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RADAR RESEARCH SPAWNS A NEW FIRM: THE CASE OF SCIENTIFIC ATLANTA

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Introduction

Ten months after Lockheed arrived in Marietta to start operations in the old Bell Aircraft Corporation factory, a tiny firm was started as a spin-off of military research being conducted at the Georgia Institute of Technology. Scientific Atlanta, Inc. (SA), the first electronics/communications company in Atlanta, was incorporated in October 1951 to provide part-time work for a group of Georgia Tech engineers and physicists. By 1999 it had grown and diversified into a major telecommunications firm with 2,800 employees and annual sales in excess of $1.1 billion. SA can fairly claim to be the premiere Atlanta technology firm, and there have been at least 30 additional technology firms spun off from it. The factors leading to the creation of the firm and its progeny offer important insights into changes in the Atlanta region that took place after World War II and are critical to a historical account of technology-based business in Atlanta. Several factors stimulated these changes:

1. Radar technologies that the new firm focused on developed during World War II, using a new model for federal support of university research in pursuit of national technological supremacy.
2. Georgia Tech, Atlanta's only technological university, won military contracts to investigate new radar applications just after the war, bringing together the group of researchers that founded SA.. At the same time, Georgia Tech put new emphasis on increasing its stature and reputation as a national engineering university through expanded research and graduate degree programs.
3. Drawing on their wartime and post-war experience, such as the Bell Aircraft Corporation plant in Marietta, Atlanta business leaders came to recognize the potential of new technology firms for contributing to regional development. This convinced the region's business leaders to add technology-based businesses to their list of development goals, in contrast to the more traditional strategies of other Southern regions.
4. Glen Robinson, the first General Manager of SA, was an extraordinary entrepreneur who successfully led the company for twenty-five years, recruiting technical talent from within and beyond the region.

Background

Scientific Atlanta incorporated under the name Scientific Associates, originated by seven Georgia Tech employees: Dr. James E. Boyd, Professor in Tech's Physics Department and Head of the Physics Division at the Engineering Experiment Station (EES); Dr. Gerald A. Rosselot, Director of EES and former Associate Professor in the Physics Department; Robert Honer and Vern Widerquist, Research Engineers with EES; Lamar Whittle, Head of the EES electronics laboratory; Glen Robinson, former Tech student and Research Assistant with EES; and Charles Griffin, Business Manager with Tech's Athletic Association[1]. Boyd and Rosselot were technical mentors to Honer, Whittle, Widerquist, and Robinson, and Boyd brought to EES the Navy research contracts on which they were all employed. In starting the firm, the founders believed there were commercial opportunities for devices, such as antennas and electronic test instruments, that the group was building at EES for the military.

All the founders except Glen Robinson chose to work part-time, while keeping their research positions at EES. Robinson, who became the full-time General Manager, was also given a part-time position with EES through Boyd's and Rosselot's efforts. However, within a few months Georgia Tech administrators discouraged him and the other EES researchers from working at both EES and SA, so Robinson resigned his part-time research job. Within two years of SA's start-up, only Robinson (as General Manager) and Boyd (as a member of the Board of Directors) remained involved in the firm, having bought out all other co-founders.[2]

Although the new firm was modestly capitalized with $100 from each of the seven founders and a short-term note for $3,000 from a local bank that Charlie Griffin personally endorsed, Robinson "did anything he could to bring in money" for the first couple of years of operation. For example, using experience with nuclear instrumentation he acquired at Oak Ridge National Laboratory during 1950-52, Robinson serviced radiology equipment at local hospitals. However, SA's business plan called for securing contracts to build antennae and Robinson worked half-time on developing new orders. Within a couple of years, Robinson found there was more value added in designing and manufacturing test instruments for the antennae SA was building for radar and communications, systems and these instruments became the firm's strategic focus. In the third year of operation SA realized a profit of $41,000 on revenues of _______, and it remained profitable for the next 25 years by selling services and products to military and commercial customers.[3]

The establishment and growth of Scientific Atlanta resulted from an expansive research culture at Georgia Tech and elsewhere after World War II. The following sections discuss the origins of this environment and its impact on the Georgia Tech R&D program that spun off the new firm.

<u>Wartime Research as a Stimulus for Technology-Based Firms</u>

Scientific Atlanta was conceived by a group of EES researchers conducting microwave radar research on a Navy contract awarded in 1948. Robinson, Honer, Widerquist and Whittle were working on the contract under the direction of Dr. Boyd, who had secured the contract as an extension of wartime radar research he conducted during 1942-45 as an officer at the Navy's Bureau of Ordnance. The contract funded EES Project No. 124, "Radar Research and Development," the largest project in funds and staff that EES had brought in during its 15-year existence. Boyd hired a number of graduate students and young engineers to help conduct the research, including Robinson, a Physics Masters student who was advised by Boyd; Honer, an Electrical Engineering graduate student who earned an MS in 1951; Widerquist, an Electrical Engineering graduate student who earned an MS in 1948 and began working full-time at EES; and Whittle, a junior engineer working full-time as Head of EES's electronics lab.

Boyd's research experience in the Navy that led to Project 124 was part of a large national radar research program started in 1940. Similar to the rapid changes experienced in the U.S. aircraft industry beginning in 1939, World War II initiated an unprecedented revolution in the development and deployment of radar technologies. In 1939 American policymakers were not planning large scale mobilization for war, hoping instead that the U.S. could avoid direct involvement. However, Franklin Roosevelt lobbied hard for appropriating more funds to build America's inventory of aircraft and ships, and to become a major supplier of materiel to Great Britain. This support of the British, who at the time were desperately fighting off a German offensive, was the genesis of the U.S. radar program. At a time when U.S. investments in research for national air defense were not significant, Americans were approached by British military planners in 1940 to aid in the development of technologies for detecting German bombers and submarines. The resulting R&D alliance led to the creation of the Radiation Laboratory at the Massachusetts Institute of Technology (MIT) in October 1940, tasked to apply newly-developed microwave radar systems to aircraft-to-aircraft detection, aircraft-to-submarine detection, gun targeting, and bomb sighting. As the "Rad Lab" achieved success and America entered the war in December 1941, similar but smaller research groups appeared at other universities, including Harvard, Princeton, Columbia, University of California at Berkeley, and University of Pennsylvania. In addition, the Army and Navy had their own dedicated groups of scientists and engineers working on radar systems. Defense planners allocated relatively large sums to these efforts; before it was disbanded, the annual budget for the Radiation Lab grew to $30 million. In August 1945 the Rad Lab had a workforce of 3,897, of which 1,169 were scientists and engineers, 500 of whom held PhDs. By the end of the war, the Allies had spent $3 billion for microwave radar systems, a technology that was virtually non-existent before 1939.[4]

World War II was a watershed that spurred the development of myriad new technologies. In addition to radar, the conflict accelerated development of numerous military technologies that found new and expanded applications after the war, including:

- Large, long-range aircraft, with pressurized cabins that allowed high altitude flying (e.g., the B-29) evolved into commercial airliners and military transports, such as the C-130. Jet engines developed at the end of the war eventually came to dominate aircraft power plant technology.
- Nuclear weapons research led to development of missiles for delivering warheads, nuclear-powered submarines and ships, and commercial nuclear power plants.
- Radar systems proved very successful during the war and, with the advent of the Cold War, the U.S. developed and deployed extensive early warning systems to alert the military of incoming bombers and missiles. Non-military technologies evolving from the WW II radar work included radio and radar astronomy, improved mainframe and mini-computers, the transistor, nuclear magnetic resonance, and microwave ovens.

Those exploring these technological frontiers included mostly civilian scientists working at technical universities who were mobilized by some of the leading research administrators of the time - Dr. Vannevar Bush, President of the Carnegie Institute, Dr. James B. Conant, President of Harvard, Dr. Karl T. Compton, President of MIT, and Dr. Frank B. Jewett, Director of Bell Labs. Bush, who served as Chair of the National Advisory Committee for Aeronautics (NACA) from 1939-1940, was an adept Washington lobbyist for the concept of mobilizing civilian science for the war. As a researcher working on submarine detection during World War I, Bush had witnessed firsthand the problems arising from military control of war-time technology development and he had a vision of unfettered civilian science making great contributions. Enlisting the support of Conant, Compton and Jewett, he persuaded Franklin Roosevelt that a new civilian science group to advise the White House was needed and FDR created the National Defense Research Committee (NDRC) in June 1940.

The NDRC was modeled after the NACA, which had existed as a Presidential advisory committee since Congress established it in 1915. By 1939, NACA had grown into the nation's leading fundamental research organization.[5] Bush sensed that intensive American technology R&D would be necessary to counter the German war machine; and he was confident that mobilizing scientists and research assistants from national universities was the best policy to pursue. Within a year of the NDRC's creation, Bush became convinced that the advisory group's limited ad hoc mission was insufficient to the mobilization task. Thus, he went back to FDR to expand the NDRC charter. The result was the creation of the Office of Scientific Research and Development (OSRD), a civilian agency within the Executive Branch with a life span explicitly limited to the duration of the war.. Bush served as Chair first of the NDRC and then the OSRD, and under his leadership these agencies created a new level of university involvement in R&D for national defense, a model still used today.. For example, the NDRC created the Radiation Lab in October 1940 in response to a request from the besieged British to help design more effective radar systems.[6]

During the years the NDRC and the OSRD existed (1940-1946), these agencies awarded contracts totaling $450 million, spread over thousands of projects and many American universities. Holding to the mode first established by the NACA and in recognition of its limited life, OSRD did not hire staff for its R&D work, but instead made extensive use of contracts with specific performance requirements. Still, there was a limit to the scope of an R&D effort OSRD could undertake. The program that produced the world's first atom bomb began in 1939 with FDR's creation of the ad hoc Uranium Committee, which became part of OSRD in 1941. In 1943, recognizing that its top secret security requirements and large-scale organization could not be managed effectively by OSRD, Bush transferred the atomic weapons program to the Army's Manhattan Project. As a result, the nuclear research program remained separate from other national science programs after the war, retaining a largely military influence.[7]

The OSRD looked to the nation's technical universities to conduct and administer war-related R&D. For example, MIT, which received more OSRD funds than any other U.S. university, had a sponsored research budget of almost $40 million during the last year of the war - more than 10 times the university's total operating budget for the year 1938-1939.[8] The wartime science agency also linked the contracts it awarded to the momentary policy goals developed by military and Executive Branch planners, so that it became a mission-oriented organization with multiple missions. The largest of these missions was effective use of radar and the post-war impact of this OSRD program was enormous.

Research efforts directed and funded by the Army and Navy complemented the OSRD research program. The highest ranks still desired the World War I model of military-controlled technological research and these programs co-existed, sometimes in a strained relation, with the more free-wheeling civilian efforts. The Naval Research Laboratory was permanently established after WW I once the wartime Naval Consulting Board ceased operations, and other departments, such as the Bureaus of Ordnance in both the Navy and Army, also conducted classified research throughout World War II. For example, a junior officer in the Research and Development Division of the Navy's Bureau of Ordnance recruited Albert Einstein during the war to work on the mechanism of torpedo detonation, a consulting assignment for which he was paid $25/day.[9]

In 1945 the Radiation Lab began publishing a series of technical reports that codified the 5+ years of intensive research done at the facility. McGraw-Hill eventually published the series in 27 volumes and an index, and this work represented an extraordinary legacy of first-rate research for U.S. businesses that wanted either to participate in the Cold War boom in defense contracting or to commercialize new products, such as the Radarrange microwave oven commercialized by Raytheon in 1946.[10] Equally important was the contracting model OSRD used to get mission-oriented, agency-directed research from universities.

Crucially, in 1945 Vannevar Bush and a group of close advisors published the seminal policy report, *Science: the Endless Frontier*, at the request of President Roosevelt. The report reflected Bush's opinion that the OSRD model should be extended to develop post-war national science. It represented a powerful argument for continuation and expansion of a central federal agency that would support R&D at American universities to retain the America's wartime technological primacy. At the same time, the military also bought into the model of contract research at universities, so that the first new science agency to be formally established after the war was the Office of Naval Research, followed by a number of other permanent, mission-oriented R&D labs within the services.

The U.S. created an enduring program of civilian R&D based on federal agencies engaging university faculty and students to help win the war. Wartime successes led to a technology-driven military that recognized the value of both basic and applied research; a growing industrial sector that specialized in developing and manufacturing technologies for the military and later for NASA; and universities that built research capabilities around the new-found federal funding. In addition, the cumulative technological knowledge created by the intensive wartime research through both domestic efforts and those impounded from the defeated enemies, represented a rich resource from which to build new enterprises. All of these outcomes influenced the founding of Scientific Atlanta.

Post-war Emergence of Research at Georgia Tech

In 1940, when the NDRC decided to create the Radiation Laboratory at MIT, Georgia Tech was no doubt far from consideration for this large mission-oriented R&D facility. As Vannevar Bush lobbied Roosevelt for a civilian R&D program that relied on the nation's leading technical universities, he assumed that universities already having strong Ph.D. programs would lead the effort; Georgia Tech was not among these schools. As the state's only public engineering college, Tech had a reputation as a practical undergraduate school with a good football team, and its administration did not place a high priority on expanded research. A 1942 report on Tech's overall effectiveness as an engineering school noted it was funded at only about half of what comparable engineering schools received to grant engineering degrees. The same report suggested that inadequate funding resulted in an underpaid and overworked faculty, as well as presenting a barrier to first-rate research and graduate programs.[11] Lack of state funding was a long-standing problem at Georgia Tech, and President Marion Brittain spent a great deal of time during his 22-year tenure (1922-1944) lobbying for the state for more public support. In 1942, Tech offered only a few Masters degrees each year, and its first Ph.D. was not conferred until 1950, a situation typical among Southern universities. Using Ph.D. production in fields related to technology development as a measure of R&D activity, Table 1 shows that southern technical schools were decades behind other U.S. technical universities before, during and after the war.

TABLE 1

Ph.D. DEGREES CONFERRED BY LEADING TECHNICAL UNIVERSITIES COMPARED WITH SELECTED SOUTHERN TECHNICAL UNIVERSITIES
(Includes Ph.D.s Awarded in Engineering, Mathematics, Physics, Chemistry, & Geo-Sciences)
Source: National Research Council Publication 1142, *Doctorate Production in U.S. Universities 1920-1962*

	1920-29	***1930-39***	***1940-49***	***1950-59***
Massachusetts Institute of Technology	131	401	694	1521
U. of California - Berkeley	183	289	346	1049
Purdue University	1	80	320	872
University of Michigan	151	411	328	826
Columbia University	269	384	403	785
Harvard University	143	298	381	771
Ohio State University	137	328	377	748
Stanford University	65	127	174	580
Cornell University	204	321	326	576
Yale University	169	273	284	576
California Institute of Technology	81	253	237	563
Princeton University	122	213	256	513
University of Florida	0	14	12	169
University of Tennessee	0	1	8	141
Georgia Institute of Technology	0	0	0	66
Virginia Polytechnical Institute	0	0	9	66
Florida State University	0	0	0	52
University of Alabama	0	0	0	23
University of South Carolina	0	0	0	7
Auburn University	0	0	0	6
Texas Technological College	0	0	0	6
Clemson University	0	0	0	0

Before the war, a small group of faculty worked to establish a formal research program on the Georgia Tech campus. During the depths of the Depression in 1934, student enrollment at Georgia Tech declined significantly. With fewer students matriculating and state funds difficult to find, Georgia Tech embarked on a mission to increase its quality as an engineering school, as well as its financial support, by seeking state-supported and contract research. The Engineering Experiment Station (EES) originated as a new campus organization that would facilitate faculty research on July 1, 1934 with a state appropriation of $6,000.

Although the Georgia legislature had designated Tech as the “State Engineering Experiment Station” in 1919 in anticipation of federal funding for engineering research, the school received no funds to start operations until the 1934 appropriation. The impetus for creating an R&D center at Georgia Tech came from a small group of faculty known as the Research Club. Members of the Research Club were also members of Sigma Xi, the national scientific honorary society. Starting in 1929 they met monthly to present papers and discuss research-related topics. The Club conducted an investigation of engineering experiment stations at other universities in 1931 and the resulting report was the basis for Georgia Tech’s administration to seek state funding for starting EES.

At the outset, EES was intended to support faculty who wanted to conduct research on a part-time basis, in addition to their full-time teaching responsibilities. Consistent with the model of engineering experiment stations at land grant universities, the research emphasis was on assisting Georgia’s indigenous industries -textile manufacturing, food processing, wood and paper products. The School of Aeronautical Engineering, owned a wind tunnel, a unique research facility acquired in the mid-1930s with support from the Guggenheim Fund for the Promotion of Aeronautics, and this was used for several state-funded investigations before the war. However, research funding at Georgia Tech during the 1930s was modest, with the majority of support contributed by Georgia’s University System. In 1941 the total EES research budget was $61,000, of which $31,700 came from state funds, while in the same year MIT’s Radiation Lab was funded for $455,000 from the NDRC.

During the war, EES received two war-related research contracts from OSRD for electronic amplifier development, directed by EES Director Dr. Gerald Rosselot. Total research funding in fiscal year 1945 was $236,792 ($83,000 from the state) and for fiscal year 1946 $240,000 ($80,000 from the state). In contrast, leading technical universities received substantial research funding during the war: MIT received $117 million, California Institute of Technology received $83 million, and Harvard and Columbia about $30 million each.[12]

Before and during the war Georgia Tech offered a limited R&D capability to OSRD and the military for several reasons. Few faculty at the school were capable of conducting research and teaching at the graduate level. During his tenure, President Brittain expected faculty to carry a heavy teaching load which allowed little time to develop or conduct research. This situation was due in large part to an inadequate operating budget that resulted in an overworked, underpaid faculty. The lack of funds also made it difficult for Tech to attract faculty with established research credentials. Recognizing this situation, the national Sigma Xi Executive Committee declined to charter a chapter of the honorary engineering fraternity at Georgia Tech until 1953, despite efforts of faculty who were Sigma Xi members.[13]

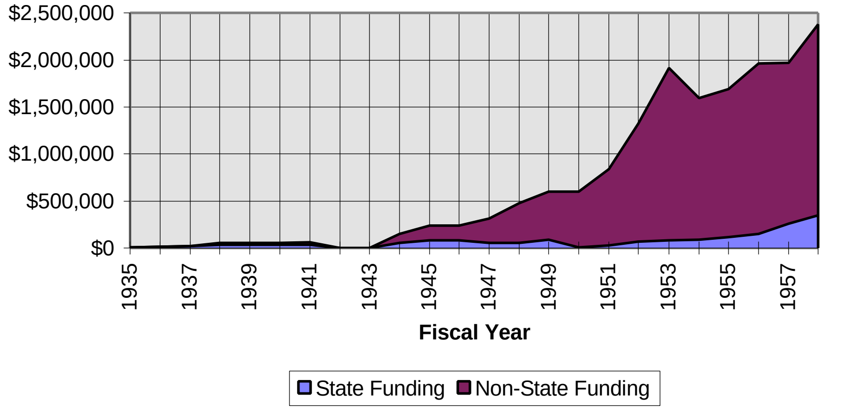
Another reason for Tech's low level of research was the lack of a strong program of graduate studies. Until 1944, when Blake Van Leer was named Georgia Tech's President, the administration had not stressed Tech's joining the ranks of more heralded engineering schools. Van Leer brought a new emphasis on improving Georgia Tech's national stature. He had a thorough understanding of what constituted an outstanding American engineering university, having earned degrees from Purdue and University of California at Berkeley, served as Assistant Secretary of the American Engineering Council, and been Dean of Engineering at the University of Florida and North Carolina State University. As Van Leer continued to confront the Georgia legislature over the lack of funding, he emphasized the need to improve and expand graduate studies and research on the campus. In a May 1946 address to the American Society for Engineering Education, Van Leer touted the value of university research in the South for economic development of the region, a powerful point to take to the Georgia legislature when asking for funds.[14] Van Leer lobbied government and business for funds for new faculty who could lead expanded research and graduate programs. Finally, in April 1946, the Regents of the University System approved Georgia Tech's first offerings of courses leading to a doctorate in engineering.[15]

Van Leer also lobbied for state and business funding to build new research facilities on campus, including:

- In 1946 $100,000 for a new AC Network Calculator, a large electronic network modeling system donated to Tech by Georgia Power Company, the local electric utility. The Regents of Georgia's University System budgeted funds for a building to house the system.
- In 1946 construction of a specialized facility to conduct testing and research on ordnance.
- In 1951 expansion of the Hinman Research Building, which housed EES operations.
- In 1956 the Rich Foundation, associated with the local Rich's department store, donated $85,000 to equip a new computer center that opened in December 1956.
- In 1955 nuclear engineering was an enticing new opportunity and Van Leer created a committee to investigate siting a research nuclear reactor on campus. A 1957 state grant of $2.5 million, combined with a $750,000 NSF grant, yielded the Neely Nuclear Research Center, completed in 1963.

As a result of Van Leer's campaign to raise Georgia Tech's stature through graduate studies and research, and the post-war increase of federal R&D funding, EES had the support and opportunity to greatly increase its research programs. Figure 1 shows that total EES budget increased dramatically after 1946 and that new contracts and grants were the primary reason for the increase. By 1957-58, EES income from contracts and grants exceeded $2,000,000 for the first time.

FIGURE 1.
Ga. Tech Engineering Experiment Station Operating Budget



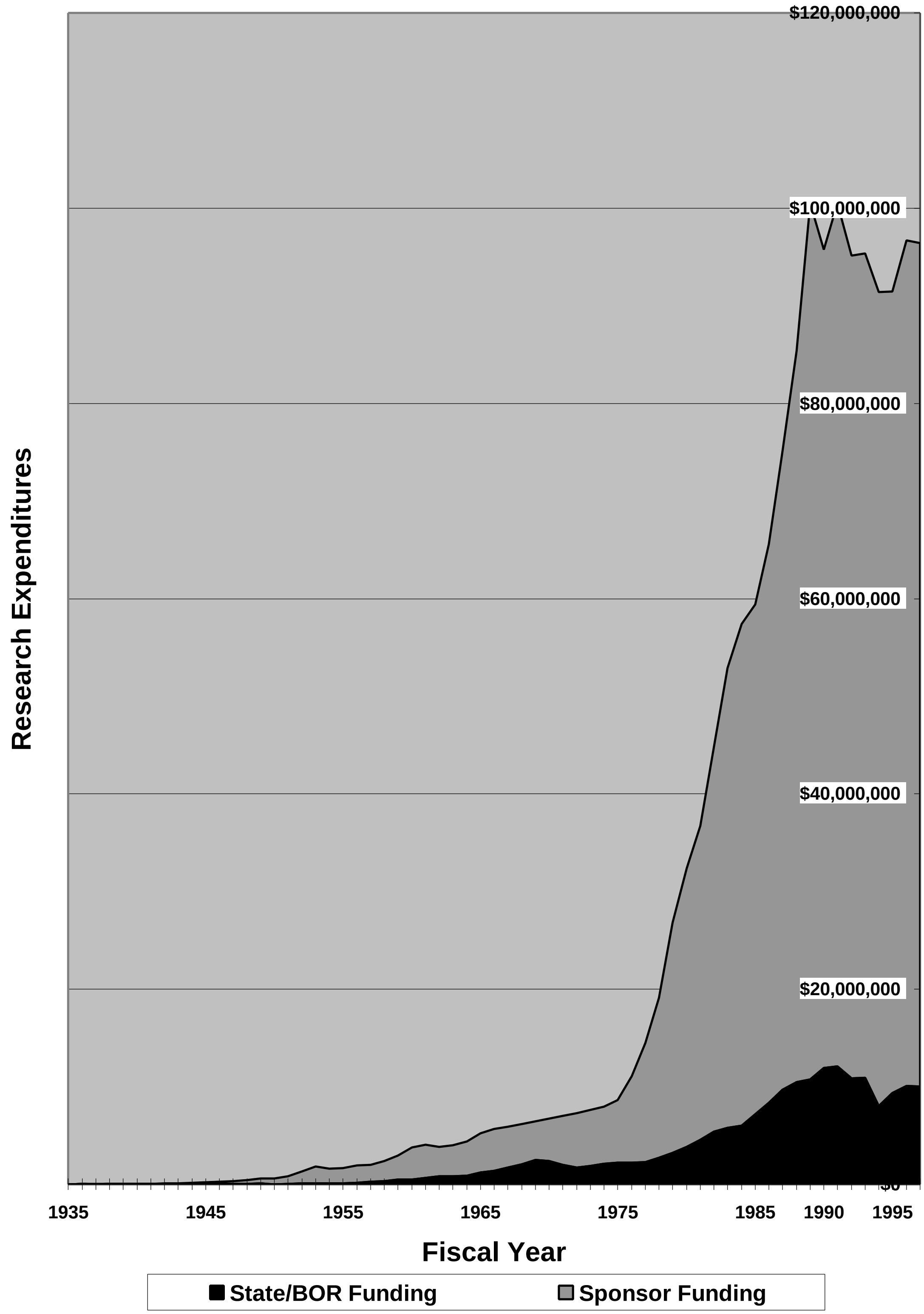
The massive wartime research programs conducted by OSRD and the military not only generated a legacy of scientific and engineering knowledge, but also produced a group of scientists and engineers with unprecedented research experience. As Georgia Tech sought new faculty who could lead it to new levels of accomplishment, it would benefit from this pool of Ph.D.s who had served R&D apprenticeships during the war. For example, Dr. Waldemar Zeigler was an Atlanta native who earned a degree in Chemical Engineering at Georgia Tech in 1927. He subsequently secured a Ph.D. at Johns Hopkins and served on the faculty there until 1944, when he joined the staff of the Manhattan Project. In 1946, he joined the Chemical Engineering faculty at Tech and immediately brought to EES an Office of Naval Research contract for investigating superconductivity at very low temperatures.[16] In 1948, the School of Chemical Engineering recruited Dr. Joseph DallaValle, a Harvard Ph.D. who brought twenty years of R&D experience with industry and federal agencies. Both Zeigler and DallaValle ultimately achieved the distinguished rank of Regents Professor in recognition of their contributions to graduate studies and research. The Chemical Engineering department, created in 1941, was the first on campus to award doctorate degrees due to the progressive leadership of Dr. Jesse Mason, the school's first Director , and Dr. Paul Weber, who succeeded Mason in 1948 when Mason became Dean of Engineering. Weber had served as Associate Director of EES under Gerald Rosselot (1941-48), and throughout his later career as a prominent academic administrator he lobbied for close ties between EES and the academic faculty.

Another Tech department that contributed significantly to the post-war growth of research was Physics, which became the School of Physics in 1946 when it started offering undergraduate degrees. Two faculty members in Physics, Dr. Gerald Rosselot and Dr. James Boyd, became the senior co-founders of Scientific Atlanta. Rosselot, hired as an Assistant Professor in Physics in 1934, arrived just as EES started operations. In 1940 he was named Associate Director of EES and a year later he became Director, a full-time appointment he held until 1952 when he left Tech for a job with industry. Rosselot brought the two OSRD projects to campus in 1942 and 1944 and during his administration, EES transformed itself from a research organization focused on solving technical problems for Georgia's industries to one focused on conducting R&D sponsored by the U.S. Department of Defense. Ultimately, Rosselot became a controversial figure on campus. Although he retained an appointment on the Physics faculty, a number of faculty and administrators came to believe that he operated the research organization with too much independence from the academic regime. This controversy came to a head in the fall of 1952 when Rosselot was forced to resign, ostensibly for a bookkeeping impropriety, but at least in part because of his association with the fledgling Scientific Atlanta.[17] Although he was President of SA when he left Tech, Rosselot sold his interest in the new firm and took the position of Vice President for Research and Engineering at the Bendix Corporation.

A faculty member who played a more influential role with SA was James Emory Boyd, a co-founder who remained on the firm's Board of Directors for 25 years. Born in the small town of Tignall, Georgia in 1906, Boyd earned a BA in Mathematics at the nearby University of Georgia in 1927. The following year he completed a Masters in Mathematics from Duke University and returned to the University of Georgia as a Physics instructor until 1930, when he entered Yale and earned a Ph.D. in Physics in 1933. Boyd returned to Georgia and taught at the small West Georgia College for two years before joining the faculty of Georgia Tech's Physics Department in 1935. Except for serving in the Navy from 1942-46, Boyd taught physics full-time until 1950, when he shifted to full time research at EES, becoming Head of the new Physical Sciences Division. After a term as EES Associate Director (1954-57), Boyd rose to Director during 1957-61, a period of unprecedented growth in contract research. In 1961 he left Tech to assume the Presidency of West Georgia College, where he had taught earlier and remained there for ten years. In 1971, shortly before retiring, he returned to Tech as Acting President and dealt with a major controversy on campus when a number of academic faculty were calling for EES to be absorbed into the academic departments. EES was countering this threat to its independence by suggesting that it spin off from Georgia Tech, much as Stanford Research Institute separated from Stanford University in 1970. Boyd, with his intimate knowledge of EES and his wisdom as a college president, was able to quell the most extreme elements of the controversy until Dr. Joseph Pettit arrived as President in 1972. Pettit had been Dean of Engineering at Stanford and he quickly made clear that the separation of EES from Tech would not happen. He subsequently reorganized research administration on the campus and by the mid-1970s EES was embarking on a period of tremendous growth in contract research that achieved an annual funding level of $100 million in 1989, as indicated in Figure 2.

Boyd was not alone on the Tech faculty in winning new military R&D contracts, his unique Navy connections and radar experience enabled him to bring in relatively large contracts that required a team of researchers and support staff to perform. In contrast to research conducted by individual faculty members acting as principal investigators who employ a few graduate students, Boyd created a new model for research during the five year period from 1946 until SA's 1951 founding, and in the process created a new workforce of graduate students and junior engineers who served radar technology apprenticeships under Boyd's leadership.

Figure 2.
EES FUNDING HISTORY



The Role of Research Leaders

Jim Boyd played a critical role in setting the stage for the creation of SA after he returned from the war in 1946. Before the war, Boyd had taught undergraduate physics to engineering students and had been a member of Tech's Research Club, while conducting a small research project in photoelasticity of material for the EES. When he entered the Navy in 1942, he was assigned as an officer to the research division of the Navy's Bureau of Ordnance. Although Boyd had not even heard of radar until just before he joined the Navy, he was soon doing investigations of shipboard radar systems. One of the technical problems he worked on was the use of radar to detect shell splashes and use this information to determine the range and direction of the shell's trajectory. Boyd apparently impressed the Navy because within a year of his return to the Georgia Tech faculty, he secured a contract from the Bureau of Ordnance to continue his investigations of radar detection of shell splashes.

As did other new and returning faculty, Boyd brought to EES a keen awareness of the model for military-funded contract research at universities. As soon as he was back on campus he won a contract from the Air Materiel Command entitled "Propagation Studies of Electromagnetic Waves" a fundamental investigation that led to additional EES contracts with this sponsor, such as a large project to build a device to track missiles in 1950.[18] Both Boyd and EES benefited from Boyd's four years of Navy research and the dramatic post-war increase of military research contracts with American universities. Although Boyd was not alone on the Tech faculty in winning new military R&D contracts,

While Boyd chose to focus his post-war efforts on EES research, his understanding of leading technical universities' (e.g., MIT) roles in radar research provided a perspective that helped the Physics Department quickly become a degree-granting school after 1946. President Van Leer's goal of improving Tech's graduate programs were fortuitous; as one of Boyd's prized students, Glen Robinson earned a Bachelors in Physics in 1948, the first year the degree was conferred, and a Master of Science in Physics in 1950, the first year that degree was conferred. Starting in 1946, Boyd developed and taught new graduate physics courses until 1950, when he stopped teaching to work full-time in EES.

Jim Boyd was a southern counterpart to more celebrated personalities at better known universities. For example, Frederick Terman, a California native who attended Stanford University as an undergraduate, received a Ph.D. at MIT in 1924, and joined the faculty of Stanford in 1926. Using MIT as a benchmark, Terman established what became a respected graduate program in radio electronics at Stanford and during the war he served as Director of the OSRD-funded Radio Research Laboratory at Harvard. Stanford, like Georgia Tech, did not attain a leading role in wartime university research programs. When Terman returned to Stanford in 1946 as Dean of Engineering, he immediately began to build a military-funded research program. As Stanford's program grew, Terman encouraged graduate students and young engineers to spin off new businesses based on the University's electronics programs, and he is widely acknowledged as the instigator of the Silicon Valley enclave of high-technology firms.

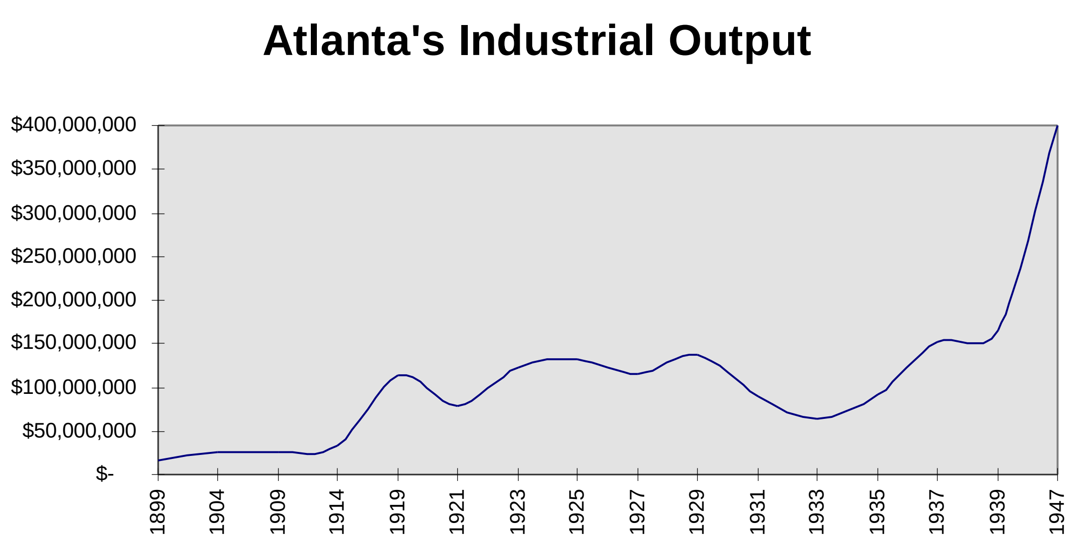
While Boyd's legacy is not nearly as prominent as Terman's at Stanford, his influence, through research and graduate programs, on the creation of Scientific Atlanta was analogous to Terman's mentoring the start-up of numerous California electronics firms. Although having opportunities to join more prestigious technical universities, both men chose to focus their talents on their home states that were rife with opportunities for growth of technical universities.

Thus, after the war Georgia Tech saw a new growth on campus of research based on technologies developed during the war and graduate programs started by Blake Van Leer, who wanted Tech to gain greater national recognition as an engineering school. Returning faculty, such as James Boyd, together with new faculty, such as Waldemar Zeigler and Joseph DallaValle used experience gained as members of national research programs to help achieve Van Leer's goals. A related Van Leer initiative in 1948 involved changing Tech's name from "Georgia School of Technology" to "Georgia Institute of Technology," in recognition that the Massachusetts Institute of Technology had proven during the war to be kind of engineering university to which Van Leer wanted Georgia Tech to grow.

Atlanta's Business Environment

Just as World War II had transformed Georgia Tech's research program, so had it transformed the Atlanta region. Figure 3 shows the impact of the war on the City of Atlanta's industrial activity. After 1946 the Atlanta region embarked on an unprecedented period of growth that has continued through 1998.

FIGURE 3.



Born as a railroad town, the city continued to focus on transportation and distribution after 1945. Mayor William B. Hartsfield, elected in 1936 on a government reform platform, led Atlanta until 1962[19] as a progressive who constantly promoted Atlanta to prospective businesses. In 1925, while serving as an Atlanta alderman, Hartsfield urged the City to lease and then, in 1930, buy land that was formerly an auto racetrack south of Atlanta to develop a municipal airport. By 1940 the airport was the nation's third busiest and in 1941 Atlanta's leading boosters promoted it as a good choice for a military air base (see preceding chapter).

Figure 4. Atlanta Municipal Airport - 1929

During and after the war, Mayor Hartsfield sought to improve on the city's standing as a regional aviation center that would attract new businesses. Hartsfield personally designed a new air terminal that opened in 1948, built frugally using donated war surplus materials.[20] In 1999, Atlanta's Hartsfield International Airport is deemed to be the nation's busiest, handling over 70 million passengers during the previous year and having an estimated total economic impact of more than $15 billion.[21] In the post-war period, the airport became an institutional symbol of Atlanta's progressive "New South" attitude of hospitality and business growth.

While Atlanta billed itself as a progressive region to prospective businesses, Georgia and the rest of the South were starting a painful, decades-long transformation from a political economy based on racial segregation to one based on legislatively mandated equal opportunity. In 1946, the Supreme Court struck down the whites-only primary elections in Georgia, resulting in a dramatic rise in the number of black registered voters in Atlanta. Hartsfield understood the ramifications of increased black voting strength and actively sought political support from this newly empowered constituency. Mayor Hartsfield and his successor, Ivan Allen, Jr. (served as mayor 1962-70), led coalitions of Atlanta business leaders to recruit new business from outside the region by touting the city as one that was "too busy to hate."[22] While vestiges of racial inequality are still evident in Atlanta, the region has adapted to racial change more readily than other Southern regions because economic growth is paramount to traditions that impede it. In 1973, Maynard Jackson was elected as Atlanta's first black mayor and he and succeeding African-American mayors (Andrew Young, Bill Campbell) have continued to promote Atlanta as a progressive region that welcomes new business and economic activities, such as the 1996 Olympics.

The wartime recruitment of the Bell Aircraft operation to Marietta (preceding chapter) and the subsequent recruitment of Lockheed are good examples of Atlanta's boosterism that were characteristic of many large Southern cities in the post-war era. However, a focus on technology-based business was not usually part of the recruitment formula, rather attracting service industries (real estate, banking, insurance) or large scale manufacturing operations were the norm. In Atlanta, however, Georgia Tech was a regular partner in the post-war coalition that sought new growth opportunities. Beginning in the late 1930s, Georgia Tech economists regularly contributed strategic economic research to business organizations, such as the Atlanta Chamber of Commerce. In 1955, the Industrial Development Branch of EES was formed in recognition of an expanding need for economic research for Atlanta and other Georgia communities/regions. Tech was a valued partner to economic development agencies and statewide utilities, such as the Georgia Power Company. These organizations viewed Tech as a public economic development agency that could provide expertise in emerging technologies through both faculty and graduates, such as transportation design for new interstate highways; aerospace engineering support for Lockheed and its progeny; progressive architecture for the downtown business district; and nuclear engineering for new electric generating plants. The university's administration and faculty were receptive to this role and viewed Atlanta's progress as an appropriate

As Georgia Tech worked with the region's economic planners, business leaders lobbied for the school to upgrade its research facilities in order to join the ranks of leading technical universities. Frank H. Neely, a Mechanical Engineering graduate of Tech, became a prominent industrial manager in Atlanta, serving first at Fulton Bag and Cotton Mills and then at Rich's department store for a number of years. As a volunteer leader of the Chamber of Commerce's Bureau of Industry, Neely played a prominent role in recruiting the Bell Aircraft plant to Marietta and later in convincing Lockheed to use the plant for their operations. However, Neely's regional leadership was most evident in his role as Chairman of the Board of Directors of the Atlanta Federal Reserve Bank from 1938 to 1953. As Chairman, he was responsible for establishing an economic research department at the Atlanta Fed and using the resulting studies to guide the Bank's policies.[23] Neely placed Georgia Tech in a prominent role as a regional institution that could help guide Atlanta to a technological future. His efforts helped secure business funding for a computer center on campus and for the nuclear reactor complex, which was named for him.

Economic research conducted by the Chamber of Commerce, the regional Federal Reserve Bank, and Georgia Tech during the late 1930s provided business leaders a comparative look at Atlanta's industrial economy, highlighting the region's shortcomings relative to other national regions. A finding that Tech's President Van Leer emphasized was that industrial research and development in the South was lagging far behind other U.S. regions before the war.[24] When the Army drafted Bell Aircraft to operate the giant new aircraft factory in Marietta in 1942, the firm continued to conduct its R&D at its corporate headquarters in Buffalo, New York. Not until Lockheed-Georgia moved the production line for the C-130 to Marietta in 1953 did they start a substantial research group. Technological research at regional universities never approached the level of nationally-renowned engineering schools until some years after the war. Recognizing these deficiencies, Atlanta business leaders supported Van Leer in his quest to improve research and graduate studies at Georgia Tech, fostering the technical and economic environment that spawned Scientific Atlanta.

Glen Robinson Leads Growth of Scientific Atlanta

Once SA was founded, the individual most responsible for its success was Glen Parmlee Robinson. Robinson was born in 1923 in Crescent City, Florida and his family moved to Valdosta, Georgia in 1937. Glen learned entrepreneurship from his father, who earned a living in the north Florida/south Georgia gum naval stores business in a number of capacities. Gum naval stores is a venerable southern industry that dates to the sixteenth century. Pine rosin is extracted from trees by manual collection and processed as a chemical feedstock to produce turpentine and related products. Robinson's father operated warehouses to store and sell rosin and turpentine products, and sold supplies and tools for harvesting rosin to pine tree farmers. As a teenager, Glen's father encouraged him to start and manage a small machine shop where he fabricated metal tools and rosin collection dollies to sell to the local industry. With his father's encouragement, Glen entered Georgia Tech in the fall of 1942 to study chemical engineering. Within a few months, he enlisted in the Navy Signal Corps as a technician responsible for installing telephone systems on re-captured Pacific islands. In 1946 he returned to his studies at Georgia Tech, but decided to change his major to Physics, which had begun a Bachelor of Science program the same year. As an undergraduate student he met Jim Boyd who convinced him to pursue an MS in Physics after earning his BS degree in 1948. Boyd hired Robinson as a graduate research assistant to work half-time in EES on the new radar contracts Boyd was responsible for bringing to Tech. Robinson earned a Master of Science in Physics in 1950, writing a radar-related thesis titled "Microwave Propagation in Water" for which Boyd served as advisor. Robinson wanted to pursue a doctoral degree, but Tech didn't offer a Ph.D. in Physics at the time, so he arranged to go to Oak Ridge National Laboratory, where he took courses towards a Ph.D. and conducted research in nuclear physics using the federal high voltage accelerator.

As a student, Glen continued to show an entrepreneurial bent; as an undergraduate he started a radio repair shop and employed some of his fraternity brothers. Glen relates that, when the first Atlanta television broadcast was made by WSB-TV in 1948, he rigged a receiver and used an oscilloscope screen to fashion a crude television set at his fraternity house. While he was at Oak Ridge, his father encouraged him to invest in a new franchise opportunity, a Dairy Queen ice cream drive-in (his father had opened a franchise in Valdosta), and Glen managed a new operation for a number of months in 1951.[25]

In 1950, Boyd brought to EES a Navy contract for building a missile-tracking radar system and Robinson was responsible for working with the EES machine shop to fabricate an antenna.[26] Work at the shop was backed up and the system of setting priorities for fabrication jobs put the radar work at the end of the queue. Having to wait for machine shop work at EES is what Robinson suggests germinated the idea for starting a business to do that type of fabrication work. While he and other young engineers were dealing with delays in their radar projects, they speculated there was an opportunity for entrepreneurs to support contracts, such as those at EES.

In 1951, two young EES engineers, Robert Honer and Vern Widerquist, and the Head of EES' electronics laboaratory, Lamar Whittle, who were working on Jim Boyd's projects approached him with the idea of starting a business to build electronic equipment based on their radar development work. The contract research for the military called for fabrication of radar antennae, transmitters and receivers, as well as test instrumentation to monitor system performance. Boyd liked the idea of starting a business, and he recruited Gerald Rosselot, the Director of EES and Charlie Griffin, then the Business Manager for the Georgia Tech Athletic Association (Griffin died in 1953). The six co-founders incorporated the firm under the name Scientific Associates in October 1951, expecting to keep their Georgia Tech jobs and run the new firm working nights and weekends. After securing a contract in August 1952 to build an antenna system for Yale University, which had Navy contracts similar to those at EES, the engineers found they needed more help. Boyd suggested they approach Robinson, who was at Oak Ridge, and see if he would agree to join the venture as the only full-time employee, with the title of General Manager. Boyd recruited Robinson to return to Atlanta to work with them, promising him a part-time EES job, as well. To capitalize the new firm, each of the co-founders contributed $100, and Charlie Griffin signed a personal note from Trust Company of Georgia for $3,000.

Robinson set up shop in leased warehouse space in downtown Atlanta and "did anything he could that would bring in money" the first year he ran the firm. Within a few months of working at both SA and EES, Tech's administration forced Robinson to resign his EES position, citing a conflict of interest. Needing to generate some income to "put bread on the table" Glen used experience from his work at Oak Ridge to service and calibrate electronic and X-ray equipment for local hospitals. In addition to this work and the Yale contract, Glen had to spend almost half his time trying to develop new contracts. In 1953, a mid-west firm also named Scientific Associates threatened to sue the fledgling Atlanta company for use of the name, and SA changed its name to Scientific Atlanta. Two years later, SA's radar and communications antenna contracts made it necessary to acquire an antenna pattern recorder to measure antenna performance. The only recorder on the market was priced at $10,000 and, lacking capital, SA decided to build an instrument instead of buying one. SA produced an instrument that outperformed the competition and sold at half the price, and they soon had several orders from customers such as Convair Aircraft and American Machine and Foundry Company.[27]

By the time the SA pattern recorder was being marketed, Robinson and Boyd were the only founders still involved with the business - Robinson as President, and Boyd, who still worked full-time at EES, was a Director. The ownership stake of the other co-founders had been bought out by other employees, starting what became a healthy local market for SA stock. Dr. Gerald Rosselot, the first President of the firm, had left EES and Georgia in November of 1952 to become Vice President at the Bendix Corporation, a major defense contractor. Robinson replaced him as President. Charlie Griffin declined to renew his personal endorsement when the $3,000 note came due, so Robinson went to another local bank and secured a loan for $5,000 operating capital there. According to Robinson, the principals who were still working at Tech expected salaries the firm could not afford in its early days, precipitating their buyouts. In addition, Georgia Tech administrators were not happy with EES employees working for the new firm and, as with Robinson, encouraged the founders who remained with EES to divest themselves of affiliation with SA.

Meanwhile, Robinson stayed busy seeking new business. A 1963 article recounts how Robinson personally delivered a newly developed antenna pattern recorder to a customer in Connecticut using his own station wagon. Along the way he stopped at ten prospective customers, including Westinghouse, General Electric and RCA. As a result of his hands-on demonstration of SA equipment, all ten firms placed orders.[28]

Through SA's early sales, Robinson determined the value-added in manufacturing instruments was greater than that for building antennae, and he adopted a growth strategy that focused on specialty instruments for a rapidly growing market. The wartime development of radar and subsequent start of the Cold War created tremendous demand for new radar and microwave communications systems, the niche market to which SA was selling. The threat of bombers and ballistic missiles carrying nuclear warheads from the Soviet Union resulted in military planners designing an extensive national radar warning system. The U.S. developed its own missile capabilities and radar systems were built to track test-fired missiles at new installations, such as the Redstone Arsenal in Huntsville, Alabama. Commercial uses of radar included a national air traffic control system and Instrument Landing Systems at major airports. These systems were all designed and built by a myriad of large defense contractors and smaller subcontractors, such as SA, that provided specialized products and services. . When satellites were put into earth orbit in the late 1950s and early 1960s, new communications systems that needed earth stations created new markets for SA, and the space program of the 60s further expanded opportunities to sell instruments and design services.

SA had thirteen employees in 1955 and thirty-two by 1957. The company added floor space and formal business procedures as the need arose, and Robinson became a very progressive manager who met frequently with employees and offered generous benefits, including stock purchase programs.[29] However, recruiting new engineers and technicians the SA instrument line required was difficult in the early years. Robinson recounts how he would have to go outside the Atlanta region to find technical prospects and then had a difficult time convincing them to move to Atlanta. The reluctance was based on the region having essentially no other technical firms, in the event the SA job didn't last. Lockheed-Georgia was the only other technology-based firm in Atlanta and SA lost a number of technical workers to the aircraft plant. In some cases the employees would come back to SA because they considered the much smaller firm to have a more pleasant work environment.[30] Although SA was an AFL-CIO organizing target after 1962, the IBEW union was voted down six times over the next 21 years.

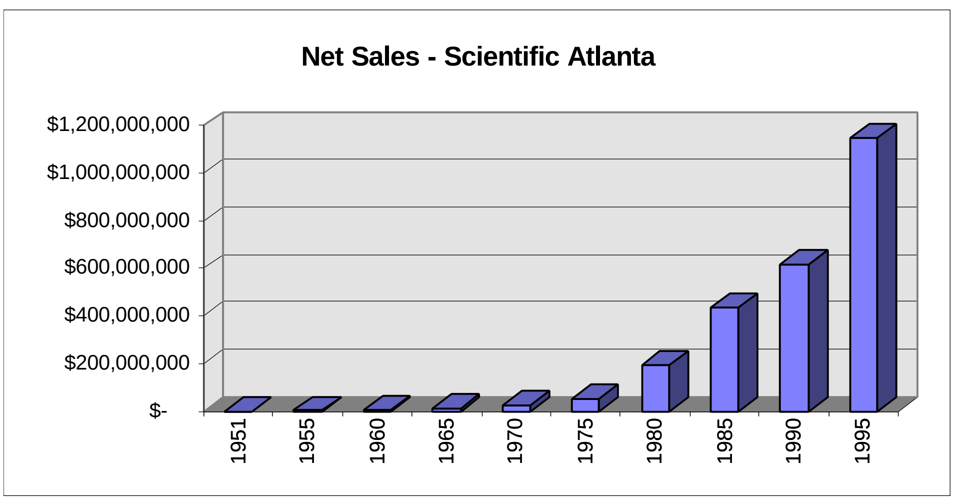
SA recruited engineers from Georgia Tech and its two-year engineering affiliate school, Southern School of Technology. In the 1950s, Robinson was seeking experienced engineers who could contribute to the fast-growing firm right away. The enclave of EES engineers who worked on military radar and electronics projects were ideally suited for SA, and some were recruited. However, the Georgia Tech administration during that period came to view SA as a threat to their workforce and SA recruiters became unwelcome on campus. Robinson, who has served on the EES Advisory Board and the Board of the Georgia Tech Research Corporation for a number of years, is much more welcome on campus today than he was 40 years ago when he was struggling to make SA successful.

By the early 1960s, the growth of SA's primary military radar/communications market tapered off, but the space program brought new business opportunities for tracking radar and satellite communications. In the mid-1960s the firm decided to diversify into commercial markets and started manufacturing electronic equipment cabinets and consoles, POLYCO blow molded plastic containers, and automated food packaging equipment. In a critical strategic move in 1966, the firm started manufacturing antennae systems for the infant cable TV industry.. Several years later, the firm sold its POLYCO product line and introduced a new line of pre-amplifiers and solid state receiver products for the cable television, and a new line of security monitors and equipment for commercial markets. The entry into the cable television market proved to be an excellent decision and SA became one of the few major suppliers that could provide a full-line of equipment to the fast-growing industry.

After fifteen years of operation SA had proved to be a well-managed firm whose products were well-placed for future growth, and there was a growing business in trading the firm's stock. In 1968 SA made a token public offering of stock in order to have its common stock listed on the American Exchange. At the time the stock was eligible for the American Exchange, the New York Exchange approached SA about listing with them. Prior to that the stock sales had been handled by SA manager/owners and a local stockbroker, Robinson-Humphrey, had signed on to handle transactions and the several stock splits that occurred.

In 1971 Glen Robinson was elected Chairman of the Board and Sid Topol was brought in as President. Topol was another product of the World War II technology revolution; he had served as an Army communications officer and had attended the Radar School taught at MIT in 1944-45. He came to SA from Raytheon, a defense contractor that had built radar systems during the war and was a major recipient of military contracts after the war. Topol led the firm on a tremendous growth spurt, fueled mainly by sales of its cable television products, while its military/aerospace sales were de-emphasized. (see Figure 4)

FIGURE 4.



In 1973 SA pioneered the use of hybrid satellite/cable television delivery, using its expertise in earth station technology and demonstrated the system via a live hookup together with an exciting new start-up firm, Home Box Office (HBO). In 1975, on the heels of a successful HBO broadcast of the Ali-Frazier fight, Atlantan Ted Turner called

SA and ordered an SA system that eventually grew into Turner's Super Station satellite broadcast television station.[31]

After twenty-five years with SA, Robinson found his position as Chairman of the firm didn't give him the satisfaction of SA's early days, when he could provide hands-on management for a small firm while being involved with technology. In 1977, both Glen Robinson and Jim Boyd retired from SA and by that time the firm had grown to one employing 2,000, with annual revenues of nearly $100 million. Under Robinson's leadership SA had been profitable since 1955, and had consistently experienced annual growth rates of nearly 25%. Topol succeeded Robinson as Chairman.

Upon leaving SA, Robinson took with him the small Solar Energy Division, a venture started to develop commercial solar energy technologies. In the late 1970s alternative energy systems seemed to be a hot market and he set about the task of starting another successful firm, E-Tech, Inc. With E-Tech, Robinson showed the same determination to find a market niche and manufacture products for it that had made SA successful in its early years. He recruited Georgia Tech faculty to join him in the 1980 start-up and they developed an electric heat pump water heater that was sold in residential and commercial markets. Robinson provided the capital for the new firm and it lost money for several years before he engineered a merger with another heat pump manufacturer in south Georgia that resulted in a new firm, CrispAire Corporation. In 1997, CrispAire merged with a division of Coleman Products and Robinson was bought out. In 1989, Robinson started another technology firm, Laser Atlanta, and in 1999 he remains Chairman and principal owner of the firm, as well as a spin-off, LaserCraft.

Conclusions

The 1951 start-up of Scientific Atlanta resulted from a confluence of institutional and economic forces, and individual efforts, including:

- As a New South initiative in the 1880s, Atlanta business leaders created a new technological college, the Georgia School of Technology, to help industrialize the region.
- In 1934, Georgia Tech created the Engineering Experiment Station to encourage faculty research. Ten years later, Blake Van Leer became Tech's president and set the university on a course of improvement in graduate programs and research.
- World War II technology development programs created new post-war opportunities for universities to conduct research under contract to federal agencies. These same national programs trained a cadre of scientists and engineers, such as Dr. James Boyd, who returned to their university positions with new research insights and a thorough understanding of the new model for federal R&D support.
- Atlanta's post-war business community launched progressive programs to recruit technology-based firms to the region, informed by economic research that demonstrated the value of such firms. Georgia Tech was the recipient of several business sector initiatives to boost its research capabilities, such as the AC Network Calculator (1947), the Rich Computer Center (1956), and the Neely Nuclear Reactor (1957).
- At Georgia Tech, Dr. James Boyd mentored graduate students and young engineers who became early entrepreneurs and started new technology-based firms. The most

prominent example was Glen Robinson, the physicist who boot-strapped Scientific Atlanta in the early 1950s, led its growth for 25 years, and left to start several other technology firms.

That these factors existed in the Atlanta region, one essentially devoid of high tech firms prior to 1950, offers insights relevant to other regions.

Endnotes

[1] The Athletic Association is a separate non-profit corporation that manages Georgia Tech sports programs.
[2] Author's interview on 2/26/99 with Glen Robinson.
[3] *Ibid.*
[4] Buderi, Robert, *The Invention That Changed the World*, p. 248.
[5] Holley, Irving, *Buying Aircraft: Materiel Procurement for the Army Air Forces*, p. 23.
[6] U.S. Congress, report from House Committee on Science and Technology, " A History of Science Policy in the United States, 1940-1985," pp. 15-19.
[7] *Ibid.*
[8] John Burchard, *Q.E.D., M.I.T. in World War II*, p. 8.
[9] Shapley and Roy, *Lost at the Frontier*, p. 13.
[10] Buderi, Chapter 11.
[11] McMath, Robert, et al, *Engineering the New South: Georgia Tech 1885-1985*, pp188-190.
[12] Leslie, Stuart, *The Cold War and American Science: the Military-Industrial-Academic Complex at MIT and Stanford*, p. 6.
[13] McMath, et al, pp. 257-258.
[14] EES quarterly report, "The Research Engineer" Vol 1, No.1, p. 2-3.
[15] McMath, et al, p. 231.
[16] Waldemar Zeigler personality file, Georgia Tech Archives.
[17] Interview with Dr. James Boyd, 2/20/84 by Drs. Gus Giebelhaus and Bob McMath.
[18] EES Project 162, "Bomb Scoring Device," sponsored by Air Materiel Command and co-directed by James Boyd and Robert Honer.
[19] Hartsfield was defeated in 1940 by Roy LeCraw, who vacated the Mayor's office in early 1942 to serve in the military; otherwise Hartsfield served continuously for 25 years.
[20] Martin, Harold, *Atlanta and Environs, Volume 3,* p. 138.
[21] William B. Hartsfield International Airport web sit, http://www.atlanta-airport.com/6frame.html
[22] Bayor, Ronald, *Race and the Shaping of Twentieth-Century Atlanta*, pp. 15-52.
[23] Gamble, Richard, *A History of the Federal Reserve Bank of Atlanta, 1914-1975*, pp. 74-78.
[24] Transcript of Van Leer speech, "Research and the Southeast" in May 1946 issue of EES publication "Research Engineer."
[25] Interview with Glen Robinson on 2/26/99.
[26] EES Project 162, "Bomb Scoring Device " funded by the Air Materiel Command was co-directed by Jim Boyd and Robert Honer
[27] "Scientific Atlanta: The Early Years", pamphlet published for SA Founders Day, 11/7/95.
[28] *Georgia Magazine*, December 1963-January 1964 issue, p. 25.
[29] "SA: The Early Years" pamphlet, pp. 4-5.
[30] Interview with Robinson on 2/26/99.
[31] "SA: The Early Years," pp. 8-11.