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The Bell Is Ringing

CORPORATIONS

(See Cover)

The world's biggest company is a bundle of paradoxes wrapped in a string of superlatives. It makes a product that cannot be bought and lives on a commodity that cannot be seen. In a nation that idealizes competition, it has practically none. Unlike other corporate giants, it cannot set its own prices, which are carefully regulated not only by the Federal Government but by individual states. It has more direct contact with Americans than any other company, yet it often feels misunderstood. Few companies are more conservative; none are more creative. It has grown huge by paying attention to little things—little efficiencies, little economies, little people. It is that ubiquitous firm whose business is talk and whose product is the telephone: the American Telephone & Telegraph Co.

At A.T.&T., superlatives recur with the persistence of a busy signal. An outsize and aggressive utility, the company owns, operates and services 83% of the nation's 84 million telephones—nearly half of all the phones in the world. Its assets of $28 bil lion top those of General Motors, General Electric and U.S. Steel put together, and since 1945 it has raised enough new capital ($26 billion) to buy up the gold reserves of the U.S., Britain and several European countries. With 733,000 workers, the company employs a labor force greater than the population of Boston; its annual wage bill of $4.7 billion

exceeds the gross national product of Ireland and Israel combined. A.T.&T.'s 1963 revenues, which reached almost $10 billion, amounted to more than the combined incomes of 30 state governments and accounted for 1.7% of the gross national product.

Long Noses. By virtue of his position as head of this colossus, the chief executive of A.T.&T. is automatically the biggest businessman in the nation. For eight years that post has been held by a square-cut, thin-lipped man named Frederick Russell Kappel, who happens to be very much like the corporation he heads—a creature of power and paradox. Chairman Kappel (rhymes with apple) mixes freely among the mighty in science, politics and business. The 65 corporate chiefs who make up the prestigious U.S. Business Council, a group that advises the Government, have elected him their chairman. Lyn don Johnson often calls Kappel to discuss the state of U.S. business, is also one of A.T.&T.'s best customers.

But for all the importance and respect his position brings, Fred Kappel, at 62, remains essentially a small-town boy who retains the earthy and often unsophisticated ways of the heartland. He runs the most modern of corporations from an old-fashioned office in a lower Manhattan building whose Doric columns and tiled floors are defiantly unmodern. In this Parthenon of the William Howard Taft era, Kappel still converses in the slangy, twangy argot of his native Albert Lea, Minn., can still cuss on occasion like the pole-hole digger he once was. One significant term that often salts his conversation is "long-nosed." Says Kappel: "It's a term I use to mean looking ahead, planning ahead. I like to think of the Bell System as a long-nosed company."

See-As-You-Talk. Today, the company that thrives on talk is creating quite a bit of talk about itself—most of it by being long-nosed. In search of new and better ways to transmit words and TV pictures (most network TV programs are transmitted over A.T.&T.'s telephone lines), A.T.&T. is reconnoitering the frontiers of technology and expanding man's inventory of knowledge. It built Telstar in its labs, and will play a major role in the new Comsat Corp., which plans to ring the earth with communications satellites within two or three years. This fall it will start laying a fourth cable to Europe beneath the ocean, and last week it completed the first telephone cable to Japan. In typically prudent fashion, the telephone company is preparing for just about any eventuality: late this year it will finish a $200 million underground cable across the U.S. that will be able to carry important calls even if all above-ground wires are destroyed in a nuclear attack. It is also developing a wide array of new equipment, including pushbutton phones, which have just gone into use in 35 cities, and a new electronic switching system so swift that it will be able to handle 1,000,000 telephone calls between two ticks of the clock.

Two weeks ago A.T.&T. announced that it will soon cross yet another frontier in technology: it will put into public operation the world's first see-as-you-talk Picturephone service. Already on view at A.T. & T.'s pancake-shaped pavilion at the World's Fair, the Picturephone will go into service next month in public booths in New York, Chicago and Washington, offer service between those cities to people who are willing to pay rates that will range from $16 to $27 for three minutes. Whereas the regular phone uses only one circuit, Picturephone in its current stage needs the equivalent of 125 of them—for the 125 hair-fine lines on its tiny TV screen. With confidence that this problem will be solved, A.T.&T. sees a bright and profitable future for its latest device.

Even more exciting than the see-as-you-talk phone to the nation's businessmen and economists is the impact of A.T.&T.'s spend-as-you-grow plans. As proof of its faith in the economy, A.T.&T. in 1964 will undertake the largest program of expansion and modernization ever launched by any company in history. The $3.35 billion that the company will spend will account for 71% of all capital spending by U.S. business, create 180,000 new jobs in supplier companies and do much to keep the U.S. economy's greatest period of peacetime expansion going strong.

Blank Checks. To get more than a third of the money it needs, A.T.&T. went to its usual source of cash: that most democratized group of capitalists, its own stockholders. The company floated history's largest stock issue, 12,241,294 shares, and gave first crack at the issue to its shareholders on a 1-for-20 basis. Openly trying to make the stock even more attractive, Fred Kappel announced an increase in the yearly dividend from $3.60 to $4 and a 2-for-1 split that next month will raise the total to 512,000,000 shares. Stockholders gobbled up almost the entire issue, and thousands sent the company blank checks in an unprecedented show of confidence, asking A.T.&T. to fill in the cost of whatever they could buy.

More shareholders have placed their savings and hopes in A.T.&T. than in any other corporation. It is a haven for 2,350,000 investors, many of whom are untutored in the nuances of high finance but feel certain that the nation's largest company will prosper so long as the nation itself does. A.T.&T. has so many stockholders that 20,500 of them are named Smith, and 100 die every day. Three-quarters of them own fewer than 100 shares, and the biggest holder, Wall Street's Merrill Lynch, keeps most of its 3,600,000 shares for small-customer accounts.* No wonder that Wall Street dubs A.T.&T. "the widows' and or phans' stock," and shareholders affectionately refer to it as "Ma Bell."

"I've Made Mistakes." Not everyone shares this fondness for the telephone company, but almost everyone has an opinion about it. To U.S. military chiefs it is a first-class defense contractor, and scientists consider its Bell Labs to be the finest industrial-research establish ment anywhere. A.T.&T.

has become so much a part of the American scene that it is at once a source of envy and admiration and a butt of jokes. Says Cartoonist Al Capp, whose Li'I Abner delights in needling Mother Bell: "In this country, if we don't like our wives, or even our Government, we can change them. But have you ever tried to change your phone company?"

Fred Kappel does not take kindly to such impertinent questions. He likes to think of A.T.&T. as a warm and faithful creature, and of anyone who does not like its predominance as something of an ingrate. He lists his own home-phone number in the directory —and so do the presidents of the 23 regional operating companies that

A.T.&T. embraces in the Bell System. He also takes time out from each busy day to study stacks of mail from customers and stockholders on the the ory that "it's a good way to get a feel for what people are thinking," has ordered that every letter must be answered within seven days.

Kappel is convinced that life's biggest kicks and greatest challenges come from working in the large corporation. "This 'Organization Man' thing makes me disgusted," says he. "When someone talks that to me I say he doesn't know what he's talking about. Somebody who is really running a railroad must do his job and not be afraid about making mistakes. I've made all kinds of mistakes.

Somebody who never makes a mistake is sitting on his fanny not doing anything. But a man ought to be right more than half the time."

Percentage Player. Kappel has seen to it that he has been right more often than that. A barber's son who worked his way to an electrical-engineering degree at the University of Minnesota ('24), he joined A.T.&T. 40 years ago at $25-a-week. He was soon promoted from pole-hole digger to such jobs as "interference engineer" and "foreign wire relations engineer" and spotted by his superiors as a cool, unflappable fellow not given to snap decisions. Every night he took home a briefcase heavy with homework, and even when he went to the ballpark he took along other A.T.&T. people to talk operations and engineering. He steadily moved up 14 levels on the corporate escalator to a vice-presidency of A.T.& T.'s Northwestern Bell. He was called to New York headquarters, became president in 1954 of A.T.&T.'s manufacturing arm, Western Electric, and took over as president and chief executive of A.T.&T. in 1956. Says Kappel, who became board chairman in 1961: "I've never had anything I didn't get for myself."

Chairman Kappel now earns $271,667 a year and lives in a four-bedroom, six-telephone house in Bronxville, a New York suburb. He allows few ex pensive tastes to enter his well-modulated life. His

wife does the cooking, except for parties. Kappel doesn't smoke, rarely drinks, and faithfully attends Bronxville's Dutch Reformed Church, whose 3,000 members make it the largest church of that denomination in the U.S. He does not openly participate in party politics ("I don't believe that I should"), but he likes to read books of a political nature. Among his recent favorites: J. Edgar Hoover's Masters of Deceit and Victor Lasky's J.F.K.: the Man & the Myth. Regularly, every two weeks, he plays with a bridge club, also enjoys an occasional shrewd game of poker. "He is a percentage player, not a chance taker," says a man who has often watched his game.

Much Like the Army. Kappel is the prototype of the A.T.&T. executive, that particular type of U.S. manager whose training and abilities make the telephone company about the best-managed firm anywhere. One former A.T.&T. vice president wrote that the company's management system "is much the same as the Army's." A.T.&T. is a pure meritocracy, run by men who started at the bottom and worked up, step by step, winning the nod of many bosses along the way. The executives at A.T.&T. combine in themselves dedication, sense of service, awareness of public responsibility, invocation of old-fashioned virtues, puritan earnestness, Rotary Club friendliness, and a touch of self-righteousness They consider themselves a breed apart —and they are. They value continuity and gradualism in management more than most, and, though at ease in handling vast sums, run their company with a peasant's fear of debt and the thrifty conviction that every piece of installed equipment ought to be good for 40 years. Most of all, they view their job—helping the people to speak —as an almost priestly calling.

To make sure of a continued supply of such men—they are not born, but made—A.T.&T. has developed one of U.S. business's most advanced programs of management training and evaluation. Every year it deploys 300 recruiters to search out 2,500 to 3,000 trainees on the nation's campuses. They pick their men only from the top half of the graduating classes, and look for those who have spent more time in the libraries than in the stadiums: A.T.&T.'s studies show that marks are the best indicator of how a candidate works out later, extracurricular activities the least reliable. The headhunters offer good starting salaries ($6,300 to $7,200) and a stock-purchase plan. Half of all employees own A.T.&T. shares, most of them bought at 85% of the market price and sometimes in installments; but no one in the company ever gets a stock option. About 900 men in Bell's system make $25,000 or more.

The new recruit soon learns that A.T.&T. insists on making one man —any man—ultimately responsible for every single project, however big or small, and that he stands to take the blame if that project sours. As soon as he joins the organization, each candidate is tossed into the decision-making maelstrom, perhaps as chief of a smalltown office or traffic department, where his performance can be easily measured. About 20% of all trainees wash out in the first year, but even those who do not make

A.T.&T.'s stiff grades are scooped up by other companies eager to hire men with some Bell seasoning.

Internal Competition. To save itself from becoming fat and lazy like most monopolies, A.T.&T. purposely sets up internal competition. It pits man against man, office against office, district against district—and carefully rates each performance on report cards that are analyzed by efficiency experts. "We have people breathing down everybody's neck," says one high personnel man at A.T.&T. The company even rates its accounting departments according to how many pieces of paper each one processes; woe to the junior executive who finds himself saddled with slothful clerks. Every month the company publishes its "Green Book," a 32-page pamphlet that critically compares the performance of Bell's operating companies, one against the other, in 41 categories that range from the percentage of calls affected by static (yearly average: 2%) to the rate of resignations (yearly average: 2.4% for men, 17.6% for women).

Many other companies try to copy A.T.&T.'s training and rating program, but they cannot copy the advantage that bigness gives to Bell. A.T.&T. has so many operating companies, divisions and branch offices that it has plenty of demanding and responsible jobs in which to develop and store up executive talent. Men with the stamp of success on them are groomed for high management positions as much as 30 years in advance. Some of the young executives are interviewed every year by one or more of A.T.&T.'s 20 staff psychologists, who plumb their changing moods, opinions and goals.

The men who travel farthest in this obstacle course are tough, well briefed and able. At the very top, A.T.&T. is run by a 2 3-man group that is led by Kappel and President Eugene J. Mc-Neely, 63, a stern taskmaster who supervises operations and personnel and has followed Kappel into three executive positions since 1949. This top team is known to company insiders as "the Cabinet." It is made up of an extremely close-knit and like-minded group of men (median age: 57) with strikingly similar backgrounds. They feel most comfortable with their own kind, even to the extent of lunching together every day in the 22nd-floor executive dining room. Three-quarters of them come from small towns, only a handful went to Ivy League universities, and ten of them have engineering training. In an age when more and more companies are bossed by accountants, salesmen or lawyers, A.T.&T. remains one of the few giants dominated by engineers—with all that implies of diligence, prudence and respect for proven rules.

Conformity or Chaos. Sharply at 10 a.m. every Monday, the Cabinet members sit down in red leather armchairs in the 26th-floor board room for a 21hour meeting. One by one, each man briefs the others on developments in his division—new products, spending plans, struggles for higher rates. But the Cabinet seldom wastes time on detail or minor decisions. All down the line, A.T.&T.'s middle executives try to solve all problems long before they reach the vice-presidential level, leaving only the

knottiest ones to the Cabinet. If there is then a dispute, Kappel has the last word. "I may get into an argument," he says. "There's nothing worse than somebody who agrees with everything. We all agree in advance not to agree with anything unless we really believe in it." But he also argues that "there must be some conformity. To be against conformity is to be against order and for chaos."

Though such a sprawling company is beyond the power of any one man to change it substantially, Kappel has made his mark on A.T.&T. Perhaps his signal contribution has been to increase earnings nicely by pushing through local rate increases and introducing myriad new efficiencies. Long-distance operators are now taught by programmed-instruction textbooks, which are much cheaper than human teachers; speed-reading courses have cut the average time that information operators need to look up a number from 37.6 seconds to 33.3 seconds, at an annual saving of $8,000,000. During Kappel's eight years, earnings have jumped 84%, to last year's $1.5 billion—after federal and state taxes of $2 billion. A.T.&T. habitually pays out 62% of its profits as dividends and invests the rest in capital spending.

Keeping the Reins On. Fred Kappel contends that A.T.&T. needs still higher profits to grow on, but he runs into opposition in Washington, where Government officials insist that his company is already too profitable and too powerful. In terms of return on net cost of plant, the usual gauge of profitability in utilities, A.T.&T. earns somewhat more than the average: 7.2%. The General Services Administration, representing the Government as a user in regulatory hearings, has recommended that Bell's return should be limited to 6.6%, and the staff of the Federal Communications Commission, which regulates the Bell System and its interstate rates, has suggested 6.5%. So far, the FCC's seven commissioners have refused to go along with this recommendation.

A.T.&T. aims at getting an 8% return whenever it can. It has to negotiate constantly not only with the FCC but with local commissions in the 48 states in which it operates (all except Alaska and Hawaii). In 47 of them, A.T.&T. hammers out local phone rates with state commissions, but in Texas it has to dicker with no fewer than 1,500 town councils. Rates vary widely, depending upon how much money A.T. & T. has invested in an area, how many numbers residents can call without paying a toll and what the local commission will allow. When commissions agree to give A.T.&T. increases, they sometimes find it politic to hold local rates steady but to raise the charges for phone installation and for such extras as color phones. Despite some increases, rates have not risen as much as the overall cost of living. While the U.S. consumer price index has gone up 59% since 1946, local telephone rates have increased 48%; interstate rates have actually dropped 20% since 1940, thanks to a combination of new efficiencies, higher volume of calling and pressures from the FCC.

Breaks for the Little. Last year the FCC forced the company to reduce some of its long-distance rates, so that anyone can now call anywhere in the continental U.S. after 9 p.m. for no more than $1 for the first three min utes. Two months ago, the FCC hit from the other side: it ordered A.T.&T. to raise rates on its "cheaper-by-the-dozen" Telpak service, which transmits printed as well as spoken messages over big bundles of circuits. The commission felt that A.T.&T. had originally priced this fast-growing service abnormally low in order to attract big users. At the same time, the FCC denied A.T.&T.'s request for permission to send printed as well as spoken messages through its own transatlantic cables, but granted that right to international competitors that lease channels within the cables.

In an open admission of favoritism for such companies as RCA, Western Union International and International Telephone & Telegraph, one FCC official said: "They're the little boys, so they deserve the breaks."

But the big boy has always managed to win the most important battle; A.T.&T. defeated the Justice Department's persistent attempts during the

Truman and Eisenhower Administrations to divorce it from Western Electric, and not much is heard about that any more. A virtual monopoly almost since it was founded in 1877, the Bell System has preserved its special status by arguing that it is much more efficient and economical than a lot of little, local phone companies would be. It has agreed not to invade the territory of the 2,645 independent companies that control the remaining 17% of the phone business. Largest of the independents by far is General Telephone & Electronics Corp., which has 5,000,000 phones as well as extensive manufacturing and research facilities. By buying up smaller companies and shrewdly moving into rural areas and fast-growing suburbs that A.T.&T. does not reach, General Telephone has lifted its sales 1,450% in the past dozen years—to last year's $1.4 billion. A.T.&T. has barely expanded its area of coverage in 42 years, and in 1956 the Justice Department ordered it to open its thousands of patents to all comers.

Lovable Green Giant. Always sensitive about its bigness, and reluctant to be viewed as the great profitmaker that it is, A.T.&T. has devised one of the most effective lobbying and public relations systems in industry. It keeps many discreet and well-connected lobbyists in Washington and in the state capitals. The phone company's public relations campaign paints it as a lovable green giant of communications. In fact, it is so anxious to be loved that it polls 80,000 stockholders each year to find out what they think about the company, even financed a study to determine whether public telephones are dangerous germ carriers. A.T.&T.'s answer: No.

Employees take company courses in politeness and courtesy, are constantly reminded that they and their customers have no fewer than 10 billion conversations a year. A.T.&T. executives are encouraged to lead civic-uplift drives, and to join many public service groups. Once they have joined, they frequently volunteer to make speeches about A.T. & T. or show company films, preaching such slogans as "The Voice with a Smile Is Still Behind Your Dial" and "Whatever the Future Brings, It's Still People Talking."

Fred Kappel himself gives about a dozen public speeches a year, and in one of them, delivered four years ago at Columbia University, he said that "low tolerance for criticism" is a sign of loss of business vitality. A.T.&T. certainly has plenty of business vitality—and plenty of sensitivity to criticism. Kappel calls A.T.&T.'s Washington critics "breaker-uppers" and "glorified publicity seekers." Fortnight ago, at the Business Council's meeting in Hot Springs, Va., he deplored increasing regulation of business by Government, and he believes that A.T.&T. could have moved much faster toward creating a large network of Telstars if the Government had only given it permission to go ahead. As it is, the ownership of Comsat Corp.—whose shares were approved for listing two weeks ago by the New York Stock Exchange—will be divided among the public and the nation's communications companies. The size of A.T.&T.'s stake has not yet been determined, but it will be substantial.

Hotter Meetings. When it comes to the customers, Kappel is often more puzzled than angered by complaints. He admits that A.T.&T. made a tactical error in pushing all-numeral dialing without a public educational campaign. By abandoning the familiar exchange prefixes (Klondike, Pennypacker, Gypsy) and forcing users to dial seven numbers, A.T.&T. raised the possible total of phone numbers in any area by 50%. But it also raised an uproar, was soon accused on all sides of an Orwellian scheme to dehumanize everyday life—even though it would really have had to dehumanize life by ultimately limiting service if it did not have the new system. "We've got to do it if the country is going to grow," says Kappel. "But I don't believe we did very well when we started explaining it. We took the attitude it's something we've got to do, and why the hell bother to explain." The fuss has since died down, and the advent of direct distance dialing will, within the next decade, enable telephone users to call any major country in the world by dialing twelve digits.

Other telephone customers complain that A.T.&T., which owns all its equipment and only rents it to subscribers, will not permit them to hook up antique phones, and that it charges them 500 a month extra for an unlisted number in New York City and Philadelphia; Cinemactor Tony Randall, who can well afford it, has dodged the charge by listing his number under a phony name, Irvine W. Tishman. As in many another company, A.T.&T.'s officers also are getting more and more harassment at annual meetings. Kappel has special controls behind the rostrum at which he stands to cut off any speaker

who becomes too windy or unruly. But he delivered his most effective cut with out benefit of switch at the April 15 annual meeting, where a professional meeting-goer asked a seemingly endless round of questions, including one seeking to know how much A.T.&T. gave to charity. Told that the amount was $10 million last year, the woman said: "Mr. Chairman, I think I'm going to faint." Replied Kappel coolly: "That would be helpful."

Hooray! For all the complaints, big and small, A.T.&T. has given the U.S. the world's least frustrating telephone service with the world's most trouble-free gadget. Kappel points out that the average U.S. phone needs a repair only once every five years; except in times of flood or other natural disasters, no A.T.&T. switching office in the past 40 years has been out of order for as long as ten minutes. No place is too inaccessible, no service request too small for A.T.&T.'s telephone men. They have put up phone booths in the middle of forests for the convenience of hunters, offer phones with gentle chimes for those who cannot stand the regular bells. Even former FCC Chairman Newton Minow, a voluble critic of many other institutions, told a Senate committee last year: "Having just returned from Europe, I would say hooray for the phone service you get here."

That service is growing even faster than the U.S. Every working day, A.T.&T. installs 11,500 new phones and handles 251 million calls. The number of Bell telephone calls within the U.S. is expanding by 15% a year, and A.T.&T. is straining to prevent a massive clogging of overloaded circuits by steadily expanding and improving its equipment. Actually, the Bell System is one great computer, linked by 24 billion interconnections and by enough copper wire to spin a four-ply cable to the sun. The computer's innards are an orderly assemblage of $24 billion worth of the most sophisticated equipment ever devised, and its long limbs sprawl over 3,000,000 square miles of city, plain, mountain, valley and river. It is in constant change, works around the clock, seldom errs—and often corrects itself when it does.

Kappel and his long-nosed engineers never cease devising comely new gadgets to hook onto this computer to bring more profit to A.T.&T. and to add luster and convenience to what they call "p.o.t."—plain old telephone service. They have successfully sold the idea of color for telephones: 21 million colored phones are now in use in U.S. homes. For a monthly charge of $25 to $35 apiece, they have installed 17,000 telephones in cars and trucks, including several in Lyndon Johnson's autos. Though 37% of the nation's telephones are already extension phones, A.T.&T. executives figure that less than a quarter of U.S. homes are "fully telephoned"—having all the telephones they could use.

An even greater field for expansion lies in the area of business phones, which already account for fully half of A.T.&T.'s revenues. The company's new pushbutton Touch-Tone, which reduces the average

"dialing" time from nine to four seconds, will make every business phone a candidate for replacement. Cost: $5 for installation, plus $1.50 to $1.90 extra a month. Another innovation that A.T.&T. recently introduced is the Card Dialer, which enables a user to reach frequently dialed numbers by slipping a punched-hole plastic card into the base of the phone. It cuts dialing time to two seconds, costs $15 to install, plus $3.50 a month extra, with 40 free cards. This year A.T.&T. will bring out the Trim-line phone, whose dial is embedded in the receiver; aside from being good-looking, it also will be a boon for the nearsighted and the bedridden.

The Hell with Economics. These new products—and the ideas behind them—spring from the fertile soil of two A.T.&T.-owned giants in their own right: Western Electric and Bell Labs. Western has 149,000 employees, turns out more than 50,000 kinds of communications gear, and buys parts and materials from small businesses in some 3,000 U.S. towns. U.S. trustbusters complain that Western sells equipment to A.T. & T. at half the price it charges competitors, point out that it earns only 5% on its sales. Kappel argues that if A.T.&T. did not have Western, its own costs would jump by hundreds of millions a year, and rates thus would have to go up. Says he: "Our first command to Western Electric is the hell with economics —produce something that will serve the phone business."

Ideas are the chief products at celebrated Bell Labs, where 4,575 scientists are engaged in what Kappel calls "the exploration of dreams." The dreams range from figuring out ways to stop squirrels from chewing up telephone wires to devising a typewriter that could work by oral dictation.

Endowed with virtually unlimited resources and free dom, Bell Lab scientists have made such major breakthrough discoveries as radio astronomy, magnetic-tape recorders, hifi, and the most important invention since World War II, the transistor. Thanks to the transistor.

Bell next year will begin to slowly convert to a fully electronic switching system that will enable the phone user to reach frequently called numbers by dialing only two digits, to call third parties onto the line, and to switch incoming calls to other numbers if he leaves his home or office. What next? At their yellow brick headquarters, which sprawls like a Pentagon of science over the wooded hills of Murray Hill, N.J., Bell's crew-cut mathematicians, physicists and chemists—many of them not yet 30—are working on pocket phones, wristwatch phones, and laser beams that someday will replace wires and microwaves as carriers of the spoken word. A Basic Difference. Looking toward his own tomorrow, Fred Kappel knows that A.T.&T.'s inflexible retireby-65 rule will compel him to step down within three years. He also knows that though personnel and products will change, A.T.&T.'s philosophy has been too successful for anyone to tamper with it. "The first thing," says Kappel, "is to make sure that we don't ever settle for second best." As a company that sells service in an economy whose biggest growth area is service, A.T.&T. can hardly help prospering and expanding rapidly.

"There's a basic difference between us and a manufacturing concern," says Kappel. "They have a judgment whether they want to expand or not. We have no choice. We are obliged to serve people adequately, and so we are always going to be growing."

* Largest individual owner: Showman Billy Rose, whose 80,000 shares, worth $11.2 million at the current price of $140 each, have brought him $288,000 in dividends during the past year.

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The Protectionist Roots of Antitrust

Donald J. Boudreaux and Thomas J. DiLorenzo*

I. Introduction

Economists and legal scholars have studied the effects of antitrust policy for decades, but it is only within the past several years that the origins of antitrust have received much scholarly attention. In *The Origin of the Sherman Act* (1985) George Stigler was among the first to reexamine "the problem of why the United States introduced an affirmative competition policy." He tested an agrarian interest hypothesis—that "the Republicans passed the Sherman Act to head off the agrarian . . . movements" for price controls and other interventions—against a self-interest hypothesis that small businesses wanted a law to protect them from their larger, more efficient rivals. He found little, if any, empirical support for either hypothesis.

DiLorenzo (1985) examined the origins of the Sherman Act from a public choice or interest-group perspective and provided evidence that industries accused of being monopolized in the late 1880s were in fact dropping prices and expanding output faster than the rest of the economy. The Sherman Act might have been a political smokescreen to pave the way for the McKinley tariff, which was passed just four months after the Sherman Act and was sponsored in the U.S. Senate by Senator John Sherman himself.

In an early analysis of the origins of antitrust, Robert Bork (1966) claimed to have found evidence in the *Congressional Record* that the

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"legislative intent" of Congress in passing the Sherman Act was consumer protection.

The public interest interpretation of the origins of antitrust—that the law was passed as a benevolent response by Congress to a form of market failure—is by far the predominant view among economists and legal scholars. This viewpoint is so widely believed that attempts to explore the alternative, self-interest hypothesis are sometimes met with indignation and dismissed out of hand. For example, when Robert Bradley recently (1990, p. 737) explored the self-interest hypothesis he was chastised by a referee for his "cynical explanation of the passage of the Sherman Act, a view not shared by most contemporary economists." Similar statements were once made about law and economics, public choice, and many other out-of-the-mainstream research programs.

Despite the predominance of the public-interest view of the origins of antitrust, there are reasons to be skeptical of this view. This paper reexamines the genuine roots of antitrust—the state-level antitrust laws that were enacted several years prior to the 1890 Sherman Act. In the mid 1880s, strong political movements emerged at the state level of government in favor of "anti-monopoly" legislation that eventually took the form of antitrust statutes. Although some analysts, such as Stigler (1985) and Thorelli (1955), have noted the existence of these state statutes, no one to our knowledge has thoroughly investigated the possible relation between these movements and the Sherman Act.

The Sherman Act was not enacted in a Washington, D.C. political vacuum. It emanated from the same economic and political forces that gave rise to state antitrust legislation. It is particularly relevant that in 1890 state legislatures still directly elected U.S. Senators, and that the Sherman Act was introduced in the U.S. Senate, not the House.

Section II discusses the economic and political forces at work during the emergence of state antitrust legislation in the late-nineteenth century by focussing on one state, Missouri, which was representative of the states that enacted antitrust legislation during this period. With the exception of Maine, all states that enacted antitrust statutes in 1889 were located in or near the Mississippi valley (see appendix table 1). Section III contains a summary.

II.
Interest-Group Politics and the Missouri Antitrust Law

Close study of late nineteenth-century politics in Missouri suggest that farmers there were a major special interest behind state antitrust legislation. There is evidence that farmers did indeed view large-scale enterprise as a competitive threat and sought antitrust laws to protect them from competition.

The Missouri Farm Lobby

The "Farmer's Alliance" was the most powerful political coalition in Missouri in the years preceding the enactment of the 1889 antitrust law. Democrats affiliated with the Alliance dominated the 1888 state elections. The Democrats were very farm conscious. There were farmer-lawyers, farmer-bankers, farmer-teachers, farmer-preachers, farmer-editors, and farmer-druggists. The Alliance confronted candidates for the state legislature with a card containing the following pledge: "I pledge myself to work and vote for the [Farmer's Alliance's] demands irrespective of party caucus or action" (Drew 1891, p. 303). The pledge card was widely distributed to farmers who were instructed: "If any candidate refuses to sign . . . vote against him and use your influence to elect those who sign, irrespective of party."

Of the 174 state senators and representatives, 140 signed the pledge, as did all of the congressmen-elect headed for Washington and the winners of all three statewide races in that year.

Antitrust and the Missouri Farm Lobby

One reason Missouri farmers wanted an antitrust law was that many of them were being *under*priced by larger, more-efficient farms. The Farmer's Alliance repeatedly warned of the dangers of "the land concentrating in the hands of capitalists" (Clevenger 1940, chap. VI). For example, at a 1889 meeting of the National Farmers Alliance in St. Louis, a Declaration was issued that first urged "care for the widows and . . . orphans," and then called for legislation to "suppress . . . all unhealthy rivalry" (Drew 1891, p. 786). Farmers were bitter about the low and falling agricultural prices, and they blamed the trusts for the decline in their economic position. They complained of "our depressed condition" because of the fact that "the price of the farmers' grain is below the cost of production." As David D. March wrote in his *History of Missouri* (1971, p. 1169), "Just as the low price of raw cotton spurred the expansion of the Southern Alliance, so low grain prices in the late 1880s caused thousands of farmers in the wheat belt . . . to join the National Farmer's Alliance."

To the extent that agricultural prices were falling, the notion that the Missouri antitrust law enhanced consumer welfare is suspect. Missouri farmers were an appropriate special-interest group to launch an antitrust policy on grounds of self-interest if it could be expected that an "antitrust" statute would be enforced and interpreted as an anti-*bigness* statute to protect some producers from the competition of larger and more-efficient rivals.

III.
Missouri Agriculture in the Late-Nineteenth Century: Monopoly or Competition?

If the consumer-welfare interpretation of antitrust legislation explains Missouri's experience with such laws, the following trends should be evident in the economic data on Missouri's agricultural sector for the 1870s and 1880s: (1) the real price of farm outputs should have been rising (or not falling); (2) the volume of farm outputs should have been falling (or not rising); and/or (3) the real price of farm inputs should have been rising.

However, if the real prices of farm outputs and inputs fell—and if the volume of output rose—the protests against supposed monopolization are inconsistent with what was actually happening in Missouri's agricultural economy. Indeed, if real prices decreased and outputs increased, the cries against monopolization are more plausibly interpreted as rent-seeking attempts of less-efficient producers to protect their markets from the increasing competition of more-efficient producers.

During the 1880s, cattle was Missouri's single largest agricultural output in terms of percentage of the state's agricultural gross output (Klepper 1978, p. 320). In 1889, nearly one-quarter of all agricultural output in Missouri was cattle production. Hog production was a close second, accounting for more than 20 percent of Missouri's agricultural gross product. Wheat was the state's third-largest agricultural product, representing more than 13 percent of Missouri's agricultural gross product in 1889. Cattle, hogs, and wheat together account for almost 60 percent of Missouri's total agricultural production in 1889.[1] Appendix table 2 shows the market value of Missouri-raised cattle and hogs per head from 1879 through 1891, as well as the price of wheat in Missouri for these years.

[1]Missouri was the fourth largest cattle-producing state in the United States (behind Texas, Iowa, and Kansas), the nation's third largest hog-producing state (behind, Iowa and Illinois), and the nation's fifth largest wheat producer (behind California, Illinois, Indiana, and Ohio). See *Abstract of the Eleventh Census: 1890*, U.S. Bureau of the Census (Washington, D.C.: U.S. Government Printing Office, 1896), Table 4 and Table 7.

Cattle

Although a simple comparison of, say, the 1879 per-head value of Missouri cattle with the 1889 value shows a slight increase, a different and more significant picture emerges by examining the trend of cattle values from the mid 1880s to the end of the decade. Compared to the peak value in 1884, the per-head value of cattle in Missouri in 1889 was 28.8 percent lower (and it was to fall even further by 1890). Looked at another way, the average value of cattle per head for the years 1887–89 was 18.8 percent less than was the average value per head for the years 1882–84. This decline in cattle values—which affected all the major cattle-producing states—was accompanied by a steady increase during the 1880s of the quantity of cattle entering into the gross national product. Measured in pounds of live weight, cattle supply during the 1880s increased by about 50 percent for the United States as a whole, while the price per hundredweight received by cattlemen in the United States fell from an average of $5.69 in 1880 to $3.86 in 1890–a 15 percent decrease.

This increased supply and reduced price of cattle resulted in *lower* prices of beef (and beef by products) for final consumers. According to economic historian Mary Yeager (1981, p. 70), the average price of beef tenderloins in the United States fell nearly 38 percent between 1883 and 1889.

Hogs

As with cattle, the market value of hogs in Missouri peaked in the early-to-mid 1880s. The 1889 value of a Missouri-raised hog was approximately 19 percent lower than it was six years earlier. The average value of hogs in the state for the 1887–89 period was more than 15 percent lower than it was in 1882–84.

The nationwide output of hogs and hog products increased during the 1880s while the price per hundredweight of hogs fell precipitously—from $6.07 in 1880 to $3.60 in 1890—a decrease of more than 40 percent.[2]

Wheat

The trend of prices for Missouri wheat was also downward during the 1880s, although as in much of the midwest during the late nineteenth century, wheat prices in Missouri fluctuated a good deal.[3]

[2]The 1870 price per hundredweight of hogs in the United States was, at $6.80, even higher than it was in 1880.

[3]McGuire (1981) ranked 14 states according to the extent of variability from year-to-year in their wheat prices. Missouri is ranked eighth.

The 1889 price of wheat in Missouri was 34.7 percent lower than it was a decade earlier. The average price of wheat in Missouri during the 1882–84 period was 97 cents per bushel as compared to 72 per cents per bushel on average for the 1887–89 years. The latter price is almost 27 percent lower than the price of wheat earlier in the 1880s.

These data do not support the notion that Missouri agriculture was becoming monopolized during the 1880s. Moreover, it is doubtful that "predatory pricing" was taking place, for prices fell for the entire decade (and, indeed, since 1870). Predatory pricing for that length of time would be irrational.

Farm-input costs

The farm input that first comes to mind as possibly having been monopolized in the late nineteenth century is transportation by railroad. Although rail rates did fluctuate over time[4]—and varied from region to region and from shipper to shipper—there is broad agreement among economic historians that railroad rates fell dramatically during the several decades following the Civil War (North 1966, pp. 139–40). According to Stigler: "[a]verage railroad freight charges per ton mile had fallen by 1887 to 54 percent of the 1873 level, with all lines in both the eastern and western regions showing similar declines" (1885, p. 2). Henry Varnum Poor found that railroad rates fell from an average charge per ton-mile of $2.90 in 1865 to $0.63 in 1885—a rate decrease of over 78 percent.[5]

Consistent with the significant railroad-rate reduction was the equally significant increase in the quantity of rail services during the latter part of the nineteenth century. According to Poor, total ton-miles carried by U.S. railroads increased by 700 percent between 1865 and 1885 (Hilton 1966, p. 89). In Missouri, there were 4,234 miles of railroad track in 1880; by 1889 this figure increased by almost 45 percent to 6,118 miles of track (Clevenger 1940).[6] No evidence that we know of exists to support the belief that railroad rates were monopolistically high during the period leading up to the passage of antitrust legislation in Missouri.[7] All evidence points in the opposite direction.

[4]Stanley Lebergott (1984, pp. 284–85) argues that the variability of rail rates during the late nineteenth century was an effect of keen competition among the railroads.

[5]Poor, quoted in Hilton (1966), pp. 89–90.

[6]Clevenger (1940) reports that in 1879 Missouri had 27 counties without railroad service, but by 1891 only 11 counties remained unserviced by the railroads.

[7]In fact, the intensity of the competition among the railroads, and the resulting continual downward trend in rail rates in the decades following the Civil War, is considered to be the reason underlying the passage of the 1887 Act to Regulate Interstate

Nor is the evidence consistent with the farmers' contention that financing costs increased during the late nineteenth century. In fact, real interest rates fell dramatically during the 1880s. In the midwest region of the country, defined to include Missouri, real interest rates on farm mortgages fell from an average of 11.41 percent in 1880 to 7.84 percent in 1889. This fall represents a 31 percent reduction in real interest rates during the 1880s.[8]

As for the prices of farm machinery, we were unable to find specific data on farm-machinery prices in Missouri. However, Clevenger reports that, although the 1880s was a period of falling input, output, and consumer-goods prices in Missouri, downward adjustments in farm-output prices usually occurred before downward adjustments in the prices of consumer goods. But, the decreases in the prices o/f farm outputs in Missouri was generally *preceded* by decreases in the prices of farm inputs. "In terms of bushels of wheat, oats, or corn, a mowing machine, binder, or cultivator could be bought for less in 1892 than in 1882" in Missouri (Clevenger 1940, p. 46).

Clevenger's claim that the price of farm inputs in Missouri decreased in real terms during the 1880s is consistent with the trends in farm-machinery prices for the United States as a whole during the latter part of the nineteenth century. This trend was downward during the decades following the Civil War. Towne and Rasmussen (1960) constructed an index of U.S. farm-machinery prices (in constant 1910–14 dollars) and found that this index fell from 251 in 1870 to 124 in 1880 and to 101 by 1890. This index shows that farm machinery was 2.5 times more costly in 1870 than it was in 1890.[9] There is no reason to believe that the trend of farm-machinery prices in Missouri differed significantly from the nationwide trend.

Missouri's economy was undoubtedly becoming more and more commercialized and competitive in the post-Civil War era. The rapid economic growth of Missouri's economy and its increasing integration with other states is reflected in the number of railroad carloads of general merchandise unloaded or loaded in St. Louis. In 1870, 20,542 cars were unloaded or loaded. By 1880 this figure had nearly quadrupled to 125,939, and by 1890 this figure had more than doubled again to 323,506 (Thelen 1986, p. 32). These data question the

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Commerce. Sponsors of this Act hoped that the Interstate Commerce Commission would effectively cartelize the railroads. See, e.g., Kolko (1963), MacAvoy (1965), and Hilton (1966).

[8]Jeffrey G. Williamson (1974, p. 153).

[9]This index fell to 94 by 1900.

contention that the Missouri economy was falling into the consumer welfare-reducing grips of monopolists.[10]

In short, available data on the economic factors pertaining to Missouri's agricultural sector in the decades leading up to the enactment of the 1889 antitrust statute contain no clear evidence of monopolization. Indeed, every sector of Missouri's economy—especially its agricultural sector—shows signs of being highly competitive during the last three decades of the nineteenth century.

What, then, did the agrarians in Missouri have to gain from the passage of an antitrust statute? Agrarians and local merchants in Missouri (as elsewhere) correctly perceived that the larger producers were responsible for the downward pressures on the prices of their outputs (Thelen 1986). Because economies of scale caused a decrease in the optimal number of producers of any particular commodity, the economy *looked* as if it were becoming more "monopolized." As such, in their attempts to protect their local markets from the lower-priced and/or higher-quality goods being shipped to towns and countrysides on the railroads from the increasingly centralized production locations, politically-organized agrarians complained of the evils of "monopoly." But "monopoly," as used by the agrarians, referred only to the larger and more efficient firms who were driving many small farmers and merchants out of their traditional lines of work and business.[11]

Our interpretation of anti-monopoly sentiment in Missouri as being rooted in local-producer opposition to the more intense competitive pressures resulting from "big" firms and the growing commercialization of Missouri's economy is more consistent with the data presented above than is the public-interest interpretation.[12]

[10]Thelen, a historian who is sympathetic with populist ideals and goals, reports that "[r]ailroads transformed the size and shape of [Missouri's] market economy, forcing businessmen and farmers to produce at unprecedented rates to survive the new competition" (p. 32).

[11]Our interpretation of the anti-monopoly protests of the late nineteenth century is, of course, not novel. For example, Dudden, argues that "in the United States by the middle of the nineteenth century, monopoly was generally deplored as *hampering opportunity*. . . . [T]he anti-monopoly spirit of the Guilded Age took shape as a widespread but essentially middle-class protest against the *centralizing* tendencies in transportation, land tenure, business, and industry, which characterized the period" (1957, p. 588; emphasis added).

[12]For further evidence in support of our interpretation of the political motivation behind antitrust legislation in the case of Missouri in particular, see Clevenger (1940), Piott (1985) and Thelen (1986). Dudden (1957), Wiebe (1967), Mayhew (1972), and McDonald (1974) are only a handful of the historians who interpret nineteenth century agrarian political protests—including the agrarians' ubiquitous calls for antimonopoly legislation—as an attempt to stave off the increasing commercialization of their occupations and lives.

However, a more complete understanding of the specific forces at work in Missouri in the late 1880s requires a discussion of the livestock and meat-packing industry. Producers in this industry played a key role in the passage of Missouri's 1889 antitrust statute.

IV.
Cattlemen, Butchers, and Other Rent Seekers

The agrarian interest group that seems to have exerted the greatest pressure for passage of Missouri's 1889 antitrust statute was comprised of cattlemen and local retail butchers who were agitated over the allegedly monopolistic practices of the "beef trust"—the centralized butchering and meat-packing firms that emerged in Chicago in the early 1880s as a result of the development of an economical refrigerated railroad car. The four largest Chicago meat packers during the 1880s were Swift, Armour, Morris, and Hammond, collectively known as "the Big Four."

Although Gustavus Swift was not the first entrepreneur to ship slaughtered cattle by refrigerated railroad car, he was the first to do so economically, shipping his first refrigerated car full of beef from Chicago to Massachusetts in the fall of 1877. The "refrigeration" of this 1877 shipment of dressed beef was little more than open doors on a railroad car being hauled in cold weather. However, Swift saw profits in being able to slaughter meat in a centralized location served by several railroads (i.e., Chicago) and shipping it out year round to cities and towns across the country. The successful development of an economically viable refrigerated car allowed Swift to begin year-round shipments of dressed meats in 1879 (Clemens 1923, pp. 235–36).

In addition to integrating forward into wholesaling and retailing, Swift and his rival Chicago meat packers created markets for beef and hog by-products that had never before existed, thus extracting more profit from each cow or pig slaughtered than was being extracted by local butchers. When this less wasteful use of the whole cow or pig is combined with the great economies of scale that were made possible by the centralization of butchering and shipping, it is not surprising that the price of meats to consumers fell throughout the 1880s (Yeager 1981, p. 70).

The average quality of beef also improved during the 1880s. This quality improvement is closely connected with the fall in the price of cattle that occurred from the mid 1880s through the early 1890s. The fall in cattle prices, in turn, was responsible for the decline of the range-cattle industry beginning in the mid 1880s.

In the wake of the decline of the range-cattle industry there emerged, for the first time in the midwest and the west, rumors of a

"beef trust." Range-cattle producers, whose product—live grass fed cattle shipped by rail to wholesale or retail butchers or sold directly to butchers in nearby towns—simply could not compete with the much less expensive and higher-quality dressed meats shipped from Chicago. Cattlemen contended that "the Big Four" meat packers were conspiring to *depress* the price of range cattle (Yeager 1981, pp. 172–73).

In May 1886 the "National Butchers' Protective Association of the United States of America" was formed in St. Louis. The goal of this organization of butchers "was to destroy the dressed meat industry, which was shipping meat from Chicago to eastern cities and selling it for less than the meat killed by local butchers" (Clemens 1923, p. 243).

The complaints of the range-cattle producers and of the local butchers prompted the first investigation of the meat-packing industry by the U.S. Congress (Clemens 1923, p. 479). Responding to these complaints, the Senate in May 1888 appointed a commission to investigate the cause for the *low* price of cattle seemingly spawned by "the Big Four."

Senator George Vest of Missouri was appointed to chair this committee.[13] From its inception to the delivery of its final report in May 1890, the Vest Committee—comprised of five midwestern and western Senators (from Illinois, Kansas, Missouri, Nebraska, and Texas)—sympathized strongly with its cattle-raising constituents. The Vest Committee concluded in its final report that "the principle cause of the *depression* in the prices paid to the cattle raiser and of the remarkable fact that the cost of beef to the consumer has not decreased *in proportion*, comes from the artificial and abnormal centralization of markets, and the absolute control by a few operators thereby made possible" (Senate Report No. 829 [commonly referred to as the Vest Report], p. vii).

The Vest Committee did not deny that the price of beef to consumers had fallen, only that this price did not fall "in proportion" to the reduction in the price of range cattle. Consumer welfare is increased, of course, when the price of a consumer good falls—especially when the quality of the good rises simultaneously—regardless of whether the price of an input fell by more or less than in proportion to the reduction of the price that the consumer must pay for the good.

The Vest Committee found no evidence of collusion by the major Chicago meat packers. Instead, the Committee *inferred* the existence

[13]The Vest Committee began its hearing in St. Louis in November of 1888, "this place being chosen because the International Cattle Range Association and the Butchers' National Protective Association were in session there" (Clemens 1923, p. 749).

of collusive action among the major packers in the buying of cattle from the fact that cattle prices fell during the mid and late 1880s. The Vest Committee reported that "Mr. P. D. Armour testifies at Washington that no such [collusive] agreement existed between himself and other packers *and we do not contradict this statement*. . . . [However] it is difficult to believe that with the most apparent motive for such action the same parties, or their subordinates with their knowledge, do not avail themselves of the opportunity presented by the centralization of markets to combine for the purpose of lowering the price of cattle" (Vest Report, p. 6; emphasis added).

Several state legislatures also attempted to take action against the "beef trust." Late in 1888, Governor Lyman Humphrey of Kansas called on the governments of the states in the Mississippi valley region to send delegates to a conference for the purpose of framing statutes that could be passed by all states in the region.[14] The ultimate goal of this conference of state legislators was uniform state statutes designed to "protect the stock-grower and farmer against the manipulations of such alleged [beef] trust."[15] It eventually adopted a model antitrust statute to meet this goal. There was no mention during the convention or in the proposed statute of the need to protect consumers from high prices; only to protect stockgrowers and farmers from lower-priced competitors.

The model antitrust statute declared all "trusts" to be in violation of the state corporate charter. Significantly, this model antitrust statute included in its definition of a trust the ability of "a combination of capital, skill or acts by two or more persons, firms, corporations or association of persons. . . . [t]o limit or reduce the production, or increase or *reduce* the price of merchandise or commodities" (emphasis added).[16] The statute that was eventually enacted in Missouri was entitled "An Act for the punishment of pools, trusts and conspiracies." It passed by a vote of 98 to 1 in the House, and by 27 to 4 in the Senate.[17]

Missouri's legislation prohibited "restraints of trade" in the form of pooling, forming trust companies, interlocking directorates, and so

[14]Piott (1985, p. 26).

[15]*Journal of the Senate of Missouri*, 35th General Assembly, 1889, p. 165. The entire text of this joint resolution of the Kansas Senate and House calling for a conference of midwestern state legislators, as well as Missouri Governor Francis's message to the Missouri General Assembly, can be obtained from the authors upon request.

[16]Ibid., p. 407. On the prevalent nineteenth century view that the proper and legal means for controlling the size and manufacturing activities of corporations was the state corporate charter, see McCurdy (1979).

[17]*Journal of the House of Missouri*, 35th General Assembly, 1889, pp. 952–53, and *Journal of the Senate of Missouri*, 35th General Assembly, 1889, pp. 410–11.

on, the effects of which were "to fix or limit the amount or quantity of any article, commodity or merchandise to be manufactured, mined, produced or sold" in Missouri.

This statute also prohibited actions intended "to *limit* or fix the price" of outputs (emphasis added).[18] Although the wording of the proscription against actions intended to "limit" the price of outputs is subject to interpretation, one plausible meaning of the verb "to limit" as it is used in this statute is "to reduce" or "to keep from rising." This interpretation of the statute as prohibiting actions intended to reduce prices is consistent with (1) the downward trend of prices in Missouri during the 1870s and 1880s; and (2) the support given by Missouri's Governor Francis and by Missouri's farmer-dominated General Assembly to the St. Louis beef-trust conference of March 1889 in light of the fact that this conference adopted a model antitrust statute that explicitly prohibited price reductions.

Our interpretation of the political events in Missouri during the winter and spring of 1889 is that Missouri's agrarian-dominated General Assembly passed antitrust legislation in 1889 as part of an attempt to shield politically powerful producer groups—especially range-cattle producers and independent retail butchers—from the intense competitive pressures being exerted by the centralized, vertically integrated meat-packing firms headquartered in Chicago. (Recall that cattle was Missouri's single largest agricultural output during the 1880s.) No evidence exists to suggest that consumers in Missouri (or anywhere else in the United States) were harmed by the so-called beef trust. In fact, as shown above, the evidence suggests just the opposite: The centralization of meat packing generated substantial benefits to consumers in the form of lower prices and higher quality meat, as well as greatly expanded use of meat by-products which, until the 1880s, were discarded as waste. However, the growth of the centralized meat packers did result in lower prices for range-cattle producers and, of course, for independent local butchers whose services ran head to head in competition with the services being performed more efficiently in the Chicago slaughtering and packing houses.

III.
Conclusions

The political and economic roots of antitrust are at the state level of government. Numerous states passed antitrust laws before the 1890

[18] *Laws of Missouri*, 35th General Assembly, 1889 (Jefferson City, Missouri, 1889), pp. 96–97; emphasis added.

Sherman Act, itself initiated in the U.S. Senate which, at that time, was directly elected by state legislatures.

The political impetus for some kind of antitrust law came from the farm lobbies of mostly midwestern, agricultural states, such as Missouri. Rural cattlemen and butchers were especially eager to have statutes enacted that would thwart competition from the newly centralized meat processing facilities in Chicago. The evidence on price and output in these industries, moreover, does not support the conjecture that these industries suffered from a monopoly in the late nineteenth century, if monopoly is understood in the conventional neoclassical way as an organization of industry which tends to restrict output and raise prices. These industries were fiercely competitive because of relatively free entry and rapid technological advances such as refrigeration.

As Armentano (1982) has shown, for over a century the antitrust laws have routinely been used to thwart competition by providing a vehicle for uncompetitive businesses to sue their competitors for cutting prices, innovating new products and processes, and expanding output. This paper has argued that, moreover, antitrust was a protectionist institution from the very beginning; there never was a "golden age of antitrust" besieged by rampant cartelization, as the standard account of the origins of antitrust attests.

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Appendix Table 1
State Antitrust Laws by Date of Passage

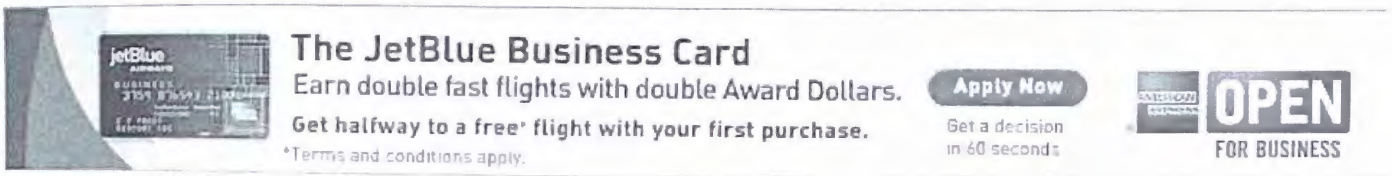
State	Year of Passage
Maryland	1867
Tennessee	1870
Arkansas	1876
Texas	1876
Georgia	1877
Indiana	1889
Iowa	1889
Kansas	1889
Maine	1889
Michigan	1889
Missouri	1889
Montana	1889
Nebraska	1889
North Carolina	1889
North Dakota	1889
South Dakota	1889
Washington	1889
Kentucky	1890
Louisiana	1890
Mississippi	1890
Alabama	1891
Illinois	1891
Minnesota	1891
California	1893

Source: George Stigler, "The Origin of the Sherman Act," *Journal of Legal Studies* 14 (January 1985): 1–11.

Appendix Table 2
Prices of Missouri's Three Leading Agricultural Products, 1879–1891

	Cattle (per head)	Hogs (per head)	Wheat (per bushel)
1879	$22.95	4.36	1.01
1880	$25.06	5.59	0.89
1881	$27.03	6.29	1.19
1882	$29.01	7.68	0.85
1883	$31.18	7.99	0.88
1884	$32.61	6.75	0.62
1885	$31.05	5.75	0.77
1886	$28.60	5.44	0.63
1887	$26.49	5.83	0.62
1888	$25.65	6.71	0.88
1889	$23.22	6.48	0.64
1890	$21.86	5.44	0.83
1891	$21.92	5.40	0.80

Source: Robert Klepper, *The Economic Bases for Agrarian Protest Movements in the United States, 1870–1900*. New York: Arno Press, 1978.



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A universal speaking service: the role of Westinghouse Electric and Manufacturing Company in the development of National Network Broadcasting, 1922-1926.

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Radio transmission evolved into something new on November 2, 1920. On Election Day a recently established radio station in East Pittsburgh, KDKA, reported the election results to a public that was becoming increasingly interested in radio. How to define "the first broadcast station" is still debated, but on that day Westinghouse Electric and Manufacturing Company, the company that owned KDKA, transmitted a general purpose program designed to reach a mass, general-interest audience of casual listeners.

As the decade progressed, corporate powers in radio manufacturing battled for prominence as the industry headed in a potentially lucrative new direction. The patent pool that had been in effect during the war was lifted, leaving corporations vying to become the bellwether of the industry. The battle for leadership and dominance in the largely experimental and unregulated world of radio broadcasting led to legal arbitration, corporate negotiations, personal animosities and, eventually, cooperation and cross-licensing (Bilby, 1986; Hilmes, 1997; Spalding, 1964; Sterling & Kittross, 1978). In his biography of David Sarnoff, Kenneth Bilby writes, "The years between 1922 and 1926 were the most crucial in the development of American broadcasting. The service matrix that exists today, for television as well as radio, was configured then" (Bilby, 1986, pp. 68). As the dominant broadcasting and communications companies of the day struggled to establish a regular, national broadcast presence, Bilby notes that "in security-sealed corporate board rooms and Manhattan legal offices, and at secret arbitration hearings, the penumbral drama unfolded" (Bilby, 1986, pp. 68).

The story of how Radio Corporation of America, General Electric, and Westinghouse Electric and Manufacturing Company worked together, if occasionally at cross-purposes, to build the structure of national network broadcasting has been told, but not from each company's perspective. The personal and business correspondence of Westinghouse Vice President and broadcast pioneer Harry Phillips Davis illustrates how Westinghouse planned to enhance and, later, preserve their leadership position as the industry evolved. If the drama unfolded behind closed doors, then these documents provide a window into the negotiation from Davis's and Westinghouse's perspective.

H. P. Davis's Broadcast Proposals

Broadcast history texts tell the familiar tale of how Frank Conrad, an engineer at Westinghouse, set up an experimental radio station at the Westinghouse factory in East Pittsburgh, Pennsylvania. At Westinghouse, Conrad had been in charge of the governmental wireless experiments during World War I. After the end of wireless restrictions imposed during the war, Conrad began airing programs of music, lectures, and sports scores that were picked up by wireless enthusiasts with receiving sets. As the broadcasts grew in popularity, a local department store, the Joseph Horne Company, ran an advertisement promoting Conrad's station and the store's radio department. The advertisement read that "Mr. Conrad will send out phonograph records this evening for amateurs with radio receivers" ("First Radiophone Station," 1922, p. 7; "Great Men of Radio," 1922, p. 6; "Story Told of Birth of Broadcast," 1922, p. 7).

Conrad's supervisor, H. P. Davis, an engineer and vice president at Westinghouse, saw the advertisement and inferred that if the broadcasts found an audience with little promotion, an organized, high-quality program designed to reach a wide, mass audience could be very effective (Barnouw, 1966; S. J. Douglas, 1987; Head, 1956; Sterling & Kitross, 1978). Davis later recalled thinking that if there was entertainment on the air, people would demand "ears," or Westinghouse could establish a wide market for radio receiver sets. ("Great Men of Radio," 1922). Davis sent for Conrad and informed him that Westinghouse was shutting down Conrad's experimental station. A two-part installment in The Chicago Evening Standard on June 17, 1922, describes Davis's recollection of the conversation.

Frank, my idea is that you stop sending from your station and we

will start a regular service from our experimental station here at

East Pittsburgh. We can arrange for a suitable wave length, and I

believe if we do this it will be the beginning of radio

broadcasting public service which seems to me to have wonderful

possibilities. ("Story Told of Birth of Broadcast," 1922, p. 7).

Whether Davis did foresee the full impact of radio as an industry and public service on that day in 1920 cannot be said for certain. As an advocate for a permanent radio station with a daily program schedule, Davis did articulate in internal correspondence his view that radio should not be limited as a point-to-point medium. Rather, Davis envisioned radio as a mass medium designed for the information, entertainment, and public service of the masses (Davis, 1928; "First Radiophone Station," 1922; "Story Told of Birth of Broadcast," 1922).

Harry Phillips Davis was born July 31, 1868, in Somersworth, New Hampshire. Davis studied electrical and mechanical engineering and joined Westinghouse's engineering department in 1891. A biographical essay in The Story of Electricity quotes Davis on his interest, beginning in the late 1880s, with "the various applications of electricity then being undertaken" (Martin & Coles, 1922, p. 1). Davis's work early in his career focused on the electrification of mass transportation systems, a field in which Davis holds more than 100 patents. Davis then turned his attention to radio, an endeavor that would make him one of the most influential Americans of the time.

In the 1920s H. P. Davis was celebrated in the popular press as "the Father of Radio Broadcasting" ("Father of Radio Broadcasting," 1922; Foster, 1923; "Great Men of Radio," 1922; Krumm, 1922; Maclaurin, 1949/1971; Martin & Coles, 1922; The National Broadcasting Company, 1931 ; "Radio's Version," 1970; "Story Told of Birth of Broadcast," 1922). In a press release issued by the National Broadcasting Company announcing Davis's death, radio pioneer and inventor Ernst Alexanderson of General Electric addressed Davis's influence.

The growth of the technical arts follows lines that can be foreseen

to some extent. Science shadows invention. But how will these

inventions be adapted to human society and how will they change it.

It takes a leader who is more than a scientist or an inventor to

blaze those trails. It is in that broader sense that we have come

to know H. P. Davis and when we call him the "Father of American

Broadcasting" it is the greatest tribute we can give. (The National

Broadcasting Company, 1931, p. 1)

In 1922, Davis wrote about the new promise of the broadcasting public service company. The radio, he wrote, offers great promise. Davis was among the first to foresee radio's practical possibilities. It was Davis's view that radio offers entertainment through its programming, but it is also a serious service for the good of the public. Davis likened the role of the radio to that of the newspaper but noted one difference. "The newspaper has been developed to a wonderful state of perfection and wields a tremendous influence in our lives today--yet that influence is more or less local." Radio had the potential to unite a nation (1922, January, p. 3).

Davis noted that when KDKA went on the air, the public response was dramatic and immediate. After 9 months of continuous operation, KDKA relayed its signal to stations WJZ in Newark, and WBZ in Springfield, Massachusetts, with a fourth station, KYW, in the works in Chicago. Still there was public demand for wider reach and more programming. Davis asked,

And where will it end? What are the limitations? Who dares to

predict? Scientists and inventors are working on relays that will

permit one station to pass its message on to another and we may

easily expect to hear from an outlying farm in Maine some great

artist singing into a radiophone many thousand miles away.... It is

not a question of possibility--it is rather a question of "how

soon." (1922, January, p. 5)

Davis also saw problems in the fast growth of early radio. The number of broadcasters on the air grew dramatically, numbering almost 600 stations in 1922 on only two wavelengths. There were no proposed plans to deal with this congestion and no clear call for action to restrict start-ups. Those who were established in the industry, like Westinghouse, looked at this chaos and feared that interference from newcomers would threaten their established stations. One idea being examined by Davis and others was a way of creating an efficient distribution system. This would be a way to reap the benefits of economies-of-scale and produce high quality programming. It would be a way to receive programming, perhaps live, from across the nation or globe. Davis called this a "universal speaking service" (Davis, 1922, April, p. 1). Others were developing this same concept and calling it chain broadcasting or network broadcasting (Barnouw, 1966; G. H. Douglas, 2002; Sterling & Kittross, 1978).

Westinghouse's Early Proposals for Networks

By 1925, the considerable interference brought about by the quick boon of the radio industry was becoming a critical issue for established broadcasters and receiver manufacturers, such as Westinghouse. The radio conferences initiated by the Department of Commerce through the early 1920s did little to solve the problem and established broadcasters were becoming anxious that their radio audiences would be discouraged by the noise on the radio band (G. H. Douglas, 2002). Broadcasters began looking for ways to rein in the competition. One method, especially for established stations and organizations, was to work together.

One way in which to do this was to create a chain of stations which could be used to distribute programming. A web of networked entities was a familiar concept in the telephonic communication sector. In 1923, the American Telephone and Telegraph Company used its existing long-distance lines to begin distributing programming to stations, an arrangement, they argued, to which they held the exclusive rights (G. H. Douglas, 2002; Sterling & Kittross, 1978). AT&T was not alone in its development of the network concept. Westinghouse experimented with relaying programs by other stations or putting "remote" programs on the air shortly after the establishment of KDKA in 1920 (G. H. Douglas, 2002).

Westinghouse also started to see how the presence of programming across wider geographic markets could lead to increased receiver sales. In a letter dated July 8, 1925, Frank E. Mulley, an editor at a farm journal, The National Stockman and Farmer, examined the correlation between desirable programming for a key audience and the adoption of radio sets. His letter documented what he saw as the influence that programming, in this case the farm report The Stockman on KDKA, had on encouraging farmers to purchase receivers. As evidence, Mulley pointed to the correlation that counties with the highest subscription rates to The National Stockman and Farmer newspaper also had the most radio sets.

There are more sets on farms in the western third of Pennsylvania

where The Stockman dominates, than in the eastern two-thirds of the

state. This in spite of the fact that there are 50,000 more farmers

in the eastern two-thirds of the state. (Mulley, 1925, p. 2)

This correlation, while not scientific, did anecdotally suggest a mutually beneficial alliance which could be formed between newspapers and radio stations. One such venture was debated at Westinghouse Electric and Manufacturing Company in 1925. The proposed chain would be a coalition of Midwestern Newspapers and Westinghouse, to be called the Mid-Continent Chain. Such a chain would place Westinghouse and affiliated newspapers in direct competition with AT&T (Conrad & Horn, n.d.).

From July through November 1925 Westinghouse Electric and Manufacturing Company considered the costs and benefits of being a part of a chain of broadcasting stations. As Davis looked for a way to promote radio receiver sales and to efficiently provide programming for an audience wary of interference, he looked at the organization of a press association or wire service. Such a group allows each individual paper to maintain its ownership and local identity, while providing content from one centralized source. He proposed that radio stations could work under the same organizational structure (Davis, 1925; Rosen, 1980).

Davis viewed the structure of the developing AT&T national chain as wasteful. Davis stated in a 1925 proposal that "a large majority of the receiving sets in use today can pick up at will a half dozen or more of the American Telephone and Telegraph Company's chain but they can listen to only one at a time" (Davis, 1925, p. 1). He added that if the AT&T stations broadcast at different times, this duplication would be reduced. The Mid-Continent Radio Chain would cull programming from its affiliate members and then share this programming among members through the week.

The Mid-Continent Radio Chain would consist of six powerful, well-established stations in the Midwest, each affiliated with a newspaper. These included WMAQ (Chicago Daily News), WWJ (Detroit News), WBAP (Fort Worth Star-Telegram), WDAF (Kansas City Star), WHAS (Louisville Courier-Journal), and KSD (St. Louis Post-Dispatch). Davis estimated that each station had a 500-mile radius. With this calculation the network would have reached 85% of the nation, and 42% of the nation's population (Davis, 1925).

Davis, working with J. C. McQuiston, Westinghouse's manager in the Publicity Department, was considering a number of possible ways to interconnect these stations. The first possibility was to emulate AT&T by employing a wire relay. Another option was to substitute short wave wireless transmission for the traditional wired approach. A final option was to create a wire/wireless hybrid model (Davis, 1925, July 8). As a plan for the network developed, executives and engineers at Westinghouse opted for a wireless short wave approach.

Westinghouse perceived several advantages in an alliance with newspapers. The first was that the newspapers were familiar with working with advertisers. The newspapers also brought to the table with them their government connections and contacts. Additionally, McQuiston noted, the press could be a beneficial ally in promoting the name of Westinghouse and the network itself.

In Davis's and McQuiston's assessment the newspaper/station owners were optimistic about the potential to work together and work with Westinghouse, yet both sides indicated they had reservations about the arrangement. McQuiston feared the newspapermen were overemphasizing advertising returns over content. McQuiston stated that he would reposition Westinghouse's proposal to emphasize how a network could "build up a high standard of excellence of broadcasting" (1925, p. 1). He questioned whether the newspaper owners would have the same commercial outlook if it were the radio broadcasters suggesting a "disregard for a high standard of editorial?" (p. 1). The representatives of the newspaper also balked at the idea of forming a new company. Davis saw this as an important part of the deal. His argument was that by committing to be part of a distinct corporation there would be a greater chance to achieve uniformity and market the group to national advertisers (McQuiston, 1925).

It was Davis's estimation that stations could receive a variety of original programming to air every night of the week and for producing a single evening's worth of programming in exchange. This promise of quality content was seen by executives at Westinghouse to be a good value in a competitive radio market where many stations were competing for the same audience and were also vying for the same

artists, and, of course, the same advertisers. The Mid-Continent Radio Chain would represent a relationship among three parties; the newspapers whose stations were affiliates, Westinghouse who would serve as the central organizing network, and advertisers who would sponsor programming (McQuiston, 1925).

Another stumbling block for this potential chain was a lack of agreement on the best way to transmit signals from the hub station to the affiliates. Westinghouse had been actively involved in short wave system experimentation and had been using short waves to transmit KDKA around the globe. The tests sending out programming to affiliates via short wave were less than promising. Although experimental broadcasts from KDKA using the short wave system reached distant locales, they did not do so with predictable reliability. Short wave radio as a form of distribution, at this time, would remain a highly questionable concept (Barnouw, 1966).

Another potential problem Westinghouse could foresee was that of a fee structure for the affiliates. McQuiston found that the stations spent about $50,000 a year on operating expenses. If the plan for the chain were to succeed broadcasters could offset or reduce their annual outlay. The network, in addition to facilitating the placement of advertising and the procurement of programming, would charge the affiliates fixed fees from gross revenue. These costs would include a 15% agency commission and charge to recoup the cost of producing programming and the cost of operating the network short wave system. This charge was projected to be approximately 35% of gross revenue (Davis, 1925). During the late summer of 1925 both sides were left to mull these considerations while Westinghouse worked on a definite proposition. However, another discussion was beginning to draw Westinghouse's attention from the Mid-Continent Radio Chain. This was the possibility of a national network being discussed among members of the Radio Group--Westinghouse Electric and Manufacturing Company, General Electric, and Radio Corporation of America. The possibility of creating a large-scale network of wire-linked stations was finally something that seemed feasible. Talks with the newspaper stations never did resume, and Westinghouse pursued a different route to chain broadcasting.

Westinghouse and the Organization of the National Broadcasting Company

While negotiations were underway for the Mid-Continent Radio Chain, negotiations were also taking place among members of the Radio Group. In 1925 the Radio Group continued their conflict with AT&T regarding each organization's rights and role in the broadcasting industry. AT&T and the Radio Corporation of America were in arbitration based on a previous cross-licensing agreement. As early as 1922, David Sarnoff, then a vice-president at RCA, prophesied a change to the model of broadcasting. In a letter to General Electric president E. M. Rice, Sarnoff outlined the problems faced by the radio industry. The novelty of the medium was wearing off and the airwaves were becoming chaotic as new stations took to the air. The public would increasingly grow to expect high-quality content, Sarnoff argued. The cost-effective way to present this programming to the nation was through a linked chain of stations. The job of putting together such a network called for broadcasting specialists who understood the audience's taste and had a plan for how to satisfy it (Bilby, 1986; Sarnoff, 1925; Spalding, 1964). To Sarnoff, the Radio Group was the logical choice for the job.

The inception of the National Broadcasting Company has been reviewed by broadcast historians. In particular, RCA, which controlled 50% of the corporation, and their role in the development of the National Broadcasting Company has been well documented (Archer, 1971; Barnouw, 1966; Bilby, 1986; G. H. Douglas, 2002; S. J. Douglas, 1987; Head, 1956; Hilmes, 1997; Maclaurin, 1971; Rosen, 1980). A less familiar examination of the network's history involves Westinghouse Electric and Manufacturing Company and their motivations for joining the association, and their reaction to the end result of the negotiations.

On June 27, 1925, H. P. Davis distributed a memorandum on the proposed organization of a broadcasting company articulating one view of this proposed network. In his opening paragraph, Davis articulates the group's objectives.

> The purpose of this Company will be to form a group of the best established and suitably located stations throughout the United States and Canada, for the purpose of organizing and improving general broadcasting conditions; to improve quality and to maintain it on the highest possible plane; to obtain the best in the way of programs; and to make available all national events and important performances of high class and acceptable character; and to make available the best talent obtainable, both musical and dramatic, occurring or appearing in the principal centers of this country. It is the purpose also, while improving quality and programs, to reduce the operating expense to all members of the Company. It is proposed to develop this organization into a national, and possibly an international, advertising medium which will be extended as much as possible with the hope of making the entire project self-supporting. (p. 1)

The proposition further organizes the technical structure of the network. One station in the group would serve as a primary station. From this station, programming would be distributed to affiliate stations via long distance wire connections. The affiliate station would retain its identity, ownership, and call letters. The member station would produce and air local programming as appropriate. The affiliate would pay a fee to the network, which would be used for the general direction of the organization, the procurement of programming, and advertising for the network. The network would be in charge of planning the direction the network was to take and evaluating its performance. The network would also conduct suitable research activities to develop the network and stations at the technical level. Members would receive dividend from profits, as these were to accrue (Davis, 1925, June).

On July 3, 1925, the board of the Radio Corporation of America passed a resolution inviting General Electric and Westinghouse Companies into their network negotiations. A few weeks later, on July 9, 1925, Davis sent a letter to E. M. Herr, the President of Westinghouse, expressing his impatience with the pace of the network negotiations. The bitter arbitration between AT&T and the Radio Group was continuing although the referee of the process, Roland Boyden, had issued an informal resolution that the Radio Group had the right to establish and maintain transmitting stations and to derive revenue from such transmissions (Davis, 1925, July 9). The resolution was not, however, final. Radio Group executives, particularly Owen Young, Chairman of the Board at General Electric, were wary of pushing too hard on AT&T before matters were finalized.

The relationship of the Telephone Company at the present moment, as

you can see, is a very sensitive one, and I think it important

beyond measure that all of us sit steady in the boat now for a

month or two until we see if we can not (sic) get it straightened

out. (Young, 1925, p. 1)

In July 1926, AT&T's broadcasting holdings were purchased by RCA. On September 9, the Radio Group formed a new corporation, the National Broadcasting Company. Ownership was held by Radio Corporation of America, owning 50%; General Electric, with 30%; and Westinghouse Electric and Manufacturing Company owning the remaining 20% of the new company (Sterling & Kittross, 1978). The network of the Telephone Company consisted of 18 stations which reached about 61.6% of the nation's radio receiving sets. These stations, based on a draft National Broadcasting Company prospectus, were to become Network Number 1. Some adjustments were made, filling holes in coverage in New York City and Washington, DC. A second network, called Network Number 2 in the prospectus, would consist largely of stations owned by RCA and Westinghouse.

Network Number 2 was seen as vital for a number of reasons. First, it was anticipated that Network Number 1 would face problems as the network quickly grew in scope and size. Due to the cost of the investment in wire for this far-reaching network, it would only be profitable if it were to remain in almost constant use. The cost of advertising would also be higher for this same reason; advertisers would sign a 1-year contract and pay for 1 hour of programming per week at a cost of $180,000. The authors of the draft concluded that an alternative way for prospective advertisers to enter into network broadcasting without as great a financial commitment would be advisable. Network Number 2 would serve as an alternative for advertisers who wanted to "test the medium" or only reach a concentrated audience in the eastern part of the country. The cost to advertise on Network Number 2 would be in the range of $50,000 to $75,000. The only difference for the advertiser, according to the prospectus, would be the size of the audience the advertiser would reach. Content would be of comparable quality (The National Broadcasting Company, 1926).

Westinghouse, KDKA, and the Blue Network

H. P. Davis reviewed the final draft of this prospectus on September 15, 1926, and sent his reaction to J. G. Harbord, President of RCA, in a letter. Davis indicated that he was a man of two minds; in his capacity as an official in the Radio Group and as the Appointed Chairman of the Board of the new National Broadcasting Company, he felt that the organization was well-conceived. However, as a Vice President at Westinghouse and one of the individuals who conceived of and developed KDKA, he was concerned. This plan would place KDKA in a secondary chain. Additionally another Pittsburgh station, WCAE, a former AT&T station, would be placed at a higher advertising rate than KDKA, despite KDKA's historic dominance over WCAE in the market. Davis suggests a compromise was needed, stating that "KDKA is the most powerful broadcasting station in the world today; it is the pioneer, and probably has at least as much reputation as any other broadcasting station, and is a very valuable asset of the Westinghouse Company" (p. 2).

An undated letter to Davis from Frank Conrad, Assistant Chief Engineer at Westinghouse and the individual who started the experimental station that would become KDKA, expressed Conrad's dismay at this situation as well. He argued that the Radio Group was investing in this venture to increase revenue, yet they were placing many of their owned-and-operated stations in the lower-tier network. Instead, they were investing in the old AT&T stations, which, in Conrad's opinion were "largely of an obsolete type, not effectively manned and mostly present glaring defects in transmission characteristics" (Conrad & Horn, n.d., p. 1). Conrad also raises questions about the promised quality of programming and transmission for Network Number 2. If the network asks less money to advertise on Network Number 2, which would later become known as the Blue Network, will that not equate to less revenue? Will the stations of Network Number 1, which would later become known as the Red Network, earn greater revenue? If so, will they be willing to redistribute those funds to stations in the Blue Network for the sake of quality?

The Inaugural Broadcast of the National Broadcasting Company on KDKA

From the Grand Ballroom of the Waldorf-Astoria Hotel on Monday, November 15, 1926, the National Broadcasting Company officially premiered. The initial ceremonial event of the evening was a brief address by Merlin Aylesworth, President of the National Broadcasting Company. Aylesworth addressed a crowd of nearly a thousand, consisting of politicians and business leaders. Also in the audience were members of National Broadcasting Company's Advisory Council, including Major General James G. Harbord, Owen Young, General Guy E. Tripp, Elihu Root, and Julius Rosenwald. The major tenor of Aylesworth's address was that this network was created for

the use and benefit of individuals and families listening across America and that broadcasting's purpose is to serve its audience. "The best it can create," Aylesworth noted, "leaves no record other than on the minds and in the hearts of those who hear it. Therefore, you in the great cities, you in the towns and villages, you on the farms, have it in your power to make the National Broadcasting Company an institution of service from the beginning" (The National Broadcasting Company, 1926, p. 1).

The program for the evening included a diverse mix of classical pieces, folk and dance music, and comedic routines. The audience listening at home also learned that not only were they receiving the performance from New York, but that those in the Grand Ballroom, were also hearing a number of live performances, which were being relayed to New York City, before being transmitted to the nation. Soprano Mary Garden of the Chicago Opera Company sang before a microphone in Chicago. Will Rogers addressed the crowd from a microphone installed in the dressing room of the theater in which he was appearing in Independence, Kansas. The performances were relayed via telephone cable to 25 stations and reached an estimated 12 million people as far west as Kansas City (Barnouw, 1966; Bilby, 1986).

Thousands of these listeners sent letters and telegrams to KDKA to share their reaction to the Monday evening show. On November 18, 1926, a selection of these letters was collected by H. P. Davis and forwarded to Aylesworth to share with him the audience's response, but also to illustrate the reach of KDKA's powerful signal, and as such, highlight the unique vantage that Westinghouse brought to the National Broadcasting Company. One letter, from a dentist in Portland, Oregon, congratulates KDKA on their "wonderful program" from New York City and adds that his reception of KDKA was "perfect" and as clear as the local broadcast stations (Dulin, 1926, p. 1). A listener in Haina, Hawaii, wrote to express his thanks for the inaugural program from National Broadcasting Company.

Thank you very much for the fine programs. We considered the New

York City dance music a big treat even tho (sic) we had to get it

via Pittsburgh. Sunday night while the RCA chain of stations was on

I tried to get some of them but KDKA was the only one my set could

pick up. (Giddings, 1926, p. 2)

In the letter to Aylesworth, Davis noted that many letters were sent on stationery "of a better class," often from a business or doctor's office. From this Davis surmised that "our radio service is reaching into a better class of homes" (Davis, 1926, November 18, p. 1). Davis also intimated that letters from listeners in places like Tampa and other parts of the Southeast could suggest a solution for their ongoing negotiations with AT&T, whose lines had been slow to reach such areas. Even after the establishment of the National Broadcasting Company's hybrid network connection, Westinghouse is emphasizing the relative benefits of their high wattage station and what it could add to the existing network structure. Westinghouse was once again positioning itself as a superpower that should be employed, and empowered, as such within the network (Davis, 1926, November 23).

KDKA received listeners who commented on the new network affiliation. Some listeners from across the nation liked the programming the new chain of stations could offer, many of which H. P. Davis saved in his personal papers. One letter dated January 3, 1927, commends the chain for their coverage of the Stanford-Alabama game from Pasadena, which was broadcast on January 1. The writer states that the announcer helped him to visualize the plays on the field, "in fact we found it easier to picture the contest than if we had been actually seated in the bowl" (Castle, 1927, p. 1).

Other long-time listeners were not pleased with the changes they heard. A letter to KDKA from Pittsburgh decried the loss of the unique voice of KDKA. The writer stated that he didn't like the new chain.

There isn't a station to compare with KDKA so why spoil it by

"chaining" to a New York Station? What is the idea with all these

chain stations anyway? Let each station broadcast their own program

(sic). Is someone trying to capture the air so we all have to

listen to a certain program or not listen at all? (McElvany, 1927,

p. 1)

Tripp collected and forwarded these letters to Aylesworth along with questions about the development of the Blue Network and the placement of KDKA. Aylesworth responded that he understood the concerns of Tripp and Westinghouse Electric and Manufacturing Company, but begged patience. Aylesworth said he planned to make the WJZ programs so good that Westinghouse would be reluctant to even want to change to the Red Network. In any case, Aylesworth noted, if a major station in the Blue Network, like KDKA or WJZ, were to leave the Blue Network would be badly wounded in both public opinion and advertising, and consequently revenue (Aylesworth, 1926, November 24).

Westinghouse Electric and Manufacturing Company did agree to remain on the Blue Network. The advertising rates and audience levels for the Blue Network never did match those of the Red Network. An aftermath of later FCC chain broadcasting rules would break NBC into two separate entities--the still powerful and popular Red Network and the less important affiliates on the Blue Network. In 1943 NBC divested itself of the Blue Network. In 1945 the Blue Network became the American Broadcasting Company (Sterling & Kittross, 1978).

Conclusion

Primary sources from the archive of H. P. Davis's personal and professional papers provide perspective on the chaotic state of radio in the 1920s. The industry was facing an unprecedented growth in revenue, audience, and demand for programming. The industry also was inventing the idea of mass communication of a message from a single point of origination to a mass audience. At first this audience was regional. As the power of stations grew and as new technologies, such as short wave, were introduced the regional audience became national and international. As these technologies became more readily available to entrepreneurs who wanted to enter the broadcasting field, the radio manufacturers, Radio Corporation of America, General Electric, and Westinghouse, who held the bulk of the financial resources, found themselves also facing interference and chaos.

The radio marketplace in the 1920s was uncharted territory for those in the radio industry. Radio manufacturers were always aware of the growing frustration of a listening public who found little program variety and increasing interference on the airwaves. In an attempt to make the creation of programming and the operation of multiple radio stations more efficient as well as more profitable, they structured a system matrix of program distribution. This matrix became the radio network, and the National Broadcasting Company became an enduring part of broadcasting. The archival papers of H. P. Davis illustrate the concerns of Westinghouse as radio's pioneers addressed the challenges of the decade. The papers and documents also show how, despite the changes of 80 years, the core concept of the network is a foundation of broadcasting.

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Comment

*245 FEDERAL CONTROL OF RADIO BROADCASTING

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That the **federal** government must **control** the **broadcasting** situation is generally admitted. The tremendous present importanceand***246** future possibilities of the **radio**, [FN1] the limitations upon the number of persons who may **broadcast** simultaneously without causing a chaos of interference, [FN2] and the fact that **radio** waves are not confined within the bounds of a single state or nation, [FN3] make obvious the necessity of a unified **federal control** . [FN4] But the difficulty of employing the usual legal tools to cope with a situation involving such unique concepts and such unusual problems is equally obvious. This is well illustrated in the attempt to solve the first question which presents itself-that of determining which stations shall have the privilege of using the limited facilities for **broadcasting**. [FN5]

***247** The earliest attempt at regulation of **radio** was the Act of 1912, providing that no person should operate any **radio** apparatus without a license, revocable for cause, granted by the Secretary of Commerce. [FN6] It was under this act, passed when **broadcasting** was unknown and **radio** was little more than a safety device for shipping, that the **broadcasting** industry developed. [FN7] Efforts of Secretary of Commerce Hoover to regulate the situation under the act were considerably hampered by a decision in 1923 that it was mandatory upon him to issue a license to every applicant. [FN8] A certain amount of unofficial control was made effective through a series of annual National Radio Conferences called by Secretary Hoover in Washington. [FN9] But in 1926, after a second adverse decision to the effect that the Secretary of Commerce had no power under the Act of 1912 to restrict the time of operation or frequency of any station, [FN10] there came a period of unregulated confusion generally known as "the breakdown of the law." [FN11]

***248** Congress finally passed the long overdue Radio Act of 1927 [FN12] providing for the creation of a Federal Radio Commission with full authority to fix wave lengths, powers, and times of operation. [FN13] All stations were required to obtain new licenses, limited to three years, which were to be granted by the Commission if the "public interest, convenience, and necessity" would be served thereby. [FN14] Since 1927, the Commission, handicapped at first by lack of funds, instability of personnel, and fear of constitutional difficulties, has succeeded in bringing about some sort of order. [FN15]

As had been foreseen by Congress, it was not long before the Commission became involved in legal troubles over "due process."***249** In *General Electric Co. v. Federal Radio Commission,* [FN16] the General Electric Company asserted that it was being wrongfully deprived of its property rights by a refusal of the Commission to permit the operation of station *WGY* after sunset in California. The Court of Appeals of the District of Columbia, while it did not expressly pass upon the contention, held that the limitation was not "reasonable" and did not serve the "public interest, convenience, or necessity." But in *United States v. American Bond and Mortgage Co.*, [FN17] an injunction was granted by a federal district court of Illinois restraining the defendants from broadcast-

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ing after the Commission had refused to renew their license. The court ruled that Congress had power to regulate broadcasting under the commerce clause of the Constitution, that it had not exceeded the legitimate bounds of its regulatory power in the Act of 1927, and that the standard of "public interest, convenience, and necessity" was not so vague as to be an invalid delegation of legislative power. A third case of interest, *Technical Radio Laboratory v. Federal Radio Commission*, [FN18] involved a somewhat different situation. Here the station which had been refused a renewal of its license had received its first license after the Resolution of December 8, 1926, [FN19] providing for a waiver of all claims to the use of the ether in radio transmission. The Court of Appeals of the District of Columbia, in upholding the order of the Commission, declared definitely that "the only property right which was acquired by appellant in the use of the ether as a medium of communication was such as was granted to it by the terms of its license" under the Act of 1927. [FN20] As yet no decision underthe***250** Act of 1927 has been rendered by the United States Supreme Court.

These cases throw considerable light upon the approach of the courts to the puzzling problem of adapting customary legal forms to the strange concepts and problems of broadcasting. A common method has been to say that the government "owns the ether" or the channels in the ether so that it may exclude all others at will. For a long time such an approach was an *idee fixe* in the debates of Congress. [FN21] It has, indeed, the advantage of simplicity. Unfortunately there is considerable doubt among scientists as to the "existence" of the ether. [FN22] Moreover, it has been argued that, even if the ether could be owned, there is no constitutional provision under which the government could claim title, but that, as in the case of navigable waters, it would belong rather to the states. [FN23] While perhaps neither of these objections would prove fatal if the fiction were necessary, the idea has not been seriously advocated of late and was not considered in the present cases.

Perhaps the more rational way of approaching the situation is to disregard the mechanics of radio waves and concentrate upon the result. Broadcasting may be considered as the business of communicating ideas and entertainment. In the United States, this business has developed almost entirely as a private commercial enterprise. [FN24] It is not surprising, therefore, thatthe***251** courts, in facing this situation with the traditional tools at their disposal, have elected to treat broadcasting as a private business to be regulated under the commerce clause. [FN25]

The question which next arises is whether the regulatory technique provided by the commerce clause is capable of achieving satisfactory results when applied to the peculiar problems of radio. Broadcasting possesses many of the familiar features of a public utility involving a natural monopoly. Yet it is unique in that the standard of the service a station may give is indefinite and flexible. For example, the standards of a railroad are relatively constant and can be achieved by one company almost as well as by another; but the possibilities of a broadcasting station are so much greater that a new applicant can often offer better service than his predecessor. Coupled with this is the fact that the investment in a radio station is relatively small, [FN26] and that there are constantly increasing numbers desirous of using the same facilities. The result is that broadcasting presents a situation where the public benefit will often demand that an existing station be curtailed or entirely eliminated in favor of a new one. [FN27] This is a condition found inno***252** other case of regulation of a private enterprise. And it is here that the main constitutional difficulties arise.

The Act of 1927 attempts to meet the situation, by limiting the term of the licenses [FN28] and providing that "the license shall not vest in the licensee any right to operate the station nor any right in the use of frequencies or wave length designated in the license beyond the term thereof." [FN29] These are probably as severe conditions as have ever been imposed upon any "legitimate business." Yet, in view of the necessity for regulation, it seems likely that they would be held constitutional in the case of stations first licensed under the Act of

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1927. [FN30] Indeed, the *Technical Radio Laboratory* [FN31] case seems to point in that direction.

The present difficulties, however, arise from the fact that most stations came into existence under the Act of 1912. [FN32] The licensing provisions of that act, as we have seen, amounted to little more than mere registration. Many individuals and corporations invested money in a station, appropriated a wave length, and started **broadcasting**, much as they would engage in any other legitimate business. When, therefore, the **Federal Radio** Commission curtails the hours of operation or refuses to renew the license of such stations, they invariably contend that they are being deprived of their property without due process of law. The claim to "property rights" may be either in the use of the physical apparatus or in the right to freedom frominterference***253** by subsequently established stations. [FN33] While never expressly admitting the existence of any such property rights, the decisions involving these stations have apparently recognized the claim by implication. [FN34] Indeed, unless one adopts the suggestion of "the government ownership of the ether," an admission of property rights seems inevitable. It is not, however, necessarily an impediment to federal regulation under the commerce clause. The question is whether it is a reasonable use of the regulatory power to deprive stations of such property rights without compensation when demanded by the "public interest, convenience and necessity."

The courts seek the answer to this question in the nebulous realms of police power. For, while it is commonly said that the federal government lacks "police power," yet whenever it exerts any of the powers conferred upon it by the Constitution, the Fifth Amendment imposes no greater limitation upon suchpowers***254** than does the Fourteenth Amendment upon state power. [FN35] So while no express authority may be found, the courts at least do not lack analogies. Thus, the taking of property rights without compensation has been held justifiable in cases where the government has forced a company licensed to build a bridge to alter the bridge after it had become an obstruction to navigation; [FN36] where improvements in navigation have destroyed privately owned structures; [FN37] where excess profits have been recaptured from the railroads; [FN38] where zoning laws have reduced the value of real estate; [FN39] where prohibition laws, [FN40] pure food laws, [FN41] the White Slave Law, [FN42] and others possessing a moral or sanitary tinge have invaded interests in established businesses. [FN43] In *United States v. American Bond and Mortgage Co.*, [FN44] the court included the radio situation within such precedents. There the general power to exclude a station from the air in the public interest was held to be "well within the regulatory power of the United States." The decision in the *General Electric* case, [FN45] however, casts some doubt upon how far the courts intend to allow the Federal Radio Commission to go in its regulation. [FN46]

***255** The courts would undoubtedly have had less difficulty with the problem of control through the commerce power had the Radio Act of 1927 included some provision for compensation to stations taken off the air. This, indeed, had been recommended by the Committee on Radio Law of the American Bar Association. [FN47] But the provision was not incorporated in the act, and to overturn the act for this reason would cause needless confusion. Moreover, it may well be questioned whether the loss to a station is such as to make compensation feasible. Few, if any, stations as now conducted make actual profits. [FN48] The physical property of a station, which is not to be confiscated, can be sold or retained until the station is again qualified to broadcast. The principal loss to a station, then, is loss of "good will" -that is, loss of advertising. Not a little difficulty would arise in any attempt to evaluate such a loss, especially if the limitation was only partial. Moreover, it is somewhat doubtful if a station should be allowed to impose a demand for compensation for future loss of advertising as a bar to regulation in behalf of the greatest public interest. [FN49]

It would seem, then, that a control adequate to meet the present problems of broadcasting can be made effective through the medium of the commerce clause. But the *General Electric* case indicates that the courts will

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proceed carefully where theinterests*256 of large stations are concerned. In view of the absolute necessity for some regulation it is very doubtful whether the Radio Act of 1927 will be declared unconstitutional when it comes before the United States Supreme Court. More likely, the courts will retain the power of passing upon the constitutionality of each case as it arises, either through an interpretation of the "public interest, convenience, and necessity" formula or in the general power to overrule arbitrary and unreasonable orders of an administrative body. Because of the unusually intricate duties of the Federal Radio Commission it would seem that its opinion should be entitled to great weight with the courts. But the *General Electric* case, as well as the history of similar commissions, [FN50] would indicate that such may not be the result.

[FN1]. According to a nationwide survey conducted in May, 1928, there were at that time nearly 12,000,000 radio receiving sets in use serving an audience of more than 40,000,000 people. REPORT OF THE FEDERAL RADIO COM MISSION (1928) 22.

[FN2]. A knowledge of certain scientific principles is essential to an adequate understanding of the problems of radio control. In brief, two stations in the same locality may transmit electromagnetic waves through the "ether," without interfering with each other, only by varying the length of the wave and the number (or frequency) of waves per second. Frequencies thus separated from each other are known as channels. By international agreement and national legislation the available channels, which are definitely limited in number, have been apportioned among the va rious types of services, such as the marine service, the transoceanic serv ice, amateurs, broadcasting, etc. In the United States there are avail able for broadcasting only ninety channels. While scientific progress is to be expected there is little hope at present that it will furnish a means by which two stations may broadcast upon the same channel or that it will provide additional channels in the broadcast band. In fact, the development of television, which requires "wider" channels than ordinary broad casting, would materially reduce the number of available channels. A system of allocating stations so as to make the best possible use of these limited facilities obviously involves intricate engineering problems which can be solved only by experts.

For a full discussion of the scientific principles of broadcasting, see HEARINGS ON H. R. 15430, 70th Cong., 2d Sess. (1929) 359 *et seq.*; A. B. A., COMMITTEE ON RADIO LAW REP. (1929) pt. 3; United States v. American Bond & Mortgage Co., *infra* note 17.

[FN3]. Conferences held at Berlin in 1903 and 1906, at London in 1912, and at Washington in 1927, have drawn up regulations covering various inter national problems. The United States has also participated in a con vention at Mexico City in 1924 and in an agreement with Canada and Cuba in March, 1929. See Davis, *International* ***Radio*** *Relations* (1928) 16 GEO. L. REV. 400; A. B. A., COMMITTEE ON RADIO LAW REP. (1929) pt. 12; Stewart, *The International Radiotelegraph Conference of Washington* (1928) 22 AM. J. INT. LAW 28; Stewart, *Recent* ***Radio*** *Legislation* (1929) 23 AM. POL. SCI. REVV. 421; DAVIS, LAW OF RADIO (1927) 175-185.

[FN4]. See Lee, *Power of Congress over* ***Radio*** *Communication* (1925) 11 A. B. A. J. 19; PROCEEDINGS OF THE 4TH NATIONAL RADIO CONFERENCE (1925) 8; Chamberlain, ***Radio*** *Act of 1927* (1927) 13 A. B. A. J. 343.

[FN5]. Problems involving the question of what a **radio** station may **broadcast** are even more difficult of solution. These have as yet received little attention except in so far as they are involved in the first question. Section 28 of the **Radio** Act of 1927, *infra* note 12, expressly allows the licensing authority no power of censorship. Obviously, however, in granting or denying licenses the **Federal Radio** Commission exercises an indirect censorship of great importance. The solution of these problems remains largely for the future.

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[FN6]. 37 STAT. 302 (1912), 47 U. S. C. §§ 51-63 (1926). The act also contained general regulatory provisions. While there was no provision as to the term of the licenses, the Secretary of Commerce made a practice of issuing them for three months only. In view of the later decisions under the act this was done quite without authority. See 35 OP. ATT'Y GEN. 126 (1926).

[FN7]. Since the establishment in 1920 of *KDKA*, the first broadcasting station, the growth of broadcasting has been phenomenal. In eight years an industry with an annual business of $500,000,000 was created. See THE RADIO INDUSTRY (Harvard Business School Lectures 1928) 106 *et seq.*

[FN8]. Hoover v. Intercity Radio Co., 286 Fed. 1003 (Ct. of App. D. C. 1923).

[FN9]. PROCEEDINGS OF THE NATIONAL RADIO CONFERENCES (Gov. Printing Of fice J 922-1925).

[FN10]. United States v. Zenith Radio Corp., 12 F. (2d) 614 (N. D. 111.1926). The act was interpreted in the same way by the Attorney General. 29 OP. ATT'Y GEN. 579 (1912); 35 OP. ATT'Y GEN. 126 (1926).

[FN11]. In July 1926 there were 528 broadcasting stations in operation. When the Radio Act of 1927 was passed in February, this number had increased to 732. Stations changed wave lengths at will without regard to interfer ence with each other or with Canadian stations operating on the channels assigned to them. See A. B. A., COMMITTEE ON RADIO LAW REP. (1929) pt. 4; DAVIS, *op. cit. supra* note 3, at 54. For several sessions it was found impossible to get a new bill through Congress. In the meantime, in Decem ber, 1926, Congress passed a joint resolution limiting licenses to ninety days and providing that no original license or renewal of a license should be issued until the applicant executed in writing "a waiver of any right or any claim to any right, as against the United States, to any wave length or to the use of the ether in radio transmission because of previous license to use the same or because of the use thereof." 44 STAT. 917 (1926), 47 U. S. C. § 51a (1928). This resolution was repealed by the Radio Act of 1927, *infra* note 12.

[FN12]. 44 STAT. 1162 (1927), 47 U. S. C. §§ 81-119 (1928).

[FN13]. *Ibid.* §§ 3, 4, 47 U. S. C. at §§ 83, 84.

[FN14]. *Ibid.* §§ 9, 11, 47 U. S. C. at §§ 89, 91. The general regulatory powers of the Commission were limited to a year, after which they were to be transferred to the Secretary of Commerce. The Commission was then to retain merely jurisdiction of an appellate nature. *Ibid.* § 5. But the Commission being unable to set things in order within the year, the time limit has been twice extended. See *infra* note 15.

Where an application for a license is refused, an appeal is allowed to the Court of Appeals of the District of Columbia; where a license is revoked, an appeal is allowed also to the district courts. The reviewing court is given the power "to alter or revise the decision appealed from and enter such judgment as to it may seem just." *Ibid.* § 16. In the case of the district courts this would seem to be an improper delegation of administrative powers. See Keller v. Potomac Electric Power Co., 261 U. S. 428, 43 Sup. Ct. 445 (1923); Note (1929) 42 HARV. L. REV. 948.

[FN15]. The first action of the Commission was to remove summarily to other channels 41 stations which were on, or overlapping, the wavelengths assigned to Canada. After public hearings in March, 1927, the Commission published an order attempting to reassign frequencies and powers to all stations so as to cause as little interference as possible. The result was not generally considered successful. During the winter of 1927 and the spring of 1928 the Commission continued its efforts to achieve order by consolidation and rearrangement of stations, gen-

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erally stopping short, however, of actually taking stations off the air. On March 28, 1928, Congress passed the Davis Amendment extending the life of the Commission for another year, limiting licenses to a term of three months, and providing for equality of broadcasting service among the five zones created by the Act of 1927. 45 STAT. 373 (1928), 47 U. S. C. SUPP. §§ 63 (1)-63 (16 1/2) (1928). In May, 1928, the Commission issued an order requiring 164 stations to make a showing before the Commission that their continued operation would serve the "public interest, convenience, or necessity." After hearings, 62 of these stations were refused new licenses. During July and August, 1928, a completely new allocation in compliance with the Davis Amendment was worked out. This went into effect in November, 1928. In the spring of 1929 the powers of the Commission were again extended to December 31, 1929. Congress has as yet taken no further action. See ANNUAL REPORTS OF THE FEDERAL RADIO COMMISSION (1927, 1928).

[FN16]. 31 F. (2d) 630 (Ct. of App. D. C. 1929). On Oct. 14, 1929, the Supreme Court granted certiorari. The main question that will be argued, however, involves only the powers of the Court of Appeals of the District of Columbia. N. Y. Times, Oct. 17, 1929, at 36. There is considerable doubt as to the power of the Supreme Court to take jurisdiction over the case. Keller v. Potomac Electric Power Co., *supra* note 14.

[FN17]. 31 F. (2d) 448 (N. D. Ill. 1929). This case has also been appealed. N. Y. Herald-Tribune, Nov. 3, 1929, § 9, at 1.

[FN18]. U. S. Daily, Nov. 7, 1929, at 2242 (Ct. of App. D. C. 1929).

[FN19]. *Supra* note 11.

[FN20]. There have been several other cases involving the Act of 1927. In White v. Federal Radio Commission, 29 F. (2d) 113 (N. D. Ill. 1928), a temporary injunction to enjoin enforcement of an order of the Commission was denied. The court held that the regulation of radio was a valid exercise of the power of Congress under the commerce clause and that the construction of the plaintiff's plant and operation under licenses prior to 1927 "did not create property rights which may be asserted against the regulatory power of the United States, if that power is properly exercised."

In a case recently decided by the Court of Appeals of the District of Columbia, the Commission's order reducing the time of operation of *WNYC*, a municipal station in New York City, was upheld. The court "did not agree with the contention" that the "appellant had acquired a property right to operate its station full time, and that the restrictions imposed by the Commission's present order amounted to a taking of appellant's property without due process of law." City of New York v. Federal Radio Commission, U. S. Daily, Nov. 6, 1929, at 2226. The same court has also upheld a decision of the Commission refusing to renew the licenses of the portable stations. Carrell v. Federal Radio Commission, U. S. Daily, Nov. 6, 1929, at 2226. But in another case it overruled an order refusing to renew a construction permit already twice extended. Richmond Development Corp. v. Federal Radio Commission, U. S. Daily, Nov. 7, 1929, at 2242.

[FN21]. 67 CONG. REC. 5500, 12351 (1926); 68 CONG. REC. 2588 (1927). In 1926 the preamble of, a bill introduced into the House declared that "the ether is the inalienable possession of the people." See *Interim Report on Radio Legislation* (1926) 12 A. B. A. J. 848.

[FN22]. EDDINGTON, NATURE OF THE PHYSICAL WORLD (1929) 31. Perhaps a more scientific analysis would be to say that for purposes of transmitting radio waves the government owns all the land and waters of the country. But the objection that there is no authority for such a declaration may be made here also.

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[FN23]. DAVIS, *op. cit. supra* note 3, at 16.

[FN24]. It has been estimated that 95% of the broadcasting stations in the United States are run by commercial concerns. Some revenue is derived from the sale of advertising time, but few stations seem to be making profits by this means. Losses in operating expenses are generally charged up to publicity. The recent growth of chain broadcasting indicates also difficulty in providing satisfactory programs. The present condition seems somewhat unstable. Future growth may well be away from stations oper ated by commercial enterprise. Welch, *Who Will Regulate Broadcasting and How* (1929) 3 PUB. UTIL, FORTNIGHTLY 90; HEARINGS ON H. R. 15430, 70th Cong., 2d Sess. (1929) *passim*.

This affords an interesting comparison with the situation in Europe where the problem of control is largely solved by government ownership and operation. In some countries broadcasting stations are operated entirely by the government as a public service. In Germany, Austria, and Czechoslovakia, the stations are run by companies, commercial in form, in which the government holds a controlling interest. The British Broadcasting Company, operating eight stations in England, is under the direct control of the Post Office but is not merged with it. The reason for government ownership in Europe seems to be partly the greater prevalence of the government in industry and partly the fact that there is not a sufficiently large market in one language to make a station pay in publicity. Throughout the continent receiving sets are taxed to support the expense of operating stations. In Japan receiving sets are tuned to only one station to which. the listener pays a fee. ENCYCLOPAEDIA BRITANNICA (14th ed. 1929) tit. **Broadcasting**; Welch, *op. cit. supra*.

[FN25]. It has been suggested that power to **control radio** communication could be derived also from the postal power, the treaty power, or the power to maintain an army and navy. Lee, *op. cit. supra* note 4. There never has been any doubt but that the power to regulate radio comes under the commerce clause. Whitehurst v. Grimes, 21 F. (2d) 787 (E. D. Ky. 1927); White v. Federal Radio Commission, *supra* note 20; see Note (1928) 26 MICH. L. REV. 919.

[FN26]. The cost of radio stations has been estimated as a "few thousand dol lars" for a 100-watt station, $50,000 to $60,000 for a 500-watt station, $150,000 to $175,000 for a 5000-watt station, and $300,000 to $400,000 for a 50,000-watt station. HEARINGS ON H. R. 15430, 70th Cong. 2d Sess. (1929) 295.

[FN27]. See PROCEEDINGS OF THE 4TH NAT'L RADIO CONFERENCE, 1925 (Gov. Printing Office 1926) 8.

[FN28]. 44 STAT. 1162, § 9 (1927), 47 U. S. C. § 89 (1928). And see *supra* note 15.

[FN29]. *Ibid.* § 11, 47 U. S. C. at § 91. Section 1 stated that the act was intended "to maintain the control of the United States over all channels of interstate and foreign radio transmission; and to provide for the use of such channels, but not the ownership thereof, by individuals, firms, or corporations, for limited periods of time, under licenses granted by Federal authority, and no such license shall be construed to create any right, beyond the terms, conditions, and periods of the license."

[FN30]. See Zollmann, *Radio Act of 1927* (1927) 11 MARQUETTE L. REV. 121; Current Legislation (1927) 27 COL. L. REV. 727.

[FN31]. *Supra* note 18.

[FN32]. Section 5 of the Radio Act of 1927 provided: "No station license shall be granted by the commission or

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the Secretary of Commerce until the applicant therefor shall have signed a waiver of any claim to the use of any particular frequency or wave length or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise." *Cf.* Resolution of Dec. 8, 1926, *supra* note 11. But if this is meant as a waiver of the right to object to a decision of the licensing authority on the ground of due process, or to consent to confiscation of the "property right" in a wave length, it is unquestionably unconstitutional. See Frost & Frost Trucking Co. v. R. R. Commission, 271 U. S. 583, 46 Sup. Ct. 605 (1926).

[FN33]. The basis for this claim rests largely upon the decision in Tribune Co. v. Oak Leaves Broadcasting Co. (unreported), 68 CONG. REC. 216 (1927) (C. C. Cook Co. Ill. 1926) where an injunction was granted restraining one station from broadcasting on the same wave length used by a prior station. By analogy to rights in prior appropriation of water, in protection granted telephone companies against electrical interference, and in trade names, good will, and unfair competition, it was held that, as between two stations, priority of time created superiority of right. See Taugher, *Law of Radio Communication with Particular Reference to a Property Right in a Radio Wave-Length* (1928) 12 MARQUETTE L. REV. 179, 299.

[FN34]. The decision in General Electric Co. v. Federal Radio Commission, *supra* note 16, was based not only on the fact that the order of the Commission did not serve the public interest, convenience, or necessity but that it was an unreasonable restriction. In United States v. American Bond & Mortgage Co., *supra* note 17, the court rested its decision on the authority of cases showing "the extent to which a state in exercise of police power may prescribe regulations which have the effect of exclusion from or limitation of privileges existing by common right, contract, charter, grant, or statute, and enforce uncompensated obedience thereto." The court also said:

"Just what is the property right which is claimed for the broadcaster when it is subjected to analysis? When we speak of wave lengths or frequencies we are dealing with intangible things, about which we really know nothing at all, except as we perceive the effect produced in an electrical device. ... In one aspect the waves may be treated as intruders. Whatever rights may exist among these intruders in their relations with each other, there certainly is no property right which can be asserted against the right of those upon whom the intrusion is made to have the intruders come 'by cold gradation and well balanced form' and not in a mob. In the very nature of things there can be no right to the use of any particular frequency or wave length, or of the ether as against the legitimate exercise of the regulatory power of the United States."

But this last sentence is meaningless, as obviously no right is valid against the *legitimate* exercise of the regulatory power. *Cf.* White v. Federal Radio Commission, *supra* note 20.

[FN35]. *Cf.* Hamilton v. Kentucky Distilleries Co., 251 U. S. 146, 156, 40 Sup. Ct. 106, 108 (1919); United States v. American Bond & Mortgage Co., *supra* note 17, at 455.

[FN36]. Louisville Bridge Co. v. United States, 242 U. S. 409, 37 Sup. Ct. 158 (1917); Union Bridge Co. v. United States, 204 U. S. 364, 27 Sup. Ct. 367 (1907). But *cf.* Monongahela Navigation Co. v. United States, 148 U. S. 312, 13 Sup. Ct. 622 (1893).

[FN37]. United States v. Chandler-Dunbar Water Power Co., 229 U. S. 53, 33 Sup. Ct. 667 (1913); Gibson v. United States, 166 U. S. 269, 17 Sup. Ct. 578 (1897). But where there has been a direct invasion of the plaintiff's land by water it has been held that compensation must be paid. Pumpelly v. Green Bay Co., 13 Wall. 166 (U. S. 1871); United States v. Cress, 243 U. S. 316, 37 Sup. Ct. 380 (1917).

[FN38]. Dayton Goose Creek Ry. v. United States, 263 U. S. 456, 44 Sup. Ct. 169 (1924). The Adamson Act, creating an eight hour day for railroad employees, was upheld in Wilson v. New, 243 U. S. 332, 37 Sup. Ct. 298

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(1917). And railroads have often been forced to eliminate grade crossings. Erie R. R. v. Board of Public Utility Commissioners, 254 U. S. 394, 41 Sup. Ct. 169 (1921).

[FN39]. Village of Euclid v. Ambler Realty Co., 272 U. S. 365, 47 Sup. Ct. 114 (1926).

[FN40]. Mugler v. Kansas, 123 U. S. 623, 8 Sup. Ct. 273 (1887).

[FN41]. Hipolite Egg Co. v. United States, 220 U. S. 45, 31 Sup. Ct. 364 (1911); Powell v. Pennsylvania, 127 U. S. 678, 8 Sup. Ct. 992 (1888).

[FN42]. Hoke v. United States, 227 U. S. 308, 33 Sup. Ct. 281 (1913).

[FN43]. Dent v. West Virginia, 129 U. S. 114, 9 Sup. Ct. 231 (1889); New Orleans Gaslight Co. v. Drainage Coram., 197 U. S. 453, 25 Sup. Ct. 471 (1905); Walls v. Midland Carbon Co., 254 U. S. 300, 41 Sup. Ct. 118 (1920); Slaughter House Cases, 16 Wall. 36 (U. S. 1872).

[FN44]. *Supra* note 17.

[FN45]. *Supra* note 16.

[FN46]. Possibly the problem could be approached through the medium of a business affected with a public interest. Broadcasting possesses enough of the elements commonly required so that the courts may label it as such if they so desire. It is a business of greatest importance to the public; it is not one where competition will protect the public interest; it may even be said that it has been "granted" or "devoted" to the use of the public. *Cf.* Wolff Packing Co. v. Court of Industrial Relations, 262 U. S. 522, 43 Sup. Ct. 630 (1923); Tyson v. Banton, 273 U. S. 418, 47 Sup. Ct. 426 (1927); Ribnik v. McBride, 277 U. S. 350, 48 Sup. Ct. 545 (1928); see Finkelstein, *From Munn v. Illinois to Tyson v. Banton* (1927) 27 COL. L. REV. 769; Comment (1928) 38 YALE L. J. 225, 232; Comment (1929) 39 YALE L. J. 256. But see DAVIS, *op. cit. supra* note 3, at 92 *et seq.*

Yet, though the courts may get over the first hurdle and find that broadcasting is a business affected with a public interest, they do not appear ever to have used the doctrine to justify such a strict regulation as the requirements of radio would seem to demand. The device was used originally for fixing rates. Munn v. Illinois, 94 U. S. 113 (1876). And the regulation permitted under it has never proceeded much beyond this. See Wolff Packing Co. v. Court of Industrial Relations, *supra* at 539, 43 Sup. Ct. at 634.

[FN47]. Interim Report on Radio Legislation, *supra* note 21. It was suggested that the necessary funds could be raised by a tax on the remaining stations. See Davis, *Radio Act of 1927* (1927) 13 VA. L. REV. 611.

[FN48]. *Supra* note 24.

[FN49]. As far as compensation for stations first licensed under the Act of 1927 is concerned, it would seem to be solely a question of whether it is required in order to induce private enterprise to enter the broadcasting business. As yet this has not appeared necessary.

[FN50]. Tollefson, *Judicial Review of the Decisions of the Interstate Commerce Commission* (1927) 11 MINN. L. REV. 389, 504.

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The ideological fight over creation of the Federal Radio Commission in 1927
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MARK GOODMAN and MARK GRING

The Ideological Fight Over Creation of the Federal Radio Commission in 1927

The future of radio broadcasting waited on a precipice in January 1927. Maine Representative Wallace White and Washington Senator Clarence Dill remained locked in Congressional debate over the language of a compromise bill intended to regulate the broadcasting industry into the future. The crux of the conflict was the creation of the Federal Radio Commission. Dill wanted a commission to control radio; White demanded that the secretary of commerce run radio with the assistance of an advisory commission. To the millions of radio listeners who were depending on these two men to sort out the chaos of radio the conflict may have seemed an absurd, bureaucratic debate since Congress would create a radio commission under either bill. Only a few insiders understood that the form of the Radio Act of 1927 would dictate the future course of the medium. Watching events closely was the Radio Corporation of America and others in the broadcasting industry, who envisioned national radio networks providing programming and making millions from advertising dollars. Insurgent Progressives, including Idaho Senator William H. Borah, were convinced that the future of democracy hung in the balance.

Another key figure, Secretary of Commerce Herbert Hoover, who was confident that he would be the next president, believed that radio needed to be developed by professionals, not amateurs. Nurtured carefully, radio could bring news and programming to millions, and radio would have an important role to play in how the federal government would communicate to American citizens. Unregulated, radio's power of persuasion, however, also meant it could be used by the unscrupulous for their personal ends.

The historical origins of the FRC are worthy of consideration given the important role of the Federal Communication Commission, the FRC's successor, in setting policy for the future of telecommunications. Historical precedence continues to shape the policies of the FCC and influences telecommunication regulation. This article discusses the conflicting interests that focused in January 1927 on passage of radio legislation and emphasizes the way the individual philosophies of the key players informed the compromise for the final bill and the effort to get it passed. This research shows that the three most influential people in the creation of the Radio Act of 1927—Hoover, White, and Dill—approached regulation of radio from three quite different perspectives. Hoover wanted the federal government to play a major role in the

In 1926, the conflicting ideologies of Senator Clarence Dill, Representative Wallace White, and Secretary of Commerce Herbert Hoover threatened pending legislation that would help end chaos on the radio airwaves. In the eventual compromise, Dill's knowledge of politics gave the edge to his ideological leanings.

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regulation of radio because he saw the potential for radio in the functions of the federal government. White sought to protect the economic interests of RCA and the rest of the radio industry. For purposes of radio regulation, freshman Senator Dill aligned himself with the Senate's insurgent Progressives whose goal was to protect the average person from corporate greed. The insurgents wanted the federal government to regulate the industry for the common good, but they believed that experts would manage radio better than partisan politicians. From the perspective of 1927, the White and Dill debate would ultimately decide whether the federal government would protect the public from the evils of radio or from the evils of RCA and other corporate interests.

Historians writing about the Radio Act of 1927 have identified a number of issues at play in the political manuevering that accompanied passage of the act. Godfrey points to the political conflict between Hoover and Progressives like Senator Borah, who feared radio would be used by Hoover as a tool for partisan politics.[1] Rowland discusses the "public interest" argument, which he suggests was an illusion masking "implicit accomodations with the regulated" industry.[2] To serve the public interest, the radio business had to survive and thrive because profits were needed to build the transmission system and create entertainment and news programming. What the industry wanted was "legal security" and enough regulation to prevent interference, which the Radio Act of 1927 was expected to provide. The radio industry could support the act because it met broadcasters' needs.[3]

Benjamin asserts, meanwhile, that free speech issues were at the core of the Radio Act debates.[4] Radio threatened to bring controversial speech into the home and to potentially unwilling listeners. In addition, amateurs might not only transmit obscene messages, they might also send false messages—deliberately or accidentally—that could threaten military and commercial operations. Such concerns motivated Congress in writing some sections of the law, including the free speech provisions.[5]

Radio's potential for propaganda is still another issue historians have covered in their discussions of the act. The Coolidge Administration worried about the power of propaganda to manipulate the public.[6] Schramm notes that the handbook *Are We Hitting the Target?* was written in the 1920s for the U.S. Informational Service, explaining how to manipulate the audience through the use of media.[7] At least potentially, radio was a powerful propaganda tool that could be used to benefit or undermine the federal government. Either scenario justified federal regulation and direct federal control, in the administration's view.

Public attention focused on the negotiations between Dill and White, but the key player from the beginning was really Hoover. As secretary of commerce, Hoover sent a statement in January 1926 to the House Committee on Merchant Marine and Fisheries, the committee from which any legislation would originate and whose members included White of Maine. Hoover told committee members that "radio legislation is absolutely and immediately essential if we wish to prevent chaos in radio communications, especially broadcasting."[8]

Hoover's view of radio was based on principles that Bensman describes as "distinctly progressive for their time."[9] Hoover's biographer Joan Hoff Wilson expands this somewhat by identifying the future president as a "progressive engineer," meaning that he believed engineering principles could be applied to social problems to bring order from chaos.[10] Hoover was a progressive in the sense that he believed in serving the public good, and that the way to do this was by promoting growth and technological development and having experts in the field to make decisions for the uneducated masses of people.

[Hoover] believed engineering principles could be applied to social problems.

The radio conferences he convened in the 1920s and his disinterested, professional management of the radio industry while secretary of commerce are indicators of his progressive engineering management. Hoover had brought together for the radio conferences experts in broadcasting, business, and government. He listened to the voices of both the radio amateurs and the broadcasting professionals. From the conferences came discussion, which in turn led to a consensus of what policies represented the public good, which led to policy and regulation. Most provisions of the Radio Act of 1927, in fact, originated with the conference reports.[11]

Implicit in Hoover's nurturing approach was the belief that the federal government needed to oversee all aspects of broadcasting. He wanted an advisory board to determine the "discretionary question" of who was to use the wave lengths, but he did not want a board with any significant

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powers. The "administrative features" would be left in the hands of the Department of Commerce. Hoover believed his commission would meet occasionally to protect the radio listeners but would not become an independent commission, thereby avoiding "all of the difficulties of the independent agencies."[12] Through disinterested regulation by the Department of Commerce, the following goals could be achieved:

(1) Ensure Radio's Growth.

The government could assist the radio industry to ensure its growth and development by regulating the technical aspects of the industry. In asking for legislation, Hoover told the House committee early in 1926, the main reason for radio legislation was the need to eliminate signal interference.[13]

(2) Protect Public.

The government needed to protect the listening public from irresponsible broadcasters. As Hoover said in his opening remarks to the 1924 Radio Conference: "We can protect the home by preventing the entry of printed matter destructive to its ideals, but we must double-guard the radio."[14]

(3) Protect Broadcasters' Speech.

The free speech of radio broadcasters could be protected with legislation. Hoover explained his concept of free speech in his opening remarks to the participants of the 1924 radio conference. Radio broadcasters could be free of government censorship, but should not be free to broadcast just any content. "We will maintain them free—free of monopoly, free in program, and free in speech—but we must also maintain them free of malice and unwholesomeness."[15]

(4) Create Better Government.

The government could use radio to create better government and to protect the government. In a memo to Hoover, H. C. Smither, Chief Coordinator, Interdepartment Radio Advisory Committee, noted all the federal agencies with a stake in radio regulation. He named the departments of State, Treasury, War, Justice, Post Office, Navy, Interior, Agriculture, and Labor, plus the Bureau of Standards, Interstate Commerce Commission, and Shipping Board. In addition, the government needed to disseminate information to the public and be aware of the role of radio in national defense.[16] Smither's views were consistent with Hoover's, judging by a statement made by Hoover to the 1924 Radio conference about his efforts as secretary of commerce to establish some rules for radio: "Through the policies we have established, the Government, and therefore the people, have today the control of the channels through the ether just as we have control of our channels of navigation."[17]

(5) Serve the Public Interest.

The ultimate role of government was to protect the rights of listeners by ensuring broadcasters served the public interest. As Hoover told the participants at the fourth radio conference, "The greatest public interest must be the deciding factor" in any regulation of radio. "Up to the present time we have had a policy of absolute freedom and untrammeled operation, a field open to all who wished to broadcast for whatever purpose desired," Hoover said. However, now the wave lengths were too crowded for such an approach. The solution was to remove some people from the airwaves and put the interest of the listening public first. As Hoover said:

> Certainly in radio I believe in freedom for the listener. He has much less option upon what he can reject, for the other fellow is occupying his receiving set. The listener's only option is to abandon his right to use his receiver. Freedom can not mean a license to every person or corporation who wishes to broadcast his name or his wares, and thus monopolize the listener's set.[18]

When Hoover convened the first radio conference in 1922 to discuss the regulation, only sixty stations were on the air. By the second radio conference a year later, the number of stations had grown to 581. Each year Hoover watched the growth of radio increase chaos on the airwaves. In 1924, Hoover discussed with White the need for new legislation. "[T]here is now opening before us a whole vista of difficult problems," wrote Hoover. The development of chain broadcasting and advertising and the growth in the number of listeners meant that radio could no longer be considered a "private enterprise" and should become a "public service," Hoover told White. For rural people, Hoover called radio "a necessity."[19]

By January 1926, a crisis existed in his view. When Hoover sent his statement to the House Committee on Merchant Marine and Fisheries, radio had grown to include 15,111 amateur broadcasters, 1,901 ships, 553 land stations, and 536 broadcasting stations. Only 89 wave lengths were available for the 536 broadcasting stations, which were providing most of the entertainment, news, and advertising to the public. The *New York Times* described resulting confusion as the "whistles of the peanut stand."[20]

Hoover tried to manipulate events, as well as individuals, in order to put pressure on Congress to write new radio law. When an Illinois Court limited Hoover's authority under the Radio Act of 1912, Hoover requested from William J. Donovan, acting attorney general, an

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opinion clarifying the scope of the secretary's authority to regulate radio. Donovan replied that the secretary had virtually no authority to deal with radio. Even his authority to assign licenses was limited, and he could not assign wave lengths, hours of operation, or put limits on transmission power.[21] Hoover spelled out in a press release the impact of Donovan's decision to the public: "The general effect of this opinion is that regulation has broken down and stations are under no effective restriction as to wave length or power used."[22] Dill claimed that Hoover requested the decision hoping it would create chaos on the air and force Congress to pass new legislation.[23] According to Dill, Hoover refused to retain control of radio after Congress failed to pass legislation in the spring. To Dill, Hoover's actions "seemed almost an invitation to broadcasters to do their worse."[24]

Hoover did not give up. For five years he had convened radio conferences, pushed for radio legislation, and watched Congress fail to act. By summer 1926 he was ready to pull out all stops to obtain a new radio bill.

White had started working on new radio law as early as 1919. In 1921, he joined with Hoover in developing radio legislation to replace the 1912 act.[25] White attended the radio conferences and introduced bills in most sessions of Congress. As a Congressman from Maine, White received an appointment onto the Merchant Marine and Fisheries committee. Since AM radio was the primary means of ship-to-shore communication, White became well informed on radio. By 1926, many in Congress considered him the foremost expert on the radio industry.

White sought industry input and contacted RCA and other major media players.[26] Hoover and White, working with the the leadership of RCA—H. G. Harbord, president, and David Sarnoff, general manager—and others in the radio industry, introduced the White Radio Bill in spring 1926. When Dill introduced a similar bill in the Senate, passage of a law reflecting Hoover's ideological positions on government regulation and the role of radio seemed well on its way to passage.

Then insurgent progressive Senator William Borah introduced his own radio bill, one written from a different ideological perspective. Borah feared for the public good if the federal government and/or the radio industry had unfettered control over radio. Borah and other Progressives also feared RCA and believed that only an independent commission would prevent RCA from using its industry dominance to create a radio monopoly.[27] Sympathetic to the Progressives' view, Dill withdrew his first bill and presented a Borah-like revision to the Senate that included a powerful FRC, which would protect the public interest by limiting the regulatory influence of the administrative branch of government and the radio industry.

White's closeness to the industry point of view was evident in his contacts in the ensuing months. In July 1926, Harbord suggested to White that he make a public statement in support of his bill. Dill had explained in a *New York Times* article why radio required a commission.[28] Now Harbord believed White needed to challenge Dill, so that the Dill bill would not "stand alone" in the public debate.[29] Harbord and White communicated again in September. White wrote: "I should also appreciate a definite expression of the views of your company" towards the House and Senate versions of the radio bill.[30] In addition, White wanted to know from Harbord to what extent he should make concessions in order to obtain passage of a new radio law. A month later, William Brown, vice president and general attorney for RCA, sent a telegram to White requesting a meeting with Sarnoff: "Meet for lunch at 1 on Tuesday with SARNOFF [capitals in original] and myself. Must be late because the General has a noon speaking engagement."[31] White sought another meeting with Brown in November as well as meetings in December with L.S. Baker, managing director of the National Association of Broadcasters, and Lloyd Espenschied of American Telephone and Telegraph, a major, corporate shareholder in RCA.[32] In negotiations with Dill over a new law, White presented the industry's positions.

As the bills were reviewed by Congress, Hoover tracked them carefully. Hoover clearly disliked Dill's Senate Bill 4156, dated May 3, 1926, and made notes on how Dill's legislation differed from White's, writing negative comments in the margin on most pages.[33] Section j calling for setting power limits during chain broadcasting was emphatically labeled "Bunk" by Hoover. The next section on charges also received a "Bunk" and the note: "There are no charges to listeners." Hoover marked whole sections of the bill with question marks and labeled others "unfair," "vicious," and "useless." His extensive comments show that Hoover believed Dill's bill had been poorly drafted and included provisions that had not been thoroughly thought out. Hoover also annotated a copy of the bill labeled "Confidential Conference Draft," an indication that he was advising White during the conference committee meetings.[34]

Hoover's influence during the radio debate was not only on White, but also extended into the White House. On

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November 20, 1926, Hoover wrote a speech for Coolidge that stated the President's opposition to a radio commission. Coolidge in his December 8 speech called on Congress to pass new legislation. Court decisions have "broken down" the authority of the court, leaving radio in chaos; therefore, legislation needs to be "speedily enacted." Coolidge then called for the creation of a committee whose purpose would be to assign frequencies and meet "whenever action" was required. Nevertheless, protecting the public interest, overseeing scientific research, and regulation should remain with the Commerce Department, Coolidge told his audience, continuing:

> Such an arrangement makes for more expert, more efficient and more economical administration than an independent agency or board, whose duties, after initial stages, require but little attention, in which administrative functions are confused with semijudicial functions and from which of necessity there must be greatly increased personnel and expenditure.[35]

Hoover was intent on placing control of radio with the executive branch. He planned to continue to use his benevolent hand to guide the direction and development of radio as it grew into a commercial network enterprise. Either as secretary of commerce or as president, Hoover could engineer radio's future if regulatory authority remained in the executive branch. The Dill legislation threatened all of that by proposing to turn radio over to a commission, which would be inherently inefficient and responsible to no one, not even the President.[36] However, Hoover could not afford to wait for a new bill with the proper commission to work its way through Congress. In effect, Hoover felt radio would pass from his hands into the hands of amateur, political appointees unless White could arrive at a satisfactory agreement with Dill. If no agreement were reached on this bill, the chaos on the airwaves would only worsen.

For months, the philosophical differences between the White version and Dill's bill threatened passage of any new law. As time ran out for the 69th Congress to pass a bill, White admitted to Espenschied he was "discouraged and disgusted" because Dill would not compromise on the commission.[37]

Until mid December, Coolidge lobbied for the White bill.[38] Then, fearing chaos on the airwaves if no law passed and feeling the heat from the public and industry demand for legislation, White and Dill agreed to create the FRC for one year and require congressional approval for a second year. Clearly the compromise had Hoover's blessing. On December 21, he told the Chicago Tribune News Service that he would accept the Dill commission as a temporary solution, allowing it to assign radio licenses.[39] Under this temporary decision, the Commerce Department would retain authority over direct contacts with the stations.[40] Hoover indicated that the only other choice was a joint resolution halting the assigning of any more radio licenses.[41] Each man believed that his philosophical perspective would ultimately win when the one-year term of the FRC expired.

The final bill, with the one-year FRC, cost Dill backing in the Senate. He lost the support of Borah and other insurgents for the bill, even though it was stalwart insurgents like Nebraska Senator George Norris and Borah who originally convinced Dill to fight for a radio commission. Borah disliked the Dill compromise because he thought a temporary commission would neither prevent a radio monopoly nor restrict the potential for the secretary of commerce to use the power of his position to control the political messages heard over the radio.[42] Norris also wanted more than a one-year commission. Some Progressives wanted the federal government to own the radio stations.[43] Dill knew the Radio Act did not meet the Progressives' expectations, but he also realized that Coolidge, Hoover, and White were not going to permit a truly progressive radio bill to pass.[44] When the Radio Act passed on a roll call vote, Dill was the only progressive senator to support it.[45]

Although the proposed law was ultimately rejected by progressive senators, Dill's objectives for it largely matched those of Borah. Dill was a self-proclaimed Progressive who won the 1920 election by running against the "monied interest of the East."[46] Once in the Senate, Tucker and Barkley identified Dill as one of the "Sons of the Wild Jackass," i.e. one of the insurgents in the Senate.[47] When he joined the Senate in 1920, Dill allied himself with Senator Norris and other members of the farm bloc.[48] Irish speculates that growing up in rural poverty in the Midwest had a lot to do with his insurgency. "There is no record of his emotions concerning this subject [poverty and hard work of farm life]," writes Irish, "but the plight of farmers must have gnawed at him; his concern for reclamation, public power, and even radio must have in some way been a response to the pitiful sight of farm families attempting to draw a living from exhausted land."[49] Dill said he became the Senate "radio expert" because he handled one constituent's complaint against a radio station, ultimately making the first-term senator the "one-eye[d] man among the blind" in the Senate.[50]

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Dill could not compromise on the Federal Radio Commission without sacrificing his belief that radio required "A Traffic Cop For the Air." This traffic cop would guarantee that broadcasters were "well-behaved" and that air "traffic rules" were followed. The commission could guide the evolution of radio because the commission staff would be composed of radio experts, not Commerce Department clerks. Finally, he believed, like Borah, that a commission could prevent the development of a radio monopoly. "The one principle regarding radio that must be adhered to, as basic and fundamental," wrote Dill, "is that the Government must always retain complete and absolute control of the right to use the air."[51] Although Dill wanted programming to be free of government censorship, he admitted later that a "twilight zone" existed in the law since he also demanded that broadcasters be well-behaved.[52]

The crux of the conflict over the Radio Act in 1926 centered on Dill's insistence that the public needed a commission independent of politics and of industry influence. The goal of radio should be to make the lives of people better through entertainment, news, and political discussion. Then radio would be an important instrument for the common people to determine their own destinies. This made sense to Dill who viewed himself as one of those common people.

"One principle . . . [is] basic and fundamental . . . the Goverment must always retain complete and absolute control of the right to use the air."

The progressive engineer Herbert Hoover also believed that radio had to be made to work for the people but he thought that they lacked the expertise to know what was best. Experts who understood the complexities of radio technology were needed to administer radio on an on-going basis. The role of the government was to protect the people, and the leaders of the country who understood what was in the best interest of the people and who understood government were the most appropriate to ensure radio was properly used. To Hoover, in the wrong hands, radio was a dangerous tool that could misguide the people.

White believed in Herbert Hoover and RCA, and where they were taking radio. These men would deliver a valuable, entertaining commodity to the listeners. White wrote: "Not only is H.H. [Herbert Hoover] the great genius of industry, the administrator who[se] fame has gone to the four corners of the earth, but he is the good samaritan of this generation."[53] White agreed an advisory commission should be a watchdog for the public interest, but putting the watchdog in control threatened the future of radio.

Hoover and White would have to sacrifice their concept of government and its role in the lives of the American people if they were to accept Dill's all-powerful FRC. Dill would have to do likewise to accept their concept of the federal government retaining authority through the Department of Commerce.

Dill's decision to offer a one-year compromise broke the stalemate by offering almost everyone what they wanted. To the listening public, a governmental agency had been formed to sort out the radio signals and prevent interference. RCA could proceed in January 1927 with the creation of NBC, knowing that a broadcasting license from the FRC would guarantee the ability of a station owner to run his programming without airwave interference. Since Hoover had always envisioned letting his advisory commission assign licenses, he did not have a problem with Dill's commission assigning licenses during the first year. Then Hoover, who anticipated being president-elect, expected to resume guidance of radio thanks to the law White finally had succeeded in getting passed and which Coolidge could be persuaded to sign.[54] Dill, however, figured he knew Washington, D.C., politics. Once Congress created the FRC and it proved its usefulness, Congress would re-authorize its existence.

A year later, Dill's prediction that the FRC would survive proved accurate. The FRC remained swamped under the technical aspects of radio and the licensing of stations. In spite of Hoover's basic opposition, Congress voted to give the FRC another year.

The Radio Act of 1927 represented much of the collective wisdom of 1926. Hoover and White had worked for years with industry leaders and other interested parties in evaluating different aspects of radio regulation. Much of the language of the law reflects their achievement of consensus. The radio industry, the Coolidge Administration, Congress, and the listening public recognized that the federal government needed to regulate the technical aspects of radio. Most people agreed that the future of radio would include news, entertainment, networks, and advertising. Such a future could not be realized unless the federal government regulated radio in the "public interest." Despite so much agreement on specific aspects of the law, ideological differences

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threatened passage of a new radio law.

All parties knew much was at stake in creating the FRC. Hoover viewed radio as an instrument for great governmental and societal good but only if wise leaders ensured that the awesome power of radio served the public good and not the interests of those seeking to manipulate the listeners for their own purposes. From the perspective of White and Hoover preventing such evil did not represent censorship since the radio industry would be free of government interference in programming, news presentation, and advertising as long as the industry served "the public interest." To trust political appointees with the potential power of radio seemed dangerous and inefficient. Experts, like Hoover, needed to provide radio a guiding hand.

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NOTES

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2. Willard D. Rowland, Jr. "The Meaning of 'The Public Interest' in Communications Policy, Part I: Its Origins in State and Federal Regulation," *Communication Law & Policy* 2 (1997): 315.
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10. Joan Hoff Wilson. *Herbert Hoover. Forgotten Progressive.* (Boston: Little, Brown and Co., DATE), 31.
11. See for example, Edward F. Sarno, "The National Radio Conference." *Journal of Broadcasting,* 13 (2:1969): 189-202; C. M. Jansky, "The Contribution of Herbert Hoover to Broadcasting," *Journal of Broadcasting,* 1 (3:1957): 241-49; Godfrey. "Senator Dill." Daniel E. Garvey, "Secretary Hoover and the Quest for Broadcast Regulation." *Journalism History,* 3 (3:1976): 66-70, 85. Frederick W. Ford, "The Meaning of Public Interest, Convenience, or Necessity," *Journal of Broadcasting,* 5 (Summer 1961): 205-19; Louise M. Benjamin, "Working It Out Together: Radio Policy From Hoover to the Radio Act of 1927," *Journal of Broadcasting & Electronic Media,* 42(2), (Spring 1998): 221-36.
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14. Hoover's opening remarks. Recommendations For Regulation of Radio. Adopted by the Third National Radio Conference. Box 496, Folder—Radio: Conferences National-third (6-10 Oct. 1924). Hoover papers.
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17. Hoover's opening remarks. Recommendations For Regulation of Radio. Adopted by the Third National Radio Conference. Box 496, Folder—Radio: Conferences National-third (6-10 Oct. 1924). Hoover papers.
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Are Regulators Forward-Looking? Copper Prices and Telecommunications Networks

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Around the world, regulators since 1996 have mandated that incumbent local exchange carriers (ILECs) offer competitors access to their network at regulated prices that reflect forward-looking cost. Regulated prices for unbundled network elements are based on total element long-run incremental cost (TELRIC), which in turn is calculated using engineering models that estimate the costs of a hypothetical carrier employing the most efficient telecommunications technology currently available and the lowest cost network configuration, given the existing location of the ILEC's actual wire centers. These cost models require detailed estimates of the equipment and installation prices of the numerous components that are used in a telecommunications network. When there is uncertainty about how these prices will change over the period for which costs and prices are required, the resulting cost estimates used for setting the regulated prices of unbundled network elements can be very inaccurate. Similarly, when regulators in other jurisdictions are considering such rates as "benchmarks," it is necessary to make adjustments to account for such large differences in critical input prices, so that the benchmark rates will be representative of the costs that actually will be incurred by efficient carriers offering unbundled elements in those jurisdictions. The precipitous rise in the price of copper since 2003 exemplifies this need to reevaluate the inputs used by regulators in their cost model, as well as the inferences drawn from those models. These increases differ from the type of constant annual expected input price growth (or decline) situation that some cost models used outside the United States have accommodated with "tilted annuity" methods. Rather than a gradual anticipated price increase, copper prices escalated rapidly and are likely to remain well above the levels that regulators used to set existing loop rates. Accounting for such evidence would change the forward-looking costs of a hypothetically efficient ILEC network that one of the most prominent U.S. state regulatory commissions—the California Public Utilities Commission (CPUC)—established in 2006. Meanwhile, in 2007, the Commerce Commission in New Zealand has similarly employed a benchmarking methodology for the pricing of unbundled loops that fails to account for the increased price of copper. A global trend may be emerging among telecommunications regulators to ignore the input requirements of their own forward-looking cost models. Such a trend would be consistent with a version of regulatory opportunism in which regulators are forward-looking only when doing so produces lower regulated prices over time.

I. INTRODUCTION

Beginning in 1996, regulators in virtually every industrialized nation started down the path of mandating that the incumbent telecommunications operator offer competitors access to its network at regulated prices that reflect the forward-looking cost of the network, rather than the incumbent's historic cost. In the United States, the Telecommunications Act of 1996 requires that incumbent

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local exchange carriers (ILECs) provide certain elements of their networks to competitive local exchange carriers (CLECs).[1] Most prominent among these elements is the local loop (the connection between a subscriber and a telephone company's local switch).

The U.S. Telecommunication Act requires that these network elements be priced at cost, with the possible addition of a reasonable profit.[2] In August 1996, the Federal Communications Commission (FCC) issued rules for determining these prices.[3] The agency invented the concept of total element long-run incremental cost (TELRIC) and enshrined it into the rules for pricing mandatory access to unbundled network elements. The FCC's rules were based on a model of a hypothetical carrier that places switches in the ILEC's existing switch locations but otherwise builds an entirely new network to serve customer locations: "The total element long-run incremental cost of an element should be measured based on the use of the most efficient telecommunications technology currently available and the lowest cost network configuration, given the existing location of the incumbent LEC's wire centers."[4] The FCC's objective in establishing this rule was unexceptionable: to determine the "incremental costs that incumbents actually expect to incur in making network elements available to new entrants" and to adopt a pricing methodology that "best replicates, to the extent possible, the conditions in a competitive market."[5]

To say that the FCC's pricing rules proved to be controversial both in theory and practice would be an understatement.[6] Between 1999 and 2002, the Supreme Court twice interpreted the rules for mandatory unbundling[7]—and thereafter issued two more decisions in 2004 and 2007 construing the relationship of antitrust law to this new regulatory regime.[8] Much of the theoretical debate has

1. 47 U.S.C. §§ 251-52

2. *Id.* § 252(d)(1).

3. Implementation of the Local Competition Provisions in the Telecommunications Act of 1996; Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers, CC Docket Nos. 96-98, 95-185, First Report and Order, 11 F.C.C. Rcd. 15,499 (1996) [hereinafter *First Report & Order*].

4. 47 C.F.R. § 51.505.

5. *First Report and Order, supra* note 3, at ¶¶ 685, 679.

6. Indeed, as we explain in more detail below, although the U.S. Supreme Court in 2002 ultimately upheld the FCC's authority to establish the TELRIC rules, in 2003 the FCC opened an investigation to reform those rules in order to (1) make them align more realistically with the underlying costs that telecommunications networks entail and (2) better achieve the important objective of promoting facilities-based competition.

7. For a detailed critique of the FCC's pricing of unbundled network elements in the *First Report and Order*, see J. Gregory Sidak & Daniel F. Spulber, *The Tragedy of the Telecommons: Government Pricing of Unbundled Network Elements Under the Telecommunications Act of 1996*, 97 COLUM. L. REV. 1081 (1997). These pricing rules, along with numerous other parts of the FCC's interconnection rules, were almost immediately challenged by ILECs and a number of state regulators. In July 1997, the U.S. Court of Appeals for the Eighth Circuit Appeals overturned the FCC's pricing rules on the grounds that the states, rather than the FCC, had jurisdiction over pricing. *See* Iowa Utils. Bd. v. FCC, 120 F.3d 753 (8th Cir. 1997). In January 1999, the Supreme Court modified the Eighth Circuit's decision, upholding the FCC's authority to establish pricing rules (which are implemented by the states), but not ruling on the merits of the rules themselves. AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366 (1999). In May 2002, the Court ultimately ruled that the FCC's pricing approach was a lawful interpretation of the (ambiguous) pricing provisions for unbundled network elements contained in the Telecommunications Act. Verizon Communications Inc. v. FCC, 535 U.S. 467 (2002).

8. Verizon Comm. Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398 (2004); Bell Atlantic Corp. v. Twombly, 127 S. Ct. 1955 (2007).

focused on establishing proper cost of capital and depreciation values that reflect the risk facing firms owning substantial amounts of capital assets that become sunk upon deployment.[9] Certain components of modern telecommunications networks typically experience steady decreases in equipment prices because of the technological progress that typifies this industry. For example, it usually costs the network operator considerably less to replace a switch or a piece of fiber electronic equipment than it did when the operator originally purchased equipment of comparable quality and capabilities. The theoretical literature explains how levelized annual cost calculations, widely used by U.S. regulators, can produce economically incorrect cost estimates in these circumstances.

This article describes another potential source of error in estimating the economic costs of network elements—an error that, despite its great practical significance, has elicited no commentary and evidently has caught regulators around the world unaware. The cost models that regulators use in practice typically require detailed estimates of the equipment and installation prices of the numerous components that are used in a telecommunications network. To represent and estimate the cost of local loop facilities, these models estimate the quantities of components—such as miles or kilometers of copper cable—as well as the purchase and installation prices for these components. Consequently, when there is uncertainty about how these prices will change over the period for which costs and prices are required, the resulting cost estimates used for setting the regulated prices of unbundled network elements can be very inaccurate. (Typically, the cost models used in regulatory proceedings essentially ignore such potential outcomes and instead implicitly assume that input prices will remain the same for the foreseeable future.) Similarly, when regulators in other jurisdictions are considering such rates as "benchmarks," it is necessary to make adjustments to account for such large differences in critical input prices, so that the benchmark rates will be representative of the costs that actually will be incurred by efficient carriers offering unbundled elements in those jurisdictions.

The precipitous rise in the price of copper since 2003 exemplifies this need to reevaluate the inputs used by regulators in their cost model, as well as the inferences drawn from those models. The recent large increases in copper prices differ from the type of constant annual expected input price growth (or decline) situation that some cost models used outside the United States have accommodated with "tilted annuity" methods. Rather than a gradual anticipated price increase, copper prices escalated rapidly and are likely to remain well above the levels that regulators used to set existing loop rates.

Part II of this article explains the data that TELRIC models require if they are to achieve their purpose of producing valid estimates of the forward-looking cost of an efficient telecommunications network. Part III documents the rapid rise in copper prices since 2003 and how accounting for such evidence would change

9. *See* Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, 1997 BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS 1; Jerry A. Hausman, *Regulated Costs and Prices in Telecommunications*, in 2 THE INTERNATIONAL HANDBOOK OF TELECOMMUNICATIONS ECONOMICS (Gary Madden, ed., 2003); Robert Pindyck, *Mandatory Unbundling and Irreversible Investment in Telecom Networks*, 6 REV. NETWORK ECON. 274 (2007); Jerry A. Hausman & J. Gregory Sidak, *A Consumer-Welfare Approach to Mandatory Unbundling of Telecommunications Networks*, 109 YALE L.J. 417 (1999); Jerry A. Hausman & J. Gregory Sidak, *Did Mandatory Unbundling Achieve Its Purpose? Empirical Evidence from Five Countries*, 1 J. COMPETITION L. & ECON. 173 (2005).

the forward-looking costs of a hypothetically efficient ILEC network that one of the most prominent U.S. state regulatory commissions—the California Public Utilities Commission (CPUC)—established in 2006.[10] Part IV explains how the Commerce Commission in New Zealand has similarly employed a benchmarking methodology for the pricing of unbundled loops that fails to account for the increased price of copper.[11] Part V asks whether a global trend is emerging among telecommunications regulators to ignore the input requirements of their own forward-looking cost models. Such a trend would be consistent with a version of regulatory opportunism in which regulators are forward-looking only when doing so produces lower regulated prices over time.

II. THE DATA REQUIREMENTS FOR FORWARD-LOOKING COST MODELS

To attain the FCC's objective for TELRIC of determining "incremental costs that incumbents actually expect to incur in making network elements available to new entrants,"[12] the results produced by the TELRIC process must be consistent with the forward-looking business decisions that those incumbents make in designing the network that produces both the network elements provided on a wholesale basis and the incumbent's retail services. In competitive markets, such investments are made with the expectation that prices will be sufficient to recover the investments in long-lived assets typically with "lumpy" capacities over their economic lifetime, to earn a normal return, and to recover the associated direct expenses, along with some portion of the joint and common costs of the enterprise.[13] The competitive prices that are the basis for such decisions are also the economically efficient rates for any unbundled elements provided to other carriers.

10. Decision 06-03-025, Opinion Establishing Unbundled Network Element Rates and Price Floors for Verizon California and Modifying Decision 99-11-050 Regarding Monopoly Building Blocks, Rulemaking on the Commission's Own Motion to Govern Open Access to Bottleneck Services and Establish A Framework for Network Architecture Development of Dominant Carrier Networks, Rulemaking 93-04-003, Investigation on the Commission's Own Motion into Open Access and Network Architecture Development of Dominant Carrier Networks, Investigation 93-04-002, Cal. Pub. Util. Comm'n (Mar. 15, 2006) [hereinafter *Decision 06-03-025*]. Because of the time taken to render the decision, the circa 2003 evidentiary record for copper cable prices had been outdated by the rapid increase in prices that followed.

11. Draft Standard Terms Determination for the designated service Telecom's unbundled copper local loop network, Decision 609, New Zealand Commerce Commission (July 31, 2007) (Public Version 2.6/J10516) [hereinafter *Decision 609*].

12. *First Report and Order, supra* note 3, at ¶¶ 685, 679.

13. In particular, Baumol and Sidak observe:

> In recovering the cost of a lumpy plant over its lifetime, the payments should be timed as they are in any competitive market. Thus, the sum of the revenues over the lifetime of the investment should be sufficient to cover all costs, including replacement of investment when the time arrives, and the cost of capital tied up in the investment during its lifetime. This fundamental relationship means that the discounted present value of these revenues must constitute a sum equal to the discounted present value of the costs. The timing of the realization of these revenues, however, cannot be determined definitively by the regulatory agency—or by the courts of the firm's management, for that matter. The timing ultimately is affected, if not entirely determined, by the state of the market at different periods during the lifetime of the investment.

William J. Baumol & J. Gregory Sidak, *The Pig in the Python: Is Lumpy Capacity Investment Used and Useful?*, 23 ENERGY L.J. 383, 390 (2002).

Accordingly, evaluating whether the results produced by TELRIC approximate such efficient prices involves an assessment of the extent to which the TELRIC assumptions that merely constrain the network design to existing switch locations—but otherwise assume complete freedom to instantaneously design a new network—depart from the economic decisions that produce real networks. In fact, previous analyses have identified at least two significant ways in which the TELRIC process departs from reality.[14]

First, because of the long lives of network assets and the fact that demand can change over both space and time, network components are built over time, not instantaneously. Second, investments in assets with long lives are made in the face of uncertainty in output prices and volumes, input prices, and interest rates. Therefore, these departures from reality imply that the costs and rate produced by the TELRIC process will differ—potentially substantially—from economic costs and prices.[15]

A simple example of the bias introduced by the first factor is that the routing of loop facilities from switches to customer locations is very likely longer in the real world than what typical cost models based on TELRIC produce, because the network was built to accommodate customer locations as they evolved (for example, to new subdivisions of housing) rather than instantaneously.[16] As a result, real routes would require more cables and support structures because of

14. See, e.g., Hausman, *Regulated Costs and Prices in Telecommunications*, *supra* note 9; Timothy J. Tardiff, *Pricing Unbundled Network Elements and the FCC's TELRIC Rule: Economic and Modeling Issues,* 1 REV. NETWORK ECON. 132 (2002) (issue 2); Graeme Guthrie, *Regulating Infrastructure: The Impact on Risk and Investment,* 44 J. ECON. LIT. 925 (2006); J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT: THE COMPETITIVE TRANSFORMATION OF NETWORK INDUSTRIES IN THE UNITED STATES 403-26 (Cambridge University Press 1997).

15. For example, Lehman and Weisman ask how much such hypothetical costs differ from embedded costs—the actual operating costs to run a network of varying vintages of equipment, valued at the prices paid for equipment when purchased. DALE E. LEHMAN & DENNIS WEISMAN, THE TELECOMMUNICATIONS ACT OF 1996: THE "COSTS" OF MANAGED COMPETITION (Kluwer 2000). Based on simulations of embedded and hypothetical costs over a long-run period, they produce ranges within which cost differences should fall. The ranges they produce are generally smaller than the differences between embedded costs and rates actually adopted by regulators, suggesting that other factors (for example, inputs such as equipment prices, cost of capital, and depreciation rates) explain the generally lower levels of the adopted UNE rates.

There is one special case under which the TELRIC assumptions could overstate costs (apart from using upwardly-biased input prices). If the price of an asset is expected to increase over time (for example, at 2 percent annually), then properly representing economic depreciation will result in costs that are lower than those produced by TELRIC's implicit assumption of constant input prices in the early years, but higher prices later. *See, e.g.,* David M. Mandy & William W. Sharkey, *Dynamic Pricing and Investment from Static Proxy Models*, 2 REV. NETWORK ECON. 403 (2003). Such an effect would be offset by the cost increases associated with accommodating uncertainty.

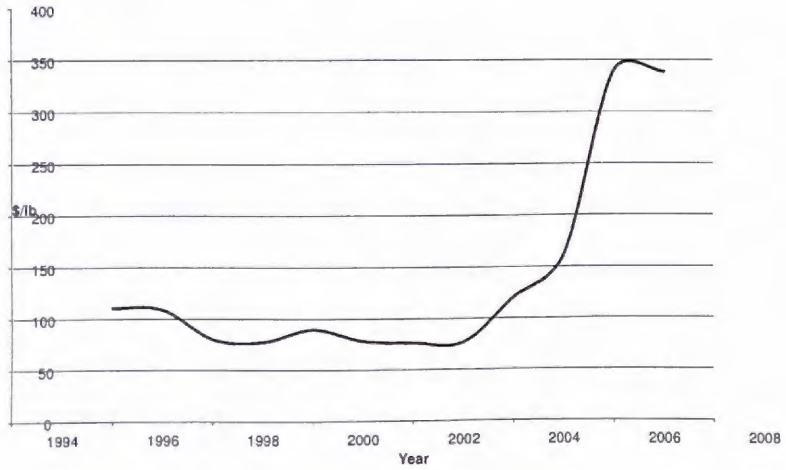
16. In fact, the FCC acknowledged that its original conception of TELRIC is likely to be unrealistic in this regard when it tentatively concluded in 2003 that TELRIC should be revised to "more closely account for the real-world attributes of the routing and topography of an incumbent's network in the development of forward-looking costs." Review of the Commission's Rules Regarding the Pricing of Unbundled Network Elements and the Resale of Service by Incumbent Local Exchange Carriers, Notice of Proposed Rulemaking, WC Dkt. No. 03-173, at, ¶ 52 (Sept. 15, 2003). Although the FCC announced this conclusion in 2003, as of October 2007 the agency had yet to complete its proceeding on the reform of the TELRIC process. Consequently, as of late 2007 it remains the case that U.S. unbundled element prices are still based on flaws that the FCC considers serious enough to require fixing.

their greater length.[17] Hausman[18] and Pindyck[19] have identified the downward biases associated with the fact that TELRIC models ignore the uncertainty under which real network investments are made. A consequence of these biases is that the TELRIC process will likely produce regulated rates for network elements that are lower than economic costs, even when all input prices are measured correctly.

III. Copper Prices and the California Public Utilities Commission

In a recent proceeding in California to establish prices for unbundled local loops, a witness for CLECs intending to lease local loops and other unbundled network elements observed that copper prices had declined by 31 percent between the passage of the Telecommunications Act in 1996 and the end of 2002.[20] The implication was that the cost of local loops, for which copper cables are a substantial component, should be expected to decrease as well. In fact, the CPUC approved new local loop rates in March 2006 using copper cable inputs from 2003.[21] Those 2003 prices turn out to be the *low point* of recent copper prices, as shown in Figure 1.[22]

Figure 1: Copper Prices



Contrary to the suggestion that copper prices were on a constant downward trend, which would justify lower local loop prices in future years, copper price

17. The shorter distance in a TELRIC model can be viewed as an artificial efficiency improvement. That is, the "production process" implied by TELRIC produces the same outputs (such as loops to customer locations) with fewer inputs. In principle, these artificial efficiencies could be mitigated by using higher rates of economic depreciation, but this adjustment would be difficult to implement in practice. Similarly, TELRIC models understate costs to the extent that they fail to anticipate the future regulatory proceedings may produce even lower rates, based on presumptively even more "efficient" hypothetical networks. *See* Guthrie, *supra* note 14, at 936.

18. Hausman, *Regulated Costs and Prices in Telecommunications*, *supra* note 9.

19. Pindyck, *supra* note 9.

20. Testimony of John Klick, California Public Utilities Commission, Proceeding I.93-04-002/R.93-04-003I.93-04-002/R.93-04-003, at 13 (Nov. 3, 2003).

21. *Decision 06-03-025, supra* note 10.

22. Prices for 1996-2001 are based on Klick, *supra* note 20, Exhibit JCK-5. Prices for 2002 through 2007 are the monthly average spot market prices reported by NYMEX. *See* www.nymex.com.

almost immediately began to increase in the 2003 time frame and by late 2007 were *more than four times* their 2003 level. Such an increase would have a noticeable impact on the regulated rate for an unbundled local loop.

Adjusting previously calculated unbundled element costs and rates for major changes in input prices proceeds as follows. In the United States, models that have been used to produce costs and rates for unbundled local loops typically depict such loops as consisting of the following basic components:

- a copper drop wire (and associated equipment at the customer's end of the loop);
- copper distribution cable connecting the drop wire to a cross-connect facility;
- fiber or copper cable between the cross-connect and the telephone company's switch;
- for fiber-fed loops, electronics that converts analog into digital signals;
- support structures, such as telephone poles and buried trenches over which cables are routed; and
- installation labor.

These cost models derive unit costs by (1) estimating the quantities of equipment needed to serve end-users (for example, lengths of copper cables of various sizes, number of telephone poles, etc.) as well as the associated labor cost for installing that equipment, (2) deriving the total investment associated with the equipment and its installation by multiplying quantities by current unit input prices (for example, the price per foot for 25-pair copper cable), (3) converting investments into annual (or monthly) capital costs necessary to recover the initial investments, pay the associated income taxes, and earn a return on those investments over the economic lives of the assets, (4) adding the annual direct (for example, maintenance) costs and some portion of shared and common costs, and (5) dividing the result by the number of units expected to be in service.

In the case of unbundled loops, if the price of a particular input changes and the other prices remain constant, the resulting change in the output price can be approximated as follows:

$$ALC = OLC \times \left((1 - w) + w \frac{P_N}{P_O} \right)$$

where ALC is the adjusted loop cost that results from the change in the input price, OLC is the original loop cost, w is the proportion of total cost accounted for by the input whose price has changed, P_O is the input price used to determine the original loop cost, and P_N is the current price of the input in question. This approximation ignores the possibility that, if a particular input becomes more expensive, there may be some substitution towards other inputs. For example, if the price of copper increases, it may become economic to deploy more fiber in the feeder. In the particular California outcome discussed (the effect of the quadrupling of copper prices on unbundled loop costs and rates), this substitution effect is small. Even at the lower prices, the model in question depicted a

predominantly fiber-fed network. Therefore, copper feeder accounts for very little of the total investment in the loop.

Returning to the recent California example, copper cable accounted for about 12 to 13 percent of total loop costs in the CPUC's calculations. Therefore, increasing copper cable input prices by the factor of 4.4 that the spot market price for copper increased between June 2003 and June 2006 would increase the loop cost by a factor of 0.12 to 0.13 × (4.4 – 1), or about 40 percent from $14 to about $19 to $20.[23] This estimate assumes that the increase in the price of raw copper passes through directly into the price of copper cable.[24]

IV. Copper Prices and the New Zealand Commerce Commission

Although the record evidence upon which the CPUC's March 2006 decision did not account for the sharp increases in the market price of copper in its forward-looking pricing of local loop unbundling (LLU), the New Zealand Commerce Commission explicitly and erroneously ignored such evidence in 2007. To understand how the Commerce Commission made that mistake, it is useful to examine first its benchmarking methodology for setting prices for unbundled local loops.

A Biased LLU Benchmark Estimates

In this section, we will assume that the Commerce Commission's analysis is based on valid forward-looking data. The Commerce Commission attempts to solve a well-posed problem in econometrics. Given the characteristics of local loops in New Zealand, what is the best prediction using the available overseas data? Econometrics (or, more generally, statistics) has developed a well-accepted procedure to answer this question. Prediction based on a linear regression model given the local loop characteristics in question yields the "best linear unbiased predictor," or BLUP. Thus, if the models are restricted to be linear and unbiased, prediction from a regression model is "best" in the sense that it minimizes the variance of the prediction.[25] Econometricians typically limit consideration to unbiased (consistent) estimation procedures because unbiasedness means that the prediction has an expected error of zero. The BLUP result follows directly from the Gauss-Markov theorem, the fundamental theorem of regression, which has been known for over a century. Thus, the correct procedure for the Commerce Commission to employ in a benchmark approach is to estimate a regression

23. Ideally, consistent with AT&T Communications of Ill. v. Illinois Bell Telephone Co., 349 F.3d 402 (7th Cir. 2003), had the CPUC chosen to update copper input prices, other prices, such as depreciation and the cost of capital, would be updated to 2006 values as well. However, because the very large increase in copper prices is very likely much larger in magnitude than potential offsetting factors that would lower the loop cost, the loop costs adopted by the CPUC was most likely immediately out-of-date and, consequently, would no longer serve as a reliable benchmark for loop costs in other jurisdictions.

24. For example, if the price of copper cable reflects other aspects of transforming raw copper into ready-to-install cable (for example, production, warehousing, and the like), then the cost increase could differ from the trend in raw copper prices. For example, if the price of cable increased by a factor of 2.5 (rather than the 4.4 increase in the copper spot price), the change in the loop price would be 0.12 to 0.13 x (2.5 – 1), or 18 to 20 percent.

25. Of course, nonlinear transformations of the variables all fit within this category, although sometimes consistency replaces unbiasedness.

model and use it to predict the LLU prices, given the characteristics of local loops in New Zealand or the particular geographic region in question.

However, the approach that the Commerce Commission used to develop benchmark rates did not follow this correct approach. Instead, the Commerce Commission used a series of bivariate analyses of "potential comparators" to determine "the relationship between each particular indicator and UCLL rates."[26] This approach leads to biased results because each bivariate regression suffers from the "omitted variable" problem.

Two examples demonstrate the omitted variables problem. Suppose one wanted to predict the performance of an incoming student to the MIT graduate economics program. If one used a bivariate regression of actual student performance on the student score on the graduate record exam (GRE) economics section, one would find a positive relationship. However, if instead one used a multivariate regression model and included undergraduate grade point average, performance on the GRE math exam, and performance on the GRE economics exam, one would find no significant relationship with the GRE economics exam. Indeed, MIT economics admission disregards this variable, performance on the GRE economics exam. If the other two variables are omitted, the GRE economics exam result is found to be important, but that is because it is positively correctly with the other two omitted variables. Conversely, if one used a bivariate relationship to consider the effect of the GRE English exam on graduate student performance, one likely would not find a relationship. However, if one included it with grade point average and GRE math exam, one would likely find a positive and significant relationship. Thus, using bivariate regression models leads to both kinds of errors: finding a variable to be important when it is not important in a multivariate relationship and finding a variable not to be important when it is important in a multivariate relationship.

The Commerce Commission approach for determining benchmark rates is to consider a number of demographic and economic factors that may be significant determinants of local loop costs so that they are reflected in LLU rates. The Commerce Commission carried out a bivariate regression analysis "to determine the relationship between each individual comparability indicator and local loop rates . . . ."[27] This bivariate regression analysis identified urban population and, less strongly, teledensity and population density.[28] These three variables were then used "to identify countries comparable to New Zealand."[29] An arbitrary range for each of the three variables was used to choose a sample of seven U.S. states, and Australia, Finland, Norway and Sweden, for a total of eleven sample observations. After converting the rates to New Zealand dollar, the Commerce Commission used the median of the eleven observations of NZ$20.77. If, instead, the average were used, it would lead to $NZ21.48.

Taking a median (similar to an average) is an incorrect econometric procedure. Only if the eleven observations were a random sample from a population "similar" to New Zealand would unbiased results occur. However, a table in the Commerce Commission's decisions shows that the sample used violated this criterion.[30] The median (and mean) of urban population in the

26. *Decision 609, supra* note 11, at 97.
27. *Id.* at 25.
28. *Id.*
29. *Id.* at 26.
30. *Id.* at 25, table 4.

Commerce Commission data is 0.77, while for New Zealand the urban population variable is 0.86.[31] Because the Commerce Commission found urban population to be the most important variable, the Commerce Commission approach is likely to generate a biased estimate of LLU rates.

Sidak and Singer, whom the Commerce Commission reference, criticize the Irish regulator for using the mean of EU countries to set Ireland's benchmark LLU rates.[32] Sidak and Singer recommend using a regression model as a superior approach to taking the sample mean.[33] In Ireland, they found a downward bias of 42 percent because the regulator used the sample average rather than the regression model prediction.[34]

B. Long-Term Benefits to End Users and Distortion of Investment Incentives

Before turning to a regression analysis, we briefly consider the Commerce Commission's consideration with regard to the criterion of "long-term benefits to end users." We do not agree with the economic analysis underlying the decision. We begin with the observation that in Canada and in many U.S. states (including California and a number of other large states) local telephone rates have been deregulated since 2006 or 2007.[35] These jurisdictions determined that deregulation was appropriate when pay TV cable based telephone and cellular (mobile) competed with the landline carrier.

Most economists agree that competition leads to superior results for consumers than "regulation forever." Thus, when the Commerce Commission considers "additional incentives for access seekers to replicate and bypass Telecom's local loop infrastructure" they are mistakenly considering that an access seeker might decide to build a new copper based network. This outcome is extremely unlikely (and probably would never happen). The relevant question is how low access rates affect the economic incentives to invest in alternative technologies—for example, a pay cable network that will compete with the landline network or new technologies such as WiMax.[36]

Our academic research has determined that low LLU rates decrease economic incentives for investment in alternative competing technologies.[37] Further, because LLU rates do not correctly account for the sunk and irreversible nature of network investment, they are too low to create incentives for efficient

31. The medians and means of the other two variables, teledensity and population density, are relatively close.

32. *Decision 609, supra* note 11, at 24 n.8 (citing J. Gregory Sidak & Hal J. Singer, *How Can Regulators Set Non-Arbitrary Interim Rates? The Case of Local Loop Unbundling in Ireland*, 3 J. NETWORK INDUS. 273 (2002)).

33. Sidak & Singer, *supra* note 32, at 289.

34. *Id.* at 289-90.

35. For a discussion, see Jerry A. Hausman & J. Gregory Sidak, *Telecommunications Regulation: Current Approaches with the End in Sight*, in ECONOMIC REGULATION AND ITS REFORM: WHAT HAVE WE LEARNED? (Nancy L. Rose, ed., National Bureau of Economic Research & University of Chicago Press, forthcoming 2008).

36. Sprint is currently building a WiMax network in the United States. *See, e.g.*, http://www2.sprint.com/mr/news_dtl.do?id=15000.

37. *See, e.g.*, Hausman & Sidak, *Did Mandatory Unbundling Achieve Its Purpose?, supra* note 9.

investment.[38] Because investors in competing technologies (such as cable networks or WiMax networks) will be required to take account of the sunk and irreversible nature of network investment, the Commerce Commission's claim of possible "inefficient by-pass" is incorrect.[39] The Commerce Commission needs to consider competitive outcomes in Canada and the United States, as well as the investment incentives and investment risks faced by potential competing network providers in New Zealand.

Our previous research has also demonstrated that the incumbent's investment is determined by its expected rate of return. This fact is especially important in the current situation because most new investment in telecommunications networks is sunk and irreversible. Indeed, the U.S. experience demonstrates that the incumbents decided to invest in residential fiber optic networks once they received the FCC's guarantee that it would not mandate that competitor have access to these new networks at uneconomic rates artificially suppressed by regulation. Currently, Verizon and AT&T are investing in these new networks at a cost exceeding US$10 billion.[40] Thus, to the extent that New Zealand will depend on its own incumbent, Telecom New Zealand, to be an important provider of new technology requiring new investment, it is important (if it is not to forbear from mandating access to new networks entirely) that the Commerce Commission establish regulated rates for mandatory access that make this investment economic in the sense of having a high enough expected rate of return.

C. Benchmark Rates Predicted from a Regression Model

We now estimate a regression model where the left left-hand side variable is the logarithm (log) of price and the right-hand side variables are log of population density, log of urban population, and log of teledensity. We do not argue that this regression model should be used to determine LLU benchmark prices, as the rates used in the model are not forward-looking. Rather, the value of the model is to demonstrate the downward bias in the Commerce Commission's approach.

Our first sample has 51 observations from U.S. states (and the District of Columbia) that are contained in the Commerce Commission data base. (We begin with U.S. states because they share a common technology arising from the Bell System before 1984 and from Bellcore thereafter.) The results appear in Table 1.

38. We have discussed this point in numerous academic papers, and it has been accepted by the U.S. Federal Communication Commission. *See, e.g.*, Hausman, *Regulated Costs and Prices in Telecommunications, supra* note 9.

39. *Decision 609, supra* note 11, at 30.

40. Despite the fact that U.S. incumbents continue to make unbundled copper loops available (or the equivalent functionality on fiber loops) after such upgrades are complete, a number of competitors have requested that the FCC and U.S. state regulators not allow incumbents to retire copper facilities. Such a perpetuation of copper facilities (especially if unbundled loop prices have not been updated to reflect recent developments in world copper markets) would harm the incentives of both incumbents and providers of competing platforms to invest.

Table 1: Log Regression Model: U.S. States

ln_llu_nz	Coef.	Std. Err.	T	P>|t|
ln_popdensity	-0.056	0.023	-2.43	0.02
ln_urbanpop	-0.229	0.083	-2.75	0.01
ln_teledensity	-0.089	0.077	-1.15	0.26
_cons	3.203	0.154	20.77	0.00
Number of obs.	51.000			
R-squared	0.581			
Root MSE	0.147			

Table 1 indicates that population density and urban population are highly significant, and that teledensity has the expected sign.[41] The root MSE is 14.7 percent, and the R^2 is 0.58; so the model has good properties. Using the values for New Zealand given by the Commerce Commission,[42] the regression model predicts a median of $23.61 with a standard error of prediction of 15.3 percent. This prediction is unbiased and is 13.7 percent higher than the Commerce Commission's median result.[43] Thus, we conclude that the Commerce Commission's median rate is downward biased by a statistically significant amount (at the 10 percent level).

We now consider another regression model that includes all the U.S. states as well as the four additional countries used in the Commerce Commission analysis, Australia, Finland, Norway, and Sweden. The results appear in Table 2.

Table 2: Log Regression Model: United States Plus Four Other Countries

ln_llu_nz	Coef.	Std. Err.	t	P>|t|
ln_popdensity	-0.031	0.020	-1.52	0.13
ln_urbanpop	-0.303	0.078	-3.88	0.00
ln_teledensity	-0.154	0.075	-2.05	0.05
_cons	3.013	0.133	22.71	0.00
Number of obs	55.000			
R-squared	0.548			
Root MSE	0.154			

The model does not fit quite as well as the previous model, as the Root MSE increasing to 15.4 percent. Teledensity now becomes significant, while population density is no longer significant. The median prediction for New Zealand is now $22.31, which is 7.4 percent higher than the Commerce Commission's prediction.[44] This result again demonstrates the bias in the

41. Although teledensity is not individually significant, it improves the predictive power of the model.

42. *Decision 609, supra* note 11, table 3.

43. *Id.* at 31, table 6.

44. *Decision 609, supra* note 11, at 31, table 6.

Commerce Commission's econometric approach. The standard error of the prediction is 15.8 percent, which again demonstrates that the regression model prediction has excellent properties.

We conclude that the Commerce Commission's approach to estimating benchmark LLU rates for New Zealand does not follow accepted econometric practice. Further, a regression model is able to give quite precise predictions for New Zealand based on a sample of U.S. states plus the foreign countries used by the Commerce Commission. The results of the regression model demonstrate a downward bias in the Commerce Commission results, as Table 3 summarizes.

Table 3: Commerce Commission Estimate and Regression Estimates

Source of Estimate	Median	% Bias Of Commerce Commission Est
CC Median Estimate	$20.77	---
Regression Model U.S. States	$23.61	13.7%
Regression Model: U.S. + Foreign	$22.31	7.4%

D. Benchmark Data That Are Not Forward-looking

The Commerce Commission states that the LLU rates should be "forward-looking."[45] We agree. However, the data used by the Commerce Commission to set benchmark rates are not forward-looking. Between 2001 and 2007, the price of copper increased by approximately 343 percent—from US$1578 per metric ton in 2001 to US$6985 in 2007. Although one of the most significant costs of a local loop is the copper cable, this increased price of copper is not reflected in the data upon which the Commerce Commission relied. In this respect, the Commerce Commission benchmark data are not forward-looking, and those data consequently cause downward bias in estimates of the forward-looking LLU price. Our unbiased median estimate of the correct LLU price for New Zealand, which is forward-looking because it takes account of the increased price of copper, is NZ$32.78. The Commerce Commission estimate is not forward-looking because it does not account for the increased price of copper. Table 4 shows the LME yearly copper price from 2001 to 2006.[46]

45. *Id.* at 21.

46. We note that the price pattern in Table 4 differs somewhat from the data used in Figure 1. For example, using the June values of the NYMEX data to construct price indices with 2001 = 1 produces slightly different indices than shown in Table 4.

Table 4: Price of Copper, 2001-2007 (US$ per Metric Ton)

Year	Price	% Increase From 2001
2001	1,577.56	
2002	1,557.88	-1.2%
2003	1,779.73	12.8%
2004	2,867.96	81.8%
2005	3,683.81	133.5%
2006	6,725.33	326.3%
2007	6,985.22	342.8%

Source: London Metal Exchange, series LCPCASH~U$.

Because copper is a storable commodity, the current spot price is an excellent estimate for the expected future price. Thus, no reason exists to believe that the copper price will return to "normal" lower levels in the future. It would be incorrect to take a long-run average for the copper price given the economic factors that determine the price of copper. Even though the New Zealand exchange rate may be subject to cyclical volatility, no reason exists to believe that the world price of copper is subject to cyclical volatility given its characteristic as a resource with an upward-sloping cumulative supply curve over time. As Table 4 and Figure 1 indicate, the price of copper has increased exponentially, driven largely by the growth of the Chinese economy.

We can now relate the decision of New Zealand's regulators in 2007 to that of California's regulator in 2006. We have analyzed 2003 data used in the 2006 CPUC decision that adopted rates for local loops averaging about US$14 for Verizon California. As noted earlier, using 2006 copper prices instead of 2003 levels, the resulting loop rate could have been more than 40 percent. Copper cable accounted for about 12 percent of total loop investment in the CPUC's calculations. Therefore, increasing copper cable input prices by the factor of 4.4 that the spot market price for copper increased between June 2003 and June 2006 would increase the loop cost by about 40 percent, resulting in an estimate of about US$20 instead of US$14.

Is the increased price of copper reflected in the Commerce Commission's benchmark data set? The share of copper cost in total LLU cost consistent with the CPUC's cost model implies an estimated coefficient in a log-log regression model of approximately 0.12. We took the data set consisting of the U.S. states and 3 of the 4 other countries and put in the price of copper in the year of the decision, under the hypothesis that the LLU estimates are forward-looking, as required by the Commerce Commission.[47] The results are in Table 5.

47. We exclude Norway from the sample because we cannot tell what year of data the LLU price was based on.

Table 5: Log Regression Model with Copper Price

ln_llu_nz	Coef.	Std. Err.	T	P>|t|
ln_popdensity	-0.045	0.020	-2.22	0.03
ln_urbanpop	-0.238	0.079	-3.01	0.00
ln_teledensity	-0.139	0.072	-1.93	0.06
ln_coppermt	-0.202	0.091	-2.22	0.03
_cons	4.782	0.794	6.02	0.00
Number of obs	54.000			
R-squared	0.594			
Root MSE	0.147			

Contrary to the expectation that the estimated coefficient of the log copper price should be positive and approximately 0.12, the regression results find a *negative and statistically significant coefficient of -.202.* Thus, the Commerce Commission's sample of LLU prices does not reflect correctly the exponential increase in the copper price during the sample years. Instead, that sample demonstrates that regulators, at least in the United States, continued to decrease the LLU rates over time to attempt to encourage more competitive entry.[48] This attempt largely failed. Many states, including California, have now deregulated local landline prices, as competing technologies constrain the price of local telephone service.

Thus, the increased price of copper is not reflected in the data relied on by the Commerce Commission. The Commission recognizes this potential problem, as it concedes that "costs may evolve over time and regulated rates may become outdated."[49] However, the Commerce Commission did no economic or econometric analysis to determine whether the international rates it used reflected costs (for example, copper prices) that have, in fact, evolved over time. In particular, when one examines the August 2006 decision of the Australian Consumer and Competition Commission (ACCC) on LLU, *Assessment of Telstra's ULLS Monthly Charge Undertaking*,[50] which the Commerce Commission used in its own estimate, one can find no reference to taking into account the increased price of copper, which should be included in a forward-looking price determination. Thus, the ACCC decision does *not* appear to be forward-looking, contrary to the Commerce Commission's determination.

However, we note that Telstra, the incumbent network operator in Australia, is well aware of the effect of the increased price of copper. In an August 2006 submission to the ACCC, Telstra noted a 76 percent increase for the prices of copper and brass and a 48.8 percent increase in the price of electric cable and

48. A regression model with yearly indicator variable (rather than copper prices) finds a monotonic decreasing LLU rate across years after controlling for the three variables used in the regression specification. This finding is consistent with regulators decreasing LLU rates over time to attempt to encourage more entry.

49. *Decision 609, supra* note 11, at 22.

50. Australian Consumer and Competition Commission, Assessment of Telstra's ULLS Monthly Charge Undertaking, (Aug. 2006), *available at* http://www.accc.gov.au/content/index.phtml/itemId/759855/fromItemId/721622.

wire over the previous four years, using data from the Australian Bureau of Statistics website.[51] The submission then estimated an "implied price escalators" for distribution conduit and trenching, main conduit and trenching, distribution cable, and main cable.[52] Each escalator exceeded 20 percent over the previous four-year period.[53] Overall, Telstra's filing estimated a 22.7 percent increase over the previous four years for the prices of "composite for network assets."[54] This evidence—drawn from the Australian government's own statistical sources—counsels the ACCC to recheck the plausibility of its estimates of the forward-looking costs of Telstra's network.

As it currently stands, the Australian data used in New Zealand by the Commerce Commission are not forward-looking, and they lead to downward bias in the estimates of the forward-looking LLU price. The failure of regulated LLU rates to accurately capture the most important input cost, other than labor, demonstrates that the benchmarking approach cannot lead to accurate LLU estimates. However, to the extent that the Commerce Commission must estimate benchmark LLU rates, we suggest the Commerce Commission take the geometric average of the regression model estimate, NZ$22.95, and then apply a 42.8 percent adjustment factor using the LME copper price in June 2007 because the modal date for the data is 2003. Using this copper adjustment factor leads to an adjusted median estimate of NZ$32.78.[55] Otherwise, the Commerce Commission estimate will not be forward-looking because it will not account for the increased price of copper.

V. Regulatory Opportunism and the Failure to Rectify the Known Deficiencies of TELRIC Pricing

TELRIC pricing was originally adopted at a time when U.S. regulators appeared widely to believe that unbundled elements would not only "jump start" competition, but also would be a major source of competition by themselves. Accordingly, it is not surprising that regulators have often regarded the growth in the number of competitors' lines as an important metric of the success of competition policy, regardless of the investments required to provide those lines.[56] As a result of a circuitous legal and regulatory path, greater emphasis on

51. The Matter Undertakings Dated 23 December 2005 Provided by Telstra Corporation Limited to the Australian Competition and Consumer Commission in Respect of Unconditioned Local Loop Service, Price Indices Supplement Statements ¶ 9 (citing (ABS.gov.au), *available at* http://www.accc.gov.au/content/index.phtml/itemId/771159/fromItemId/743667).

52. *Id.* at ¶ 12.

53. *Id.*

54. *Id.* at ¶ 16.

55. The change in the copper price from June 2003 to June 2007 is used for the adjustment. We make all adjustment using constant New Zealand dollars. Ideally, if data on the change in the price of copper cable from 2003 to 2007 were available (for example, from carriers participating in the regulatory proceeding), a more refined adjustment to the benchmark would result.

56. For example, during the time when the unbundled element platform (UNE-P) was being offered in the United States, state regulators generally lowered its price. At its peak—at the time the FCC was beginning to respond to court directives that ultimately ended the availability of UNE-P at favorable regulated rates—over 60 percent of the competitive lines in the US were obtained at wholesale from the incumbents and involved no use of competing network facilities. *See, e.g.*, Timothy J. Tardiff, *Changes in Industry Structure and Technological Convergence: Implications for Competition Policy and Regulation in Telecommunications*, 4 Int'l Econ. & Econ. Pol'y 109 (2007), *available at* http://www.springerlink.com/content/wg612681347lk809/.

full facilities-based competition—typically over platforms other than traditional copper loops—is becoming increasingly prominent at the same time that competition from providers reselling all or parts of incumbent networks has receded. However, the regulatory reform of TELRIC pricing that would naturally accompany this shift in direction has stalled. This and other sources of regulatory lag have resulted in TELRIC prices that are still based on a methodology that the FCC—its sponsor—has tentatively concluded is in need of reform. Perhaps more important, extant values of critical components such as unbundled loops are based on inputs that are out of date because of the changes in copper prices (and perhaps other markets supplying telecommunications inputs).

With these developments, the challenge of developing economically proper regulated input prices (either through full blown cost studies or benchmarking other jurisdictions) becomes increasingly challenging. Under these circumstances, it is important that artificially low input prices not be maintained by failure to adjust out-of-date costs in the hopes that they would give the appearance of more competition, under the guise of greater volumes supplied not by competitors actually investing in network technologies, but by carriers that continue to resell the older technology of incumbent providers.

VI. Conclusion

Regulated prices for unbundled network elements have based on total element long-run incremental cost, which in turn is calculated using engineering cost models that require detailed estimates of the equipment and installation prices of the numerous components that are used in a telecommunications network. When there is uncertainty about how these prices will change over the period for which costs and prices are required, the resulting cost estimates used for setting the regulated prices of unbundled network elements can be very inaccurate. Similarly, when regulators in other jurisdictions are considering such rates as "benchmarks," it is necessary to make adjustments to account for such large differences in critical input prices, so that the benchmark rates will be representative of the costs that actually will be incurred by efficient carriers offering unbundled elements in those jurisdictions.

The precipitous rise in the price of copper since 2003 exemplifies this need to reevaluate the inputs used by regulators in their cost model, as well as the inferences drawn from those models. Accounting for such evidence would change the forward-looking costs of a hypothetically efficient ILEC network that one of the most prominent U.S. state regulatory commissions—the California Public Utilities Commission (CPUC)—established in 2006. Meanwhile, in 2007, the Commerce Commission in New Zealand has similarly employed a benchmarking methodology for the pricing of unbundled loops that failed to account for the increased price of copper. In order for the input requirements of their own forward-looking cost models to be satisfied and economically proper network element prices attained, it is important for regulators to resist the opportunistic policy of employing forward-looking costs only when doing so produces lower regulated prices over time.

Physical Scarcity, Rent Seeking, and the First Amendment
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PHYSICAL SCARCITY, RENT SEEKING, AND THE FIRST AMENDMENT

*Thomas W. Hazlett**

The disparate treatment of the print and electronic media under federal regulation has been a curiosity to lawyers and economists for decades. Now, dynamic technical change in telecommunications markets is credited with bringing a new tension to the underlying premises of the law, calling into question the "physical scarcity" doctrine, which has long been one of the foundations for federal regulation of broadcasting. Yet, the omnibus Telecommunications Act of 1996 glaringly failed either to promote competition in the broadcasting sector or to disturb the legal distinction between broadcasting and the traditional press. Indeed, the physical scarcity doctrine is still the law of the land—despite the explicit policy goal in the 1996 Act to end disparate treatment of rival media. Professor Hazlett argues that this legal anomaly is all the more striking in light of the physical scarcity doctrine's gaping illogical holes, its shaky legal foundation, and the growing abundance of modern wireless communications. After demonstrating that the First Amendment arguments that focus on these three factors are analytically incomplete, Professor Hazlett goes on to provide a richer explanatory model, which includes examination of the public choice dynamics driving the historical development of broadcasting law. In this model, Professor Hazlett reveals that the physical scarcity doctrine can be criticized even on its own terms, and that the ancillary doctrines that have arisen in support of this doctrine are merely outgrowths of classic regulatory capture. Professor Hazlett concludes that the First Amendment implications are stark: the "chilling effect" on broadcast speech, which the U.S. Supreme Court first feared and then dismissed as empirically inconsequential, is a vital—and lasting—component in the regulation of electronic communications.

I. THE 1996 TELECOMMUNICATIONS ACT: SPEECHLESS ON WIRELESS

> An Act to promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies.
>
> Preamble to the Telecommunications Act of 1996[1]

Despite ambitious rhetoric regarding the scope of liberalization in telecommunications markets, the omnibus 1996 Telecommunications Act

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1. Pub. L. No. 104–104, 1996 U.S.C.C.A.N. (110 Stat.) 56, pmbl. (to be codified at scattered sections of 47 U.S.C.).

did shockingly little to disturb age-old regulatory arrangements in radio and television broadcasting. Consider that the primary reforms in this sector involved the following:

- TV and radio licenses have been extended to eight years (from seven in radio, five in TV);
- Renewal of licenses has been made easier as the burden has shifted to the Federal Communications Commission (FCC) to show a "pattern of abuse" to justify non-renewal;
- Incentives for third parties to challenge license renewals have been reduced;
- Various ownership restrictions have been relaxed, particularly in radio markets;
- A violence-filtering "V-chip" has been mandated for television sets, and violence-labeling for TV shows;
- The FCC has been prohibited from awarding new licenses for Advanced Television to any applicants other than existing TV stations, and from charging money for such awards.[2]

These policy reform measures are so favorable to industry incumbents that, with the exception of the V-chip provision, they could well have been written by the National Association of Broadcasters. In essence, the legislation—called sweeping by many and dubbed "revolutionary" by the President[3]—took serious spectrum reform off the table. One half of the telecommunications world, traditionally partitioned into "wireline" and "wireless," has survived the first "major" rewrite of the 1934 Communications Act intact. Indeed, ever since the Radio Act of 1927 instituted "public interest" regulation, little has changed in how we allocate spectrum and assign licenses to private wireless service providers. Despite the announced goals of competition and deregulation, the recent legislation has, in fact, extended the problems with administrative control of spectrum.[4]

The means by which we regulate broadcasters have proven amazingly successful in terms of political survivorship. The current system, devised under the regime of President Calvin Coolidge and Secretary of Commerce Herbert Hoover, has continued virtually unamended through decades of technological progress, the invention and adaptation of television, political reform movements (including deregulation), and a "top-to-bottom" rewrite of telecommunications law. This implies a remarkable stability.

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2. See generally Thomas G. Krattenmaker, The Telecommunications Act of 1996, 29 Conn. L. Rev. 123 (1996) (identifying the 1996 Telecommunications Act's chief reforms).

3. See Mike Mills, Ushering in a New Age in Communications: Clinton Signs "Revolutionary" Bill into Law at a Ceremony Packed with Symbolism, Wash. Post, Feb. 9, 1996, at C1.

4. As Thomas Krattenmaker observes: "The new Act does very little to reform broadcasting law and policy in helpful ways. Censorship is not repealed, but rather is extended. The horrors of spectrum allocation for television are not ameliorated, but compounded." Krattenmaker, supra note 2, at 157.

Well over a generation ago, our current regulatory structure was properly condemned as anticompetitive. Since the publication of Nobel Laureate Ronald Coase's classic paper[5] on the FCC in 1959, many policy analysts have shown that the spectrum allocation and licensing procedures employed by the FCC unduly restrict competition in the broadcasting marketplace.[6] The legality of restricting broadcast entry—which immediately raises the spectre of limiting and policing speech—has likewise attracted severe criticism from legal scholars.[7] Yet the basic rules concocted in 1927 continue in force. The government issues FCC broadcasting licenses as special privileges, using this power to coerce certain types of speech or to engage in subtle but nonetheless potent forms of censorship. Where is the momentum for reform in broadcasting law?

This paper examines this question by investigating the so-called physical scarcity doctrine. This doctrine, established by the Supreme Court's 1943 *NBC* opinion,[8] posits that broadcasting frequencies constitute a distinctly finite natural resource that must be rationed in special ways.[9] The doctrine has been the primary rationale under which the Supreme Court has distinguished electronic communications from print and other forms of communication, permitting regulation of both speakers and speech in the former, but not the latter. Current critiques focus on the doctrine's economic and technological shortcomings. This paper dissects the doctrine with different tools, revealing that the doctrine owes its longevity to the compelling political coalition that spontaneously forms in each regulatory episode to support the underlying arrangement. This phenomenon results in a standard rent-seeking[10] outcome, in which pressure groups share gains from policies that lower overall social welfare—pre-

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5. Ronald H. Coase, The Federal Communications Commission, 2 J.L. & Econ. 1 (1959).

6. See, e.g., Roger Noll et al., Economic Aspects of Television Commercial Regulation 112–20 (1973); Douglas W. Webbink, How Not to Measure the Value of a Scarce Resource: The Land-Mobile Controversy, 23 Fed. Comm. Bar J. 202 (1969).

7. See, e.g., Thomas G. Krattenmaker & Lucas A. Powe, Jr., Regulating Broadcast Programming 310 (1994) ("editorial control, because it is invariably content based, is an inherently impermissible government function"); David L. Bazelon, FCC Regulation of the Telecommunications Press, 24 Duke L.J. 213, 234–37 (1975) ("A government which can dictate what is 'fair' reporting can control information to the public in a manner which subverts self-government.").

8. See NBC v. United States, 319 U.S. 190, 227 (1943).

9. See Note, Cable Television and the First Amendment, 71 Colum. L. Rev. 1008, 1017–18 (1971).

10. The term "rent-seeking" is used here to refer to the rivalry to obtain resources yielding supracompetitive returns. It differs from profit-seeking in that the activities incurred do not increase consumer welfare. Classic rent-seeking is simply distributive; it determines who gains, and who loses—not what is available in the aggregate. Whenever rivals expend real resources to vie for rents, the process yields net social losses. See Richard A. Posner, The Social Costs of Monopoly and Regulation, 83 J. Pol. Econ. 807, 809–12 (1975) (discussing "the tendency of monopoly rents to be transformed into costs" and "its implications both for the measurement of the aggregate social costs of monopoly and for . . . other important issues relating to monopoly and public regulation").

cisely the sort of politically profitable government influence over speech that the Constitution was designed to prohibit.

Part II of this Article provides an overview of the physical scarcity doctrine, its importance in First Amendment jurisprudence, and the principal critiques that have been levied against it. In Part III, I undertake a positive examination of the legal development of broadcasting law, showing that typically, the pre-1927 Radio Act wireless marketplace was not "chaotic," and access to radio spectrum was not lawless. Rather, I will show that the political momentum to enact "public interest" licensing arose from the efforts of industry leaders and political actors who—for self-interested reasons—desired to replace the rules that had previously governed orderly development of the broadcasting sector. In Part IV, I demonstrate that the physical scarcity doctrine is internally inconsistent, and cannot form any cogent rationale for public policy. Part V discusses the traditional First Amendment "values" derived from the physical scarcity analysis, tracing their roots to economically based arguments for protection advanced by rent-seeking constituencies. Part VI offers persuasive empirical evidence regarding the existence of a "chilling effect" associated with broadcast license regulation, the Supreme Court's suggested test for constitutionality of the physical scarcity doctrine. Part VII deals with the important debate over the issuance of new licenses for High Definition Television, an issue raised by the Senate Majority Leader as a primary target for legislative reform in the Telecommunications Act of 1996. Part VIII offers a concluding comment regarding the First Amendment implications of this state of affairs.

II. The Physical Scarcity Doctrine and the First Amendment—An Overview

> Before 1927, the allocation of frequencies was left entirely to the private sector, and the result was chaos. It quickly became apparent that broadcast frequencies constituted a scarce resource whose use could be regulated and rationalized only by the Government. Without government control, the medium would be of little use because of the cacophony of competing voices, none of which could be clearly and predictably heard. Consequently, the Federal Radio Commission was established to allocate frequencies . . . in a manner responsive to the public "convenience, interest, or necessity."[11]

The dichotomy between constitutional protections extended to the print media and those afforded the electronic media has received a great deal of attention in the legal, communications, and public policy literature.[12] First Amendment protection blankets print publishers, as vividly

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11. Red Lion Broad. Co. v. FCC, 395 U.S. 367, 375–77 (1969) (citations omitted).

12. See, e.g., Ithiel de Sola Pool, Technologies of Freedom (1983); Lucas A. Powe, Jr., American Broadcasting and the First Amendment 197–212 (1987); David L. Bazelon, The First Amendment and the "New Media"—New Directions in Regulatory

seen in *Tornillo,*[13] but has only scantily covered electronic publishers since *NBC*[14] and *Red Lion.*[15] An impressive regulatory structure for the electronic press has been erected around the legal interpretation found in this line of cases, with broadcasters licensed as "public trustees" by the FCC, and cable television operators franchised by local governments. In either situation, the character and performance of electronic publishers are explicitly taken into account in licensing and renewal decisions—an activity that seriously compromises the strictures against government discretion in regulation of the press.

United States law holds that broadcasting is fundamentally different from print in two ways. First, without government regulation of the broadcast band, no electronic speech would be possible; hence, the government in essence *creates* the entire category of broadcast speech[16] via regulation, giving it special authority to influence communication.[17] Second, the "physical scarcity" of the electromagnetic spectrum dictates that not all who wish to broadcast may do so; hence, the government must, in its simple custodial role, employ some discretion in selecting licensees.

Telecommunications, *in* Free But Regulated: Conflicting Traditions in Media Law 52, 52–64 (Daniel L. Brenner & William L. Rivers eds., 1982); Matthew L. Spitzer, Controlling the Content of Print and Broadcast, 58 S. Cal. L. Rev. 1349 (1985); Abbott B. Lipsky, Jr., Note, Reconciling *Red Lion* and *Tornillo*: A Consistent Theory of Media Regulation, 28 Stan. L. Rev., 563 (1976).

13. See Miami Herald Pub. Co. v. Tornillo, 418 U.S. 241, 256 (1974) (finding governmental "compulsion to publish that which 'reason' tells [newspapers] should not be 'published' is unconstitutional").

14. See NBC v. United States, 319 U.S. 190, 227 (1943) ("The standard [ ] provided [by Congress in the Communications Act of 1934] for the licensing of stations was 'the public interest, convenience, or necessity.' Denial of a station license on that ground . . . is not a denial of free speech.").

15. 395 U.S. at 400–01 (finding that FCC rulemaking to implement fairness doctrine, under which broadcaster required to provide free reply time to party attacked in a broadcast, did not violate First Amendment).

16. In the discussion to follow, we will consider only broadcasting. In a recent opinion, the U.S. Supreme Court delineated three distinct policy regimes under the First Amendment: print, cable, and broadcasting. See Turner Broad. Sys., Inc. v. FCC, 512 U.S. 622, 637–39, 656 (1994). The decision made it clear, however, that the fundamental schism was created when broadcasting was split from print. See id. The original divergence of electronic media from traditional press outlets, therefore, appears to open each new media form to its own constitutional analysis.

17. This rationale actually predates the First Amendment analysis rendered by the Supreme Court in *NBC.* In a 1929 case in federal district court, it was found that regulation under the 1927 Radio Act did not violate the Fifth or Fourteenth Amendment rights of radio licensees for the following reason:

> The act in this respect is well within the regulatory power of Congress. The provisions of the act prescribed the only method by which order could be brought out of chaos and this form of interstate commerce saved from destruction. . . . Unregulated broadcasting would create a national nuisance, and the power of Congress extends to the adoption of all measures reasonably necessary for its prevention.

United States v. American Bond & Mortgage Co., 31 F.2d 448, 456 (N.D. Ill. 1929).

A. *The Economic Critique*

Since Coase's pathbreaking analysis,[18] many scholars have asserted that the physical scarcity doctrine crafted in *NBC* was logically false.[19] Simply because exclusive rights to spectrum are necessary for the efficient functioning of the broadcasting industry, it does not follow that government must either own or use its discretion to assign such rights.[20] Nor, certainly, does it call for government regulation of the content of programs broadcast. It would suffice that the time, place, and frequency coordinates of spectrum use be legally defined. Defining (and enforcing) such access rights, moreover, turns out to be nothing more than the property rights "traffic cop" function that government must undertake to deter anarchy in any market. Coase noted that the Court, by arguing that federal licensing of broadcasters was necessary to eliminate the interference threat endemic to common property,[21] mistakenly compacted two distinct functions—rights *definition* and rights *assignment*—into one.

The economics of this analysis are flawless. The argument's persuasiveness has attracted many efforts to fix this "mistake" in First Amendment law by showing that a *private* assignment mechanism is indeed workable for policing access to electromagnetic spectrum.[22] Regu-

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18. See Coase, supra note 5 (arguing that a private property system for allocating broadcast rights would be more efficient than the regulatory model). An even earlier analysis with similar insights, however, appears in Comment, "Public Interest" and the Market in Color Television Regulation, 18 U. Chi. L. Rev. 802 (1951).

19. Lee C. Bollinger describes *Red Lion*'s reasoning (borrowed from *NBC*) as possessing "devastating—even embarrassing—deficienc[ies]," most notably "the simple-minded and erroneous assertion that public regulation is the only allocation scheme that can avoid chaos in broadcasting." Lee C. Bollinger, Images of a Free Press 88–90 (1991).

20. Coase wrote:

> The Supreme Court [in *NBC*] appears to have assumed that it was impossible to use the pricing mechanism when dealing with a resource which was in limited supply. This is not true. Despite all the efforts of art dealers, the number of Rembrandts existing at a given time is limited; yet such paintings are commonly disposed of by auction. But the works of dead painters are not unique in being in fixed supply. If we take a broad enough view, the supply of all factors of production is seen to be fixed (the amount of land, the size of the population, etc.).

Coase, supra note 5, at 20.

21. The interference threat will reliably occur wherever valuable rights are ill-defined due to either a lack of legal structure or excessively high enforcement costs. In some situations, alternatively, the private market may well handle the property rights enforcement problem as well as or better than government police powers. It appears that spectrum rights, like many other goods (copyrights, trade names, water rights, etc.) are expensive to enforce without state-supplied legal institutions. An interesting institutional fact, however, is that the FCC largely relies on licensees to self-police bands allocated for exclusive use, and uses private frequency coordinators to police bands allocated for non-exclusive licenses. See National Telecomm. and Info. Admin., U.S. Dep't of Commerce, U.S. Spectrum Management Policy: Agenda for the Future 43 (1991).

22. See Arthur S. DeVany et al., A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic-Engineering Study, 21 Stan. L. Rev. 1499 (1969); Jora R. Minasian, Property Rights in Radiation: An Alternative Approach to Radio

lation of content is not required to solve the technical commons problem in airwave usage.[23] Proponents of such regimes appear to believe that the analytical errors of earlier generations may now be corrected by implementing more logically appealing regulatory structures and by auctioning off FCC licenses.[24] Indeed, while Congress gave up its decades-long resistance to auctions in 1993, it authorized the FCC to sell only nonbroadcast licenses. The $20 billion in auction receipts thus far obtained starkly shows that there are no "technical" barriers to assigning broadcasting rights by the price system.[25]

B. *The Technological Critique*

The second line of criticism of prevailing law, which has gathered considerable support, suggests that the communications marketplace has clearly changed since the current regime was constructed (or even since *Red Lion*). According to this view, the technical ability to exploit the electromagnetic spectrum has vastly increased in recent decades, with cable, satellite, and wireless cable (to name just three new product delivery sources) adding dramatically to viewer choice. Any once-critical scarcity problem appears to have been surmounted.[26] Similarly, powerful new communications systems have led some to herald the triumph of technology over traditional regulatory approaches.[27] This view has been em-

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Frequency Allocation, 18 J.L. & Econ. 221 (1975); Richard W. Stevens, Anarchy in the Skip Zone: A Proposal for Market Allocation of High Frequency Spectrum, 41 Fed. Comm. L.J. 43 (1988).

23. Supreme Court Justice William O. Douglas nicely explained why the technical reasons given by the Court in *Red Leon* were logically insufficient to justify content controls:

> Licensing is necessary for engineering reasons; the spectrum is limited and wavelengths must be assigned to avoid stations interfering with each other. The Commission has a duty to encourage a multitude of voices, but only in a limited way, *viz.*, by preventing monopolistic practices and by promoting technological developments that will open up new channels. But censorship or editing or the screening by Government of what licensees may broadcast goes against the grain of the First Amendment.

Columbia Broad. Sys. v. Democratic Nat'l Comm., 412 U.S. 94, 157–58 (1973) (Douglas, J., concurring) (footnotes omitted).

24. See Peter Passell, Managing the Airwaves for Productivity and Profit, N.Y. Times, Mar. 9, 1995, at D2. Revealing the faulty logical underpinnings of a legal regime, however, may not be enough to alter it—stripping the Emperor of his clothes may annoy the King, but will fail to change public policy.

25. See Thomas W. Hazlett, Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years? 50–60 (July 27–29, 1996) (Paper presented at the Conference on the Law and Economics of Property Rights to Radio Spectrum, Marconi Conference Center, on file with the Columbia Law Review).

26. See Powe, supra note 12, at 200–09; Mark S. Fowler & Daniel L. Brenner, A Marketplace Approach to Broadcast Regulation, 60 Tex. L. Rev. 207, 225 (1982); J. Gregory Sidak, Telecommunications in Jericho, 81 Cal. L. Rev. 1209, 1229–34 (1993) (book review).

27. Fiber optics seemed the rage in the early 1990s. Of late, however, wireless digital compression seems to have replaced fiber. See George Gilder, Think Waves, Not Wires, Forbes ASAP, June 5, 1995, at 124.

braced by the Speaker of the House of Representatives, Newt Gingrich (R-Ga.), who has advocated abolition of the FCC on the theory that the new digital and spread spectrum technology makes the agency obsolete.[28] Media "convergence" also demonstrates the effect of technology on the cogency of the physical scarcity doctrine. Not only are the electronic press conduits becoming more abundant, but they are converging as well, becoming seamlessly integrated with those of print and other media. Thus, as technological change has accelerated, regulatory distinctions between media have become less precise, undermining the rationale for distinct treatment of broadcasting.

C. *A Public Choice Analysis*

While the Economic Critique forcefully refutes the logic of the physical scarcity doctrine, and the Technological Critique amasses impressive marketplace evidence for its view, neither explains key determinants of the current policy regime. Hence, they do not squarely join the public policy debate. Physical scarcity and its ancillary justifications for content regulation must be understood as ad hoc rationalizations of policies adopted to achieve specific distributional goals, not to correct a market failure (tragedy of the commons), as has been asserted previously in both case law and the scholarly literature. Congress did not advance broadcast licensing in the "public interest" to remedy "chaos" or "physical scarcity" problems—problems that would be placed center stage by the U.S. Supreme Court long after the advent of radio legislation. Instead, Congress was motivated to institute regulation of a new technology that it correctly identified as a powerful source of news and information that could dangerously challenge existing political interests.

Congress's motivation in establishing a broadcast licensing scheme was not to further unregulated and constitutionally protected speech, but rather to assert control over the content of the material that might be broadcast. Since then, the driving force in federal licensing has been rational tripartite maximization: legislators maximize political support by arbitrating a rent-seeking competition for valuable licenses and by gaining editorial influence over broadcast material; incumbent broadcasters maximize profits by obtaining both free licenses and the erection of barriers barring new entrants, realizing significant license rents; and "public interest" lobbyists maximize utility in a politicized assignment process that yields the highest returns on their human capital. Hence, a classic rent-seeking competition forged the licensing regime for broadcasting in the 1920s, and has steadfastly maintained it ever since, due to the dominating vector of political support associated with the scheme. In the pages that follow, I will demonstrate just how this occurred.

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28. See Jeff Nesbit, Gingrich's "Cabinet" Puts FCC on Hit Lists, Wash. Times, Jan. 13, 1995, at B6.

III. The Genesis of Regulation

The support for this thesis begins with evidence suggesting that the historical rendition of the pre-regulation broadcasting market offered in both *NBC* and *Red Lion* was largely fanciful. A more accurate history of the early broadcasting period reveals that an orderly market was reshaped by political interests in order to yield a specified pattern of rents, and not to solve transmission interference problems.

In a previous paper, I presented detailed evidence indicating that major broadcasters, leaders in both the executive and legislative branches of the federal government, and, to a lesser extent, "public interest" advocates, combined politically to produce the Radio Act of 1927.[29] The motivating force behind the law was not the interference problem in broadcasting. That problem had been dealt with smoothly on a first-come, first-served exclusive rights rule, implemented by the U.S. Department of Commerce and in effect from 1920–1926. The real motivation behind the law was to address the more difficult question of "Who Should Control the Airwaves?"[30] The short story describing this episode proceeds as follows.

A. *Broadcasting Prior to the 1927 Radio Act: "Five Years of Orderly Development"*

Commercial radio broadcasting was launched in the United States on November 2, 1920, and began catching on as a business proposition in late 1921. By the end of 1922, there were over 550 broadcasters (see Figure 1), all confined to basically *one* frequency by the federal authorities. Separation by time and place, involving a difficult coordination of a new media, routinely kept transmissions from interfering with one another. Such divisions were supervised under the licensing function of the Commerce Department, often subject to agreements worked out voluntarily (sometimes entailing the exchange of money) between broadcasters. The assignment rule used by the Commerce Department was *priority-in-use*, a product of the regulatory authority invested in the Department by the Radio Act of 1912.[31] A new broadcaster could not interfere with an existing broadcaster, although time-sharing of a frequency was common.

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29. See Thomas W. Hazlett, The Rationality of U.S. Regulation of the Broadcast Spectrum, 33 J.L. & Econ. 133, 152–71 (1990).

30. This is how the ACLU's Morris Ernst appropriately put the question. See Morris L. Ernst, Who Should Control the Airwaves?, 122 The Nation 443, 443 (1926).

31. Act of Aug. 13, 1912, ch. 287, 37 Stat. 302 (1912) (repealed 1927). The 1912 Radio Act was crafted prior to the advent of commercial broadcasting and was drawn with only point-to-point radio transmissions in mind. It has been seen by most commentators, including this one, see Hazlett, supra note 29, at 135, as mandating open access to the radio spectrum, and thus potentially leading to chaos. This is questionable. While two federal courts found that the Secretary of Commerce was obligated to issue radio licenses to any applicant who met the statutory qualifications, see Hoover v. Intercity Radio Co., 286 F. 1003, 1006 (D.C. Cir. 1923); United States v. Zenith Radio Corp., 12 F.2d 614, 617 (N.D. Ill. 1926), the Act did allow the Secretary to issue licenses so as to "minimize

Figure 1. U.S. Radio Broadcasters
1921 - 1935

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the U.S., Part 2 (September 1975), p. 796.

The Department of Commerce expanded the AM broadcasting band in 1923 and again in 1924, establishing a range from 550 Kilocycles to 1500 Kilocycles, virtually the current U.S. AM dial. Preferential assignments were made to the most established broadcasters with the largest audiences, an extension of *priority-in-use* principles. Overall, the radio listening audience grew rapidly, and the quantity of radios sold increased steadily. Retailers proclaimed the 1924 holiday season, "Radio Christmas."

Property rights were secure enough, in fact, that transferability was respected, and stations sold for significant premia, reflecting the value of their broadcasting rights. Interference between radio broadcasters did, occasionally, appear, but when it did the law was available to provide a remedy. This can be seen in the rather sensational telegram sent to the Secretary of Commerce by the always provocative Reverend Aimee Semple McPherson, a Los Angeles broadcaster whose signal had drifted into taboo airspace:

> TO SECRETARY OF COMMERCE HERBERT HOOVER:
>
> PLEASE ORDER YOUR MINIONS OF SATAN TO LEAVE MY STATION ALONE. STOP. YOU CANNOT EXPECT THE ALMIGHTY TO ABIDE BY YOUR WAVE LENGTH NONSENSE. STOP. WHEN I OFFER MY PRAYERS TO HIM I MUST FIT INTO HIS RECEPTION. STOP. OPEN THE STATION AT ONCE. STOP.
>
> AIMEE SEMPLE MCPHERSON[32]

The historical account of the early radio broadcasting market, given by the Court in *NBC* and repeated in *Red Lion*[33] as the basis for broadcasting's unique regulatory treatment, is cast into serious doubt by the simple evidence in Figure 2, showing radio set sales, and households with radio sets, monotonically increasing year-by-year until 1926. Under the Court's pre-1927 "chaos" version, the predicted radio set sales profile would exhibit a significant upwards kink upon establishment of an orderly mar-

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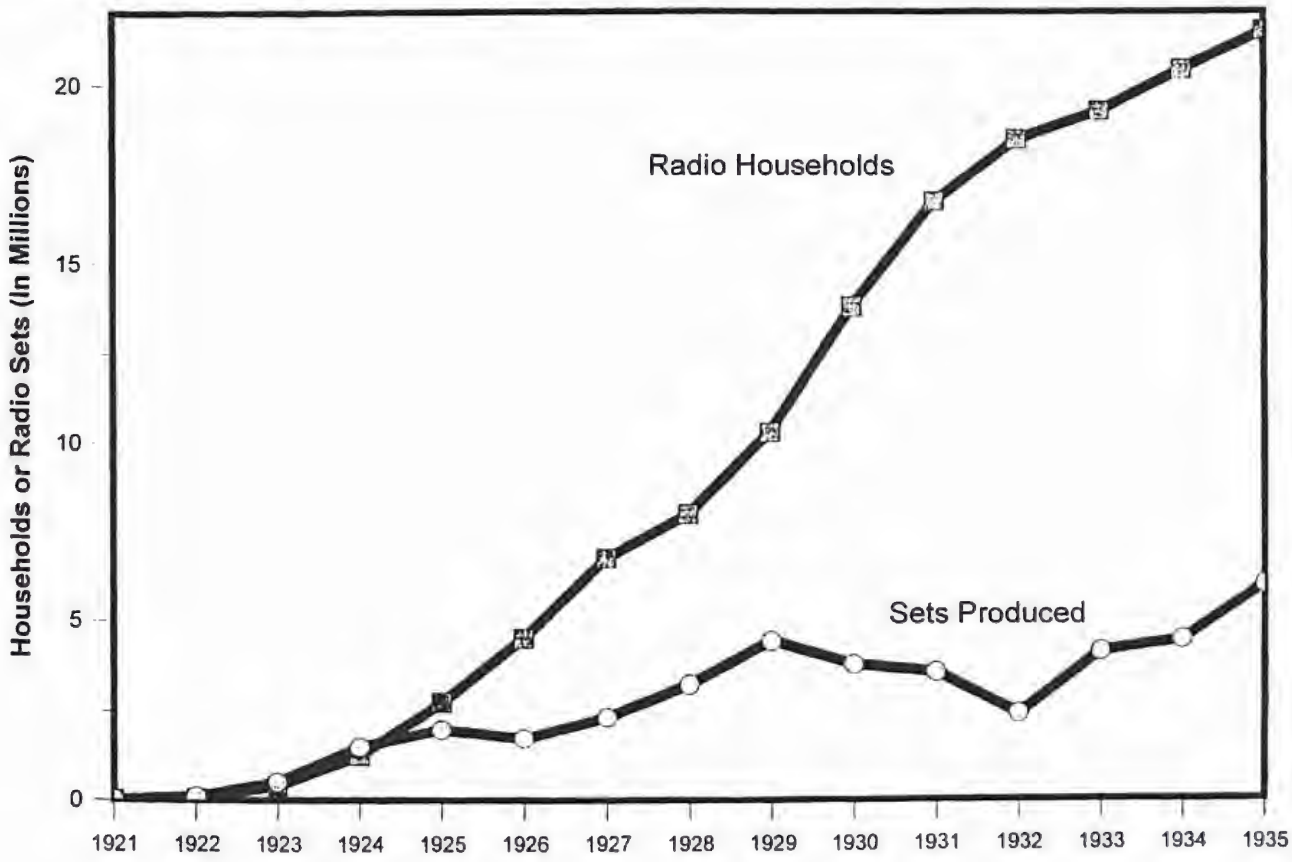
interference." § 4, 37 Stat. at 304. This authority was the basis for the 1921–1926 procedures followed by Commerce Department in employing priority-in-use. Conditioning new licenses such that entrants either coordinate shared frequency use with incumbents or limit access to virgin spectrum space was a policy entirely consistent with open access *and* minimizing interference.

32. William B. Ray, The Ups and Downs of Radio TV Regulation 126 (1990).

33. See supra text accompanying note 11.

Figure 2. U.S. Radio Households and Sets Produced
1921 - 1935



Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the U.S., Part 2 (September 1975), p. 796.

ket,[34] i.e. in 1927 (the year in which the Radio Act was signed into law).[35] Instead, radio sales rose steadily throughout the early radio years, with a downturn in 1926–1927.[36] This can clearly be explained by the creation of de facto property rights by the Department of Commerce on a priority-in-use basis, and the interruption of that system from July 1926 to February 1927, a time frame then commonly referred to as the period of the "'breakdown of the law.'"[37]

This period was brought on by a "wave-jumping" case invited by Secretary of Commerce Herbert Hoover, in which a federal district court ruled that the Secretary had neither the legal right to deny a broadcasting license, *nor* the ability to set place or hours of operation restrictions.[38] Contrarily, an earlier verdict had allowed the Secretary to set wavelength assignments so as to minimize interference.[39] On July 8, 1926, the Acting Attorney General of the United States, William Donovan, issued an opinion stating that the later decision was the correct interpretation of the law, and the following day the Commerce Department issued a statement declaring its allocations to be legally unenforceable. The decision by Hoover effectively abandoned the property rights system which had efficaciously solved the potential "commons" problem in radio. Chaos en-

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34. Precisely the same empirical test for discerning airwave chaos was employed by Congressman E.L. Davis (D-Tenn.), who in 1928 argued that federal regulators had shorted Southern consumers with respect to radio assignments:

> As a matter of fact, the people in the southern zone have manifested a remarkable interest in purchasing as many receiving sets as they have, in view of the intolerable conditions under which they have suffered. If accorded proper treatment, there will be a large and immediate increase in the purchase of receiving sets in the third zone. I have a letter from a radio dealer in my State, stating that radio reception is so bad that he does not sell one-fourth as many sets as he did a year or so ago; that the people are trying to sell their sets.

E.L. Davis, Will the Davis Amendment Bring Better Radio? Pro, 7 Cong. Dig. 268 (1928). Note that the worsening airwave conditions cited are said to occur following the alleged (pre-1927 Radio Act) period of chaos.

35. See Radio Act of 1927, ch. 169, 44 Stat. 1162 (1927) (repealed 1934).

36. The orderly development of the U.S. radio market is apparent not only in a time series examination of technology diffusion, but also in a cross-sectional analysis. Citing the "[g]overnment-controlled monopoly" prevailing for "any system of communications" in England, long-time journalist French Strother wrote in 1926 that the result was that "the per capita consumption of radio apparatus in Great Britain is incomparably less than in the United States." French Strother, Is There a Monopoly in Radio?, 9 Radio Broadcast 471, 473 (1926).

37. Louis G. Caldwell, Clearing the Ether's Traffic Jams, Nation's Business, Nov. 1929, at 33, 34. Louis G. Caldwell, the first General Counsel of the Federal Radio Commission, summarized the history of radio regulation in a 1929 article: "Looking at broadcasting alone, the first period might be described as 'before the deluge,' the second as 'after the deluge.' The deluge was 'the breakdown of the law,' lasting from July 9, 1926, to February 23, 1927." Id. at 34.

38. See United States v. Zenith Radio Corp., 12 F.2d 614, 617 (N.D. Ill. 1926).

39. See Hoover v. Intercity Radio Co., 286 F. 1003, 1007 (D.C. Cir. 1923).

sued from the ruling, as was predictable not only in hindsight,[40] but also as promised by Hoover and a host of contemporary commentators.[41]

Rather than "confusing" federal licensing under a public trusteeship standard with the necessary and *sufficient* enforcement of exclusive rights to spectrum, there was widespread understanding of the source chaos at the time of the 1927 Act. To wit, the official government explanation contained in the first annual report of the Federal Radio Commission:

> We have had about six years of radio broadcasting. It was in 1921 that the first station (KDKA) started operating,[42] and soon other stations followed. From 1922 to the middle of 1926 radio grew and grew in popularity, sales mounted, and a great new industry was in the making. Then something happened.
>
> In July, 1926, just 10 months ago, the Attorney General of the United States rendered his famous opinion that the Secretary of Commerce, under the radio law of 1912, was without power to control the broadcasting situation or to assign wave lengths. Thus, *after five years of orderly development*, control was off. Beginning with August, 1926, anarchy reigned in the ether.
>
> As the result many stations jumped without restraint to new wave lengths which suited them better, regardless of the interference which they might thus be causing to other stations. Proper separation between established stations was destroyed by other stations coming in and camping in the middle of any open spaces they could find, each interloper thus impairing reception of three stations—his own and two others.[43]

The solution created by the new Commission was to order established broadcasters to return to previously held assignments (i.e., pre-breakdown), and to expropriate new entrants.[44] Two proposals to expand the number of broadcast frequencies so as to accommodate all then-existing broadcasters were instantly, and emphatically, rejected by the Federal Radio Commission. One policy offered would have accommodated additional radio broadcasts by enlarging the commercial broadcasting band from 1500 Kilocycles to 2000 Kilocycles; the other by reducing channel separations from 10 Kilocycles to 7 Kilocycles. Radio broadcast interests bitterly opposed either solution to excess demand for spectrum access, and the idea of eliminating interference via supply expansion was dropped with finality.[45] The result was a classic regulatory

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40. See Coase, supra note 5, at 5.

41. See Hazlett, supra note 29, at 139–42.

42. Actually, KDKA began broadcasting in 1920. It was not licensed as a radio broadcaster, however, until the creation of such a Commerce Department license category in September 1921.

43. 1927 Fed. Radio Comm'n Ann. Rep. 10–11 (emphasis added) (quoting Commissioner O.H. Caldwell, of New York, Speech (June 11, 1927)).

44. See Hazlett, supra note 29, at 35 ("specific interest win in the legislative process because of their representation within the political process").

45. The Federal Radio Commission noted that "[u]nited opposition to widening the broadcasting band in order to accommodate more stations was expressed at the hearings

capture, creating significant industry rents that were shared with political constituencies in proportion to their effective influence over policy.[46]

B. *The Demand for Political Control in the 1920s Radio Debate: Entering the "Twilight Zone"*

Numerous scholars, finding the *Red Lion* physical scarcity logic uncompelling, have argued that the Court's deferential attitude towards regulatory authority sprang from the view that the electronic media are just not like the hard-news media of print journalism.[47] Whatever the understanding of jurists who later delineated the applicable constitutional law, this description of congressional intent in crafting licensing legislation is easily revealed to be false. Indeed, the political demand for regulation of radio from nonindustry sources arose precisely because radio was instantly identified as a powerful medium of expression.[48] This fact adds a different gloss on the modern interpretation, which implies that analytical error (confusion over property rights), and ignorance as to future market events (i.e., abundance replacing scarcity), were the major components fueling the demand for licensing of the electronic press.

The common assertion in the contemporary legal literature that radio regulation was established before it was realized how important and influential electronic communications would become suggests that the tension between public interest regulation and free speech was not initially appreciated. "First [A]mendment issues raised by the original proposals for government control may not have come to the fore because the potential importance of broadcasting as a speech medium was not fully recognized at the time."[49] Another modern commentator writes: "At the outset, radio was perceived primarily not as a medium for speech, but as a device to aid ships at sea. . . . No substantial body of thought conceived of radio or television in their infancy, as a new form of newspaper."[50]

Senator Clarence C. Dill (D-Wash.), the author of both the 1927 Radio Act and the 1934 Communications Act, expressed the reverse viewpoint, however, by acknowledging that the courts would have to deal with First Amendment conflicts embedded within his legislation. While both the 1927 and 1934 Acts have clauses prohibiting censorship, they appear to require censorship in their licensing provisions. Wrote Dill:

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by representatives of the radio art, science, and industry. . . . Stout opposition was registered also against reducing the frequency separation between channels from 10 to 7 kilocycles . . . ." 1927 Fed. Radio Comm'n Ann. Rep. at 3.

46. See Thomas W. Gilligan et al., Regulation and the Theory of Legislative Choice: The Interstate Commerce Act of 1887, 32 J.L. & Econ. 35, 39–45 (1989).

47. See, e.g., Pool, supra note 12, at 142; Powe, supra note 12, at 39–45.

48. See, e.g., James C. Young, Is the Radio Newspaper Next?, 7 Radio Broadcast 576, 576 (1925). ("The future of the press lies in the air. Radio represents the one channel of news expansion not already developed to the full.").

49. Lipsky, supra note 12, at 566 n.12.

50. Monroe E. Price, Congress, Free Speech, and Cable Legislation: An Introduction, 8 Cardozo Arts & Ent. L.J. 225, 230 (1990).

> The provision which forbids the Commission to censor radio programs does not prevent the Commission from determining whether or not a station's programs are in the public interest. The extent of the 'twilight zone' between censorship and the refusal to renew a station license because of the service rendered, is undetermined.[51]

Moreover, Dill was crystal clear as to why government regulation was necessary:

> Congress has good reason for this jealousy as to the control of radio. Nobody can even imagine what the use of radio may some day mean to the human family. When Marconi first sent radio signals across the English channel and even after he sent them across the Atlantic, the most fantastic imagination could not foresee the marvelous programs of music encircling the earth or literally all of the peoples of the world being able to listen to the speech of a king or a president. Nor can any one even now dream of the possibilities of television . . . .[52]

This was the state of the debate in the 1920s: a hot public discussion over an emerging market of immense, if unpredictable, social import. RCA's David Sarnoff touted the new medium as "the bar at which great causes will be pleaded for the verdict of public opinion."[53] According to one recent historical account,

> radio was seen as a new kind of public forum. It would provide for the nation what the New England Town Meeting provided the small isolated communities of early America. Radio had the advantage over the newspaper, moreover, because it reached the illiterate as well as the literate, the comic strip readers as well as the readers of the editorial page.[54]

And so the debate over regulatory response to the new media, rather than underestimating the influence of radio, was driven by respect for its immense significance: "many people of the 1920s believed that control of the airwaves had political consequences for the future of democracy."[55]

C. *The Immediate Rise of Radio Censorship*

The birth of commercial broadcasting had an instant involvement with politics, as Westinghouse initiated the first continuous broadcasting station, KDKA in Pittsburgh, to transmit presidential election returns on November 2, 1920. Similarly, the party conventions of 1924 were

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51. Clarence C. Dill, Radio Law 93 (1938) (citation omitted).

52. Id. at 127.

53. David Sarnoff, Uncensored and Uncontrolled, 119 The Nation 90, 90 (1924).

54. Mary S. Mander, The Public Debate About Broadcasting in the Twenties: An Interpretive History, 28 J. Broadcasting 167, 183–84 (1984) (citations omitted).

55. Id. at 184.

landmarks for broadcasters, who eagerly exploited the high profile news events to build radio audiences across the country. Concern instantly arose over the political ramifications of specific radio programs, and was expressed on both sides of the market: political actors were quick to intimidate, and radio producers were quick to self-regulate.[56]

Revealingly, radio coverage of the 1924 Democratic Convention proved controversial, as the Party distrusted radio reporters to provide sufficiently favorable news to the public.[57] It is interesting that the Republicans were not similarly nervous; their Party controlled the licensing process and had more subtle means of control at its disposal. Moreover, the incumbent party had proven its influence when earlier that year it cowed a New York radio station from airing a speech critical of Secretary of State Charles Evans Hughes, who had previously delivered a major policy address on the station.[58]

Censorship involved specific issues and stances taken by radio personalities, including the advocacy of property rights in water,[59] birth control,[60] and evolution.[61] Stations were encouraged by the political explosiveness of controversial programming to stick to safer fare, such as music.[62] American Telephone & Telegraph specifically eschewed programming its own broadcast stations, preferring to operate on a common carrier basis, so as to forego anticipated problems with the authorities. As a regulated utility, executives believed that the corporate exposure to penalties, in the form of denied rate increases and the like, was significant, and sought to remove themselves from any such liability that "editorial troubles" might create.[63]

The creation of the first radio network, the National Broadcasting Company (NBC), is noteworthy for the very politic manner in which it organized itself. While newspapers of the era were openly partisan, radio network organizer David Sarnoff methodically composed an advisory board of prominent citizens representing a wide spectrum of opinion. Although Sarnoff had explicitly declared that the new medium should enjoy the same legal status as newspapers—"[t]he same principles that

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56. Numerous instances of censorship appear in the historical accounts of Eric Barnouw, Ithiel de Sola Pool, and Philip Rosen. See Eric Barnouw, A Tower in Babel 87, 102, 139–41, 197–98 (1966); Pool, supra note 12, at 119–29 (recounting, among other examples of censorship, a Newark radio station that cut off speakers in mid-sentence if their material—including that related to birth control, prostitution, and cigarettes—"was deemed unfit for human ears") (quoted material at 119); Philip T. Rosen, The Modern Stentors: Radio Broadcasters and the Federal Government, 1920–1934, 138–42 (1980).

57. Democratic censorship efforts are detailed in Barnouw, supra note 56, at 149–50.

58. See id. at 139–40.

59. See Pool, supra note 12, at 120.

60. See id. at 119.

61. An early congressional measure to outlaw the advocacy of the theory of evolution (on radio) was voted down. See Barnouw, supra note 56, at 197.

62. See id. at 141.

63. Id. at 186.

apply to the freedom of the press should be made to apply" to radio[64]—the careful political balancing by NBC advisors was an attempt to preempt anticipated calls for censorship. Indeed, the choice for chairman of the Radio Corporation of America was itself largely motivated by the need for political connections to preempt government control.[65]

D. *Herbert Hoover as Political Entrepreneur*

The political slant of the Department of Commerce during the early days of radio was obvious, although the limitations that priority-in-use rules placed on regulatory discretion were apparent as well. The ability of the Department to use its rights-enforcement apparatus to influence program content was truncated by the lack of statutory authority for any such action.

The political influence of radio was obvious to Secretary Hoover, who (it is now safe to say) had his eyes set on higher political office, and who saw clearly that even the slightest ability to monitor the performance of radio broadcasters would be a capital asset. Indeed, cynical comments were made in the trade and popular press during the middle 1920s, associating Hoover's interest in radio with his presidential ambitions. Without question, Hoover sought to establish political control over radio in the Department of Commerce early on in the Harding Administration (wresting it away from the Navy Department and other governmental interests after a rough political skirmish), and immediately embarked on a legislative campaign (via his ally, Congressman White of Maine) to procure a mandate to regulate broadcasting according to the "public interest."

An accomplished engineer and political operative, Herbert Hoover comprehended the subtleties of the emerging radio market. He always considered it a great organ of the press. As his Memoirs summed up: "I was early impressed with three things [concerning radio]: first, the immense importance of the spoken radio; second, the urgency of placing the new channels of communication under public control; and, third, the difficulty of devising such control in a new art."[66]

Also pronounced was Hoover's belief that the outbreak of airwave chaos during the "breakdown" period was a welcome opportunity for achieving greater regulatory discretion over radio licenses.[67] While making precisely the same paeans to free speech that were customary then and now, Hoover revealed the driving force for such control—not for

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64. Sarnoff, supra note 53, at 90.

65. In January 1923, the firm specifically searched for an individual whose mainstream politics (and "Americanism") were unassailable, settling on General Harbord, a super-patriot who was formerly General Pershing's Chief of Staff. See Barnouw, supra note 56, at 124.

66. Herbert Hoover, The Memoirs of Herbert Hoover: The Cabinet and the Presidency, 1920–1933, at 139 (1951).

67. See Hazlett, supra note 29, at 158.

perfunctory traffic cop functions (which, in any event, had worked in the pre-breakdown period without a "public interest" licensing standard), but to exercise influence over what was said and who was to be allowed to say it:

> It seems to me we have in this development of governmental relations two distinct problems. First, is a question of traffic control. This must be a Federal responsibility. . . . This is an administrative job, and for good administration must lie in a single responsibility.
>
> The second question is the determination of who shall use the traffic channels and under what conditions. This is a very large discretionary or a semijudicial function which should not devolve entirely upon any single official and is, I believe, a matter in which each local community should have a large voice—should in some fashion participate in a determination of who should use the channels available for broadcasting in that locality.[68]

E. *The Partisan Battle Over the Licensing Authority Established in the Radio Act*

The intensity with which rival factions fought to establish control over the licensing authority reflects the early recognition by policymakers that broadcasting would be extremely influential. "Between 1921 and 1927, more than fifteen bills had been introduced in both houses to 'regulate radio communications' and several more to amend the 1912 act to meet the new situation; but these died in committees, most often without hearings."[69] By mid-1926, however, both legislative bodies had passed bills. The House version, drafted by Hoover's Commerce Department, allowed the Secretary to employ a "public interest" standard in selecting licensees. The Senate held out for an independent regulatory commission whose members would require Senate confirmation, a strategy quite similar to that pursued in crafting the Interstate Commerce Act.[70] While Hoover argued for his plan on the grounds of governmental efficiency—Coolidge and Hoover attacked the creation of new independent agencies as a wasteful proliferation of government—this claim fooled no one in Congress. Instead, Hoover was attacked by Representative E.L. Davis who accused him of attempting a bureaucratic power grab.

This argument proved persuasive to Hoover's Republican opponents in the Senate who, suspecting that the Secretary of Commerce would stra-

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68. Radio Control: Hearings on S.1 and S.1754 Before the Senate Comm. on Interstate Commerce, 69th Cong. 57 (1926) (statement of Herbert Hoover, Secretary of Commerce).

69. Carl J. Friedrich & Evelyn Sternberg, Congress and the Control of Radio-Broadcasting, I, 37 Am. Pol. Sci. Rev. 797, 799 (1943).

70. See generally Gilligan et al., supra note 46, at 46, 48, 52 (describing the legislative disagreement over an appropriate enforcement mechanism for the Interstate Commerce Act, and ultimate agreement on a commission).

tegically use such power to run for President, backed the Dill bill's independent agency approach. This finally received the endorsement of Congressman White, thus breaking the legislative deadlock in January 1927. Hence, the Federal Radio Commission was born out of legislative squabbling directly caused by the politically important nature of radio. In fact, the agency was specifically removed from the Department of Commerce out of fear that Hoover would use his leverage over radio broadcasters to gain favorable treatment from the Commission in the upcoming 1928 presidential campaign.[71]

F. *Senator Dill's Explanation of the 1927 Radio Act*

The regulatory path chosen by Congress in the 1927 Radio Act, and repeated in the 1934 Communications Act,[72] specifically overruled private property rights to radio spectrum, which were then emerging not only de facto (according to the rights definition and enforcement rules used by the Department of Commerce) but de jure. The key concern of Congress in legislating the system of radio licensing regulation we have today was, in fact, to prevent the courts from applying common law principles that would grant radio broadcasters legally enforceable property rights. This was certainly the view of Senator C.C. Dill.

Dill expressed this perspective in a book he wrote, upon retiring from the U.S. Senate, in which he clearly laid out the rationale for radio regulation.[73] First, he noted that traditional common law forms were capable of coordinating the marketplace. Second, he stressed congressional concern that these legal forms were already establishing property rights to radio frequencies. Third, Congress acted in order to nip this development in the bud. Fourth, Congress was motivated by a desire to control this highly influential medium of expression.[74]

Dill believed that the original radio station broadcasters were protected in their frequency assignments by a "long established principle of law that if a citizen openly and adversely possesses and uses property for a long period of time without opposition, or without contest, he acquires title by adverse possession."[75] Dill called this "property by right of user."[76] He described how these rights were being asserted by radio broadcasters and recognized in an important common law decision

71. See Rosen, supra note 56, at 10–11, 84, 95–96.

72. The law governing broadcast licensing was crafted in the Radio Act of 1927, ch. 169, 44 Stat. 1162 (repealed 1934), which was repeated virtually verbatim in the Communications Act of 1934, 47 U.S.C. § 301 (1994). Prior to the passage of these laws, telephony had been regulated by the Interstate Commerce Commission. See Mann-Elkins Act, ch. 309, § 7, 36 Stat. 539, 544 (1910) (repealed 1913).

73. See Dill, supra note 51, at 77–80.

74. See id.

75. Id. at 78.

76. Id. This is analogous to priority-in-use. Other terms expressing similar common law principles included squatter's sovereignty, right of first appropriation, pioneering rights, and homesteaded rights.

granting a private property right to a radio broadcaster who wished to protect its airspace from interference.[77] Congressional intent behind the Radio Act of 1927 is described in a section of Dill's book entitled, "Why Congress Became Aroused on Subject":

> The development of these claims of vested rights in radio frequencies had caused many members of Congress to fear that this one and only remaining public domain in the form of free radio communication might soon be lost unless Congress protected it by legislation. It caused renewed demand for the assertion of full sovereignty over radio by Congress.[78]

The response of Congress to the burgeoning legal reality of private (or vested) rights to frequencies was to legislate away any such propertied interests, first in a resolution, passed in December 1926, that all broadcasters must waive any and all vested rights, and then in the Radio Act, passed two months later, which likewise included a mandated waiver of licensee property rights. As detailed in a law review article some years later:

> [The] proposed radio legislation in the nineteen twenties required a licensee to sign a waiver indicating that "there shall be no vested property right in the license issued for such station or in the frequencies or wave lengths authorized to be used thereon." . . .
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> . . . .
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> . . . The Commission, fearful that licensees would assert property interests in their coverage to the listening public, has inserted elaborate provisions in application forms precluding the assertion of any such right.[79]

The concern over vested rights in radio frequencies was widespread. In noting that Congress explicitly rejected an amendment that would have paid existing radio broadcasters monetary compensation for frequencies taken away under enactment of "public interest" licensing, Dill notes that the measure (and its rejection) "shows that the purpose of Congress from the beginning of consideration of legislation concerning broadcasting was to prevent private ownership of wave lengths or vested rights of any kind in the use of radio transmitting apparatus."[80]

The system of regulation adopted was to encourage private investment capital as an expedient means of economic development, but to maintain federal oversight of both property rights (the traffic cop function) and broadcast content (the censorship function). Dill's book sums up the result under the section, "The Alpha and Omega of Radio Law":

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77. See Tribune Co. v. Oak Leaves Broad. Station, Inc. (Cir. Ct., Cook County, Ill. 1926), reprinted in 68 Cong. Rec. 216 (1926).

78. Dill, supra note 51, at 80.

79. Paul M. Segal & Harry P. Warner, "Ownership" of Broadcasting "Frequencies": A Review, 19 Rocky Mtn. L. Rev. 111, 113, 121 (1947) (citation omitted).

80. Dill, supra note 51, at 81.

> Instead of establishing government owned and government operated radio stations as most other great nations have done, Congress has adopted a policy of permitting private individuals to own and operate radio stations. But Congress provided that these privately owned and privately operated radio stations should be subject to a system of government regulation. Congress desired to secure the use of private funds and, most of all, the benefit of individual initiative for the more rapid development of the radio art, but all of this development to be kept under government control. The means and method of administering and enforcing this system of government control is the radio license.[81]

IV. The Vacuity of "Physical Scarcity"

While the view has developed that the physical scarcity doctrine in *NBC* and *Red Lion* is an analytical error, the conventional wisdom ascribes the confusion to a technological sophistication of electronic communications media that appeared relatively obscure to older jurists.[82] Yet, it is difficult to regard the physical scarcity doctrine as meaning anything at all. There is the economic argument of Coase, well-taken, that scarcity pervades all economic goods, and that, for example, while the number of Renoir paintings may be finite, the market routinely auctions them off. Conversely, airwaves cannot be thought of as physically scarce in this manner, because frequencies are divisible (or expandable) in ways that works of art are not. The spectrum can be mined more intensively, using less separation between frequencies with more (or higher quality) broadcast transmitters and better receivers, or more extensively, deploying more sophisticated sending and receiving equipment so as to exploit progressively higher or lower wavelengths.[83]

Since the very early days of radio communications, capacity has been seen as a systematic trade-off between bandwidth and technology. As a paper written to commemorate the centennial of Guglielmo Marconi's invention (or discovery) of wireless radio details:

> One of the very first questions asked of young Marconi about his nascent technology was whether it would ever be possible to operate more than one transmitter at a time. Marconi's key British patent No. 7,777 was a milestone as it taught the use of resonant

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81. Id. at 127.

82. See Pool, supra note 12, at 141–42; Powe, supra note 12, at 44 ("The justices deciding the case in 1969 were all raised during the era of the crystal set; many were born before the invention of the vacuum tube.").

83. See Bruce M. Owen, Different Media, Differing Treatment?, *in* Free but Regulated: Conflicting Traditions in Media Law 35, 39 (Daniel L. Brenner & William L. Rivers eds., 1982).

> tuning to permit multiple transmitters to simultaneously occupy the radio spectrum.[84]

Of course, advances in the state of the art brings progressively more radio spectrum into productive use: today there is "over 30,000 times more spectrum at our disposal than in Marconi's day."[85] While this relationship between man-made tools and the radio spectrum resource can clearly be seen over time, it is true at any moment in time as well. The number of frequencies assigned for use by various parties always involves cognition of the relevant range of possibilities—a range that is limited by economic cost, not by fixed physical proportions. This was seen and acknowledged explicitly by informed commentators at just the moment that the Radio Act of 1927 was being crafted. As an article in *Science* summarized the broadcasting situation:

> We have at the present time only 89 wave lengths and Canada uses five of these, leaving the United States 84. . . .
>
> Increasing the number of wave lengths is possible, but would involve difficulties, [W.D. Terrell, chief of the Department of Commerce's Radio Division] explained. Radio receiving apparatus is now made to cover the broadcasting band from 200 meters to 545. . . .
>
> If broadcasting stations were allotted wave lengths outside the present range radio apparatus would have to be altered to permit reception.[86]

The idea of a fixed number of frequencies to be awarded to a fixed number of speakers simply begs the question of unit definition, as well as the question regarding how much of the spectrum is to be used for radio broadcasting.[87] Reduced to its simplest form, the proponent of "physical scarcity" must be asked to name the number of *technically* available frequencies. Any number less than infinity can be increased by further subdivision of time, power, or bandwidth coordinates.[88]

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84. Paul Baran, Is the UHF Frequency Shortage a Self Made Problem? 1 (June 23, 1995) (Paper given to the Marconi Centennial Symposium, Bologna, Italy, on file with the Columbia Law Review).

85. Id.

86. Science Service, Science News, Science, Dec. 17, 1926, at x, xiv.

87. The *Red Lion* opinion itself expressed awareness of the inherently arbitrary definition of physical scarcity. As the court pointed out the possibility of time restrictions for broadcasting on any given frequency:

> Rather than confer frequency monopolies on a relatively small number of licensees, in a Nation of 200,000,000, the Government could surely have decreed that each frequency should be shared among all or some of those who wish to use it, each being assigned a portion of the broadcast day or the broadcast week.

Red Lion Broad. Co. v. FCC, 395 U.S. 367, 390–91 (1969). The same, obviously, is true with respect to geographical and frequency divisions.

88. Of course, the cellular architecture now used to deliver various wireless services makes the power/bandwidth tradeoffs ever more visible. Cellular systems "create" additional communications capacity by reusing frequencies cell to cell. (This is made possible by powering transmissions at sufficiently low levels as to allow nearby cells interference-free reception.) By continued cell splitting, such a system adds capacity as

Decisionmakers in the early days of radio could not have been unaware of such considerations; indeed, the first substantive Federal Radio Commission ruling in 1927 (as noted above) rejected two suggestions to increase the number of available frequencies, one by increasing the radio band, the other by reducing bandwidth per assigned license. The range of possibilities was explicitly discussed and, while anticompetitive arguments put forth by radio broadcasters were persuasive beyond their social value,[89] the rules adopted were justified not on grounds of physical scarcity (which would have been incomprehensible) but on distributional (fairness) or economic efficiency criteria. In fact, the regulation of radio waves began with a clear recognition that new station assignments could be created by altering the bandwidth, frequency, power, location, and time coordinates. This understanding is fundamentally at odds with the notion that radio spectrum constitutes a fixed, or "physically scarce," resource.

Yet, an even more fundamental way of addressing physical scarcity could be advanced. Suppose one just cannot grasp the notion that intensive and extensive margins exist for further exploitation over all ranges in radio, or that power and time coordinates can be adjusted to create additional frequency "slots." Physical scarcity is still inexplicable.

This can be deduced from the consideration of cable delivery of radio waves. We are today familiar with cable television transmission of video signals over coaxial copper wires. Such cables are just "spectrum in a tube," as they have been dubbed by engineers.[90] Whatever limits in bandwidth are thought to exist in the airwaves cannot lead to a *physical* scarcity constraint due to the *physical* possibility of delivering precisely the same (non-interfering) signals over a wire between any two points served via wireless. Furthermore, this is not a miracle solution provided by modern technology: U.S. consumers were receiving radio service via cable as

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dictated by costs and demand. Interestingly, cellular proposals began to appear in telephone system proposals as long ago as the late 1940s. See George Calhoun, Digital Cellular Radio 39 (1988).

89. The primary argument advanced by commercial broadcasting interests was that consumers would be hurt by any enlargement of the AM band because it would render existing equipment obsolete. In fact, enlargement of the AM band would have allowed all existing radios to access interference-free broadcasts, and allowed purchasers of new sets to have the choice of selecting a model delivering a broader range of stations. Simply truncating station competition and limiting consumer choice to the existing band, was unambiguously inferior for consumers. But it was trumpeted by broadcasters and repeated in the public debate by non-industry sources.

90. Fiber optic cables used today are "just high-frequency radio (red-colored light) in a glass conduit." Howard Shelanski & Peter Huber, The Attributes and Administrative Creation of Property Rights in Spectrum 4 n.8 (Sept. 1996) (Paper presented at the Conference on the Law and Economics of Property Rights to Radio Spectrum, Marconi Conference Center, on file with the Columbia Law Review).

early as 1923,[91] and AT&T first considered transmitting radio signals in 1919 not via airwaves, but by wire.[92]

The ability to substitute wired frequencies for wireless spectrum space should be self-evident today, when consumers and businesses choose daily between the rival forms of communications transmissions—for example, when deciding whether to use a TV antenna or satellite dish versus a cable TV hook-up, or placing a telephone call via a landline versus a cellphone (or cordless phone). Stated bluntly, the *technical* possibility of creating additional frequency space via wires renders the physical scarcity doctrine meaningless. This conclusion is legally inescapable in that the federal courts have rejected the physical scarcity doctrine for cable television transmission. Cables are not finite like the airwaves, goes the logic. Yet, they can deliver precisely the same range of frequencies, and function as technical substitutes. Since "physical scarcity" denies the relevance of the economic (i.e., cost-based) approach to scarcity, the fact that one medium is more efficient in a given context is beside the point. The ability to replicate a "physically scarce" technology with "non-physically scarce" conduits leaves the former concept an empty box.

Ironically, the absolute lack of content in the physical scarcity *concept* has helped to enable the physical scarcity *doctrine* to live a long and healthy life. The criticism that the doctrine has repeatedly invoked inevitably focuses on the relative lack of scarcity—indeed, a relative abundance—which the electronic media increasingly exhibit when compared to the traditional print press. This line of attack became acute when, in 1974, *Tornillo* established that the *Miami Herald* newspaper was entitled to sweeping First Amendment protections regardless of its market dominance or political influence. This came only five years after the *Red Lion* verdict put the Supreme Court on record as justifying FCC rules requiring (unpaid) right-of-reply over a tiny, daytime-only radio station.

The emptiness of physical scarcity as a concept, however, has rendered empirical challenge moot. It specifies something distinct from *economic* scarcity, the only sense in which we might meaningfully discuss scarcity, and simply asserts a state of nature. Since this assertion itself lacks substance, empirical falsification becomes quite impossible. This has led to apparent frustrations on the part of many expert commentators. The late Ithiel de Sola Pool observed that the *Red Lion* Court's finding that "scarcity is not entirely a thing of the past" compelled the Court to characterize "scarcity as a continuing objective fact."[93] This was curious to Pool, in that, "[b]y the time of [*Red Lion*] it was technically possible to provide as many channels on cable television as consumers would pay for. With cable, the limitations on spectrum are gone."[94] Yet, in that physical

91. See Barnouw, supra note 56, at 154.

92. See id. at 106.

93. Pool, supra note 12, at 142.

94. Id. As noted above, the availability of cable actually preceded the 1927 Radio Act. See supra text accompanying notes 91–92.

scarcity admits to no coherent definition, the "objective" facts of the marketplace will not overcome the unique property alleged for spectrum. There is, in short, no way to disprove a logical cipher. This forms the impressive legal contribution of the doctrine. In Pool's apt description: "The notion that nature itself inexorably required the selective licensing of broadcasters has persisted to the present. It is the core of the 1969 [*Red Lion*] decision."[95]

V. The "Rights of the Listener" and "Diversity of Expression"

> As a matter of history it should be stated that at each of the four National Radio Conferences called, and presided over, by President Hoover when Secretary of Commerce, emphasized the interest of the listening public as the paramount consideration in the regulation of broadcasting.[96]

The origins of radio regulation provide interesting vintages for the development of two doctrines used to buttress the physical scarcity analysis and to justify government regulation of broadcast speech. These spring from the following idea: As new technology takes us beyond the traditional forms of communication known to the Founding Fathers, the First Amendment's harshly libertarian stricture, "Congress shall make no law . . . abridging the freedom of speech, or of the press," must be replaced by affirmative governmental obligations to advance the *underlying values* of free speech and press. Rather than delimiting the sphere of state action in regard to the broadcast press, the Constitution actually calls for the governmental promotion of, (1) the *rights of listeners*, which should overrule those of speakers;[97] and, (2) a *diversity of voices*, such that various viewpoints may be heard.[98]

Revealingly, this line of argument was actually concocted by Herbert Hoover and the broadcasting interests as early as 1922. Beginning with the first of the annual Radio Conferences sponsored by the Department of Commerce, the major broadcasters adopted yearly resolutions requesting federal licensing according to "public interest, convenience or necessity." From the first, this proposed regime was justified by Hoover, Sarnoff, and the Conference resolutions as demanded by the rights of the listening public.[99]

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95. Pool, supra note 12, at 142.

96. Louis G. Caldwell, The Standard of Public Interest, Convenience or Necessity as Used in the Radio Act of 1927, 1 Air L. Rev. 295, 324 (1930). Caldwell was the first General Counsel of the Federal Radio Commission. The National Radio Conferences were dominated by the major commercial radio broadcasting companies.

97. "It is the right of the viewers and listeners, not the right of the broadcasters, which is paramount." Id. at 390.

98. "There is no sanctuary in the First Amendment for unlimited private censorship operating in a medium not open to all." Red Lion Broad. Co. v. FCC, 395 U.S. 367, 392 (1969).

99. See Barnouw, supra note 56, at 95; Hazlett, supra note 29, at 152–53, 157.

Senator Dill thought this quite significant, and noted in his book that "the broadcasters themselves suggested the inclusion of the words 'public interest' in the law as a basis for granting licenses."[100] Dill was quite correct, in that the objective of broadcasters in lobbying for licensing legislation was to exclude new entrants while maintaining existing frequency rights. While the industry already believed it possessed vested interests in airwave access under existing common law, the same legal principles by which they had established tenure could be utilized to expand broadcasting via homesteading of new frequency bands by entrants. It was correctly augured that the public interest standard would create a constitutional basis for legally denying such entry.

But the switch to a new property rights regime entailed some risk: existing licensees, under a new (public interest) standard, might lose standing. Here is where the "rights of the listeners" became doubly important: the justification for grandfathering existing licensees was that they delivered important service to the public. Hence, the language of the Fourth National Radio Conference, convened by Hoover's Department of Commerce and dominated by commercial broadcasting interests: "'That public interest as represented by service to the listener shall be the basis for the broadcasting privilege.'"[101]

A three-sided coalition lobbied for the 1927 Radio Act, with each seeking government benefits (i.e., rents) in self-interested fashion. The bargain executed under the public interest standard gave major broadcasters de facto property rights, which they could have obtained (at a litigation cost) at common law, *and* barriers to new entry, which they could not have. Broadcast regulators, including Congress and the Executive Branch, became vested in a regulatory oversight role that allowed them to exercise some jurisdiction over valuable license assignments and some influence over program content—a position they were not surprisingly eager to seize. Most interesting, perhaps, is that advocates for "the public interest" (non-profit broadcasters such as universities, churches, municipalities, labor unions, as well as the American Civil Liberties Union) were also vocal supporters of the licensing scheme.

We now know the ironic end of the story. Non-profit broadcasting licenses were largely extinguished by the Federal Radio Commission by the early 1930s.[102] With the advantage of hindsight, we can deduce either an agency problem existing between the constituents of such non-profit groups and their appointed lobbyists, or a serious case of miscalculation. The former is the more plausible: because non-profit lobbyists rationally perceive federal licensing as an institution affording them a higher return on their human capital, such agents will strongly favor pub-

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100. Dill, supra note 51, at 89.

101. Id. (quoting National Assoc. of Broadcasters, Resolutions of Fourth National Radio Conference (1925)).

102. See Robert W. McChesney, Telecommunications, Mass Media, and Democracy 30–37, 254–55 (1994).

lic trusteeship for self-interested reasons. In this sense, the failure of such regulation to achieve its ostensible goals will only raise the demand for non-profit group advocates.[103]

Whatever the source for the enthusiasm of public interest advocates for federal regulation of content, it was abundant, and it appears to have overwhelmed competing concerns, such as a fear of government censorship. Indeed, the single most outspoken public interest advocate on this issue, Morris Ernst of the ACLU, adamantly endorsed far-reaching state monitoring of broadcast speech:

> All records of broadcasting stations should be kept on forms prescribed by the Department [of Commerce] and open periodically to the public. Such records should include programs which have been broadcast itemized in accordance with types of broadcasting such as jazz, opera . . . speeches, etc., ... The public and the Department, in possession of such facts, may more wisely come to a determination as to whether or not the particular station should have its license renewed or revoked on the sole basis of public benefit.[104]

The notion that government control should be asserted on behalf of the public was soon supported by the argument that a "diversity of voices" was a goal of public interest licensing. That the standard was vague, and that it would require vigorous government monitoring to achieve, was certainly appreciated by Morris Ernst. Yet, just as clearly, public interest spokespersons such as Ernst would stand to gain by a policy that allowed their public interest "currency" to help purchase broadcast rights in the rights "auction." This calculus recognizes the essential fact that the public trusteeship approach substitutes political discretion for market allocation, the latter being the alternative wherein rights are assigned via a competitive bidding process.

Similarly, the "rights of the listeners" argument has been popular among diametrically conflicting political interests because it effectively transfers decisionmaking over outputs into the regulatory process.[105] Listeners and viewers are served in the economic marketplace by private sellers, and in the political marketplace by democratic officeholders and government regulators. To argue for the "rights of listeners," however, is to beg the question of *how* such rights are to be exercised, i.e., via voluntary patronage (private market) or political representation (government regu-

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103. Another factor leading one to this conclusion is that public interest group advocates enjoy loose monitoring by principals—i.e., the citizenry at large. The primary mechanisms for monitoring corporate executives extant in capital markets are notably absent in the non-profit sector.

104. Morris L. Ernst, Radio Censorship and the "Listening Millions," 122 The Nation 473, 474 (1926).

105. For instance, both leading conservative organizations, such as the National Rifle Association and Accuracy in Media, and leading liberal activists, such as Ralph Nader, favored the retention of the Fairness Doctrine. See Thomas W. Hazlett, The Fairness Doctrine and the First Amendment, Pub. Interest, summer 1989, at 103, 114 & 115 n.7.

lation). Hence, as applied, the argument confuses listeners' rights proper with government regulatory jurisdiction. It collapses an agency relationship into the right itself. Here, the FCC's agency relationship with listeners and viewers is imposed on the market on the pretext that such principals have the right to control content. Yet, they do not end up with any such rights—regulators do. This insight, while perhaps subtle to outside analysts, has apparently been straightforward to petitioners for government discretion (always properly vested) since Hoover's initial arguments on the subject in the early 1920s.

VI. *RED LION* AND THE "CHILLING EFFECT"

A. *The "Chilling Effect" of* Red Lion *Itself: Law Imitates Life*

Perhaps the most compelling test of the chilling effect is embodied within the real-world dynamics of the *Red Lion* case itself. Due to an extraordinary book by a former president of CBS News, Fred Friendly,[106] published some six years after the Supreme Court rendered its decision, the evidence now at our disposal is a good deal richer than the record that was available to the Court.

The facts that the Court heard were as follows. On November 25, 1964, WGCB, a radio station in Red Lion, Pennsylvania, owned by Reverend John Norris, aired a fifteen-minute commentary by the evangelist, Reverend Billy James Hargis. Hargis's "Christian Crusade" program was heard on about 200 radio stations nationally, with the time being purchased with funds donated by supporters. This particular spot on the Red Lion AM outlet cost Hargis's organization $7.50. In it, Hargis took two minutes to discuss one Fred Cook, author of *Goldwater—Extremist on the Right.* Hargis claimed that Cook was a leftist writer who was employed by *The Nation*, and had been fired by *The New York World Telegram* for a breech of journalistic ethics. Hargis denounced both the author and the book as untruthful.[107]

Cook, appealing to an FCC regulation ancillary to the Fairness Doctrine, demanded that the station afford him equal time to respond to this personal attack. Norris invited Cook to spend $7.50 for a fifteen-minute spot, the same bargain he had afforded Hargis. Cook declined the offer, electing to press his claim for free time with the Commission. Ultimately, Cook prevailed at the FCC, and at the United States Supreme Court, winning the decision there 8–0.[108]

What the Court did not know was this: the entire challenge to Norris's editorial policy was part and parcel of a campaign to *create* a chil-

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106. See Fred W. Friendly, The Good Guys, the Bad Guys, and the First Amendment (1975).

107. See Red Lion Broad. Co. v. FCC, 395 U.S. 367, 371 & n.2 (1969).

108. See id. at 367. William O. Douglas was recused due to medical problems. He later wrote that had he sat for the case, he would have dissented. See Columbia Broad. Sys., Inc. v. Democratic Nat'l Comm., 412 U.S. 94, 154 (1973) (Douglas, J., concurring).

ling effect via the licensing system. The political machinations began at the beginning, when Cook's Goldwater volume was published with an undisclosed subsidy from the Democratic National Committee (DNC). That much was straightforward politics—and an exercise in First Amendment protected speech—but then the regulatory gamesmanship kicked in. The WGCB broadcast was not heard by Fred Cook, but was monitored by an extensive operation established by the DNC for the purpose of filing Fairness Doctrine-type challenges against right-wing broadcasters. This group of DNC-annointed (and funded) media monitors had been instituted after President John F. Kennedy's bitter experience with conservative radio shows during the 1962 campaign to gain passage of the Nuclear Test Ban Treaty.[109]

It is likely that the DNC knew more about the impact of public interest licensing than did the Supreme Court. Wayne Phillips, a housing official in the Kennedy-Johnson Administration, was chosen to head the radio watchdog effort. In his words: "'Even more important than the free radio time was the effectiveness of this operation in inhibiting the political activity of these right-wing broadcasts. . . .'"[110] One Phillips assistant was Martin Firestone, a former FCC lawyer, who wrote in a memo that the DNC's efforts were paying dividends in that they "'may have inhibited the stations in their broadcast of more radical and politically partisan programs.'"[111] According to Firestone, it was not the large broadcaster or mainstream viewpoint that was at risk of being hurt by the economic disincentives created by the Fairness Doctrine. Indeed, he attributed the source of the DNC campaign's success as follows:

> The right-wingers operate on a strictly cash basis and it is for this reason that they are carried by so many small stations. Were our efforts to be continued on a year-round basis, we would find that many of these stations would consider the broadcasts of these programs bothersome and burdensome (especially if they are ultimately required to give us free time) and would start dropping the programs from their broadcast schedule.[112]

The strategy of the campaign was not subtle: tax anti-government speech. As Bill Ruder, an assistant secretary of commerce in the Kennedy Administration and another operative in the scheme, later testified: "'Our massive strategy was to use the Fairness Doctrine to challenge and harass right-wing broadcasters and hope that the challenges would be so costly to them that they would be inhibited and decide it was too expensive to continue.'"[113] That this tax was dutifully levied first by the Commission, and then approved by the Supreme Court, graphically illustrates the possibility that neither the regulatory system nor the judicial

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109. See Friendly, supra note 106, at 34–39.

110. Id. at 41 (quoting Wayne Phillips).

111. Id. at 41–42 (quoting Martin Firestone).

112. Id. at 42 (quoting Martin Firestone).

113. Powe, supra note 12, at 115 (quoting Bill Ruder).

system will prove effective in discovering and countering outright political censorship.

B. *The Supreme Court's "Chill" Test*

The Supreme Court has recognized the possibility that government regulation of the electronic press may discourage controversial speech, and that such an outcome would lead to grave constitutional concern. That, the Court noted in *Red Lion*, would be the result where enforcement of content controls led to a "chilling effect," prompting licensees to avoid broadcasting dissenting or unpopular speech due to regulatory disincentives. In dealing with the broadcaster's contention that government enforcement of the Fairness Doctrine would tend to silence certain speakers, the Court responded that such a possibility was indeed "a serious matter, for should licensees actually eliminate their coverage of controversial issues, the purposes of the doctrine would be stifled."[114]

Yet the concern was put to rest in *Red Lion* both logically and empirically. First, the Court noted that in the event that broadcasters were deterred from airing controversial speech, the FCC could simply mandate licensees to air more of such programming. Second, the Court found no evidence as to the existence of a "chilling effect."[115] Indeed, the Court found just the opposite, quoting Frank Stanton, President of the Columbia Broadcasting System, in his November 21, 1968 speech to the Sigma Delta Chi National Convention: "[W]e are determined to continue covering controversial issues as a public service, and exercising our own independent news judgment and enterprise. I, for one, refuse to

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114. Red Lion Broad. Co. v. FCC, 395 U.S. 367, 393 (1969). The Supreme Court has reaffirmed this test in FCC v. League of Women Voters, 468 U.S. 364, 378 n.12 (1984): "[W]ere it to be shown by the Commission that the fairness doctrine '[has] the net effect of reducing rather than enhancing' speech, we would then be forced to reconsider the constitutional basis of our decision in [*Red Lion*]." In 1985, the FCC produced just such a showing, which led the Commission to abolish the doctrine in 1987. See In re Inquiry into Section 73.1910 of the Commission's Rules and Regulations Concerning the General Fairness Doctrine Obligations of Broadcast Licensees, 102 F.C.C.2d 145, 147 (1985).

115. Arguments about the disincentives provided by government-mandated right-to-reply rules had carried the day in *Tornillo*, where the Supreme Court held a newspaper free to publish—or not publish—a response to its attack on a political candidate. But no such luck for the electronic publisher:

> Identical arguments with respect to the costs and adverse incentives imposed by access obligations were made in Red Lion Broadcasting Co. v. FCC, but there the Court relied on the FCC's finding that blunted coverage of controversial issues arising out of enforcement of the fairness doctrine was "at best speculative," noting: "if present licensees should suddenly prove timorous, the Commission is not powerless to insist that they give adequate and fair attention to public issues."

Lipsky, supra note 12, at 570 n.32 (citations omitted). The writer goes on to observe that, "The response is circular, since it assumes the FCC's power over content that was at issue in the case." Id.

allow that judgment and enterprise to be affected by official intimidation."[116]

This standard of proof could be called into question. It appears that while Mr. Stanton gave moving public speeches on the matter of "official intimidation," he held substantially different private views. In fascinating internal White House memoranda made public during the Watergate investigation, Nixon Administration attorney Charles W. Colson prepared a September 25, 1970 report for Herb Klein and H.R. Haldeman detailing the pointed meetings he had held with the "three network chief executives"[117] concerning the Administration's views on news reporting. Among the highlights are the following observations by Colson:

> The networks are terribly nervous over the uncertain state of the law . . . . They are also apprehensive about us. Although they tried to disguise this, it was obvious. The harder I pressed them (CBS and NBC) the more accommodating, cordial and almost apologetic they became. Stanton for all his bluster is the most insecure of all.
>
> To my surprise CBS did not deny that the news had been slanted against us. Paley merely said that every Administration has felt the same way and that we have been slower in coming to them to complain than our predecessors. He, however, ordered Stanton in my presence to review the analysis with me and if the news has not been balanced to see that the situation is immediately corrected. (Paley is in complete control of CBS—Stanton is almost obsequious in Paley's presence.)
>
> I had to break every meeting. The networks badly want to have these kinds of discussions which they said they had had with other Administrations but never with ours. They told me any time we had a complaint about slanted coverage for me to call them directly. Paley said that he would like to come down to Washington and spend time with me anytime that I wanted. In short, they are very much afraid of us and are trying hard to prove they are "good guys."
>
> The only ornament on Goodman's desk was the Nixon Inaugural Medal. Hagerty said in Goldenson's presence that ABC is "with us." This all adds up to the fact that they are damned nervous and scared and we should continue to take a very tough line, face to face, and in other ways.
>
> I will review with Stanton and Goodman the substantiation of my assertion to them that their news coverage has been slanted.

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116. *Red Lion*, 395 U.S. at 393 n.19 (quoting Frank Stanton, keynote address at Sigma Delta Chi National Convention (Nov. 21, 1968)).

117. David L. Bazelon, FCC Regulation of the Telecommunications Press, 1975 Duke L.J. 213, 244 (quoting report by Charles W. Colson). That a high ranking White House official journeyed to New York to engage in extended (and unreported) conversations with all three broadcast network heads on the chosen topic of media bias might itself have been material evidence in the Supreme Court's analysis in *Red Lion*.

> We will go over it point by point. This will, perhaps, make them even more cautious.[118]

These passages colorfully indicate two things. First, they reveal the essential dynamic involved in federal licensing of broadcasting facilities. The nervousness of licensees is economically predictable, and is here demonstrated in the behavior of both regulators and regulatees. The second implication is that Frank Stanton, whose public comments were taken as evidence by the Supreme Court, provides stunning and compelling support for the "chilling effect" in his reported private behavior.[119] Not only had Stanton been a stalwart ally of President Lyndon Johnson, helping him secure CBS affiliations for his radio and television properties,[120] but he proved adept at accommodating the not infrequent requests for government accommodation on items of broadcast content. In the one empirical test chosen by the Court—the beliefs of CBS President Frank Stanton on the relationship between broadcasters and the state—the "chilling effect" is found to be alive and frigid.

C. *Radio Deregulation and Quantitative Evidence of the Chilling Effect*

More systematic evidence on the chilling effect can be gleaned from radio market data observed since the FCC issued its "Deregulation of Radio" rulemaking in January 1981 and abolished the Fairness Doctrine,[121] for both radio and television, in August 1987. Since the Commission largely maintained its radio rules to force the provision of

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118. Id.

119. Daniel Schorr reports on Nixon Administration attempts to censor network news coverage. See Daniel Schorr, Clearing the Air 35–47 (1977). While his account generally supports the view conveyed by Colson's memos (in some cases citing actual programming altered in response to Administration threats, see id. at 39–47), he suggests some measure of bravado in them, as well. See id. at 44. The value of these memos as evidence must be viewed relative to the Stanton speech cited in *Red Lion*. See *Red Lion*, 395 U.S. at 393 n.19.

120. The network executive who did most to aid the LBJ cause was Frank Stanton, a Ph.D. from Ohio State University who became president of CBS and one of broadcasting's most adroit operators.

. . . .

. . . [W]henever there was a business matter to be discussed between CBS and the LBJ stations, Johnson would summon the appropriate CBS personnel to the White House to discuss it. Once he called Stanton in New York to complain that CBS was charging one of his TV stations too much for a syndicated program. Stanton told his staff to furnish the program to the station free.

William B. Ray, FCC: The Ups and Downs of Radio-TV Regulation 36–37, 41 (1990).

121. The Fairness Doctrine was a two-pronged obligation formally imposed on radio and TV licenses in 1949. (There had been "fairness" considerations as part of the "public interest" test for broadcasting dating as far back as 1929.) The first prong was an affirmative obligation for a broadcast licensee to air coverage of important public issues. The second was a responsibility to air such coverage from balanced perspectives. See Syracuse Peace Council, Memorandum Opinion and Order, 2 FCC Rcd. 5043, 5043 n.2 (1987); In re Inquiry into Section 73.1910 of the Commission's Rules and Regulations Concerning the General Fairness Doctrine Obligations of Broadcast Licensees, 102 F.C.C.2d 145, 146 (1985).

"nonentertainment" program services,[122] which it saw as fulfilling its role to protect the interests of listeners by providing for a diversity of expression, the marketplace experience after either round of deregulation is instructive: Did the quantity, or proportion, of informational programming fulfilling the FCC's self-stated objective rise or fall in the wake of deregulation?

As shown in a forthcoming paper, the diversity of radio station formats expanded in both the AM and FM radio markets after the controls in each market were relaxed.[123] As measured by a concentration ratio index, the concentration of formats declines most pointedly after 1987—the year the Fairness Doctrine was abolished. Moreover, the supply of informational programming formats (news, talk, news/talk, and public affairs) explodes both absolutely, and as a proportion of all formats after 1987 (see Figure 3).[124] In percentage terms, informational formats rose from about 7 percent of AM formats in 1994, to nearly 30 percent in 1995. This market reaction is entirely consistent with the mirror image of a "chilling effect." Faced with less disincentive in the airing of potentially controversial speech[125] when the Fairness Doctrine is revoked, station owners appear to have elected to air substantially more informational programming.

VII. TV License Auctions and the 1996 Telecommunications Act

While the 1996 Telecommunications Act took a pass on even the slightest liberalization of the spectrum allocation policy crafted in 1927, the Act was not speechless on wireless out of simple neglect. The omission was sufficiently flagrant to have resulted in a hot public debate, provoked by none other than the then-Senate Majority Leader, Robert J. Dole (R-Kan.).[126] After a bipartisan group of Senators (including Democrats John Kerry of Massachusetts and Russ Feingold of Wisconsin, and Republicans John McCain of Arizona and Fred Thompson of

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122. Information—news and public affairs programming—was actually labeled as "nonentertainment" fare by the Commission. See In re Deregulation of Radio, 84 F.C.C.2d 968, 975 (1981) (report and order).

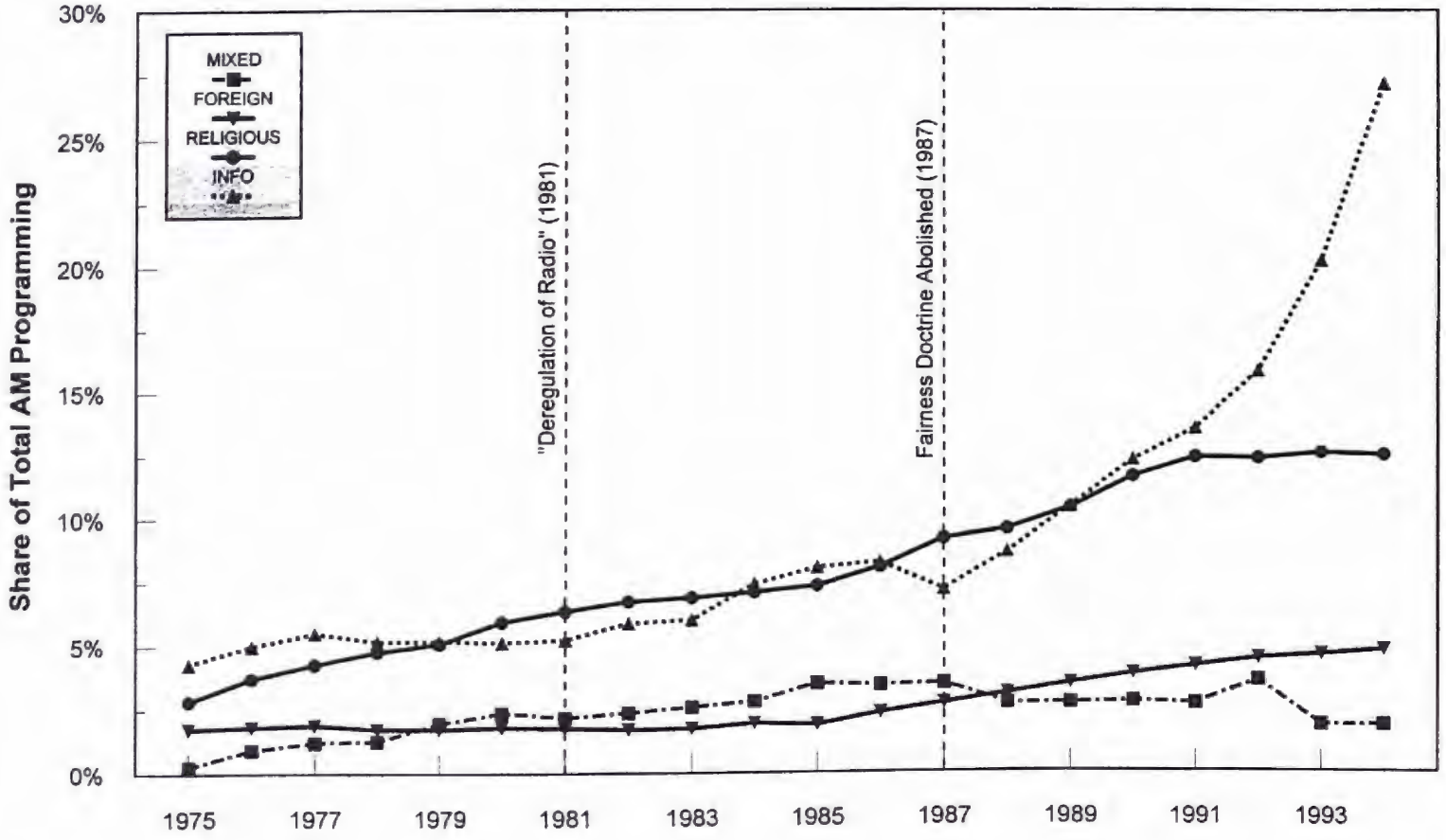
123. See Thomas W. Hazlett & David W. Sosa, Chilling the Internet? Lessons from FCC Regulation of Radio Broadcasting, 3 Mich. Telecomm. & Tech. L. Rev. <http://www.law.umich.edu/mttlr/> (forthcoming 1997) (manuscript at 15–17, on file with the Columbia Law Review) (also available at <http://www.cato.org./pubs/pas/pa-270.html>).

124. This shows nonmusic formats as a percentage of total AM radio station formats (music, the residual category, is not shown). FM, while more devoted to music programming, shows similar trends. See Thomas W. Hazlett & David W. Sosa, Was the Fairness Doctrine a "Chilling Effect"? Evidence from the Postderegulation Radio Market, 26 J. Legal Stud. 279, 294 (1997).

125. Airing controversial material subjects the broadcast licensee to costly requests for "free" equal time, litigation, and/or license renewal difficulties—a situation that can be avoided by music programming.

126. See Ted Hearn, Spectrum Debate Splits GOP Leaders, Multichannel News, Jan. 22, 1996, at 1.

Figure 3. Selected AM Formats
1975-1994



Tennessee[127]) protested the "corporate welfare" of the "license giveaway" to broadcasters for High Definition television (HDTV) licenses[128] (an FCC proposal that the Act codified), Senator Dole held up passage of the Telecommunications Act in January 1996 until the issue could be resolved. This sent shock waves through both Congress and the telecommunications sector, as a legislative compromise several years in the making was put at risk.[129] It was only upon a bargain worked out with the FCC that Senator Dole relented, allowing the Telecommunications Act to move forward. (It was signed into law on February 8, 1996.) The deal was that the FCC would not award any new HDTV licenses until Congress had sufficient time to legislate spectrum reform.[130]

That understanding held until only a few days after Senator Dole departed the Senate on June 11, 1996. Broadcast interests were then able to persuade the Republican leadership to send the FCC a letter canceling the Dole agreement.[131] Indeed, the letter—under the signature of House Speaker Newt Gingrich and the new Senate Majority Leader Trent Lott—instructed the Commission to issue licenses (without charge) in an expeditious manner, and to refrain from implementing any plans allowing other wireless users (other than incumbent TV licensees) to access any part of the spectrum band reserved (since 1952) for television.[132] This letter, which brought rebuke only from Congressman Barney Frank (D-Mass.),[133] implied total victory for the status quo.

The debate over HDTV within the context of the 1996 Telecommunications Act vividly illustrates the strength of the political equilibrium in broadcast regulation. Since FCC auctions were initiated in 1994 for *non*broadcast licenses, over $20 billion has been raised in federal

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127. See Office of U.S. Senator John McCain, Press Release, McCain-Feingold-Thompson-Kerry Corporate Welfare Amendment Could Save Up to $60 Billion, Oct. 24, 1995, at 1,3 (on file with the Columbia Law Review) (listing broadcasting spectrum sixth on list entitled "Dirty Dozen Corporate Pork Chops," and claiming that the government would raise an additional $35 billion if it auctioned off all electro-magnetic spectrum rights).

128. See Paul Farhi, Broadcast Executives Say Dole Vented Anger at Them, Wash. Post, Jan. 12, 1996, at F1.

129. See Ted Hearn, B'Casters Make White House Pitch, Multichannel News, Jan. 15, 1996, at 1, 1.

130. See Ted Hearn, Clinton Will Sign It, Multichannel News, Feb. 5, 1996, at 1, 1.

131. See Joel Brinkley, Congress Asks F.C.C. to Begin Lending Channels for Digital TV Broadcasts, N.Y. Times, June 24, 1996, at D6.

132. Commission Chairman Reed Hundt had proposed an auction of FCC licenses allocating the spectrum space reserved for UHF channels 60–69, frequencies which were virtually unused and which were not needed even to accommodate the award of additional HDTV licenses. See Jeffrey Silva, TV Spectrum Could Convert to Wireless, Radio Comm. Rep., July 8, 1996, available in LEXIS, News Library, US File.

133. See Letter from Barney Frank, Congressman, United States House of Representatives, to the Honorable Reed Hundt, Chairman, FCC 1 (June 26, 1996) (on file with the Columbia Law Review). See also Thomas W. Hazlett, Industrial Policy for Couch Potatoes, Wall St. J., Aug. 7, 1996, at A12.

receipts.[134] Licenses for HDTV service were estimated to be worth a minimum of $12.5 billion.[135] With the federal deficit figuring centrally in the political debate between the Republican Congress and the Democratic Administration, the old regime of free licenses for radio and TV broadcasters—now receiving a special legal exemption not afforded other wireless licensees—was a striking public policy curiosity. Articles appeared in many respected outlets condemning the "great airwave robbery,"[136] and the Senate Majority Leader held up important legislation to force action on the issue.

And nothing happened. Well, not precisely nothing. The broadcasters, true enough, have received free licenses, and new competition to TV broadcasters will not be allowed to settle in the vast stretches of the 402 Megahertz of spectrum allocated to broadcast TV (67 channels of 6 Megahertz per TV signal) where greater communications are easily possible (often by the adoption of new technologies, including digital transmission modes).[137] The change visible to the naked eye is in the ratcheting up of "public interest" obligations on broadcasters. As Thomas G. Krattenmaker observes of the Act: "I think it is downright shameful to pretend to enact a pro-competition policy, while continuing to preserve the worst features of our old spectrum allocation policies . . . ."[138] But continuation of that "old policy" enables broadcasters and prominent policymakers (both public and private) to create and distribute rents in a manner benefitting each key constituency. Hence, the Act's protection of TV licensees from auctions was accompanied by the V-chip plan, a legislative accomplishment sure to generate continued demand for the policy advocates who promote it. While the broadcasters had sternly threatened to take this mandate to court as a violation of their First Amendment rights, top broadcast executives capitulated almost instantaneously on the issue, negotiating surrender in the Oval Office only three

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134. Auction receipt information is available on the FCC's web page. See FCC Wireless Telecommunications Bureau Auctions Home Page, Summary Charts, Total Revenue (visited Mar. 27, 1997) <http://www.fcc.gov/wtb/auctions/summary/revenue.gif>.

135. See Edmund L. Andrews, Digital TV, Dollars and Dissent, N.Y. Times, Mar. 18, 1996, at D1.

136. Mark Lewyn, The Great Airwave Robbery, Wired, Mar. 1996, at 115; see also Edmund L. Andrews, Airwaves Plan Is Called Give-away to Broadcasters, N.Y. Times, Oct. 28, 1995, at 9; Ralph Kinney Bennett, The Great Airwaves Giveaway, Reader's Digest, June 1996, at 147; GOP Giveaway, Wall St. J., Sept. 12, 1995, at A26; Neil Hickey, What's at Stake in the Spectrum War?, Colum. Journalism Rev., 39, July/Aug. 1996, at 39.

137. Paul Baran writes:

> In reality, the major spectrum hog is analog broadcast TV transmission. In the US . . . a spectrum analyzer will find much of the allocated VHF and UHF TV spectrum unused, even in big cities. The UHF television band is punctured with vast empty holes called taboo channels. . . . We should never forget that any transmission capacity not used is wasted forever, like water over the dam.

Baran, supra note 84, at 3.

138. Krattenmaker, supra note 2, at 172.

weeks after the passage of the Act.[139] Release of the TV labeling plan soon after the November 1996 elections—not incidental timing—generated still more front-page controversy for public policy entrepreneurs to trade on.[140]

Beyond the Telecommunications Act, the political landscape in 1996 was dotted with broadcaster pledges to advance the "public interest"—each ceding some discretion over the content of broadcast speech to regulators. Each was also a featured photo-op in Campaign '96; indeed, Republicans and Democrats fought to take credit for "standing up to" the broadcast industry.[141] Rupert Murdoch, chairman of the Fox TV network, was the first to devote free television time to presidential candidates, and was soon joined by the three larger networks.[142] A highly publicized deal, brokered by the FCC, imposed a first-ever "quantitative" standard for educational programming over commercial broadcast TV stations—three hours per week.[143] Overall, a thinly disguised quid pro quo motivated broadcasters to remember that discretion is the better part of valor. Broadcasters were seen "'tripping all over themselves to give up their First Amendment rights,'" as one high-level FCC official put it, to avoid the prospect of license assignment by competitive bidding.[144]

We can now evaluate the substance of the "physical scarcity" rationale for broadcast content regulation with crystal clarity. There cannot possibly be confusion at the FCC, Congress, or the Supreme Court, regarding the technical issues involved: wireless licenses are now routinely

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139. See Jane Hall, Hollywood Warily Joining Clinton's TV Ratings Push, L.A. Times, Feb. 28, 1996, at A1.

140. See, e.g., Roger Fillion, TV Industry Unveils Controversial Ratings System, Reuters N. Am. Wire, Dec. 19, 1996 available in LEXIS, News Library, US File; TV Ratings Opponents to Continue Fight Against Industry Plan at FCC, Comm. Daily, Dec. 23, 1996, at 3.

141. When broadcast industry executives met with officials to negotiate surrender on the V-chip, for instance, the issue provided such a golden opportunity to score political points that they had to take care to balance their visits. One TV executive noted, "'We need to have some kind of agreement to announce . . . to show that we're responding to the concerns of the president and the public. But we can't cut off Gingrich and other Republicans by giving President Clinton the only "photo-op" on the issue of children and television in a presidential election year.'" Hall, supra note 139, at A1. A White House policymaker was upset by the competition, saying, "'Newt smells credit available and he's trying to steal some of it.' . . . 'It baffles me how he can claim credit for people responding to the president's challenge to do something he has opposed for years.'" Id. The article was careful to note that it was vitally important not to offend key members of Congress who would "be voting on a proposal to auction airwaves spectrum space for billions of dollars." Id.

142. See Eliza Newlin Carney, Not Ready for Prime Time, Nat'l J., June 8, 1996, at 1284, 1284.

143. See, e.g., Clinton Gives TV for Kids a Boost, S.F. Chron., July 30, 1996, at A1. The article garnered the front-page headline. It should be noted that the "quantitative" standard of three hours per week of educational programming can be met through various alternative contributions to the "public interest."

144. See Thomas W. Hazlett, The 'Public Interest' Fraud, Wall St. J., May 6, 1996, at A14.

auctioned by the FCC for nonbroadcast services. The technical uniqueness alleged for broadcasting has not required personal communications services providers, paging companies, microwave or satellite TV licensees—all winning bidders at FCC auctions—to be selected according to "public interest, convenience, or necessity." There is nothing "physical" about the use of airwaves that requires broadcast licenses to be regulated differently than newspapers or magazines—or wireless service providers.

Indeed, the opportunity to regulate broadcast speech has now, ever so smoothly and naturally in the era of FCC auctions, slipped into a naked rationale for differential treatment of the broadcast press. The problem with auctioning broadcast licenses is that it would remove the subtle political influences that the "license giveaway" makes possible. It would push TV and radio license assignment into an "arms-length" transaction, where any obligations of the winning competitive bidder would need to be objectively stated in the terms of the license put up for sale. This is not where the Congress (Republican or Democratic), the Administration (Republican or Democratic), nor public interest groups (which are still committed to the process of publicly attempting to extract concessions from broadcasters), nor certainly the broadcasters themselves choose to be. Market prices set in a license auction are just too high for broadcasters—playing the quid pro quo game against policymakers (government and public interest) remains a steal, even accounting for the potential expense of additional public interest obligations. The intense anti-auction campaign waged by broadcaster trade groups in 1995 and 1996 is striking evidence of the industry's revealed policy preference,[145] particularly when coupled with the industry's eagerness to deal on the V-chip, "kidvid" and free time for political candidates.

VIII. Conclusion

> The publishing business is, in short, the only organized private business that is given explicit constitutional protection.[146]
>
> Ever since the first regularly scheduled public radio-broadcast in 1920, Congress has played a unique and central [role] in the control of radio-broadcasting.[147]

The interests of the regulated industry, broadcasting, are served by erecting entry barriers against competition. That mission has been ac-

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145. "Some people in Washington want to tax local TV broadcasters billions of dollars in order to balance the budget," the announcer continues. Each of the tiny images flickers to darkness in turn until only empty, black screens remain. Telephone your elected representatives, the disembodied voice advises, and tell them to vote against the "TV tax. Call now—while you still can." Those scare commercials, produced by the National Association of Broadcasters, aired thousands of times a week on TV stations all across the U.S. . . . .
Neil Hickey, supra note 136, at 39.

146. Potter Stewart, Or of the Press, 26 Hastings L.J. 631, 633 (1975).

147. Friedrich & Sternberg, supra note 69, at 797.

complished via the public interest standard. As is customary, recipients of license rents agree to an implied regulatory contract, what in broadcasting is called "public trusteeship." In agreeing to submit to various aspects of content control, including licensing itself, broadcasters are allowed to realize rents.

Regulators and public interest advocates have benefitted from a system that allows political decisionmakers to overrule consumer choices in an unregulated marketplace. By being in the loop on licensing decisions, such players are automatically in the loop on content decisions, thus achieving proximity to political clout as well as important status within the regulated (broadcasting) industry itself. That this creates First Amendment problems is virtually self-evident.[148] But the fact that the courts have remained deferential to such regulatory discretion being imposed on electronic speech is a tribute to the effectiveness of the political coalition vested in the physical scarcity doctrine.

What is most clear is that the demand to regulate broadcasting in the United States has not been driven by any technical necessities, policymakers' misunderstandings, or the naiveté of experts. Rather than a passive governmental response to market failure, as hypothesized in *Red Lion*, the motive to regulate broadcasting has been, since its earliest days, driven by the rents available to licensees on the one side, and the gains available to political actors from influence over a medium of pervasive social importance on the other.

This brings us to the very heart of the First Amendment question in electronic communications. To borrow Charles Fried's phrase, "primacy of politics" was asserted.[149] What we are led to conclude is that the demand to regulate electronic communications has arisen for reasons having nothing to do with physical scarcity—a concept that fails to survive even the most cursory logical scrutiny. Nor can it be attributed to any alleged confusion of early radio industry regulators concerning property rights, as radio's earliest regulators were demonstrably facile with rules to "minimize interference" using traditional—and available—legal institutions. Nor, lastly, was there any doubt as to the reason radio was especially important: it was seen as a dramatically influential medium of expression. Hence, the demand to allocate and license radio spectrum administratively has arisen from the very quarters against which the Founders crafted a First Amendment to protect us: an alliance of private publishers and government agents creating and distributing monopoly rights in an industry of supreme importance to democratic life.

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148. That censorship was unavoidable under the 1927 Act—despite both the First Amendment and a section of the act banning it—was instantly grasped: "In spite of the prohibition of § 29 it would seem that the licensing authority cannot avoid some measure of censorship through the very issuance or denial of a license." Current Legislation—The Radio Act of 1927, 27 Colum. L. Rev. 726, 732 (1927).

149. Charles Fried, The New First Amendment Jurisprudence: A Threat to Liberty, 59 U. Chi. L. Rev. 225, 253 (1992).

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station at East Pittsburgh the election returns as they came into their wire services room. At our transmitter, an announcer would speak into the microphone there, putting the information on the air.

In order to make it legal to transmit on the air, a licensed operator had to be obtained. In addition, a member of the publicity department, a Mr. Rosenberg, was the so-called announcer who actually talked into the microphone, and I was the so-called engineer of the station. I didn't have an assistant. That was the full staff for KDKA when it first appeared.

It was thought that election news would not occupy the whole time so a hand-wound, spring-driven phonograph and a selection of records were provided for fill-in purposes. I arrived at the station about 6 P.M. the night of November 2, 1920, in plenty of time to be sure all would be in readiness to start the program at, as I remember it, 8 P.M. To my dismay, I found that the gooseneck of the phonograph tone arm had disappeared. It was never found and to this day I do not know whether it was maliciously stolen or simply mislaid accidently. It was obviously up to me to provide some sort of substitute which I did by rushing down to our laboratory and putting together a clamp and hinge gadget that hinged the microphone to the tone arm. It was quite satisfactory and was used for the opening program and several later ones. A separate microphone was used by the announcer.

At that time we had no studio; everyone was in the same room with the transmitter. There was only one microphone other than the phonograph pickup. The first program, which ran from about 8 P.M. to some time after midnight, consisted only of the election returns repeated into our microphone by Rosenberg from what he heard by phone from the *Post* downtown, interspersed with recorded music.

The company received quite a lot of mail on this broadcast. Our election night broadcast was also picked up by a receiver and a loud-speaker which Mr. Chubb, newly appointed manager of the new radio engineering department, and I installed at the Edgewood Club—this was in Edgewood, just outside of Pittsburgh. The club had an auditorium and a good many of the club members congregated there on the evening of November 2, as it was pre-advertised that they would get election returns. From time to time during the evening Mr. Chubb phoned us comments on how the program sounded and I recall he told us once that the audience preferred less music and more election returns.

(And so regular broadcasting began for many Americans. WWJ, Detroit's first station, disputes the claim to priority made for KDKA, but its case, while recorded, has yet to be submitted in final form to the Oral History Research Office.)

Radio gets a policeman

HERBERT HOOVER

When former President Hoover was secretary of commerce under Harding and Coolidge, he was called upon to cope with a new and perplexing activity.

In the years immediately following the First World War, I had a boy who, like all boys of that period, had gone daft on wireless; and the house was cluttered with the apparatus which he had assembled. It was demanded of me that I listen in on his crystal set, which I did, so I had some interest in wireless before I became secretary of commerce.

On January 15, 1921, some six weeks prior to my taking that office, I delivered an address from the Duquesne Club of Pittsburgh. That speech was broadcast. It was probably one of the earliest broadcast speeches.

Before I became secretary of commerce, I was very much aware that I would control broadcasting as a part of my administrative work. I had examined the functions of that department before I went into it.

Wire and wireless transmission had been put under the department by the law of August 13, 1912. At that time the use of wireless was in the international telegraph area to some extent, but was mainly used for ship-to-shore communications. The law at that time provided for the licensing of operators; punishment for unlicensed operators; and the regulation of wave lengths—although it was a pretty vaguely phrased law. It was not, of course, adapted to the general broadcasting. That had not yet been heard of.

When I came into the department no special policies had been determined by my predecessors. They were administering the law through, I think, the Bureau of Navigation. As I said, it was mostly confined to ship-to-shore use.

I soon became aware of the importance of broadcasting. Two stations had been erected, one by the Westinghouse Company of Pittsburgh and one by the General Electric Company of Schenectady. There were probably at the time that I came into the Department of Commerce less than fifty thousand full-sized receiving sets. They were not too good.

The American boy, however, had enthusiastically taken up radio and his crystal sets and earphones were spreading interest all over the country.

Suddenly a great public interest awoke in radio and my recollection is that in six months after I came into office there were three hundred and twenty broadcasting stations. Fortunately, in view of interference difficulties, most of them were of low power and short range.

The law proved a very weak rudder with which to

steer the development of so powerful a phenomenon as this, especially as it so rapidly developed over the next few years.

I was, of course, at this moment—when we had three hundred and twenty stations—greatly impressed with the immense importance of its contribution to the spoken word and the vital necessity of seeing that new channels of communication should be under public control. We in the department realized the difficulties of devising such control in a new art and in some phases of vital importance.

The radio world was anxious for regulation to prevent interference with each other's wave lengths. A good many of those then broadcasting were insisting on the right to a title to the channels through the air as private property. I concluded that it would be a monopoly of enormous financial value and that we had to do something about it.

In order to do something, I called a conference of the representatives of all of the radio people—the broadcasters, the manufacturing industry, the representatives of the Army and Navy, the amateurs—in general, all of the interested groups. This conference was called for February 27, 1922. About a year after I became secretary of commerce I stated in my address to that conference, "We have witnessed in the last four or five months one of the most astonishing things that has come under my observation in American life. The department estimates today that there are over six hundred thousand persons—one estimate being a million—who possess wireless telephone receiving sets, whereas there were less than fifty thousand of them a year ago.*

"The comparative cheapness of receiving sets bids fair to make them almost universal in the American home." I went on to say, "I think it will be agreed at the outset that the use of the radio-telephone for communication between single individuals, as in the case of the ordinary telephones, is perfectly hopeless. Obviously if ten million telephone subscribers are crying through the air for their mates, they'll never make a junction. So that wireless telephone between individuals must be suppressed, or, limited to very narrow use.

"We are here primarily interested in broadcasting. It becomes a primary public interest to say who is to do the broadcasting and under what circumstances and with what type of material. It is inconceivable that we should allow so great a possibility for service and for news, for entertainment and education and for vital commercial purposes to be drowned in advertising chatter."

I continued in that address, saying: "The problem is one of the most intensely technical character, and even if we use all the ingenuity possible, I do not believe there are enough permutations to allow an unlimited number of sending stations. So this is a problem of regulation. Regulations will need to be policed, and thus the celestial system, or at least the ether part of it [we always referred to the medium as "ether" in those days] comes under the province of a policeman. Fortunately the art permits such a policeman, by licensing it, to detect those who either hog or endanger the traffic.

"There is in all of this the necessity to establish public right over the radio bands. There must be no national regret that we have parted with so great a national asset."

The conference agreed to a voluntary system of regulations and between conferences to abide by my decisions as an umpire, no matter what the legal right may have been, until we could devise the needed legislation. The first conference agreed that certain parts of the wave bands be set aside for public broadcasting, certain parts for the Army and Navy, the public services, and we gave a wave band to the boys, or more properly, the amateurs. We agreed to forbid the use of person-to-person telephoning.

As far as the art had developed, there were sufficient wave lengths for all the purposes then known. Then the department set itself to solve the picture puzzle of allotting the wave lengths to the broadcasting stations, so that they would not interfere with each other.

Very fortunately, at that time, owing to the weak sending, the same wave lengths could be used in different cities situated at only a little distance from each other. So we were able to accommodate everybody that came along for a while.

Subsequently in March, 1923, a year later, I called a second conference. I called a third one a year later in November, 1924, and a fourth in November, 1925, where we expanded the voluntary system.

Perhaps a little later than 1922, but certainly before 1924, the British had established governmental broadcasting. My statements made at that time bear out the fact that I objected to such a system for the United States. I thought that free speech and general communication would be safer in private hands. While that system would be most advantageous to free speech, obviously the only method of support would be advertising. But I found it necessary to constantly object to the amount of time devoted to commercials.

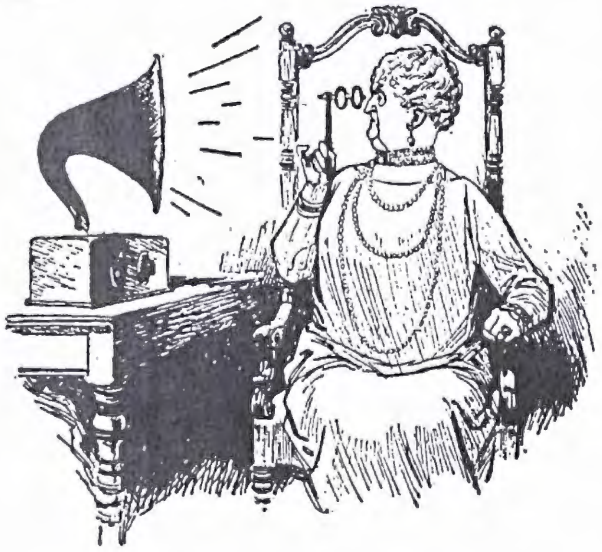
As to advertising, I announced what proved a fool-

* The fantastic development of radio cited by Mr. Hoover in 1922 had barely begun. By 1954, 50 million American homes were radio-equipped; in all, 127 million radio sets were in use.

ish thought. That idea was that the advertiser should at the opening of a broadcast confine himself to the announcement that he was contributing his program to public service. I thought he could then omit interference with the program until the end. At that moment he could again make a simple statement as to what kind of business he had and what goods for sale. I felt that such a practice would commend itself to more customers than annoying the public with the immediate and the long commercials we were receiving.

I have often felt when I listen to present-day commercials that I will never buy that product. I have thought the receiver would have a more favorable reaction to the advertiser if he said simply: "We are now presenting you with the following program which we hope that you will enjoy, but remember that we are a

Life, 1926



The loudspeaker (cheerily): HELLO, FOLKS!

commercial concern in business and if our products commend themselves to you, we would be glad to have your custom." I believe something of that kind would attract far more purchasers of goods than this hideous repetition. But it was a futile idea and received little attention.

In this whole period of conferences from 1921 to 1924, I held that we should have more experience before we attempted to draft legislation. At the 1924 conference I proposed a draft bill which had in the main met the approval of that conference. I found, however, that Congress was overburdened with more urgent work and that they did not rush to take up such a complex subject, especially as they would have to resist pressure from various interests.

One of our difficulties in securing legislation was the very success of the voluntary system. Members of congressional committees kept telling me, "It's working all right; why do you bother us?" Thus there was a long period of delay.

One bill died between the House and the Senate in 1925. But finally a Chicago station broke away from our voluntary system. They preempted a wave length for themselves and established in the courts their contention against our weak legal authority. Then Congress woke up, and finally in February, 1927, it passed the law which was recommended by the Department of Commerce with the advice of our conferences.

The law which Congress passed firmly established the public ownership and regulation of wave channels.

One of my most vivid experiences in the early days of radio was with the evangelist, Aimee Semple McPherson, of Los Angeles. She was one of the first to appreciate the possibilities of radio and she established a small broadcasting station in her temple. That station, however, roamed all over the wave band and caused interference and bitter complaints from all the other stations in southern California. We repeatedly warned her to stick to her assigned wave length. But the warnings did no good. Finally our inspector sealed up her station with the great seal of the United States and this fearsome act stopped it.

At any event the next day I received this telegram from Miss McPherson. She said, "Please order your minions of Satan to leave my station alone. You cannot expect the Almighty to abide by your wave length nonsense. When I offer my prayers to Him, I must fit in with His wave reception. Open this station at once."

Our tactful inspector finally persuaded her to employ a capable manager for her station to keep her on the proper wave length.

Another case with a little humor in it was when the representatives of a religious sect in southern Illinois came to Washington to secure a wave length. They were ushered in to see the head of our radio division and myself. They said that they were going to build a broadcasting station. They explained that the world was coming to an end in about six months and they felt that to broadcast the news would be the way to notify as large a number of people as possible to get ready.

I inquired if they had the money to build such a station and they said that they had. Most of them had sold their property and they had about $200,000. We suggested to them that they use the $200,000 to buy time on existing stations instead of building a single station for themselves. Thus they could get a lot wider audience and a station would be of little use to them after the world came to an end.

About this time, in 1926, it became evident that much interference was coming in from abroad and that there had to be some kind of international regulation. Through the State Department, I secured the calling of an international conference which assembled in Washington on October 4, 1927. It was attended by delegates from 76 nations and I was elected to preside. The task proved so difficult that the sessions extended over five months.

We finally signed the treaties which established world order in radio by the assignment of wave bands and of certain principles of conduct. The curious thing is that most of these treaties have lasted to this day, in spite of all the wars and turmoil.

The small boys in radio were a constant interest to me. Having their own wave band they had established an association of radio amateurs with whom we dealt constantly.

One day I asked them how they were going to deal with enforcing the assignments of their wave band to prevent interference.

The president of the association said, "Well, I don't think you'd like to know what we do."

"Oh, yes," I said, "I would."

He said, "Well, we just take the fellow out and beat him up."

The American system of radio has worked out pretty much as I envisaged its possibilities in my addresses to the conferences from 1922 to 1925. It has made, of course, a fabulous contribution to American life. But it has developed certain liabilities that have always distressed me. Aside from the abuses in advertising which I have already mentioned, the question of truth is far less safeguarded in the radio than in the press. Too often broadcasters disseminate mendacity, malice and defamation of character that no newspaper would ever countenance. To make things worse, there is no adequate answer to a lying microphone because the audience is never the same on any two days, or hours, whereas the newspaper can make a correction the following day reaching the same people. Thus there are great injustices perpetrated over the radio and in any event the privilege of answer to misrepresentation is practically limited to people of importance. Persons who do not have the influence to secure time for refutation do not have a chance to answer.

But remedy in the courts to libel and slander is very feeble. The common law on this subject has been attenuated by court rulings over the last fifty years to the point where the remedy does not amount to much. At the present moment, most plaintiffs must show actual financial damage. Whereas in Great Britain, which has almost the same libel laws, people can secure moral damage. Often enough the British courts award great sums for moral damage. If our libel and slander laws were restored on the British basis, we would have less of such rotten statements poured out over the radio.

The radio itself also lends itself to propaganda much more easily than the press or the platform. Officials currently in office have the preponderant time before the microphones. Theirs becomes the dominant voice. Propaganda, even when it sticks to facts, can be slanted by the magic of the human voice. All of which can be accomplished by emotion and emphasis on words and phrases.

Often enough nobody is interested in providing counter-propaganda. In any event few people can get access to radio to answer propaganda.

Another difficulty in radio is its instantaneous character. There is no time to check up on the reliability of information.

But despite these minor faults, the radio has been an enormous contributor to the advancement of the human race.

A young man named Sarnoff

CHESTER H. LANG

A long-time executive of the General Electric Company who became associated with its broadcasting activities just before the pioneer G. E. station, WGY, went on the air in February, 1922, Mr. Lang tells how he and his company got to know a young man named Sarnoff.

In the summer of 1920, I was assigned with an associate to audit the newly formed Radio Corporation of America.

I shall never forget that experience, because RCA was then a pretty small enterprise, and it seemed as though—and its budget for 1921 reflected that—its business for all time might be transoceanic communication, into which we had been brought via the Alexanderson alternator (they were then being installed in a number of stations). The business of transoceanic communication—then made really practical for the first time—seemed to be the real potential business for RCA.

Mr. David Sarnoff at that time was commercial manager. He decidedly gave the impression of tremendous energy. And of course, as a young man, just a little younger I guess than he, I was fascinated with the story of his life, with his coming here as a boy from Russia, the principal support of his mother and one or more other children.

I'm not sure at that precise moment that I could have predicted for him the things which he has

Analysis

Indecency regulation: beyond broadcast?

By David L. Hudson Jr.
First Amendment Scholar
12.05.07

The Federal Communications Commission currently regulates indecency on broadcast television but not on cable television or DBS â€" direct broadcast satellite TV or radio. But could that change?

In recent years the FCC and Congress have expanded or attempted to expand government regulation of indecent material to advance the laudable goal of protecting minors. For example, Congress passed the Broadcast Decency Enforcement Act, which President George W. Bush signed in June 2006. This measure increased financial penalties tenfold for indecency violations on broadcast TV. Congress passed the measure in the wake of the controversial 2004 Super Bowl halftime show featuring Janet Jacksonâ€™s infamous â€œwardrobe malfunction.â€

Members of Congress have introduced measures to regulate indecency on broadcast and cable television, and some have included satellite. The most aggressive of these proposals was West Virginia Democratic Sen. Jay Rockefellerâ€™s Indecent and Gratuitous and Excessively Violent Programming Control Act of 2005, although it never made it out of committee. Rockefeller and others have introduced a variety of measures to address the perceived problems of indecent and violent content on television. As Rockefeller said in 2005: â€œEach day, and for hours and hours every day, broadcast, cable, and satellite television outlets indiscriminately barrage our children and families with indecent and violent images.â€ In 2007 he asserted that â€œFor our children, there is little or no meaningful distinction between the broadcasters and the cable producers.â€

The fact that the FCC can regulate indecency on the public airwaves but not on cable or DBS at least partly explains why in October 2004 shock-jock Howard Stern left broadcast radio for Sirius Satellite Radio â€" to escape further potential crushing FCC fines for his indecent material.

Proponents of government regulation stress societyâ€™s compelling need to protect children from harmful material online. Commentator Matthew S. Schwartz argued in a 2007 article for the *Richmond Journal of Law & Technology* that â€œif the government is serious about its stated goals of protecting children and the sanctity of the home, then the FCC should expand indecency regulations to cable and DBS.â€

Opponents counter that extending FCC authority could lead to rank censorship. Gene Policinski, executive director of the First Amendment Center, wrote in

2007 that â€œthe public ought to be very careful about handing over the national TV remote control to the heavy hand of government so that it can restrict the free choice of some viewers to tune in.â€

Still others argue that while distinctions between cable and broadcast seem to have lessened, the FCC should abandon enforcement of broadcast indecency rather than expand into other realms.

Legal framework for regulating indecency

Certain types of sexually explicit material â€" obscenity and child pornography â€" receive no First Amendment protection. The Supreme Court has reasoned that the harm from this material far exceeds any possible value in the expression. However, the Court has also approved of the concept of variable obscenity in *Ginsberg v. New York* (1968), reasoning that material can be obscene as to children (â€œharmful to minorsâ€) but not as to adults. Society simply doesnâ€™t want harmful material to fall into the hands of minors. However, the government has also attempted to regulate material even beyond the expression prohibited under a harmful-to-minors law. This is the area of indecent expression.

In 1978, the U.S. Supreme Court ruled 5-4 in *FCC v. Pacifica Foundation* that the government could fine a radio station for playing a George Carlin comedic monologue containing profanity during daytime hours. The case stemmed from an incident on Oct. 30, 1973. John R. Douglas â€" a member of the group Morality in Media â€" heard a radio broadcast of Carlinâ€™s â€œFilthy Wordsâ€ monologue at 2 p.m. while driving in his car with his minor son in New York. The monologue broadcast on a New York radio station owned by Pacifica repeatedly featured Carlinâ€™s â€œseven dirty words you can never say on televisionâ€ â€" â€œshit, piss, fuck, cunt, cocksucker, motherfucker, and tits.â€

Douglas filed a complaint with the FCC, contending that minors should not be exposed to such profane and indecent comments. The FCC agreed and issued an order in February 1975 that said the station â€œcould have been the subject of administrative sanctions.â€ The FCC did not impose formal sanctions but placed a letter in the stationâ€™s file that could be used to increase future punishments. The FCC determined that â€œthe language as broadcast was indecent and could be prohibited by federal law 18 U.S.C. Â§ 1464,â€ which prohibits the radio broadcast of â€œobscene, indecent or profaneâ€ speech.

When the case reached the U.S. Supreme Court, the justices ruled 5-4 in favor of the FCC. Justice John Paul Stevens noted in his majority opinion that the speech took place in the broadcast medium, which â€œhas received the most limited First Amendment protection.â€ He emphasized â€œtwo distinctionsâ€ between broadcast and other media that justified this lower level of protection: (1) broadcastâ€™s â€œuniquely pervasive presenceâ€ and (2) its accessibility to children. â€œThe ease with which children may obtain access to broadcast material â€¦ amply justif[ies] special treatment of indecent broadcasting,â€ Stevens wrote.

The current distinction between broadcast and cable exists in part because the broadcast medium uses limited public airwaves and offers free services, while cable and other media offer subscription-based services and do not use the public airwaves. Cable television transmits programming through fiber-optic

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cables rather than over the air.

Some contend that the distinction between broadcast and cable is no longer tenable, particularly based upon the two justifications offered in *Pacifica.* They point out that cable television has acquired a â€œpervasiveâ€ presence and that children easily can obtain access to indecent material on cable. Congress already can punish obscenity transmitted over cable via 18 U.S.C. Sect. 1468(a), which provides: â€œWhoever knowingly utters any obscene language or distributes any obscene matter by means of cable television or subscription services on television, shall be punished by imprisonment for not more than two years or by a fine.â€ To tackle indecency in addition, Congress seemingly could simply amend 18 U.S.C. Sect. 1464, which criminalizes â€œany obscene, indecent or profane language by means of radio communication.â€ Could Congress constitutionally amend this statute by adding the words â€œor cable or other subscription-based servicesâ€?

Lower courts that have grappled with this question struck down state or local laws that sought to prohibit indecent programming on cable. In *Cruz v. Ferre* (1983), a federal district court in Florida invalidated a Miami city ordinance that provided: â€œNo person shall by means of a cable television system knowingly distribute by wire or cable any obscene or indecent material.â€ The federal district court cited a litany of differences between the broadcast and cable media, concluding *Pacifica* â€œinapplicableâ€ and the law unconstitutional.

Later Supreme Court decisions have emphasized the distinction between broadcast and cable or other media. For example, in *Turner Broadcasting System v. FCC* (1994), the Court wrote: â€œIn light of these fundamental technological differences between broadcast and cable transmission, application of a more relaxed standard of scrutiny in â€¦ broadcast cases is inapt when determining the validity of cable regulation.â€

But two years later in *Denver Area Educational Telecommunications Consortium, Inc. v. FCC* (1996), the Court upheld a federal law that allows cable operators to prohibit indecent material on leased-access channels. In reaching its decision, the plurality wrote that cable â€œis as accessible to children as over-the-air broadcasting, if not more so.â€ The Court added that cable has â€œestablished a uniquely pervasive presence in the lives of all Americans.â€

However, the Court in *Denver Area* still applied a tougher standard to regulations that affect speech on cable. This approach led the Court to invalidate two other cable-indecency laws in the decision.

Several years later, the Court again addressed indecency on cable. In *United States v. Playboy Entertainment Group* (2000), the Court rejected 5-4 a federal law prohibiting transmission of indecent programming during daytime hours to address the problem of signal bleed â€" where some indecent material comes through scrambled channels. The Court again addressed the difference between broadcast and cable: â€œThere is, moreover, a key difference between cable television and the broadcasting media, which is the point on which this case turns: Cable systems have the capacity to block unwanted channels on a household-by-household basis.â€ In *Playboy Entertainment,* the Court proceeded to apply strict scrutiny â€" the most rigorous form of judicial review â€" to invalidate the federal law.

In *Reno v. ACLU* (1997), the Court struck portions of a federal law that would have criminalized the transmission of patently offensive or indecent communications on the Internet. The Court rejected the governmentâ€™s arguments under *Pacifica* and applied strict scrutiny to invalidate those provisions.

Analyzing these decisions for the Congressional Research Service in 2005, Henry Cohen concluded that attempts to regulate indecency in the cable medium would be unconstitutional:

> â€œIt appears that a strong case may be made that applying the FCCâ€™s indecency restriction to cable television would be â€˜unreasonableâ€™ under this formulation. This is because, as the Supreme Court wrote when it struck down the ban on â€˜indecentâ€™ material in the Internet, â€˜the Government may not reduce the adult population â€¦ to â€¦ only what is fit for children.â€™ In Playboy, the Court, applying strict scrutiny, struck down a speech restriction on cable television, in part because â€˜for two-thirds of the day no household in those service areas could receive the programming, whether or not the household or the viewer wanted to do so.â€™ Thus, it appears likely that a court would find that to apply the FCCâ€™s indecency restriction to cable television would be unconstitutional.â€

And First Amendment attorney Robert Corn-Revere wrote in 2006: â€œCourts consistently have invalidated indecency regulations when applied to cable television both at the local and national level, and the reasons supporting these rulings have only gotten stronger as time and technology have transformed the media landscape. In these circumstances, any effort to extend indecency regulation to cable television or other non-broadcast media would be almost certain to fail a constitutional challenge.â€ (â€œCan Broadcast Indecency Regulations Be Extended to Cable Television and Satellite Radio?â€ 30 *Southern Illinois University L.J.* 243.)

Continuing controversy, technological answers and the future

The debate over extending FCC indecency rules to cable and other non-broadcast media continues, though there are many other controversies regarding the FCC and television content.

In April 2007, the FCC issued a report recommending legislative action to deal with the problem of violent content on broadcast, cable and other media. Then in June 2007, the 2nd U.S. Circuit Court of Appeals ruled in *Fox Television Stations v. FCC* that an earlier FCC policy change on â€œfleeting expletivesâ€ was arbitrary. (After years of not pursuing enforcement action against the occasional, stray profane remark, the FCC had changed course.) The appeals court noted that it was "skeptical that the commission can provide a reasoned explanation for its fleeting expletive regime that would pass constitutional muster." The government has appealed the 2nd Circuit ruling to the U.S. Supreme Court.

In June 2007, several members of Congress introduced the Family and Consumer Choice Act of 2007, which observed in its findings that â€œParents need more effective ways to limit the exposure of children to television with harmful content by being able to purchase cable programming that only

contains programming that is child-friendly.â€ One provision of the bill would prohibit indecent programming during the daytime on broadcast or cable. The bill was referred to the House Subcommittee on Telecommunications and the Internet in June.

The bill comes at a time when FCC Chairman Kevin Martin pursues his goal for â€œa la carteâ€ cable programming, which he touts as a pro-consumer choice mechanism that would obviate greater government content regulation. In a letter to several minority groups, Martin stressed that â€œan a la carte regime would enable viewers to buy their television channels individually, in smaller packages, or in the large packages currently offered.â€ That would mean subscribers could opt out of channels they felt were inappropriate for their households.

Many believe that the solution to protecting First Amendment values and minors lies more in enhanced technological tools than in pervasive government regulation.

Technology can provide methods for parents to control childrenâ€™s access to indecent material. For example, a provision of a 1996 federal telecommunications law provided for the installation of the V-chip in television sets above a certain size. While the V-chip has proven to be an effective tool, many insist that much more comprehensive and advanced technologies are needed.

Adam Thierer, senior fellow and director of the Center for Digital Media Freedom, writes that tools such as digital video recorders and video-on-demand services enable parents to control objectionable content without requiring intrusive regulation. â€œIt is impossible to consider video programming an â€˜intruderâ€™ in the home when tools exist that can help parents almost perfectly tailor viewing experiences to individual household preferences.â€

These technological tools not only could provide the answer to parentsâ€™ concerns but also could doom direct content regulations. One of the reasons that the Supreme Court invalidated an online harmful-to-minors law â€” the Child Online Protection Act â€” in *Ashcroft v. ACLU* (2004) was that a less-speech-restrictive alternative existed in the form of filtering software. The Court explained: â€œBlocking and filtering software is an alternative that is less restrictive than COPA, and, in addition, likely more effective as a means of restricting children's access to materials harmful to them.â€ One of the reasons the Court invalidated the signal-bleed provision in *United States v. Playboy Entertainment Group* was the availability of a lockbox alternative.

No one knows the ultimate likely outcome in this cauldron of political pressure, changing legal terrain, a differently composed U.S. Supreme Court and an upcoming election year.

â€œUltimately, as in the prior history of FCC content regulation, it will be a complex interaction of legal rules, marketplace developments, technology, consumer pressure and politics that will influence the extent of indecency and violence available on mass media," Professor Lili Levi concludes in her comprehensive report for the First Amendment Center, â€œThe FCCâ€™s Regulation of Indecency.â€

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Universal Concerns
Donny Jackson
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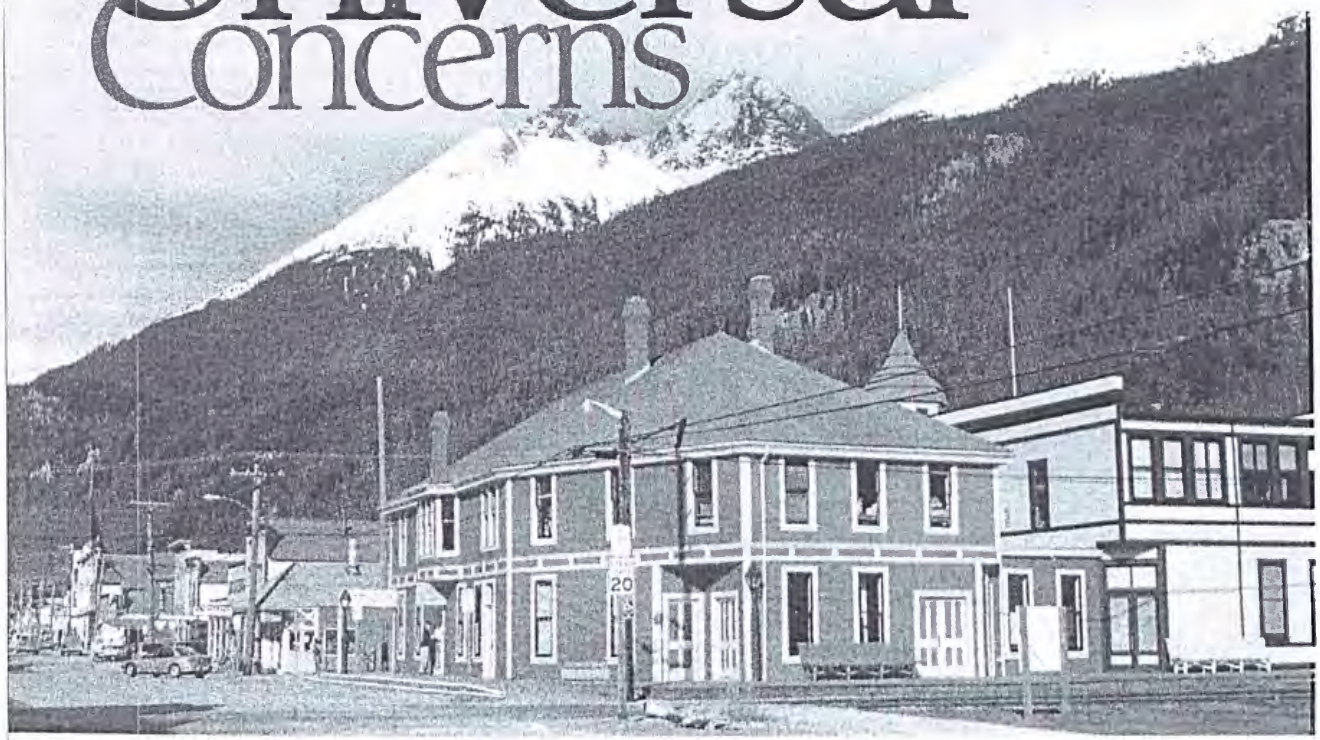
REGULATORY

Universal Concerns



Universal service has been at the forefront of U.S. telecommunications policy for 70 years. But financial woes, market changes and political shifts could result in the universal service fund's role changing dramatically during the next year.

by DONNY JACKSON

Since legendary AT&T boss Theodore Vail convinced regulators in the 1930s that a regulated monopoly would best advance U.S. communications, the concept of universal service has been the driving force for the nation's telecommunications policy.

Through the explicit subsidy—and implicit subsidies included in the intercarrier compensation system—even those living in the most remote and unprofitable locations in the nation have been assured of quality phone service at prices comparable to those offered in densely populated areas. The universal service program made the telephone a ubiquitous communications tool in the U.S. and enhanced the value of the public network to all users.

For all its past success, universal service support today is at a crossroads. The current funding mechanism is inadequate and must be altered dramatically to ensure long-term sustainability. But whether the current universal service fund (USF) should be sustained is a vexing question.

During the last 20 years, U.S. policymakers have eschewed the monopoly model in favor of a telecom policy that encourages free-market competition—a notion the FCC has said is inherently contradictory with the notion of universal service.

Meanwhile, many question whether the goal of the current universal service program—affordable telephone serv-

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ice—is appropriate for a society that is increasingly dependent on broadband technologies. But others believe expanding universal service this way would only greatly increase the already-burdensome fund and that introducing subsidies would distort any attempts to establish the broadband free market many policymakers seek.

With so many questions surrounding the program, the one certainty is that universal service has become a front-burner issue for the FCC and Congress, with both entities indicating they will seek to resolve the complex issue during the next year.

Indeed, policymakers are almost obligated to address universal service issues quickly because it is obvious the program will collapse financially without changes. While accounting issues (see news story, page 10) and fraud allegations have grabbed headlines in recent months, the real problems are based on fundamental market changes.

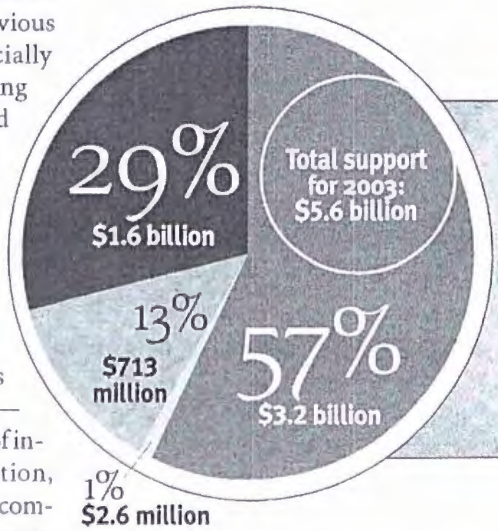
Currently, USF funding is generated from charges paid by consumers who make long-distance calls. The $6 billion federal USF is bankrolled by taking a percentage—8.9% in the third quarter of 2004—of interstate access revenues. In addition, more than 15 states have their own complementary universal service programs that generate a combined $1.9 billion annually, according to the National Association of Regulatory Utility Commissioners (NARUC).

But long-distance revenues are shrinking. Not only are technological advances and IXC competition driving down costs, but an increasing amount of long-distance traffic is being handled through mobile wireless and voice over IP (VoIP) offerings—technologies that effectively let providers pay into universal-service programs at reduced rates.

Meanwhile, the size of the fund is growing. With the passage of the 1996 Telecom Act, the USF—once used solely to ensure that copper wires were affordable to the poor and those in high-cost areas—was expanded to fund Internet connections to schools, libraries and health-care facilities (see figure).

The decreasing funds and increasing demands on the USF have some telecom analysts comparing universal service to Social Security—a longtime sacred cow that politicians have been hesitant to address, even though the current subsidy program obviously cannot be sustained. Certainly, it's not a formula for long-term stability.

"You have decreasing revenues and increasing obligations," said Ray Gifford, president of the Progress and Freedom Foundation. "Obviously, that's not sustainable long term."



Phone Support

How the Universal Service Fund gets distributed to rural areas, schools and other recipients.

- High-cost areas
- Schools and libraries
- Low income areas
- Rural health-care providers

Source: Company reports

In addition, the USF program also stopped benefiting only traditional wireline carriers, as the FCC allowed wireless carriers to apply for the funds via requests to state commissions. But many believe state commissions have been overly liberal in granting the eligible telecommunications carrier (ETC) designations because the funding comes from the federal USF program instead of a state-supported source.

"They [state regulators] really don't have any incentive to refuse ETC applications—after all, the funding's not coming from the state, so it's like free money to them," said one rural carrier source.

As a result, the amount of ETC funding has skyrocketed during the last five years. While this growth is a significant point of contention among rural ILECs, Western Wireless CEO John Stanton notes that wireless carriers receive only 3% of the federal USF support despite contributing 27% of the revenue into the fund—a discrepancy he believes has to change quickly.

"If the system is not fixed, we will revolt," Stanton said during a keynote delivered at Telecom '04.

Meanwhile, the adoption of VoIP technology promises to be even more problematic. Many believe the FCC's recent decision that VoIP is an interstate service likely precludes the possibility that VoIP calls will be subject to intrastate access charges, so there would be no contributions to state universal-service programs.

In addition, the FCC must rule by March 22, 2005, whether to adopt a Level 3 Communications forbearance petition requesting that VoIP calls terminating on the public network be subject only to reciprocal compensation, not long-distance access charges that contribute to universal-service programs.

Currently, the most popular funding proposal being discussed is a numbers-based approach es-

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poused by FCC Commissioner Kevin Martin. By charging a flat rate of $1 to every working telephone number, Martin has said enough money would be generated to address all ongoing federal USF obligations while quelling concerns that the contribution system favored one technology over another.

While that could work well for the federal USF program, there are legal questions about whether states could pursue the same approach, according to NARUC general counsel Brad Ramsay.

Courts have prohibited states from assessing state universal service changes on interstate access charges "because that's what the FCC does" to generate funds for the USF, Ramsay said. Applying the same logic to the numbers-based system could preclude states from collecting universal-service revenues via a numbering plan.

"It will be interesting to see how the FCC decides to address this," Ramsay said. "I don't think the FCC wants to fold the $1.9 billion [in the state universal-service systems] into its program."

Of course, the other way to resolve the USF funding concerns would be to reduce the amount of money disbursed through the programs, but there has been virtually no consensus to date. Fundamentally, most FCC commissioners have said they do not advocate the use of USF funds to subsidize competition in areas where it is difficult for even a monopoly carrier to make a return on its investment, but no specific proposal has been made public.

Rural ILEC representatives advocate stricter ETC criteria to reduce the number of carriers getting payouts, thereby reducing pressure on the fund. In addition, they believe the formula for determining payout amounts should be changed. Today, a wireless ETC receives the same amount of money per customer in high-cost areas as the wireline provider, even if the ETC's cost structure to provide service is significantly different. Rural carriers believe ETCs should be compensated based on their own reported costs.

Tom Tauke, Verizon Communications executive vice president of public affairs and communications, said he supports a policy that would eliminate ETCs altogether.

regulatory

To see how the universal-service fund changes might affect other telecom technologies—such as cable and VoIP—check out our Web site.

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"We believe payment should be changed so that it goes only to one carrier in a given geographic territory—the carrier that would probably be designated as the carrier of last resort," Tauke said. "We don't think it makes sense to support multiple infrastructures in an area that is hard to serve."

But some question whether this is practical if a numbers-based collection system is adopted because cable, wireless and VoIP providers likely would object to a system in which they were required to contribute to USF but would not be eligible for universal-service disbursements.

The most formal proposal to reduce USF obligations was adopted early this year by the Federal-State Joint Board, which recommended that the FCC only provide universal-service support for the "primary" line in a given home.

After being roundly criticized as bad for economic development in rural areas and a logistical headache—determining which line is the primary line—the Senate prohibited the FCC from even considering the primary-line proposal when voting on the agency's budget.

The action underscored the power rural carriers wield in the Senate, where the membership must show sensitivity to rural issues in order to be re-elected.

"As long as two senators are elected from every state, rural carriers will be protected," said Bill Hunt, vice president of public policy for Level 3.

And rural carriers' sentiments likely will be a central topic of discussion in future USF debates as Congress revisits the Telecom Act during the upcoming year. That's because the Senate Commerce Committee will be led by two senators from the most remote states in the union—Ted Stevens (R-Alaska) and Daniel Inouye (D-Hawaii).

In the FCC and in Congress, expect USF proposals to be linked closely to plans designed to revamp the intercarrier-compensation system. Together, these two sources generate 50% to 90% of many rural carriers' revenues.

But Beltway observers are watching closely to see where the agenda of rural carriers wanting to maintain this system and the RBOCs' deregulatory agenda collide. After all, it would be tricky for RBOCs to convince policymakers at the FCC and Congress that a deregulated broadband market should be allowed to flourish in the free market while arguing for the preservation of an explicit subsidy like universal service.

Even with support in the Senate, rural carriers may need to revamp their business plans to reduce their dependence on subsidies, according to Jake Jennings, senior vice president of regulatory and industry affairs for NuVox Communications.

"Every carrier has its addictions," Jennings said. "CLECs were addicted to reciprocal compensation, ILECs are addicted to special access and rural carriers are addicted to universal service and access fees. So far, [CLECs] are the only ones that have gone through forced rehab. Now, it's everyone else's turn."

Most rural representatives have indicated they do not plan to let the current universal-service system expire without a fight, but Alltel President and CEO Scott Ford encouraged other rural carriers at Telecom '04 to be open-minded about rules that will give them a way to make a transition to an IP-based environment.

"If all we do is resist, the [universal-service] system will snap," Ford said. ■

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The Wall Street Journal

November 12, 2007

EU Telecom Plan Draws Fire

Effort Could Lead To Lower Costs; Industry Resists

By ANNE JOLIS
November 12, 2007; Page A9

BRUSSELS -- The European Commission is preparing to unveil a plan this week to inject more competition into the European telecommunications industry and reduce costs for consumers.

Many of the continent's dominant companies and the governments that often control them are fighting the plans, and they could succeed in watering down important aspects.

European Telecom Commissioner Viviane Reding is expected to unveil a plan tomorrow that would allow national regulators to force dominant operators such as France Télécom SA to break up their operations, making it easier for other companies to offer competing services over the dominant operators' networks.

[Viviane Reding]

Ms. Reding is also expected to propose giving a Brussels-based authority oversight of the 27 national regulators, in essence creating an agency like the U.S. Federal Communications Commission. The national regulators would act as a board of directors to that authority. Her plans have been widely leaked and discussed in the media.

In recent speeches, Ms. Reding has said her ideas for spurring competition are based on the model of the United Kingdom's BT Group PLC, which spun off Openreach, its network-access unit, in January 2006.

That plan involved what is known as functional separation, in which an operator's network-infrastructure division and services division are split into separate units. After the January 2006 BT split, the average monthly telecoms costs for British residential customers fell to 20% below their 2004 levels, according to the U.K. telecom regulator.

Critics say the Openreach experience can't be replicated in every country. Some companies are coming forward with plans aimed at forestalling the need for a similar approach.

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France Télécom, for example, last month offered to give its competitors access to its underground ducts, allowing rivals to lay cables in them. The ducts house France Télécom's fiber-optic cables, which provide high-speed services. France Télécom says there would be room for several operators to lay cables to their customers.

"This is the way to create real competition, not to disintegrate a company and take away incentives to invest," said Jacques Champeaux, France Télécom's executive vice president for regulatory affairs.

It isn't clear that such a move would satisfy the commission. Ms. Reding's spokesman, Martin Selmayr, said providing open access to ducts is an important step but would, "in most cases, not be the appropriate tool," in less-populated rural areas, where laying fiber-optic cable is risky and costly.

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The Switchboard Problem: Scale, Signaling, and Organization in Manual Telephone Switching, 1877-1897

Milton Mueller

Technology and Culture, Vol. 30, No. 3. (Jul., 1989), pp. 534-560.

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The Switchboard Problem: Scale, Signaling, and Organization in Manual Telephone Switching, 1877–1897

MILTON MUELLER

A telephone exchange is a radical rearrangement of social space. It brings any two speakers together on demand, regardless of where they are located. By thus collapsing social space, it also vastly expands its scale, making millions of people who would otherwise be inaccessible to each other capable of instant, real-time conversation.

The very radicalism of this act of social integration led the early developers of telephone switching into one particularly troublesome dilemma. In 1881, the manager of the fledgling Milwaukee Bell telephone exchange complained that "the general impression among subscribers is that if an exchange of 100 subscribers can be run at [rates of] $12 a month, then an exchange of 1,000 ought to be run for about 40 cents. You can't make them believe anything else." In fact, as he was painfully aware, telephone exchanges became *more* expensive to run (per subscriber) as the number of subscribers rose. The "economies of scale" eagerly anticipated by customers did not exist. On the contrary, growth brought only rate increases, and the large exchanges in New York, Chicago, and Boston charged three or four times the rates of smaller cities.

The locus of the problem was the switching process, and the problem was not technical so much as it was organizational. As the number of subscribers to a telephone system grows, the number of possible connections among them grows much faster—roughly as the

MR. MUELLER is a Ph.D. candidate in the Annenberg School of Communications at the University of Pennsylvania. He thanks the members of the AT&T historical archive; stimulating discussions with Alan Gardner and the support and encouragement offered by Robert Garnet and Robert Lewis are especially appreciated. He also thanks Dr. Thomas Hughes, whose University of Pennsylvania graduate seminar led to the exploration of the topic, and his adviser, Dr. Carolyn Marvin, for permitting one more independent study project.

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square of the number of subscribers. Consequently, switchboards became increasingly expensive to construct, and the operations needed to make connections became increasingly complex and slow, as more people joined the exchange. This diseconomy of switching was the most important "reverse salient" encountered during the early years of telephone development. More than any other single factor, it constricted progress by linking system growth to slower service and higher costs. It also was unusually persistent. It took the Bell system twenty years and three generations of switching technology to come up with a long-term solution to the problem. Not until the introduction of automatic lamp signals, the common battery switchboard, and the development of a science of traffic engineering between 1892 and 1897 did switching cease to be a constraint on telephone system growth.

This article differs from other works on the history of switching technology both in terms of its subject and its approach. The account of manual switching technology in volume 1 of the *History of Engineering and Science in the Bell System* series,[1] while containing much useful information, fails to identify the central role played by the diseconomies of growth in the development of the technology. Other works on the history of switching tend to separate automatic from manual switching in order to concentrate on the former. A. E. Joel's history of switching in the Bell system, for example, begins in 1925, after Bell had committed itself to automation.[2] Robert Chapuis, in an otherwise thorough treatment of the first 100 years of switching, devotes only a few pages to the manual era.[3] In effect, developments before 1910 are consigned to the prehistory of switching. This bias is understandable; from a purely technical viewpoint, automatic switches *are* more interesting than their predecessors. But this article is not about the technical apparatus of switching per se. Its subject is the confrontation with the multiplying possibilities of an expanding network, a problem that was most visible during the manual era.

This confrontation is of interest for two reasons: its importance to an understanding of telephone history and its implications for social theory. Exchange diseconomies were an overriding concern during the first twenty years of telephone development, affecting, for example, the Bell system's rate policies, the political climate in which it

[1]M. D. Fagen, ed., *History of Engineering and Science in the Bell System*, vol. 1, *The Early Years, 1876–1925* (Warren, N.J., 1975).

[2]Amos E. Joel, *History of Engineering and Science in the Bell System*, vol. 3, *Switching, 1925–1975* (Warren, N.J., 1982).

[3]Robert J. Chapuis, *100 Years of Telephone Switching*, pt. 1, *Manual and Electromechanical Switching, 1878–1960s* (Amsterdam, 1982).

operated, and its approach to the introduction of automatic switching. The deeper significance of this history, however, concerns the power of technological systems to connect and integrate human society into ever-larger units. It should be seen as a case study of how the communicative relations that maintain and constitute social organization are transformed by growth.

There is evidence that almost identical problems have characterized the growth of other systems. Alfred Chandler, for example, demonstrates that, as the railroads first evolved from local operations into larger, regional networks in the 1850s, their per-mile operating costs drastically increased.[4] The source of the diseconomies, as with the telephone, was not the cost of materials or labor per se, but the increasing complexity of organization and control once the railroad's operations extended beyond the domain of a single mind. Currently, the purveyors of cellular radiotelephone services have been accused of a failure to recognize the complexities involved in accommodating subscriber growth. The telecommunications trade press wonders "how long present systems can hold out before new technology is needed to handle the massive growth in cellular usage expected by the end of the decade."[5] What will be presented here as "the switchboard problem" is simply an unusually clear example of the kind of reordering of organization and communication that must occur as the scale of social interaction is enlarged. In the concluding section, I relate these organizational diseconomies of growth to current speculation about the emergence of an "information society."

The Uneasy Birth of the Exchange

Switching was not immediately recognized as an essential part of the telephone business. Alexander Graham Bell had invented a device that transmitted the human voice over wire. His invention contributed nothing to the immense technical and organizational apparatus required to bring any two users of the telephone together on the same circuit. The Boston capitalists who commercialized the telephone saw it as a machine to be leased to customers rather than as part of a service provided by an operating company. For most of 1877, telephone pairs were connected by their own private lines.

It did not take the Bell companies long, however, to hit upon the principle of the telephone exchange, a central office where multiple

[4]Alfred D. Chandler, Jr., ed., *The Railroads, the Nation's First Big Business: Sources and Readings* (New York, 1965), p. 101.

[5]*Communications Week*, February 2, 1987, p. 29.

subscriber lines would converge for interconnection. Both the people and the techniques involved in the earliest exchanges had their roots in "District" telegraph companies, which supplied burglar alarm, fire alarm, and messenger call services over local telegraph networks. Since the process of signaling a central office from outlying call boxes was an established part of their business, an exchange arrangement of telephones came naturally to them.[6]

After successful exchange operations were established in a few New England locations, the Bell Company began to encourage its licensees to open exchanges. In February 1878 it published instructions to licensees urging them to promote the telephone as a substitute for district telegraph services. By March of that year, Alexander Graham Bell was able to speak, in his talks promoting the telephone around the world, of "central offices" where telephone wires could be connected to "establis[h] direct communication between any two places in the city."[7]

It was probably the Bell Company's incursion into telegraphic territory that finally provoked a response from Western Union. The telegraph giant, which had earlier dismissed the telephone as "an electrical toy," obtained the patents for an improved telephone transmitter invented by Thomas Edison and launched the American Speaking Telephone Company in 1878. The year and a half of competition accelerated the trend toward exchange operations. Western Union mobilized its nationwide network of telegraph affiliates to establish telephone exchanges, brought in hundreds of new subscribers, and deployed its resources toward improvements in switching facilities.

In a purely mechanical sense, the problem of setting up and taking down connections rapidly was solved almost immediately. About fifty subscribers' lines would terminate in an upright board equipped with magneto-powered signals and some form of connecting apparatus. The signals, known as annunciator shutters, were flaps that were released and dropped whenever the subscriber cranked the magneto generator on his telephone (fig. 1). A variety of connecting apparatus was in use, including the jack and cord that eventually became dominant.[8]

[6]Robert Garnet, *The Telephone Enterprise* (Baltimore, 1985); Fagen (n. 1 above), p. 489.

[7]Speech in Kensington, England, March 25, 1878; cited in John Kingsbury, *The Telephone and Telephone Exchanges: Their Invention and Development* (London, 1915), p. 92.

[8]As late as 1883, the Bell licensees were using the switchboards of twelve different manufacturers.

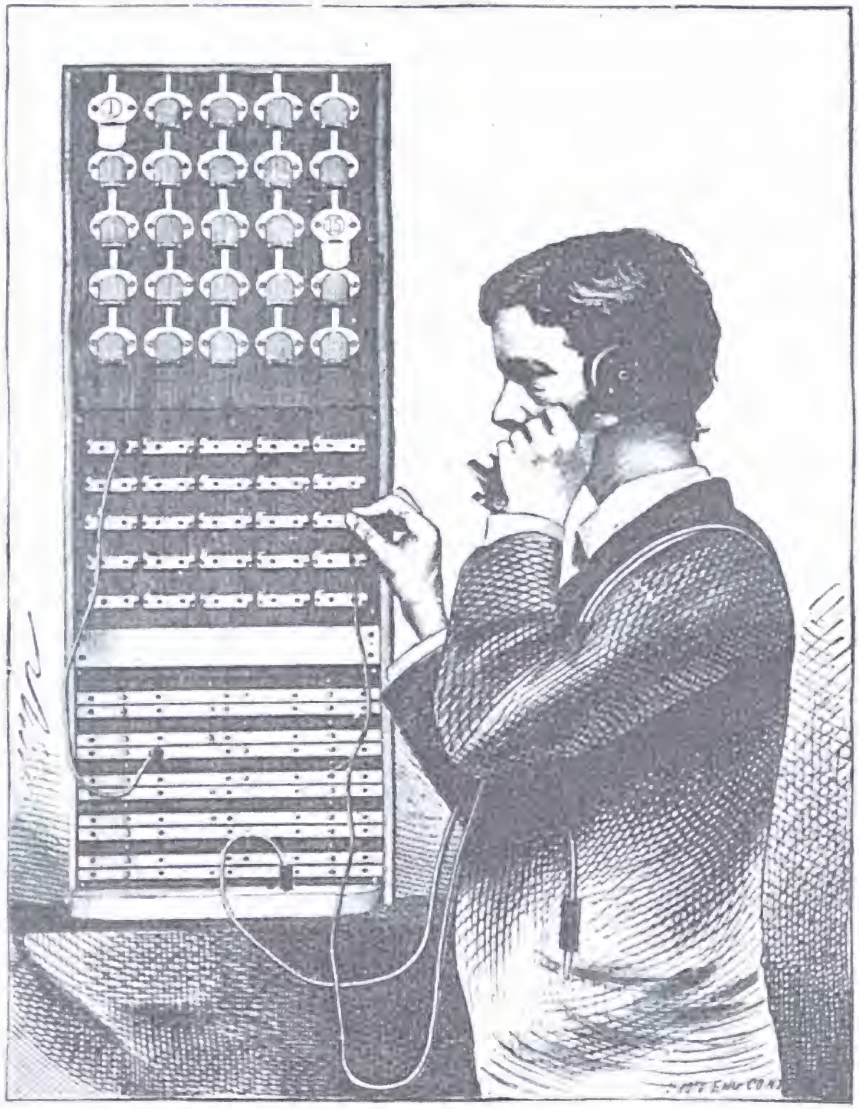


FIG. 1.—The telephone switchboard of the Gold & Stock Telegraph Co. of New York, a Western Union–affiliated exchange, ca. 1880. (George Bartlett Prescott, *The Electric Telephone* [New York: D. Appleton & Co., 1890], p. 231.)

Aside from its inability to signal for disconnection adequately,[9] this technology handled calls quickly and smoothly—as long as both the called and the calling party terminated on the same switchboard. Each time 100 or so new subscribers were added to an exchange, however, some calls had to be transferred from one switchboard to another. Here lay the root of what became known as "the switchboard problem." The need to "trunk" or "transfer" connections swelled the amount of time and resources expended on one connection. The operator had to know the board on which the desired party terminated, find an open trunk line to that board, and signal the operator there. Two or more operators had to participate in setting up and taking down connections; each had to spend time getting the other's attention, communicating with the other, and monitoring the call. One connection, handled so simply on a single board, became a highly complex operation.

In late 1878 and 1879, during the competition between Bell and Western Union, exchanges first grew to the size where trunking between boards became necessary. Organizing communication between operators immediately developed into a major problem. At first, the operators simply shouted at each other across the central office. The din generated by this method often led to mistaken connections or delays. As the switchboard stations became larger, an elaborate division of labor evolved, until a single call could pass through the hands of five different people.[10] Operators in some of these central offices communicated by the circulation of written tickets, and making a connection by this method often took as long as five minutes. Other offices used talking circuits and found that, while it was faster, repeating the number several times increased the chance of error. C. E. Scribner, a Western Electric engineer whose inventions dominated the first twenty years of switching, summed up the situation succinctly: "in the first months of 1879, perfect chaos existed in the larger telephone exchanges."[11]

[9]When the conversation was over, subscribers were supposed to "ring off," i.e., crank their magneto generator again, dropping the shutter and notifying the operator that the connection could be taken down. Many did not remember to do this; even when they did, the method did not always work, so the operators had to break into the conversation regularly to find out whether the line was still in use. See, e.g., *Electrical Review* 2 (April 12, 1883): 6: "Everybody who uses the telephone knows what it is to be interrupted in the midst of his most earnest talk."

[10]*Telephone Switch Boards,* Report of a Conference held at the Office of the AT&T Co., December 19, 20, and 21, 1887, p. 172. Bell Labs Archives, Warren N.J. (Hereafter cited as *AT&T Switchboard Conference* [1887].)

[11]Kingsbury, *The Telephone and Telephone Exchanges* (n. 7 above), p. 222.

To the businessmen and electricians involved, it was clear that exchange operation had completely transformed the nature of the telephone business. It was no longer just a matter of leasing an instrument, but a service of extraordinary complexity. After the Bell–Western Union patent settlement of November 1879 ceded the telephone business to the Bell interests, representatives of the Bell licensee companies came together in a national conference in September 1880 to compare notes on the economic and technical aspects of running an exchange. The convention formally incorporated itself as the National Telephone Exchange Association (NTEA) and continued to meet once or twice a year until 1890.

A report at the first conference by C. N. Fay, the president and general manager of the Chicago Bell exchange, laid out the problem in clear and bold language. In 1880, Fay's Chicago exchange was the largest in the country, with 1,633 stations, 9 separate central offices, and 153 trunk lines connecting them. Like many others, Fay had learned during the competition with Western Union that the initial business plan of leasing phones for a flat rate of about $20–$40/year was not congruent with the economics of exchange operation. Around July of 1879, he said, the opinion was "gaining ground" that "we would have to charge by the switch and not by the year," and he began to keep records of connections.[12] Fay recognized that a "connection"—the establishment of a talking circuit between two subscribers—was the basic product of the exchange rather than telephones. His observations, based on his records, confirmed what many other exchange managers already knew intuitively: the expense per subscriber increased as the exchange grew.

By the time of the second and third NTEA meetings in 1881, the need to adjust rates to compensate for rising average costs was a major concern. The most significant indicator of the problem was the ratio between subscribers and operators. Without exception, the largest exchanges had the worst ratios. That is, it took more operators, more work, to handle the same number of subscribers when they were part of a large exchange than when they were part of a smaller exchange. New York, Chicago, and Cincinnati, with roughly three times the number of subscribers, were burdened with almost ten times the number of trunks as the medium-sized exchanges in Albany and Buffalo (see table 1). The biggest exchanges needed twice as many operators to handle a given number of subscribers as the medium-sized exchanges, and three or four times that of the small exchanges.

[12]Minutes, National Conference of Telephone Companies, Niagara Falls, N.Y., September 7, 8, and 9, 1880 (New Haven, Conn., 1881). Bell Labs Archives.

TABLE 1
TELEPHONE SUBSCRIBER/OPERATOR RATIOS 1881–1883

	SUBSCRIBERS			NUMBER OF TRUNKS			SUBSCRIBERS PER OPERATOR		
	1881	1882	1883	1881	1882	1883	1881	1882	1883
New York	2,747	2,873	3,576	...	274	339	23	23	23
Chicago	3,054	2,596	2,903	...	228	245	24	25	31
Cincinnati	1,741	2,056	2,099	...	277	312	24	26	32
Albany	1,058	1,100	1,076	...	35	69	71	77	72
Buffalo	990	1,047	1,208	...	21	26	40	40	67
Evansville	320	440	550	0	0	0	106	146	183
Owensboro	...	120	109	...	0	0	...	120	109

SOURCES.—National Telephone Exchange Association minutes: no. III (1881), p. 46; no. IV (1882), pp. 39–49; no. V (1883), pp. 33–39. Bell Labs Archives.

Although all three categories show a slight improvement in the subscriber/operator ratio over the three-year period, the division between the categories remains marked and intact.

It is not hard to show why the technology and economics of telephone switching proved to be so sensitive to subscriber growth. The reason is essentially mathematical. As the universe of subscribers (S) to an exchange grows, the number of circuits required to connect them all (N) does not grow in direct proportion, but roughly at the more rapid rate $N = S^2/2$.[13] The central exchange itself was the first concession to this principle. If each subscriber was linked by direct wire to every other, N would represent the total number of wires that would have to be strung to interconnect all subscribers. An exchangeless telephone system of only 500 people would be burdened with 124,750 separate wires, with 250 wires emanating from each telephone.

A central exchange eliminates the multiplication of wires but not the mathematical increase in the number of possible connections. The increasing complexity is simply shifted to the central office, where the operators and switching apparatus must be equipped to handle a constantly expanding array of possibilities. As noted earlier, once the process of interconnecting subscribers extended beyond a single switchboard, connections became slower for the subscribers, used more physical plant, consumed more of the operators' time, and were more likely to be incorrect. Yet as the number of switchboards in an

[13]The actual formula is $[S(S-1)]/2$, the expression for the number of different combinations of two that can be selected from the number S.

exchange increased, the number of transferred connections increased proportionally. An office with all of its subscribers on one board could make 100 percent of its connections directly. An office with two boards had to transfer half of them; an office with three boards had to transfer two-thirds of them; and so on.[14]

The telephone exchange's great promise was to establish a talking circuit on demand between any pair of subscribers. By committing itself to the performance of this task, however, the developers of the telephone had set in motion a mathematical spiral that progressively increased the complexity and cost of switching. Subscriber growth and the expanding geographic scope of telephonic interconnection created quantum leaps in the number of possible connections. How to handle these quantum leaps without equally large jumps in the cost of equipment and labor was the fundamental problem facing switching technology in the early years.

The Multiple Switchboard: Solving the Problem or Perpetuating It?

The first great technical advance made in response to the increasing complexity of large exchanges was the "multiple switchboard." The essential principle behind the multiple switchboard was simple enough: it put a connecting jack for every subscriber before each operator. The operator would *answer* the calls of only 100 subscribers, as before, but below (or above) his or her set of annunciators was an array of connecting jacks for every subscriber in the exchange. Subscriber lines ran in series through all switchboard sections. This entirely eliminated the need to transfer calls within a central office; only one operation was needed to complete a talking circuit. While this simplified the process of making a connection, it complicated the circuitry and signaling. If any operator could plug into any subscriber's line without the intervention of another operator, then an electrical "busy test" had to be devised to warn operators which lines were already in use at another operator station.

The principle of the multiple switchboard was conceived as early as March 1879 in Leroy Firman's Chicago Western Union exchange.[15] Because of the complications involved in devising a workable busy test, full-fledged use of the multiple did not begin until 1883. By 1885, multiple switchboards had been introduced in fifteen cities, ranging in size from Elgin, Illinois (pop. 14,000), to the three largest central offices in New York City.

[14]Assuming that all subscribers are equally likely to call each other.
[15]F. L. Rhodes, *The Beginnings of Telephony* (New York, 1929), p. 159.

Boston in particular had taken the lead in converting its entire exchange over to multiple switching, and in 1885 John J. Carty of the Boston-based American Bell Telephone Co. delivered a paper before the NTEA enthusiastically endorsing the new technology. After documenting how it had reduced the operator force by 25 percent, Carty concluded his report with a bold statement: "in my judgment I consider the switchboard problem solved."[16] For the next four years, Carty's optimistic assessment seemed to be corroborated by the experience of other cities.[17]

The most thorough evaluation of the multiple and other issues in switching occurred during the three-day "Telephone Switch Board" Conference held at the offices of American Telephone and Telegraph Company (AT&T) in December 1887. The switchboard conference was modeled after the very successful Cable Conference held in September of the same year to improve the techniques of voice transmission. But the difference between the two meetings is instructive. The Cable Conference, being concerned with narrowly technical solutions to well-defined problems, was a one-time affair that succeeded in formulating exact standard specifications to be implemented throughout the Bell licensee companies. The switchboard conference, on the other hand, raised more questions than it answered. Its members found it necessary to attempt to define just what the function of a telephone exchange was. The issues it identified did not prove to be susceptible to consensus, much less immediate resolution. On the contrary, the conference participants became the nucleus of an ongoing "switchboard committee" that intermittently struggled with the same problems for the next eight years.

Presiding over the conference was E. J. Hall, former manager of the Buffalo exchange and now vice-president and general manager of AT&T. The AT&T Co. had been formed in 1885 to finance and manage long-distance development. Its engineer Angus Hibbard was also present. The Boston-based ABT Co. was represented by electrician Thomas Lockwood, who drafted the conference synopsis, and consulting engineer Joseph Davis. Charles Scribner and E. M. Barton represented the switchboard manufacturer Western Electric Co. In addition to these representatives of the nationwide Bell interests, ten electricians and managers from the larger Bell exchanges in Brooklyn, New York, Chicago, Pittsburgh, Cincinnati, Boston, Kansas City,

[16]Convention minutes, National Telephone Exchange Association, Philadelphia, September 16 and 17, 1884. Bell Labs Archives.

[17]See, e.g., the reports in the convention minutes of NTEA VII (1885), p. 161; NTEA IX (1887), p. 82; and NTEA XI (1889), p. 94.

and St. Louis participated. The makeup of the conference was an indication of the increasing stratification between the technical demands of large urban centers and the rest of the country. Indeed, the conference began by "dismiss[ing] from consideration all switchboards and central offices with less than 1,000 lines" because the problems with which the conference was concerned "do not begin until that number is reached."[18]

Among other recommendations pertaining to long-distance development, the conference gave the multiple its official stamp of approval.[19] But the most important decision to come out of the conference was an explicit definition of the role of the exchange in telephone service. Led by Thomas Lockwood, the conferees agreed that the telephone company should absorb as much of the switching and signaling functions of telephone service as possible. Their desire to popularize the telephone and gain acceptance for it as an indispensable utensil of modern life committed them to making switching as transparent to the user as possible. The process of making a connection should be handled entirely by trained professionals and assume no special knowledge or intelligence on the part of the user. As E. J. Hall put it several years later, "any attempt to take the user into our service and make him do a part of the work is a movement which is not in the right direction."[20]

The principle of "user transparency" played a major role in decisions to accept or reject switching and signaling technologies for the next forty years. It was a major consideration, for example, in the Bell system's decision to resist automatic switching, for the so-called automatic switch actually increased the subscriber's involvement in the switching process by making him dial numbers. This attitude had much of its origin in the organizational problems faced by switching offices in the early years. Switching was hard enough to manage and

[18] *AT&T Switchboard Conference* (1887), p. 13.

[19] "The multiple switchboard for large central offices is a material improvement upon, and presents decided advantages in the matter of efficiency and economical operation over the grouping or sectional switchboard. . . . No circumstances can be conceived which would render a return to the grouping or trunk line boards desireable" (ibid., p. 3).

[20] *Committee on Switchboards and Telephonic Apparatus.* Transcript of a meeting held at the AT&T Co. office, March 15–18, 1892, p. 123. Bell Labs Archives. This committee met six times. The transcripts, which are held in the Bell Labs Archives, will hereafter be cited as follows: *Switchboard Committee I* for the meeting of July 21, 1891; *Switchboard Committee II* for the second meeting of 1891; *Switchboard Committee III* for the meeting of March 15–18, 1892; *Switchboard Committee IV* for the meeting of May 18–20, 1892; *Switchboard Committee V* for the meeting of 1893; and *Switchboard Committee VI* for the meeting of May 1895.

control effectively without introducing the random and uncontrollable element of subscriber participation. It also militated against the division of labor in making connections. The managers wanted to concentrate all the operations needed to bring two subscribers together in the hands of one operator who could see the process through to completion and take full responsibility for the connection. This was another strong reason to embrace the multiple switchboard, which accomplished just that. As Thomas Lockwood pointed out in a debate over the merits of the old and the new switchboards, the transfer system "needs the cooperative intelligence of two persons to make a connection," while "in the equivalent of the trunk wire which is used in the multiple, the intelligence of only one person is required."[21]

Despite the conference's strong endorsement of the multiple, its participants had already begun to confront some of its latent problems. The multiple's improvements in efficiency were almost entirely due to its elimination of transferred connections. It was able to do this, however, only by vastly increasing the number of wires and connecting jacks in an exchange. The Metropolitan Telephone Co. of New York City had already discovered that building one 10,000-line multiple switchboard for the entire city would cost more than twice as much as building three smaller, dispersed central offices and retaining some trunking.[22]

In fact, the multiple switchboard had, at a higher-level component of the telephone system, wholeheartedly embraced that mathematical increase in connection facilities which the exchange itself was originally invented to avoid. Within the central office, it ran a direct line for each subscriber from one section of the board to every other section, just as a primitive, exchangeless telephone system might run a direct wire from each telephone to every other.[23] At this point in the evolution of switching, the costs and delays associated with using the "cooperative intelligence of two persons" to make a connection were so forbidding that to most the multiplication of physical apparatus seemed a preferable alternative. Consequently, the quantity of jacks and wires in a multiple switchboard increased as the *square* of the rate of increase in the number of subscribers. For central offices in the range of 500–3,000 subscribers, the additional plant appeared to be worth the savings in efficiency and in labor. But how long could this

[21] *AT&T Switchboard Conference* (1887), pp. 36–39.

[22] Ibid., pp. 226–44.

[23] The actual formula is S^2/C, where C = the subscriber capacity of an operator station.

geometric increase go on before diseconomies began to set in once again?

Back to the Drawing Board

Carty had hailed the multiple as the solution to the switchboard problem in 1885. It took only six years to prove him wrong. By the summer of 1891, diseconomies of scale and assorted technical problems had become worrisome enough to prompt the formation of a special committee. A memo drafted by Joseph Davis of ABT claimed that "while the multiple switchboard in its present form is now in general use and seems to meet the necessities of the case better than any other, it is evident that a sentiment of uneasiness still exists in the minds of many of our foremost thinkers regarding its permanent employment."[24]

The multiple had proved to be susceptible to a number of electrical difficulties.[25] But these technical bugs could be and quickly were overcome by refinements in the circuitry. The real source of "uneasiness" was fundamental to the design of the multiple. In big-city exchanges, the multiple part of the switchboard was threatening to become so large that a single operator could not reach all the jacks. (At this time, the minimum size of a jack was about a half-inch square, and only 6,000 of them could be arrayed within an operator's reach.) By the time it reached that point, the enormous cost of multiplying jacks and wires began to take its toll.[26]

These problems were exerting a noticeable drag on the growth of telephony. Subscribers were becoming restive over rates. In New York City the business rate was up to $240 a year. The ABT Annual Report for 1892 found it necessary to mention and counter criticism that the rates in larger cities were too high when compared to those of smaller cities by appealing to exchange diseconomies. The subscriber growth rate was dwindling down to 5 percent a year or less.

The operating companies themselves were becoming as discontented as their subscribers. As Scribner pointed out to the committee, they "have refrained from ordering switching apparatus that they needed; in some cases [they] have refused subscribers because they

[24] *Switchboard Committee I* (n. 20 above).

[25] In the original design of the multiple, the subscriber's circuit made a direct serial connection with each section of the switchboard. If the circuit were broken on any switchboard section because of a weak jack or dirt, the whole circuit would be held open and give off a false busy signal. The circuit had to pass through so many sections that electrical imbalances in a metallic circuit could be produced, because one side of the loop could be hundreds of feet longer than the other.

[26] *Switchboard Committee IV* (n. 20 above), p. xx.

were without facilities for connecting them with the exchanges; and they are today unable to give orders for switchboard apparatus because they do not know what form of apparatus they need."[27]

To add to the operating companies' woes, the trunking problem was back. In large metropolitan areas a growing number of the connections handled were between subscribers served by different central offices. Trunking was most pronounced in New York and Chicago, where only 40 and 50 percent of the connections, respectively, were local to an office.[28] The problems with trunked connections between central offices were exactly the same as those which had plagued transfer connections inside switching offices ten years earlier: they took more time, tied up two operators, and were more liable to error.[29] In these large, dispersed exchanges, switching had come full circle back to the problem of using "the cooperative intelligence of two persons" to make a connection, only at a higher-level component of the system (interoffice rather than intraoffice connections).

The Committee on Switchboards and Telephonic Apparatus was a group of seven men representing AT&T, ABT, Western Electric, and the exchanges in Boston, New York, and Chicago. Once again, E. J. Hall presided over it. The group met six times, from July 1891 to May 1895. Its membership changed slightly over this period, with Davis eventually supplanting Hall as its head. After a year of false starts, its records document a revolution in signaling, power supply, and organization that solved the switchboard problem for many years. While the committee's records provide the most complete documentation of the kind of problems that led to this revolution, the committee itself was rarely responsible for the changes. Many of its recommendations turned out to be wrong, and its proposals often turned out to be dead ends. It was, rather, a valuable forum where new ideas could be brought for discussion and evaluation and then tested in the local exchanges.

The committee's first two meetings aired the problems and pursued two innovations: a switchboard in which the jacks were placed horizontally rather than vertically to enlarge the capacity of operators, and a "combination line exchange system" that used shared trunks rather than individual lines to connect subscribers to the central office. Working models of both were constructed by AT&T and

[27]Ibid., p. 385.

[28]*AT&T Switchboard Conference* (1887), p. 223; *Switchboard Committee III* (n. 20 above), p. 126.

[29]New York operators, who averaged only ten connections/hour, were busier but less productive than operators in Kansas City, where there was only one office and an average of thirty-five connections/hour. *Switchboard Committee III* (n. 20 above), p. 137.

Western Electric engineers and evaluated at the committee meetings. Both were dead ends.

The horizontal switchboard did succeed in reducing the multiplication of equipment somewhat, but the placement of annunciator drops overhead made them harder to see and reach, and the horizontal layout tended to tangle the cords and bring operators into interference with each other as they made connections.[30] The combination line system, on the other hand, was not a complete failure. Although the specific technology was never adopted, it represented the Bell system's first realization that shared trunking facilities could be a source of great economy rather than a cause of headaches, expense, and delays.

The combination line plan was based on a fundamental principle of traffic engineering: since the number of circuits in use at one time is always far less than the total number of subscribers, only facilities sufficient to handle the peak load need be provided. If so, why run 1,000 separate wires to 1,000 subscribers? Why not run a cable containing only 100 circuits to them and find some way to allow subscribers to plug into whichever ones were not in use? That way facilities could be shared while the advantages of privacy and individual signaling could be maintained.

The combination line working model was virtually a reinvention of the entire telephone system. Five trunks served twenty to forty subscribers. The telephone was equipped with a plug; whenever a subscriber wanted to get a connection, he would go to his telephone and insert a plug into the jack of the first free trunk line. Inserting the plug tripped a signal at all the other stations in the trunk group, showing that the line was in use, and caused a shutter on the central office switchboard to fall. The new system allowed subscribers to be called while they were talking, because they could be reached through another open trunk line. It made it possible to attach automatic meters to a line, allowing callers to see their bill add up. It simplified and reduced the size of the switchboard, since jacks and drops were required only for trunk lines rather than for each individual subscriber.[31]

Hall and the rest of the conferees were highly enthusiastic about the combination line exchange. As Hall stated, "the most attractive part of it perhaps is the possibility which it offers of making a very low priced service to meet the wants of the small customers."[32] Yet after the

[30]Ibid., p. 3.
[31]Report of Sherwood J. Larned, *Switchboard Committee II* (n. 20 above), pp. 67–77.
[32]*Switchboard Committee II* (n. 20 above), p. 209.

second meeting of the switchboard committee in October 1891, when the model and designs were displayed, little more was heard of the combination line project. Unlike the horizontal switchboard, it was never explicitly rejected by the committee. The most likely explanation for its nonadoption may have been the signaling problems that arose because of the impersonal relation between the subscriber and the operator. Because any subscriber in the trunk group could show up on the switchboard on any one of the lines, the operator had no way of knowing which subscriber to contact if a connection was broken. It may also be true that its development was overtaken by other innovations that promised the same or greater economies.

The first two committee meetings did result in an important improvement in the multiple switchboard. The electrical difficulties mentioned above were eliminated by the invention of the "branch terminal" multiple switchboard, which used a common ground wire and had a separate test wire for each jack. But there is a clear and important distinction between the areas in which the committee's first meetings succeeded and those in which they failed. Problems that could be addressed by the construction of more refined circuitry and machinery were solved. Problems that were not electrical or mechanical but organizational, such as trunking and diseconomies of scale, eluded the committee. As Hall concluded, "the work of the Committee had not resulted, as it was hoped that it might, in any suggestions tending to reduce the cost of the switchboard. On the contrary, while we have a better board than we had before, we have also one which is more expensive."[33]

Toward a Science of Exchange Organization

The switchboard committee's third and fourth meetings, held in March and May 1892, mark a turning point in the Bell system's struggle with the switchboard problem. Present in embryo are four ideas that eventually opened the way for the unlimited expansion of telephone switching: (1) traffic engineering, (2) the divided switchboard, (3) the lamp signal, and (4) the common battery. The solution did not emerge smoothly. The years between 1892 and 1897 saw so much upheaval and experimentation in switching and signaling that Angus Hibbard estimated the expected life of a switchboard at no more than one or two years.[34] All of the critical innovations listed developed independently of one another. By 1900, however, they had converged into a mature switching technology and practice that

[33] *Switchboard Committee III* (n. 20 above), p. 244.
[34] *Switchboard Committee VI* (n. 20 above), p. 385.

provided the foundation for the next four decades of growth in telephone service.

1. The basis of traffic engineering is the scientific observation of calling patterns and the use of the data so gathered to maximize the efficiency of an exchange. The work of the third switchboard committee meeting stands apart from its predecessors in this respect. The meeting contains or makes reference to four detailed traffic studies. Unlike the casual and incommensurable exchange statistics that had been gathered by NTEA previously, the statistical reports of this meeting approximate focused, scientific experiments. The data were collected and analyzed to test a specific hypothesis. The method of collecting data was systematic and replicable.

The impetus for this change was the desire to combat the diseconomies of the multiple. In one report, E. J. Hall used records from the Buffalo exchange to compile a massive report on calling patterns among its subscribers. Hall's report was part of an attempt to find a way to divide a large multiple switchboard into two smaller, less expensive parts. The obstacle to doing this before, of course, was that the cost and inconvenience of trunking calls between two boards were thought to outweigh the savings in wires and jacks. But a traffic analysis of the sort he had prepared, Hall argued, would allow them to divide subscribers into two relatively self-contained groups and keep trunking to a minimum.[35]

Following up on the link between traffic analysis and the planning of exchange facilities, ABT in 1893 undertook a study of the Chicago central office.[36] The study was supervised by Hibbard, who prepared a standard method and data form that was subsequently disseminated to other exchanges through the switchboard committee. The method Hibbard used to gather traffic statistics, known as a "peg count," became a standard tool of traffic engineering during the era of manual switching.[37] By 1895 the taking and recording of peg-count data were standardized throughout the Bell companies by the switchboard committee.[38] Traffic data were used to equalize the load of

[35]In making this argument, Hall explicitly applied the term "traffic" to telephone-switching problems for the first time in the NTEA and switchboard committee records. *Switchboard Committee III* (n. 20 above), p. 248.

[36]*Switchboard Committee V* (n. 20 above), pp. 669–73.

[37]For a twenty-four-hour period operators would count each call they handled by moving a peg along a row of numbered jacks. At the end of each hour they recorded the number of the jack and returned it to zero. The statistics were aggregated to prepare a load chart for the entire exchange, or broken down to determine the operator load at a particular section of the board.

[38]*Switchboard Committee VI* (n. 20 above), pp. 2, 11–12.

operators, thereby expanding their capacity and reducing the size of the switchboard, and to identify the minimal amount of trunk lines needed to handle the peak load traffic flowing between two central offices.

2. The problems involved in switching, however, came out most clearly in the proposals to jettison the multiple principle altogether and implement what was called a "divided exchange." In one sense, the divided exchange was a radical departure from existing switching technology. Rather than attempt to reduce or eliminate the need for operator cooperation in the making of a connection, it wholeheartedly embraced the division of labor. In another sense, the divided exchange was a return to the premultiple switchboard, albeit with new signaling techniques. The number and variety of these proposals between 1892 and 1895 make it clear that the organization of exchange operations was in a state of total ferment.

Divided exchanges used two or more operators at separate boards to establish a single connection. In effect, every call became a transferred call. This eliminated the need for costly multiplication of equipment and made it easier for the system to handle large volumes of trunking. The proponents of such schemes understood that dividing the responsibility for making a connection required rapid, routinized cooperation between operators and virtually automatic, error-free signaling. Thus they were forced to rethink and rationalize the process of handling calls: How should a busy line be indicated? What happened when a wrong connection was made? How did the operators learn that the subscriber could be disconnected? By focusing attention on these questions, the divided exchange made a lasting contribution to telephone operations.

The proposals came in a variety of forms. At the fourth switchboard committee meeting E. J. Hall proposed a "divided switchboard" that went far beyond his earlier idea of dividing the multiple according to traffic patterns.[39] It physically and functionally separated the operators who answered subscribers from those who connected them with the desired party. At about the same time, President Sabin of the Pacific Telephone Co. developed a different division of labor for his San Francisco exchange. The "Express system," as it was called, dealt with complexity by establishing a hierarchy. The exchange was broken down into two kinds of switchboards called A and B boards. (See fig. 2.) Each B board contained the basic terminal equipment (annunciators and jacks) for 100 subscribers. Trunk lines from several B boards converged on an A board, the operator of which controlled

[39]*Switchboard Committee IV* (n. 20 above), pp. 30–50.

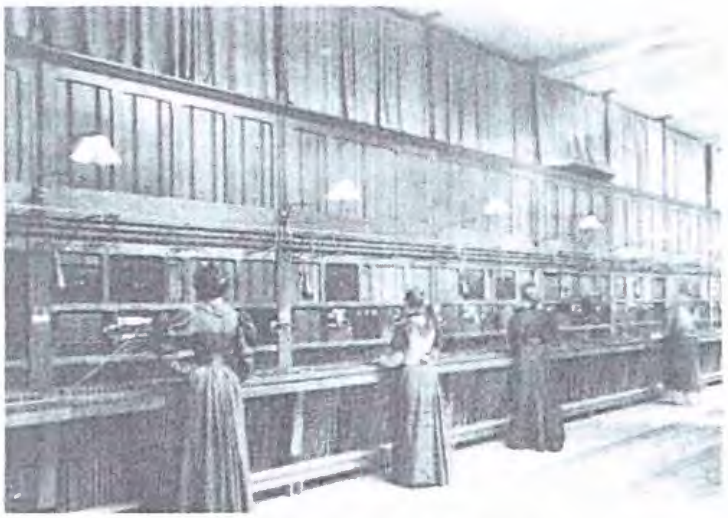


FIG. 2.—Sabin's "Express system" in operation at the San Francisco exchange of the Pacific Telephone & Telegraph Co., 1894. (Courtesy of AT&T Archives.)

the establishment of a link between two subscribers by signaling the appropriate B operators. Sabin's Express system was also the first to rely on the switchhook to send signals from the subscriber to the central office automatically.

More than 10,000 subscribers on the Pacific Coast were served by Sabin's Express system in 1895. In 1894 the Chicago Telephone Co. implemented an express system designed by Hibbard and Sabin in two of its offices. By 1896, about 15 percent of Chicago subscribers were served by it.[40] Less than ten years earlier, the multiple switchboard had been developed to avoid the expenses of trunking and the division of labor. Now trunking and the division of labor were being embraced as the solution to the costliness of the multiple.

3. The drive to reorganize the switchboard was supplemented by experimentation with new signaling techniques. One of the most important was the use of the telephone's switchhook for sending calling and disconnect signals from the subscriber to the central office. In this arrangement, the telephone rested on a hook, and its being lifted up for use automatically activated a drop in the central office showing that the subscriber wished to place a call. "Hanging up" automatically gave the disconnect signal. There was nothing new

[40]B. W. Trafford, "Report on Chicago Express System," American Bell Telephone Company, September 1, 1896. Box 1276, Bell Labs Archives.

about the switchhook—it had been patented in 1879.[41] What was new was the understanding of the importance of signaling for efficiency, and the determination to use every means available to check the ballooning costs of the central office.

The use of small electric lights as signals was another important new development.[42] Smaller and more noticeable than the annunciator drop, the "glow lamp" lent itself to automatic signaling because it responded to the presence or absence of current with no need for manual restoration. Its flashing could be controlled automatically as a by-product of the operator's or subscriber's actions.

In 1890, the Chicago Telephone Co. began to use light bulbs as trunk line signals, and they made a big difference. With the new signal, a light directly over the jack to be disconnected came on as soon as the subscriber hung up. There was less need for an operator to spend time waiting to get the attention of another.

Other signaling innovations were not so well received. Around 1895, the ABT Mechanical Department developed a "Call Distributing" system wherein subscribers would use a signaling device at home to tell special "Y" operators which central office they wished to call.[43] This was supposed to hasten the handling of trunked calls by allowing the caller quickly to indicate which central office his call should be routed to without talking to an operator. Call Distributing, however, made the subscriber do some of the "work" of switching: each telephone would come with a push-button device which, when pressed a given number of times, told the operator which exchange office was desired. For this reason it was strongly opposed by Thomas Lockwood on the grounds that it violated the principle of user transparency. Lockwood pointed out that the plan was "diametrically opposed" to the principle of absorbing all switching functions, and added acerbically that many subscribers could not be trusted to remember their own exchange, much less a code for the one they wanted to call.[44]

It should be added that the economy of the multiple was greatly improved by automatic lamp signals. Improved signaling speeded up the making of both regular and trunk connections, increasing operator capacity and hence reducing the amount of multiplication.

[41]"Relation of Patents to the Present Telephone Exchange System and Switchboard," memo from Thomas Lockwood to Theodore Vail, August 8, 1907. Box 1274, Bell Labs Archives.

[42]Fagen (n. 1 above), p. 523. See also *Switchboard Committee IV* (n. 20 above), p. 96.

[43]*Mechanical Department Annual Report*, 1895. Box 2021, Bell Labs Archives.

[44]Thomas Lockwood to President Hudson, March 3, 1896. Box 1274, Bell Labs Archives.

Improvements in circuitry also made it possible to reduce the size of the jack, allowing multiple boards to put thousands more subscribers within the reach of a single operator. During the period of ferment, the multiple switchboard equipped with automatic signals was still a serious contender.

4. Eventually, one proposal absorbed and integrated all the new ideas about switching and signaling: the common battery switchboard. The common battery switchboard used a centralized power supply in the switching office to run all the telephone transmitters and signals. Before it was invented, each telephone station had come with its own battery and magneto calling-signal generator. Those two components, in fact, were the costliest and bulkiest part of the instrument and created numerous labor and maintenance costs. The telephone companies paid men in wagons to circulate through the city to inspect and recharge local batteries. A central power supply promised a far less expensive telephone and drastically reduced maintenance costs.

But the significance of the common battery goes far beyond these economies. More than any previous technology, battery centralization required a high degree of technical compatibility among the components of the telephone system. It wove the patchy Bell network into an integrated system, simultaneously absorbing and solving problems of signaling, transmission, maintenance, and local–long distance relations. It was possible to introduce automatic line signaling with local batteries and annunciators. But an electric light was clearly the superior signal, and a common battery the most simple and effective way to activate it. Battery centralization also made it possible to equalize the electrical properties of two subscribers' lines when connected, and ensured that a bad local circuit would not unbalance a long-lines circuit. It allowed for instant detection of a defective local circuit and made the quality of telephone service more uniform and less dependent on the distance to the exchange.

The common battery switchboard was the first switching innovation developed internally by Bell. It emerged from the Mechanical Department, ABT's earliest "research and development" arm, under the guidance of department head Hammond Hayes. Hayes had designed a Private Branch Exchange (PBX) telephone system that used a common battery in 1888. In 1892, Hayes brought the idea of extending central power supply to the subscriber before the fourth switchboard committee meeting.[45] Despite opposition and foot-dragging from some members of the committee, Hayes patiently but firmly pushed the idea for the next five years. Stigmatized as

[45] *Switchboard Committee IV* (n. 20 above), pp. 252 ff.

"unimaginative" because of the practical, nontheoretical focus of his work,[46] Hayes was instrumental in devising a comprehensive solution to one of the most important technical problems facing telephony.

Around 1895 the Bell Company began systematically to assess the new ideas about switching. The timing, not coincidentally, corresponds to the year after the expiration of Alexander Graham Bell's fundamental patents, which had protected Bell from competition for seventeen years. In anticipation of the new era, ABT had drastically reduced the rental price it charged the licensee companies for telephones. Independent companies, consciously exploiting public exasperation with high Bell rates, were beginning to spring up. Although in 1895 most were still confined to areas left unserved by the Bell companies, the threat of competition was real enough to make the company take every precaution to ensure that it was prepared. Most of all, with lower rental rates and competing companies, it had to be able to handle large increases in exchange size economically. A detailed cost comparison of the branch terminal multiple, the Express system, the Hall divided exchange, and the Call Distributing system was prepared by W. S. Ford in 1895. In mid-1896, B. W. Trafford was sent to Chicago to conduct a month-long study of the workings of the Express system there.[47]

It had become apparent that signaling was the key to improving the efficiency and economy of the exchange. Effective interoperator communication would allow Bell to retain the advantages of multiplying while reducing its costs. As the importance of signaling became larger, the common battery looked more and more like the direction to pursue, for a centralized power source lent itself to the use of automatic lamp signals. The first common battery multiple fitted with automatic signals based on Hayes's plans was put into operation at Worcester, Massachusetts, in the summer of 1896.

By 1897 the American Bell Telephone Co. was finally—after six years of uncertainty—able to give its licensees firm direction in the acquisition of switching apparatus. Increasingly, the ABT Engineering Department took over the job of preparing plans and specifications for central office equipment for the local companies, perform-

[46]N. R. Danielian, *AT&T: The Story of Industrial Conquest* (New York, 1939), pp. 99–103.

[47]Trafford (n. 40 above), p. 55. Trafford's report documented certain advantages in the division-of-labor method: no need for a complicated busy test, no long reaches for the operators, savings in capital equipment, and faster disconnection. But in his opinion, the disadvantages of the Express system outweighed these. Most of the disadvantages were a direct consequence of the fragmentation of knowledge and responsibility that flowed from the division of labor.

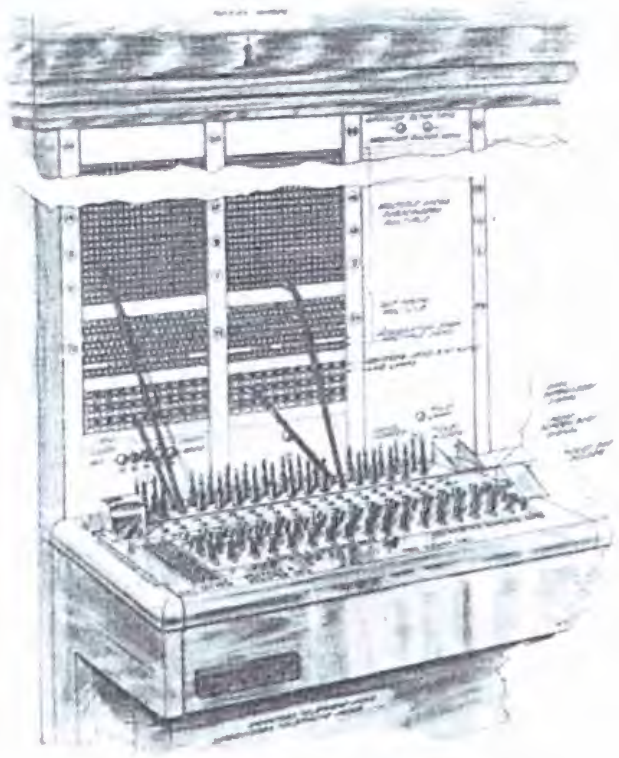


FIG. 3.—Drawing of an A position with subscribers' common battery multiple. (Courtesy of AT&T Archives.)

ing this service for thirty cities from 1895 to 1897. Hayes was able to write in the Mechanical Department's annual report for 1897: "[A]ll the equipments of telephone central offices ordered during the past year have been of the common battery type." Noting that the new switchboards would reduce the cost of exchange service by 8 percent, Chief Engineer Joseph Davis remarked, "This is a notable result in the history of switchboards, for almost . . . without exception, while each new style of board that has been adopted for general use up to this time has improved the service, it has also increased its cost."[48]

By 1900, all the essential elements of a mature switching and signaling technology were in place. A standardized common battery multiple was the building block of the switching system (see fig. 3) and sufficed for most single-office exchanges. But since automatic lamp signals had made the transfer of calls relatively quick and efficient,

[48]*Engineering Department Annual Report*, 1897, p. 6. Box 2021, Bell Labs Archives.

system planners were able to limit the multiplication of jacks and rely on trunking and the division of labor whenever necessary. Indeed, in the largest cities, the subscriber multiple was eliminated altogether and all calls were trunked through a B board.[49] The organization and signaling practice of these exchanges thus was really a carryover from the Express system. In addition, traffic engineering methods gave system managers a scientific basis for organizing and planning exchange facilities.

It was during a traffic study of the Boston metropolitan area in 1898 that G. T. Blood of AT&T first noticed a similarity between the terms of a binomial expansion and the distribution of busy trunks in a trunk group.[50] Following up on this insight, Malcolm Rorty of American Bell's traffic department attempted to formalize traffic problems by using probability theory.[51] In October 1903, the same month and year that Rorty circulated a paper on the subject, the ABT Engineering Department issued its first comprehensive manual on traffic engineering practices based on peg-count data collected in 1902.[52] While empirically derived, its curves were remarkably close to those that would have been generated by means of probability theory. Thus, while a complete and accurate formalization of traffic problems using probability theory had to await the work of E. C. Molina between 1906 and 1908,[53] the essential outlines of a functional traffic engineering technique had appeared by 1903, the legacy of twenty-five years of exchange diseconomies.

Conclusion

The organizational diseconomy of the exchange is a dominating feature of the first thirty years of telephone history. The Bell system's initial definition of the role and function of the exchange cannot be understood without reference to it. It was a major preoccupation of Bell's earliest research and development efforts. The linkage of growth with rate increases strongly affected the political climate in which telephone companies operated. Politicians and the public, who had difficulty understanding why growth did not bring lower costs,

[49]Fagen (n. 1 above), p. 503.

[50]E. C. Molina, *Bell System Technical Journal* 1 (November 1922): 69.

[51]M. Rorty, "Application of the Theory of Probability to Traffic Problems," October 22, 1903. *Probability Research, 1903–1919*, file at Bell Labs Archives.

[52]AT&T Engineering Department, "Notes on Traffic Studies," October 1903. Cited in R. Wilkinson, "The Beginnings of Switching Theory in the United States," *Teleteknik* 1, no. 1 (English ed.) (1957): 15–16.

[53]Molina's work took Rorty's paper as its point of departure but overcame some of its limiting assumptions. See *Probability Research, 1903–1919* (n. 51 above).

came to embrace competition, municipal rate regulation, or both. Exchange diseconomies also created a neat little trap that snared many an independent competitor after 1894. The independent would come roaring into the business with drastically lower rates, boasting of its ability to undercut the monopoly. But it soon attracted so many subscribers that its unit costs increased and it was forced to seek both a rate increase and additional capital for expansion. The independents, in effect, reproduced the early history of the Bell exchanges, alarming customers and clashing with suspicious city councils by demanding rate increases as they grew.

The Federal Communications Commission's investigation of the telephone industry in the 1930s directed much criticism at AT&T's early research efforts, accusing the firm, among other things, of tardiness in the introduction of automatic switching and a nontheoretical approach to research during the Hayes era.[54] Had the federal investigators been more interested in historical background and less in justifying their own existence via an attack on AT&T, they would have found the company's behavior more understandable. Hayes and his Mechanical Department may not have been the equal of Albert Einstein and the Manhattan Project, but the development of the common battery switchboard was a successful response to the most important reverse salient faced by telephony at the turn of the century.

As for automatic switching, it was resisted for two reasons that emerge clearly once the prior history is understood. First, it violated the user transparency principle, which for many years had proved to be a successful approach to the popularization of the telephone. Bell managers argued that the "manual" central office was far more "automatic" than the dial system: all subscribers had to do was pick up the phone and speak. In reality, Bell underestimated both the ability and the willingness of subscribers to perform part of the act of making a connection. But this was an honest mistake. An even more important consideration was that, ultimately, the issue of machine versus manual switching was secondary to whether switching technology and practice could successfully cope with the increasing organizational complexity of a growing network. Bell developed its science of traffic engineering, as we have seen, to combat the diseconomies of manual switching. As it had just tamed the dragon of organizational

[54]U.S. Federal Communications Commission, *Investigation of the Telephone Industry in the United States* (Washington, D.C., 1939), reprinted by Arno Press (New York, 1974), pp. 183–86. Danielian worked on the FCC staff and his 1939 *AT&T: The Story of Industrial Conquest* presents the same evidence and arguments as the *Investigation*.

complexity with manual technology, changing made little sense, especially since automatic switching around 1910 was not competitive with manual in making extensive toll and interexchange connections.[55]

Of broader interest is this case study's demonstration of the way in which increasing scale affects the structure of social relations. I am concerned here with *social* scale, not physical scale; that is, with the number of people encompassed by a system of social interaction rather than the size of machinery or the volume of its input and output. We readily accept the idea that large aggregations of capital, expertise, and machinery can lead to significant improvements in efficiency. Even in the 1880s, "economies of scale" were a well-understood feature of industrial production and, moreover, were *expected* to accompany growth. That expectation still holds today. Our recent experience with microprocessors, for example, reinforces our faith in the inevitability of the link between large-scale production, technological innovation, and falling prices. This case study brings out a less commonly perceived but equally important aspect of industrial growth, one that contrasts markedly with the assumption that bigger means cheaper. When it comes to the *relations of communication* that bind society together, growth not only increases the complexity of communicative relations but increases it at a *faster* rate than the growth in the group's size. Thus, in communications, bigger can easily mean more expensive, at least until the adoption of a comprehensive organizational system compensates for the disproportionate growth of complexity.

The switchboard problem may well be kept in mind during the present era's transition to computerized communications. Most of the new technologies dangled before the public are at work in relatively small-scale, specialized applications. Telephones, computer terminals, and other forms of electronic *equipment* may well continue to decline in cost. But the fusion of voice, data, and video communication into an internationally integrated digital network connecting a majority of the population will probably not follow the same pattern of falling prices. In all likelihood, the expansion of such a network will pose organizational and technical problems as large and unruly as those faced by the developers of the telephone exchange in the 1880s. If the public enters into this experience with expectations of scale economies and falling prices, as it did a century ago, the political climate of the 1990s and early 2000s could easily become as explosive as the utility politics of the Populist era.

[55]See Chapuis (n. 3 above), p. 76.

The Bell system's encounter with the switchboard problem may also hold the clue to the intepretation of a broader trend in social evolution. If every increment of growth seems to produce a somewhat greater increment of organizational complexity, then we have the beginnings of an explanation for what has been called an "information society" by various social theorists.[56] The most satisfactory definition of "information" is that it is a measure of organizational work.[57] In this respect it is notable that, after unsuccessfully attempting to cope with growth by adding labor and/or multiplying apparatus, the Bell companies discovered that they had to invest in organizational techniques to pave the way for continued expansion. Automated and improved signaling, a rational division of labor, and the collection and analysis of empirical data about the system's behavior for the purpose of planning and optimization became effective substitutes for bigger switchboards and more workers. In short, the "informational" component of the system increased at the expense of physical resources and labor.

While there has been much discussion and documentation of the growth in the size of the "information sector" of modern economies, there has as yet been no convincing demonstration of *why* its size should increase relative to other sectors. James Beniger does attempt to link the development of an information economy with the control problems posed by the harnessing of artificial energy sources. But *The Control Revolution* contains no coherent argument about why the control of artificial energy sources should result in more growth in the "information sector" than in, say, energy production or manufacturing. This case study suggests one possible explanation based on a clearly discernible disproportionality between information and other aspects of production. Enlarging the scale of social organization requires relatively more organizational work, because the complexity of communication and coordination increases more rapidly than the size of the group.

[56]Fritz Machlup, *The Production and Distribution of Knowledge in the U.S.* (Princeton, N.J., 1962); Daniel Bell, "The Social Framework of the Information Society," in *The Computer Age: A Twenty-Year View*, ed. Michael L. Dertouzos and Joel Moses (Cambridge, Mass., 1979); Marc U. Porat, *The Information Economy: Definition and Measurement* (Washington, D.C., 1977); James Beniger, *The Control Revolution* (Cambridge, Mass., 1986).

[57]Information is "the equivalent of or the capacity to perform organizational work, the difference between two forms of organization or between two states of uncertainty before and after a message has been received." Klaus Krippendorff, *A Dictionary of Cybernetics* (Philadelphia, 1985).

Guglielmo Marconi and Early Systems of Wireless Communication

by R. W. SIMONS, OBE, C.Eng., F.I.E.E., M.I.Mgt.,
formerly at Marconi Radar Systems

R. W. Simons joined Marconi's Wireless Telegraph Company in 1943 as a member of the Research Division. After an initial period developing special receivers for wartime direction-finding systems, he worked exclusively on military and civil radar systems until his retirement in 1986. He was the first Technical Director of the newly-formed Marconi Radar Systems Ltd. in 1969 and in the subsequent years he took responsibility for all Company development at both Chelmsford and Leicester, as well as – for a period – all Company production. Latterly he had direct control of the Radar Research Laboratory at Baddow.

This paper is based on a lecture given in 1984 by the author when Chairman of the South East Centre of the Institution of Electrical Engineers. It has been revised and is published here as a contribution to the Marconi Centenary celebrations currently taking place.

The description of Marconi as 'the Father of Wireless' is attributed to Aleksandr Popov (1859–1906), the contemporary Russian Scientist, who was one of the many people studying the work of Hertz in the latter part of the last century.

Having spent over forty years in the Marconi Company, I came to realise that I did not know very much about Marconi himself (fig. 1), or the origins of the technique of wireless communication. I soon discovered that I was not alone in my lack of knowledge about the man, and also that the modern Electronic Engineer has never heard of 'syntony', or of a 'coherer', or of a 'jigger'. Names and words that have passed out of the technical vocabulary. This paper describes some of the work carried out during the pioneering days of wireless communication with particular reference to Marconi and the Company that subsequently carried his name. In addition to the technical aspects of this work there is some insight into the commercial difficulties that Marconi had to face, as well as quotations from many of his contemporaries.

1 ***Guglielmo Marconi, 1874–1937***

Archive Material

I have had the privilege of access to the archives of the Marconi Company, which are carefully preserved at Great Baddow, Chelmsford, and which give a relatively complete and formal record of the early progress of the Company. Some of the archives are very frustrating, as often only one side of a series of letters has been retained and it is necessary to guess the other part.

One of the largest parts of this store of information is the 150 or so large volumes of press cuttings. These were started in 1897 when the daily national and local newspapers and technical journals, both in the UK and overseas, were read and extracts taken. More recently (and they are still maintained), because of the impossibility of dealing with the vast amount of technical material currently being generated, the extracts are much more mundane.

Because of the completeness of these records of press material, it is possible to read the daily interchange that was vigorously fought on the claims of various protagonists, about who did – and who did not – originate a particular improvement.

There are hundreds of photographs of people, places and equipment, regrettably some of these will never be properly identified and catalogued.

As the archives are not only of Marconi, but of the Marconi Company, there are Company records from the earliest days, including, for example, the first staff book, which contains some very well-known names, and the manufacturing drawings of the earliest production equipment. One should realise that, because there were no copying machines, each 'copy' is an original drawing.

There are also copies of handbooks, catalogues and even of advertisements – Marconi's used to advertise in those days!

There is plenty of technical library material, including a full set of the 'Marconigraph' which was published by the Company and became the 'Wireless World' in 1913. The American Marconi Company also produced the 'Marconigram' from 1903 on a weekly basis. Many of Marconi's own lectures are available.

Patents formed – and still form – an important part of the Company's activity. There were many cases brought before the courts in the period up to the First World War, by companies that had been set up to compete with the Marconi Company, and the evidence is all retained. Some of this material forms the best record that we have for the very early work of Marconi and his contemporaries. The Company continued challenging the infringement of the early Marconi patents as recently as 1943. Not always with success.

Among the unpublished papers is a large biography of Marconi, written by his secretary, De Sousa, in about 1921. It is in the first person, as if dictated by Marconi.

In addition to all the paper there are many artefacts. Of the earliest, a few only are original, but an attempt has been made to construct replicas and display these in a properly organized manner in a special building at Great Baddow. Together, these records and items form a fascinating wealth of material covering the progress of wireless from 1897 until the present day.

Another feature that quickly comes to light when comparing the material written on the subject at the turn of the century and the papers that were read to learned societies at that time with further papers by the same people, ten, twenty or thirty years later, is that the detail has changed and there is some evidence of time and events modifying the recollection of history. That is why I use the word attributed, when referring to Popov's comment about Marconi.

Many people have studied Marconi's contribution to wireless communication over the years. Many books and articles have been written, and papers presented, on the life and work of Marconi and of the history of the Marconi Company. However, one aspect that emerges quite early in a study of some of the published work, is that the majority are written around the particular person, without bringing out the contemporary work of other people in the same field. It is fascinating to discover the friendships and exchanges of information that occurred between people with aims similar to those of Marconi, and how mutually complimentary they were in their public comments.

Some of these early personal friendships persisted for years, despite the competition that rapidly arose as soon as businesses were set up and it became important to be recognized by potential customers as a leader in the field. Others, such as Silvanus P. Thompson, continued to object for years that Marconi had never invented anything.

Looking briefly at the history of wireless telegraphy before and after Hertz (fig. 2), one should realise that, in 1865, Maxwell had predicted the existence of electromagnetic waves in the æther, and that these waves would have the same characteristics as light. However, Maxwell died in 1879, aged 48, ten years before Hertz was able to confirm

2 *Heinrich Hertz (1857–1894)*

his theories. Hertz showed that it was the presence of a spark that allowed waves to pass to a suitable arrangement which operated as a detector and which was placed at a greater distance than would be possible by induction. He also showed that these 'electric waves' were capable of reflection and refraction and that an interference pattern of maxima and minima could be produced, allowing the measurement of wavelength. Hertz worked at about 30cm wavelength in 1887; he was just 37 when he died.

It is necessary to refer to D.E. Hughes (1831–1900) – the inventor of the microphone – who, in 1879, within a few weeks of the death of Maxwell, noted that a spark produced a current in a telephone receiver. He showed this work to William Spottiswood (the President of the Royal Society), to Prof. Huxley, and to Sir George Gabriel Stokes, demonstrating transmission and reception from 60 yards (55m) to over 500 yards (460m) and noting the variation in signal strength with range. Stokes said that all the results could be explained by known electromagnetic effects and he therefore could not accept the suggestion that electric waves existed. Hughes was so discouraged at not being able to convince them that he refused to write up his work in a paper until he had better proof. In fact he did no further work and the record of his discouragement only came to light in a letter to J.J. Fahie in 1899.

I am sure that had Hughes received encouragement he would have followed up his clues and it is likely that he could have anticipated Hertz, Edouard Branly and Marconi, finding himself amongst the foremost names of all time. He did, however, make a large fortune out of his electromechanical telegraph. He was ingenious, but with limited electrical knowledge. Hughes was a Professor of Music and there is a picture of his apparatus in the Oxford Companion to Music by Percy Scholes.

Early Telegraphy Systems

Telegraphy, as distinct from signalling by flags or beacon fires, probably dates from the patents for the electric telegraph in 1837 by Cooke, Wheatstone and Morse. In 1838, Steinheil proposed the use of the earth return as part of the circuit – a form of wireless. The earth also became used in several other ways, sometimes with less-than-obvious advantages.

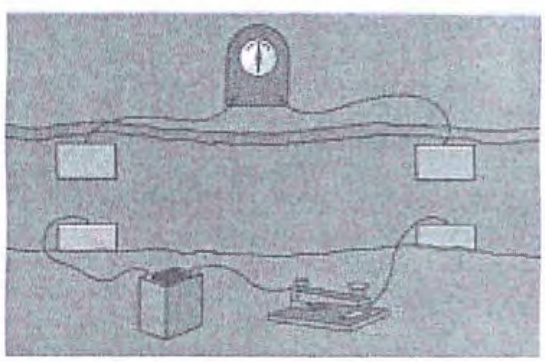
Prior to the use of Hertzian waves, three possible wireless systems were explored: by conduction, by induction, and by electrostatic means.

Little progress was made using electrostatic means, but both conduction and induction systems of wireless telegraphy were being demonstrated from 1842 onwards and both types had some practical use. They were installed in situations where it was particularly difficult to run a cable, or where a cable had failed.

The Morse Experiment

It was Samuel Morse, in 1842, who showed that wireless communication was possible across a river by using separated plates on each bank, opposite one other (fig. 3). He established a relationship between the current flowing in the circuit, the size of the plates, and the width of the river.

Many people continued to experiment with this system and it was made to operate over distances of several miles. It was not long before someone, using a 'rule-of-thumb' derived from experimental results, suggested that it would be possible to set up a system to communicate across the Atlantic, if the batteries, immersed sheets, and plate separation were large enough†.



3 ***The general arrangement of Morse's experiment***

Conduction Systems

As an illustration, the following two conduction signalling systems had considerable use.

The Isle of Wight System

In 1882 W.H. Preece, the Chief Engineer of the British Post Office, installed a conduction system across the Solent, between the UK mainland and the Isle of Wight, when the submarine cable failed at Hurst Castle.

Fig. 4 shows the land lines that existed between Portsmouth (Southsea), Southampton and Hurst

† The proposer, J. B. Lindsay (1799-1862), did say that 'further work was necessary to determine the accuracy of the prediction', but considered that, if the length of Gt. Britain was used as the baseline, the immersed sheets would each be 3000 sq. ft. (279m^2) and the area of the zinc plates to give enough battery power would be 130 sq. ft. (12m^2).

4 *The Isle of Wight system*

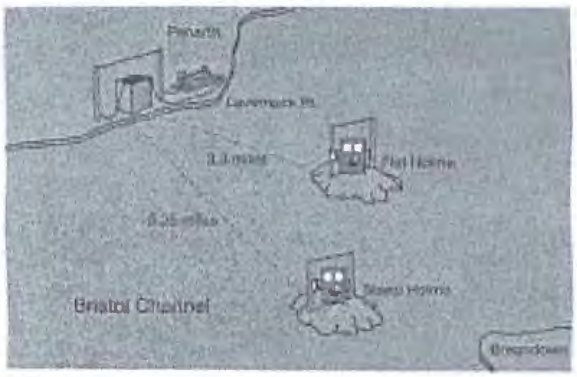
Castle, and also those between Sconce Point, Newport and Ryde. Morse signals were transmitted and received between Southampton and Newport with considerable success, using a telephone receiver, there not being enough current to operate a paper tape inker. When the cable was repaired and this method discontinued, some commented that the iron sheath of the broken cable had probably helped the results.

Fastnet

The second example is the installation at Fastnet Rock (fig. 5), where it had been found impossible to maintain a cable connection, because of the constant battering of the sea, causing the cable to be worn through by chafing on the rock face.

Fastnet Rock is eight miles from the SW corner of Ireland. It is 360 ft (110m) by 150 ft (46m) and stands 80 feet (24m) above mean sea level. An insulated cable was laid to within 100 feet (30m) of the rock where the end was laid bare and connected to a copper anchor. Across the rock, on the north and south faces, copper rods were fixed into the rock face to a depth of 20 feet (6m) below the surface. The system, which worked well and reliably, was devised by Willoughby-Smith in 1895.

5 *The Fastnet Rock system*



6 *W.H. Preece's Bristol Channel system*

Inductive Systems

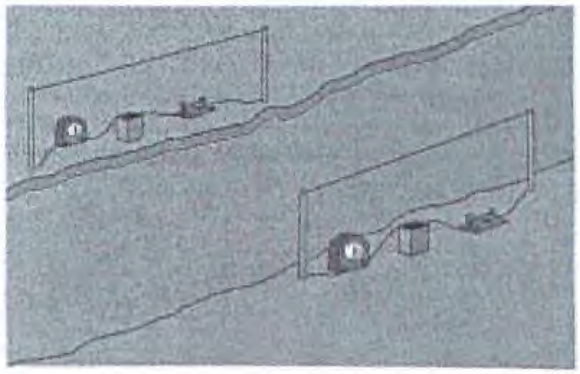
Bristol Channel

W.H. Preece was active in experimenting with inductive systems, notably a system in the Bristol Channel between the mainland and the two islands, Flat Holme and Steep Holme, set up in 1892 (fig. 6). He also used this installation for direct comparison with Marconi's system a few years later.

Arran

In 1894, he (Preece) also set up an arrangement between the Isle of Arran and the Mull of Kintyre, across the Killrannan Sound, which is about four miles (6.4km) wide, using two parallel lines of six miles (9.6km) in length along each side, both 500 feet (150m) high, and an ordinary land line at sea level. In other words, two wire rectangles facing each other, of dimensions 6 miles by 500 feet (fig. 7).

The system worked well, but it was found that if the ground level return wires were removed and replaced by earth plates at each end the performance was much better. When using the earth between the separated plates, the current flow takes place along a hemispherical surface and the calculated mean depth of the equivalent



7 *The general arrangement of the Isle of Arran system*

wire was 900 feet (275m), giving nearly twice the effective area to the loops, allowing communication over a larger distance. This system was also used at Frodsham, with an equivalent depth of 300 feet (90m), and at Conway with 350 feet (107m).

So much for some of the alternative **wireless** telegraphy systems of the time, but it must not be forgotten that, at this time (say 1895), telegraphy and telephony by wire and cable were well-established world-wide. Those with an investment in these systems did not welcome any new system that might intrude and diminish their market share, expansion and profitability.

Guglielmo Marconi

In order to put his work into its proper place, it is necessary to mention not only his activities, but those of Lodge and Jackson in this country, of Popov in Russia, and Slaby† in Germany. There were many more people than this, too numerous to mention, actively experimenting at that time. In the United States, for instance, De Forest, Fessenden, Stone and Shoemaker took out hundreds of wireless telegraphy patents, shortly after the original idea had been demonstrated by Marconi.

Marconi was born in Bologna, Italy, on 25 April 1874. He was the second son of the runaway marriage between Giuseppe Marconi, the son of a wealthy landowner, and Annie Jameson, daughter of Andrew Jameson of the Irish Whiskey Company (this whiskey connection could be regarded as a crucial component in determining the eventual success of Marconi in business).

Marconi was initially educated, between the ages of five and seven, at a private school in Bedford. He went to school in Florence up to the age of fourteen and then for two years at the Leghorn Lyceum (Livorno). He also received extra private instruction in science from a tutor named Professor Rosa. Despite this, however, he did not gain the qualifications needed to enter either the University at Bologna, or the Naval Academy.

At the age of eighteen, after he had passed the examination that allowed him to delay his compulsory military service until the age of 26, he attended lectures at Bologna University by Righi and Dessau, by special arrangement.

During 1894 (aged 20) he studied the works of Hertz (who had died that year). This interest was probably prompted by a commemorative article written by Righi, having previously become familiar with the mathematical conclusions of Maxwell and Kelvin. He had also read a description of the results obtained by Branly and Onesti, with detectors consisting of imperfect electrical contacts.

Early Experiments

Marconi started his experiments on the application of Hertzian waves to the transmission and reception of messages over a distance, without wires, in the early summer of 1895 at the Villa Grifone at Pontecchio Bologna (fig. 8).

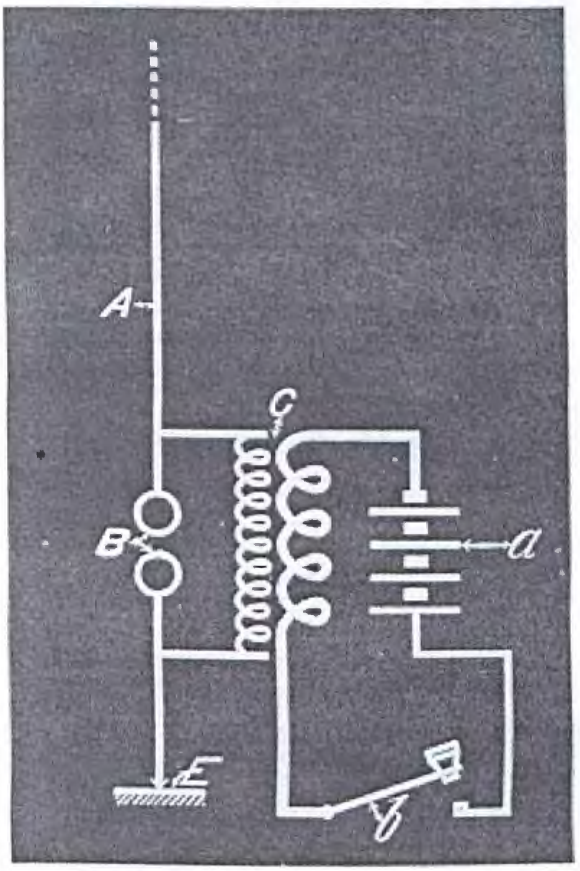
He clearly began by repeating the experiments of Hertz, but unfortunately there are no detailed records or notes of the steps that he took to improve the performance of his apparatus, so that transmission and reception of signals was progressively possible across a room, down the length of a corridor, and from the house into the fields. Success was signalled initially by the waving of a handkerchief, and progressed to the need to fire a gun in order to indicate reception at a distance of about two kilometres, out of sight over an adjacent hill, in September of that year.

Although no notes exist, many anecdotes refer extensively to his intense dedication to achieving a successful and improved system. He was clearly a great experimenter, who, if he lacked a scientific means of pointing the way forward, would, by a great many iterations, obtain an optimum solution. For example, if we take these earliest days. He started transmitting with the short dipoles and sheet reflectors of Hertz, connected to a battery powered induction coil (fig. 9).

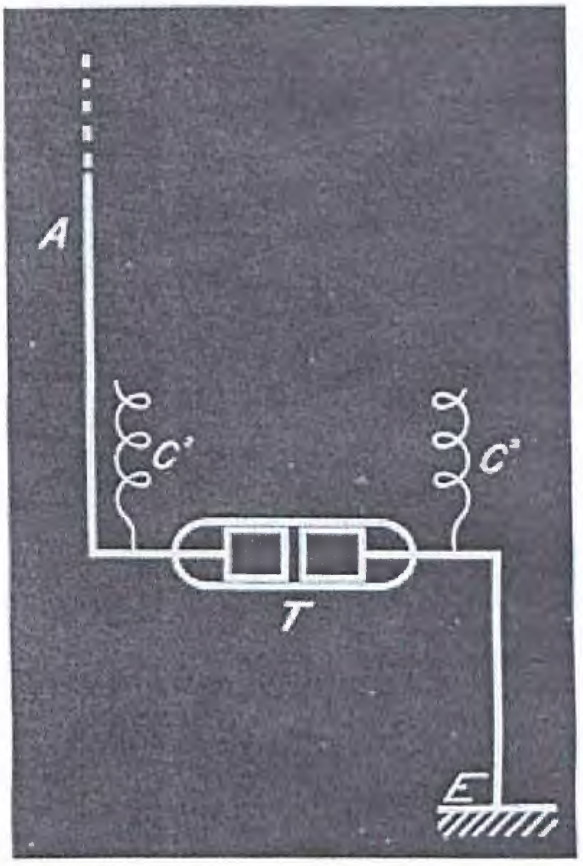
A next step was to leave the spark gap at ground level and to raise the arms of the dipole above ground or alternatively one arm to a plate on (or in) the ground and the other to a plate on a pole. Both methods were used in subsequent demonstrations. He had made a modified Hertz oscillator, but one with much greater capacitance and hence greater radiating power.

8 ***Villa Grifone***

† Professor Adolf Slaby was the German Emperor's Scientific Advisor.



9 ***Early transmitter***

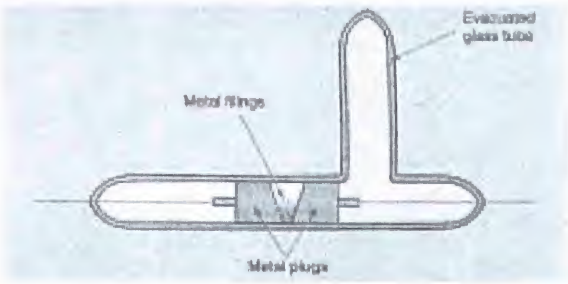


10 ***Early receiver***

The Coherer

Similarly, his inventive and intuitive ability was applied to the receiver (fig. 10)†, which consisted essentially of a coherer connected to a similar aerial arrangement to that used by the transmitter and then to a conventional relay and inker system, borrowed from telegraphy equipment. Marconi's coherer seems to have been derived from Branly, but Popov had used a very similar type for the recording of lightning strikes in 1893. There were many versions of basically the same design, where filings of metal were held in between metal plugs in a tube (fig. 11).

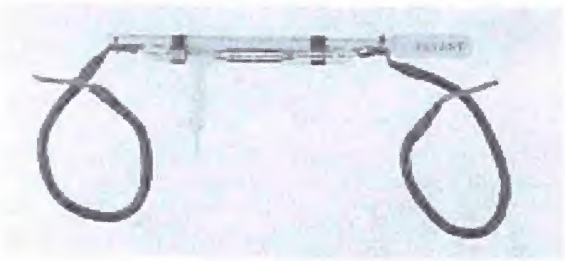
The coherer was perhaps the most important of the very early detectors. The precise theory of operation has never been determined, but it can be regarded as a device with a specially-constructed 'dry joint' which has two states: one of high resistance and the other of very low resistance. It has the characteristic that the application of an RF signal will change it from the high to low resistance state, where it will stay until mechanically shaken.



11 ***Coherer***

It is said that Marconi tried several hundred combinations of metal filings of various sizes between metal plugs of different shapes and spacings before settling on undoubtedly a very refined version. Marconi's tube (which was evacuated) was much smaller, (about 2 inches [50mm] long), the gap between the slightly tapered silver plugs was small (0.025 inches [0.635mm]) and the

† Figs. 9 and 10 are copies of the slides used in Marconi's lecture to the Royal Society of Arts in 1901. He continued to use them for several years himself and they were also used by Prof. Sir Ambrose Fleming in his commemorative lecture in November 1937.



12 ***Marconi coherer***

faces had been treated with mercury. He used 95% nickel mixed with 5% silver (fig. 12).

There is an apocryphal story about the experience of H.M. Dowsett (who was to become the Technical General Manager of The Marconi Company in 1931) on his first day in 1899. Marconi gave him an old smooth file and a small piece of metal and told him to make some filings. After half an hour he had made a very small heap and was convinced that as the 'new boy', he was having his leg pulled. However, Marconi subsequently told him that he had produced one coherer's-worth of filings and that only a clogged-up file would produce small enough particles!

Improvements and Patents

Even at this early stage, Marconi had showed that he was very capable of developing his concepts and apparatus to a high level of performance and reliability, and he started to relate the performance to the parameters of his equipment. He discovered, as a result of many iterations, that the distance over which signals could be transmitted and received, varied in proportion to the square of the length of the vertical wires attached to the transmitter and receiver. Furthermore he found that when plates were attached to the top of the wires, the range varied in proportion to the square of the height of these plates from the earth. Probably the plates were not themselves so important, but the increase in capacitance was. Marconi referred to this relationship with height in his Nobel Prize Speech in 1909. A 2m pole gave a range of 30m, a 4m pole 100m and an 8m pole a range of 400m.

He also showed at that time and many times later, as is evident from his numerous patents, that 'improvements to design' was a continuous process – for example, putting the receiver in a metal box to avoid spurious interference to the recording equipment caused by the transmitter, a means that would be obvious today.

Similarly, automatically disconnecting the receiver aerial by using a back contact on the sending Morse key was another improvement, known as the 'Grasshopper' key.

In January 1896, less than a year after he had started experimenting seriously, he was considering applying for a patent for his invention. But prior to so doing, he offered to make the information available to the Italian Government. He did so via a family friend, General Ferrero, who was the Italian Ambassador in London. Marconi came to London in the middle of February 1896 with his mother and called on the Ambassador. Unfortunately, Marconi's 'Black Box' (fig. 13) had been broken by the Customs in the course of their examination of this unfamiliar apparatus.

After many months of consideration, the Italian Government advised Marconi to make his

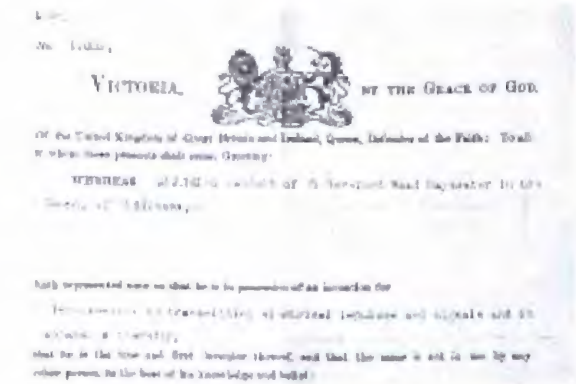
13 ***Marconi soon after arriving in England in 1896***

inventions available world-wide and British Patent 12039 was filed on June 2 1896, the first wireless telegraphy patent (fig. 14).

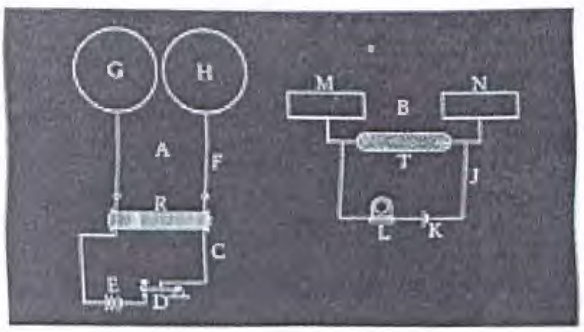
This patent includes the words:

'I believe that I am the first to discover and use any practical means for effective telegraphic transmission and intelligible reception of signals produced by artificially-formed Hertz oscillations.'

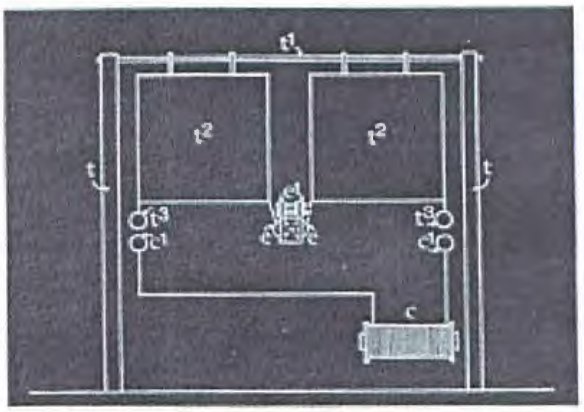
The description in the patent papers is a very complete practical disclosure, with layout diagrams. The claims cover the use of a keyed induction coil producing sparks across a gap, one (fig. 15) or both sides (fig. 16) of which may be connected to elevated plates or wires, or placed in a parabolic reflector (fig. 17). One rather unusual item to find in the patent is the use of a rotating contact driven by an electric motor to keep the trembler contacts smooth and without a tendency to stick – just another improvement. Alternatively one side of the transmitter (fig. 18) may be earthed and the other side connected to a plate or wire. Similarly for the receiver, with the spark gap replaced by a coherer (fig. 19). There are many claims for the coherer and the tapper and the method of connection using chokes.


VICTORIA, BY THE GRACE OF GOD

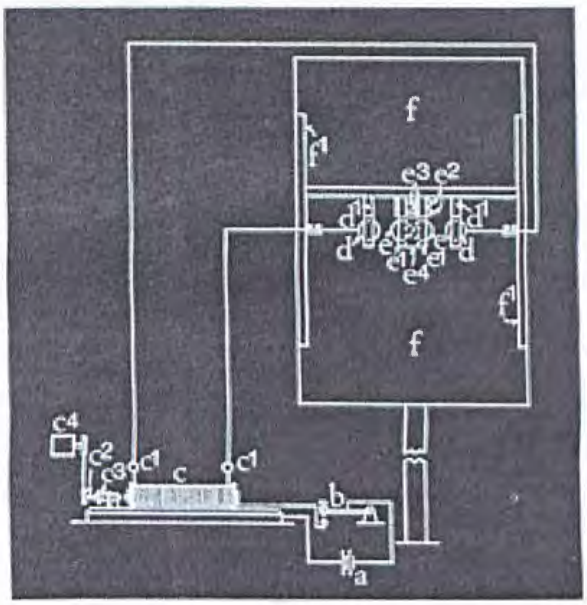
14 *Patent 12039*



15 *Keyed coil with single gap*



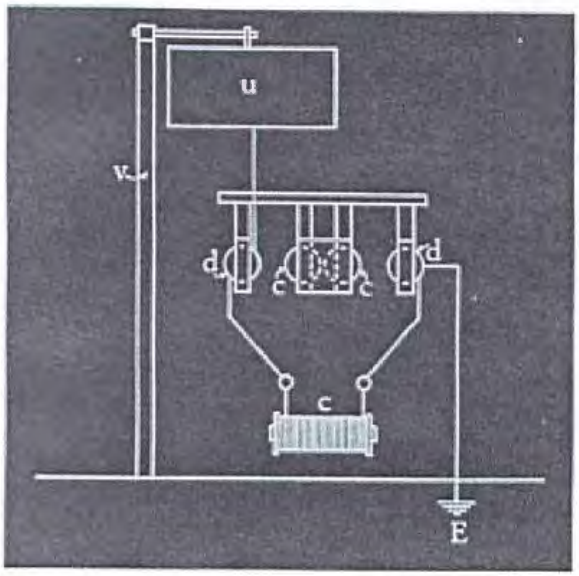
16 *Keyed coil with two gaps*



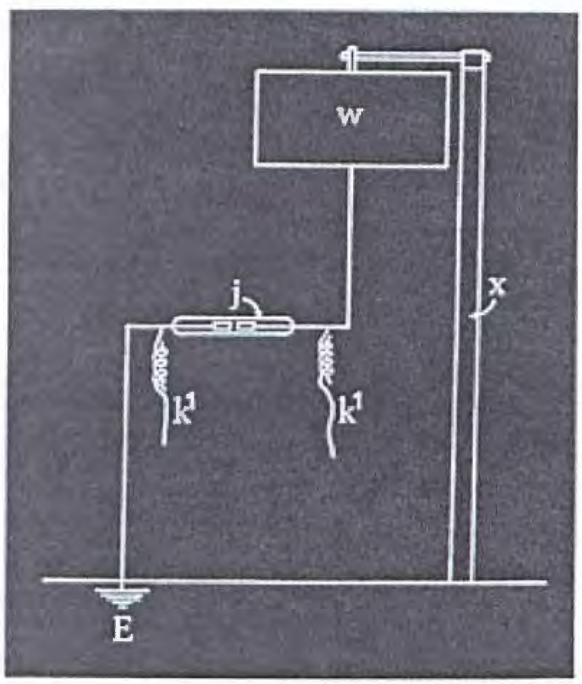
17 *Parabolic reflector*

Wireless Demonstrations in England

It was Marconi's cousin, Henry Jameson-Davis, who met the Marconi family when they arrived in London and it was Jameson-Davis who introduced Marconi to A.A. Campbell-Swinton who, having seen a demonstration, gave him a Letter of Introduction to W.H. Preece in June 1896. In July of that year he demonstrated his apparatus to both the Post Office and the War Office, and there was a further historic demonstration at Three Mile Hill on Salisbury Plain on 2nd September, with the GPO, the Navy and the Army present (fig. 20). This demonstration worked at 2m wavelength. The service representatives were, even at this time, concerned with the security of communication.



18 *Transmitter with one side earthed*



19 *Receiver with one side earthed*

The Naval observer on Salisbury Plain was Capt. H. Jackson, who, in that same year, had succeeded in communicating between ships, using equipment similar to Marconi's, but totally independently. The Army observer, Major Carr, was impressed and, as a result, Marconi was asked to develop apparatus that would activate a receiver in a steel box immersed in the sea, a mile off shore, to detonate mines remotely. This was not followed up!

20 *Impression of Marconi's demonstration on Salisbury Plain in 1896 by the artist Steven Spurrier*

William Preece, assisted by Marconi, gave an important lecture at Toynbee Hall on 12 December 1896. The Press who attended, headlined Marconi as 'the **inventor** of wireless'. This description prompted a strong reaction from scientific circles and Oliver Lodge, who also had made valuable contributions, was outraged.

Lodge had shown to a meeting of the Royal Institution on June 1 1894, and in the same year at Oxford, that his form of a Branly detector could detect signals at 150 yards (138m). He did not however appear to have grasped the significance of this demonstration and had not extrapolated from his experiments to a form of practical long-distance telegraphy.

Lodge said later (1897):

'stupidly enough, no attempt was made to apply any but the feeblest power so as to test how far the disturbance could really be detected.'

Rutherford, using a magnetic detector, had also signalled across a half mile (800m) of streets in Cambridge, in June 1896.

In 1895–1896, Popov, Minchin, Rutherford and others, used these methods applied to the study of atmospheric electricity, using vertical rods similar to those used by Marconi. Popov's use of an aerial was only as part of a receiver, with no transmission. Popov, in December 1895, said:

'I hope that when my apparatus is perfected, it will be applicable to the transmission of signals to a distance ..... when a sufficiently powerful generator of these vibrations is discovered.'

He did not really need more power, but a more sensitive detector.

One comment made by Preece during his lecture, which was not borne out, was that the Post Office had decided to spare **no expense** in experimenting with the apparatus, and one of the first trials would be from Penarth to an island in the (Bristol) Channel. This was the path used by Preece for his induction experiments (fig. 6). The trials took place, but no money came from the Post Office.

Preece went on to say that he had the greatest faith in the apparatus:

'The curious thing about it is that there is no new principle introduced. The first man who taught us how to generate these waves was Hertz, and they have been developed by others, but in making practical use of these waves, Mr. Marconi has invented devices which are highly novel and very beautiful, and when they are patented and can be made public, I think they will be admired by everybody.'

Marconi did not claim novelty, only improvements, these improvements were the subject of the 12039 patent.

'My invention relates in great measure to the manner in which the above apparatus is made and connected together.'

Nothing false was ever claimed by either Marconi or Preece.

More experiments continued in the following year (1897) with the assistance of Preece, with whom Marconi remained a great friend for years, although Preece sometimes had to take a formal position because of his Post Office appointment.

Although Marconi did not like public speaking, he gave lectures at the Royal Institution,' The Royal Society of Arts, the Institution of Electrical Engineers and many other venues, on the progress of his work, any or all of which could have been done by Preece, or many others, but none of them did.

In March he was back on Salisbury Plain and achieved a range of 7 miles (11.2km).

The reports of Captain Jackson to the Commander-in-Chief, Devonport, on both of the Salisbury Plain demonstrations are complete and contain considerable detail of Marconi's equipment. Capt. Jackson acknowledged that there was little difference between his and Marconi's apparatus and that the results were similar, although Jackson's were slightly inferior because he had a less powerful transmitter and a less sensitive receiving apparatus.

He commented that the Marconi apparatus consumed 13W to transmit over 2 miles (3.2km), whilst the power required for a ship's mast-head lamp was 260W.

He was, however, the recorder of the reported remark that:

'there is no possible market for the instrument, except for naval and military purposes.'

Who **actually** said this is not clear.

George Kemp

21 ***George Kemp (seated) with Marconi***

George Kemp was very active as Marconi's assistant (fig. 21). He was an ex-Petty Officer and had been one of Preece's laboratory assistants. He joined Marconi from the Post Office, becoming his assistant and technician for more than thirty years. He kept notebooks of his work and, in the 1930s, prepared further, more complete records. These latter documents are in the Marconi archives. Unfortunately, although his copperplate handwriting gives a general description, there is more detail about the travelling arrangements and times of trains, than of the exact equipment used in the experiments!

The Bristol Channel Trials

There is much more detail available about the trials across the Bristol Channel in May, as Preece presented a lecture on the results at the Royal Institution on June 4 1897. These tests were conducted, as usual, in the normal bad weather conditions and the record speaks of people huddled in huts on the beach to get out of the storm. No success was achieved on the first two days with the aerial at 150 feet (46m), but on the fourth day, with the aerial at 300 feet (92m) and using a 20 inch

(0.5m) spark coil, a new record range of 8.7 miles (14km) was achieved. The Morse message that was sent was 'let it be so' (at a wavelength of 1.25m).

During this period, Preece repeated his electromagnetic experiment on May 10th with perfect results.

Among the people who witnessed these tests was Prof. Slaby from Germany. He commented:

'What I saw was something new; Marconi had made a discovery; he worked with means, the full importance of which had not been recognized and which alone explained the secret of his success. He has thus, first shown, how by connecting the apparatus with the earth on the one side and by using long-extended vertical wires on the other side, telegraphy was possible.'

Slaby suggested therefore that wireless telegraphy was a misnomer and proposed 'spark telegraphy'. 'Die Funkentelegraphie' was the term adopted in Germany.

Slaby proposed that there should be a commercial arrangement between Marconi and AEG, but there was failure to agree on terms. Later Slaby, Arco of AEG and Braun of Siemens & Halske amalgamated to form a new company in 1903, called Gesellschaft für Drahtlose Telegraphie, and who marketed the Telefunken system, becoming a formidable rival to Marconi.

The Formation of the Marconi Company

There were many approaches to buy Marconi's patents and there were rumours that the taxpayer 'was funding him to the detriment of British scientists'.

Once again this was where the whiskey connection was significant because Jameson Davis, his cousin, became the first Managing Director of the Wireless Telegraph and Signal Co. on 20 July 1897. Col. Jameson Davis was a corn-milling engineer and seven of the eight other first subscribers were corn factors, or corn merchants.

The new Company purchased all Marconi's patent rights. Marconi received £15,000 cash, less the legal fees of forming the Company; he also received 60,000 shares of £1, the remaining 40,000 shares were put on the market. Marconi was one of five directors.

The Marconi's Wireless Telegraph Company of America was formed on November 22nd 1899 and became the Radio Corporation of America in 1919.

The UK Company name was changed to Marconi's Wireless Telegraph Co. Ltd on 24 March 1900 when Samuel Flood Page became Managing Director. The Marconi International Marine Co. was created on April 25 1900, Marconi's 26th birthday.

Further Demonstrations

With the setting-up of the Company, the number of demonstrations increased significantly. Marconi was in Italy when the Company was being formed and, as a result of this visit, it was announced shortly afterwards that the Italian Navy would adopt Marconi's apparatus.

Later that year, in October 1900, Marconi was back on Salisbury Plain, now communicating with Bath at a distance of 34 miles (54km).

The new Company created a separation with the Post Office, which carried out experiments of its own at Dover, but without much success. The report by Preece to the Post Office on this work, said to be for the purpose of 'determining the laws which govern this method of transmission' includes the comment: 'the results at Dover are distinctly unfavourable when compared with those we had between Lavernock and Brean Down in the Bristol Channel'.

Marconi then concentrated on his original idea of communication with, and between ships at sea. He established a coastal station at the Needles Hotel, Alum Bay, Isle of Wight (fig. 22), and carried out tests with two steamers, achieving ranges of up to 18 miles (29km) – always, it seems, in bad weather. Bad weather and the results of gales, continually appear in the records of Marconi's work.

A second station was set up at the Madeira Hotel, Bournemouth. Lord Kelvin sent the first **paid** message (he insisted on paying), the first wireless telegram (fig. 23), from the Isle of Wight to Bournemouth in early 1898, thus creating a problem with the Post Office, whose monopoly covered all messages within the three mile limit.

Towards the end of September 1898, Marconi left the Madeira Hotel because of a dispute with the management over the cost of accommodating the aerial (115 feet (35m) high) in the front garden. He moved to the Haven Hotel at Poole, where he worked and lived from time to time until 1926 (fig. 24).

Further demonstrations were given at many places including:

- from the House of Commons to St. Thomas' Hospital;
- from the Lighthouse at Ruthlin Island to Ballycastle NI;

22 *The 115'(35m) aerial at the Needles on the Isle of Wight*

23 *Lord Kelvin's telegram, sent from the Isle of Wight to Bournemouth in 1898 – the first paid message*

- at the Kingstown Regatta – sponsored by the Dublin Daily Express (SS 'Flying Huntress');
- at the Cowes Regatta. From Queen Victoria at Osborne House to the Prince of Wales on the Royal Yacht 'Osborne' – 150 messages were passed;
- from the East Goodwin Lightship to the N. Foreland Lighthouse at a range of 12 miles (19.2km). This link was maintained by the Company for 14 months at its own expense;
- from South Foreland to Wimereux on the 27th March 1899; and

24 *The Haven Hotel, Poole*

- at the America Cup races 1899, at the request of the New York Herald and Evening Telegram (Editor – Gordon Bennett).

Most of these events are well documented and each could be the subject of a complete paper.

The Naval Manœuvres of 1899 gave the opportunity for communication over a distance of 95 miles (152km) using an intermediate ship as a repeater (HMS 'Europa' to HMS 'Juno' to HMS 'Alexandra'), giving that section of the fleet an advantage of about three hours.

Capt. Jackson (HMS 'Juno') noted that the distance of the horizon from the height of the aerials (150 feet) was 31 miles (50km) and that communication between 'Juno' and 'Europa' had been achieved over 60 miles (96km). He says:

'the induction must have passed through or over a mass of sea water about 500 feet high and 30 miles thick.'

On his return from the USA in the SS 'St. Paul' (fig.25) in 1899, Marconi established contact with the Needles at 60 miles, receiving the latest news of

25 ***SS 'St. Paul'***


THE TRANSATLANTIC TIMES.

26 ***The first issue of the 'Transatlantic Times'***

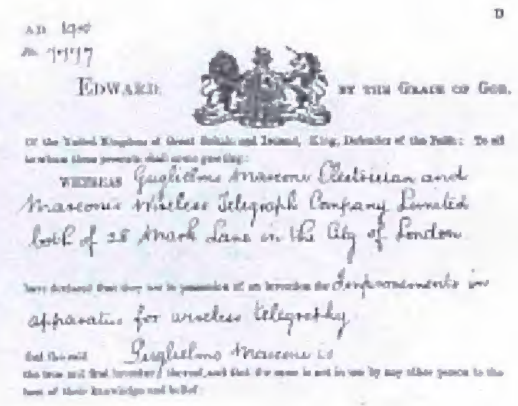
the South African war. The 'Transatlantic Times', Vol.1., No.1. was produced, dated November 15 1899, at $1 a copy (fig. 26).

As a result of these and many other trials, Marconi obtained the initial orders for his new Company. However the Company did not show a profit for several years and if it had not been for the continued financial support from his fellow directors, he would not have been able to continue his experiments and the Company would have failed.

Marconi engaged technical staff, Dr. J. Erskine-Murray in 1898, and Dr. W. H. Eccles in 1900. This support gave him a significant advantage over both Oliver Lodge, who had to run a department at Liverpool University, and Capt. Jackson, who had to carry out his Naval duties, in addition to their studies of wireless.

The 7777 Patent

In April 1900, the famous 'Four Sevens' patent was granted for 'Syntonic Transmission and Reception' (fig. 27). As with the first patent, the novelty consisted not in a new discovery of scientific principle, but in its method of application to the purposes of wireless telegraphy.


EDWARD BY THE GRACE OF GOD,

27 ***Patent 7777***

Two Tuned Circuits

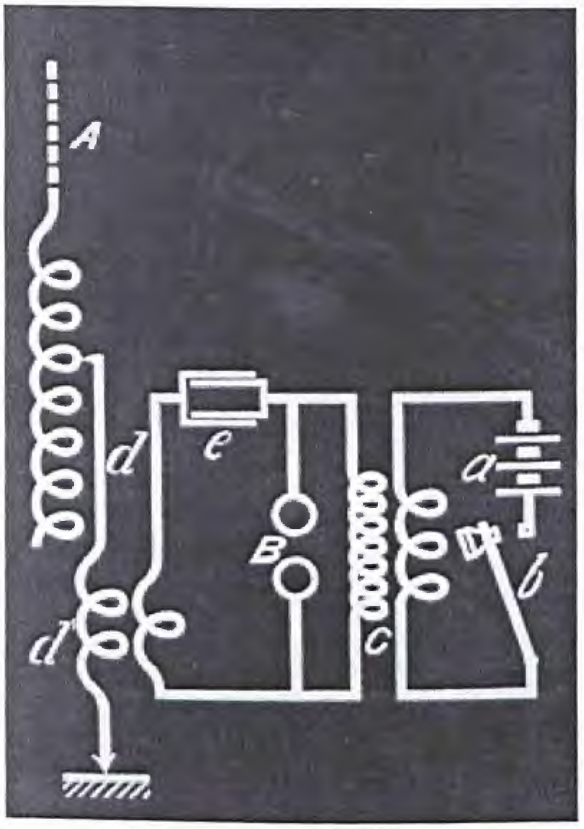
The method by which the natural frequency of oscillation of a circuit could be controlled was already known. If a circuit were constructed to be a good radiator of energy, (for example an open aerial), the oscillations set up therein by a spark discharge would quickly die away as the energy was dissipated in radiation. Ideally the circuit would maintain the oscillation between each discharge by resonating. Such a circuit could be constructed, but the two requirements of being a good radiator and for sustained resonance were recognized as being mutually conflicting.

By combining within his apparatus two tuned circuits, one being a highly resonant closed circuit and the other an aerial circuit of good radiating characteristics, and weakly coupling the two together, a successful result was obtained, with greater range and selectivity (fig. 28).

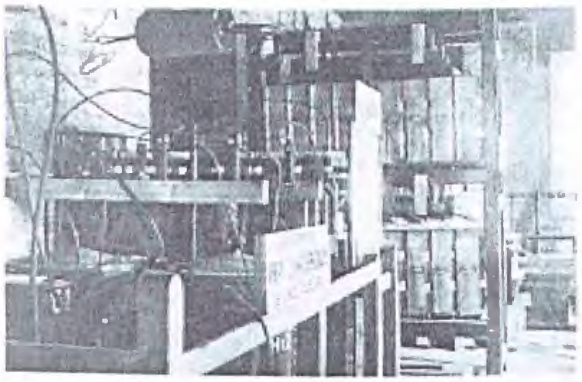
The radio frequency transformers were called 'jiggers'. Marconi had effected the practical compromise that allowed control of the rate at which energy was transferred to the aerial.

Poldhu

It would be a serious oversight to omit reference to the transatlantic experiments, although these were only possible by virtue of enormous investment by the Board of the Company. Ambrose Fleming designed the apparatus at Poldhu, having been appointed Scientific Adviser to the Company. Work started in October 1900 and tests started in the beginning of 1901. The input power was 20–25kW from an alternator giving 2000V at 50Hz, this was stepped up to 20kV into a closed oscillating circuit. The keying was achieved by shorting out chokes in the output of the alternator.



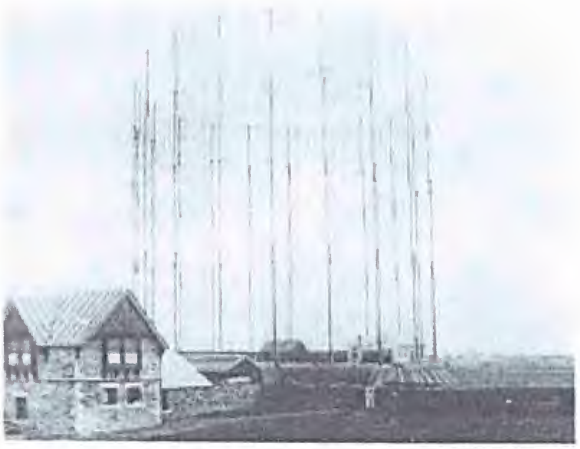
28 *Two tuned circuits*



29 *The Poldhu transmitter*

In the photograph (fig. 29) the rack contains many capacitor boxes, each 0.05mF, made of twenty glass plates 16 inches square (0.4m square).

It was decided to build a second similar station at Cape Cod but, once again, the weather took an active part and the large inverted cone aerials at both sites were wrecked (figs. 30 and 31). Poldhu replaced this with a 60 wire fan between two 150 foot (46m) masts (fig. 32).



30 *The first inverted-cone aerial at Poldhu*

31 *The effect of bad weather on the first Poldhu aerial*

Marconi decided to do a one-way test, by taking a receiver to Signal Hill at St. Johns', Newfoundland. He gave the wavelength of operation as 366m.

At St. Johns', Marconi and Kemp used a kite to lift the aerial wire to 400 feet (122m) (fig. 33), but because of the wind the system would not stay in tune and hence the new syntonic receiver was abandoned for a plain aerial-to-earth circuit, coupled by a jigger to a circuit containing a mercury coherer (probably operating as a rectifier) with a telephone earpiece in series. The dots were received at 12.30 p.m. on December 12th 1901 local time and recorded in his diary (fig. 34). The weather got worse and the tests could not be continued, preventing confirmation by an independent person.

Immediately after this success and in order to ensure the presence of Marconi, the American Institute of Electrical Engineers brought forward, at very short notice, the date of their Annual Dinner at the Waldorf Hotel and held it in honour of

a)

b)

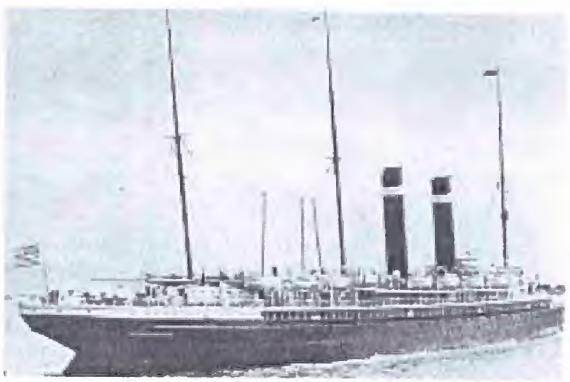
32 a) ***The replacement fan aerial at Poldhu, and*** b) ***the site as it appears today***

33 ***Raising the kite at Signal Hill***

Marconi on January 13th 1902. The room was decorated with lamps flashing the Morse 'S', and the menu (signed by many, including Alexander Graham Bell) had a cover that reflected the transatlantic achievement (one item on the menu was 'Potage Electrolytique').

Subsequent work in the SS 'Philadelphia' (fig. 35), in February 1902, revealed that the range obtainable at night was much greater than at day, achieving 2099 miles (3358km) (fig. 36). I am

34 ***Marconi's diary recording the events at St Johns'***



35 ***SS 'Philadelphia', showing her 150-foot (45m) masts***

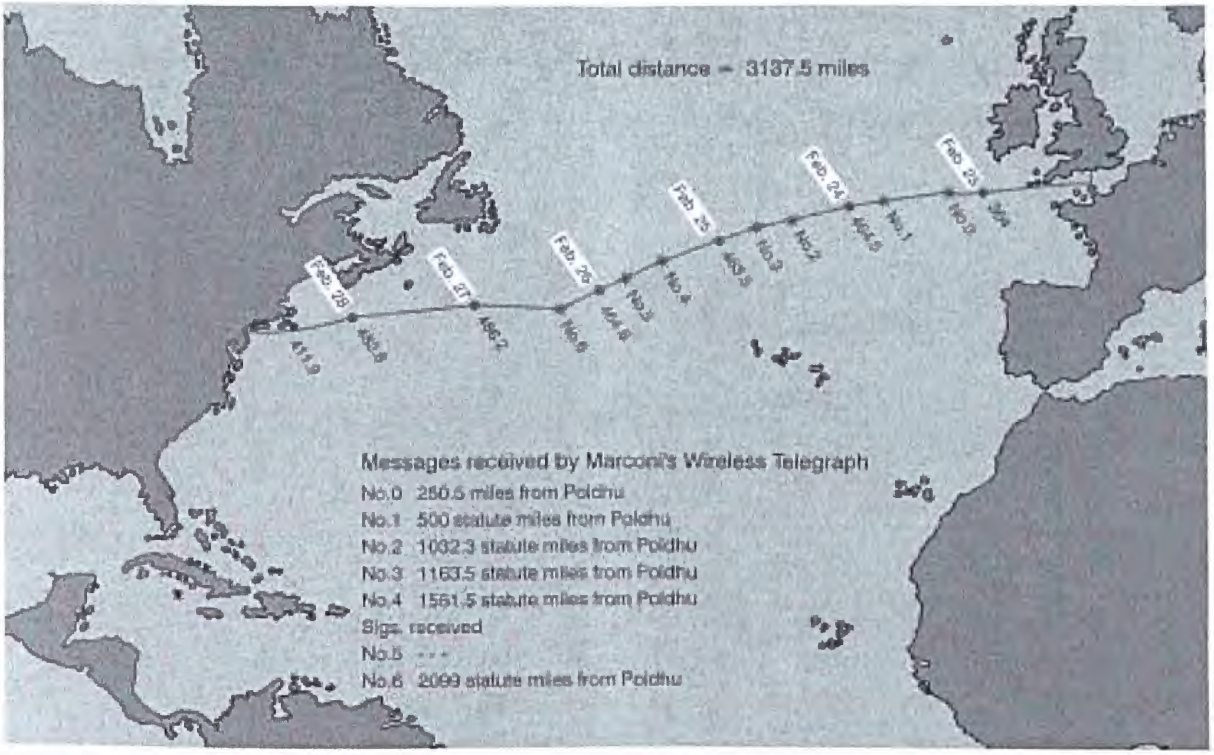
intrigued that the certified tapes of the messages that we have, do not contain any recognizable plain language, or code, unlike the earlier records of experiments.

'Carlo Alberto'

The King of Italy placed the new warship 'Carlo Alberto' (fig. 37), with a crew of 800, at Marconi's disposal enabling him to carry out more experiments, over a period of six months, from Finland, Prussia, the Mediterranean and the North Atlantic coast of America.

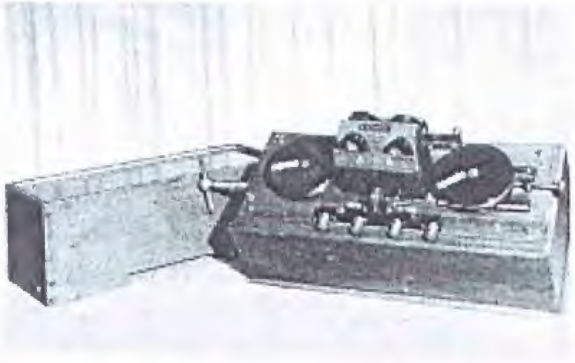
The Magnetic Detector

A most significant invention of Marconi was the Magnetic Detector (fig. 38), which became the standard system for reception for many years, superseding the coherer. Again, Marconi applied a phenomenon, discovered by Rutherford in 1895, which was based upon the effect of high frequencies on the magnetic characteristics of iron. The rigorous explanation of the actual operation of the detector was not understood until research into the theory of magnetic materials produced the explanation in 1931.



36 ***The route diagram for the experiments aboard the SS 'Philadelphia'***

37 ***The 'Carlo Alberto'***



38 ***The magnetic detector***

A Summary of Early Events

For reference, the following lists some of the progress in the wireless communications business, that took place in the first few years of the 20th century.

The Marconi Company had been formed in 1897 with Wireless Telegraphy in a very rudimentary state. By 1903, as a consequence of Marconi's efforts, there had been the following achievements.

- There was a daily service of news between Glace Bay, Nova Scotia, and Poldhu at a range of 2400 miles (3840km).
- The Italians were building a station to communicate with Buenos Aires – a range of 5000 miles (8000km).

- The Marconi System had been adopted by British and Italian Navies.
- There were 32 installations on British warships and 20 installations on Italian warships.
- Lloyds had a contract to use only the Marconi system.
- There were ten coastal stations in England.
- The Dover-Calais and Ostend-Boulogne ships were fitted.
- The Slaby-Arco installations in Germany were replaced by a Marconi system.
- Italy was building several coastal stations.
- There were ten coastal stations in the U S A, and also at Chicago, in Cuba, Hawaii (4), Alaska and Milwaukee.
- Eighteen transatlantic liners had been fitted by 1901, and thirty by 1903.

This rate of progress in just six years was certainly impressive. On the other hand, Marconi experienced the problems with Government contracts, which are still all too familiar today.

There were difficulties in agreeing terms with both the Post Office and the Admiralty. Neither of these organizations wishing to be the first to set a pattern. The Admiralty wanted to use Marconi equipment, as there had been very successful results during the naval manœuvres in July 1899, when three warships were fitted. However, they could not wait for the contract to be agreed, particularly as Marconi wanted a royalty of £100 per annum for each ship fitted. A royalty of this amount would have produced an income of £10,000 if all the relevant ships of the fleet were fitted. This was the sum being offered by the Post Office for all the Marconi patents.

A complete receiver and transmitter with batteries, key and inker was sold at £93 16s 6d. The breakdown of prices was as follows:

Receiver	£13	16s	0d
Inker	£15	0s	0d
Bell		3s	6d
Coil attachments and Key	£4	5s	6d
10-inch Coil	£38	11s	6d
100 'M' Cells	£22	0s	0d

Several sets to the design of Capt. Jackson were made at HMS 'Vernon', but these were of inferior performance to that achievable by Marconi sets. The Admiralty used their Crown Rights to employ inventions and to manufacture, under the terms of the Patents, Design and Trade Marks Act of 1883, and had fifty copies of the Marconi sets made by Ediswan (also a root of GEC), having in the end bought just thirty-two sets, but paying the required royalty for only these.

Eventually, most of the Jackson sets were modified to Marconi standard and became of equal performance and represented the ultimate development of untuned spark gap systems.

Marconi – the Man

What sort of a person was Marconi? The comments of contemporaries are many:

'Always the clear leader, but somewhat aloof, even at 23, when his Company was formed.'

'Not a cordial man, a human loveable man.'

'His manner is of chilly reserve, charm and distinctly scientific.'

'English in dress, unduly serious for his age.'

'English in speech, trustworthy.'

'Not the fastest spark of southern fire. A cool calculating man of the North.'

'For a successful inventor, Marconi appears the least joyous of men.'

'His features are melancholy in expression. They are of a man fast approaching forty, not those of a man of twenty-eight. His face is impassive, his eye almost cold.'

'When he smiles he half shuts his eyes, wrinkles the muscles of his cheek. It is not a pleasant smile.'

'If you visit Marconi with the expectation that he will do most of the talking, you find that you must do the talking yourself. To be sure, he answers questions frankly and fully; but he will not converse voluntarily.'

'You discover quickly enough that his reticence is the reticence of modesty. When he discusses the Marconi system of wireless telegraphy, he refers to it as 'our system' not as 'my system'. He praises, where praise is due, he acknowledges fully how important to him has been the work of his predecessors.'

'As he himself recognized the merit of the labours of those who went before him, it is fitting that others should recognize the fact that his organizing talents have brought together a hundred contributory speculations and detached discoveries into harmonious relation, and have given us a system of wireless telegraphy, still susceptible

of improvement in many respects, no doubt, but practical in the attainment of results scarcely deemed possible by present agencies.'

'He insisted on a clear order of rank, which was evident when his party sat down to a meal.'

'The greatest thing about him is his capacity for labour.'

'A determined worker from the earliest times.'

'Said to have locked himself in his laboratory in the attic for days on end ceaselessly without food or rest.'

'Very adroit with his hands and a good pianist. A great traveller, almost constantly on the move.'

'A great persuader of his business friends to put up more and more money, to enable more demonstrations to be staged and to build new and higher-powered stations, at a time when virtually no orders had been received by the Company.'

'He clearly enjoyed the large number of events, discussions and awards given to honour him. It seemed that every new success was followed by some public celebration, and the newspapers of the period carried daily reports of his activities.'

'He was a great developer.'

Solari of the Italian Navy and a lifelong friend said:

'In intimate circles and with trusted friends he displayed a simple and youthful joy which was very surprising to people who had only met him at official meetings.'

If we remember that the first person to notice that the lid of the kettle lifted when the water boiled did not himself design the steam engine, then we can identify the qualities that marked Marconi as the pioneer of wireless. He was not primarily interested in the purely scientific aspects, but in the practical application for useful purposes.

He was also a great predictor. At a joint meeting of the IRE and the American Institute of Electrical Engineers on June 20 1922, he concluded with the following remarks:

'As was first shown by Hertz, electric waves can be completely reflected by conducting bodies. In some of my tests, I have noticed the effects of reflection and deflection of these waves by metallic objects miles away. It seems to me, that it should be possible to design apparatus by means of which a ship could radiate or project a divergent beam of these rays in any desired direction, which rays, if coming across a metallic object, such as another steamer or ship, would be reflected back to a receiver screened from the local transmitter on the sending ship, and thereby immediately reveal the presence and bearing of the other ship in fog or thick weather.

One further great advantage of such an arrangement would be that it would be able to give warning of the presence and bearing of ships, even should these ships be unprovided with any kind of radio.

I have brought these results and ideas to your notice as I feel and perhaps you will agree with me that the study of short electric waves, although sadly neglected practically all through the history of wireless, is still likely to develop in many unexpected directions, and open up new fields of profitable research.'

He felt that it was his initiative in using longer and longer wavelengths that was responsible for this neglect as everyone followed his preoccupation with increasingly greater wavelengths (Poldhu/Clifden: 1100m (1901), 2000m (1903), 3660m (1904), 6660m (1907)).

And in 1927 he said:

'I am known as a man who deals in cold scientific facts and practicalities, not in Utopian fantasies,.....As to talk of a saturation point, a limit to radio progress, there is no limit to distance, hence there can be no limit to wireless development.'

The picture shown in fig. 39 (note the slight misquotation) emphasises the reason for Marconi being regarded as justifiably as the Father of Wireless in the simplest of terms. No challenge was too great.

Acknowledgements

I must, in particular, mention the help of Mr. Roy Rodwell, who is responsible for the Marconi Archives, also Keith Geddes lately of the Science Museum, and the late Gerald Garrett who made available some of his unpublished work for study.

39 ***A girdle round the Earth***

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THE INTERNATIONAL RADIOTELEGRAPH CONFERENCE OF WASHINGTON

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The International Radiotelegraph Conference of Washington was opened on October 4, 1927, with an address by President Coolidge [1] and was closed on November 25, 1927, with the signing of an International Radiotelegraph Convention and Annexed General Regulations by delegates representing 78 governments [2] and a set of Annexed Supplementary Regulations by representatives of 75 governments.[3] In his closing address, Secretary Hoover, president of the conference, referred to it as "the largest international conference of history." [4]

The Washington Convention, embodying the general principles agreed

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[1] Published in New York Times, October 5, 1927.

[2] Union of South Africa, French Equatorial Africa and other colonies, French West Africa, Portuguese West Africa, Portuguese East Africa and the Portuguese Asiatic possessions, Germany, Argentine Republic, Commonwealth of Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Republic of Colombia, Spanish Colony of the Gulf of Guinea, Belgian Congo, Costa Rica, Cuba, Curacao, Cyrenaica, Denmark, Dominican Republic, Egypt, Republic of El Salvador, Eritrea, Spain, Estonia, United States of America, Finland, France, Great Britain, Greece, Guatemala, Republic of Haiti, Republic of Honduras, Hungary, British India, Dutch East Indies, French Indo-China, Irish Free State, Italy, Japan, Chosen, Taiwan, Japanese Sakhalin, the Leased Territory of Kwantung and the South Sea Islands under Japanese Mandate, Republic of Liberia, Madagascar, Morocco (with the exception of the Spanish Zone), Mexico, Nicaragua, Norway, New Zealand, Republic of Panama, Paraguay, the Netherlands, Persia, Peru, Poland, Portugal, Rumania, Kingdom of the Serbs, Croats, and Slovenes, Siam, Italian Somaliland, Sweden, Switzerland, Surinam, Territories of Syria and The Lebanon, Republic of San Marino, Czechoslovakia, Tripolitania, Tunis, Turkey, Uruguay, and Venezuela. Of these Liberia, Persia and Rumania signed *ad referendum*. In signing the general regulations, Poland made a reservation concerning paragraph 4 of Article 5 in the terms found in the *procès verbal* of the eighth plenary session, Nov. 22.

A statement was inserted in the *procès verbal* of the eighth plenary session, Nov. 22, to the effect that the list of names appearing in the preamble as those of the contracting governments should not affect the question of votes in the next Conference.

The convention and regulations were sent to the Senate by the President on December 12, 1927, and the injunction of secrecy removed from the document on December 17. An English translation of the convention and regulations has been published as Senate Document, Executive B, 70th Congress, 1st Session. That document, hereinafter referred to as Executive B, also contains English translations of the *procès verbaux* of the plenary sessions.

[3] All of the countries listed in note two except the United States, Canada and Honduras.

[4] *Procès verbal* of ninth plenary session, Nov. 25, 1927; Executive B, p. 288.

upon by the conference, is the third of the series of conventions treating generally of the subject of radio.[5] The Berlin Convention of 1906 [6] was the first international convention which purported to cover the field of radio as it currently existed; it is of little or no importance now, as it is binding only as between countries adhering to it, when one of the interested governments has not become a party to the London Convention of 1912.[7] This latter convention, which is at present in force and will continue to be binding until it is superseded by the Washington Convention, had at the time of the opening of the 1927 conference been adhered to by 97 separate contracting parties.[8] By the time of the second plenary session, held on October 25,[9] four additional countries had adhered to the London Convention, and the adherence of still another was announced at the third plenary session, November 3.[10] Of the original 97, several adhered only a short time before the convening of the Washington Conference. The reason for adherence at that time was that the 1912 convention, under the terms of which the 1927 conference was held, permitted only governments which were parties to that convention to participate in subsequent conferences with the right to vote.

The fifteen years between the signing of the London and the Washington Conventions were exceedingly important in the field of radio communication, and the need of revising the London Convention was felt long before the 1927 conference. At the time the London Convention was signed, it was thought that the next radiotelegraph conference would be held in Washington in 1917. The World War, however, made impossible the convening of a conference at or near the tentative date. As the London Convention was not sufficient adequately to provide for the regulation of the enlarged field of radio communication, the Allied and Associated Govern-

[5] Of course, conventions not in this series have contained provisions bearing upon radio, or even, as in the case of the draft prepared by the Commission of Jurists in 1922, have been devoted to a particular phase of radio. The various earlier provisions of multilateral treaties bearing upon radio are to be found conveniently listed in *The Law of Radio Communication* by Stephen Davis, pp. 175–185. In addition to those treaties which have radio as their special subject matter, Judge Davis mentions the Convention Respecting the Rights and Duties of Neutral Powers and Persons in War on Land (1907), the Convention for the Adaptation to Naval War of the Principles of the Geneva Convention (1907), the Convention Concerning the Rights and Duties of Neutral Powers in Naval War (1907), the unratified Declaration of London (1909), the Convention for the Safety of Life at Sea (1914), the resolution on Radio Stations in China passed by the Limitation of Armament Conference of Washington (1922), and the draft prepared by the Commission of Jurists (1922). To this list should be added the Convention for the Regulation of Aerial Navigation (1919).

[6] U. S. Treaty Series No. 568; Malloy, Treaties, Conventions, International Acts, Protocols, etc., Vol. III, p. 2889.

[7] U. S. Treaty Series No. 581; Malloy, Vol. III, p. 3048.

[8] *Procès verbal* of the opening session; Executive B, p. 100.

[9] *Procès verbal* of the second plenary session; Executive B, p. 134.

[10] *Procès verbal* of the third plenary session; Executive B, p. 153.

ments prepared and put into effect a draft of revised radio regulations responsive to current developments.[11]

A resolution was adopted at Paris by the five Principal Allied and Associated Powers, looking toward the convoking of an international congress to consider all international aspects of communication by land telegraphs, cables, or radio. A conference, preliminary to such an international conference and composed of representatives of the Principal Allied and Associated Powers, convened at Washington on October 8, 1920.[12] The product of the labors of this preliminary conference was a draft of convention and regulations for a universal electrical communications union, to serve as the basis for an electrical communications conference. A technical conference held in Paris in July and August of the following year revised the technical parts of the Washington draft. Differences of opinion as to the advisability of forming an electrical communications union led to a decision to hold separate telegraph and radiotelegraph conferences. The Telegraph Conference was held in Paris in 1925, the Telegraph Regulations there adopted including as well a number of radio regulations.[13]

One of the results of these various conferences and conventions and regulations was that by the time of the opening of the Washington Conference, the problem of adjusting radio regulation to the present state of the radio art had been given thorough consideration. The governments invited to participate in the Washington meeting were well aware of the questions which would arise; and the delegates, familiar with the viewpoints of the various countries, were prepared to take all the steps which should prove necessary to reach an agreement on the proper solution of these questions.

As the basis for its labors, the Washington Conference had a Book of Proposals compiled by the International Bureau of the Telegraph Union at Berne from replies received to requests for proposals of modifications to be made in the London Convention and in the revised Washington draft of 1920. The book was printed in two columns: on the left appeared the

[11] The EU-F-GB-I (United States, France, Great Britain, Italy) Radio Protocol of Aug. 25, 1919. This document was published by the United States Navy Department in 1920.

[12] Provided for by an act dated Dec. 17, 1919, 41 Stat., Vol. I, p. 367.

[13] Particularly Articles 1 and 64; see page 34 *infra*. It is of interest to note that at its second plenary session, the Paris Conference passed the following resolution: "The conference expresses the opinion that, after the Radiotelegraph Conference of Washington, the contracting governments should consider the best way of modifying the St. Petersburg Convention, and of introducing into it the provisions of the Radiotelegraph Convention by a congress possessing the necessary powers. It, expresses the hope that the Washington Conference may be able to make a similar recommendation."

At the eighth plenary session, Nov. 22, the following resolution passed by the Convention Committee on Nov. 19 was adopted: "The International Radiotelegraph Conference of Washington expresses the desire that the contracting governments shall examine the possibility of combining the International Radiotelegraph Convention with the International Telegraph Convention, and that, eventually, they shall take the necessary steps for this purpose." Executive B, p. 271.

articles of the London Convention and of the Washington draft, while on the right appeared proposals for the amendment of the particular articles or for the insertion of relevant new matter. The book proper contained 601 pages with 1768 separate proposals. It was circulated for study several months before the date set for the convening of the conference. After the publication of the book, various additional proposals were sent to the Bureau and were circulated in the form of Supplements to the Book of Proposals. Still other proposals were made during the course of the conference, so that by the time the conference adjourned a total of 1951 proposals had been circulated and had been considered by the conference.

ORGANIZATION OF THE CONFERENCE

The conference was opened by President Coolidge at 3.00 p. m., October 4, 1927, with a brief address emphasizing the importance of the work before it.[14] Mr. G. J. Hofker, head of the delegation from the Netherlands, acting as dean of the conference in the absence of Count Hamilton of Sweden, responded and nominated Mr. Herbert Hoover, head of the delegation of the United States, as president of the conference. Mr. Hoover was elected by acclamation. In his address the new president alluded to a number of the problems confronting the conference and touched in particular upon one which loomed large at the beginning of the conference—that of providing regulations which would be acceptable to those countries in which the control and management of radio communication were in the hands of private enterprises as well as those in which such communications were operated by government administrations.

The first plenary session of the conference, held on October 5, was devoted largely to the adoption of rules of procedure and the organization of committees.[15] Printed copies of a "Draft of Rules of the Conference, Submitted by the President" had been distributed in advance. In the main, the draft followed the rules which had governed the procedure of the London Conference. The more important alterations were those in Article 2 giving the president the power to select a vice-president to preside in his absence and to appoint such acting vice-presidents as might be necessary, and in Article 5 recognizing in a qualified manner the use of English. The first of these changes was made necessary because the demands upon Mr. Hoover's time were such that it would be impossible for him to be present at all of the plenary sessions. Under this provision, the president immediately designated Judge Stephen Davis, vice-chairman of the United States delegation, as vice-president. On the occasions when Judge Davis also was unable to be present, the Honorable Wallace White, Member of Congress from Maine, was designated to preside. In all three cases the conference was very fortunate in the choice of its presiding officers.

[14] *Procès verbal* of the opening session; Executive B, pp. 77–118.

[15] *Procès verbal* of the first plenary session; Executive B, pp. 119–128.

Article 5 of the draft rules provided that French should be the official language of the conference. It continued: "Nevertheless, since the presiding administration has so requested, and as an exceptional measure, English may be used. Delegations are recommended to use this privilege with discretion. Translations from French into English and *vice versa* will be made only at the request of a delegation. French alone will be used for the *procès verbaux* and the text of the convention and regulations." On the floor of the conference the Italian delegation moved to replace the third quoted sentence by the following: "Declarations, remarks and speeches pronounced in English shall immediately be translated into French." The Chinese delegation in supporting this motion suggested the following addition to it: "Those pronounced in French shall be translated into English only upon request of a delegation." The article was adopted with the amendments suggested by these two delegations.

In the course of the discussion on the adoption of Article 5 of the Rules of Procedure the Japanese delegation indicated that it desired translations from French into English. This was followed at the first meeting of the Convention Committee by a request on behalf of that delegation that all statements made in French be translated into English without further request for translations of particular remarks.[16] This procedure was adopted and was followed at all committee meetings where translation was desired as well as in plenary sessions. All documents necessary to the work of the conference were published in French by the Bureau of the conference, but unofficial English translations were usually furnished by the American delegation shortly after the distribution of the French originals.

A plan for the organization of the committees of the conference, together with an assignment of the committee chairmanships and vice-chairmanships by countries, had been prepared in advance of the opening of the conference and distributed prior to the first plenary session. Before submitting the suggested plan to the conference, the president announced some changes in the list of committee chairmanships and vice-chairmanships. The list as amended by the Chairman and adopted by the conference without change,[17] is as follows:

Committee	*Chairman*	*Vice-Chairman*
1. Convention	United States	Canada
2. General regulations	Great Britain	Spain
3. Mobile and special service regulations	Germany	Brazil
4. Point-to-point regulations and regulations for other services	Uruguay	
5. Special section to consider the report of the Committee on the Study of Code Language	Italy	Czechoslovakia
6. Tariffs, word count, and accounting	Italy	Australia

[16] *Procès verbal* of first meeting of Convention Committee, Oct. 7.

[17] *Procès verbal* of first plenary session, Oct. 5.

Committee	*Chairman*	*Vice-Chairman*
7. Technical	France	Denmark
8. Drafting	Belgium	Sweden
9. International Code of Signals	Japan	Netherlands
10. Work of the International Bureau	China	Mexico

At the second plenary session, October 25, a committee on full powers was appointed, consisting of the heads of the delegations from Finland, as chairman, Siam and Venezuela.[18]

Though the chairmanship of the Convention Committee was assigned to the United States, all of the sessions of that committee were presided over by the head of the Canadian delegation. Italy was given the chairmanship of one of the regular committees of the conference (tariffs, word count, and accounting). In addition, because of the highly specialized character of the work to be performed by the Committee to Consider the Report of the Committee on the Study of Code Language, which latter committee had met at Cortina d'Ampezzo, Italy, in 1926, under the chairmanship of the chief of the Italian delegation to the Washington Conference, the chairmanship of this special committee was likewise given to Italy. This special committee of the conference had an interesting, though brief, history, which will be touched upon later.[19]

As the Book of Proposals had been the subject of study prior to the conference with a view to the assignment of proposals to the various committees, the president submitted a preliminary list of assignments of proposals at the first plenary session. Tentatively, each committee was composed of representatives of those governments which had made proposals included within the list referred to that committee. As a delegation, however, might obtain assignment to any committee by notifying the Director of the International Bureau of its desire to serve on such committee, each delegation was represented on such committees as it cared to be.

At its first session the Convention Committee adopted as a rule of procedure, that before an article would be discussed by the committee it must be considered by a sub-committee consisting of delegates representing those governments which had made proposals for the amendment of the particular article.[20] In practice, the subcommittee was enlarged to include any delegates who desired to attend. Prior to each session of the subcommittee, its chairman prepared a transactional text of each article to be considered at that session, based upon a consideration of the various proposals for the amendment of the particular article. After a number of transactional texts had been debated, amended and finally adopted by the subcommittee, the full committee would adopt them, with or without amendment. Similar procedure was established for most of the other committees, some of which had three or more subcommittees.

[18] *Procès verbal* of second plenary session; Executive B, p. 136.

[19] See page 38 *infra*.

[20] *Procès verbal* of first meeting of Convention Committee, Oct. 5.

After an article had been adopted by the appropriate committee, the language in which it was couched was revised by the chairman and the rapporteurs of the Drafting Committee for consideration by the Drafting Committee.[21] Only after that committee had placed them in proper form did the articles come before the plenary session. In plenary session, they received two readings; the first as groups of articles came from the Drafting Committee, the second at the closing session of the conference when the entire treaty was read for the second time, the reading being of articles by number only.

THE TWO SETS OF REGULATIONS

The relationship between the Telegraph Convention and Regulations and the Radiotelegraph Convention and Regulations promised to be one of the most difficult problems of the conference.[22] The Telegraph Convention remains as it was drawn up in St. Petersburg in 1875, while the most recent regulations annexed to that convention are those drawn up in Paris in 1925. Although the United States and Canada, among other countries, have never adhered to the Telegraph Convention and Regulations, those documents are in effect among most of the countries participating in the Washington Conference.

The complications arose largely from the fact that the Regulations Annexed to the London Radiotelegraph Convention, to which the United States is a party, provide in Article 50 that:

> The provisions of the International Telegraph Regulations shall be applicable analogously to radio correspondence in so far as they are not contrary to the provisions of the present regulations.

The article then specifically enumerates a number of articles of the Telegraph Regulations applicable to radio communications. The first article of the Paris Telegraph Regulations provides:

> So far as these Regulations do not provide otherwise, provisions applicable to wire communications are also applicable to wireless communications.

In addition to this blanket clause and to several brief provisions applying specifically to radiotelegrams, the Paris Regulations contain an entire article (64), several pages in length, governing radiotelegrams. Paragraph 19 of this article states:

> Modifications of the provisions of these Regulations relating to radiotelegrams and to telegrams for multiple destinations (Art. 69), which may be rendered necessary in consequence of decisions of subsequent Radiotelegraph Conferences, will be put into force on the date fixed for the application of the provisions made by each of these latter Conferences.

[21] To Mr. Pierart, of Belgium, chairman of the Drafting Committee, more than to any other single individual, belongs the credit for the final form of the convention and regulations.

[22] See the notes exchanged between the United States and France prior to the Paris Conference; Dept. of State press release Sept. 28, 1927, U. S. Daily, Sept. 29, 1927.

The situation which confronted the conference was this: On the one hand, the governments not parties to the Paris Regulations did not desire to adopt without consideration rules in the formation of which they did not participate or of which the operation might involve constitutional difficulties. Moreover, they did not desire to incorporate by reference, rules which in the future might be altered without their consent. On the other hand, the parties to the Telegraph Regulations were opposed to reopening questions which had been settled only two years previously after long discussion and serious consideration. They felt that in services as analogous as cable and point-to-point radio, different rules should not be permitted to obtain. And they objected even to writing into the Radio Regulations the exact wording of the Paris Regulations, because future amendments of the Telegraph Regulations would not affect the corresponding changes in the Radio Regulations.

To this complication, a further one was added. While most of the important Powers represented at the conference conducted their own communication services, those services in the United States were largely in the hands of private enterprises. This meant that most of the delegates could act as representatives of governments and as heads of telegraph administrations, while the delegates of the United States were present solely as representatives of their government. Consequently, the United States delegation was compelled to refrain from taking part in those matters which were a matter of internal administration as distinguished from those of governmental concern.

This dual problem was given serious consideration by the American delegation prior to the conference. The American proposals for the amendment of the London Convention were divided into two groups: the first, the Convention and the annexed Government Regulations; the second, so-called Management Regulations.[23] At the first meeting of the Convention Committee on October 7, Judge Davis, on behalf of the delegation of the United States, formally called attention to the proposed division of the regulations into two parts.[24]

After much informal discussion of the situation with delegates from other countries, the American delegation, on October 25, presented a plan for the solution of the difficulty.[25] In brief, its four points were: (1) that the convention and annexed regulations adopted by the conference be divided into three classes, of equal binding force among the countries which signed

[23] The Management Regulations were to be signed by the operating agencies, whether government administrations or private companies. A clear and concise statement of the United States position was printed in French and Spanish, as well as English, and distributed prior to the conference. See *Projet de Convention Radioélectrique Internationale et de Règlements Gouvernementaux Annexés*, and *Proyecto de Convención Internacional de Radio y Reglamentaciones de Gobierno Anexas* (Government Printing Office, 1927).

[24] *Procès verbal* of the first meeting of the Convention Committee.

[25] At the sixth meeting of the Subcommittee of the Convention Committee.

them, namely, the convention, general regulations, and supplementary regulations; (2) that the convention consist of general provisions covering the subjects included in the London Convention and any further proposals of an amendatory character which might be adopted at the conference; (3) that the general regulations include the provisions which all governments agree must, in the public interest, be followed by their operating agencies, whether publicly or privately owned; (4) that the supplementary regulations include all rules which the countries adhering to the International Telegraph Convention and Regulations consider desirable among themselves, either in addition to those regulations or as modifications of them, and any further provisions which might be deemed advisable by the conference. It was stated that the United States expected to become a party to the convention and general regulations but not to the supplementary regulations. The heads of a number of important delegations immediately declared themselves in favor of the adoption of the plan, and it was followed by the conference without a formal vote being taken on it.

No attempt was made to separate the articles in the committees which acted upon them in the first instance, though a number of changes were made from time to time in order to avoid the necessity of certain articles being placed in the supplementary regulations. The division of the regulations into two groups was not definitely made until the Drafting Committee met to prepare the text of the entire convention and regulations for second reading, although the United States delegation made a preliminary designation on November 17.[26] The desires of the United States in the matter of placing certain articles in the supplementary regulations, arrived at in conjunction with Canada, were observed by the conference; and the document as it appears in its final form carries in the supplementary regulations only those articles which were placed there at the request of the United States.[27]

VOTES

Aside from technical problems, the question which offered the most difficulty was that of voting. The provisions of Article 12 of the London Convention on this point were unusual. According to that article, each country was entitled to one vote. If, however, a government adhered to the convention for its colonies, possessions or protectorates, subsequent conferences might decide that such colonies, possessions or protectorates, or a part thereof, should be considered as forming a country as regards the right to vote. The only qualification upon this was that the votes at the disposal

[26] At a joint meeting of the General Regulations, Mobile Services, Point-to-Point Services, and Technical Committees called for that purpose; see *procès verbal* of that session.

[27] In the *procès verbal* of the seventh plenary session, Nov. 19, there was inserted a statement by the American delegation that references in the convention or general regulations to provisions of the supplementary regulations should not be binding upon the United States. Executive B, p. 240.

of one government, including its colonies, possessions or protectorates, might never exceed six. The article concluded with a list of dominions, colonies, possessions and administrative units each of which was to be given a vote under the terms of the article.

The net effect of the article was to give Germany, the United States, France, the British Empire and Russia six votes each; Italy, the Netherlands and Portugal three votes each; Belgium, Spain and Japan two votes each; and the remainder of the contracting parties one vote each.

Whatever might have been the justification of such a provision in 1912, clearly it did not represent any adequate measure of the relative importance of the contracting countries in radio communication in 1927. Moreover, certain complicating factors had arisen. Germany had lost the colonies which had nominally been given the five extra votes accorded to the German Empire.[28] The Irish Free State had been created, and it was clearly apparent that strenuous efforts would be made to obtain for it the right to vote. Japan had been given six votes in the Washington Draft Convention of a Universal Electrical Communications Union[29] and gave notice that a similar number would be requested at the Washington Conference.[30] In addition a number of other countries had indicated their dissatisfaction with the existing arrangement.

The most comprehensive proposal for the modification of Article 12 was submitted by the British Government.[31] Briefly, it was to the effect that every independent state, dominion, colony, possession, protectorate, or territory under mandate which conducted public communication services or authorized private enterprises to conduct such services might become a contracting country and as such be entitled to one vote. Under such a plan the internal organization of the communications system would be the controlling, if not the sole, factor in the determination of the number of votes which would be accredited to a single political sovereignty. Amplifying the proposal, the British Government suggested that not more than one vote should be claimed in respect of the British non-self-governing colonies, protectorates, etc., it being understood that the British Government itself and the government of each of the self-governing dominions and British India should be given votes. The exact number of votes which it would be possible for a single government to obtain under this proposal was never definitely stated, though the number would certainly be very large.

No other general plan for the revision of Article 12 having been proposed, the British proposal formed the basis of the discussion in the subcommittee of the Convention Committee. The debate on the proper distribution of votes extended over several days, during which exceedingly divergent views were expressed. Among other suggestions was one by Dr. Wang, head of

[28] At the second plenary session, Oct. 25, Germany was granted the right to cast six votes. Executive B, p. 136.

[29] Article 22. [30] Proposal No. 105a. [31] Proposals Nos. 100, 101, 138–140.

the Chinese delegation, which would have given to each country a number of votes conditioned upon its importance in the field of radio communication, as determined by the number of radio messages in the international service originating in its territory within a specified time. Shortly after this, the United States delegation declared itself absolutely opposed to the British proposal, and indicated that it was prepared to accept as an alternative, either a system of plural votes worked out along the lines of the suggestion made by Dr. Wang or a plan under which each contracting government should receive only one vote, the term "contracting government" being narrowly defined. Finding agreement in full committee or subcommittee difficult, the delegations represented passed on to the consideration of subsequent articles.

A series of informal conferences followed, as a result of which it was decided to suppress Article 12 of the London Convention, to make no provision whatever for votes, and to leave the question of votes to be settled by the foreign offices prior to the next conference, or, failing that, by the next conference itself. The conference followed this decision.

This action called for a further decision. Various units which normally would not be considered as properly parties to an international agreement[32] were, in accordance with the terms of the London Convention, participating in the conference. The decision to abolish the unusual situation created by the London Convention gave rise to the question whether the delegates representing these units were entitled to sign the convention embodying the work of the conference. A special subcommittee of the Convention Committee, presided over by Mr. W. R. Castle, Assistant Secretary of State and member of the United States delegation, was appointed to consider the question. This subcommittee decided that as the London Convention determined the composition of the Washington Conference, the latter had no authority to refuse to any participating government the right to sign the documents adopted by the conference.[33] The course recommended by the subcommittee was adopted by the committee and followed by the conference. To forestall complications in future conferences, a statement was inserted in the *procès verbal* of the seventh plenary session, November 19, to the effect that the manner of signing the convention and regulations should have no effect whatever on the question of votes. A similar declaration was made in connection with Article 16, relating to adherences to the convention.[34]

THE CORTINA REPORT ON CODE LANGUAGE

The Paris Telegraph Conference of 1925 created a special committee for the study of the question of code language, which met at Cortina d'Ampezzo, Italy, from August 2 to August 26 of the next year. The committee's re-

[32] Compare the list of signatories given in footnote 2.

[33] *Procès verbal* of meeting of Subcommittee on Signatures, Nov. 15.

[34] *Procès verbal* of seventh plenary session, Nov. 19; Executive B, p. 235.

port, according to the resolution passed by the Paris Conference on October 17, 1925, was to be "submitted to the examination and decision of the first telegraph or radiotelegraph conference following the conclusion of the labors of the Committee."

The Cortina Conference issued a majority report signed by fourteen countries and a minority report signed by one.[35] The fundamental difference between the two reports was that the former favored a five letter code word with a rate coefficient to be determined, while the latter preferred the retention of the ten letter code word with certain modifications.

In accordance with a request transmitted by the French Government in its capacity as manager of the Telegraph Union, the Government of the United States issued invitations to the interested countries to send delegates to the Washington Conference empowered to consider and dispose of the Cortina Report. These delegates composed Committee No. 5 in the list of committees of the conference.

The first question considered by that committee at its opening session on October 11 was whether it was sitting as a part of the Washington Radiotelegraph Conference or, with the consent of the United States, as an entirely distinct Telegraph Conference. After some discussion the chairman, Mr. Gneme, head of the Italian delegation, concluded that the committee must proceed as a special Telegraph Conference, convened in Washington with the consent of the Government of the United States. This ruling was accepted by the committee, and rules modeled on those of the Paris Conference were adopted to govern the work of the newly created Telegraph Conference. After further debate on the constitution of the conference, the meeting adjourned in order that formal notification of the opening of the Telegraph Conference might be given to all the nations represented at Washington.

Two days later, October 13, the first plenary session of the Telegraph Conference was held. Immediately upon the opening of the session the British delegation made a declaration challenging the existence of the conference, on the ground that the conference had not been established in conformity with the provisions of the Telegraph Convention. The French delegation agreed with this view because the Paris Conference had decided that the next Telegraph Conference would be held in Brussels in 1930, and Article 88 of the regulations while permitting the date to be advanced, did not permit a change in the place of meeting. Other delegations expressed the fear that a difference of opinion as to the validity of the decisions reached by the conference might imperil the eventual solution of the entire question of code language.

As its final action, the committee decided to report to the Washington Conference that (a) the question of code language could not be treated as a matter pertaining to the International Radiotelegraph Conference of Wash-

[35] Great Britain.

ington; (b) that the telegraph delegations present at Washington could not organize themselves into an International Telegraph Conference in view of the provisions of Article 15 of the St. Petersburg Convention; and (c) that it was desirable that the date of the Brussels Conference be advanced from 1930 to 1928 for the sole purpose of the study of code language. The British delegation abstained from voting on paragraph (c).

The report of the committee was presented to the fourth plenary session, November 10, at which time the head of the Belgian delegation read a telegram from his government authorizing him to declare that the Belgian Government was willing to advance the date of the Brussels Conference to 1928. The British delegation objected to advancement of the date of the conference, stating that the matter deserved further consideration. At the suggestion of the President, the conference adopted the report of the committee and postponed the decision to be taken with regard to the Telegraph Conference. Later in the same session, the chairman of the Italian delegation stated that in his opinion the date for the Telegraph Conference was not within the province of the Radiotelegraph-Conference; that the normal procedure would be to inform the French administration as manager of the Telegraph Union of the recommendation of the Washington Conference and to request it to communicate with the Belgian Government. This course was followed by the conference.

THE CONVENTION AND REGULATIONS

Although the article setting out definitions is the first in the convention,[36] it was among the last adopted. Terms were used with an understanding of their general meaning, and near the end of the conference a special subcommittee was charged with the duty of defining terms in the sense in which they had been used. The definitions in the convention are supplemented by additional definitions in the general regulations, each group defining terms used in the document in which it appears. Of the convention definitions probably the most interesting is that of "radio communication," which is defined to apply "to the transmission by radio of writing, signs, signals, pictures, and sounds of all kinds by means of Hertzian waves." As this definition indicates, the title of the convention does not reveal its extent. Although the document is called a "Radiotelegraph Convention," its provisions were written to apply not only to radiotelegraphy but also to radiotelephony, facsimile transmissions, and all other radio transmissions by means

[36] As has been stated, the conference took the London Convention and Regulations as the basis for its labors. Consequently, the articles coming from the various committees bore numbers corresponding to those in the London documents. This numbering was retained by the plenary session, the Berne Bureau being charged with renumbering the articles and writing titles. (See *procès verbal* of ninth plenary session, Nov. 25; Executive B, p. 279.) In the succeeding pages the numbers assigned to the articles are those which will be given by the Berne Bureau; the numbers in parentheses are those designating the articles in the convention and regulations as signed.

of Hertzian waves. Another definition bearing upon the scope of the convention is that of "international service," which, after including services that are strictly international, continues: "An internal or national radio communication service which is likely to cause interference with other services outside the limits of the country in which it operates is considered as an international service from the viewpoint of interference."

Article 2 (Article 1) defines the scope of the convention. In the first paragraph the contracting governments undertake to apply the convention to all radio communication stations established or operated by them, open to the international service of public correspondence, as well as to special services covered by the regulations. These special services are defined in Article 1 of the general regulations as "services of radiobeacons, radiocompasses, transmissions of time signals, notices to navigators, standard waves, transmissions having a scientific object, etc." By paragraph 2 they further agree to take or to propose to their respective legislatures the necessary measures to impose the observance of the provisions of the convention and regulations upon individuals and private enterprises authorized to establish and operate radio communication stations in international service, whether or not open to public correspondence.[37] Paragraph 3 recognizes the right of two contracting governments to organize radio communications between themselves within certain limits.[38]

The difference between the scope of the 1912 and 1927 conventions is readily apparent. While the provisions of the earlier treaty applied only to

[37] Over the objection of the United States, this paragraph as reported out of the Convention Committee imposed upon the contracting parties a similar obligation with regard to "individual and private enterprises authorized to establish and operate radio communication stations whether or not open to the international service of public correspondence." Such a provision would have made the convention and regulations applicable to all radio communication stations, regardless of the service in which they were engaged. The conference at the second plenary session, Oct. 25, changed the paragraph into its present form; but in order to protect international communications from interference set up by stations engaged in national service, the term international service was extended to include such interference. Executive B, p. 137.

[38] The Convention Committee at its second meeting, Oct. 11, adopted a fourth paragraph in which the contracting governments agreed to exchange traffic with properly authorized private enterprises. Upon further consideration in the Subcommittee of the Convention Committee, the government administrations represented were of the opinion that the paragraph lacked mutuality; and an amended paragraph was suggested to the effect that all of the contracting parties would refuse to exchange traffic with a private enterprise that declined to deal with a government administration for the sole reason that the latter was an administration. This new provision was believed by the United States and other countries in which radio communication is conducted by private enterprises to deal too severely with such an offending company. It was finally decided to eliminate the paragraph, a decision which was reached the more readily because it was believed that no administration or private enterprise respectively would give as the sole reason for refusing to deal with a private enterprise or administration the private or public character of the latter. (Sixth session of the Subcommittee of the Convention Committee, Oct. 25.)

stations in the maritime mobile service,[39] the later one has the enlarged scope just indicated. The necessity for enlarging the scope of the 1912 convention was in a large measure responsible for the convening of the Washington Conference; the changes made merely reflect the progress of the radio art.

Article 3 (Article 3) is largely a repetition of provisions in the 1912 convention. The first paragraph relating to the organization of the service of, and the determination of the correspondence to be exchanged by, fixed stations is carried over from Article 21 of the London Convention. That part of paragraph 2 subjecting fixed stations when engaged in international service from country to country to the appropriate provisions of the convention and regulations is new, though that referring to correspondence with stations in the mobile service is not. Paragraph 3 makes obligatory the reciprocal exchange of radiotelegrams by stations in the mobile service, without regard to the radio system employed by those stations. It was largely for the purpose of obtaining the insertion of a provision similar to this that the Berlin Conference was called in 1906. It appears in both the Berlin and London Conventions. A fourth paragraph, found also in the London Convention, states that in order not to impede scientific progress the preceding paragraphs shall not prevent the eventual use of a radio system incapable of communicating with other systems, provided that this incapacity be due to the specific nature of that system and not the result of devices adopted solely to prevent intercommunication. Article 4 (Article 4) further limits the application of Article 3 by providing that notwithstanding the provisions of the latter article, a station may be assigned to a limited international service of public correspondence determined by the purpose of the correspondence or by other circumstances independent of the system employed.

Article 5 (Article 4 *bis*) is designed to insure the secrecy of radio correspondence.[40] The commitment of the governments in this article is not very extensive, but it is the most stringent upon which agreement could be reached. The Convention Committee clearly recognized that the agreement by the contracting governments "to take or to propose to their respective legislatures the necessary measures to prevent," etc., was one which could easily be made of no effect by any government so desiring. It was felt, however, that the contracting parties could be relied upon to carry out the spirit of the article, within the limits of their powers.

The specific acts to be prevented are (a) the unauthorized transmission and

[39] Article 1. The provisions relating to interference and distress had a wider scope. See Article 15.

[40] The debate on this article revealed the difference between the position of the United States and that of a number of European countries in the matter of licensing of receiving sets. The United States Government has never attempted to require any such license, and the American delegation was continually on the alert to prevent the insertion of any provision in the convention or the regulations which would compel it to do so.

reception by means of radio installations of correspondence of a private nature; (b) the unauthorized divulging of the contents, or even of the existence, of correspondence intercepted by means of radio installations; (c) the unauthorized publication or use of correspondence received by means of radio installations; and (d) the transmission or the placing in circulation of false or deceptive distress signals or distress calls. The London Convention contains no similar provision.

By the terms of Article 6 (Article 4 *ter*) the contracting governments undertake to assist each other by supplying information concerning violations of the convention and regulations, as well as, if necessary, in the prosecution of persons violating the provisions of these documents. This article, likewise, has no parallel in the London Convention.

Article 7 (Article 5) of the Washington Convention has the same purport as Article 5 of the London Convention. The earlier convention bound the contracting governments to connect coast stations with the telegraph network of the country, or at least to take other measures to insure a rapid exchange between coast stations and the telegraph system. It was clearly impossible for a government situated as that of the United States to fulfill the obligation to connect the coast stations with the telegraph system. In the Washington Convention, therefore, the provision was altered to bind the contracting governments to take the necessary measures in order that such connections be made, or at least to take steps to assure rapid and direct exchanges between land stations and the general communication system. It will be noted that the Washington Convention differs from the London Convention in that it requires the connection to be with the general communication system, whereas the London Convention merely required connection with the telegraph system.

Article 8 (Article 6) makes the International Bureau of the Telegraph Union the intermediary between the contracting governments in the furnishing of the names of stations engaged in the international service of public correspondence, of the names of stations carrying on public correspondence, of the names of stations carrying on special services, and of all data for facilitating and expediting radio communication. This article is expanded by the provisions of Article 13 of the general regulations; it is an enlargement of Article 6 of the London Convention, responsive to the enlarged scope of the new convention.

Article 9 (Article 7) is a reservation of the right of each of the contracting governments to permit in the stations mentioned in the preceding article the establishment and operation of devices, other than those covered by the data to be published in accordance with that article, for special radio transmission. It is practically identical with Article 7 of the London Convention.

Article 10 (Article 8) contains a statement of the ideal sought in international radio service. "The stations covered by Article 2 (Article 1) must,

so far as practicable, be established and operated under the best conditions known to the practice of the service and must be maintained abreast of scientific and technical progress." Delegates from a number of the smaller countries kept constantly before the conference the fact that radio apparatus is expensive, and that in view of the rapid development of the art, installations comparatively new in point of time may soon not be the most efficient developed. The phrase "so far as practicable" was inserted to cover this situation; it is to be hoped that it will not be extended to permit the continuance in operation of an antiquated and inefficient station whose activities constitute a disturbance to a large number of more modern and more efficient stations.

The article is completed by a second paragraph to the effect that all stations, whatever their purpose, must, so far as practicable, be established and operated so as not to interfere with radio communications or services authorized by one of the contracting governments. It is to be noted that this paragraph applies not only to the stations covered in Article 2 (Article 1), but also to those stations, including naval and military installations, with regard to which liberty is reserved by Article 22 (Article 21). The article corresponds to Article 8 of the London Convention, but it so far expands that article that the resemblance between the two is slight indeed.

Article 11 (Article 9) relative to priority for distress calls is identical with Article 9 of the London Convention. Article 12 (Article 10) contains the only reference which the convention makes to charges. It differs from Article 10 of the London Convention (upon which the United States reserved at the time of signing) in that all details concerning charges are left to the regulations. Detailed provisions concerning charges are contained in two articles of the regulations (numbered 24 and 33 in the draft adopted by the conference), both of which at the request of the United States were inserted in the supplementary regulations.[41]

In Article 13 (Article 11) official recognition is accorded to the division of the regulations into two parts—general regulations which have the same force and go into effect at the same time as the convention, and supplementary regulations which bind only the governments which have signed them. Only the United States, Canada and Honduras did not sign the supplementary regulations, so that if ratification follows signature in all cases, the supplementary regulations will be effective among by far the larger number of parties to the convention.

The second paragraph of this article, making provision for the alteration of the convention and regulations, corresponds to Article 11 of the London Convention with some important changes. Under the Washington Convention changes may be made only by conferences of plenipotentiaries of the

[41] In accordance with a statement made by the American delegation at the seventh plenary session, reference in the convention to articles in the supplementary regulations is not binding upon the United States. Executive B, p. 240.

contracting governments, each conference fixing the time and place of the next meeting.[42] The London Convention had also a provision for the modification of the convention and regulations between conferences by common consent. With the deletion of the article relating to votes, and the understanding that the entire question of votes would be settled before the next conference, the deletion of the provision for amendments between conferences necessarily followed. Article 13 also carries a third paragraph, without precedent in the London Convention, stating that before any deliberation, each conference shall establish rules of procedure to govern debate.

In Article 14 (Article 12 *bis*) the contracting governments reserve for themselves and for private enterprises duly authorized by them, the right to make special arrangements on matters of service which do not affect the governments generally, on the condition that such arrangements must be in conformity with the convention and regulations so far as concerns interference which their execution might produce with the services of other countries. No similar provision occurs in the London Convention.

In Article 15 (Article 12 *ter*) each government reserves the right to suspend international radio communication service for an indefinite period either generally or only for certain connections or certain kinds of radio communication, provided that it immediately so advise the other contracting governments through the intermediary of the International Bureau.

The first paragraph of Article 16 (Article 13) relating to the duties of the International Bureau is almost identical with the corresponding paragraph of Article 13 of the London Convention, the changes being responsive to the enlarged scope of the new convention. The second paragraph of the article provides for the expenses of the bureau and the manner in which they are to be borne. It is completed by Article 34 (Article A49) of the general regulations, which follows Article 84 of the Telegraph Regulations rather than Article 43 of the London Regulations. Unlike the Telegraph Regulations, the Washington Radio Regulations do not assign the contracting governments to particular classes for the payment of expenses, but leave each government to notify the International Bureau of the class in which it desires to be placed.

Article 17 (Article 13 *bis*) of the convention is entirely new, the subject matter of the article having caused one of the most prolonged debates in the conference. It provides that an International Technical Consulting Committee on Radio Communications shall be established for the purpose of studying technical and related questions pertaining to these communications. This provision is amplified by Article 33 (Article 34) of the regulations. There it is specifically stated that the functions of the committee are limited to giving advice on questions which shall have been submitted to it

[42] The conference at the eighth plenary session, Nov. 22, accepted the invitation of the Spanish Government to hold the next conference in Madrid, and set the date for 1932. Executive B, p. 274.

by the participating administrations or private enterprises, and which it shall have studied. This advice is to be transmitted to the International Bureau with a view to its being communicated to the administrations and private enterprises concerned. The opposition to the establishment of the committee was based on the fear that it might develop into a supercommittee which might tend to stifle radio development. Agreement upon the creation of the committee was obtained by the limitation of its functions to a strictly advisory character.

After the question of the creation of the committee and of its powers had been disposed of, the contest centered on its composition. Countries in which radio communication is a government function felt that the dignity and authority of the committee would be impaired if representatives of private enterprises were accorded the full rights and powers granted to representatives of the administrations. They recognized the importance of having representatives of the large radio communication companies at the meetings of the committee, but they wished this presence to be in an advisory character only without carrying with it a vote in the determination of the decisions of the committee. Such a system, however, would have deprived the United States and other countries not operating their radio communication systems of any effective participation in the work of the committee. This situation, reënforced by the desire of the contracting governments to obtain the advice of the technical experts to be found in the employment of American companies, led to a compromise embodied in Article 33 of the regulations. It is there provided that the committee shall be formed, for each meeting, of experts of the administrations and authorized private companies who wish to participate in the work of the committee. Experts of the private companies participate in the work in an advisory capacity. When, however, a country is not represented by an administration, the experts of the authorized private enterprises of that country have the right to cast a single vote. Expenses of any meeting are to be borne in equal parts by the administrations and private companies participating therein; personal expenses of the experts are to be borne by the administrations or private enterprises which appointed them.

The administration of the Netherlands is charged by Article 33 with organizing the first meeting of the committee, and of drawing up its program of work.[43] Thereafter, the administrations represented at any meeting are to designate the administration which shall call the following meeting. Questions to be studied by the committee are to be sent to the administration organizing the next meeting, and this administration shall fix the date and program of that meeting. While no regular schedule of meetings of the committee is designated in the regulations, it is provided that in principle these meetings shall take place every two years.

[43] At the sixth plenary session, Nov. 18, the Netherlands delegation announced that the first meeting of the committee would be at The Hague. Executive B, p. 229.

Article 18 (Article 14), which declares that each of the contracting governments shall determine the conditions under which it will accept telegrams or radiotelegrams originating in or destined to a station not subject to the provisions of the convention, is almost identical with the first part of Article 14 of the London Convention. The article further provides that if the message is accepted, it must be transmitted and the usual charges applied to it; in the corresponding part of the London Convention nothing was said of the obligation to transmit, though the provision relative to charges is contained therein.

Article 19 (Article 16), authorizing the adherence to the convention of non-contracting governments and stating the effect of adherence and denunciation upon colonies, etc., is identical with Article 16 of the London Convention, except that the later provision treats of "colonies, protectorates, or territories under sovereignty or mandate" while the earlier one listed "colonies, possessions, or protectorates."

Article 20 (Article 18) is devoted to the arbitration of disputes regarding the interpretation or execution of the provisions of the convention or regulations. In addition to rearranging and rewriting the provisions of Article 18 of the London Convention, the conference wrote into the new document one departure from the older one, namely the provision for compulsory arbitration. While the change was opposed, there can be no doubt that the new provision is responsive to the desires of a large majority of the contracting governments.[44]

Article 21 (Article 20) differs from Article 20 of the London Convention only in providing that regulations as well as laws relating to the object of the convention shall be exchanged and that the exchange shall be through the intermediary of the International Bureau.

In Article 22 (Article 21) each of the contracting governments reserves its liberty regarding radio installations not covered in Article 2 (Article 1), and especially with reference to naval and military installations. It is further provided that, so far as practicable, these installations must comply with the provisions of the regulations regarding assistance to be given in case of distress and measures to be taken to avoid interference. To this point the article closely resembles Article 21 of the London Convention. The 1927 convention, however, proceeds to state that they must also, so far as practicable, observe the provisions concerning the types of waves and the frequencies to be used, according to the type of service which these stations carry on. The subject matter of this latter provision is more recent than the 1912 convention. Article 22 carries a further concession in the interests of efficient international radio communication in a third para-

[44] Opposition to compulsory arbitration was led by Great Britain and Japan. A British motion to eliminate the compulsory feature was defeated 43 to 7, and the article with the provision for compulsory arbitration was adopted, 38 to 10. See *procès verbal* of seventh plenary session, Nov. 19; Executive B, pp. 237, 238.

graph which obligates these stations when used for public correspondence or for special services, to conform, in general, to the provisions of the regulations for the conduct of these services. That portion of Article 21 of the London Convention which deals with fixed stations has its counterpart in paragraph 1 of Article 3 of the Washington Convention, no corresponding provision being carried in Article 22.

Articles 23 and 24 (Articles 22 and 23) are formal articles dealing with the time the convention shall go into effect, its duration, and ratification. The effective date of the convention is fixed at January 1, 1929, and the place of deposit of ratifications at Washington; otherwise Articles 22 and 23 of the London Convention are almost unchanged.

The general regulations annexed to the convention are composed of 34 articles and 8 appendices taking up more than 67 pages, as against 24 articles of the convention filling 9 pages. The provisions are largely of a technical nature, of interest primarily to telegraph operators. Extensive changes have been made in the London Regulations.

Probably the most important of the new provisions of the regulations is that contained in Article 5 relating to the allocation of frequencies. The principle of allocation of frequencies to services, not countries, was followed, and an elaborate table showing this allocation was incorporated into the article. Beginning with frequencies in the band 10–100 kilocycles per second (30,000–3,000 meters), the table shows the allocation of frequencies up to 60,000 kc/s (5 m.), with only two bands unreserved. Above the latter figure, frequency bands are unreserved.

Another important decision incorporated into the regulations is that for the eventual abolition of damped waves. Generally, the use of damped waves of a frequency of less than 375 kc/s (wave length above 800 m.) is forbidden beginning January 1, 1930; no new installations of damped wave transmitters (spark sets), except low-power transmitters, may be made in ships or aircraft beginning at the same date; the use of damped waves of all frequencies is forbidden beginning January 1, 1940, except for the low-power transmitters mentioned above; no new installations of damped wave transmitters may be made in land or fixed stations henceforth; and waves of this type are forbidden in all land stations beginning January 1, 1935. (Article 5, paragraph 8 and Article 16 [18], paragraph 1.)

The supplementary regulations are few in number, consisting of but six articles and one appendix. For the most part these relate either to raidotelegraph charges or to the procedure to be followed in radiotelephony. The Government of the United States has consistently refused to attempt to regulate charges to be applied in the radio communication service. The reason for the insertion of the article and appendix regarding radiotelephony in the supplementary regulations was the belief that the service has not yet developed to the point where specific detailed regulation is desirable. Two other articles relate to priority of communications (a part of this article

appears as Article 23 of the general regulations) and to ocean letters. The remaining article provides that the International Telegraph Convention and annexed regulations shall be applicable to radiotelegrams in so far as they are not inconsistent with the International Radiotelegraph Convention and regulations. In part it corresponds to Article 50 of the London Regulations.

One of the committees of the conference devoted its entire time to a study of the International Code of Signals. Though its labors constituted an important part of the work of the conference, the conclusions of the committee have been incorporated in another document and do not appear in the convention or regulations.[45] In other cases also, careful work on the part of committees of the conference is not immediately apparent; as, for instance, in the delicate problem of preserving the proper relationship between the Radio Convention and the Convention for the Safety of Life at Sea and the Convention for the Regulation of Aerial Navigation.

An appreciation of the difficulties confronting the conference can be obtained from a careful study of the convention and regulations. Some of those difficulties appeared insurmountable even as late as the opening of the conference. The fact that the conference was a success is a tribute to the ability and earnestness of the delegates, and to the decision of their governments that a working basis for the conduct of the radio communications of the future must be found. The conference made no attempt to devise permanent regulations. It is believed that the fruit of its labors, not unduly restrictive of the progress of the radio art, will be a satisfactory guide for the period of approximately five years it is due to remain unchanged.

[45] Report of the chairman of the Committee on the International Code of Signals to the President of the International Radiotelegraph Conference, November 17, 1927.

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UNNATURAL MONOPOLY: CRITICAL MOMENTS IN THE DEVELOPMENT OF THE BELL SYSTEM MONOPOLY

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Congress finally began the long-needed process of comprehensive telecommunication deregulation in 1994, exactly 60 years after their last major legislative effort, the Communications Act of 1934, was enacted. Legislators appear to finally realize what has been evident to many industry leaders and analysts for years--regulation is impeding the growth of new technologies, jobs, and exports, while simultaneously denying consumers the benefits of competition. Unfortunately, in an attempt to remedy the inefficiencies created by nearly a century's worth of regulation, Congress crafted a reform package that was anything but deregulatory. Both the House and Senate bills were over 200 pages long, contained 50 new regulatory powers, and included protectionist manufacturing requirements. Largely as a result of this pro-regulatory baggage, the bill finally died in the Senate in mid-September of 1994.

Before Congress makes any rash decisions on how to manage competition within the industry, legislators should review how the old Bell monopoly developed. Most legislators, academics, and many others believe the telephone industry is a natural monopoly that was privately monopolized by the aggressive actions of the American Telegraph and Telephone Company (AT&T). That was hardly the case. Although AT&T undoubtedly encouraged the monopolization of the industry, it was the actions of regulators and federal and state legislators that eventually led to the creation of a nationwide telephone monopoly.

In this paper I shall argue that the reason competition did not arise within the industry earlier this century is because it was not allowed to. Specifically, three forces drove the monopolization process:

1. The intentional elimination of what was considered wasteful or duplicative competition through exclusionary licensing policies, misguided interconnection edicts, protected monopoly status for dominant carriers, and guaranteed revenues for those regulated utilities;

2. The mandated social policy of universal telephone entitlement, which implicitly called for a single provider to easily carry out regulatory orders; and

3. The regulation of rates (through rate averaging and cross-subsidization) to achieve the social policy objective of universal service.

The combined effect of those policies was enough to kill telephone competition just as it was gaining momentum. Hopefully, by understanding exactly how those policies encouraged the growth of a telephone monopoly, policymakers can craft more pro-competitive legislation in the future.

The Bogus Natural Monopoly Model

For many decades, economic textbooks have held up the telecommunications industry as the ideal model of natural monopoly. A natural monopoly is said to exist when a single firm is able to control most, if not all, output and prices in a given market due to the enormous entry barriers and economies of scale associated with the industry. More specifically, a market is said to be naturally monopolistic when one firm can serve consumers at lower costs than two or more firms (Spulber 1995: 31). For example, telephone service traditionally has required laying an extensive cable network, constructing numerous call switching stations, and creating a variety of support services, before service could actually be initiated. Obviously, with such high entry costs, new firms can find it difficult to gain a toehold in the industry. Those problems are compounded by the fact that once a single firm overcomes the initial costs, their average cost of doing business drops rapidly relative to newcomers.

The telephone monopoly, however, has been anything but natural. Overlooked in the textbooks is the extent to which federal and state governmental actions throughout this century helped build the AT&T or "Bell system" monopoly. As Robert Crandall (1991: 41) noted, "Despite the popular belief that the telephone network is a natural monopoly, the AT&T monopoly survived until the 1980s not because of its naturalness but because of overt government policy."

Indeed, a chronological review of the industry's development produces an indisputable conclusion--at no time during the development of the Bell monopoly did government not play a role in fostering a monopolistic system. Adherents to the old school of thought correctly point out that AT&T attempted to restrict competition throughout this century. Yet, this fact is irrelevant. Every business logically tries its hardest to exclude competitors. What is more important, and widely ignored, is exactly how federal and state government actions encouraged the Bell monopoly to develop during the early years of this century. Once the government allowed this monopoly to develop with its assistance, AT&T's strength could not be matched by any competitor, resulting in a monopolistic market structure that survived well into the 1980's.

AT&T's Patent Monopoly, 1876-94

When Alexander Graham Bell patented the telephone on March 7, 1876, few people realized just how important his new invention would become for American commerce and society in general. America was still in love with the telegraph and saw little immediate use for the telephone. Mark Twain even likened investment in the new technology to "wildcat speculation." Western Union, the most powerful telegraph company of the era, actually passed up the opportunity to buy the Bell patents for $100,000 believing the device was nothing more than a passing novelty.

Unfortunately for Western Union, the telephone turned out to be anything but a passing fad. Use of the device slowly gained acceptance, primarily among business users. Yet, compared to later decades, this Bell patent monopoly era was characterized by limited growth of service. From 1880 to 1895, average daily calls per 1,000 of population rose from only 4.8 to 37. Contrasting this 15-year patent monopoly period with the competitive period that followed the expiration of the Bell patents in 1894, average daily calls per 1,000 people jumped from 37 in 1895 to 391.4 in 1910. The number of telephones per 1,000 people also showed much more dramatic expansion during the competitive period after patent expiration than before. Telephones per 1,000 people rose from only 1.1 in 1880 to 4.8 in 1895, but skyrocketed to 82 by 1910. (See Table 1.)

Clearly, the Bell patent monopoly period was not as beneficial for the extension of service as the

competitive period that would follow. Yet, by the end of its patent monopoly period, the Bell System had grown large enough to pose a formidable challenge to Western Union, the same company that had failed to buy up the original patents just 20 years earlier. But, with the expiration of their crucial patents between 1893-94, the Bell system faced an uncertain future. Although Bell had filed over 600 patent infringement suits to defend its 900-plus patents during this period, the company had no choice but to try its hardest to fend off the many new firms that were waiting for a chance to gain access to this lucrative new market. The Bell monopoly was, at least temporarily, dead.

Table 1

Spread of Telephone Service, 1880-1920

Year	Average Daily Calls Per 1,000 Population	Telephones Per 1,000 of Population
1880	4.8	1.1
1885	13.3	2.7
1890	23.0	3.7
1895	37.0	4.8
1900	103.6	17.6
1905	258.7	48.8
1910	391.4	82.0
1915	446.0	103.9
1920	486.5	123.9

SOURCE: Hyman, Toole, and Avellis (1987: 93).

The Development of Competition, 1894-1913

Despite AT&T's rapid rise to market dominance, independent competitors began springing up shortly after the original patents expired in 1893 and 1894. These competitors grew by servicing areas not served by the Bell System, but then quickly began invading AT&T's turf, especially areas where Bell service was poor. According to industry historian Gerald W. Brock (1981: 112), by the end of 1894 over 80 new independent competitors had already grabbed 5 percent of total market share. The number of independent firms continued to rise dramatically such that just after the turn of the century, over 3,000 competitors existed. Illinois, Indiana, Iowa, Missouri, and Ohio each had over 200 telephone companies competing within their borders (Brock 1981: 111). By 1907, non-Bell firms continued to develop and were operating 51 percent of the telephone businesses in local markets. Prices were driven down as many urban subscribers were able to choose among competing providers. AT&T's profits and prices during this period began to shrink due to increased competition. Whereas AT&T had earned an average return on investment of 46 percent in the late 1800s, by 1906 their return had dropped to 8 percent (Hyman et al. 1987: 78). As Brock (1981: 122) noted, this competitive period brought gains unimaginable just a few years earlier,

> After seventeen years of monopoly, the United States had a limited telephone system of 270,000 phones concentrated in the centers of the cities, with service generally unavailable in the outlying areas. After thirteen years of competition, the United States had an extensive

> system of six million telephones, almost evenly divided between Bell and the independents, with service available practically anywhere in the country.

Industry historians Leonard S. Hyman, Richard C. Toole, and Rosemary M. Avellis (1987: 90) summarize the overall effect of this period by saying, "It seems competition helped to expand the market, bring down costs, and lower prices to consumers."

The rapid ascendancy of competition casts doubt on the natural monopoly model of this industry. It appears AT&T's only claim to monopoly power prior to this period could be attributed to their numerous patents, not superior economies of scale as the natural monopoly theorists believed. In fact, as J. Maurice Clark concluded in his famous 1923 *Studies in the Economics of Overhead Costs*, "Telephone companies . . . show no signs of economy with increased size, but rather the opposite" (1923: 321). Hence, the most important justification for regulation of the telephone industry--that it was a natural monopoly with rapidly declining costs as its size increased--was not present during this era. Yet, as we shall see later, that fact would not stop AT&T and government regulators from arguing to the contrary.

Economies of scale constitute only part of the natural monopoly equation; high barriers to market entry constitute the other half. Yet, despite the large costs associated with telephone service initiation, new competitors were entering the market easily during this period. Hence, the barriers to entry were not so high as to exclude immediately new competitors. To explain the rapid demise of competition that would take place over the next few years, some other type of entry barrier had to develop. That new impediment would take the form of both subtle and blatant government intervention throughout the next decade.

Theodore Vail, Nationalization, and the End of Competition, 1913-21

Before examining exactly how the legal barriers to competition developed within the telephone industry, it is important to review the significance of a single man--Theodore Newton Vail. On April 30, 1907, Vail returned to AT&T as president,[1] marking the beginning of [cl12.25]the end of telephone competition. His return to the firm changed its fundamental focus from competition to consolidation. Vail's most important goals upon taking over AT&T were the elimination of competitors, the befriending of policymakers and regulators, and the expansion of telephone service to the general public. Reflecting Vail's belief in the superiority of a single telephone system, AT&T adopted a new corporate slogan as part of an extensive advertising campaign: "One Policy, One System, Universal Service." In AT&T's 1910 Annual Report, Vail summarized his belief in a single system saying, "Effective, aggressive competition, and regulation and control are inconsistent with each other, and cannot be had at the same time." To achieve this vision, Vail began acquiring a number of independent telephone competitors, as well as telegraph giant Western Union. However, the government made it known quickly that such activity was suspect under existing antitrust statutes.

Wisely realizing the government was considering action to break up the growing firm, Vail decided to enter an agreement that would appease governmental concerns while providing AT&T a firm grasp on the industry. On December 19, 1913, the "Kingsbury Commitment" was reached. Named after AT&T Vice President Nathan C. Kingsbury, who helped negotiate the terms, the agreement outlined a plan whereby AT&T would sell off its $30 million in Western Union stock, agree not to acquire any other independent companies, and allow other competitors to interconnect with the Bell System.

The Kingsbury Commitment was thought to be pro-competitive. Yet, this was hardly an altruistic action on AT&T's part. The agreement was not interpreted by regulators so as to restrict AT&T from acquiring

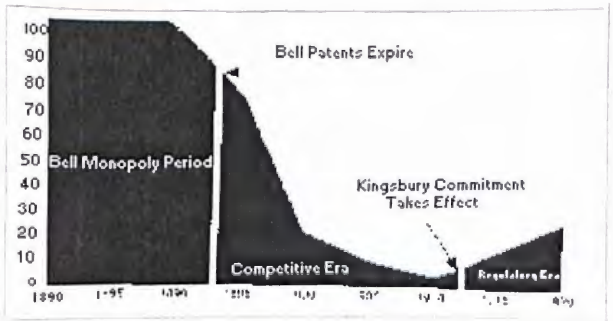
any new telephone systems, but only to require that an equal number be sold to an independent buyer for each system AT&T purchased. Hence, the Kingsbury Commitment contained a built-in incentive for monopoly-swapping rather than continued competition. Brock (1981: 156) noted, "This provision allowed Bell and the independents to exchange telephones in order to give each other geographical monopolies. So long as only one company served a given geographical area there was little reason to expect price competition to take place."

Ironically, the move toward interconnection, while appearing in the independents' favor, actually allowed AT&T to gain greater control over the industry. Brock (1981: 156) found that "interconnection reduced the Bell's ability to drive the independents out of business but also eliminated the independents' incentive to establish a competitive long-distance system." Michael K. Kellogg, John Thorne, and Peter W. Huber (1992: 16-17) concluded:

The government solution, in short, was not the steamy, unsettling cohabitation that marks competition but rather a sort of competitive apartheid, characterized by segregation and quarantine. Markets were carefully carved up: one for the monopoly telegraph company; one for each of the established monopoly local telephone exchanges; one for the Bell's monopoly long-distance operations. Bell might not own everything, but some monopolist or other would dominate each discrete market. The Kingsbury Commitment could be viewed as a solution only by a government bookkeeper, who counted several separate monopolies as an advance over a single monopoly, even absent any trace of competition among them.

Hence, AT&T's short-term deal to steer clear of government regulation, would have long-term gains exactly the opposite of those the government supposedly desired. This was the beginning of the end for telephone competition (see Figure 1). Although it is impossible to say exactly what would have happened if AT&T had not been pressured into the Kingsbury Commitment, it is not outrageous to hypothesize that competition would have continued to flourish.

Figure 1
Percentage of Telephones Owned by Bell, 1800-1920



At this point, more explicit government actions began to have a deleterious impact on the industry. Despite the fears of many public officials that AT&T could become a ruthless monopolist, a contradictory notion began to develop that monopoly was inherently "natural" within this industry. Numerous federal and state officials began arguing quite openly that the telephone industry would function most efficiently if unified as one system. Legislators began referring to competition in the same terms as Vail--"duplicative," "destructive," and "wasteful." A Senate Commerce Committee hearing in 1921 stated that "telephoning is a natural monopoly." And a House of Representative committee report noted, "There is nothing to be gained by local competition in the telephone business" (quoted in Loeb 1978: 14). A Michigan Public Utilities Commission report (1921: 315) from that same year also

illustrates this prevailing sentiment, "Competition resulted in duplication of investment. . . . The policy of the state was to eliminate this by eliminating as far as possible, duplication." Many state regulatory agencies began refusing requests by telephone companies to construct new lines in areas already served by another carrier and continued to encourage monopoly swapping and consolidation in the name of "efficient service" (Lavey 1987: 184-85). Kellogg, Thorne, and Huber (1992: 17) sum up the prevailing sentiment: "To judge by actions, then, rather than words, government officials had no strong objection to monopoly telephone service. This was especially true for state regulators. For them, a local telephone monopoly was both welcome and convenient."

Not surprisingly, Vail's vision of "one system" that would provide "universal service" to everyone, began looking more attractive to many in public office. Richard H.K. Vietor (1994: 172) of Harvard University argues, "Vail chose at this time to put AT&T squarely behind government regulation, as the quid pro quo for avoiding competition. This was the only politically acceptable way for AT&T to monopolize telephony. . . . It seemed a necessary trade-off for the attainment of universal service." As AT&T's 1917 Annual Report noted, "A combination of like activities under proper control and regulation, the service to the public would be better, more progressive, efficient, and economical than competitive systems."

Industry historian Robert W. Garnet (1985: 130) provides further support for Vietor's findings:

> Regulation played a crucial role in Vail's plans. Astute enough to realize that the kind of system he proposed--universal integrated monopoly--would stand little chance of gaining public approval without some form of public control, he embraced state regulation. In doing so, he broke with the company's long-standing opposition to what [AT&T] management had traditionally regarded as an unwarranted intrusion on its prerogatives. But after years of unfettered competition, during which the firm's financial strengths had been sapped and its efforts to build an integrated system had been dangerously undermined, regulation became a much-preferred alternative. Thus, Vail obviously saw government regulation as the way to eliminate competitors: the one-way ticket, not only to universal service, but also to monopoly profits.

World War I and Nationalization

The stage was then set for the complete monopolization of the industry by AT&T. The regulatory treatment AT&T received was facilitating their take-over of the industry while, at the same time, allowing them to state publicly that they were under strict government control. Yet, despite the fact that the tables were certainly tilted in AT&T's favor in most areas, competition persisted in some regions. It was World War I, the nation's first global crisis, that would provide the government with a convenient excuse to forcefully gain control over communications and forever change the structure of the telephone industry. On August 1, 1918, in the midst of World War I, the federal government nationalized the entire telecommunications industry for national security reasons.

At first, AT&T executives became nervous when it was announced that Postmaster General Albert S. Burleson, a long-time advocate of nationalizing the telegraph and telephone industries, would assume control of the market. But, once the benefits of nationalization where made evident to Vail, his anxieties disappeared. Industry historian George P. Oslin (1992: 278) notes when Vail expressed concern over the plan to Western Union President and close personal friend Newcom Carlton, Carlton reassured Vail that the plan was in his interest: "It's your salvation. The government will be able to raise your rates and get you new money." As Oslin (252) argues, "That was what happened. Burleson appointed Vail, rated by Carlton as a genius, to manage the telephone, and Carlton to operate the telegraph."

Noobar R. Danielian (1939: 248) concurs: "There is evidence that Vail appreciated the advantages of Federal control . . . he was not in much of a hurry in the early part of 1919 to have his System back from nominal government control." This attitude should not be at all surprising since shortly after the industry was nationalized, AT&T's proposed contract establishing the terms of government ownership and compensation was accepted by the postmaster general. Danielian (1992: 252) summarizes the deal as follows:

> The federal government . . . agreed to pay to AT&T 4 1/2 percent of the gross operating revenues of the telephone companies as a service fee; to make provisions for depreciation and obsolescence at the high rate of 5.72 percent per plant; to make provision for the amortization of intangible capital; to disburse all interest and dividend requirements; and in addition, to keep the properties in as good a condition as before. Finally, AT&T was given the power to keep a constant watch on the government's performance, to see that all went well with government operation, by providing that the books of the Postmaster General would be at all times open for inspection. One might well wonder where the real control was lodged. Needless to say, the contract was eminently satisfactory to the Bell System.

In addition, once the nationalized system was in place, AT&T wasted no time applying for immediate and sizable rate increases. High service connection charges were put into place for the first time. AT&T also began to realize it could use the backing of the federal government to coax state commissions into raising rates. Vail personally sent Postmaster General Burleson studies that displayed the need to raise rates. By January 21, 1919, just 5 1/2 months after nationalization, long-distance rates had increased by 20 percent. In addition to being much greater than returns earned during more competitive years, the rates established by the postmaster during the year of nationalization remained in force many years after privatization. Consequently, AT&T's generous long distance returns continued to average near or above 20 percent during the 1920s.

By the time the industry was returned to private control on August 1, 1919, the regulatory route to competition elimination had paid off handsomely for Vail and AT&T. Of the estimated $50 million in rate increases approved by the postmaster general during nationalization, approximately $42 million, or 84 percent went to AT&T. Additionally, the government cut AT&T a $13 million dollar check at the end of the period to cover any losses they may have incurred, despite the fact that none were evident.

The Importance of Rate Regulation

The year of government nationalization was the nail in the coffin of competition. However, the favorable regulatory treatment AT&T received during government ownership was only partially to blame for the death of competition. Of much greater importance, according to Hyman, Toole, and Avellis (1987: 81), was the initiation of extensive rate regulation:

> During this period of government ownership, the decision was made to set standard long-distance rates throughout the country, based on average costs. In other words, subscribers calling from large cities would pay above costs in order to provide a subsidy to those in rural areas. So, early in the century cross-subsidization began, embraced by the industry, which rarely question the premise behind [fn5]the arrangement that the ability to communicate with subsidized subscribers was of value to the subsidizing subscribers. As long as the telephone industry had a monopoly and regulators approved of the arrangement, it did not matter what subscribers wanted. They had no choice.

The intention of this action was obvious--Vail's vision of a single, universal service provider was being adopted and implemented by the government through discriminatory rate structuring.

The decision to initiate rate averaging is vitally important to understanding exactly how the telephone monopoly developed for three reasons. First, rate regulation in the pursuit of universal service objectives virtually demands a single monopolistic provider in order to be truly effective. Few firms would ever have the ability to adequately fulfill universal service obligations unless they were already sufficiently large to use revenues from one segment of their business to subsidize the extension of service to citizens that policymakers wanted covered. In addition, regulators favor monopolies or cartels to carry out such social polices since they find it easier to control their actions rather than the actions of multiple competitors. Hence, in the quest to achieve social policy goals, regulatory commissions end up depending upon one, or a handful of firms to provide all industry output. Consequently, competition is made difficult, if not impossible. In the words of regulatory economist Alfred E. Kahn (1971: 12),

> When a commission is responsible for the performance of an industry, it is under never completely escapable pressure to protect the health of the companies it regulates, to assure a desirable performance by relying on those monopolistic chosen instruments and its own controls rather than on the unplanned and unplannable forces of competition.

Second, the initiation of extensive federal rate regulation is important because it propelled state regulatory commissions to follow suit by greatly extending the scope of their authority. By 1922, 40 of 48 states were regulating telephone rates (Noll 1991: 180). The public utility commissions at the state level immediately began to mimic federal policies established during World War I. Businesses and urban subscribers were charged more than rural customers to help extend service to distant locations. Likewise, long-distance rates were averaged to ensure a company could not charge more for toll calls of the same distance. Robert Garnet (1985: 152) describes this state-based rate regulation: "Statewide rate averaging would eventually become a distinguishing feature of Bell System subscriber charges and would be embraced by regulators as a strategy for promoting the extension of telephone service to areas of marginal earnings potential." And that is exactly what happened. By 1925 not only had virtually every state established strict rate regulation guidelines, but local telephone competition was either discouraged or explicitly prohibited within many of those jurisdictions. [2]

Third, by averaging rates geographically to artificially suppress rural rates, policymakers and regulators created a serious disincentive to local telephone competition. Few firms, after all, will seek to enter a market and offer service if they realize it is difficult, if not impossible, to undercut the subsidized service of the incumbent carrier.

After reflecting on the overall impact of the introduction of regulation during this period, Brock (1981: 159-61) maintained,

> The combination of state and federal regulation stabilized the industry and ended the rate wars that had occurred during the early period of competition. Regulation increased the difficulty of new entry. . . . By accepting regulation voluntarily, Bell reduced the risk that unfavorable regulation would be imposed. The system of competing federal and state regulation, together with the complex Bell structure, prevented real regulatory control while providing the protection and legitimacy of a regulated utility. . . . The acceptance of regulation was a risk-reducing decision. It substituted a limited but guaranteed return on capital and management freedom for the uncertainty of the marketplace. It gave the Bell system a powerful weapon to exclude competitors and justification for seeking a monopoly,

as well as reducing the chances of outright nationalization or serious antitrust action.

Hence, universal service, the final element of AT&T's strategy to eliminate competition, was in place thanks to the explicit actions of both federal and state legislators and regulators. Once AT&T's motto was adopted as the nation's *de facto* regulatory policy, no other firm was in a position to adequately extend service in accordance with the new federal and state mandated social policy. The Bell monopoly was here to stay.

The FCC and Telephone Entitlement

A few years later, this new unwritten law of the land was codified as the raison d'etre of the Federal Communications Commission (FCC) with the passage of the Communications Act of 1934. The commission was created, "for the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges."

In effect, every American was henceforth found to be entitled to the right to telephone service, specifically cheap telephone service. To carry out this difficult policy objective, the FCC was given sweeping powers. Beside its powers to regulate rates to ensure they were "just and reasonable," the FCC was also given the power to restrict entry into the marketplace. Potential competitors were, and still are required to obtain from the FCC a "certificate of public convenience and necessity." The intent of the licensing process was again to prevent "wasteful duplication" and "unneeded competition." In reality, it served as a front to guard the interests of the regulated monopoly and the FCC's social agenda.

The overall hostility to competition by the FCC and the drafters of the legislation that gave birth to it is best illustrated by a 1988 Department of Commerce report on the development of the telecommunications industry. The report notes, "The chief focus of the Communications Act of 1934 was on the regulation of telecommunications, not necessarily its maximum development and promotion. [T]he drafters of the legislation saw the talents and resources of the industry presenting more of a challenge to the public interest than an opportunity for national progress" (164).

Over time the FCC would come to see the Bell System simply as the implementor of its agenda. Consequently, it would continue to use its power in favor of AT&T when potential competitors threatened the firm's hegemony. Their bureaucratic mismanagement of the radio spectrum (which was nationalized under the Radio Act of 1927) meant the most capable competitor of the era would never be given a chance to compete. Despite the fact that wireless technologies would be greatly developed in the near future, the possibility of serious wireless competition rising up to meet the Bell challenge in the first half of this century became less likely once government forces, instead of market forces, controlled how the spectrum was allocated. Just as the wireline technologies where subject to blatant political manipulation, the wireless spectrum became the tool of regulatory and special interests; competition was again dealt a severe blow.

Thomas Hazlett (1990) has proven that the nationalization of the radio spectrum was a special interest fiasco that was totally unnecessary. Property rights within the spectrum were developing and could have become the norm if not for the intervention of federal regulators at the request of industry leaders. Kellogg, Thorne, and Huber (1992: 19-20) have also pointed out the anti-competitive nature of the 1927 Radio Act:

A gentlemanly agreement, reached under political pressure, had once again replaced

> competition with complementary monopolies. It reaffirmed the general prohibition on "monopoly" of the airwaves--meaning that competition over the airwaves was prohibited, at least if it came from Bell. The Act forbade cross-ownership of telephone companies and broadcasting stations, and flatly rejected the operation of radio stations as `common carriers.' None of this could have concerned top officials at RCA or Bell very much. Congress merely cemented and strengthened a division of markets and territories that the parties had already voluntarily embraced.

Likewise, when the cable industry appeared on the scene several years later, it was restrained from entering other market segments. Finally, as mentioned, in those intrastate markets the FCC did not have jurisdiction over, state commissions protected local monopolies by restricting entry and guaranteeing their revenues.

Needless to say, by World War II, the communications industry had become a good old boy network. Regulators and the regulatees realized they had something to gain by allying in opposition to the forces of competition. Alfred Kahn (1971: 46) recognized the cozy nature of the regulator-regulatee relationship: "Responsible for the continued provision and improvement of service, [the regulatory commission] comes increasingly and understandably to identify the interest of the public with that of the existing companies on whom it must rely to deliver goods."

Hence, owing to a federal policy that placed higher value on immediate universal service than competition, the Bell monopoly was solidified.

The Lessons for Today's Legislators

The belief that government intervention substantially decreased competitive opportunities within the telecommunications industry is borne out by the historical record. The actions of legislators and regulators, both deliberate and accidental, led to the creation of the Bell monopoly. The demise of competition within the industry was brought about by three primary forces:

> 1. The removal of "wasteful" or "duplicative" competition through exclusionary licensing policies, misguided interconnection edicts, protected monopoly status for dominant carriers, and guaranteed revenues for those regulated utilities;
>
> 2. The mandated social policy of universal telephone entitlement, which called for a single provider to easily carry out regulatory orders; and
>
> 3. regulation of rates (through averaging and cross-subsidization) to achieve the social policy objective of universal service.[3]

The combination of these government-induced policies, which were introduced in rapid succession, was enough to kill telephone competition just as it was gaining momentum.

Despite this evidence, many economists still argue that in the absence of government control, a monopoly would have developed and consumers would have been exploited to a greater extent in the process. Such an outcome is questionable. Even if the assumption is granted, it is arguable that such an outcome would have proven as disastrous as the monopoly theorists believe. Such a suboptimal market setting would have invited entrepreneurial solutions to the monopolistic practices, encouraging the development of competitive technologies to satisfy consumer demands. [4] This entrepreneurial activity might have taken place much sooner had government not erected legal barriers to competition

throughout the industry. Once the government rigged the rules of the game to favor one firm over all others, competition was virtually impossible.

A review of the historical record of American telephony, considered to be the prime example of a natural monopoly industry, serves as an excellent starting point for a fundamental reassessment of the validity of natural monopoly theory. Some economists have challenged the notion that monopolies are in any sense natural. James R. Nelson (1966: 3) claimed:

> One of the most unfortunate phrases ever introduced into law or economics was the phrase "natural monopoly." Every monopoly is a product of public policy. No present monopoly, public or private, can be traced back through history in a pure form. "Natural monopolies" in fact originated in response to a belief that some goal, or goals, of public policy would be advanced by encouraging or permitting a monopoly to be formed, and discouraging or forbidding future competition with this monopoly.

Hazlett (1985: 21) has also weighed in by refuting many of the obsolete notions upon which natural monopoly theory is based:

> The economists' analysis of the inefficiency of unregulated natural monopoly markets did not spring from a scientific or particularly scholarly research program but in response to "a growing clamor for more government." Indeed many of the early natural monopoly writers had attacked the problem because of personal ideological agendas; their politics preceded their studies.

Finally, economists with allegiance to the Austrian School of economics, such as Dominick T. Armentano (1990), F.A. Hayek (1948), and Israel M. Kirzner (1973), believe that not only are answers to the questions about natural monopoly wrong, the questions themselves are improperly formulated. Competition, these scholars insist, is a dynamic process of constant entrepreneurial adjustment to market signals. The market is never at rest; today's monopoly could be tomorrow's competitive market. A truly competitive marketplace, therefore, will be free of any artificial restraints or barriers to entry that interrupt this dynamic adjustment process. Hence, when examining the development of the telephone market through an Austrian paradigm, it should be obvious that the only "failure" was not of the market, but of legislators and regulators who failed to allow entrepreneurial solutions to develop.

The most important lesson legislators can draw from this study is that government intervention need not be explicit or massive to have serious long-term and deleterious effects on competition within an industry. In the case of telecommunications, the government's simple stipulation that rates be artificially set to reflect certain social policy objectives was the crucial factor that led to the creation of the AT&T monopoly. Other factors, such as interconnection requirements, also illustrate how good intentions can often have disastrous results. In this case, interconnectivity provided a disincentive to built competing systems, tilting the market in AT&T's favor.

Still, legislators demand specific answers for many difficult questions. First, there is the question already addressed briefly above--would not a free market for telecommunications be privately monopolized or oligopolized anyway? To answer this more succinctly, there is no doubt that all businesses would like to capture an entire market for themselves and receive exorbitant profits from the goods and services they produce. But, the beauty of the free market is that it tames such tendencies through competition and entrepreneurship. Every time a producer ignores the needs of consumers, entrepreneurs see the opportunity to step in and fill the market's need. General Motors and IBM can both attest to the truth of

this phenomenon. At one time they both sat atop their respective markets, only to find their perfect worlds shattered by innovative competitors. Ironically, both GM and IBM were once targets of federal antitrust investigations. Would the automobile or computer industry be any more competitive today had the government broken up either of these companies? Likewise, would consumers have been better off if either firm was granted the status of a government-regulated monopolist? It would be hard to argue that that would be the case--both industries are now vigorously competitive precisely because the market was allowed to work; consumer power took precedence over arbitrary regulatory power.

But what about universal service? Would a telecommunications free market have guaranteed everyone access to a telephone? At first, definitely not. Competition would have taken time to develop to the point were everyone was provided access. But, just as virtually every American gained access to a radio and television (and many to a video cassette recorder) through free-market competition, telephones would have eventually become ubiquitous without government mandates. The demand for telephone service is too inelastic to image the opposite being the case. Quite likely, innovative products would first have been introduced into lucrative business markets and then slowly spread out to rural, residential areas as consumer demand grew. Thus, the extension of telephone service probably would have progressed much as television and computers have. Competitors would have eventually formulated appropriate interconnection charges to ensure that a spontaneous universal system developed. It would have become virtually impossible for a firm to survive if it did not agree to interconnect with others. As for those citizens in far-off rural areas that legislators most fear would be forgotten, wireless systems would have eventually arisen to accommodate their needs. Although such service would not have been cheap initially, it would have been available.

Yet, instead of patiently allowing competition to develop within the telecommunications industry, arrogant legislators thought they better understood how to order the marketplace, and intervened to conduct their experiment. Their hastiness allowed AT&T to monopolize one of the most important industries in existence. Their mistakes should make us question the validity of any statements by today's legislators that they better understand how to make the marketplace competitive.

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Notes

[1] He had previously served as president from 1885-87.

[2] Many such prohibitions and restrictions still exist today. According to the National Association of Regulatory Utility Commissioners' Summary of Competitive Status by Population, 19 states still have substantial legal barriers to competition, and another 20 only allow partial competition. When population is taken into account, roughly 70 percent of Americans live in a state that either allows only partial or no competition.

[3] This list closely resembles Warren G. Lavey's outline of the "five major public policies which accounted for much of the transition to regulated monopolies." His list is as follows: "(1) efficient supply of services; (2) reasonable revenues; (3) extension of service to remote areas; (4) averaged rate structures; and (5) below-cost pricing for residential services" (Lavey 1987: 171).

[4] This is exactly what began to happen under the government-regulated market anyway as new wireless and computerized inventions gradually eroded the Bell System's technological advantages. Yet, various bureaucratic gaffes and outright regulatory prohibitions continued to limit the extent to which new technologies could have a substantial impact on industry-wide competition. The result was minor gains for rivals in new market segments, such as microwave communications and resale, but little else in the way of a serious challenge to AT&T's hegemony.

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