

# John Herbert Orr and the Building of the Magnetic Recording Industry, 1945...1960

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From a thesis submitted to the graduate faculty of Auburn University  
in partial fulfillment of the requirements for the degree of Master of Arts  
Auburn, Alabama  
March 16, 1990

This historical study examines part of the career of Alabama native John Herbert Orr (1911...1983). Orr is perhaps best known for his OrRadio Industries, Incorporated, of Opelika, Alabama, a company that manufactured magnetic recording tape after World War 2.

While a radio technician in Europe during the war, Orr studied advanced recording tape manufacturing methods developed by the Germans. When Orr returned to the United States, he used this knowledge to establish his own tape manufacturing company in eastern Alabama. Because Orr used this German technical knowledge and avoided most research and development costs, he was able to establish his manufacturing business with a minimum investment.

Although Orr's continued financial success increasingly resulted from fortunate business circumstances or internally-generated innovations, OrRadio Industries probably could not have been formed without confiscated German technology. Orr's career in manufacturing is an example of technology transfer, and the role of the individual in it.

## 1. INTRODUCTION

As Allied military forces approached the western frontier of Germany in 1944, the propaganda branch of the Allied Supreme Command worked steadily to try to control the mass media of captured areas. Within days of the capture of the tiny country of Luxembourg, the Psychological Warfare Division moved into the area to inspect the transmitting facilities of Europe's most powerful radio station, Radio Luxembourg. It found that the retreating Germans had unsuccessfully tried to destroy the station, and that most of the essential electronic equipment was intact. When Allied engineers came to restart the station, they found equipment the likes of which they had never before encountered. While expecting banks of phonographs, they found hulking, mysterious devices called Magnetophones that appeared to record sound on filmy strips of plastic. The engineers quickly mastered the simple operation of the machines, and found that the machines played back voices and music with a fidelity previously unimagined.

In the more than four decades since the end of World War 2, magnetic recording technology has challenged such older forms of information storage as printing and photography. Having proved adaptable to the storage of many different types of information, magnetic recording has found wide and varied applications. Most of the information seen or heard from the television and radio media has been recorded on strips of

magnetic tape. Many printed documents are generated directly from computers which store the information on magnetic tape or disks. The technology touches consumers directly in the form of cassette tape recorders, video cassette recorders, and personal computers.

While most manufacturers of magnetic recording equipment in the 1990s are located overseas, for a time after World War 2, the United States was the center of the magnetic recording industry. John Herbert Orr, an American engineer with the Psychological Warfare Division, encountered German tape recording technology during World War 2, brought it to the United States, and helped introduce Americans to one of the crucial technologies of the twentieth century.

Of the broad categories of electronic technologies, magnetic recording has gone longer than any other without being seriously addressed by historians. Neither the major figures, the technological accomplishments, nor any of the massive research and development projects that brought magnetic recording to its present state have been subjected to critical historical investigation. Consequently, historical knowledge of magnetic recording has been based primarily on limited research that was published in a few short articles. The authors of these articles have in turn taken their information from a variety of sometimes questionable sources, including the personal observations of those involved in magnetic recording's development, or handed-

down myths of unknown origin.<sup>1</sup> Furthermore, the extant accounts offer only limited analysis or interpretation of the relevance of magnetic recording in history.

While such an interpretive history of this important technology should be undertaken, the effort in this thesis is not to produce such a comprehensive history; this study of John Herbert Orr and his career highlights some of the powerful implications of technology transfer and suggests some critical approaches to the technology as a whole. The name John Herbert Orr is not widely known; nonetheless, Orr was one of the pivotal figures in the history of this technology.

The first publicized magnetic recorders appeared following radio pioneer Valdemar Poulsen's 1890 patents for a device called the Telegraphone. In the Telegraphone, a carbon microphone was used to convert sound waves into electrical voltage. This voltage (converted to a current) then passed through an electromagnetic transducer (or "head"), creating a magnetic field that varied in intensity in a pattern analogous to the original sound waves. A thin, magnetizable steel wire passed close to the excited electromagnetic transducer and retained a record of the magnetic field. Replaying the record was basically the reverse of the recording operation. By drawing the wire past another electromagnetic transducer, the magnetic record from the wire induced a varying electrical voltage at the reproducing head, which in turn could be used to drive a telephone receiver, thus reproducing the original sounds.<sup>2</sup>

During the next twenty years, Poulsen and other inventors in the United States and Europe continued to improve wire recording. The technique gradually grew more sophisticated, and information about advances in magnetic recording moved in both directions across the Atlantic, reinforcing a common style of development. The similarity between European and American versions of this technology persisted as late as the 1920s.

In the United States, magnetic recording did not catch on commercially, as demonstrated by the quick failure of Poulsen's American Telegraphone Company in Springfield,

Massachusetts.<sup>3</sup> During the 1920s and 1930s, magnetic recording passed into a period of commercial dormancy in the United States, and was revived in the late 1930s and early 1940s. In the meantime, a few researchers at the U.S. Naval Research Laboratory and the laboratories of the Bell Telephone Company periodically undertook studies in magnetic recording. Despite the small scale of this research, important theoretical advances were made, including the use of high-frequency (or AC) biasing for reducing noise.<sup>4</sup>

By contrast, European magnetic tape recorders found applications in radio broadcasting almost as soon as professional broadcasting appeared. The BBC, for example, used German designs to build its own steel-tape recorder for use in short-wave stations in the 1920s.<sup>5</sup> In Germany, independent researchers and electrical manufacturers produced a stream of new tape recorders which grew increasingly more sophisticated. Eventually tape rivaled the phonograph in sound quality, and it had the additional advantages of editing capability and program length. The German firm C. Lorenz was especially active in producing some of the early broadcast tape recorders, and it was an important promoter of the technology.<sup>6</sup>

A turning point came in the early 1930s when the German firm Allgemeine Elektrotechnische Gesellschaft (AEG) committed itself to a major research and development program in tape recording. The result was the Magnetophone, a high-quality broadcast recorder capable of superior sound recording and reproduction. By 1944, after a decade of production, the latest K-4 and K-7 model Magnetophones incorporated scores of technical innovations. Most importantly, these innovations included manufacturing techniques for the mass production of special tape recording components like recording heads.

A crucial complement to the Magnetophone was its special recording tape. Instead of relying on the existing technology of steel bands, AEG had called upon the German chemical firm I.

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1 Recent examples include Heinz K. Theile, "Magnetic Sound Recording in Europe Up To 1945," *Journal of the Audio Engineering Society* 36 (1988): 396...408. Theile, chairman of the AEG Technical Archives Committee, European Region, worked in the German electronics industry during the 1940s. Also see Friedrich Karl Engel, "Magnetic Tape: From the Early Days to the Present," *Journal of the Audio Engineering Society* 36: (1988): 606...616. Engel in 1988 was an employee of BASF (formerly the division of I.G. Farben that made Magnetophone tape). These accounts, based primarily on the personal recollections of the authors or on limited research in company archives, are nonetheless two of the more informative studies of the history of magnetic recording. Most others incorporate elements of pure fantasy, emanating either from the flawed accounts hastily constructed by the United States Army during World War 2 or from spurious contrivances of the public relations departments of the corporations involved. [For a more recent account of Ampex, see [http://www.aes.org/aeshc/docs/company\\_histories/ampex/leslie\\_snyder\\_early\\_days\\_of\\_ampex.pdf](http://www.aes.org/aeshc/docs/company_histories/ampex/leslie_snyder_early_days_of_ampex.pdf) - dm 2014-02-20]

2 U.S. Patent 661,619 (13 November 1900), Valdemar Poulsen, "Method of Recording and Reproducing Sound"; J. Gavey, "Telegraphs and Telephones at the Paris Exhibition," *The Electrician* 46 (23 November 1900): 166...169; Carl Hering, "An American Criticism of the Paris Exhibition," *The Electrician* 46 (28 December 1900): 364...367; U.S. Patent 789,336 (9 May 1905), Valdemar Poulsen and Peder O. Pedersen, "Telegraphone."

3 Robert Angus, "75 Years of Magnetic Recording," *High Fidelity Magazine* 23 (March 1973): 42.

4 AC biasing refers to the use of a high frequency current in recording. Superimposed on the signal to be recorded, it has the effect of reducing distortion. Represented graphically, a signal recorded with AC biasing is shifted to a flatter portion of the hysteresis loop than would be the case without the bias. U.S. Patent 1,640,881 (30 August 1927), Wendell L. Carlson and Glenn W. Carpenter, "Radio Telegraph System."

5 Basil Lane, "75 Years of Magnetic Recording, Part Two," *Wireless World* 81 (April 1975): 161...162.

6 D. W. A[ldous], "Recording on Steel Tape," *The Wireless World* 44 (29 June 1939): 611...612; Curt Stille, "Die Elektromagnetische Schallaufzeichnung," *Elektrotechnische Zeitschrift*, 27 March 1930, 451; Robert Angus, "History of Magnetic Recording, Part I," *Audio* 68 (August 1984): 27...30; H. Dewald, "Application of Lorenz Communication Technique at the Olympic Games, Germany, 1936," *Electrical Communication* 15 (July 1936): 282...283. Dewald was an employee of C. Lorenz; [S.J. Begun], "The New Steel Tone Tape Machine," *Electrical Communication* 15 (July 1936): 62...69; A. E. Barrett and C. J. F. Tweed, "Some Aspects of Magnetic Recording and its Application to Broadcasting," *Journal of the Institution of Electrical Engineers* 82, *Proceedings of the Wireless Section* (1938): 265; S.J. Begun, "Recent Developments In Magnetic Sound Recording," *Journal of the Society of Motion Picture Engineers* 28 (May 1937): 464...472.

G. Farben to develop a new tape.<sup>7</sup> AEG was determined to develop a substitute for heavy, expensive steel tape. I. G. Farben introduced a plastic tape base coated with a form of carbonyl iron oxide. Following more research to improve methods of making the tape, engineers realized that the coated plastic tape had the potential to exceed the performance of the best steel tape.<sup>8</sup>

By the end of the war, the Germans had developed an improved tape formulation and had successfully recalibrated the tape recorder to take advantage of the new tape's superior frequency range, noise, and distortion characteristics. The Magnetophone factory was ready to produce the new K-7 model machines in the closing days of the war, but the Allies overran the factory before any were produced. The available parts and the pertinent patents and designs were placed under the authority of the United States and disseminated by the government.<sup>9</sup>

The war years saw a brief but influential period of intense research and development in wire recording in the United States. The leading figure in the research was Marvin Camras, an engineer at the Armour Research Foundation. Camras helped Armour<sup>10</sup> acquire a government contract for portable wire recorders. The Armour recorders and similar machines manufactured by the Brush Development Company of Cleveland, Ohio, were used extensively by the military during World War 2.

Armour used Marvin Camras's numerous patents to establish an extensive network of licensing agreements, by which electrical manufacturers planned to build consumer wire recorders after the war. In this way wire recording loomed on the postwar horizon as an important new product in the home entertainment market that had been opened up by the phonograph and the radio earlier in the twentieth century.

A profound difference existed between the state of the art in magnetic recording in the United States up to World War 2 and European tape recording technology developed during the same period. Recorders designed for the military emphasized portability and all-weather reliability, and were never intended

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7 U.S. Dept. of Commerce, Report PB 385 (Washington, D.C.: GPO, n.d.[1946]), a reprint of SHAEF, Combined Intelligence Objectives Subcommittee, G-2 Section, Chemical Warfare and Miscellaneous Chemicals Section, "I.G. Farbenindustrie A.G., Ludwigshafen and Oppau au Rhein, Wehrmacht Items," by J. G. Kern, et al. (N.p.: SHAEF, 19...30 June 1945).

8 U.S. Dept. of Commerce, Report PB 45518 (Washington, D.C.: GPO, n.d. [1946]), a reprint of German Patent Application I 71,652 IX a/42g (26 February 1942), "Verfahren zur Herstellung von Tragerschichten fur Magnetonaufzeichnungen," I.G. Farbenindustrie Aktiengesellschaft.

9 U.S. Dept. of Commerce, Report PB 3586 (Washington, D.C.: GPO, n.d. [1946]), a reprint of U.S. Army, Office of the Theater Chief Signal Officer, Technical Liaison Division, U.S. Headquarters, Theater Service Forces, European Theater. Intelligence Report SRM-1, "Magnetic Sound Recorders 'Magnetophone' and 'Tonschreiber,'" by U.S. Army Signal Corps (N.p.: U.S. Army Signal Corps, 25 November 1945), 3...4; U.S. Dept. of Commerce, Report PB 79558 (Washington, D.C.: GPO, n.d. [1946]). A reprint of U.S. Army Field Intelligence Agency, Technical. FIAT Final Report 923, "Further Studies in Magnetophones and Tapes," by Col. Richard H. Ranger (N.p.: FIAT, May 1947), 3, 5, 12, 67.

10 The Armour Research Foundation, in Chicago, is the research branch of the Armour Institute of Technology, later called the Illinois Institute of Technology.

for applications beyond the recording and playback of intelligible voice messages. German-built machines were the products of a huge research and development project extending over most of a decade. While portable, voice-only versions of the Magnetophone were produced, the centerpiece of the Magnetophone line was the highly advanced studio model. Seemingly every aspect of the Magnetophone system was the product of investigation and improvement, far outstripping the American product in sophistication and refinement. Where American machines, for example, used a simple steel wire as a recording medium, the Magnetophone required a relatively complex, coated plastic tape. In contrast to the simple, pulley-operated winding mechanism used to shuttle the wire in the American recorders, the Magnetophone used a highly-accurate, three-motor tape transport system, using advanced synchronous motors, precisely-regulated motor speeds and torques, and even a system of cast-aluminum cooling ducts and fans for the motors. The technical differences between American wire recorders and the Magnetophones helped make the transfer of German tape technology to the United States a dramatic and disruptive event.

## 2 THE SPOILS OF WAR

As World War 2 raged in Europe, the flow of scientific and engineering knowledge out of Germany and the other Axis countries diminished to a trickle. At the same time, magnetic tape recording, already highly advanced in Germany, developed at a rate accelerated by the AEG/I.G. Farben project. The Magnetophone, apparently ignored by the big American magnetic recording interests before the war, became a German military secret. Thus its further improvement was unknown both to the Allied intelligence services and to the few American engineers who were experimenting with magnetic recording.

Meanwhile, a civilian technician with the United States Army named John Herbert Orr found himself in possession of knowledge that would enable him to profit from German Magnetophone technology. His story provides an excellent case study in the transfer of industrial technology. Orr was one of a group of electrical technicians and engineers, mostly working outside their specialties, who brought the Magnetophone back to the United States, caught the big American electronics companies completely off guard, and established a magnetic recording industry in this country.

John Herbert Orr was born on a Lee County, Alabama, farm on 19 August 1911. Orr remembered that his father Robert and his mother Molene wanted him to become a farmer, although from an early age he was interested in radio. At age twelve he used money earned from hauling firewood in a wagon over the twenty-five miles to Columbus, Georgia, to pay for his first radio. It was a home-built crystal set, and Orr claimed it was the first radio of any kind in east Alabama.

Orr retained an interest in radio while in high school. Because he was one of the few people in eastern Alabama with experience in Morse code, he took a job teaching code at Alabama Polytechnic Institute (now Auburn University) under the supervision of professor Victor C. McIlvaine.<sup>11</sup> Struggling

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11 James M. Rosene, "The History of Radio Broadcasting at Auburn University (1912...1961)," (M.A. thesis, Auburn University, 1968), 14...15; John Herbert

to establish itself as a bona fide engineering school, Alabama Polytechnic Institute (API) had welcomed the donation of a powerful radio transmitter in the 'teens. Orr was involved with the dismantling of WAPI, the school's radio station, during the mid-1920s when the transmitter was moved from Auburn to Birmingham.

Orr received high school credit for his teaching job and used this credit in lieu of one year of his high school curriculum, graduating in 1928. He was admitted to API in 1928 and began taking courses. He never completed his first semester, and never again attended college.<sup>12</sup>

About 1929 when Orr was still involved with activities at Alabama Polytechnic Institute, a representative of the General Motors Corporation (GM) offered him a summer job. He was sent to the Dayton, Ohio, headquarters of GM's Delco Corporation. There he worked under the direction of Dr. Charles F. Kettering, head of Delco and one of the nation's most celebrated electrical engineers and inventors. After this, Orr returned to Alabama to hold a succession of unremarkable occupations. Out of this association with Delco, Orr was eventually able to secure a permanent job in Atlanta in 1936 at the regional center for the Delco Light Company.

Delco Light, an offshoot of the Delco Corporation, was concerned with the sales, service, and installation of generator-powered home lighting schemes for rural areas. During the Depression years of the 1930s, the sales of Delco Light systems plummeted due to the Roosevelt administration's Rural Electrification Administration programs. In response to the decline in the market, Delco Light began to sell the commercial refrigeration systems that Charles Kettering had innovated.<sup>13</sup>

Orr replaced a Frigidaire Delco serviceman at the Atlanta office who had died suddenly. While he felt that he did not possess the qualifications for such a job, evidently his enthusiasm and his connections within Delco made up for that disadvantage. He worked hard in Atlanta and moved up through the ranks, rising from refrigeration serviceman to assistant branch manager by 1939.<sup>14</sup>

By the late 1930s, Delco turned its Atlanta plant over to the manufacture of electrical parts for automobiles. Orr remembered that he was never happy with his last promotion, which moved him into a position that involved the manufacture of these automobile parts. Uninterested in that work, in 1939 he began moonlighting with a group of his friends. In their spare time, Orr and five other men at Delco acted as engineering consultants for

companies that wanted to build new commercial radio stations or wanted to modify existing stations.<sup>15</sup>

One of the most lucrative aspects of this consulting business was in the field of directional antenna work for the large, high-powered regional stations in the Southeast. Orr won a contract for station WGST in Atlanta, for example. To perform such work legally, Orr had to keep his first-class Radio-Telephone Operator's License. This license had to be renewed every two years, and in 1941 Orr visited the Federal Communications Commission (FCC) in Washington, D.C., to retake the required test.

In Washington, a representative of the FCC convinced him to take an optional "Waveguide Transmission" test, involving an experimental system of navigational electronics later known as radar. Orr had read about this system and had devoted some time to studying its theory, but he had no formal training in the field. Despite this disadvantage, Orr was one of the dozen or so persons who scored well on the test.

Late in 1942, the Department of State cabled Orr, suggesting that it could find him a job with the navy. Orr offered to quit his job at Delco to work with the Radio and Radar Division of the War Production Board in Washington. Instead, his application was sent to the navy, which offered him a civilian job as a radio technician with a radar project. A few weeks later, before Orr had begun work with the navy, he received a letter informing him that his job had been eliminated in a reorganization of certain navy departments, and that his application had been sent back to the Civil Service.<sup>16</sup>

When Orr finally secured a position with the government, it turned out to be a desk job with little or no real duties at the navy department in Washington. Disappointed, he asked to be reassigned, and soon found himself in North Africa taking field-strength readings at government radio installations for the Office of War Information. In Africa, Orr's expertise brought him to the attention of General Robert A. McClure of the United States Army.

General McClure was part of the army's Psychological Warfare Branch that was organized in North Africa in 1942. By 1943, the branch was preparing to transfer to England, to expand and become part of the staff of the Supreme Headquarters, Allied Expeditionary Force (SHAEF) under General Dwight D. Eisenhower. McClure met with Orr and offered him a position as

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Orr, Interview by Carl F. Voelcker, 21 January 1981, Audio Tape Collection, access. 89-17, Auburn University Archives, Auburn, Alabama.

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Voelcker, Orr interview, 21 January 1981; Alabama Polytechnic Institute, Freshman/Sophomore Record of Enrollment for John Herbert Orr, 8 September 1928, Auburn University Archives, Auburn, Alabama.

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T. A. Boyd, *Professional Amateur: The Biography of Charles Franklin Kettering* (New York: E.P. Dutton and Co., Inc., 1957), 93...96.

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Voelcker, Orr interview, 21 January 1981.

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*Ibid.*; [John Herbert Orr], "Brief Biographical Sketch, John Herbert Orr," typescript, n.d.[c.1955], access. 84-33, box 18, File: "Magnetic Recording and Its Future," John Herbert Orr Collection, Auburn University Archives, Auburn, Alabama (hereafter cited as JHO Collection).

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John Herbert Orr, untitled typescript, n.d., access. 84-88, box 3 of 4, file: "Speech Outlines," JHO Collection; Carl F. Voelcker, "Orr of Opelika: John Herbert Orr and Magnetic Recording Tape" (M.A. thesis, Auburn University, 1984), 14; "Brief Biographical Sketch, John Herbert Orr," Unpublished typescript of a press release, n.d.[c.1975], access. 84-33, box 18 of 19, file: "Magnetic Recording and its Future," JHO Collection; Orr to Ray C. Ellis, 19 February 1943, access 84-103, box 91, *ibid.*; U.S. Dept. of the Navy to Orr, 26 April 1943, access 84-103, box 91, *ibid.*; F. J. Leary to Orr, 15 May 1943, access. 84-103, box 91, *ibid.*

radio technician. Orr was then sent to England to join the new Psychological Warfare Division (PWD) of SHAEF.<sup>17</sup>

The group to which Orr was assigned was charged with waging psychological warfare, using the various mass media to sustain morale of "friendly nations occupied by the enemy," conducting "consolidations programs" in liberated friendly countries (that is, seeing that beaten enemy military forces complied with the orders of the occupying force's commander), and controlling the mass media if Germany were occupied. Eight sections were involved with the PWD, all improvisational in nature, and all led by General McClure. Essentially a special staff section of SHAEF, the group included civilian experts chosen mostly from American and British intelligence organizations. The eight sections included plans and directives, intelligence, radio, leaflets, press, films, publications and displays, and special operations. Five sub-groups from these sections were active in Western Europe and Great Britain.<sup>18</sup>

Orr was involved in a group that was originally charged with aiding liberated countries in reestablishing public communications. After Orr's arrival at London in January 1944, he monitored both Allied and enemy communications, and in preparation for D-Day, he organized the collection of radio equipment to be used in Europe.<sup>19</sup>

One of Orr's assignments during this period was to try to follow the movements of Adolf Hitler, using evidence gleaned from radio broadcasts. Orr and others noticed that, based on logistical restrictions in Germany, it was virtually impossible for Hitler to broadcast live the speeches he was apparently making. His voice was heard at all hours of the night and day, and he seemed to move with mercurial speed among widely separated radio stations.<sup>20</sup>

It became obvious that the Germans had developed some new and highly advanced form of voice recording, capable of making recordings indistinguishable from the original source. At night Orr sat alone listening to the frighteningly realistic voice of Hitler, though he knew he was just hearing a recording. To him, the recordings were "so good that it was enough to make the hair stand up on the back of my neck," and he wondered just what the Germans had devised.<sup>21</sup>

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Voelcker, "Orr," 15; Alfred H. Paddock, Jr., *U.S. Army Special Warfare: Its Origins* (Washington, D.C.: National Defense-University Press, 1982), 13...14.

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William Daugherty and Morris Janowitz, *A Psychological Warfare Casebook* (Baltimore: Johns Hopkins University Press, 1958), 131; Paddock, *Special Warfare*, 13...14.

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Forrest C. Pogue, *The U.S. Army in World War 2, The European Theater of Operations: The Supreme Command* (Washington, D.C.: Office of the Chief of Military History, Dept. of the Army, 1954), 336...337; Voelcker, "Orr," 16; John Herbert Orr, "Orradio Irish Tape Story," unpublished tape recording, n.d. [circa 1955], access. 84-103, box 73, JHO Collection.

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Voelcker, "Orr," 16; Orr, "Irish Tape Story."

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John Herbert Orr, quoted in Voelcker, "Orr," 17.

A technical report that appeared in one morning's paperwork on Orr's desk answered some of his questions. He was always given copies of intelligence reports on the various enemy radio installations and broadcasting equipment. That morning he received a report on the highly-advanced German Magnetophone tape recorder. It not only "solved the mystery for him," but took hold of his imagination. He became fascinated with this German recorder.<sup>22</sup>

By the late summer of 1944, the Allied forces had advanced through France toward Germany. On their heels came teams of experts chosen to handle the administration of liberated areas. One such group included Orr, who was given the responsibility of overseeing the reestablishment of civilian radio services. In September, the PWD targeted the recapture of Radio Luxembourg as a prime objective. This was one of Europe's most powerful short-wave radio stations, capable of being heard over most of the western part of the continent. The Germans had used Radio Luxembourg to great advantage for propaganda purposes, and now the Allies would be given their chance to do the same.<sup>23</sup>

The retreating Germans had taken great care to destroy radio installations that might be of use to the invading forces, and had designated special troops for that purpose. The capture of Radio Luxembourg was a significant achievement for the Allies. As told by a former British army officer, two spies had infiltrated the station's staff, and they hid themselves in the station as explosive charges were being set. When the Germans evacuated the transmitter facility, the spies emerged to defuse the charges.<sup>24</sup> A more pedestrian version of the story is related in the PWD's official history, written in 1945. When the Allies came within 100 kilometers of Luxembourg, the Germans blew up the control room of the the main studio. The vacuum tubes in the remaining equipment at the studio facility were then destroyed. On 10 September 1944, when the Fifth Armored Division of the United States First Army arrived in Luxembourg, it found unexploded charges set in the studio itself. The separate transmitting facilities, in which the transmitting tubes were found smashed, were captured the next day. By October 1944, the station had been put under the direct control of Lieutenant Colonel Samuel R. Rosenbaum of the PWD.<sup>25</sup>

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Orr, "Irish Tape Story."

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Pogue, *The U.S. Army in World War 2*, 377; John Herbert Orr to Dr. F. Krones, 11 July 1956, access. 84-103, box 9 of 92, file: "Dr. F. Krones AGFA," JHO Collection.

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George Raynor Thompson, *The U.S. Army in World War 2, The Technical Services, The Signal Corps: The Outcome* (Washington, D.C.: Office of the Chief of Military History, Dept. of the Army, 1966), 136; Voelcker, "Orr," 18; Francis McClain, Interview by Carl F. Voelcker, 3 May 1984, Audio Tape Collection, access. 89-17, Auburn University Archives, Auburn, Alabama; Don Davis, "Success Spun Out of Tape," *Christian Science Monitor* 18 February 1959, 12; Allen Rankin, "Rankin File," *Montgomery Advertiser*, 21 February 1954, 33.

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SHAEF, Psychological Warfare Division, *The Psychological Warfare Division, Supreme Headquarters, Allied Expeditionary Force: An Account of Its*

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During the summer of 1944, when it had become clear that the Allies would soon be advancing into Luxembourg, the PWD assembled in Belgium special engineering teams, composed mostly of civilians, to plan for the operation of Radio Luxembourg. Orr was not originally among the staff. Sir Francis McLain, a former BBC employee, was in charge of the engineering section of the Luxembourg staff. Richard Condon, an American civilian, held the position of Deputy Chief Engineer at Radio Luxembourg until about May 1945. He was replaced by Orr, who was then located in Belgium and who had apparently been working with teams that had established radio stations in the Alsace area.<sup>26</sup>

Among the equipment captured at Radio Luxembourg were some of the first broadcast-quality Magnetophones ever seen by the Allies. In the late spring of 1945, Orr was part of a group of officers and civilians who witnessed a demonstration of the Magnetophone in the Luxembourg studios. The machine played back sound which, to the ears of those present, was indistinguishable from live music. Nothing like this had ever been approached by conventional phonograph technology, and Orr realized that he was hearing something special.

The event catalyzed Orr's ingenuity and natural affinity for things electrical and caused him to redirect his energies toward tape recording. It was at this event, Orr remembered, that he became committed to bringing magnetic recording to the United States. Others were as impressed as he was. Years later Orr noted that a careful examination of the leadership of the American magnetic recording industry would find that, almost to

a man, they were among those present at the Luxembourg demonstration.<sup>27</sup>

Under the direction of Francis McLain, the Allied engineers, most of whom were civilians like Orr, worked to put the station back into operation. The discovery of a cache of transmitting and other tubes near Luxembourg aided the restoration of the transmitter. In the spring of 1945 Orr arrived and helped complete the work started by others. Allied radio engineers had to repair the various machines on hand, including the Magnetophone.

Because the station had so much recording tape lying around, few gave much thought to finding a different supply of it. Most of the tape had been used, but it could be easily and quickly erased and used again, seemingly indefinitely. This policy came to a sudden, and in retrospect humorous, halt not long thereafter.

An otherwise unremarkable speech by General Eisenhower was prepared for broadcast to occupied Germany on Radio Luxembourg by recording it onto used German Magnetophone tape. The recording was being broadcast without incident when suddenly Eisenhower's voice faded away and was replaced by a more impassioned one, speaking in German and belonging to Adolf Hitler himself. Station engineers, who were now used to the reliability and "fiddle-free" operation of the Magnetophone, and who failed to monitor what was actually going out over the air, allowed Hitler to rant for a period of minutes before switching to another program.

The occasion evidently brought little mirth to Eisenhower, who quickly issued an order disallowing the application of "used" tape to broadcast purposes. The Psychological Warfare Division was given responsibility for finding a supply of new recording tape or for manufacturing it if necessary. Because Orr had shown so much interest in the Magnetophone, it fell to him to carry out the general's order.<sup>28</sup>

Various Allied intelligence groups already had begun producing technical reports on German magnetic recording technology. Using these accounts, Orr was able to locate Dr. Karl Pflaumer, an employee of I. G. Farben. Orr confused Karl Pflaumer with Dr. Fritz Pfleumer of Dresden<sup>29</sup> and was not

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Operations in the Western European Campaign 1944..1945 (Bad Homburg, Germany: Psychological Warfare Division, SHAEF, 1945), 39..40, Records of World War 2, Allied Operational and Occupation Headquarters, World War 2, Supreme Headquarters, Allied Expeditionary Force, Special Staff, Psychological Warfare Division, Executive Branch, RG 331, National Archives, Washington, D.C.

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A twenty-three page list of personnel contains a Clifford Orr, who was in fact John Herbert Orr, as possible engineer "to succeed [Richard] Condon." Davidson Taylor to General Robert A. McClure, 15 March 1945, 2, Decimal File, 1944..45, 120 to 200, box 12, file 200; Michael Barkway to Major Raymond K. Fried, 3 October 1944, Decimal File, 1944-45, 120 to 200, box 12, file 200; Davidson Taylor, "List of Personnel," Decimal File, 1944..45, 120 to 200, box 12, file 200; William Paley to Major Raymond K. Fried, 14 December 1944, Decimal File, 1944..45, 120 to 200, box 12, file 200; Davidson Taylor to Colonel Kehm, 21 December 1944, Decimal File, 1944..45, 120 to 200, box 12, file 200; Orr to Supply and Transport Section [SHAEF?], 13 June 1945, Decimal File, 1944-45, 400.22 to 413.44, box 29, file 413.44; Orr to Supply and Transport Section [SHAEF?], 12 June 1945, Decimal File, 1944..45, 400.22 to 413.44, box 29, file 413.44; Orr to Supply and Transport Section [SHAEF?], 12 May 1945, Decimal File, 1944..45, 400.22 to 413.44, box 29, file 413.44; Orr to Supply and Transport Section [SHAEF?], 20 April 1945, Decimal File, 1944..45, 400.22 to 413.44, box 29, file 413.44; Richard J. Condon to Major Morley, 4 December 1944, Decimal File, 1944-45, 400.22 to 413.44, box 29, file 413.44; Davidson Taylor to Lt. Col. Rosenbaum, 19 January 1945, Decimal File, 1944..45, 120 to 200, box 12, file 200.

The preceding citations are found in Records of World War 2, Allied Operational and Occupation Headquarters, World War 2, Supreme Headquarters, Allied Expeditionary Force, Special Staff, Psychological Warfare Division, Executive Branch, RG 331, National Archives, Washington, D.C.

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John Herbert Orr, "Mr. John Herbert Orr Speech Troy Rotary Club Troy, Alabama," unpublished tape recording, 22 May 1955, access. 84-33, box 15, tape no. JHO 6870, JHO Collection; John Herbert Orr, "To Whom It May Concern," unpublished manuscript, access. 84-103, box 8, *ibid*.

28

[John Herbert Orr], "OrRadio Irish Tape Story," unpublished tape recording, n.d. [circa 1955], access. 84-103, box 73, *ibid*.

29

Fritz Pfleumer, who described himself as an "independent" researcher, experimented with iron oxide-coated magnetic recording tapes during the late 1920s and early 1930s. Sometimes cited as the inventor of magnetic recording tape, his patents became the basis for later research conducted by I. G. Farben. See for example German Patent 500,900 (5 June 1930), Fritz Pfleumer "Lautshriftträger"; German Patent 593,878 (15 February 1934), Fritz Pfleumer, "Lautshriftträger."

[For a more recent account of Fritz Pfleumer's contributions, see Heinz H. K. Thiele, "The Austrian Pfleumer Invented and Introduced Magnetic Tape", AES Preprint 3236; Convention 92; 1992 February"]

aware of the mistake until well after the war ended. Nonetheless, when Orr found Karl Pflaumer at his country estate in northern Germany, the old scientist and the American became friends.<sup>30</sup>

Pflaumer was quite willing to cooperate with the Allies. According to the story told by Orr, when he told the doctor of his need for new recording tape, Pflaumer agreed to give him the simplest and easiest formula he knew for making tape that would work on the Magnetophone. Orr recalled that, with paper being one of scores of consumer products that was scarce in occupied Germany, he found himself without anything on which to write the tape formula. Orr's jeep driver had a brown paper sack full of K-rations, which Orr emptied and commandeered for the army. Pflaumer flattened the sack on the fender of Orr's jeep and wrote out the formula, which became the basis for military production of magnetic tape coating. Returning to Luxembourg, Orr and several helpers began producing tape on an experimental basis. The tape was, in the literal sense, manufactured; Orr himself painted the crudely-mixed coating emulsion onto the tape base and slit it into strips with a knife.<sup>31</sup>

In the meantime, Orr and Captain Edward L. Schacht, a United States Army officer attached to the PWD, visited the Magnetophone Company's tape manufacturing facility at Ludwigshafen. The plant had been heavily damaged by bombs late in the war and could not be reopened immediately. Orr was unable officially to enlist the help of German experts, many of whom were willing to assist, until they had been investigated and cleared for security. He was able to request that Dr. Pflaumer and his associates prepare a history of their work on magnetic tape up to 1945.<sup>32</sup>

Orr began to work out his ideas regarding magnetic recording and what he wanted to do with it. He experimented with the idea of making a magnetic disk recorder for use by broadcasting stations. The recorder would use as much existing phonograph equipment as possible, employing a conventional turntable and consisting of little more than a modified tone-arm. A magnetic pickup would ride over grooved magnetic disks recording or replaying as desired. Orr even started to make a model of his device using parts scavenged from surplus phonograph equipment.

The Psychological Warfare Division and others continued to collect information on the Magnetophone, most of which was

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[http://www.aes.org/aeshc/docs/magnetic-recording/magnetophon/thiele\\_aes-preprint-3236.pdf](http://www.aes.org/aeshc/docs/magnetic-recording/magnetophon/thiele_aes-preprint-3236.pdf). dm 2014-06-18]

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Orr, "To Whom It May Concern," n.p.

31

John Herbert Orr, "Narrative History of and by John Herbert Orr Relating to Information and Samples of Magnetic Oxide Obtained in Germany in Summer 1945. Interrogator Al Johnston. Persons Present William Samford, Joseph Aires [sic], Edward T. Newton, and George M. Hopkins on November 14, 1956 at the Office of William Samford, Opelika, AL.," unpublished tape recording, six reels, access. 84-103, box 10, *ibid*, tape 3. "Aires" was probably Joseph Ayers, an employee of the C.K. Williams Company of New York, OrRadio's supplier of iron oxide.

32

Orr, "To Whom it May Concern," n.p.

organized in files at the PWD Radio Engineering Headquarters near Frankfurt, where Orr was assigned during the Magnetophone tape project. The files, according to Orr, were open to almost anyone and were read frequently by various military personnel interested in magnetic recording. From these files many future American tape recording entrepreneurs got their starts.<sup>33</sup>

In an effort to get tape produced on a larger scale, the Ludwigshafen plant was repaired. A field radio engineering group under the leadership of Edward Schacht made up the bulk of the manpower on this project, as few German workers had obtained the security clearances that would have allowed them to return to their old jobs.

Before Orr could get the Ludwigshafen plant fully reopened, he was severely injured in an automobile accident. As part of his duties, he spent time traveling to different parts of Germany, collecting the raw materials necessary to produce his tape coatings. According to his own account, on 12 August 1945 Orr was returning from one of these trips when his jeep ran over a land mine. Fortunately, a German hospital was nearby, and German doctors spent hours in the operating room trying to save Orr's life. After lying unconscious for weeks, he awoke to the news that he would be paralyzed from the waist down.<sup>34</sup>

Orr later recovered the use of his legs, though his military career was over. In late November, 1945, he returned to his old office and found that someone new had taken over his job and that most of his staff had been replaced. He spent the greater portion of a Saturday afternoon cleaning out the personal files in his office; he found that many of the drafts of his technical reports had disappeared and that the personal effects in his office had been stolen. No complete report on German magnetic tape was ever made by the PWD.<sup>35</sup>

Dr. Pflaumer visited Orr before he left the hospital. Orr recalled that "we had only a few minutes together, but his visit was to prove helpful to me later." Pflaumer had taken a liking to this American, and he honored Orr by giving him a small envelope with all the known tape formulations in it. On 8 December 1945 Orr was transferred to Holland Hospital on Staten Island, New York, and was soon allowed to depart to Alabama to finish his recovery.<sup>36</sup>

Before he left Germany, Orr spoke with a number of his army friends on the subject of going into business. These included Ed Schacht, the commander of the mobile radio unit Orr had drawn on for labor at the Ludwigshafen tape plant, and

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*Ibid.*, n.p.; John Herbert Orr to Lewis Lind, 12 July 1956, accession 84-103, box 9, file: "Mr. Lewis Lind," JHO Collection; Orr also noted FIAT Report 923, authored by his friend Col. Richard Ranger, as the basis of the magnetic tape industry in the United States. John Herbert Orr, untitled notes on Richard H. Ranger, n.d., access 84-103, box 9, file: "Misc.," *ibid*.

34

Orr, "To Whom It May Concern," n.p.

35

Orr, "Narrative History," tape 1.

36

*Ibid.*, n.p.

Colonel Richard H. Ranger.<sup>37</sup> Ranger was another officer attached to the PWD at SHAEF who, like Orr, gathered information on German Magnetophone technology. Ranger was the author of one of the most complete technical reports on the broadcast Magnetophones, a report that was published by the Department of Commerce and made public as early as the winter of 1946. Although Orr kept in touch with both Schacht and Ranger after the war, it was with Ranger that Orr would later form a loose business partnership.<sup>38</sup>

Perhaps as many as a dozen Americans were intimately familiar with German tape recording technology early in 1946. Many of them, including Orr, later returned to the United States and became involved in the commercialization of tape recording. The confiscation of German magnetic tape recording technology was made possible by the actions of Allied intelligence groups like the PWD, and the transfer of that technology took an easily identifiable and direct route to its new home in the United States. Its movement is the simplest manifestation of the historical phenomenon of technology transfer.

### 3 ORR IN ALABAMA, 1945...1949

Recent contributions to the history of technology attempt to explain radical shifts in technology, or changes in the "technological paradigm." The thesis was inspired by Thomas Kuhn and modified by Edward Constant, and continues to be used by historians. Constant, for example, shows how aeronautical engineers affected the onset of the "turbojet revolution" through their realization that at some point the conventional technology (piston engines) would become inadequate. Their replacement technology--in Constant's case the turbojet engine--cannot be fully appreciated in the context of the old applications; rather, its innovators were aware of its potential in new applications. Historian Hugh G. J. Aitken also has used

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Born in 1889, Richard H. Ranger was a 1911 graduate of the Massachusetts Institute of Technology and had been one of America's early radio enthusiasts. After serving with the Army Signal Corps during World War I, he had authored a book for radio hobbyists in 1922. During the early 1920s, he held a job with the Radio Corporation of America (RCA) as a radio researcher, and he is credited with one of the first facsimile transmissions, using a system demonstrated by RCA in 1924. He left RCA in the late 1920s to establish Rangertone, Inc., a company that manufactured the first commercial electronic organ. Ranger was deeply involved with electronic music and the improvement of sound recording, and as an organist himself had a deep sense of the aesthetics of music. After working on a radar development project for a few years early in World War 2, Ranger was assigned to the Army Field Intelligence Agency, Technical, as a colonel. George Zazalli, Rangertone Research, Inc., interview by author, 13 February 1989, by telephone; Albert Abramson, *The History of Television, 1880 to 1941* (Jefferson, N.C.: McFarland and Company, Inc., 1987), 1; Richard H. Ranger, *The Radio Pathfinder* (London: William Heinemann, 1922), 1...7; Orpha Ochse, *The History of the Organ in the United States* (Bloomington: Indiana University Press, 1975), 370; "Richard H. Ranger, Dead at 72; Inventor of Electronic Devices," *New York Times*, 12 January 1962; Orrin E. Dunlap, Jr., *Radio's 100 Men of Science: Biographical Narratives of Pathfinders in Electronics and Television* (New York: Harper and Brothers Publishers, 1944), 239-240.

38

Ranger's report has been cited previously as U.S. Dept. of Commerce, Report PB 79558.

such a model in his study of the introduction of continuous wave radio technology during the 1920s.<sup>39</sup>

In a similar vein, implicit in the Luxembourg demonstrations of the Magnetophone in 1944 is an analogous situation. Orr observed that "there were 35 present at the first demonstration to the Army brass, and if you will name... the 17 American engineers that have contributed most to tape recording, they will be on the list that were present that day at Radio Luxembourg."<sup>40</sup> Although Orr did not name those engineers, his statement and the speed with which these men involved themselves with magnetic recording after the war indicates how impressed they were with the Magnetophone. Unlike the turbojet or the continuous wave technique that Aitken examines, tape recording was a transferred technology rather than a new technology. That fact, however, made its introduction in the United States an even sharper break with the past. In describing the efforts of those engineers who broke with tradition and developed a new type of radio transmission, Aitken says:

Without exception, the early devotees of continuous wave radio had in mind the transmission of the human voice and not merely a marginal improvement in radio telegraphy. This had implications for the standards of performance that continuous wave radio was expected to meet. A slight competitive advantage over spark telegraphy was not enough to attract venture capital: the lure was wireless telephony--initially not for broadcast entertainment but to provide the kind of point-to-point communication that the American Telephone and Telegraph Company provided, only without the fixed costs of a wire network.<sup>41</sup>

In terms of sound quality, the Magnetophone was so vast an improvement over what was otherwise available that it is hard to imagine what the Americans had in mind when they first heard it. For the recording of conventional programming, voice, music, or transcription record, the low quality of the source signal would all but negate any advantage the Magnetophone held. It was obvious that Magnetophone technology would not fit neatly into the equipment racks of American radio stations. The vision of men like John Herbert Orr must have included also a radical change in broadcasting technology, and the application of the tape recorder to entirely new fields. With work, the ways in which radio (and television and motion picture) programming was produced could be changed to fit the requirements and take advantages of the benefits of tape recording.

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Edward W. Constant 2, *The Origins of the Turbojet Revolution* (Baltimore: Johns Hopkins University Press, 1980), 12...32; Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), 52...65.

40

John Herbert Orr, "Speech to be Given the Miami Chapter of the IRE, January 29, 1954," unpublished typescript, access. 84-88, box 3, file: "Speech Outlines," JHO Collection.

41

Hugh G. J. Aitken, *The Continuous Wave: Technology and American Radio, 1900...1932* (Princeton: Princeton University Press, 1985), 10.



When Orr returned to the United States from Germany, he set up household with his wife in the town of Opelika, Alabama, a medium-sized textile mill town near Columbus, Georgia. Opelika was also the home of WJHO, a small AM radio station Orr had begun building just before he went to Washington. WJHO was operated under a system worked out by Orr and his fellow moonlighters from Delco before the war. By locating the studio and transmitter together, the station could be operated by about five people and was thus much cheaper to run. These smaller stations could be placed in "any town large enough to support a newspaper." WJHO served as a model for such a system.<sup>42</sup>

Orr also sustained his interest in producing his magnetic recorder. During the war he had obtained permission from General McClure, his commander in PWD, to ship some German tape recording equipment and supplies back home, including a Magnetophone and some samples of German tape.<sup>43</sup> Because the K-4 Magnetophone was too big to send home due to size restrictions, he had disassembled the unit and shipped it back piecemeal. After he got back to Opelika, he reassembled the Magnetophone and experimented with it, modifying it to run at the slower speed of eighteen inches per second and converting it to AC bias.<sup>44</sup>

Orr's original plan was to build a magnetic disk recorder that could be easily installed in existing radio station studios. He continued to develop plans for such a device after returning to the United States, and he also continued to investigate the possibilities of producing magnetic tape. During the fall of 1946, for example, he reduced a small quantity of unprocessed German oxide for experimental purposes. With this crude and inconsistent product, he coated a number of aluminum discs and made small lengths of paper tape in November of that year. The tapes, tested by ear on the reconstructed Magnetophone, were found wholly inadequate. Similarly, the coated disks sounded distorted and noisy.<sup>45</sup>

The radio station was able to run itself, and Orr set up a company in 1947 called the Southeastern Merchandise Exchange (which he referred to as SEME) in the "arcade" area outside the

Martin Theater in Opelika.<sup>46</sup> This was actually just a continuation of his prewar consulting firm. SEMA bought and installed electronic equipment for radio stations, and Orr oversaw the construction of small radio stations in Georgia and Alabama.<sup>47</sup>

Orr's army buddy, Colonel Richard Ranger, had acquired several Magnetophones in Germany for himself. When he returned from Europe, Ranger assembled the machines with Orr's assistance. Ranger later bought a German-made tape coating machine, and in late 1944 or 1945 was in the process of conducting experiments making recording tape. Orr and Ranger discussed the idea of going into business together, with Ranger financing the venture, but the deal was never consummated. Instead, Ranger convinced Orr to become a dealer for the proposed Rangertone recorder for the Southeast with the promise of an exclusive franchise.<sup>48</sup>

In the meantime, Orr decided to drop his plans for designing his own tape recorder and opted instead for manufacturing the tape itself. This decision must have been based partly on the fact that he had more firsthand experience in the tape-production process than anyone else in the United States. He visited Colonel Ranger at his home in New Jersey in September 1947 and found that Ranger had already set up a machine shop and production line and was making recorders in small quantities. Orr agreed to buy the small tape coating machine owned by Ranger and he became the sole authorized sales representative in the Southeast region for Rangertone Corporation.<sup>49</sup> Ranger, in turn, gave Orr a 10 percent commission on each recorder he sold and supplied tape recorders for demonstration purposes at cost.<sup>50</sup>

Back in Alabama, Orr leased a building from the city of Opelika that was located in a complex previously used as a prisoner of war camp. The tape coater was shipped to Opelika, and Orr experimented with hand-coated tapes with the help of Bill Brassell, his first employee. The first tapes they managed to

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<sup>42</sup> Voelcker, Orr interview, 21 January 1981.

<sup>43</sup> Although Orr stated that he intended to produce his own recorder after the war, the bulk of German supplies he brought home were related to making magnetic tape. These supplies included rolls of metal foil (which apparently had also been used by the Germans as a tape base), uncoated plastic tape, German Magnetite (a magnetic oxide used on early versions of Magnetophone tape), I. G. Farben yellow (a non-magnetic iron oxide used as the starting compound in making the latest type of Magnetophone tape), binders, plasticizers, drawings of all the equipment used in producing tape, plus miles of prerecorded tapes. In contrast to this, he imported just one early model Magnetophone. Orr, "To Whom It May Concern," n.p.

<sup>44</sup> Gen. Robert A. McClure to Orr, 17 May 1956, access. 84-103, box 9, file: "Gen. Robert A. McClure," JHO Collection; Orr, "Narrative History," tape 3.

<sup>45</sup> Orr, "Narrative History," tape 2; *ibid.*, tape 3.

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<sup>46</sup> Richard H. Ranger to Orr, 14 November 1947, access. 84-103, box 9, file: "Col. R.H. Ranger," JHO Collection; Telephone Directory, Auburn, LaFayette, Opelika, Waverly [Ala.] (N.p.: Southern Bell Telephone and Telegraph Co., Inc., December 1948).

<sup>47</sup> S. D. Fuller and Co., Offering Brochure (New York: S. D. Fuller and Co., 14 October 1953), 11, access. 84-88, box 3, JHO Collection.

<sup>48</sup> Voelcker, "Orr," 26...27.

<sup>49</sup> Tape coaters were readily available because they were used for various other processes, such as the application of adhesive to masking tape. The machines were modified to suit the requirements of the customer.

<sup>50</sup> Orr, "Narrative History," tape 5; Orr to John Gardner, Rangertone, Inc., 5 January 1948, access. 84-103, box 9, file: "1948 Correspondence," JHO Collection; Richard H. Ranger to Orr, 14 November 1947, access. 84-103, box 9, file: "Col. R.H. Ranger," *ibid.*; Richard H. Ranger to Orr, 24 February 1948, access. 84-103, box 9, file, "1948 Correspondence Rangertone Inc.," *ibid.*; Orr to John S. Gardner, Rangertone, Inc., 25 July 1947, access. 84-103, box 8, file: "Rangertone Correspondence 1949," *ibid.*

produce were made on paper for lack of anything else to use as a base.

Paper had been used as a tape base by both the Germans and the Brush Development Company, and it was notable for its strength and resistance to stretching. Most others, however, had used something more exotic than the rolls of electrical transformer insulation that Orr selected. He coated his first long lengths of usable paper tape in the spring of 1947, using a domestically-manufactured oxide sent to him from New York by Captain Ed Schacht.<sup>51</sup>

For a while, Orr put up with Ranger's insistence on keeping the remanence and coercivity specifications of Magnetophone tape. Related to the magnetic properties of the recording tape, remanence and coercivity values had to be carefully matched to the physical and electrical specifications of recording and playback components to achieve low distortion and noise while retaining a full frequency range. The magnetic properties of the most common Magnetophone tape, low in coercivity, demanded a high tape speed. But Orr recognized that the thirty inches per second of the K-4 Magnetophone was too fast; a standard ten-inch reel of tape lasted only fifteen minutes at thirty inches per second. To Orr it had always seemed more practical to experiment with slower speeds, and his sentiments were soon reflected by the nascent tape recording industry.

Again technology pioneered by the Germans entered the scene. During the mid-1930s, AEG and I. G. Farben had proposed a special tape recorder for field use. The recorder, known as a Tonschreiber and running at a speed of about fifteen inches per second in order to save tape, required a tape that would record adequately at the slower speed. Although existing tapes could be used, their marginal performance apparently was the impetus for the development of their important new slow-speed oxide. I. G. Farben had discovered a particular iron oxide formula that produced elongated (or accicular) particles and that worked adequately at slower speeds. The Germans, however, had opted to develop the high-speed studio versions of the Magnetophone during the war, and had dropped development of the Tonschreibers.<sup>52</sup>

When Orr interviewed I. G. Farben employees, he questioned them specifically about the "slow speed" oxide he had learned about from company records, and he planned to apply the idea to his magnetic disk scheme. Orr had even asked Dr. Pflaumer, the German recording engineer, to provide him with a sample of the slow speed oxide, which Orr promptly shipped home.<sup>53</sup> Years later Orr recalled that the Germans, who

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Orr to Gardner, 25 July 1947; Ranger to Orr, 24 February 1948; Orr to John Gardner, 5 January 1948, access. 84-103, box 9, file: "1948 Correspondence," *ibid.*; Invoices 7053 (29 July 1948), and 662 (30 December 1948), The Minnesota Mining and Manufacturing Company, access. 84-103, box 9, file: "Minnesota Mining and Manufacturing Co.," *ibid.*; Minnesota Mining and Manufacturing Co., to Southeastern Merchandise Exchange, 12 April 1948, access. 84-103, box 9, file: "Minnesota Mining and Manufacturing Co.," *ibid.*; Orr, "Narrative History," tape 5; *ibid.*, tape 3.

52

Orr, "Narrative History," tape 1.

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*Ibid.*, tape 4; *ibid.*, tape 1.

conversed with Orr in broken English, had used the word "sticks" to describe the slow-speed tape particles. Orr had not understood at the time the significance of what they had been trying to explain-- that it was the shape of the particles that seemed to improve the tape's slow speed performance.<sup>54</sup>

Orr felt that the slow-speed, high-coercivity tape developed by the Germans, with the corresponding speed and bias settings, was best suited for a commercial product. Within a short time after the commercial appearance of tape recording in the United States, Orr's sentiments would be echoed by all other tape and recorder manufacturers. Those recorder manufacturers who agreed with Ranger about tape characteristics would find themselves unable to convince any manufacturer to produce tape for them, and had to conform or quit.<sup>55</sup>

In fact, during 1947 and 1948, several tape manufactures almost simultaneously introduced 1/4-inch-wide tape to the market, and all of these manufacturers used the same oxide as found in the low-speed Magnetophone tape. During this period, Orr devoted more and more of his time to selling Rangertone machines and allowed his experimentation with recording tape to lapse.<sup>56</sup> His own tape was generally too inconsistent to use for demonstrations of the machines he was selling, so he bought tape from the Minnesota Mining and Manufacturing Company (3M) and Audio Devices, Inc., the first two companies to offer low-speed tape for sale.<sup>57</sup> Convinced of the superiority of the high-coercivity, low-speed tape offered by other manufacturers, Orr converted his Rangertone demonstrator to a speed of fifteen inches per second and recalibrated its bias current.

A few successful lengths of Orr's own experimental tape supplemented the meager supply he was able to buy from other manufacturers. From the beginning, the tape industry lagged far behind in keeping up with the demands of the many new recorder owners. Although sales figures are not available for the industry during this period, Orr often found himself entirely without a tape that he dared use for demonstration purposes. The early machines tended to break tapes regularly during rewinding and fast forwarding operations, resulting in Orr's demonstration tapes being full of fragile splices. The worst that could happen in a sales demonstration was for the recorder to confirm the doubts of station executives by breaking a tape while in playback; the biggest obstacle to overcome in selling the machines was the

54

*Ibid.*, tape 4.

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*Ibid.*, tape 5.

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Voelcker, Orr interview, 21 January 1981.

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Minnesota Mining and Manufacturing Co., acknowledgment for order from Orradio Industries, 12 April 1948, access. 84-103 box 9, file: "Minnesota Mining and Manufacturing Co.," JHO Collection; Invoice 7053, Minnesota Mining and Manufacturing; Invoice 662, Minnesota Mining and Manufacturing.

argument that the tape would break while a program was on the air.<sup>58</sup>

As Orr got closer to his goal of being able consistently to produce a high quality recording tape, he began to make a serious financial commitment to the project. He sold WJHO and his interest in the Southeastern Merchandise Exchange and invested his entire personal savings in magnetic recording. Though Orr was a good salesman, his efforts to peddle Rangertones were sometimes thwarted by the machines' unreliability, or, more often, by the reluctance of local radio stations to invest in these highly advanced, expensive machines. By the late summer of 1949, he was nearly broke, and confided to Richard Ranger that he would not be able to remain solvent much longer unless the problems with tape coating cleared up and he was able to sell some tape.<sup>59</sup>

The breakthrough came in late 1949. Orr's earliest tape samples, tested by Richard Ranger on the latest Rangertone, reproduced the entire audible frequency range to 15,000 hertz. Still, quality control problems plagued Orr, just as they plagued the rest of the industry. Orr's paper-backed tape shed some of its oxide as it was played, and his plastic tape, though it avoided this problem, would not produce the suitable range of frequencies.<sup>60</sup>

Several other manufacturers already had their recording tapes on the market, and a larger number of makes of recorders were now available. Orr himself bought a number of rolls of 3M recording tape before 1949, presumably for demonstration or resale through the Southeastern Merchandise Exchange. Meanwhile the market was gradually growing. Already a nationwide shortage of tape existed, and operation of recorders was often hampered by either a total lack of tape or the necessity of using tape that had been repeatedly edited and spliced, leaving it in a weakened condition.

During the first few years after his return from Europe, Orr experimented with tape manufacture and groped towards the establishment of a full-scale tape-making company. By the end of the 1940s he was faced with persistent, but superable, technical problems and an almost overwhelming debt. For a decade or so after 1947, the American market for tape recording products would expand to include a consumer market far wider than the small circle of commercial customers whom Orr originally targeted. As Orr began to sell his first tapes, he faced the prospect of both a rapidly expanding market and ever-increasing competition.

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Orr, "Narrative History," tape 5.

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Orr to Richard Ranger, 24 September 1949, access. 84-103, box 8, file: "Rangertone Corresp. 1949," JHO Collection; Lindsey G. Riddle [of WDSU, New Orleans] to Orr, 6 January 1949, access. 84-103, box 8, file: "Rangertone Prospects General All U.S.A.," *ibid*.

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Richard H. Ranger to Orr, 27 December 1949, access. 84-103, box 8, file: "Rangertone Correspondence 1949," *ibid*.

#### 4 ORRADIO INDUSTRIES, 1950...1956

W. Rupert MacLaurin's 1949 study of invention and innovation in the American radio industry concluded that, with the commercialization of radio during the 1920s, technological change in radio ceased to originate from without. The establishment of dominating radio research and development institutions funded by American Telephone and Telegraph, General Electric, Westinghouse, and RCA by 1940 resulted in what MacLaurin calls a technologically "monopolistic" situation. How did magnetic recording fit into this situation?<sup>61</sup>

It would be reasonable to conclude, from a lack of contrary evidence, that the American electrical research and development concerns for the most part were not interested in magnetic recording until after it became commercialized (the limited research performed by AT&T during the 1920s and 1930s notwithstanding). [see

[http://www.aes.org/aeshc/pdf/mcknight\\_ac-bias-at-btl-1936-1939.pdf](http://www.aes.org/aeshc/pdf/mcknight_ac-bias-at-btl-1936-1939.pdf) - dm 2014-02-20]

The basic theory of magnetic recording was well documented during this period, and it would be wrong to assume that these companies were not aware of its existence. The failure of magnetic recording to attract commercial interest fits MacLaurin's thesis, simply because the large electronics manufacturers, for whatever reasons, did not try to develop magnetic recording technology. MacLaurin's model even fits circumstances outside the United States, as shown by the rapid and significant development and marketing of magnetic recording represented by the AEG-I. G. Farben Magnetophone. After the entrance of the United States into World War 2, the various government contracts for developing magnetic recording indicated an interest in magnetic recording, albeit a tardy one, coming from outside the industry. As the primary consumer of radio and electrical equipment and a crucial force in the direction of wartime research, the United States government during this period might also justifiably be called part of the industry. Although Brush Development, one of the two biggest research contractors during the war, was really a division of General Electric, there was no rush by the big electronics companies to exploit magnetic recording during the war.

Orr did not invent a new technology, but in transferring a radically new technology into a "virgin" market, he must be called an innovator. Effectively bypassing the invention and development stages and going straight to production and marketing might make this case special. But, if one overlooks that seeming anomaly, the history of tape recording in America contradicts MacLaurin's thesis by representing an instance of innovation in electronic communication coming from outside the industry establishment.

In 1950 John Orr's OrRadio Industries began life as the smallest of the new tape manufacturers, and in many ways OrRadio more closely resembled the hand-built approach of the early recorder manufacturers. But like the other new members of the magnetic recording club, Orr recognized that the radio

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W. Rupert MacLaurin, et al., *Invention and Innovation in the Radio Industry* (New York: The Macmillan Co., 1949), 153...190.

industry--the broadcasters, not the equipment manufacturers--might be successfully converted to the gospel of tape recording. Breaking with tradition, Orr and his competitors came from outside the electronics industry. The story of the first years of OrRadio Industries' existence serves as an example of the successful marketing of technological innovation. Much of Orr's success was related to the small amount of money he had to invest in research and development. Because the Germans had done this for him, the start-up capital for his venture was quite low, which was an advantage in competing with larger firms. As a model of technology transfer, magnetic recording was readily and rapidly accepted in the United States. As early as 1950, the phonograph, radio, and television industries were beginning to change to suit the new technology.

By 1950, Orr made a commitment to the production of magnetic recording tape. His early experiments with recording tape had failed to produce consistent results, but he was so encouraged that he decided to form his own tape manufacturing company. Although he was able to avoid most of the costs of research and development, he had to build up enough capital to enable him to have the right kind of tape producing machinery custom made.

Orr personally supervised his OrRadio Industries from 1950 through 1959, when the company was bought by Ampex Corporation of Redwood, California. This period was one of rapid expansion, fierce competition, and technical development in electronics that carried magnetic recording on the crest of a wave.

Orr formed OrRadio Industries on the first day of March, 1950. A total of \$20,000 worth of stock was authorized, but only \$5,000 was issued, mostly to Orr himself. Orr, by taking a bank loan, had personally financed this endeavor. At the beginning of April 1950, presumably using the tape coating equipment sold to him by Richard Ranger, Orr wrote enthusiastically to Ranger announcing the first successful production run. His first tape, called 211RPA, was made at a rate of 125 reels per day, using what was rapidly becoming a standard package in the industry: the seven-inch reel holding about 1,200 feet of tape. Such a quantity of tape would record thirty minutes of programming at seven and one-half inches per second on a full-track monophonic machine.<sup>62</sup>

Orr arranged to have tape boxes labeled and began to promote his tape to his established or prospective Rangertone customers. Orr's product entered the market at an opportune time. By the early 1950s, the simplicity and economy of tape recording equipment for broadcasting use was widely recognized. Also during this period, the development of high-fidelity FM broadcasting brought additional demand for tape

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Orr to Richard H. Ranger, 4 April 1950, access. 84-103, box 8, file: "Rangertone Correspondence 1950," JHO Collection; "Information Regarding OrRadio Industries, Inc.," subtitled "For John Jipp," unpublished typescript, n.d., access. 84-88, box 3, *ibid.*; 211 RPA tape later became more popularly known as "Green Band," and for the next decade was the standard, professional quality, acetate base, "Irish Tape." A full-track mono machine records on the entire width of the tape. Half-track mono machines were later developed to record on half the width of the tape, allowing the tape to be recorded on both "sides." Half-track stereo machines, recording four total tracks on this same 1/4-inch-wide tape, were introduced about 1953.

recording products. Concurrent with the development of microgroove phonograph records in the late 1940s was the widespread adoption of tape recording equipment by recording studios.<sup>63</sup> These factors, combined with the entrance of only a few companies in the tape manufacturing business, gave Orr an opportunity to break into the market with relative ease.

Further, by 1950 the first low-priced home recorders were produced, giving Orr a new market to exploit. By 1954 there were more than forty manufacturers of tape recorders, with the vast number of them offering home versions. Prices for top quality home recorders stayed around \$500-\$600; the machines in the \$100-\$300 range sold in the greatest numbers, even though they were vastly inferior in terms of fidelity.<sup>64</sup>

Orr chose the brand name "Irish tape" for the OrRadio product, thus sparking an almost immediate controversy. Most people assumed that he had simply chosen a name that would be easily remembered by consumers already familiar with 3M's "Scotch" brand of tape. Orr insisted that he had named it after Molly, an Irish nurse who had befriended him in a German hospital after the war.<sup>65</sup>

The "Irish" name would have been dismissed as simply a clever twist on Minnesota Mining and Manufacturing's "Scotch" brand products had 3M not itself introduced a recording tape. The 3M Company, which at the turn of the century had started life as a manufacturer of sandpapers, had sold Scotch masking tape as early as 1924. The Scotch brand cellophane tape of 1930 rapidly became a household necessity, and "Scotch tape" became the generic term for the product. Thus, had 3M never entered the recording tape business, "Irish tape" might have become the "Scotch tape" of magnetic recording.<sup>66</sup>

Whatever the true background of the Irish name, Orr stuck with the Irish nurse story even after Scotch recording tape appeared in 1947, and held fast to that version until his death. In 1950, when his new tape was ready for sale, Irish tape competed with only five other manufacturers: 3M, by far the market leader; Audio Devices, a newcomer in 1950; Indiana Steel Company; the Brush Development Company; and to a much lesser extent, German Magnetophone tape made at Ludwigshafen by BASF (once part of the I. G. Farben combine). Between 1950 and 1956, only two new tape manufacturers entered the market, Reeves

63

Erik Barnouw, *Tube of Plenty: The Evolution of American Television* (New York: Oxford University Press, 1975), 79...81.

64

A 1954 issue of a recording trade magazine held advertisements for dozens of recorders, including offerings from Webcor, Ampex, RCA, Crestwood, Berlant, U.S. Time (the only magnetic disk recorder advertised), Crown, Fenton, Magnecord, and Pentron. Prices ranged from \$59.95 for the disk recorder to \$545 for an Ampex 600, a top-quality home unit. *Magnetic Film and Tape Recording*, December 1954, *passim*; Robert Oakes Jordan, "Introducing Tape Recorders," *Saturday Review of Literature*, 29 May 1954, 36...37.

65

Stuart X. Stephenson, "Sentimental Story of a Name," *Montgomery Advertiser*, 20 February 1959.

66

Virginia Huck, *Brand of the Tartan: The 3M Story* (New York: Appleton-Century-Crofts, Inc., 1955), 138, 144, 250.

Soundcraft and Technical Tape Corporation of New York, while one, Brush, exited.

The early Irish tapes were fraught by quality control problems arising both from inconsistencies in raw materials and difficulties with the manufacturing process itself. Orr constantly had to adjust the proportions of some of the ingredients in his tape emulsions due to slight variations in the composition of the plastic base or changes in the lacquer binder. Often these changes could not be made until a problem showed up with the tape later and complaints started coming back. To combat these problems Orr established rigorous visual and magnetic testing procedures at the factory, which not only improved his product but later established OrRadio's reputation as a manufacturer of highest quality tape.<sup>67</sup>

During 1950...1953 OrRadio Industries expanded and solved a number of technical problems connected with Irish tape. In 1951 Orr contacted the Southern Research Institute in Birmingham, Alabama, to ask its opinion on a tape squeal problem. As Irish tape passed against the recording and playback heads of test machines, the tape emitted a loud squealing noise. An engineer at the institute, Herbert Hard, Jr., briefly experimented with samples of Irish tape and solved the problem temporarily by applying floor wax to the tape. This incident was less important for solving a particular problem in the development of Irish tape than it was for the fact that Orr later hired Hard as production supervisor at OrRadio, and Hard became a key figure in the firm.<sup>68</sup>

During the later part of 1952, the company used large loans to finance a new 13,500-square-foot building on the Opelika site and for the purchase of a number of new tape coating machines. The Waldron brand film coating machines Orr bought were generic devices for coating any number of substances onto a plastic film, and were custom modified for the buyer by Waldron before delivery. The machines could be used for making photographic film, motion picture film, or adhesive tapes.<sup>69</sup> These machines significantly increased the output of the OrRadio plant, for they were capable of coating 7,500 feet of tape per minute. The machines figured significantly in Herbert Hard's discovery of a way to improve the performance of Irish tape.<sup>70</sup>

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[John Herbert Orr?], "John Herbert Orr: A Pioneer in the Magnetic Tape Recording Industry," unpublished typescript, October 1971, access 84-88, box 3, JHO Collection; Sam L. Ackerman to Orr, 24 April 1951, access. 84-103, box 8, file: "Rangertone Correspondence 1950," *ibid.*; Sam L. Ackerman to Orr, 23 February 1951, access. 84-103, box 8, file: "Rangertone Correspondence 1950," *ibid.*

68

Herbert Hard, Jr., interview by Carl F. Voelcker, 3 June 1984, Audio Tape Collection, access. 89-17, Auburn University Archives, Auburn, Alabama.

69

Herbert G. Hard, Jr., interview by author, 17 April 1989, by telephone. One main difference in the coating operations between recording tape and, for instance, adhesive tape is the tolerance for the coating thickness. Adhesive tape is not at all critical; for recording tape in 1955 it had to be about +/- 50 microinches. "How Magnetic Tape is Made," *Popular Electronics*, February 1955, 24.

70

S. D. Fuller and Co., Offering Brochure, n.p., n.d.

One of the principal goals of all the early recording tape manufacturers, German and American alike, had been to provide as smooth a recording surface as possible. Engineers recognized that coating the tape with smaller particles, or somehow trying to smooth the surface of the tape, improved high-frequency response by bringing the tape into closer physical proximity with the recording head during operation. Early tapes sounded better after they had been played a few times, because the rubbing action between the tape heads and the recording medium polished the tape.<sup>71</sup>

Orr's first solution to this problem was polishing the tape before it was sold, but this was too expensive to be practical. The German idea of pressing the iron oxide into the plastic base was no more promising. This method produced a smoother surface, but it seriously weakened the tape.

Herbert Hard visited a factory where a Waldron tape coater was modified to make a plastic strip with a decorative pattern embossed on it. The tape was rolled through heated drums, upon which was inscribed the desired pattern. Hard reasoned that smooth drums might make a recording tape smooth as well. When he returned to Opelika, he discussed the idea with Orr, and the two agreed that it warranted further experimentation. The humorous episode that followed, though it produced a successful new tape, demonstrates the crude way in which important incremental inventions can be made, even in a relatively "high-tech" atmosphere.

For experimental purposes Hard took home some sheets of unslit tape in the form of the wide, coated-plastic "web" as it came from the coating machine. He borrowed his wife's ironing board, warmed up her iron, and ironed the surface of the tape. The first experiment was a disaster. Hard had turned the heat up too high--to the cotton setting--and the coating had come off on the hot surface of the iron. Intervening in the development of magnetic tape, Mrs. Hard demanded a new iron. After enduring this delay, Hard again ironed a section of the web and found that the silk setting imparted a smoothness to the surface of the tape.<sup>72</sup>

Further testing indicated that the new process dramatically increased output, and Orr worked quickly to incorporate it into the production line. Calling it "Ferrosheen," Orr for a time had one of the best sounding tapes on the market, beginning in the fall of 1954 when the first tapes were made with this technique.<sup>73</sup>

Further technical development resulted in the introduction of 220 RPA Sound Plate tape in 1953. This was intended as a high-speed, professional recording studio product. Orr added this

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U.S. Dept of Commerce, Report PB 87901 (Washington, D.C.: GPO, n.d. [1946]), a reprint of British Intelligence Objectives Subcommittee, BIOS Final Report 1379, "Plastics in German Sound Recording Systems." by Crawford, J.W.C., et al. (London: HMSO, 24 April-29 May 1946).

72

Herbert Hard, Jr. interview by author, 17 April 1989.

73

OrRadio Industries, Inc., Annual Report to Stockholders, Year Ending February 28, 1954 (Opelika, Alabama: OrRadio Industries, 1954), access 84-88, box 3, JHO Collection.

to his growing line of products and packaging variations, which included his 211 RPA Green Band, the original professional low-speed tape, and 195 RPA Brown Band, a "domestic grade" oxide. This last tape was essentially scrap tape or tape that did not meet performance standards during testing, and was sold at a discount. Green Band and Sound Plate cost dealers \$3.30 per 1,200-foot reel, while Brown Band sold for \$2.50.<sup>74</sup>

The continuing effects of the quality control problems of 1950...1952, combined with Orr's heavy capital investments, culminated in late 1952 and 1953. The company was starved for money, and though Herbert Hard was rapidly surmounting technical problems, OrRadio suffered from a lack of marketing expertise. Orr moved quickly to remedy the situation.

Part of the money for continued expansion and development came from investors. OrRadio offered shares of stock to the public beginning in 1953.<sup>75</sup> Stock sold at \$2.00 per share, with 50,000 shares offered. Even at that price, the stock was not easy to sell because of the assumed risk involved. Opelika, Alabama, was provincial compared to the northern metropolises that were home to other tape makers. Also, magnetic recording was still very much an infant industry, with OrRadio the smallest and most vulnerable tape manufacturer. Nonetheless, numbers of small investors, local families, and employees bought up the available stock.<sup>76</sup>

In the meantime a young Alabama businessman named Nathaniel Welch contacted Orr with the intent to work with and invest in the company. Welch, an Alabama native, had been an advertising representative for the venerable Southern Farmer, a monthly farming journal published in Montgomery.<sup>77</sup>

With youthful idealism, he hoped to improve the lot of the Alabama working classes by investing in and stimulating local industry. An official of the Birmingham Trust National Bank suggested that Welch contact OrRadio Industries. Nathaniel Welch asked if OrRadio needed "high voltage sales power" and

promised some "additional working capital." Impressed, Orr welcomed Welch's offer of cash and offered him a job as sales manager in June 1953.<sup>78</sup>

Welch was instrumental in making a number of marketing changes that were implemented in 1952...1954. The main objective was to cut into 3M's share of the market, which was as high as 50 percent during the mid-1950s. 3M had not only beaten Orr to the marketplace, but had the added advantage of a marketing budget that was huge by OrRadio standards. 3M dominated the professional market and had gained inroads into the nascent consumer market by convincing many tape recorder manufacturers to include a few rolls of Scotch recording tape with their products.

The retail market seemed more and more promising toward the mid-1950s, leading Welch to concentrate much of his effort on exploiting it. Yet the industry suffered from a poorly-managed system of wholesale distribution. During the late 1940s and early 1950s, when radio and television stations were the primary tape customers, radio parts jobbers became the primary tape merchants. While the home market expanded, these same parts jobbers sold to retail customers, effectively at wholesale prices.<sup>79</sup>

Welch's desire to expand OrRadio's distribution network to include retail department, appliance, jewelry, camera, and record stores reflected his recognition that some coherent system of retail marketing would have to be created.<sup>80</sup> To do this, Welch created a system of master jobbers, based on independent radio and appliance wholesalers. OrRadio protected its master jobbers by selling them tape at a special price, with the understanding that the jobbers would then sell to retail distributors at a price that would leave the retail product competitive. OrRadio sales representatives selling tape on commission disseminated information about new products and new advertising campaigns across the country. This system stayed intact through the 1950s and into the 1960s.<sup>81</sup>

74

Orr's discussion of Brown Band tape comes from a manuscript from which Orr apparently read in producing a taped message sent to sales representatives and company salesmen; perhaps Orr envisioned the "paperless society." John Herbert Orr, untitled typescript, n.d. [c1955], access. 84-88, box 3, file: "Speech Outline," JHO Collection; "New Price Structure on Irish Recording Tape," Photographic Trade News, n.d., a clipping from a scrapbook in the Nathaniel Welch Collection, in the possession of Nathaniel Welch, Atlanta, Georgia (hereafter referred to as NW Collection); advertisement, Columbia Heights

(Minnesota) Record, 12 August 1954, a clipping from a scrapbook, NW Collection.

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Voelcker, "Orr," 30; S.D. Fuller and Co., Offering Brochure, n.p.

76

Nathaniel Welch, interview by author, 25 March 1989, Atlanta, Ga.; "Orr--Stockholders, Auburn," typed manuscript, n.d. [1953], NW Collection; [OrRadio Industries, Inc.], "Stockholders in Southeastern Alabama," typed manuscript, n.d. [1953], *ibid.*

77

Nathaniel Welch, interview by author, 25 March 1989; "Next Time She'll Duck," promotional copy for Southern Farmer, n.d. [1952?], NW Collection; "Call, Wire or Write--NAT WELCH," promotional copy for Southern Farmer, n.d. [1951], NW Collection.

78

Nathaniel Welch, interview by author, 25 March 1989; Nathaniel Welch, untitled typescript, notes for a resume/proposal, n.d. [May 1953], NW Collection; Orr to Nathaniel Welch, 5 June 1953, *ibid.*

79

Richard Hammer, "Versatile Tape: A New Method of Recording is Rapidly Coming of Age," *Barron's*, 10 September 1956, 6.

80

"Orr Sees 1956 As Top Year For Tape Recording Industry," *Opelika-Auburn Daily News*, 19 January 1956, 5. OrRadio's new distribution system and revamped price structure is discussed in Clay Fisher, "Dollars for Dealers in Magnetic Tape," *Radio and Television Journal*, July 1956, 12...13; [Nathaniel Welch], "2% More Incentive for Reps Cleans a Jammed Warehouse," *Sales Management*, 7 June 1957, 100.

81

Nathaniel Welch, interview by author, 4 April 1989, Atlanta, Ga.; "Irish Magnetic Recording Tape Jobber Price List, February 20, 1960," NW Collection; [Nathaniel Welch], "Webcor Distributors Handling Irish Tape," November 10, 1959, *ibid.*; [Nathaniel Welch], "VM Distributors Who Handle Irish Tape," November 6, 1959, *ibid.*; [Nathaniel Welch], untitled typescript listing names and addresses of members of Irish sales representatives, February 1960, *ibid.*; [Nathaniel Welch], untitled typescript comparing 1958...59 and 1959...60 sales records of representatives, 12 May 1960, *ibid.*; [Nathaniel Welch], "Sales May 1958 ... April 1959 compared with May 1959 ... April 1960," 12 May 1960, *ibid.*

As part of the expansion of the company, OrRadio retained the services of a New York advertising agency. It produced a more sophisticated look for the product and a brand mascot, the cartoon leprechaun F. R. O'Sheen, by early 1954.<sup>82</sup> OrRadio launched a series of advertising gimmicks aimed at expanding the home market. The reel tab, a paper label for tape reels, was one such device. A new seven-inch plastic reel featuring an embossed clover and the Irish name appeared, as well as a "gift package" that contained three 600-foot reels of Green Band tape, splicing tape, leader tape, twenty reel tabs and two empty reels; this package was wrapped up in a green, simulated leather-covered box and sold for \$8.95 retail. Orr even experimented unsuccessfully with green tape. He frequently offered special sales on tape, and tried to stimulate commercial sales by sending a hundred southeastern radio stations a free reel of Irish tape and a coupon for special prices.<sup>83</sup>

A series of sophisticated advertising campaigns and a number of retail store displays were especially effective. One series of magazine advertisements featured the stars of the New York Metropolitan Opera and singers including Roberta Peters, and also band-leader Guy Lombardo, with endorsements that they used Irish tape themselves.<sup>84</sup> Another series of advertisements prominently displayed some of the better-quality home recorders and informed owners of these machines that "where there's a fine tape recorder . . . there's Irish tape."<sup>85</sup>

To promote retail sales, the New York advertising agency devised special store displays and tape packaging intended to boost sales. These displays, first tried in 1954, tended to be highly successful. They ranged from a brightly colored shipping case, which unfolded into a store display, to a huge, free-standing wire display rack. Tape packaging was continually revised, using color or design to create a more attractive or noticeable product.<sup>86</sup>

The combination of better sales direction, stock sales, and technical improvement resulted in a 54 percent increase in gross sales over the previous year, as shown in OrRadio's 1954 annual

report. The report reflected a 307 percent increase in sales as compared to 1952. Capital equipment expansion, however, had consumed all the profits, and the company barely managed to break even. Still, there was considerable reason for optimism. Sales for the month of January 1954 were claimed to be 80 percent higher than January 1953, and OrRadio had distributors in all forty-eight states plus a few in Europe and Africa.<sup>87</sup>

The next year was even better, both for OrRadio and for the industry as a whole. Yet euphoria over the 80 percent increase in net sales over the previous year was soured by thousands of dollars worth of "inventory write offs" in the form of defective tapes and other expenses, leaving a net income of only about \$1,300. The \$422 profit from fiscal 1954 had dissipated to a loss of \$852 for fiscal 1955. The purchase of a Chicago manufacturer of metal tape reels and the construction of an oxide manufacturing plant cut heavily into revenues; these were considered necessary capital expenditures that held the promise of increased profits in the future.<sup>88</sup>

The solvency of the company remained precarious. Orr confided to Richard Ranger, with whom he had nearly lost contact by this time, that he had sold or borrowed on "everything" in his personal possession to keep the tape project going. Heavily in debt, OrRadio could not afford to make any mistakes. Problems with the quality of raw materials, for example, were directly responsible for the near-loss of an important air force contract in 1954...1955 that threatened to bankrupt the company. The air force contract for Irish Instrumentation tape was typical of the kind of government contracts which helped sustain a small but steady income for tape manufacturers in the early years. The best quality, most consistent runs of Irish tape were packaged and sold as Instrumentation or Geophysical tape depending on the width at which it was slit. Geophysical tape was used to record seismological data magnetically rather than on paper. Instrumentation tape was used for data storage on computers, and in missiles and airplanes for telemetering or navigational purposes. In practice, even the best tapes often would not operate satisfactorily on military recorders. Sales of these tapes seem to have been much less profitable than audio tape, both for OrRadio and the rest of the industry, and OrRadio and others dropped government contracts during the 1950s.

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82  
Welch, "Jammed Warehouse," 100.

83  
Sales literature, OrRadio Industries, n.d., access. 84-103, box 8, file: "Instructions for Mixing Irish Tape Coating Dispersions," JHO Collection; advertisement for OrRadio "gift box," possibly from Photographic Trade News, October 1954, clipping from a scrapbook, NW Collection.

84  
Advertisement proofs, n.d.[1955?], NW Collection.

85  
The recorders featured included the mid-priced offerings from Bell, Pentron, Viking, Revere, Magnecord, VM, Webcor, Ekotape, Concertone, and Norelco. Despite the cooperation of these manufacturers, OrRadio was still largely unable to break into the so-called O.E.M. market, the business of selling the sample tape included with new recorders. Advertisement proofs, n.d. [1955?], NW Collection; "Exploiting a New Market," *Modern Packaging*, April 1955, 178.

86  
"Exploiting a New Market," 179; Nathaniel Welch, "Effective Merchandising Essential for Recording Tape," *Radio and Television Journal*, 8 November 1958, a clipping from a scrapbook, NW Collection.

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87  
OrRadio Industries, Annual Report 1954.

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"ORRADIO INDUSTRIES, INC. OPELIKA ALABAMA STATEMENT OF INCOME AND EXPENSES," company memo, (May, 1953), NW Collection. Later, an Alabama company, Decatur Plastics, subcontracted for the custom manufacture of plastic reels, and many different designs were produced. Reprint, advertisement, The Monsanto Chemical Company, Plastics Division, 1958, *ibid.*; [Nathaniel Welch], "Memo to all Reps," 15 January 1958, *ibid.*; "Orradio Industries, Inc., Special Letter to Stockholders, December 31, 1954," *ibid.*; OrRadio Industries, Inc., Report to Stockholders, February 28, 1955, *ibid.*; Plans for the OrRadio oxide manufacturing facility, drawn on commission by engineers at the Georgia Institute of Technology, were finished by early 1954, and the addition was completed in 1955. "Tentative Proposal for Experimental Program of Methods of Manufacturing Gamma-Ferric Oxide," Georgia Institute of Technology, 21 April 1954, access 84-103, box 8, file: "4" JHO Collection; LeRoy A. Woodward to Herbert G. Hard, Jr., 30 April 1954, access 84-103, box 8, file: "4" *ibid.*; J. D. Walton, "Tentative Design for Pilot Plant for Converting Fe2O3 \* H2O Fe2O3," drawing, 7 May 1954, access 84-103, box 8, *ibid.*

Difficulties with quality control caused by inconsistent materials persisted until purchases became sufficiently large to warrant the custom manufacture of raw materials for sale to Orr. The remainder of the 1950s ironically saw both growing sales and continued financial insecurity, and would culminate in the sale of OrRadio.<sup>89</sup>

##### 5. COMPETITION AND TAKEOVER, 1956...1960

During the last years of the 1950s, OrRadio continued to expand rapidly. Although sales were strong, the burden of debt kept OrRadio on the brink of financial collapse. Furthermore, OrRadio faced problems as a small company competing with a much larger industry leader, 3M. A potential disaster struck OrRadio in late 1956, just after the conclusion of another year of rapidly expanding sales. On 13 November 1956, the United States District Court for the Middle District of Alabama presented Orr with a subpoena. Marvin Camras of the Armour Research Foundation had been granted a patent that gave him the exclusive rights to the manufacture of recording tape. A hearing on the case would attempt to determine if Orr had manufactured recording tape by the process described in Camras's patent before 25 July 1947, the date of the patent application.<sup>90</sup>

Armour Research had, unknown to Orr, licensed 3M several years earlier as a manufacturer of recording tape under Camras's process. Their agreement broadly covered the manufacture of both recording devices and tapes, and demanded a 2 1/2 percent royalty on the sale of each device (meaning a tape or a recorder), based on an agreed-upon definition of the net selling price. The document as modified in 1954 specified that tapes, which sold at a retail average price of \$3.00...\$4.00, would draw a royalty of \$0.50, the minimum amount specified in the agreement. With roughly \$1,500,000...\$1,750,000 in 3M's yearly gross sales of magnetic tape in the mid-1950s, this amounted to a considerable accrual. In return, Armour Research supplied technical information and allowed unlimited production of magnetic recording devices.<sup>91</sup>

When the patent was approved, Armour and 3M sued C. K. Williams and Company, the prime manufacturer of magnetic

oxide for the other tape manufacturers.<sup>92</sup> In a separate legal action, Audio Devices, Inc., filed for interference in 1955 in an attempt to invalidate the Camras patent. If granted, an interference proceeding would give Audio Devices a chance to prove that Camras was not the inventor of the method described in his patent.<sup>93</sup> If the patent was upheld or C. K. Williams defeated, Orr would be forced to cease operations or become a licensee of Armour Research Foundation on its terms.

With the arrival of the subpoena, Orr was both outraged and griefstricken. He and his lawyers were not wholly convinced that Camras's patent would be disallowed even when the courts saw for themselves that Camras was not the inventor of the process in question. Orr also realized that if he were directly involved in a court battle, it would probably bankrupt the business he had built up over the past six years. He privately composed a heart-rending but somewhat contrived account of his activities since the war and, with an eye towards future historians, titled it "To Whom it May Concern." In it he indicated how he had learned about the Magnetophone and how he had taken this information from the Germans.<sup>94</sup>

His official deposition, left to posterity on five reels of Irish tape, is as fascinating for what it does not say as for what it does. Orr submitted to questioning from lawyers who wanted to know if he could prove his assertions that he made recording tape, however crude the process, before July 1947. For all the moral indignation Orr affected at the attack on his livelihood represented by this case, neither he nor the lawyers seemed to be interested in who really deserved credit for developing magnetic tape. Implicitly, and without objection from the plaintiff's lawyers, he treated the commandeering of German technology as rightful spoils of war. The deposition drips with irony.

The future of magnetic recording seemed unimaginably profitable to Orr, even in 1956, and to allow Armour and 3M to dominate the industry was unthinkable. Orr and his lawyers steeled themselves for a bitter court battle.<sup>95</sup> The hearings dragged on until 1959, but Armour and 3M never actually brought OrRadio into court.<sup>96</sup>

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Orr to Richard H. Ranger, 16 February 1954, access. 84-103, box 8 file: "Rangertone Correspondence 1950," JHO Collection. A volume deal was concluded with DuPont Corp. in 1954 or 1955 whereby DuPont sold OrRadio very high quality Mylar plastic film. Orr, untitled typescript, n.d.; Voelcker, "Orr," 35; John Herbert Orr, "The Magic of Magnetic Tape," unpublished speech, n.d.[1958], access. 84-33, box 18, file: "The Magic of Magnetic Tape," JHO Collection. Reeves Soundcraft dropped its government contracts in 1956. Hammer, "Versatile Tape," 6.

90

U.S. Patent 2,694,656 (16 November 1954), Marvin Camras/Armour Research Foundation, "Magnetic Impulse Record Member, Magnetic Material, and Method of Making Magnetic Material"; U.S. District Court for Middle District of Alabama, Civil Action files 3200 and 3438, Subpoena of John H. Orr, 13 November 1956, access 84-103, box 9, JHO Collection.

91

Untitled Licensing Agreement between the Minnesota Mining Company, Inc., and Armour Research Foundation, n.d. [1947], access. 84-103, box 9, JHO Collection, 8, 11.

92

Joseph Ayers, interview by author, 23 June 1989, by telephone; C. Allen Lindquist, Jr., interview by author, 21 June 1989, by telephone. 3M had been a manufacturer of pigments since the late 1940s and produced its own oxide. OrRadio, had begun setting up oxide-producing facilities in 1954.

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Interference proceedings may be filed up to one year after a patent is issued. The Patent Office then determines priority. William J. Navin, *Patents* (n.p.: Practising Law Institute, 1946, revised edition 1966), 34...38.

94

Orr, "To Whom It May Concern," n.p.

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John Herbert Orr, company memorandum to William H. Orr, 20 April 1956, access. 84-103, box 9, file: "Miscellaneous," JHO Collection.

96

During this period the justice department wrote Orr indicating its feeling that the Camras patent was a fraud. As well, Alabama Senator John Sparkman, chairman of the Senate Sub-Committee on Small Business, corresponded with Orr regarding his concern that the patent litigation would ruin Orr's small company. Apparently neither organization took action, but these letters show the



On 4 March 1959 Judge William C. Jeurgens of the United States District Court for the East District of Illinois decided against the Camras patent. He found that the "invention had been shown in previous patents and publications, particularly . . . in Germany." Further, 3M and others had "publicly used the invention before the patent application was filed." Most important, the court found that "the tape did not involve products or processes that could be patented here."<sup>97</sup> The decision was appealed in 1959, but the appeal was later denied.<sup>98</sup>

The uncertainties of the patent litigation hanging over OrRadio and the entire industry during that last half of the 1950s proved to be the company's last financial worry. After 1955 or so, sales expanded so rapidly that the costs of doing business and of expansion were more than adequately covered, and OrRadio became profitable and financially secure.

Sales figures for the industry were first collected for 1955 and provide a good indication of the vitality of the industry. Retail sales for tape recorders grew from \$50 million in 1955 to an estimated \$120 million in 1958. Retail sales of blank tapes rose from \$800,000 to \$8 million during the same period. About 65 percent of the tape manufactured in the industry was used for audio purposes, and 35...45 percent of this percentage was sold to home users. In this atmosphere, OrRadio could count on increasing success.<sup>99</sup>

The company's healthy growth, combined with technical coups like the Ferrosheen process, attracted the attention of the Ampex Corporation in 1956. Ampex became popularly known after a successful video tape project of the mid-1950s, although it was only one of a series of frenetic video tape research and development projects being undertaken simultaneously in the United States and Europe. The idea was fairly straightforward. The kinescope tube used in television cameras had already made it possible to convert a visual image into electrical impulses, but the only way to store those impulses continued to be photographic film. Researchers soon found that storing video signals on tape was more difficult than storing audio signals because of the wide bandwidth of signals created during the translation of light to magnetic impulses. Tape has a theoretical limit that defines a maximum relation between the highest frequency recorded and the tape speed. It was found that no

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widespread realization that the Camras tape patent was undefendable. T. Hayward Brown to Orr, 17 August 1956, access. 84-103, box 9, file: "Wm. P. Rogers, Deputy Attorney General," *ibid.*; John Herbert Orr, untitled memorandum, 15 May 1956, access. 84-103, box 9, file: "Miscellaneous," *ibid.*; Senator John Sparkman to Orr, 1 June 1956, access. 84-103, box 9, *ibid.*

97

"U.S. Court Invalidates a Patent Pertaining to a Magnetic Tape," *New York Times*, 4 March 1959.

98

"Main Brief for Defendant: Technical Tape Corp.," (n.d.: n.p.), access. 84-103, box 8, JHO Collection.

99

"Record Players and Magnetic Recorders," *Electrical Manufacturing*, January 1958, 132, 136; "Records and Tape," *Electrical Merchandising*, January 1959, 112-20; "In Chicago, Tape Stays in Turmoil," *Electrical Merchandising Week*, 11 July 1960, 81.

known tape would record video at a tape speed below 100 inches per second.

The first successful video tape recorders appeared from RCA in late 1953. These machines, running a half-inch tape at high speed, could record color or black and white signals with an acceptable degree of picture quality. These machines, although they devoured tape at a high rate, still represented some cost savings over photographic devices. The huge reels of tape used on the machines, however, made mechanical considerations involved with tape transport undesirably complex.<sup>100</sup>

The Ampex idea was to solve the tape speed problems by rotating the recording and playback heads at high speed in relation to the tape, instead of moving the tape at high speed past the heads. Its prototype, the size of several large refrigerators, could not be demonstrated, though, because the machine would not operate with conventional audio tape.

For one thing, the tape had to be slit two inches wide instead of the quarter-inch size used for audio. Further, during the manufacture of the tape while the tape coating was still wet, the magnetic particles needed to be aligned perpendicularly to the length of the tape, rather than parallel to it as in audio tape.

Ampex contacted several tape manufacturers, including 3M and OrRadio, in an effort to obtain usable samples of tape for this machine and in hopes that the recorder could be demonstrated at the 1956 meeting of the National Association of Broadcasters (NAB). No manufacturer, however, was able to provide a tape with the critically important homogeneity of coating dispersion and surface smoothness necessary to provide a television picture free of streaks and "drop outs."<sup>101</sup>

As the date of the NAB show grew near, OrRadio and others were producing batch after batch of experimental video tape, mailing it to Ampex, and waiting for the results. There was no other way to test the tape, because only the prototype video tape machines existed. Finally, according to the story told by Orr, Hard, and Welch, OrRadio delivered one roll of tape that possessed the elusive perfect qualities. With this one roll of tape, the legend goes, Ampex was able to demonstrate its novel Videotape (a registered trademark) recorder at the NAB show. The story may not be true, but the machine was successfully demonstrated and Ampex emerged with orders for the expensive machines that would eventually lead to the corporation's dominance in video tape recording for many years. Ironically, OrRadio was never

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Audio tape had been used since the early 1950s in television stations for recording the soundtracks for television shows. Rangertone Corporation correspondence shows that at least one television network (not named but probably NBC) employed a Rangertone recorder using Irish tape for the purpose of recording an obscure TV series, "The Pharmacist's Mate." Sam L. Ackerman to Orr, 12 January 1951, access. 84-103, box 8, file: "Rangertone Correspondence 1950," JHO Collection; "RCA Demonstrates TV Tape Recorder and Tells Plans for Perfecting It," *Advertising Age*, 14 December 1953, 68...69; Lawrence Lichty and Malachi C. Topping, *American Broadcasting: A Sourcebook on the History of Radio and Television* (New York: Hastings House, 1975), 70; Waldemar Kaempffert, "Science in Review," *New York Times*, 13 December 1953; Bernard F. Osbahr, "Recording TV on Magnetic Tape," *Tele-Tech* 13 (January 1954): 81, 124...125; George Landry, "Magic Magnetic Tape Used to Film TV Shows," *Columbus (Ga.) Ledger*, 17 December 1953.

101

Vulcan, "From Where I Stand," *Birmingham News*, 29 March 1954.

able to make another successful roll of video tape. Only after Ampex bought the company was usable video tape produced.<sup>102</sup>

More important, the relationship that developed between Ampex and OrRadio led to a merger in 1959. In the late summer of 1956, an Ampex official contacted John Herbert Orr and proposed that Ampex buy OrRadio outright. Ampex, the proposal stated, wanted direct control over the quality of its magnetic tape supply.<sup>103</sup> Orr felt that he was not yet ready to sell the company, but allowed Ampex to buy a 25 percent interest in the firm in 1957.<sup>104</sup>

Orr's reluctance to sell probably did not come from any emotional attachment to the company. Rather, the OrRadio venture had been primarily a way to make money, and Orr felt that the real money would come from selling the business as soon as it had been firmly established. Nonetheless, company records showed 1955 as the first year OrRadio had made money. Net profit before income taxes had jumped from almost nothing to more than \$140,000 that year. In 1956, rising sales had prompted the company to put on another shift at the factory and at the end of the year net profits had jumped another \$100,000. Orr therefore waited a few more years before he sold out. The years between 1956 and 1959 showed uninterrupted growth.<sup>105</sup>

The emphasis OrRadio paid to the home market proved to be a boon to the company after 1955 when "Hi-Fi" home audio systems came into fashion in the United States. Inspired in part by developments like professional tape recording and FM radio, and later stereo and the microgroove phonograph record, home-built high fidelity audio systems became increasingly popular after World War 2. Perceiving a new market, electronics manufacturers introduced their own high-fidelity equipment during the 1950s. Tape recorders were widely perceived as essential high fidelity components, and inexpensive units were in mass-production by mid-decade. A typically-American craze, "Hi-Fi" expanded an already increasing retail consumer market for OrRadio.

The company's continued growth was reflected in the February 1958 completion of a \$500,000 tape manufacturing facility near the original Opelika plant. The facility, which offered a 400 percent increase in production potential, promised to end problems with back orders. It also included OrRadio's first

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Joseph F. Robinson, *Videotape Recording: Theory and Practice* (London: Focal Press, 1975), 17; Davis, "Success Spun Out of Tape," 12; Hammer, "Versatile Tape," 5...6.

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John Jipp to Orr, 20 August 1956, access. 84-88, box 3, JHO Collection.

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"Ampex, Orradio Pool Talents," *Electronic Week*, 29 April 1957, 21; OrRadio Industries Inc., letter to stockholders, 1 October 1957, NW Collection.

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The increased production due to the addition of a second shift produced temporary overproduction, but market expansion and aggressive sales corrected the problem. Welch, "Jammed Warehouse," 100; OrRadio Industries, Inc. Seventh Annual Report To Stockholders, OrRadio Industries, Inc., 28 February, 1957, 1, NW Collection; OrRadio Industries, 8th annual report to stockholders for the Fiscal Year ended February 28, 1958, 3, *ibid*.

real testing facilities, above and beyond simple visual or aural testing. By this time Orr was being hailed in Alabama as an important industrialist and a local hero. The speaker at the grand opening ceremonies for the new facility was Alabama Senator John Sparkman, with CBS-TV announcer Douglas Edwards acting as the master of ceremonies. Edwards's "Douglas Edwards and the News" show on CBS was one of the first shows regularly recorded on video tape, and CBS had been the first to place a large Videotape order with OrRadio.<sup>106</sup>

The merger of Ampex Corporation and OrRadio Industries, Inc., was formally proposed during the summer following the plant opening. The merger represented a windfall gain in the amount of research and development and marketing capital available to OrRadio, and it allowed Ampex to control production of magnetic tape. As part of the agreement, all OrRadio employees were allowed to stay with the new firm, if they wished. Stockholders had the option to exchange their common stock for Ampex common stock at the ratio of 2.2 OrRadio shares to each Ampex. With the consent of major stockholders, the merger took place late in 1959.<sup>107</sup>

Although Ampex soon shifted its focus away from the consumer audio tape market, the Ampex Magnetic Tape Division, established about 1960, was representative of the nature of the recording tape industry in the United States. Borrowing heavily from German research and development and benefiting from low startup costs, American manufacturers, through mass production and the stimulation of mass consumption, created a large market for a new product. This technology was rapidly accepted by Americans. Professionals recognized tape's advantages of cost, convenience, and recording quality. Consumers eagerly bought the product, especially after tape recording became associated with the high-fidelity trend of the middle 1950s.

When the Ampex-OrRadio merger became complete, John Herbert Orr left the company to pursue other ventures. One of

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"Orradio Dedicates New Tape Factory," *Radio and Television Weekly*, 12 April 1958, 18; Emmet Atkins, Jr., "Senator John Sparkman Speaks at Formal Opening of Orrradio's New Half Million Dollar Plant, Opelika," *Southern Appliances*, April 1958, 8; Davis, "Success Spun out of Tape"; "Attractive Plans Made For Orrradio Opening," *Lee County Bulletin*, March 27, 1958; "Sparkman Blasts Monopoly Trend," *Columbus (Ga.) Ledger-Enquirer*, 30 March 1958; invitation, OrRadio Industries, Inc., for the "Grand Opening of its New Plant, Saturday, March 29, 1958," NW Collection; "Grand Opening, New \$500,000 Plant For the Manufacture of Magnetic Recording Tape, ORRadio Industries Inc.," n.d. [1958], program of events, *ibid.*; Hammer, "Versatile Tape," 5; "New Plant Opening: Ceremonies and Publicity," OrRadio memo [1958], *ibid.*; "Opelika Firm to Build New Magnetic Tape Plant," *Alabama Journal*, n.d.[1958], *ibid.*; "New Opelika Plant to Open March 29," March 11, 1958; "Senator John Sparkman to Talk at Opening of Orrradio Plant"; "Sparkman to Speak at Opening of Plant"; "OrRadio Officials To Show Use Of Videotape Recorder," newspaper clippings from a scrapbook, *ibid*.

107

Orr Industries, Inc., letter to stockholders, "Proxy Statement Information Concerning Proposed Merger of Orr Industries, Inc. with Ampex Corporation," 1 July 1959; Orr Industries, Inc., "Notice of Special Meeting of Stockholders," 8 July 1959; "Orr, Ampex Seal Merger"; OrRadio Industries changed its name to Orr Industries shortly before the merger; Orr Industries, Inc., untitled list of executives and managers, 25 July 1959; Orr Industries, Inc., "Employees' Names and Addresses," 3 December 1959, NW Collection; "Ampex Absorbs Orr," *Wall Street Journal*, 12 October 1959.

the more interesting was ORRtronics, Inc., a company that manufactured a cartridge-type continuous-loop tape player using an Orr-designed lubricated tape. The controlling interest in this company was sold to the Champion Spark Plug Company in 1965, which later helped market versions of these machines as the familiar "eight track" players of the 1960s and 1970s.

In March 1962 Orr founded the company that became Magna-Tech Corporation after the sale of ORRtronics in 1965. Magna-Tech produced professional eight-track equipment for copying prerecorded tapes. Later, a new division of Magna-Tech called ORRox was created to sell equipment used for a new process of making magnetic oxide.<sup>108</sup>

Orr's practice of establishing businesses and then selling them proved financially advantageous, and he continued to dabble in business ventures well into his old age. He died a moderately wealthy man in 1984 in Opelika. Ampex, which pulled out of the retail consumer tape market in the early 1960s, has long since ceased to use the Irish name on its products. The headquarters for the magnetic tape division has been moved to Redwood City, California, the site of the company's main headquarters. A few relatives and an industrial park bearing his name are the only tangible traces of John Herbert Orr that have remained in Opelika. Yet throughout the city, one finds people who remember Orr well, and there is a certain amount of hero worship surrounding his memory and accomplishments.<sup>109</sup>

Richard Ranger died suddenly in 1962, leaving his company to his younger associate, George Zazalli. Nathaniel Welch left Ampex in 1960 and set up his own marketing company in Opelika. He currently lives in Atlanta, Georgia. Herbert Hard worked for Tandy Corporation's Magnetics Division in Dallas, Texas, at the time of his retirement, and now lives on the Gulf coast of Alabama.

These men and the others remember building the American magnetic recording industry. Invariably they look back at their work in the 1950s and 1960s and recall those years as part of some bygone era. For the 1990s the epicenter of commercial activity in magnetic recording has once again moved west, this time to Japan, Korea, and other Pacific rim countries.

## 6. CONCLUSION

John Herbert Orr's sudden rise from a self-trained electronics technician to a successful entrepreneur cannot be wholly attributed to his finding himself "in the right place at the right time" during World War 2. Orr's wartime employment did not place him in a position of unique privilege as regards to

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[Magna-Tech Corp.], "What is Magna-Tech?," typescript, n.d. [c.1970], access. 84-40, box 13, file: "Magna Tech" JHO Collection; Magna Tech Corp., ORRox Division, intra-office memorandum, 13 August 1970, access. 84-40, box 13, file: "Magna Tech," *ibid.*; ORRox Corporation," typescript, n.d., access. 84-88, box 3, *ibid.*; OrRadio Industries, Inc., Orrtronic Service Manual (Opelika, Ala.: OrRadio Industries, Inc., n.d. [c. 1961]), access 84-40, box 13, *ibid.*

109

"John Herbert Orr," Opelika-Auburn (Ala.) Daily News, 7 May 1984; "Tape Pioneer Orr Dies at 72," Opelika-Auburn (Ala.) Daily News, 7 May 1984; "John Herbert Orr, Industrialist, Dies," Birmingham News, 7 May 1984; National Register Publishing Co., Inc., Directory of Corporate Affiliations 1977 (Skokie: National Register Publishing Co., Inc., 1977), 30.

magnetic recording. Dozens of others working with him shared his knowledge of tape recording. Further, the United States Department of Commerce, by disseminating detailed knowledge of the Magnetophone system after the war, effectively countered any technical advantage Orr might have gained from his personal investigation of tape recording in Germany.

It was no accident, however, that the same man who studied tape technology in Germany returned to the United States to manufacture it. Orr's personal role in the transfer of tape technology was inspired by enthusiasm and a belief in the potential for tape recording. His experiences with the Magnetophone appealed to his sense of esthetics and his intellectual appreciation of a complex, well-conceived instrument. Because of this emotional attachment, Orr was willing to take a chance on introducing magnetic tape recording to the American market.

Although the evidence is unclear and sometimes conflicting, Orr's reminiscences of his early experiences with tape recording tend to support a model of technological change similar to Edward Constant's "paradigm shift" thesis. Orr's experience in commercial radio broadcasting made him aware of the difficulties involved in introducing to radio a technology as radically different as tape recording. The feasibility of the phonograph in the American broadcast studio was unquestioned, and in-studio recording was only rarely demanded. Yet Orr's commitment to magnetic recording indicates that he perceived radio broadcasting in a way that incorporated the extensive use of tape recording equipment. He probably, therefore, sensed the possibilities of such a paradigm shift.

Orr's wartime experience in magnetic tape production made it easier for him to set up OrRadio Industries in Opelika, Alabama, an area without abundant investment capital. Orr's knowledge allowed him to act as his own industrial, chemical, and electrical engineer. Thus, his initial need for skilled labor was low, and he was able to reduce his operating costs while the company became established.

Once in production, Orr's small business benefitted immensely from the fact that tape recording technology had already reached a high degree of sophistication and viability, virtually eliminating the need for further research and development to produce a salable product. German development extended even to mass production manufacturing techniques, which Orr had simply to emulate to produce a marketable product. Although he initially experienced some trouble consistently duplicating the German product, his tape was good enough to compete with other brands in the marketplace.

OrRadio Industries was also aided by the heavy commercialization of tape recording by larger American tape and recorder manufacturers. OrRadio initially was small and had only a meager budget for advertising and marketing, and larger companies were much better prepared to blaze the trail in introducing tape to the American marketplace. OrRadio in the early years thus avoided some of the uncertainties of trying to sell a new technology to skeptical buyers.

As the tape recording industry grew, the activities of large electronics companies continued to ease the way for OrRadio. Initially a hand-built professional device, the tape recorder proved adaptable to cost-lowering design changes that made it suitable for mass-production. The steady democratization of tape

recorders in turn expanded the market for tape. Orr and other manufacturers had followed German models in designing their tape production facilities, and these facilities were intended to produce finished tape continuously in large amounts. Thus, to a certain extent, OrRadio could work more efficiently as demand grew.

As the company expanded, Orr followed modern models of corporate structure by hiring professional managers to handle marketing, and technical experts to streamline production. His marketing executive, Nathaniel Welch, successfully constructed a distribution network that reflected Irish tape's mid-1950s transition from the professional to the consumer market. Although OrRadio was still the smallest manufacturer in the field, by the late 1950s Irish tape was as widely available in retail stores as brands made by firms with much larger marketing resources. The production problems Orr faced in the early years were quickly overcome by the addition of professional chemist Herbert Hard. After solving the initial problems, Hard actively pursued technical improvements in the production process and contributed significantly to the improvement of the product. In employing these professionals, Orr took on a role more oriented toward the general goal of expansion and was less concerned with the daily affairs of the company.

OrRadio never became financially secure. The 1956 announcement that the company might be sued for infringement upon an important tape recording patent came at a time when OrRadio was still financially unable to survive an expensive court battle. Though sales figures were skyrocketing and the company was expanding, OrRadio was also financially stretched to the limit. As the tape recording industry matured in the late 1950s, smaller companies were absorbed or fell by the wayside and the industry became the domain of an oligopoly of the larger electronics firms. Orr soon found it desirable to sell out.

Although the OrRadio story says much about the possibilities for an individual's role in the transfer of technology, it uncovers little about the effects of German magnetic tape technology on the indigenous magnetic recording industry in the United States. Aside from the important tape recording patent litigation of the mid-1950s, OrRadio had little contact with the manufacturers of wire recorders. The technical sophistication and the high-fidelity potential of German tape recording made American wire recorders instantly obsolete. In making wire recording a low-priced, consumer technology from the outset, wire recorder manufacturers anticipated the market that tape recording would one day enter. While their product was technically inferior, the marketers of wire recording were quite forward-looking.

From a wider perspective, perhaps the large corporations like 3M, RCA, and Ampex, and institutions like the Armour Research Foundation deserve the most credit for establishing the magnetic recording industry in the United States, rather than OrRadio. The activities of these companies with regards to magnetic recording should someday be the basis of continued historical research. Further research should also be undertaken regarding the British and German contributions to tape recording, especially before World War 2. John Herbert Orr's career in the tape industry is only a small, but significant part of a much larger story.

## 7 BIBLIOGRAPHY

### Manuscript Collections

John Herbert Orr. Collection. Auburn University Archives, Auburn, Alabama.

John Herbert Orr. Freshman/Sophomore Record of Enrollment. Alabama Polytechnic Institute, 8 September 1928. Auburn University Archives, Auburn, Alabama.

Orradio Industries, Inc. Collection. Auburn University Archives, Auburn, Alabama.

Records of Allied Operational and Occupation Headquarters, World War 2, Supreme Headquarters, Allied Expeditionary Force, Special Staff, Psychological Warfare Division, Executive Branch. Record Group 331. National Archives and Records Administration, Washington, D.C.

Nathaniel Welch. Collection. In the possession of Nathaniel Welch, Atlanta, Georgia.

### Government Documents

#### Germany

German Patent 500,900 (5 June 1930), Fritz Pfleumer "Lautshrifttrager."

German Patent 593,878 (15 February 1934), Fritz Pfleumer, "Lautshrifttrager."

#### United States

U.S. Dept. of Commerce. Report PB 79558. Washington, D.C.: GPO, n.d. [1946]. A reprint of U.S. Army Field Intelligence Agency, Technical. FIAT Final Report 923, "Further Studies in Magnetophones and Tapes," by Col. Richard H. Ranger. N.p.: FIAT, May 1947.

U.S. Dept. of Commerce. Report PB 385. Washington, D.C.: GPO, n.d.[1946]. A reprint of SHAEF, Combined Intelligence Objectives Sub-Committee, G-2 Section, Chemical Warfare and Miscellaneous Chemicals Section. "I.G. Farbenindustrie A.G., Ludwigshafen and Oppau au Rhein, Wehrmacht Items," by J. G. Kern, et al. N.p.: SHAEF, 19...30 June 1945.

U.S. Dept. of Commerce. Report PB 3586. Washington, D.C.: GPO, n.d. [1946]. A reprint of U.S. Army, Office of the Theater Chief Signal Officer, Technical Liaison Division, U.S. Headquarters, Theater Service Forces, European Theater. Intelligence Report SRM-1, "Magnetic Sound Recorders

David L. Morton: John Herbert Orr and the Building of the Magnetic Recording Industry

'Magnetophone' and 'Tonschreiber,'" by U.S. Army Signal Corps. N.p.: U.S. Army Signal Corps, 25 November 1945.

U.S. Dept of Commerce. Report PB 87901. Washington, D.C.: GPO, n.d. [1946]. A reprint of British Intelligence Objectives Subcommittee. BIOS Final Report 1379, "Plastics in German Sound Recording Systems," by Crawford, J.W.C., et al. London: HMSO, 24 April...29 May 1946.

U.S. Dept. of Commerce. Report PB 45518. Washington, D.C.: GPO, n.d. [1946]. A reprint of German Patent Application I 71,652 IX a/42g (26 February 1942), "Verfahren zur Herstellung von Tragerschichten für Magnetonaufzeichnungen," I.G. Farbenindustrie Aktiengesellschaft.

U.S. Patent 661,619 (13 November 1900), Valdemar Poulsen, "Method of Recording and Reproducing Sound."

U.S. Patent 789,336 (9 May 1905), Valdemar Poulsen and Peder O. Pedersen, "Telegraphone."

U.S. Patent 1,640,881 (30 August 1927), Wendell L. Carlson and Glenn W. Carpenter, "Radio Telegraph System."

U.S. Patent 2,694,656 (16 November 1954). Marvin Camras/Armour Research Foundation, "Magnetic Impulse Record Member, Magnetic Material, and Method of Making Magnetic Material."

Miscellaneous

"Call, Wire or Write--NAT WELCH," promotional copy for Southern Farmer, n.d. [1951], NW Collection.

"Next Time She'll Duck," promotional copy for Southern Farmer, n.d. [1952?], NW Collection.

OrRadio Industries, Inc. Annual Report to Stockholders, Year Ending February 28, 1954. Opelika, Alabama: OrRadio Industries, 1954. Access 84-88, box 3, JHO Collection.

S. D. Fuller and Co. Offering Brochure. New York: S. D. Fuller and Co., 14 October 1953. Access. 84-88, box 3, JHO Collection.

Telephone Directory, Auburn, LaFayette, Opelika, Waverly [Ala.]. N.p.: Southern Bell Telephone and Telegraph Co., Inc., December 1948.

Untitled Licensing Agreement between the Minnesota Mining Company, Inc., and Armour Research Foundation, n.d. [1947]. Access. 84-103, box 9, JHO Collection.

Books

Abramson, Albert. The History of Television, 1880 to 1941. Jefferson, N.C.: McFarland and Company, Inc., 1987.

Aitken, Hugh G. J. The Continuous Wave: Technology and American Radio, 1900...1932. Princeton: Princeton University Press, 1985.

Barnouw, Erik. Tube of Plenty: The Evolution of American Television. New York: The Oxford University Press, 1975.

Boyd, T. A. Professional Amateur: The Biography of Charles Franklin Kettering. New York: E.P. Dutton and Co., Inc., 1957.

Constant, Edward W., 2. The Origins of the Turbojet Revolution. Baltimore: Johns Hopkins University Press, 1980.

Daugherty, William, and Janowitz, Morris. A Psychological Warfare Casebook. Baltimore: Johns Hopkins University Press, 1958.

Dunlap, Orrin E., Jr. Radio's 100 Men of Science: Biographical Narratives of Pathfinders in Electronics and Television. New York: Harper and Brothers Publishers, 1944.

Huck, Virginia. Brand of the Tartan: The 3M Story. New York: Appleton-Century-Crofts, Inc., 1955.

Kuhn, Thomas S. The Structure of Scientific Revolutions. Chicago: University of Chicago Press, 1962.

Lichty, Lawrence and Topping, Malachi C. American Broadcasting: A Sourcebook on the History of Radio and Television. New York: Hastings House, 1975.

MacLaurin, W. Rupert, et al. Invention and Innovation in the Radio Industry. New York: The Macmillan Co., 1949.

National Register Publishing Co., Inc. Directory of Corporate Affiliations, 1977 Skokie: National Register Publishing Co., Inc., 1977.

Navin, William J. Patents. N.p.: Practising Law Institute, 1946, revised edition 1966.

Ochse, Orpha. The History of the Organ in the United States. Bloomington: Indiana University Press, 1975.

Paddock, Alfred H., Jr. U.S. Army Special Warfare: Its Origins. Washington, D.C.: National Defense-University Press, 1982.

Pogue, Forrest C. The U.S. Army in World War 2, The European Theater of Operations: The Supreme Command. Washington, D.C.: Office of the Chief of Military History, Dept. of the Army, 1954.

Ranger, Richard H. The Radio Pathfinder. London: William Heinemann, 1922.

Robinson, Joseph F. Videotape Recording: Theory and Practice. London: Focal Press, 1975.

## David L. Morton: John Herbert Orr and the Building of the Magnetic Recording Industry

Thompson, George Raynor. *The U.S. Army in World War 2, The Technical Services, The Signal Corps: The Outcome.* Washington, D.C.: Office of the Chief of Military History, Dept. of the Army, 1966.

### Articles

Advertisements, Magnetic Film and Tape Recording, December 1954, *passim*.

Advertisement for OrRadio "gift box," possibly from *Photographic Trade News*, October 1954, clipping from a scrapbook, NW Collection.

Aldous, D. W. "Recording on Steel Tape." *The Wireless World* 44 (29 June 1939): 611...612.

"Ampex, Orradio Pool Talents." *Electronic Week*, 29 April 1957, 21.

Angus, Robert. "75 Years of Magnetic Recording." *High Fidelity Magazine* 23 (March 1973): 42...50.

\_\_\_\_\_. "History of Magnetic Recording, Part I." *Audio* 68 (August 1984): 27...30

Atkins, Emmet Jr. "Senator John Sparkman Speaks at Formal Opening of Orradio's [sic] New Half Million Dollar Plant, Opelika." *Southern Appliances*, April 1958, 8...10, 22.

Barrett A. E., and Tweed, C. J. F. "Some Aspects of Magnetic Recording and its Application to Broadcasting." *Journal of the Institution of Electrical Engineers* 82, *Proceedings of the Wireless Section* (1938): 265.

[Begun, S.J.], "The New Steel Tone Tape Machine." *Electrical Communication* 15 (July 1936): 62...69.

\_\_\_\_\_. "Recent Developments In Magnetic Sound Recording." *Journal of the Society of Motion Picture Engineers* 29 (May 1937): 464...472.

Dewald, H. "Application of Lorenz Communication Technique at the Olympic Games, Germany, 1936." *Electrical Communication* 15 (July 1936): 282...283.

Engel, Friedreich Karl. "Magnetic Tape: From the Early Days to the Present." *Journal of the Audio Engineering Society* 36: (1988): 606...616.

"Exploiting a New Market." *Modern Packaging*, April 1955, 178...179.

Fisher, Clay. "Dollars for Dealers in Magnetic Tape." *Radio and Television Journal*, July 1956, 12...13.

Gavey, J. "Telegraphs and Telephones at the Paris Exhibition." *The Electrician* 46 (23 November 1900): 166...169.

Hammer, Richard. "Versatile Tape: A New Method of Recording is Rapidly Coming of Age." *Barron's*, 10 September 1956, 5...6.

Hering, Carl. "An American Criticism of the Paris Exhibition." *The Electrician* 46 (28 December 1900): 364...367

"How Magnetic Tape is Made." *Popular Electronics*, February 1955, 23...25.

"In Chicago, Tape Stays in Turmoil." *Electrical Merchandising Week*, 11 July 1960, 81.

Jordan, Robert Oakes. "Introducing Tape Recorders." *Saturday Review of Literature*. 29 May 1954, 36...37.

Lane, Basil. "75 Years of Magnetic Recording, Part Two." *Wireless World* 81 (April 1975): 161...162.

"New Price Structure on Irish Recording Tape," *Photographic Trade News*, n.d., a clipping from a scrapbook, NW Collection.

"Opelika Firm to Build New Magnetic Tape Plant," *Alabama Journal*, n.d. [1958], NW Collection.

"OrRadio Dedicates New Tape Factory," *Radio and Television Weekly*, 12 April 1958, 18.

"OrRadio Officials To Show Use Of Videotape Recorder," a clipping from a scrapbook, NW Collection.

Osbahr, Bernard F. "Recording TV on Magnetic Tape." *Tele-Tech* 13 (January 1954): 81; 124...125.

"RCA Demonstrates TV Tape Recorder and Tells Plans for Perfecting It." *Advertising Age*, 14 December 1953, 68...69.

"Record Players and Magnetic Recorders." *Electrical Manufacturing*, January 1958, 132, 136.

"Records and Tape." *Electrical Merchandising*, January 1959, 112...120.

"Senator John Sparkman to Talk at Opening of Orradio Plant." Unidentified news article, n.d. [1958]. A clipping from a scrapbook, NW Collection.

"Sparkman to Speak at Opening of Plant." Unidentified news article, n.d. [1958]. A clipping from a scrapbook, NW Collection.

Stille, Curt. "Die Elektromagnetische Schallaufzeichnung." *Elektrotechnische Zeitschrift*, 27 March 1930, 451

Theile, Heinz K. "Magnetic Sound Recording in Europe Up To 1945." *Journal of the Audio Engineering Society* 36 (1988): 396...408.

## David L. Morton: John Herbert Orr and the Building of the Magnetic Recording Industry

Welch, Nat[aniel]. "2% More Incentive for Reps Cleans a Jammed Warehouse." *Sales Management*, 7 June 1957, 100...101.

Zazalli, George. Interview by author, 13 February 1989, by telephone.

\_\_\_\_\_. "Effective Merchandising Essential for Recording Tape." *Radio and Television Journal*, 8 November 1958, a clipping from a scrapbook, NW Collection.

### Newspapers

Birmingham News, 1954...1984.

Christian Science Monitor, 1959.

Columbia Heights (Minnesota) Record, 1954.

Columbus (Ga.) Ledger, 1953...1958.

Lee County (Ala.) Bulletin, 1958.

Montgomery (Ala.) Advertiser, 1954...1959.

New York Times, 1953...1962.

Opelika-Auburn (Ala.) Daily News, 1956...1984.

Wall Street Journal, 1959.

### Theses and Dissertations

Rosene, James M. "The History of Radio Broadcasting at Auburn University (1912...1961)." M.A. Thesis, Auburn University, 1968.

Voelcker, Carl F. "Orr of Opelika: John Herbert Orr and Magnetic Recording Tape." M.A. Thesis, Auburn University, 1984.

### Taped Interviews

Ayers, Joseph. Interview by author, 23 June 1989, by telephone.

Hard, Herbert, Jr. Interview by author, 17 April 1989, by telephone.

Lindquist, C. Allen, Jr. Interview by author, 21 June 1989, by telephone.

Orradio Industries, Inc. Employee interviews. Audio Tape Collection. Auburn University Archives, Auburn, Alabama.

Welch, Nathaniel. Interview by author, 25 March 1989, Atlanta, Ga.

\_\_\_\_\_. Interview by author, 4 April 1989, Atlanta, Georgia.

This paper is online at the Audio Engineering Society Historical Committee's site at:

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### The Author

David Lindsay Morton, Jr., son of David Lindsay and Kathryn (Pye) Morton, was born December 17, 1964, in Charlotte, North Carolina. He attended public schools in Cuyahoga County, Ohio, and DeKalb County, Georgia, and graduated from Lakeside High School, Atlanta, in 1983.

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He attended the Georgia Institute of Technology in its History of Technology program and received its first Ph.D. He was hired by the IEEE History Center at Rutgers University in 1995, and continued to work there through 2002.

For a recent complete biography of Dr Morton (education, presentations, publications, employment history, etc), see <http://www.catea.gatech.edu/staff/morton2013.pdf>

2014-07-09