interference be seen as a positive challenge that would stimulate technological development. "If I had my own way," he declared, "I should produce as many interferences as I possibly could, for the purposes of development of the art."<sup>15</sup> The scientists and engineers testifying before Congress believed they deserved a special role in advising the country on national radio policy. Radio was their invention and they felt confident future research would assure its great promise. Their testimony also implicitly demonstrated a commitment to particular economic and social views: technical progress should not be stifled by government control but should be driven by the industrial research laboratories of GE, AT&T, Westinghouse, and other large manufacturers.

In retrospect, it seems clear that the predictions of these technical experts were not entirely realistic. The introduction of vacuum-tube technology after World War I did lead to the widespread use of high-quality continuous-wave transmitters and tunable receivers. But sometimes new advances created their own problems. One popular receiver using vacuum tubes could actually become a transmitter if improperly adjusted; this resulted in thousands of new sources of potential interference. Irrespective of this new problem, improvements in the sensitivity and selectivity of transmitters and receivers that were possible at that time would not have been enough to overcome the severe problem of interference and spectrum scarcity that developed after the rise of radio broadcasting during the 1920s. As Aitken argued, given the decision not to limit access to the broadcast spectrum by authorizing private property rights, "technological advance alone would not have solved" the problem: "There were too many beasts foraging in the pasture."<sup>16</sup> But the technocratic arguments helped defeat naval attempts to gain control of radio and, as we will see, continued to play an important role during the policy debates of the 1920s.

### The Department of Commerce Takes Control

When radio broadcasting emerged during the early 1920s, it upset the balance of power among different groups of radio users in the United States. Broadcast stations competed with government institutions and private companies specializing in point-to-point transmissions. An intra-governmental contest also complicated matters tremendously. The navy had been unsuccessful in its bid to gain complete control of radio after World War I, but it continued to seek to influence policy, especially by trying to maintain close contacts with RCA. At the same time, the Post Office Department resisted naval influence and, following the pattern in European countries, attempted to assume control of all communications. In 1919, by authorizing construction of a series of land radio stations to support the new airmail service, Congress affirmed that the Post Office Department would have an important role to play. Other stations, managed jointly with the Department of Agriculture, transmitted market and weather reports to the public. While government institutions competed for influence, private companies resisted all attempts at government control. During the first year after its establishment in 1919, RCA and the navy cooperated on policy matters; however, when RCA, by constructing its own coastal stations, began during 1920 and 1921 to threaten the

"Slotten effectively uses published primary sources and unpublished archives to discuss the complex interactions between engineers and policy-makers in the United States. The scope of the book is excellent and covers decisions over a forty-year period involving four major technologies (AM radio, monochrome television, FM radio, and color television) that defined the broadcast industry until the passage of the Telecommunications Act in 1996."

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