Huntsville Historical Review

Volume 42 | Number 1 Article 3

4-1-2017

A Technical Perspective of Greater Huntsville's First 150 Years, Part II

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A Technical Perspective of Greater Huntsville's First 150 Years

By Raymond C. Watson, Jr.

A book, *Huntsville's Technological Evolution* (Trafford 2015) by the author of this article, provides a technical history of Greater Huntsville from 1800 to the present. While the primary intent in preparing the book was to document detailed coupling of technical activities throughout the years, the first two chapters are more of a general history nature. This article abbreviates the information of these chapters, perhaps making it of interest to a broader readership.

The article is in two Parts covering 1800-1890 and 1890-1950; Part I also has information on the native Indian land. Several notes are included, indicating technological advancements as of the present time. Sources and references, if desired, may be found in the parent book.

The Fall/Winter Issue of the Review; Volume 41 Number 1 addressed the origins and maturing of the technical advances in the Greater Huntsville area through the Spanish American War. This issue Mr. Watson tells the rest of the story.

PART II – MANUFACTURING ERA

This Part is composed of two periods: textile manufacturing and munitions manufacturing. In the 40-years from the start of the 1890s into the 1930s, Huntsville was a city with its economy almost completely dependent upon cotton manufacturing – mills that turned cotton lint into cotton thread and goods. With the start of the Great Depression, textile manufacturing entered a major decline, but started to recover as the nation prepared for another

war. Going into the 1940s, there was a rapid and drastic change to manufacturing chemical munitions; this essentially stopped with the ending of WWII in 1945.

TEXTILE PERIOD

Cotton mills – spinning thread and cloth from ginned cotton – came to America in Massachusetts during 1814. Cabannes, noted earlier, added a spinning mill at his Barren Fork gin site in 1819; it gradually expanded and was renamed the Bell Factory in 1832. This is considered the first full cotton mill in Alabama; powered by water, it had 2,323 spindles and 52 looms. However, it closed before the area became highly involved in textile manufacturing.

Textile Manufacturing

From medieval times, homes had spinning wheels where wool, cotton, flax, and silk fibers were spun into spools of yarn; a loom was then used in weaving the yarn into fabric. In 1673, the flying shuttle was invented in Great Britain, leading to automated weaving looms. The next year, a multi-spool spinning frame was invented, making it possible to simultaneously produce many spools of yarn. These inventions were quickly incorporated into large cotton mills concentrated in Manchester, England.

The textile manufacturing technologies were closely held in Great Britain. Nevertheless, Francis Cabot Lowell, visited the Manchester cotton mills and brought to America details of the equipment and operations. Opened in 1814, the Boston Manufacturing Company at Waltham, Massachusetts, was the first in the Nation in which all operations for converting cotton lint into finished cloth could be performed in one building. The firm also manufactured and sold spinning and weaving equipment for use in other mills.

Prior to 1890, little attention was given to the manufacturing of cotton fabric in the Southern states. The first cotton mill in Alabama – the Bell Factory – started operating near Huntsville in 1832; it initially used slave labor and was unable to adjust to post-war labor conditions, finally closing in 1885. At about this time, investors began to recognize the potential cost benefit of having cotton mills near the cotton farms. As an example, the comparative costs in Madison County of delivering a bale of cotton from the gin to the mill were as follows: $0.50 to a local mill, $3.00 to a northern mill, and $5.00 to $7.50 to a foreign mill.

Tracy Pratt

Tracy W. Pratt (1861-1928) had a recognized influence on the early industrialization of Greater Huntsville. He built and operated the relatively small West Huntsville Cotton Mills, but envisioned the area as a major textile center and had a significant role in making this happen. Following a pattern found over much of the South, this started with outside investors establishing a number of large cotton mills. After this, the city's economy was greatly dependent upon the price of cotton, and so was the economy of Madison County and the cotton farmers.

In the latter part of the 1800s and early 1900s, a number of cotton mills opened in Huntsville. Although some had different names over the years, the largest were best known as Dallas, Lincoln, Merrimack, and Lowe. Smaller cotton mills included Huntsville Cotton Mill, Huntsville Spinning Company, West Huntsville Cotton Mills, Admiral Braid Mill, Huntsville Knitting, and Erwin Manufacturing. The larger mills were all on property outside the city limits. All of these mills initially used steam power, but converted to electrical in the early 1920s.

The advent of cotton mills made a radical change in Greater Huntsville's work organization. For the first time, large numbers of workers – mainly women – were used in industrial tasks, necessitating a hierarchy of supervisors and managers. Although the equipment involved was built elsewhere, it required engineers and mechanics for plant layout and hardware maintenance. Unfortunately, the census records do not show these as occupations, but the cotton mills initiated the local need for technical and managerial specialists.

Inside a Cotton Mill

Operating the spindles and looms was reserved for White workers; these were often impoverished sharecroppers and tenant farmers who had abandoned worn-out farms for the hope of steady employment in the mills. Entire families worked in the mills, and children were expected to work; employees, who were often called "lint heads," sometimes included children as young as 8 years and working up to 12 hours a day. The State Law required children to attend school eight weeks a year; mills often interpreted this to be satisfied by two hours of school a day. Starting in 1908, Madison County required the mills to obtain an affidavit permitting employment of children between 12 and 17 years.

Although always in the top growers of cotton, Alabama was never better than about fifth in the nation for cotton fabric manufacturers. The best year was 1916, with about 70 cotton mills employing around 16,000 operators.

Petroleum Exploration

Little is known about it, but some serious petroleum exploration took place in the Huntsville area during this time. There was speculation that since petroleum was under the Appalachian chain of mountains in Pennsylvania, it might be expected beneath the end of this chain in Madison County. In the 1910s, with possible encouragement from the State geologist, industrialist / entrepreneur Tracy W. Pratt drilled about 20 shallow wells around Madison County, including one in West Huntsville. In most of these, traces of natural gas and very small pools of oil were found, but the venture was abandoned.

World War I

World War I (WWI) started as a local conflict, with the Austro-Hungarians invading Serbia in 1914. It shortly became two primary combatants: the Allies, with the United Kingdom, France, and the Russian Empire, and the Central Powers of Germany and Austria-Hungary; many other nations eventually joined both sides. From the start, the German U-boats (submarines) were a major threat to the shipping of supplies to England; then, after the U-boats sank seven U.S. merchant ships, Congress declared war on Germany on 6 April 1917. In July, the drafting of American civilians started and the first U.S. troops were sent to France. After a slow start, the United States was a major participant in the war until an armistice was signed on 11 November 1918.

During the year and one-half of World War I, the United States military built to over 4,700,000 troops, including about 2,800,000 draftees. Almost 95,000 persons from Alabama saw military service during WWI, of whom 6,262 were killed; 19 men from Alabama were awarded the Distinguished Service Medal. (The records do not show the portions of these numbers for servicemen

from Madison County.) The cotton mills in Huntsville went into high production, supplying fabrics for bedding, uniforms, sand bags, and tents. Aside from this fabric production and personnel in the armed services, Greater Huntsville had little direct involvement in WWI.

Strikes and Mill Declines

Wages paid by the Southern mills were low – averaging 38 percent less than that paid in the Northern and Eastern plants; this was one reason for the textile manufacturing to transfer to the South. In 1930, with the start of the Great Depression, mills began a reduction of workers, and remaining employees had to work longer hours to keep production up. In 1933, Congress passed President Franklin Roosevelt's National Industrial Recovery Act, calling for voluntary acceptance of a 40-hour workweek, minimum weekly wage of $12 ($13 in the Northeast), and the elimination of employing persons under age 16.

All of this gave rise to the labor unions in the mills. In a year of intensive organizing, the United Textile Workers of America increased nationwide membership by 270 percent and called for a general strike. On 14 July 1934, a wildcat strike started in Guntersville. This quickly spread to Huntsville where on 16-17 July, an estimated 4,300 workers in six mills went on strike; Lowe had already settled with the union. The movement rolled across the state, and in a few days 20,000 textile workers had walked out. By 15 September, about 400,000 workers nation-wide were involved, making this the largest labor conflict in American history.

The strike brought violence to Huntsville – assaults, shootings, and bombings; carloads of strikers roamed the streets, intimidating anyone who appeared to be going to work; girls who crossed the

picket lines had their hair cut off. On 22 September, national union leaders reached a settlement and the great strike was over. No charges were ever filed concerning the hundreds of acts of lawlessness. The strike, however, was the beginning of the end of Huntsville as Alabama's textile center.

As another war approached, the government made major purchases of fabrics for uniforms and bedding. In December 1941, and the start of World War II, the Huntsville mills were fully loaded with work, but as the end of the war approached, this work slowed, then essentially stopped after the defeat of Germany and Japan. For a few years, the local mills upgraded to compete with those in other parts of the country, but the advantage of cheap labor was largely gone; then the Asian fabric manufacturers took over the market.

Aviation

In the late 1800s, William L. (Will) Quick had a woodworking and machine shop on the bank of Flint River a few miles east of Hazel Green. A creative and inventive person, Quick became interested in flight and started the design of a flying machine fashioned after those of nature. With a book on experimental aerodynamics providing the theoretical basis, Will Quick and his sons began the construction of a powered aircraft in 1900. This was a monoplane having a 38-foot wing span, with the wing covered only on the bottom side (for accepting the aerodynamic lift force). Completion was held up by an unresolved problem: the availability of an engine with sufficient power and light enough to be carried in the craft.

In 1903, the Wright brothers flew an airplane that they had designed and built – the first in America. Quick continued his search for a suitable engine, finally settling on one from a 1907

Ford Model R automobile. This was a four-cylinder, L-head engine producing 18 horsepower.

Will Quick's 16-year old son, William Massey Quick, was selected to make the first test flight; this was done in April 1908 – the first airplane to be flown in Alabama. After becoming about 10-feet airborne and flying near 70 feet, the pilot leaned to the side to see his position and lost control; the craft tipped to the side and came down, destroying the landing gear. The wreckage was returned to the shop and placed in storage; there it remained until it was eventually reconstructed for museum display in 1956.

Thomas Quick, another son of Will Quick, was a leader in developing Huntsville's first air field. Located in the area south of Bob Wallace Street between Whitesburg Drive and the L&N railroad track, the 150-acre Mayfair Flying Field was officially dedicated in June 1931. Three years later it was listed as a commercial field with four dirt runways, the longest being a 2,400-foot northeast-southwest sod strip. Airmail deliveries using this field began in May 1938.

Huntsville's second airport, located about a mile west of the original Mayfair site, opened in 1941. It had two paved runways, the north-south one initially 4,000 feet long. A full terminal and control tower were added in the 1950s, but all operations ended when a new commercial airport opened 10 miles west of the city in 1967. As noted later, a 5,000-foot airstrip was opened by the U.S. Army on Huntsville Arsenal in 1953.

Utilities Updated

Essentially from its formation, Huntsville had utilities earlier and superior to most comparably sized cities. For most of the 19th century, the utilities were primarily to serve homes and small businesses. As Greater Huntsville grew, the utility services were

expanded. With the emergence of large factories, the utilities were further expanded to meet their needs.

Water Utility Updated - Even with the continued demand for water as the 20th century started, Big Spring remained as the sole source. After a severe outbreak of typhoid fever in 1917, Huntsville's first Public Health Officer, Carl A. Grote, Sr., decided that open toilets on the square above the spring were to blame and directed that a sewer line be installed; this, plus a new, efficient chlorinator at the pump station, resulted in a very clean water system.

By 1950, it was evident that the city could no longer depend upon Big Spring for the sole water source. A Water Board was formed to oversee the future development and maintenance of the Huntsville water system. Plans were drawn for accessing the aquifer through wells, and consideration was given to a purification plant for water drawn from the Tennessee River. The wells were accomplished quickly, but the purification plant would wait until the next decade.

Gas Utility Updated - In 1902, the assets and franchise of the Huntsville Gas Light Company were acquired by another private firm, the Huntsville Gas Company; Cyrus S. Sugg was the principal owner. It continued with its facility on Dallas Street, producing manufactured gas through processing coal. By 1913, there were over 12 miles of pipes serving customers in the city.

The local gas company was acquired by Alabama Gas Corporation (Alagasco) in 1946. The old plant for producing manufactured gas was replaced by a facility using liquid propane and air to produce gas for distribution. Propane, a natural petroleum product, is in liquid form when under pressure and is then 270 times more compact. It was shipped to Huntsville in

large tank trucks, then, at the plant, allowed to become gas and mixed with air for distribution.

The city of Huntsville bought the gasworks system from Alagasco in 1950. It was placed under the Huntsville Utilities, and a contract was made with Alabama-Tennessee Natural Gas Company to pipe natural gas into the city, finally closing the local gas production.

Electric Utilities Updated: In 1899, the Huntsville Railway, Light and Power Company (HRLPC) was formed; it acquired the stock and assets of the Huntsville Power Company, and also initiated a streetcar operation. The streetcar system included the cars, about five miles of track, and a central power system consisting of a 200-horsepower steam engine directly connected to a 200-kilowatt DC dynamo that likely had an output of 600 volts. The streetcar system was put into operation in early 1901.

In 1909, the Light & Power Company was formed; still privately held and located in Huntsville, it purchased the stock and assets of the HRPLC and converted the central generators and distribution lines to AC. The new system included a 75-kilowatt, 2,300-volt, 3-phase generator. The DC power for the streetcars continued to be separately provided.

The Alabama Power Company was founded at Gadsden, Alabama, in 1906, with a primary intent of developing a hydro-electric power network. Alabama Power acquired the Huntsville-based Light & Power Company in June 1915. In 1924, Alabama Power constructed the first rural electric power line in Alabama, running it out of Huntsville to Whitesburg. During the years of the Great Depression, small communities throughout Madison County received this utility.

As a major element of President Franklin Roosevelt's New Deal in combating the Great Depression, the Tennessee Valley

Authority (TVA) was established by Congress in 1933. Among many other projects, TVA built dams and hydro-electric generating plants along the Tennessee River, and sold power at low cost to locally owned utilities. As an additional benefit, the building of dams finally opened all of the Tennessee River to boat traffic.

The City of Huntsville purchased the electrical system in Madison County from Alabama Power in July 1940, forming a part of the emerging Huntsville Utilities. A contract was made with TVA wherein electrical power for all of Madison County would be purchased from that agency. At that time, there were 5,810 Huntsville and Madison County consumers connected to about 250 miles of electrical distribution lines.

Commercial Expansion

It was previously noted that a number of commercial industries were started in Greater Huntsville during the latter part of the 19th century. Except for the cotton mills – which boomed and dominated the local economy – few others were such that they continued well into the next century. The Huntsville Chamber of Commerce noted having 65 industries in 1925, most being textiles mills or related firms. By the start of the second half of the 20th century, there were only three textile mills still operating, and all were gone in a few years. Two new industries operating in this period will be described.

John Blue Company - In 1886, the John Blue Company was formed on a farm near Laurinburg, North Carolina, to repair cotton gins and farm equipment. The founder, himself a farmer, was creative and soon had developed a variety of farming implements. In the early 1940s, the foundry in Laurinburg burned, and John Blue, Jr., then the owner, examined sites for moving the full operations. In Huntsville, he found potential workers, available

buildings, and saw the potential for a locally operated farm equipment manufacturer. John Blue Company opened in Huntsville during 1945, with facilities on a large lot at the intersection of Bob Wallace and First Avenue.

Within a few years John Blue was a powerhouse in the city's economic leaders with several hundred employees. Among other products, John Blue made fertilizer spreaders, cotton wagons, and agricultural and industrial pumps. For a while, they had a production line manufacturing a tractor – Model G-1000 painted bright blue – developed by Ervin West and Wesley Cagle, their engineering VP. Eventually, John Blue had branches in five other states; a fleet of trucks and a company plane were indicative of their success.

As Huntsville grew, the original plant moved to the outskirts of nearby Madison in 1986. Stiff competition resulted in downsizing, and the firm eventually became a division of Virginia-based Advanced Systems Technology, but the John Blue operations remained in Madison.

Martin Stamping and Stove Company - In 1905, two Martin brothers opened a cast iron foundry in Sheffield, Alabama. They expanded their business in 1918, acquiring a stove factory in nearby Florence, Alabama. In 1939, the Martins purchased a bankrupt manufacturing plant in Huntsville on West Clinton Street (later Governors Drive); they reopened this as Martin Stamping and Stove Company, initially producing a line of unvented gas heaters. A spur railroad track came directly to the Martin building.

During World War II, all of the Martin facilities manufactured radiant heaters for the Army, and Martin Stamping also made bomb crates and related materials for the Army's Huntsville Munitions Plants. Following the war, the companies returned to manufacturing wood, coal, and gas heaters, and Martin Stamping

added electrical heaters to the Huntsville line. As America grew and more modern homes were built, the market for space heaters declined. In 1974, the various Martin holdings were consolidated into Martin Industries, Inc., with administration, engineering, and marketing centralized in Florence. The plant in Huntsville was eventually closed in 2000.

Civilian Conservation Corps

During the Great Depression, one of the many activities under President Franklin Roosevelt's New Deal was the Civilian Conservation Corps (CCC). Established in 1933 by Congress through the Emergency Conversation Work Act, this put 500,000 men to work on 35 project areas such as forestry, road improvement, and building national parks.

Functioning in a military-like operation, volunteers were assigned to companies of about 200 men each, led by a Captain and two Lieutenants. CCC camps usually had about 20 buildings, but the men often slept in tents. They were paid $30 per month, of which they were required to send about $25 home to a dependent. The first camps opened in late 1933, and all CCC activities ended in mid-1942.

There were 28 CCC camps in Alabama, not all open at the same time; two camps were located in the Huntsville area. Camp Clement, opened in June 1935, was located atop Monte Sano Mountain where they primarily worked on improving the Monte Sano State Park. A stone entrance to the camp still exists at Highland Plaza Street. Camp Silver Dollar, opened in August 1935; it was about 1.5 miles southeast of downtown on Tennessee Street in what is today the Blossomwood area. Men from this camp also worked on the State Park and nearby roads. When Huntsville Arsenal was started in 1941, Camp Silver Dollar was

assigned to assist in its establishment. Clement closed during 1940, and Silver Dollar during 1942.

Agriculture

As the 20th century got underway, Alabama was still primarily an agricultural state, and cotton was still the number one cash crop. In 1909, there were about 3.7 million acres in cotton throughout Alabama, with some 1,130,000 bales produced. In that year, however, boll weevils started invading southeastern Alabama, and ten years later they had infested all cotton-growing regions of the United States, causing the greatest agricultural disaster in American history

Calcium arsenate was the first insecticide available for killing boll weevils. Hand-cranked or mule-drawn blowers were first used to spread calcium arsenate dust; the process was called dusting, and experimental dusting from Army Air Service aircraft showed this method to be effective. In 1924, Curtis Quick (son of Will Quick) modified for dusting a WWI surplus biplane, and started in Huntsville what was possibly the first crop-dusting service in the Nation.

Tractors and other mechanical equipment for farms started to become available following WWI, but it was expensive and few farmers in Madison County could afford this technical advancement. By the late 1930s, tractors began to be used locally, and this was followed by mechanical cotton pickers in the 1940s. A mechanical harvester could pick almost 1,000 pounds of cotton per hour compared with the 15 to 20 pounds per hour by a human. These and other agricultural advancements are reflected in the following official data for Madison County (dates are when the census was taken):

	1929	1949
Number of Farms	7,178	5,004
Total Area in Farms, Acres	387,612	415,332
Percent of County	74	80
Average Farm Size, Acres	54	83
Cotton, Acres	129,800	109,400
Cotton, Bales	41,700	50,800
Cotton Yield (pounds/acre)	154	223
Corn, Acres	62,300	56,400
Soy Beans, Acres	---	5,400

MUNITIONS PERIOD

The second portion of Greater Huntsville's Manufacturing Era, the Munitions Period, primarily concerns the 1940s decade. The Second World War (WWII) dominated the first years of this decade, and brought about some of the most significant political and technological changes in history. Therefore, the activities in the Munitions Period start with a brief description of this event.

World War II

The Second World War started 1 September 1939, with Adolph Hitler's Wehrmacht invading Poland. Great Britain immediately declared war on Germany, but the United States hesitated until after Japan attacked Pearl Harbor on 7 December 1941. Following declaration of war against Japan on 8 December and against Germany and Italy three days later, America became the leader of the Allies (United States, United Kingdom, Soviet Union, and 19 other nations) in a conflict against the Axis powers (Germany, Japan, Italy, and three other nations) that eventually covered much of the world.

An estimated 60 to 85 million people, the majority of them civilians, were killed during WWII, making it, in size, the deadliest conflict in human history. During the war years, 16.1 million Americans served in active military duty; of these 291,557 were killed or missing (1.81 percent) and over twice this number were wounded. The European and Atlantic war ended 8 May 1945 (V-E Day), but the war in the Far East and Pacific continued four more months, ending 2 September 1945 (V-J Day).

Even before the United States' official involvement in the war, Greater Huntsville was already engaged in the development of two huge facilities for the production of chemical munitions: the Huntsville Arsenal and the Redstone Ordnance Plant. Throughout the war years –at times employing as many as 11,000 regular workers – these two facilities were at the heart of Huntsville's wartime involvement. In 1943, the estimated total employment in Greater Huntsville was 30,000; aside from those directly working at the Government munitions plants, essentially no others were involved in this activity – the city had no supporting infrastructure.

The cotton mills were heavily engaged in making cotton material for military uniforms and bedding. Textile workers and management came together to fill orders, and unionization was at a minimum. As of the end of 1944, Dallas had 725 employees, Merrimack had 850, and Lincoln had 1,200. Madison County farmers were tasked with producing as much cotton as possible, as well as grain and meat for supplying the military.

The first war casualty from Madison County was Luther James Isom of West Huntsville; he was killed aboard the battleship USS *Arizona* in the Japanese attack on 7 December 1941. Throughout the war, some 6,000 persons from Madison County served in the military; of these an estimated (using the 1.81 percent national average) 110 were killed or missing. Carl M. Crabtree of

Huntsville was the first person accepted by the local Draft Board when it started in October 1940 (the nation's first peacetime draft); he was killed on Luzon in the Philippine Islands in 1945.

Many from Madison County served with distinction; Cecil H. Bolton and Paul L. Bolden were each awarded the Medal of Honor. Bolden was Madison County's most decorated WWII veteran; an 18-mile stretch of Alabama State Route 53, from Research Park Boulevard in Huntsville to just south of Ardmore, Tennessee, is designated as the "Paul Luther Bolden Memorial Highway" in his honor.

After the Allies retook North Africa and until V-E day in May 1945, about 240,000 German and Italian soldiers were sent to America for internment at some 500 prisoner-of-war (POW) camps. In Alabama, there were 4 primary camps, including one at Fort McClellan near Anniston, and 16 satellite camps. During early 1944, the Army Corps of Engineers (CoE) built a camp on Huntsville Arsenal (one of the munitions facilities described later) as a satellite to Fort McClellan. The camp was initially designed to accommodate 250 German POWs, then increased to 655 by mid-year. The CoE constructed the original camp, but the remainder was completed by POW labor.

Before the war, the Axis had superior military technologies, but the Allies, particularly America, quickly responded, pulling ahead with innovation and production. Two of the most important technologies were radar and the atomic bomb – it is often said that radar won the war and the atomic bomb won the peace. Huntsville and Madison County, however, had no role in these technological advancements.

Munitions Production

Following the First World War and the devastation caused by both sides using chemical weapons (primarily mustard gas), the Geneva Protocol prohibited the first-use of such weapons, but not their manufacture or in-kind retaliation. Recognizing that potential adversaries were continuing with research and production in this field, the United States also continued; the Army's Chemical Warfare Service (CWS) was the responsible unit. Edgewood Arsenal in New Jersey was the only existing source, and, as another major war loomed closer, a second source was needed. The CWS dated from 1918, as did the Edgewood Arsenal.

In early 1941, a national search was started for an inland location for a second arsenal. James Center, industrial agent for the Nashville, Chattanooga and Saint Louis (NC&StL) railroad in Nashville, was contacted about available land with existing rail and water transportation, and on 8 June he brought Lt. Col. Charles E. Loucks and a civilian civil engineer to Huntsville. They first visited an area just south of the Tennessee River, but found it too hilly; they then visited the flat farmland immediately southwest of the city. Following their visit, the search team said that the site adjacent to Huntsville was a perfect location for the new arsenal. James Center must be credited with initiating the activity that so drastically changed the future of Greater Huntsville.

Loucks filed a report to Maj. Gen. William N. Porter, Chief of CWS, recommending this location. In a few days, Porter and Col. Paul X. English from Edgewood Arsenal personally reviewed the Huntsville location. Other locations that had been surveyed and were being considered were Florence and Tuscaloosa, Alabama; Kansas City and St. Louis, Missouri; Memphis, Tennessee; Toledo, Ohio; El Dorado, Arkansas; and Charleston, West Virginia.

Huntsville Arsenal


EXTRA The Huntsville Times EXTRA

Huntsville Gets Chemical War Plant; Cost Over $40,000,000

Total Expenditure Due To Exceed $47,000,000 For Vast Establishment

On 3 July 1941, the selection of the site for Huntsville Arsenal was announced with headlines in *The Huntsville Times*. The selection was based on four major factors: immediate availability of suitable, low-cost land; availability of a lower-paid, production work force; availability of good rail and river transportation; and availability of a plentiful supply of electric power (from the TVA).

The Huntsville site included 32,244 acres of land just southwest of the city, buffered on the south by land owned by the TVA along the Tennessee River. The primary land was acquired through condemnation, and land-use agreements were made with TVA for an additional 1,200 acres. Existing railroads bordered the north and east edges. There were a number of rural roads; main ones were Martin going east-west and Patton and Rideout, about 2.5 miles apart, going north-south. Most of the land was relatively flat, with an average elevation of near 680 feet. Unusable land included about 10,000 acres of swamps and some 2,800 acres around Ward and Madkin Mountains located near the top of the site.

Displaced were about 6,000 men, women, and children; between 70 and 75 percent Black; comprising up to 1,000 families; and occupying about 550 dwellings. Some of the families were tenant farmers, but many, both Black and White, were landowners who had worked the fertile soil of the region for decades. Farmers

were allowed to continue using their land until all of the existing crops were harvested.

Before the end of July, the War Department awarded a cost-plus-fixed-fee contract to Whitman, Requardt, and Smith of Baltimore, Maryland, for architectural and engineering services for designing the Huntsville Arsenal and Redstone Ordnance Plant facilities (described later). In September, as designs were completed, cost-plus-fixed-fee contracts were awarded to C. G. Kershaw Contracting Company of Birmingham, Alabama; Engineers Limited of San Francisco, California; and the Walter Butler Company of St. Paul, Minnesota, for the construction of buildings.

By early October, about 3,500 construction workers were involved at the facilities; by the end of 1941, this had swelled to near 12,000. A total of 1,016 buildings and structures were eventually built for the Huntsville Arsenal, Redstone Ordnance Plant, and Gulf Chemical Warfare Depot. These were connected by about 66 miles of paved roads, 25 miles of gravel roads, and 75 miles of railroad tracks. At its peak, about 2,000 railroad cars per month would move along the tracks.

Colonel Rollo C. Ditto

The Army Corps of Engineers had the overall responsibility for construction of the two arsenals and the depot. When the Corps of Engineers left in mid-1943, it turned over the largest chemical warfare manufacturing operation in the world. By the end of World War II, the cost of all construction, including land, totaled $63,431,925 – about $857 million in today's dollars.

Colonel Rollo C. Ditto arrived as the first commanding officer of Huntsville Arsenal on 4 August 1941; in early October, he was

promoted to Brigadier General. Ditto had served in the Army since 1907 – first in enlisted status and then as an officer in the CWS starting in 1922.

The recruitment and hiring of operating personnel involved a major initial effort. A cadre of specialists was brought from Edgewood Arsenal, but many professionals and production workers were needed. Recent college chemistry graduate John L. McDaniel was one of those hired in February 1942, with a daily salary of $6.24; when McDaniel retired from the Government almost three decades later, he was the highest ranking civil service employee in the Huntsville area.

The advent of munitions production first brought security in employment to Huntsville. Very few of the potential employees had ever been exposed to secrecy, and no formal process existed for vetting them for their eligibility. Most of the civilian employees were natives of the region – mainly "good old boys" and hard-working women who had always been the backbone of Southern citizenry. Thus, the ordinary personnel managers could easily make a basic determination of their "security" qualification.

Facilities and Products - The first construction centered on roads and railroad tracks; buildings were started in September. Huntsville Arsenal's first production facility was activated in March 1942, just 7 months after Ditto's arrival.

The production plants were in three distinct areas: Plants Area 1, 2, and 3. Areas 1 and 2 were essentially duplicates, based on the concept of one surviving after a major attack. Plants Area 1 was located at the northeast corner of Rideout and Martin Roads, while Plants Area 2 was about 2.5 miles

Incendiary Production

away at the southwest corner of Patton and Martin Roads. These were primarily plants for chemical gas munitions. For community safety, the plants were located near the center of Huntsville Arsenal. Plant Area 3 was on the west side of Patton Road about a mile north of Area 2. Smoke munitions filling, incendiaries, and non-lethal tear-gas munitions, but no actual chemicals, were made at Area 3; the buildings were spread apart because of the explosive nature of their products. Each of the three areas had its own administrative units for engineering, personnel, property, storage, and transportation.

In 1943, a 5,000-ft airstrip and several small supporting buildings were built on the northern portion of the Arsenal, primarily to assist the Army Air Forces in testing incendiary devices in preparation for firebombing Japanese cities. Six Air Forces personnel and two planes – a B-26 and an L-20 – were stationed at the Huntsville Arsenal Airstrip (later named Redstone Airfield).

By May 1944, Huntsville Arsenal's need for production, maintenance, and administrative personnel had accelerated greatly. That month civilian employment at the arsenal reached a WWII peak of about 6,700, divided 63 percent male (52 percent White and 11 percent Black) and 37 percent female (26 percent White and 11 percent Black).

More than eight million pounds of munitions were dropped on Huntsville Arsenal test areas during the war. One test area, on the west side of the Arsenal, was called "Little Tokyo" and had three streets, about 50 small wooden houses and buildings, and a 200-foot structure for proof-testing large bombs; these were totally obliterated by late 1944. There was also a thick, 500-foot-square concrete mat for testing penetration capabilities of dropped bombs.

During the war years, 27 million items of chemical munitions were produced at Huntsville Arsenal. The coveted Army-Navy "E" Award was received four times.

Redstone Ordnance Plant

When the Chemical Warfare Service decided on the Huntsville area for its new arsenal, it was recognized that an ordnance plant in the same general area would be very beneficial. The Chief of Ordnance, Maj. Gen Charles M. Wesson, sent Major Myron Leedy to examine potential sites. Leedy was accompanied by Major Carroll Hudson, who would later command the new plant. Leedy recommended an area about 10 miles south of Huntsville and adjacent to the southeast corner of the Huntsville Arsenal land. This was a rolling, rural terrain, wholly agricultural in nature. There were no interior paved roads, but the NC&StL Railroad had a spur track along part of the eastern border and a main Southern Railroad track was near the top of the area.

On 8 July 1941, the War Department announced that an ordnance facility, designated Redstone Ordnance Plant, would be built on a 4,000-acre tract southeast of, and adjacent to, the chemical munitions arsenal. This was a rolling, rural terrain, wholly agricultural in nature. There were no interior paved roads, but the NC&StL Railroad had a spur track along part of the eastern border and a main Southern Railroad track was near the top of the area.

Carroll Hudson

Major Carroll D. Hudson was named Commanding Office on 25 September 1941; he was promoted to Lt. Colonel in 1942, and then to Colonel in 1944. A graduate of Stanford University in mechanical engineering, Hudson was personally involved in

designing and building the new plant; then throughout the years of operation, he made many valuable engineering contributions.

A few key civilians were sent to Picatinny Arsenal and Charleston Ordnance Depot for intensive operational instruction. It was not until the summer of 1942, however, that a full complement of officers and key civilians was obtained.

Facilities and Products - Huntsville Arsenal would function as a "works" facility, producing basic materials, while the Redstone Ordnance Plant would operate as a "plant" (commonly called LAP – largely assembly-and-pack) making finished munitions.

The Plant initially had four assembly lines; there were also supporting storage and administrative buildings, all completed before the end of 1941. Each assembly line had about 15 buildings distributed on some 25 acres. Lines No. 1 and 2, which were completed first, were similar and both used for the loading of burster tubes – the empty tubes themselves were from private manufacturers. Other Ordnance plants supplied the explosive ingredients – tetryl and TNT; these were mixed to form tetrytol, a very-high powered explosive.

Lines No. 3 and 4 loaded and assembled chemical ammunitions, eventually centering on 81-mm and 105-mm mortar shells. Plans for these lines were suggested by Picatinny Arsenal, but were redesigned by Major Hudson to meet local problems and conditions. Line 3 was built using Hudson's design, and Line 4 used the Picatinny design. Early efficiency testing using the same number of workers showed that Line 3 was 25 percent more productive; thus, Line 4 was modified to the Hudson design. Line 1 started full operations in April, and Line 4 in August.

In the fall of 1942, the plant expanded to have an additional large assembly line (No. 5) for manufacturing chemical projectile shells, soon producing up to 190,000 projectiles per month. Igloo,

warehouse, and magazine areas for the finished products were also greatly expanded. Initial production included the 105-mm M60 white phosphorus (WP) or mustard gas (HS) shells, the 155-mm WP or HS-filled shells, M5 and M6 burster charges, the 100-pound A1 WP bomb, and the 100-pound A47A2 HS bomb. In 1943, production added M4, M8, and M10 burster charges, 115-pound M70 HS bombs, 75-mm WP M64 shells, and 105-mm M84 HC base ejection shells.

Between March 1942 and September 1945, over 42 million units of ammunition were loaded and assembled for shipment at Redstone Arsenal. Demolition blocks for the Corps of Engineers and Airborne Troops were a particular specialty; about 12 million blocks were produced.

Civilian personnel at the beginning of each year were as follows: 1942 - 24; 1943 - 1,906; 1944 - 3,422; 1945 - 4,252, the highest ever. In addition, there was an average of about 25 military personnel each year. From the opening of Redstone Ordnance Plant, many women were employed for the production work; they peaked at 62 percent by September 1945. In March 1944, 2nd Lt. Eleanor B. Wilson became the first Woman's Army Corps (WAC) person assigned to the Arsenal.

Gulf Chemical Warfare Depot

Approximately 7,700 acres in the southern portion of the arsenal along the Tennessee River were intended as a depot site. Initially this was the Storage Division of Huntsville Arsenal. In March 1942, the depot was activated as a separate installation named the Huntsville Chemical Warfare Depot. General Ditto (and successive Huntsville Arsenal Commanders) also served as the Depot Commander, with Capt. William C. Behrenberg as Executive Officer. The Depot had no office buildings; the

headquarters were in the James Cooper House, an old mansion originally built in 1818, and one of the few houses left standing when the arsenal area was cleared.

In August 1942, the name was changed to the Gulf Chemical Warfare Depot. The depot received, stored, and shipped chemical warfare materiel, including bulk chemicals, decontaminating apparatus, and protective materials. It covered nearly twelve square miles and was divided into three principal areas: the toxic gas yard, the munitions branch, and the warehouse area. All were in operation by October 1942.

By early 1943, the Gulf Chemical Warfare Depot consisted of 7 warehouses, 370 igloos, 55 above-ground magazines, several outdoor storage areas, 12 miles of railroad track, and dock facilities on the Tennessee River.

Related Information

There has long been a question as to the origin of the name "Redstone." In 1955, the Army conducted a study concerning the origin. It turned up a Major H. Sachs who said that he was in the Ordnance Department when the Arsenal was being planned, and was asked to give the facility a name. To find more about the location, he consulted Lt. Col. Jack A. Goodwin, who earlier, as a Captain, had led a Huntsville-based CCC Camp that had worked on roads in the area. Goodwin told him, "It was beautiful country with red rocks predominating and was sometimes called the Redstone Area." Sachs then submitted the name Redstone Ordnance Works; this later became Redstone Arsenal.

Redstone Land Areas

Arsenal Casualties - Considering the hazardous products involved at the two arsenals and the depot, it is a testimony to the safety training and practices that there were only eight fatalities in the operations during the war years: seven civilian workers and one Army officer. Easter Posey of Hazel Green was killed on 21 April 1942, in an accidental explosion of an incendiary bomb at Huntsville Arsenal; she is recognized as the first American woman killed in the line of duty during WWII.

In addition to those killed in the munitions plants, three Army Air Forces personnel were killed in a crash of a Martin Marauder B-26 bomber while flight-testing incendiary bombs. On 27 June 1944, the Martin Marauder bomber took off from the Huntsville Arsenal Airstrip with bombs that were to be drop-tested on Little Tokyo. Climbing north, at about 3,000-feet altitude, an engine problem developed. The pilot turned back and dropped one of the 500-pound bombs into a vacant field near the present HudsonAlpha Institute. He again attempted a landing, but crashed into a cotton field just north of the highway near the present Memorial Gardens Cemetery. Killed were 1st Lt. Emmett J. Hale, the pilot; 2nd Lt. Jerome Loeffler, the bombardier; and Tech. Sgt. Antone Valim, the onboard engineer

Missile Precursor - The long-range missile was another technology that came into being during the war; this was essentially developed solely in Germany. Only after the V-1 and V-2 missiles began raining down on England were the Allies aware of the existence of these developments, and the U.S. Army initiated a desperate attempt to replicate the V-1. It was in this that Greater Huntsville had its first and only wartime involvement with missile technology.

When the German V-1 – forerunner of the cruise missile – became known to the Allies, the U.S. Army Air Forces (AAF) and

contractor Republic Aircraft began the development of a similar weapon designated the JB-2 (JB for jet bomb), and commonly called the "Loon." (Earlier, there was a JB-1 "Bat" built by Northrop and using a General Electric J31 engine – the first jet engine produced in the U.S. – but the JB-1 was never successfully flown.) The engine for the JB-2 was reverse-engineered from a pulse-jet found in a downed V-1. The AAF asked the Army's Chemical Warfare Service (CWS) to be responsible for the propellant. In support of this, Huntsville had its first, and only, involvement with missile technology during WWII.

To meet this need of the AAF, CWS turned to Huntsville Arsenal. Between January and September 1945, Huntsville Arsenal conducted investigations of three systems of liquid propellants: hydrogen peroxide-permanganate, fuming nitric acid-aniline, and mononitromethane-catalyst. Called the FRED Project, Major Frederick Bellinger headed the team performing the study. Of special interest was the potential of Huntsville Arsenal manufacturing these propellants. The only reference to this project states that it was successful; otherwise, there is no known documentation concerning details of the activity. The project concluded in September when JB-2 jet-powered missiles were successfully tested at Eglin Field, Florida.

In 1945, no locals would have ever imagined that within five years some of the most capable German scientists and engineers who had developed the V-2 would come to Huntsville and make major contributions to this area becoming a world center for defense and space technologies.

Post War Drawdown

After V-E (Victory in Europe) Day (8 May 1945) shutdown of production at Huntsville and Redstone Arsenals began. Following

V-J (Victory over Japan) Day (2 September 1945), most of the operating buildings and production lines were placed in standby condition, and large quantities of finished products were placed in long-term storage.

At Redstone Arsenal, the reduction in force and readjustment to a standby activity was completed by early 1946; Colonel Carroll Hudson remained the commander until 15 March. The standby organization involved several officers and about 250 civilian employees. Redstone Arsenal was still an official unit under the Ordnance Department at the Pentagon, and major political and commercial efforts were made in searching for government or business tenants for space at both Redstone and Huntsville Arsenals.

There were several attempts to commercialize plants originally associated with chemical munitions manufacturing. These included the Solvay Process Division of Allied Chemical and Dye Corporation, and Stauffer Chemical Company, both leased chlorine manufacturing plants. General Aniline and Film Corporation (GAF), the largest manufacturer of roofing in America, leased the plant making iron carbonyl and continues with this operation on Redstone Arsenal today. Two other commercialization efforts are described:

Keller Automobile Plant - Keller Motors was incorporated on 25 November 1947. The objective was to develop and produce small, inexpensive automobiles and make Huntsville the "Detroit of the South." Central offices of Keller Motors were in downtown Huntsville, and Buildings 471 and 481 (later numbered 4471 and 4481) on Huntsville Arsenal were placed under a 15-year lease for automobile development and production. George D. Keller, formerly vice president of sales for Studebaker, was the president, and Hubert Mitchell, a successful entrepreneur from Hartselle,

Alabama, provided initial financing. John Liefeld, an experienced automotive engineer, led the technical efforts, and Mitchell began the sale of dealer franchises. Some $450,000 was quickly raised and about 65 designers, engineers, and other production personnel were hired by Liefeld. Huntsville native Henry L. Hilson was a lead production engineer.

By early 1949, prototypes for convertible roadsters and 'woodie' station wagons were ready. A $5 million stock issue was approved by the SEC, and half of the stock was quickly sold. On 4 October 1949, a celebration was held in New York; the next morning, 52-year-old Keller was found dead in his hotel bed. An acceptable leader could not be found, and the Keller Motor firm went into history. A total of only 18 Keller convertibles and station wagons had been built. The three remaining Keller vehicles are now valuable items sought by antique automobile collectors.

DDT Manufacturing - In 1947, Benton H. Wilcoxon, a California expert in chemical manufacturing, came to Huntsville and formed Calabama Chemical Company. The firm leased land and facilities on Redstone Arsenal and began manufacturing the insecticide DDT (dichlorodiphenyltrichloroethane).

The manufacturing process resulted in significant amounts of DDT-laden wastewater being released into a reservoir that drained into the Huntsville Spring Branch; this flowed into the Indian Creek and eventually into the Tennessee River near Triana. In 1948, the Calabama operation was acquired by the Olin Mathieson Chemical Company (later known as Olin Corporation), and this firm continued the production of DDT. The production was about 12.500 tons per year. When investigated, the water in Huntsville Spring Branch had DDT as high as 0.3 parts per million. This

resulted in major fish kills, particularly in Indian Creek and the Tennessee River in the vicinity of Triana.

Production of DDT was stopped and the plant was demolished in 1973. From July 1979 to August 1982, the U.S. Army conducted an extensive DDT abatement program. The residents of Triana, along with the Justice Department, filed lawsuits against Olin Corporation. In 1982, an out-of-court settlement resulted in Olin pursuing clean-up operations; these were basically completed by 1987, and were called fully successful in 1995.

Transition of Redstone Arsenal from Chemical Weapons to Guided Missiles

Small rockets using solid fuels had been of interest world-wide for many centuries. In the early 1930s, a number of university students in Berlin formed a *raketenwesen* (rocketry) group, building and launching rockets with liquid fuels. One designated A-1 reached altitudes up to 360 meters (1,200 feet). Werhner von Braun, a 22-year old doctoral student, was a participant. Upon learning of their success with liquid-fueled rockets, the Ordnance Department of the German *Heer* (Army) put the group under contract to do rocket research and development. By 1933, they had a rocket called the A-2 that, with a pressure-fed propellant system burning alcohol and liquid oxygen, attained an altitude of near 2.5 km (1.5 mi). Their rockets were flight tested from Borkum Island in the Baltic Sea.

In 1937, a joint *Heer* and *Luftwaffe* (Air Force) center doing military rocket research and development was established at Peenemünde, a peninsula along the Baltic seacoast; the Berlin activity was transferred there. With von Braun as the leader of the Army activities, rocket A-4 had a range of about 175 km (110 mi) and could carry a payload of 1,000 kg (2,200 lb).

Near the end of 1943, production of A-4s started at the Mittelwerk (General Works) underground factory in central Germany; eventually some 6,000 of these missiles were built, at the cost of an estimated 12,000 forced laborer's lives. Beginning in September 1944, over 3,000 A-4s were launched as military rockets against Allied targets, resulting in 7,250 deaths. The propagation ministry called this missile the *Vergeltungswaffe 2* (Retaliation Weapon 2); hence, the popular designation V-2.

It is noted that the *Vergeltungswaffe 1* (V-1) flying bomb with a pulse-jet engine was also developed at Peenemünde, but by the German *Luftwaffe*; the von Braun team was not directly involved in this effort.

During 1943, the U.S. Army learned the extent of missile weapon developments in Germany, and in September the Rocket Branch was formed in the Technical Division of the Army's Ordnance Department. Although small rockets had always been used by America's military, they in no way competed with artillery weapons. Formation of the Rocket Branch gave recognition to the importance of this technology in augmenting or even extending the existing capabilities of weaponry. Although some missile analysis was done by the initial staff of the Rocket Branch, awareness of German developments spurred the Ordnance Department to enlarge this activity and seek outside assistance.

An operation called the Ordnance Research and Development Division Sub-office (Rocket) was set up at Fort Bliss, a large Army post just north of El Paso, Texas. Also, contracts were awarded to the California Institute of Technology (CIT) and the General Electric Company (GE) for initiating missile research and development for the U.S. Army. Testing was mainly conducted about 30 miles away at White Sands Proving Grounds in New Mexico.

After May 1945 and the close of the war in Europe, the U.S. and the USSR were in great competition to gain the benefits of Germany's weapon developments. As a part of this, about 1,500 key German and other Axis scientists, engineers, and technicians were to be brought to the United States through Project Paperclip to work under one-year contracts. Colonel Holger N. Toftoy, then head of the Ordnance Department's Rocket Branch, arranged for 125 specialists who had developed rockets at Peenemüde to be included. In January 1946, the German team led by Wernher von Braun began arriving at Fort Bliss, Texas, where they became contract employees of the Rocket Sub-office.

By early 1948, activities at Fort Bliss had progressed to a point where the Chief of Ordnance decided to establish a permanent rocket research and development center at a better location. During the summer of 1948, a survey was made of available Ordnance installations, and in early December, the Chief of Ordnance announced that Redstone Arsenal in Huntsville had been selected.

On 1 June 1949, Redstone Arsenal was officially reactivated, and the Chief of Ordnance designated this as the Ordnance Rocket Center. Its mission included research and development of guided rockets and related items. This, then, began a totally new and different era for Huntsville and Madison County.

On 30 June 1949, the Chemical Corps deactivated Huntsville Arsenal and the CoE put it up for sale, but the new operations of Redstone Arsenal needed the land and facilities. On 1 April 1950, the consolidation of the two arsenals was made official; at this time, the Redstone reservation was expanded to include an approximately 10-by 12-mile area, comprising about 40,300 acres. The Ordnance Guided Missile Center (OGMC), a unit of Redstone Arsenal, was officially activated on 15 April 1950. All guided

missile activities at Fort Bliss, including the German team led by Wernher von Braun, would be transferred to OGMC by November.

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Notes:

1. Evolution in Transportation: Leap ahead 200 years. Transportation technology in Greater Huntsville has evolved to the point that people working just a short distance from Ditto's Landing are developing rockets that might someday propel future explorers over 35,000,000 miles to Mars.

2. Evolution in Communications: Today, fiber-optic networks routinely carry digital information between Huntsville and many areas of the world at gigabit rates – 1,000,000,000 electrical impulses per second, sufficient to transmit over 3,000 average-sized (50,000 words) books per second.

3. Evolution in Arms Accuracy: In 1984, Huntsville-based Army and industry engineers conducted an experiment demonstrating the

equivalent of hitting a bullet with a bullet; in this, a missile intercepted a small target at an altitude of over 100 miles and moving with a closing speed of 13,600 miles per hour.

4. Evolution in Cotton Farming: In 2013, as much cotton lint was produced in Madison County as produced there in the year just before the Civil War. Amazingly, this was grown in fields whose total acreage was only seven percent of the acreage in 1860! The yield (pounds per acre) had increased by a factor of about 14 times; technology improvement played a major role.