"Pushing Technology: David Sarnoff and Wireless Communications, 1911-1921"

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Between the creativity and advocacy of inventors and the realization of need or want by consumers, there exists a wide gulf. How does it happen that an idea, a proof of principle, meets the succession of markets that results in the addition of new technology to society? An inventor, after all, must persuade other technically competent people to join in making an invention practical, and a series of lawyers, investors, manufacturers, and marketers to join in agreeing that it is worthy of bringing to a market of ultimate consumers.

This applies not just to basic inventions, but to their further innovation and application in other markets. The company pushing its diffusion in the market with which it is most familiar may be less interested in bringing the technology to other markets, other consumers, who see its utility for quite different purposes. In that case, it is up to individuals within the company, or at other firms, or among the consumers, to advocate the broader application and try to bridge the space between the push or flow in one direction and the pull or pool of consumers in another.

This was David Sarnoff's role early in his career. During his twenties, between 1911 and 1921, he acted as advocate and medium for the expanded use of what we call radio: for wireless telegraphy, wireless telephony, and for broadcasting—on ships, trains, and overland. His role has been tainted by his own overreaching claims and those of later detractors in response.[1] This paper will attempt to place his claims and his role in a more reasoned perspective, and thereby highlight the role of the middleman in the diffusion of technology.[2]

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[1] Revisionism of claims made by David Sarnoff and repeated by RCA's public relations department for the rest of the twentieth century began with Carl Dreher's Sarnoff: An American Success (New York: 1977); continued with Kenneth Bilby's The General: David Sarnoff and the Rise of the Communications Industry (New York: 1986); and reached a peak with Tom Lewis's Empire of the Air: The Men Who Made Radio (New York: 1991), which accompanied a popular television documentary of the same name.

[2] In many ways this version of Sarnoff's early life reflects that described by Elmer E. Bucher in the unpublished typescript, Radio and David Sarnoff (1943; deposited at the David Sarnoff Library), and Eugene Lyons's authorized biography, David Sarnoff (New York: 1966). Both writers have been discredited as sources because of their uncritical and largely undocumented approach to Sarnoff and their reliance on his patronage. Closer examination of their narratives of Sarnoff's early career and documentation within the David Sarnoff Library and at other sites shows that Sarnoff deserves more credit in the development of radio than his detractors have given him.

Who was David Sarnoff? Born in a shtetl outside Minsk in tsarist Russia in 1891, he arrived in the Lower East Side of Manhattan nine years later. Sarnoff sold newspapers before and after school to help support his family, until 1906. By then his father's incapacity from tuberculosis forced Sarnoff to give up school and seek a full-time job.

He was especially interested in communication, inspired in part, no doubt, by the contrast between Russian and American experiences in making information available. In the fall of 1906 Sarnoff joined the Marconi Wireless Telegraph Company of America as an office boy. The company and the technology at the time were hardly impressive. Marconi was one of several companies building a wireless business, and a year later a cable telegrapher asserted that wireless transmission enabled "about twenty-five words an hour, and they send it over four times, but before sending they try to get the gist of the thing."[3]

Nonetheless, inventors, engineers, and scientists were improving the means and companies promoted its unique advantages, particularly in shipping communications. By January 1911, Sarnoff had worked his way up to operator at two Marconi stations when his father died.[4] Shortly afterwards, he signed up to install, operate, and promote the use of wireless equipment on the Job Brothers' Canadian sealhunting fleet in Labrador and Newfoundland. Fifteen years after Marconi's first demonstration, its use was still novel; as Sarnoff noted, one of the Jobs thought "it's great business but he'll soon get accustomed to it."[5]

The commercial benefit appeared when Sarnoff signalled the owners' other ship on the location of a large pack of seals; the humanitarian aspects appeared in the course of Sarnoff's arranging medical help for an operator at an isolated outpost.[6] [See Image 1 below] On the other hand, communications between rival ships made less sense since the captains "would no more give a helping advice than they would give away their money yet they continue asking and answering questions, and in answering lie like hell. So even the wireless has been put to an evil purpose tonight."[7]

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[3] E. J. Nally to W. I. Capen, October 25, 1907. Nally Papers, Princeton University Library, box 3, folder 7.

[4] David Sarnoff diary entry for March 20, 1911. Sealing Expedition, Labrador 1911, David Sarnoff Library, Princeton, New Jersey (hereafter DSL).

[5] Idem: diary entry for March 2.

[6] Idem: Wireless log entry for March 22, and diary entries for March 26-April 3, passim.

[7] Idem: diary entry for March 23.

Page from David Sarnoff's diary on board the Job Brothers' seal-hunting ship, the Beothic, in which he describes his relaying the dialogue between the ship doctor and the radio operator at Belle Isle, Labrador, March 26, 1911. David Sarnoff Library.

A year later, Sarnoff was manager of the Marconi station atop the Wanamaker's department store at Broadway and Eighth Street. Sarnoff exaggerated his role in the aftermath of *Titanic*'s sinking, but he was involved, first in working with two other operators at the Wanamaker station to obtain the number of survivors and then in trying to get their names from the Marconi Seagate station before the *Carpathia* arrived with the survivors in New York City.[8]

David Sarnoff's telegram to "Captain Jordan" giving total number of survivors from Titanic, April 16, 1912. David Sarnoff Library.

WIRELESS

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In the wake of the Titanic, American Marconi expanded its business by a factor of twenty over the next two years. This occurred partly from legislation mandating continuous staffing of shipboard radio stations and partly from the

[8] "American Gets Wireless News in New York City," The Boston American, April 16, 1912, p. 4, reproduced in Extra Titanic: The Story of the Disaster in the Newspapers of the Day, from the Collections of Eric Caren and Steve Goldman (Edison, NJ: 1998), n.p. See also http://www.marconicalling.com/museum/html/indexes/titanicmessagelist.html, visited July 31, 2001, for two links to messages received at the Marconi Seagate station by Sarnoff on April 18, 1912. The scans are from originals in the Marconi Collection, donated by Marconi plc to the Essex Record Office in Chelmsford, England.

acquisition of the United Wireless Telegraph Company, which gave Marconi control of virtually all American coastal stations. Nonetheless, at a time of expanding opportunities within the company's standard market, Sarnoff, as radio inspector and assistant engineer, was advocating two other applications.

First was that of radio communications with railroads. In November 1913, Sarnoff worked with the Lackawanna Railroad's telegraph superintendent to design, install, and demonstrate a mobile system between the stations at Binghamton, New York, and Scranton, Pennsylvania.[9] This led to major demonstration in January 1914, and Marconi obtained contracts for five stations on the line over the next nine months.[10] While it appears that few other railroads joined in adoption of the technology, Sarnoff continued to campaign on its behalf until 1927, through annual appearances at the meetings of the railway telegraph superintendents and the American Railway Association.[11]

The wireless telegraph installation.

David Sarnoff in radio cabin on board Lackawanna Railroad passenger car, November 1913. From Scientific American article, December 6, 1913, no page number, David Sarnoff Library.

[9] Scientific American, December 6, 1913, n.p., in DSL, David Sarnoff Papers, box 1, "Railroad Wireless" binder.
[10] David Sarnoff to E. J. Nally, January 26, 1914, idem; E. J. Nally to Board of Directors, Marconi Wireless Telegraph Company of America (MWTCA), October 13, 1914, Nally Papers, box 3, folder 7.
[11] See Wireless Telegraphy in Railroad Service, passim, DSL.

Nineteen fourteen proved to be a busy year for Sarnoff, during which time he was promoted to contracts manager for the company, which provided him with contacts not just within the company, but with the commercial and technical competition faced by the Marconi company. Concerned with the limited resources for R&D within Marconi, therefore, he not only reported on E. Howard Armstrong's demonstration of his regeneration circuit, but arranged a field test at the company's station in Belmar. In this he was accompanied by Roy Weagant, who was equally impressed by the quality of reception. Sr. Marconi, when apprised of the results, was not because he thought engineer H. J. Round had already accomplished a similar improvement, and the rest of the company's senior management expressed unhappiness over the unauthorized use of corporate facilities by an unaffiliated inventor.[12]

Later that spring, the Marconi Company in England announced the development of a wireless telephone system, based on H. J. Round's hydrogen arc transmitter. This was installed experimentally at the Wanamaker station in New York. From there, Sarnoff arranged to have phonograph music played into the microphone, which he and his group en route to a railroad convention in New Orleans could as they steamed some sixty miles away.[13]

David Sarnoff and associates on board S. S. Antilles, May 13, 1914. That evening, some sixty miles out of New York harbor, Sarnoff worked with the ship's operator to tune in phonograph music transmitted via Harold J. Round's experimental hydrogen arc transmitter, below. David Sarnoff Library.

The next year saw AT&T demonstrate voice programs transmitted from Arlington, Virginia and received in Paris, San Francisco, and Hawaii. These took place in September and October 1915, and it would hardly be surprising for Sarnoff to propose a home receiver as another business opportunity to his superior, E. J. Nally. Given Nally's work in rationalizing American Marconi during its enormous expansion in the previous three years, the company's conflicts with the U. S. Navy, and the expanded trans-Atlantic traffic occasioned by the outbreak of World War I, it is equally unsurprising that he should ignore it.

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[12] See the copies of the correspondence between Sarnoff and others at Marconi in January-February 1914 in Early Reports on Radio, Section 5, "Armstrong Inventions," DSL; and George H. Clark, The Life of Roy Weagant (1943), 29-31, in Nally Papers, box 4, folder 3.

[13] See the correspondence in Early Reports on Radio, Section 1, "Radio Telephone Tests," DSL; and correspondence between Godfrey C. Isaacs, E. J. Nally, the Admiralty, and the Naval Department in April-May 1914, Nally Papers, box 3, folder 7.

The original memo on Sarnoff's "radio music box" does not exist—at least not in his papers, where there is reference to it in 1922 and evidence of a search in 1925.[14] Nor have I found it yet in Nally's papers. Nonetheless, in November 1916, Lee DeForest's election broadcasts moved Sarnoff to remind his boss of an earlier discussion.[15]

Newspaper clippings of Lee DeForest's broadcast of election night results from the Bronx, November 7, 1916. Sarnoff evidently sent them to his boss, E. J. Nally, along with the note referring to his earlier proposal. David Sarnoff Library.

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[14] Louise Benjamin analyzed the circumstances of the missing memo without being able to visit the DSL in "In Search of the Sarnoff 'Radio Music Box' Memo," Journal of Broadcasting and Electronic Media 37, 3 (Summer 1993), pp. 325-35. After reading of the circumstantial evidence at the library (see http://www.cinemedia.net/SFCV-RMIT-Annex/rnaughton/SARNOFF_BIO.html), Dr. Benjamin visited in the summer of 2000. She read her follow-up, "In Search of the Sarnoff Music-Box Memo: Nally's Reply," at the Broadcast Education Association meeting in April 2001. She is waiting to hear if it will be published in the Journal of Radio Studies this winter.

Reprints of later memos exist in the DSL, and originals can be found in Owen D. Young's papers at the Owen D. Young Library, St. Lawrence University, Canton, New York. For references to the earlier memo, see David Sarnoff to Alfred Goldsmith, August 2, 1922, David Sarnoff Papers, box 1, "Individual Radio 'Radiolette,'"; and T. N. B. (E. J. Nally's secretary) to David Sarnoff, May 22, 1925, Early Reports on Radio, Section 9, "Broadcasting—The 'Radio Music Box,'" DSL.

[15] Idem.

Four days earlier, Sarnoff looked beyond current business as well in a memo on the consequences of the court decision validating the Fleming patent. If Marconi needed to buy the three-element valve rights from DeForest, Sarnoff thought that "a good field can be worked up in the amateur line." Direct sales alone from the 5,000-bulb annual market would mean $10,000 net profit, while the company could also "license amateur concerns, such as Sears Roebuck . . . to sell bulbs to amateurs, we to manufacture and supply them at a good profit."[16]

Again, a survey of Nally's correspondence for the period indicates his focus on current customers and markets, as well as control of American Marconi's technology by its British affiliate. The amateur market was not significant to a company whose net profits were in the midst of more than doubling to $434,000 between 1915 and 1917.[17] Nally kept in touch with other companies' advances, in particular those of General Electric Company, to which he proposed a joint monopoly of production and operation of wireless communications in 1915.[18] He also continued to promote Sarnoff, who became second vice-president and commercial manager and a member of the company's board in 1917.[19]

With the conversion of American Marconi to the Radio Corporation of America under the ownership of GE in the fall of 1919, Sarnoff had to summarize business prospect to GE executives who knew very little about the technology or its applications. In a twenty-eight page review, Sarnoff discussed his home receiver only after reviewing current marine and government markets. He distinguished it from "Sales to Amateurs" who were already buying components and making their own radios for the pleasures of distant reception, and his estimate of gross profits suggested that the company could multiply its earnings by an order of magnitude.[20] A broader, less technologically oriented population would need content, however, and in the summer of 1921, Sarnoff acted as patron for an event that helped accelerate interest in broadcasting as a mass medium.

In a thorough history of the Dempsey-Carpentier boxing match broadcast, Thomas White credits Sarnoff with "the ability to spot good ideas."[21] Sarnoff and the broadcast, however, had more effect than he gives them credit for. J. Andrew White, who oversaw the development of the broadcast program by acting as intermediary with the National Amateur Wireless Association and RCA, submitted a twenty-three page report on the event to Sarnoff, who promptly circulated it among management sympathizers and superiors at RCA

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[16] David Sarnoff to E. J. Nally, November 4, 1916, p. 2, Nally Papers, box 4, folder 2.
[17] E. J. Nally to Board of Directors, MWTCA, October 9, 1917, Nally Papers. box 3, folder 4. The amount is for the first eight months of each year.
[18] E. J. Nally to E. W. Rice, jr., June 4, 1915, Nally Papers, box 3, folder 6.
[19] E. J. Nally to G. C. Isaacs, p. 4, October 25, 1917, Nally Papers, box 3, folder 4.
[20] David Sarnoff to O. D. Young, January 31, 1920, pp. 13-5, Early Reports on Radio, Section 8, "Prospective Radio Business," DSL.
[21] http://www.ipass.net/~whitetho/WJY.htm, visited July 21, 2001.

and GE.[22] Recently promoted to general manager, Sarnoff made available $1,500 for organizational expenses, a high-power GE transmitter, and the Lackawanna Railroad terminal antenna in Hoboken.

The eight pages of listener responses indicated the positive word-of-mouth that broadcasting received as a result, notwithstanding the long wavelength and lack of support from the American Radio Relay League. Whether or not 300,000 people in the region between Pennsylvania and Massachusetts heard the fight, the fact remains that tube and component sales continued to build in the fall of 1921, when Sarnoff also helped open RCA's station WJY in Roselle Park, New Jersey.

This is one of a series of photos taken at RCA's first broadcast station, WDY, which went on the air December 14, 1921. None of them identify the men in the studio and all include the individual at the cloth-covered microphone. Why David Sarnoff never acknowledged his presence at this shortlived station is a mystery, but it would be difficult to find another individual connected with WDY with the round face, relaxed disposition, and French cuffs. David Sarnoff Library.

By the following spring, the interest in and demand for broadcast radio made even Sarnoff's superiors realize that wireless technology had wider applications than they had given it credit for, and began to look to the thirty-year-old Sarnoff on guidance as to how to exploit it further. At that point he concluded his role as a technology bridger from one type of application in one market to other markets and other applications. For the next thirty years, he became a technology pusher, advocating the development of broadcast technologies in the home market he had helped create, particularly in the form of electronic television.

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[22] J. Andrew White, "Report: Radiophone Broadcasting of Dempsey-Carpentier Fight on July 2, 1921," and Sarnoff's cover notes in "First Broadcast—Dempsey-Carpentier Fight," David Sarnoff Papers, box 1, DSL.