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**A Social and Political History of the National Radio Astronomy Observatory
at Green Bank, WV**

Lenora G. Kenwolf

**Thesis Submitted to the
Eberly College of Arts & Sciences
at West Virginia University
in partial fulfillment of the requirements
for the degree of**

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in
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Ken Fones-Wolf, PhD.
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Marland, Calvin W. Price, Lloyd V. Berkner, Merle A. Tuve, Amateur Radio
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ABSTRACT

A Social and Political History of the National Radio Astronomy Observatory at Green Bank, West Virginia

Lenora G. Kenwolf

This thesis examines the role of the people of West Virginia in bringing the NRAO to Green Bank, West Virginia. It explores the impact of the space race, big science and the Cold War on a small rural community nestled in the heart of the Appalachian Mountains during the 1950s. There has been very little scholarship done on how local residents and state politicians helped to shape big science. The thesis opens with a brief history of early radio astronomy starting with the work of Karl Jansky and Grote Reber. It discusses the influence of HAM radio on radio astronomy. It also briefly details the arguments between NRAO founders Lloyd Berkner and Merle Tuve about the direction of the NRAO. In addition, it examines U.S. Senator Harley Kilgore's (D - WV) role in the development of the National Science Foundation.

It focuses on the contributions of West Virginia Governor William Marland towards establishing the West Virginia Radio Quiet Zone, which later lead to the National Radio Quiet Zone. This was a unique piece of legislation. This is the only radio quiet zone in the country, not to mention the first in the world. U.S. Representative Harley Staggers (D - WV) played the largest role of any politician in bringing the NRAO to Green Bank. Considerable attention is given to Pocahontas Times editor, Cal Price in convincing the local citizenry to accept the limitations of living in the National Radio Quiet Zone. It also describes the reactions of the local residents to, and the continuing impact of, the NRAO on Green Bank and Pocahontas County, West Virginia.

Dedicated in loving memory to:

Dr. Otis K. Rice

1919-2003

West Virginia's first Historian Laureate

Teacher, mentor, friend

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Lenora Kenwolf

Chapter 1: Introduction

In 1955, Green Bank, West Virginia was just another sleepy, little Appalachian town no different than any other farming hamlet across the mountains except for one thing --- It was completely cut off from radio signals. Little did its residents know that one day, a huge bowl that picked up signals from space would catapult this quiet little West Virginia town into the space race, forever leaving its mark in history. Out of twenty-nine locations across the eastern seaboard, only Green Bank was the perfect spot for the National Radio Astronomy Observatory.

In 1990, West Virginia University doctoral candidate Benjamin Malphrus wrote his dissertation on the history of radio astronomy and the NRAO facility at Green Bank. This dissertation is an excellent scientific study of radio astronomy and the facility's history as far as the scientists and the science are concerned. However, it totally ignored the input and contributions of West Virginia politicians, both national and local, local newspapers, the West Virginia State Geologist Office, and West Virginia residents in the establishment of the NSF and the NRAO at Green Bank.

In fact, it appears there has been no research done on the influence of local residents or government on any radio telescope facility in the United States or Great Britain. In the case of Jodrell Banks, it is located on property previously owned by the University of Manchester. Unlike the NRAO in Green Bank, the support of local residents was not required for the university to build this facility. In addition, the Socorro, New Mexico site is actually located fifty miles outside of the town of Socorro in the middle of the desert.¹

¹ *Very Large Array (VLA)/Expanded Very Large Array (EVLA)*, <http://www.nrao.edu/index.php/about/facilities/vlaevla> (accessed 17 January 2010).

This thesis covers a short history of early radio astronomy, including a brief history of Senator Harley Kilgore's role as the "father" of the National Science Foundation. It explores how and why Green Bank was selected for a radio astronomy facility. It also delves into a short discourse on how Associated Universities Incorporated was selected to manage the NRAO over West Virginia University, NSF President Dr. Alan Waterman's first choice. In addition, it establishes the existing economic situation in the second district, which encompasses Pocahontas County, and what people hoped the NRAO would bring in terms of economic prosperity and increased tourism.

This thesis seeks to explore the contributions of West Virginians in bringing the NRAO to the state and provides biographical information on some of the key players. It argues that the contributions of West Virginians were considerable and critical in all levels of selection, construction and operation of this facility. Finally, this thesis defines West Virginia's role and contributions to the space race and the impact of the Cold War and the Cold War experience on local residents. Previous research on the Cold War and the space race tend to emphasize aspects other than the impact of either on local communities.

“There can be no thought of finishing, for “aiming for the stars,” both literally and figuratively, is a problem to occupy generations, so that no matter how much progress one makes, there is always the thrill of just the beginning.”

--Robert Goddard, 1932, in a letter to his hero, H.G. Wells

Chapter 2: A Brief History of Early Radio Astronomy

Radio astronomy is “the science of radio waves in space, for gathering data - concerning outer space.”¹ All heavenly bodies generate a relatively constant radio frequency signal. Astronomers can determine health, distance and many other facts about a star, or other heavenly body, by studying these transmissions. Before the invention of the Hubble Space Telescope, radio telescopes could “see” further than any known traditional optical telescopes.

In 1932, while working for Bell Laboratories, Karl Jansky discovered that stars created radio waves.² His assignment was to learn what types of radio noise interfered with Bell’s new transatlantic telephone, find ways to eliminate it, and thus increase the clarity of telephone conversations. In the process, he discovered that unwanted radio noise originated from three sources: local and distant thunderstorms and a steady directional signal whose origins were unknown.³

Jansky discovered a strange phenomenon. After a few months of studying this signal, he discovered that the signal did not repeat every 24 hours, but every 23 hours and 56 minutes. This had previously been determined to be a “characteristic of the fixed

¹ *The Pocket Webster School and Office Dictionary* (New York: Pocket Books, 1990), 587.

² Bell Laboratories was reluctant to hire Jansky due to his chronic health problems. His brother, C. M., who had worked for Bell Labs ten years previously, was able to convince the company to hire Jansky in spite of his health problems. C. M. Jansky. *Cosmic Search Magazine*. <http://www.bigear.org/vol1no4/jansky.htm> (accessed 9 January 2010).

³ Benjamin Malphrus, “The History of Radio Astronomy and the National Radio Observatory: Evolution Towards Big Science” (Dissertation, Educational School, West Virginia University, 1990), 39-40.

stars, and other objects far from our solar system.”⁴ Radio signals from the sun recycle every twenty-four hours. The strongest of these signals was generated from the constellation Sagittarius, in the center of the Milky Way galaxy.⁵ Unlike the short and long distance thunderstorms, these extra-solar signals did not interfere with telephone communications. Jansky wanted to continue his research into extra-solar radio signals, but Bell Labs was reluctant to finance continued research in this area and he was reassigned to another project.⁶

Although he wrote three papers on the topic, Jansky’s work was largely ignored for several years, seen by many as a mere curiosity.⁷ He would not live to see the importance of his discovery, dying in 1950. The radio astronomy community recognized his contributions to the field by naming a unit of measurement after him.⁸ He has received many other honors from the National Radio Astronomy Observatory and Bell Labs. A scale model of his antenna is currently on display at the NRAO in Green Bank, WV.⁹ Bell Labs also has a scale model of the antenna on display.

Although Karl Jansky’s discovery generated interest in radio astronomy among the scientific community, it was Grote Reber who forged a permanent place for radio astronomy in the scientific community. In the ten years following Jansky’s discovery,

⁴ *Karl Jansky and the Discovery of Cosmic Radio Waves*. <http://www.gb.nrao.edu/fgdocs/jansky/jansky.html> (accessed 16 January 2002).

⁵ Malphrus, 43.

⁶ *Karl Jansky and The Discovery of Cosmic Radio Waves*.

⁷ *The History of Radio Astronomy*. <http://web.haystack.mit.edu/education/radiohist.html>. (accessed 6 Aug 2002).; *Early Radio Astronomy: The Ham Radio Connection*. http://www.nrao.edu/whatisra/hist_ham.shtml (accessed 13 January 2010).

⁸ Jansky died on February 14, 1950 from chronic kidney disease - the very condition that almost kept him from being employed at Bell Labs. Paul A. Heckart, *Karl Guthe Jansky: A Brief Biography of the Father of Radio Astronomy*. (http://great-scientists.suite101.com/article.cfm/karl_guthe_jansky), 9 January 2010.; “The Jansky is the equivalent to 10^{26} watts per m^2 per Hz.” Ibid.; *Karl Jansky and the Discovery of Cosmic Radio Waves*, (accessed 16 January 2002).

⁹ *Karl Jansky and the Discovery of Cosmic Radio Waves*, (accessed 16 January 2002).

fellow American Reber was practically the only person who pursued the matter.¹⁰ An amateur radio operator, he worked for various radio manufacturers in the Chicago area from 1933 to 1947. Initially, he tried to get a job working with Jansky at Bell Labs, but they were not hiring at the time. In 1937, he constructed a telescope at his own expense in his backyard in Wheaton, Illinois. He was forced to work primarily at night to avoid interference from automobile engines.¹¹

In the years from 1938 to 1943, Reber made the first surveys of radio waves from the sky and published his results both in engineering and astronomy journals. His accomplishments insured that radio astronomy became a major field of research following World War II. Research groups in many countries began building bigger and better antennas and receivers to follow up Reber's discoveries.¹²

In the 1960s, he donated his telescope to the National Radio Astronomy Observatory in Green Bank, West Virginia, where it remains on display today.

In the meantime, British scientist Dr. Bernard Lovell worked for the cosmic ray research team at the University of Manchester. With the outbreak of the Second World War, Lovell answered the call to serve his country, designing radar equipment for the Telecommunications Research Establishment. He was named Officer of the British Empire for his efforts in 1946.¹³

Lovell continued his work in radio astronomy after the war, but soon found noise from trolleys caused problems with his research. Therefore, he moved his observations to the current location in Jodrell Bank near Goosfreys, England.¹⁴ In December 1945, Dr. Lovell and his students made their first observations at the Jodrell site. By 1947, they

¹⁰ Richard M. Emberson *Radio Astronomy and the New National Observatory*, Reprinted from Transactions of the New York Academy of Sciences Ser. II, Vol. 22, No. 6. (April 1960), 420.

¹¹ *Grote Reber and his Radio Telescope*. <http://www.gb.nrao.edu/fgdocs/reber.html>, (accessed Jan. 16, 2002).

¹² Ibid.

¹³ *Bernard Lovell* <http://www.absoluteastronomy.com/topics/BernardLovell> (accessed 29 January 2010).

¹⁴ Ibid.

built the 218ft parabolic reflecting aerial antenna, then the largest radio telescope in the world. Although the antenna could only make observations of a limited area of the sky, his findings allowed him to acquire funding to build the MK1, a 250ft radio telescope.¹⁵ This telescope was named in his honor. In 1961, he was knighted for his contributions to radio astronomy.¹⁶ Jodrell Banks continues to be a force in radio astronomy today.

Dr. John D. Kraus, also an amateur radio operator, was the founder and director of the Ohio State University Radio Observatory. During WWII, he worked for the Radio Research Laboratory, developing radar counter-measures “including locating and jamming radar.”¹⁷ Following the Second World War, John Kraus started a radio observatory for Ohio State University and wrote a textbook on radio astronomy that is still considered the “bible” of radio astronomy.¹⁸

It is interesting to note that several early researchers in radio astronomy were amateur radio operators. Ham radio operators have a long history of research in radio phenomena. Before World War I, there was very little government regulation of radio. Ham radio operators could pretty much use the entire spectrum of available frequencies.¹⁹ All ham radio use was shut down in 1917 for the duration of the war. When it resumed again in 1919, the government began crafting and enforcing rules governing how the radio spectrum would be used. Ham radio operators were forced to use only shortwave

¹⁵ *Jodrell Bank Observatory – The Early History*. <http://www.jb.man.ac.uk/public/story/early.html>. (accessed May 2, 2002).

¹⁶ *Bernard Lovell* <http://www.absoluteastronomy.com/topics/BernardLovell> (accessed 29 January 2010).

¹⁷ Jerry R. Ehman *History of the OSU Radio Observatory*. http://www.bigear.org/ohsmarkr/History_OSURO.htm. (accessed May 2, 2002)

¹⁸ *Ibid.*

¹⁹ *Early Radio Astronomy: The Ham Radio Connection* http://www.nrao.edu/whatisra/hist_ham.shtml (accessed 13 January 2010).

frequencies, then considered useless and undesirable, which lead to a great deal of experimentation to see just how far they could communicate within these limitations.²⁰

Beginning in 1921, amateur radio enthusiasts made a concerted effort at transcontinental communications, using these shortwave frequencies. In December 1921, an American ham operator was able to transmit to another in Scotland under the new restrictions.²¹ American and French amateur radio operators achieved two way communications on November 27, 1923.

Within a few months, 13 European and 17 American amateur stations had made two-way transatlantic shortwave contacts. Within a year, amateurs had communicated between North and South America, South America and New Zealand, North America and New Zealand, and London and New Zealand ... Further amateur experiments showed that, by using a variety of frequencies in the shortwave region (3-30 MHz), long-range communication could be maintained both day and night. In addition, the shortwave communications were accomplished with transmitters of only modest power, unlike the giant, many-kilowatt transmitters needed for long-range communication at the lower frequencies."²²

Unfortunately, this discovery attracted the attention of commercial interests – especially telephone companies.²³ What was once undesirable radio spectrum suddenly became prime radio real estate, again forcing ham radio operators out of choice frequency ranges. This again caused them to do more and more experimentation in the less desirable ranges to make up for the loss. This curiosity and determination to push the limits lead many amateur radio operators into radio astronomy and continues to today.²⁴

²⁰ Ibid.

²¹ Guglielmo Marconi made the first transatlantic radio communication in 1901. He received the Nobel Prize in Physics in 1909 for his work with radio communications. *Guglielmo Marconi: The Nobel Prize in Physics* http://nobelprize.org/nobel_prizes/physics/laureates/1909/marconi-bio.html (accessed 21 January 2010).

²² *Early Radio Astronomy: The Ham Radio Connection* http://www.nrao.edu/whatisra/hist_ham.shtml (accessed 13 January 2010).

²³ Ibid.

²⁴ Ibid.

In spite of Jansky and Reber's discoveries, interest in radio astronomy did not really take off in the United States until the 1950s with the beginnings of the Cold War. In fact, even the term "radio astronomy" did not exist until the late 1940s. Jansky and Reber did not think of themselves as radio astronomers, merely engineers chasing interesting extraterrestrial signals. Russian scientist Vitaly Ginzburg first used the term "radio astrophysics" in the Russian magazine *Uspekhi Fizicheskikh Nauk* in March 1947. By this time, Russia was closed off by the iron curtain; therefore, this usage went unremarked in the western world.²⁵ By 1948, the term was in use among the scientific community with a growing interest in the topic. Martin Ryle used it in a speech to the Royal Astronomical Society in April 1948. By May, it was used again at a one day conference in the U.S. In August, the International Astronomical Union formed a "radio astronomy" commission. From that point, the term continued to grow in popularity until the early 1950s, when it became accepted and widespread.²⁶

Americans grew increasingly concerned about scientific discoveries made in the Soviet Union and the threat they posed to Americans. Although radio astronomy was "born" in the United States, the U.S. made relatively few new discoveries after Jansky and Reber.

²⁵ Woodruff T. Sullivan. *Cosmic Noise: A History of Early Radio Astronomy* (Cambridge: Cambridge University Press, 2009), ch. 17, pg. 2-3.

²⁶ Ibid.

Chapter 3: Senator Harley Kilgore and the Establishment of the NSF

In an effort to close the presumed distance between American and Soviet scientific discovery, Congress created the National Science Foundation in 1950. West Virginia Senator Harley M. Kilgore had proposed such an agency earlier in 1942.¹ It was Kilgore, in fact, who penned the name National Science Foundation.

Kilgore was a 1914 graduate of WVU law school and passed the bar that same year. After leaving law school, he taught school in Hancock, WV, but shortly thereafter moved to Raleigh County, where he organized the first public high school in the county and became its first principal for a year. In 1916, he began to practice law in Beckley, but soon followed the call to defend his country in the First World War as an infantry officer.² Upon returning to the United States, he “organized the West Virginia National Guard in 1921.”³ He served in the guard until 1953, when he retired as a colonel.⁴

In 1940, Kilgore was elected to the United States Senate on the Democratic Party ticket. He became the first senator from West Virginia to serve three consecutive terms since 1914.⁵ Kilgore was perhaps one of the most influential liberals of his day. He was a strong supporter of the New Deal, President Franklin D. Roosevelt and later, President Harry S. Truman. During World War II, he was an “outspoken critic of military waste and inefficiency.” He spearheaded several investigations into this issue. During his tenure on the Subcommittee of War Mobilization, he developed new ideas on how scientific research should be conducted. He thought the university system was the natural

¹ Lockman, *But It Was Fun*, x.

² Kilgore, *Harley Martin, (1893 - 1956)* <http://bioguide.congress.gov/scripts/biodisplay.pl?index=K000176> (accessed 21 January 2010).

³ Ibid.

⁴ Ibid.

⁵ *The Election Case of Tom Sweeney v. Harley M. Kilgore of West Virginia (1949)* http://www.senate.gov/artandhistory/history/common/contested_elections/128Sweeney_Kilgore.htm (accessed 10 January 2010).

source for unbiased scientific study. Following the war, he protected basic New Deal programs from conservative attacks. “He openly and eagerly opposed the tactics of Senator Joseph McCarthy [of Wisconsin].” Although liberalism declined under President Dwight D. Eisenhower, Senator Kilgore continued to press liberal objectives. As chairman of the Judiciary Committee, he hoped to strengthen the antitrust laws. His death in 1956 cut short these ambitions.⁶

Kilgore cared deeply about continuing a high level of scientific research in both the military and civilian sectors after the Second World War. During the war, he found the current system of scientific development even for war weapons muddled and inefficient. Many Americans saw the rubber shortage and internal bickering on Capitol Hill as a sign the war could and might be lost in Washington. Kilgore said the system in place was such a “labyrinthine maze” of offices and bureaucratic red tape even senators could not negotiate, let alone the scientists.⁷

On August 17, 1942, Kilgore introduced a bill (S-2721) drafted by Dr. Herbert Schimmel, who had a Ph.D. in physics and was very familiar with the difficulties in developing synthetic rubber. This bill sought “to establish an Office of Technological Mobilization.” It gave power to the office “to mobilize technical personnel, patents, secret processes, and research facilities needed for “winning the War.” It made greater funding and resources available for scientific research. In spite of several hearings and

⁶ Robert Maddox. *The Senatorial Career of Harley Martin Kilgore*. (New York: Garland Publishing, Inc., 1981): v.

⁷ Robert Maddox. “The Politics of World War II and Science: Senator Harley M. Kilgore and the Legislative Origins of the National Science Foundation,” *West Virginia History* XLI, no. 1 (1979):21- 22.

testimony of some supportive witnesses, the bill did not pass in 1942, at least partially due to lack of support from the military.⁸

These hearings and the bill's failure to pass only spurred Kilgore on. The National Science Foundation evolved from this original proposal. He was deeply concerned about the German military industrial complex and how they conducted research. I. G. Farben was the firm that directed all of Germany's technological development. Sometimes called "Hell's Cartel," this umbrella corporation was notoriously involved with slave labor at the Nazi death camps. The most famous and the worst example of this was the concentration camp Auschwitz in Poland.⁹ According the Auschwitz Sixty Year Anniversary website:

IG Farben was the most powerful German corporate cartel in the first half of the 20th century and the single largest (German) profiteer from the Second World War. IG (Interessengemeinschaft) stands for "Association of Common Interests": IG Farben included BASF, Bayer, Hoechst, and other German chemical and pharmaceutical companies. As documents show, IG Farben was intimately involved with the human experimental atrocities committed by (Dr. Josef) Mengele at Auschwitz ... It was no coincidence that IG Farben built their giant new plant in Auschwitz, since the workforce they used (altogether about 300.000 people) was practically for free.¹⁰

Kilgore saw that it was critical for the U.S. not to make the same mistake of allowing monopolistic control of U.S. technological development by a single company. After the war, Kilgore pushed for prosecution of forty-two top German industrialists who had been long time and "enthusiastic" Nazis.¹¹

The Kilgore Committee's constant exposure of cartel relationships between German and American companies, and its warning of a possible German resurgence, made it a leading force in educating the public to the dangers of the

⁸ Ibid 23- 25.

⁹ Ibid, 25.

¹⁰ Alliance for Human Research Protection. "Auschwitz: 60 Year Anniversary-- the Role of IG Farben-Bayer" AHRP.org <http://www.ahrp.org/infomail/05/01/27a.php> (accessed March 21, 2010).

¹¹ Maddox. *The Senatorial Career of Harley Martin Kilgore*, 236.

German menace ... The committee's reports buttressed Roosevelt's resolve to maintain a tough policy towards Germany ... The Saint Louis Dispatch [stated] ... The Kilgore group has performed the war period's outstanding service to the American People.¹²

As chairman of the Judiciary Committee, Kilgore continued his fight against American monopolies until his death in 1956. Schimmel convinced him that the bill should continue through the legislative process in hopes that funding of scientific research would continue after the war.¹³

During his long Senate tenure, Kilgore continued to push for passage of legislation designed to promote government sponsored scientific research. Senate bills 607 and 702 proposed to set up four distinct offices: 1) Office of Production and Supply; 2) Office of Manpower Supply; 3) Office of Scientific and Technological Mobilization; and, 4) Office of Economic Stabilization. The bills included a \$600 million price tag. They allowed for more voluntary cooperation of scientists and would allow for the continued funding of scientific research after the war.¹⁴

Not everyone in the scientific and commercial sector was happy with the proposed legislation. Walter Murphy of Industrial and Engineering Chemistry wrote a scathing criticism of the bills in the April 1943 issue of the magazine, stating the bills took too much power from the President to run the war efforts. The bills also lacked support from government scientists, including Dr. Vannevar Bush, Director of the Office of Research and Development, which controlled all aspects of developing war weapons, including weapons of mass destruction and the Manhattan Project. He strongly opposed

¹² Ibid. 236-237.

¹³ Robert Maddox. "The Politics of World War II and Science: Senator Harley M. Kilgore and the Legislative Origins of the National Science Foundation," *West Virginia History* XLI, no. 1 (1979):25.

¹⁴ Walter Murphy. "Scientific Regimentation," *Industrial and Engineering Chemistry* Vol. 35 no. 1 ACS Publications [Database online.] 1943, 385.; Maddox, 26.

Kilgore's ideas, saying his "underlying philosophy was wrong" and unnecessary. Bush, "whose own recommendations were embodied in a bill [later] introduced by Senator Warren Magnuson," disagreed with Kilgore's focus on applied scientific research. The debates continued through 1944 with still no success for Kilgore.¹⁵

Failure did not dissuade Kilgore from his cause. It only served to convince him further that scientific research and development did not belong solely in the hands of giant corporations or the government. He strongly believed that scientific discovery and research had a great potential to improve the everyday lives of ordinary Americans beyond war applications. Kilgore would not give up.¹⁶

Discussion on the proposal to establish the National Science Foundation did not heat up until 1945 when Democratic Senator Warren G. Magnuson of Washington sponsored S-1285, another bill to create government financing of scientific research. The Office of Scientific Research and Development actually drafted the bill. Dr. Vannevar Bush, one of the bill's primary supporters, was conveniently unavailable, even by telephone the day Magnuson introduced the bill.¹⁷ That same day, Bush's report to the President on the continuation of scientific research after the war "Science, the Endless Frontier", was released.¹⁸ Kilgore was furious and convinced that he had been "double crossed."

On July 23, 1945, Magnuson introduced his own bill. It was very similar to S-1297, sponsored by Sen. Kilgore (D-WV). Both bills:

¹⁵ Ibid 26, 30.; Jerome B. Weisner. *Vannevar Bush 1890-1974* (Washington, D.C: National Academy of Sciences, 1979): 99-100.

¹⁶ Maddox, 28.

¹⁷ Ibid, 32.

¹⁸ Ibid, 33.

propose the creation of an independent agency of the Federal Government for the supervision of Federal funds to be appropriated for the support of scientific research in the basic sciences, medicine, the development of new weapons, scholarships and fellowships to talented individuals in science, and for the creation of facilities to assist in the interchange of scientific information.¹⁹

Although the bills were very similar, there were significant differences. Under Magnuson's proposal, a part-time board of preeminent scientists would control the NSF. These men (and now women) would be appointed by the President and would elect their own director. The Kilgore bill instead required a full time director be appointed by the President "with the aid of an advisory National Science Board."²⁰ The other consequential difference was control over patents. The Kilgore bill stated "any invention or patent on any invention produced in the course of federally funded research shall be the property of the United States and shall be freely dedicated to the public." Contractors, universities and inventors would retain patent rights under the Magnuson Bill.²¹

Senators Kilgore and Magnuson were not the only ones interested in the government's long term investment in scientific research. Democratic Senator James William Fulbright of Arkansas had another idea, which he put forth in his bill S-1248, appropriately called the Fulbright bill. Senator Fulbright was more of an idealist than his contemporaries, Kilgore and Magnuson. According to the *Encyclopedia of Arkansas History and Culture*, his legacy is "tolerance, peaceful coexistence, respect for human rights and collective security."²² The scope of the Fulbright bill was much more limited than the Kilgore and Magnuson bills. He proposed creating a division within the

¹⁹ John H. Teeter. "Federal Aid to Research." *The Journal of Higher Education* Vol. 9, no. 16 (1945): 455.

²⁰ Laurel N. Tanner. "Big Science and Little Social Science." *The School Review* Vol. 77, No. 1 (1969): 1.

²¹ Teeter, "Federal Research Aid", 458.

²² "Bill Fulbright (1905-1995)." *Encyclopedia of Arkansas History & Culture*. Available from <http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=1652>. Internet; accessed 11 January 2010.

Department of Commerce to sponsor inventors developing inventions for industrial use.²³ His proposal was the most conservative in keeping government involvement in scientific research to a minimum.

The Senate Committee on Military Affairs and the Senate Committee on Commerce held over sixty hours of hearings with over 117 witnesses, “including many of the nation’s most prominent educators, scientists, engineers, medical authorities, military leaders and cabinet members.”²⁴ These hearings focused primarily on Kilgore’s and Magnuson’s bills, S-1285 and S-1297. The testimony overwhelmingly supported the need for government support of scientific research, but not without oversight. Only one witness, Frank Jewett of the National Academy of Science²⁵ disagreed about the need for government spending on research.²⁶

Despite their differences, the Kilgore and Magnuson bills were later combined to form S-1720, henceforth, called the Kilgore-Magnuson Bill.²⁷ Congress passed the measure in 1950 thus creating the National Science Foundation. This bill marked the beginning of West Virginians’ participation in the development of big science.

²³ Teeter, “Federal Aid Research,” 455.

²⁴ Ibid.

²⁵ Maddox, 34.

²⁶ Teeter, “Federal Aid Research,” 455.

²⁷ Congress. Senate. Senator Kilgore of West Virginia to the Committee on Military Affairs. S. 1720 *Congressional Record*. 79th Cong. 1st Sess. 91, pt. 9 (21 Dec 1945): 12493.; Congress. Senate. Senator Mead of New York speaking for the Creation of the National Science Foundation to the President. S. 1850, 79th Cong., 2nd Sess. *Congressional Record*, 92, pt. 6 (29 June 1946): 7935-36.

Chapter 4: The NSF and Radio Astronomy

In keeping with the plan to “maintain our country’s position of world leadership in science,” the NSF’s first project in radio astronomy was the construction, in 1952, of a fifty foot steerable antenna for the Naval Research Laboratory located in Washington, D.C.¹ It was the largest steerable radio antenna of its time. Many important discoveries were made using this antenna, including “the first detection of radio emissions from Mars, Venus, Jupiter, and Saturn (1956 to 1958)” and “the first detection of the absorption of emission of radio stars by interstellar hydrogen gas (1956).”²

Radio astronomy was not the sole purpose of the NRL. It was “the corporate research laboratory for the Navy and Marine Corps and conducts a broad program of scientific research, technology and advanced development.” Its other notable achievements included the invention of several different types of radar equipment, and, in 1964, “the first time based navigational system which led to the global positioning system.” Established 85 years ago, it continues to serve the country and the Navy today.³

Although, the NRL antenna was making ground breaking discoveries, it was not open to universities and other radio astronomers. To this end, the NSF, the Carnegie Institution of Washington, and the California Institute of Technology sponsored a joint conference in January 1954 to determine how to further research in radio astronomy. Seventy-five astronomers, physicists, and electronic engineers from around the world met to discuss the future of radio astronomy. Participants came from Australia, Canada,

¹ Teeter. “Federal Research Aid,” 456.; Bok “A National Radio Observatory”, 57.

² *Radio Astronomy*, <http://www.nrl.navy.mil/content.php?P=RADIOASTRO> (accessed 17 Jan 2010).

³ *U. S. Naval Research Laboratory*, <http://www.nrl.navy.mil/> (accessed 13 January 2010).; *Systems*, <http://www.nrl.navy.mil/> (accessed 17 January 2010).

England, India, the Netherlands, Norway, and Sweden as well as the United States. They represented universities, commercial and government laboratories.⁴

This conference triggered a heated debate between Dr. Merle Tuve, Director of the Department of Terrestrial Magnetism (DTM), and Dr. Lloyd Berkner, President of Associated Universities, Inc (AUI).⁵ Before the Depression, Berkner had worked for the National Bureau of Standards where he utilized Gregory Breit's and Tuve's radio pulse procedures in his studies on "radio wave propagation in the ionosphere." When funds for his research dried up, Berkner went to work for DTM in Washington, D. C.⁶ Dr. Merle Tuve, on the other hand, dedicated his life to the study of nuclear physics, although he was also a capable administrator. Some of the important projects he worked on included determining the "biological effects of gamma-rays" and "carbon radioactivity and other resonance transmutations by protons."⁷

Berkner felt that universities and academics had a vital role in promoting and protecting national security in peacetime as well as during periods of war.⁸ He also thought the scientific community had much to offer outside military research and weapons development. He said there were three stages to scientific development in American history --- the industrial revolution, the communications revolution and the nuclear age. In the past, science had been guided by markets and profits with only

⁴ Radio Astronomy Conference" *Science*: Vol. 119 (April 1954), 558.

⁵ Berkner worked with Karl Jansky's brother, C. M. Jansky at the University of Minnesota developing an experimental radio station. In addition to being an amateur radio enthusiast, he was also a naval aviator and helped Amelia Earhart "plan her first transatlantic flight." Allan Needell. *Big Science: The Growth of Large Scale Research*. Peter Galison and Bruce William Hevly, ed. Stanford: (Stanford University Press, 1992), 294.

⁶ Ibid.

⁷ Philip H. Abelson. "Merle Antony Tuve: June 27, 1901 - May 20, 1982," NAP.edu <http://www.nap.edu/html/biomems/mtuve.html> (accessed 17 January 2010).

⁸ Allan Needell "Lloyd Berkner, Merle Tuve, and the Federal Role in Radio Astronomy," *Osiris*, 2nd Series, Col.2nd Series, Vol. 3 (1987) <http://www.jstor.org/stable/301761> (accessed 13 January 18, 2010).

occasional interference from the government. The invention of the atomic bomb changed the landscape of the scientific community from one of individual research to large group efforts. Berkner wanted to ensure continued government involvement in funding science on a large scale.⁹

He frequently stated “that science had become an essential political, economic and military force, one that required resources, planning, and leadership far beyond what was traditionally provided from within universities.” He felt, with his military and other leadership experience, that he was the person to lead these efforts. He became one of the first statesmen of science.¹⁰

Dr. Tuve, on the other hand, had opposing ideas. Unlike Berkner, Tuve had actually done active research in radio astronomy while it was still possible to do so with limited resources. One of his principle objections to AUI managing a radio telescope facility was that no one at AUI, including Berkner and his assistant Dr. Richard Emberson, was actively involved in radio astronomy research.¹¹ He disagreed with AUI that large telescopes were necessary. He felt, with justification, AUI was determined to build a telescope even bigger than the 250 ft. dish that British astronomers were building in Manchester. He proposed a study to determine what would best meet radio astronomers’ needs, instead of simply the largest dish possible.¹² Although Tuve’s efforts proved ultimately unsuccessful, he was able to spur more discussion on the topic.

⁹ Allan Needell. *From Military Research to Big Science: Lloyd Berkner and Science-Statesmanship in the Postwar Era*, edited by Peter Galison and Bruce Hevly (Stanford: Stanford University Press, 1992), 304, 306.

¹⁰ Needell, “Lloyd Berkner, Merle Tuve, and the Federal Role in Radio Astronomy,” 264.

¹¹ Ibid, 267, 272.

¹² Ibid.; In this regard, Tuve did succeed. The first radio telescope built at the Green Bank site was the Tatel telescope with an 85 ft dish. A 300 ft dish was built in 1962. This dish was only supposed to be in use for five years, but served for 26 years until it collapsed on Nov. 15, 1988, due to structural problem. Some less reputable newspapers reported at the time that aliens from outer space were responsible for the

In 1954, the NSF decided to build a National Radio Astronomy Observatory to accommodate the needs of many universities.¹³ The Tatel telescope was the first to be built on the Green Bank site. For this telescope, scientists created a new system of mapping, using the relative location of the planets to determine the location of cosmic phenomena. Telescopes in operation before the Tatel determined the positions of phenomena more abstractly by starting with a known reference in the sky and determining coordinates from there. The new system allowed for a more absolute reference. This was an improvement because the position of cosmic objects appear to change, depending on the frequency used to observe them. If an astronomer changed the frequency used to observe a reference to a celestial object, he or she might not be able to find the object where he expected it to be. The Tatel also allowed for measurements or observations over greater frequency ranges, which helped to determine the characteristics of space phenomena such as an objects motion, composition, size and shape.¹⁴

By July 1956, there were three schools of thought on who should manage the facility. The first option was administration by a single university – West Virginia University “being the preferred choice” due to its close proximity to the Green Bank site. The second alternative, favored by Dr. Merle Tuve, was “management by a new organization, undoubtedly one being established by [noted astronomer] William Pollard”

antenna’s collapse. *Radio Telescopes*, <http://www.cv.nrao.edu/course/astr534/RadioTelescopes.html>, (accessed 20 January 2010).

¹³ R. M. Emberson and N. L. Ashton, “The Telescope of the National Radio Astronomy Observatory at Green Bank, West Virginia” *Proceedings of IRE*, Vol. 46, No. 1-3, Jan. 1958, 24.

¹⁴ O. Stuve, R.M. Emberson, and J.W. Findlay. “The 140-Foot Telescope of the National Radio Observatory” *Publications of the Astronomical Society of the Pacific*. Vol 72, No. 42, Dec. 1960, 441, 445.

or Associated Universities Incorporated. Berkner favored AUI while NSF Director Dr. Alan Waterman endorsed WVU. Neither liked the idea of Pollard in charge.¹⁵

Waterman thought highly of WVU President Irvin Stewart. After many discussions and much research, Stewart decided that West Virginia law would make financing the project excessively complex. Therefore, he recommended another university be found. A physicist from the University of Virginia, Jesse Beams, stated his university was also interested in managing the project, but his university was also rejected.¹⁶

AUI was eventually selected to oversee the project. AUI member universities included Columbia University, Cornell University, Harvard University, John Hopkins University, the Massachusetts Institute of Technology, the University of Pennsylvania, Princeton University, the University of Rochester, and Yale University. It was a corporation “established in 1946 as an educational institution dedicated to research, development, and education in the physical, biological and engineering sciences.”¹⁷ Through a grant from the NSF, AUI completed a study to determine the best possible site for the new facility to be built.

The Observatory’s main objective was “to provide observational facilities and support to the nation’s scientific community.”¹⁸ Previously, the U.S. Navy, universities, or other nations owned radio telescopes. This was to be the first radio telescope built in the United States that could be used by any astronomer, or group of astronomers, without

¹⁵ Allan A. Needell. *Science, Cold War and the American State: Lloyd V. Berkner and the Balance of Professional Ideals*. Amsterdam: Harwood Academic Publishers in Association with the National Air and Space Museum, Smithsonian Institute, 2000, 288.

¹⁶ Needell, “Lloyd Berkner, Merle Tuve, and the Federal Role in Radio Astronomy,” 285.

¹⁷ *Associated Universities, Inc.: Background Information*. <http://www.aui.edu/asibackground.html>. (accessed Feb. 2, 2002).

¹⁸ *Ibid.*

private or university affiliations. International scientists were also to be welcomed by the new NRAO facility. Twenty-nine locations were considered throughout the northeast, but Green Bank, West Virginia, finished first.

In seeking a site for the new telescope, researchers were looking for several things. First, it was desirable to have as little radio noise as possible. They hoped to find a large, flat valley surrounded by high mountains that was at least fifty miles from any sizable city. One locale that met these requirements was the town of Green Bank in Pocahontas County, West Virginia. However, they also wanted the amenities of city life like theaters, shops, and recreational activities.¹⁹ This turned out to be almost impossible to satisfy in a rural community like Green Bank. By definition, a remote place in the country will not have the luxuries of big city life.

Although scientists loved the radio quietness and beauty of rural West Virginia, they soon complained about the lack of cultural activities. In an article for United Press International, Robert M. Gormall wrote “scientists find no culture at Green Bank, W. Va.” At 35 mountain miles away, Elkins provided the closest bowling alley, full service gas station, supermarket and hospital. After the NRAO became operational, at least two women gave birth on the way to the hospital. Wives pressured their husbands to leave and scientists complained of not being able to get out enough.²⁰ Elinor Langer wrote in *Science* magazine in November 1965: “The best environment for science is not necessarily the best environment for scientists.”²¹

¹⁹ F. J. Lockman, F. D. Ghigo, and D.S. Balsar, ed., *But It Was Fun: The First Forty Years of Radio Astronomy at Green Bank* (Charlottesville: National Radio Astronomy Observatory, 2007): 8.

²⁰ *Ibid*, 529-530.; Mountain mile is a term used by West Virginians to describe the distance between two places that includes allowances for the height and contours of the mountainous geography. The time it takes to navigate one mile over the mountains and twisting mountain roads is significantly longer than a mile driven across flat land without hairpin turns.

²¹ Lockman, 529.

Pocahontas County residents were naturally upset by these comments about the community and land that they loved. An editorial in the Pocahontas Times favored improving “educational, health, spiritual, social and economic conditions for a better living for our own people, but retain, and enjoy the basic simplicity and beauty of our rural way of life and try not to be upset by others’ comments.”²² In late 1965, the NRAO moved its headquarters from Green Bank to the University of Virginia campus, about 118 miles from Green Bank.

Another requirement for the site was that it be located far enough to the south to see the center of the Milky Way and far enough north “to permit researches that involve aurorae, ionospheric scintillation, and polar blackouts.”²³ Lastly, AUI was looking for a place with low snowfall, and it sought to avoid areas “subject to violent winds and tornados.” It wanted a mild climate and relatively low humidity and yet within three hundred miles of Washington, D.C.²⁴ This stipulation also proved to be tricky. Although the requirement of low winds was easily satisfiable, any area in the mountains less than three hundred miles from D.C. was going to get snow and ice – sometimes more than a little. To this end, the NRAO technical and maintenance staff eventually purchased a jet engine snow blower. B. Viers and J. Spargo wrote in the NRAO newsletter, “Observer”:

This hearty corps, consisting of the personnel from Telescope Operations and Plant Maintenance, were called upon on two memorable occasions to remove, using brooms, an accumulation of one foot of snow from the [300 foot] telescope’s surface. A quick calculation shows that 1.8 acres of snow one foot deep equals roughly 78,000 cubic feet of snow or about 38 railroad cars full.²⁵

²² Pocahontas Times, Nov. 25, 1965.

²³ Lockman, 7.

²⁴ Ibid, 7-8.

²⁵ Ibid, 103.

Initially, AUI hoped to build the facility on ground already owned by the government. To this end, they put out a call to the Forest Service, the Park Service, the Geological Survey, the Tennessee Valley Authority, the Army, and the Real Property Disposal office of the U.S. General Services Administration. It quickly became apparent that this would not be possible as all the land desirable for the project had already been snapped up by private owners over a century before.²⁶

At last, the committee came up with a list of twenty-nine possible sites. Most were abandoned immediately upon visual inspection for being too close to urban or industrial areas. Only five warranted further detailed study and analysis.²⁷ Finally, the choices were narrowed down to three: Green Bank, West Virginia, Massanutten and Deerfield, both in Virginia. Both Virginia sites had complications which made them less desirable. Massanutten looked promising because construction costs could be kept to a minimum. Unfortunately, the site was actually a “shallow gorge on top of a mountain.” The larger telescopes would peek over the mountain tops.²⁸

The Deerfield site had many advantages. The topography was somewhere between Green Bank and Masanutten. Although it was smaller than the Green Bank site, it had acceptable levels of radio noise and low airport activity. Also, the University of Virginia was only eighty miles away. Ultimately, its close proximity to Staunton, Virginia, posed a problem in regards to future population growth.²⁹

Only Green Bank met all the requirements and promised to be sparsely populated for generations to come. These factors made it the ideal location. One of the primary

²⁶ Richard Emberson, “National Radio Astronomy Observatory” *Science*, Vol. 30 (1959): 1307.

²⁷ *Ibid.*

²⁸ Lockman, 8-9.

²⁹ *Ibid.*, 9.

reasons West Virginia was selected was its geographical location. It was ideal for viewing both the northern and southern hemispheres. Other important considerations were its proximity to Washington, D.C., rural atmosphere, absence of power lines, aircraft normally did not fly over the high mountainous area, and a low growth rate. In addition, the site was protected from extremes of weather and wind.³⁰

Since the West Coast dominated optical astronomy, AUI wanted to ensure the new radio astronomy observatory would be on the East Coast near Washington, D.C. The D.C. area was home to “the largest number of active radio research groups (NRL, DTM, and the National Bureau of Standards).”³¹ Therefore, the country was split in half. The western U.S. would be solely the purview of optical astronomy because “climate and atmospheric conditions are most favorable, and the light and dust generated by cities [is] at a minimum.”³² At that time, the largest traditional American optical telescope was the Hale Telescope in Palomar, California. It took twenty-one years to construct and finally came into operation in 1949.³³ It remained the largest optical telescope until 1993.³⁴

Deer Creek Valley, where Green Bank is located, is a deep, flat 10,000 acre basin enclosed by several mountain ranges of over one thousand feet. “Here the radio noise level is probably lower than anywhere else east of the Rocky Mountains excepting possibly some places in northern New York and Maine, but there the winters are too severe to operate large telescopes.”³⁵ Because there were very few radio wave

³⁰ Lockman, 7-8.

³¹ Allan Needell, *Science, Cold War, and the American State: Lloyd V. Berkner and the Balance of Professional Ideals* (Amsterdam: Harwood Academic, 2000): 275-276.

³² “National Observatory Site” *Science News*, Vol. 70, September 8, 1956: 149.

³³ “The Early History of Palomar Observatory.” <http://www.astro.caltech.edu/palomar/history.html> . (accessed 25 January 2010).

³⁴ “The 200 inch Hale Telescope.” <http://www.astro.caltech.edu/palomar/hale.html>. (accessed 25 January 2010).

³⁵ “American Astronomers Report” *Sky and Telescope*, Vol. 15, July 1956: 389.

disturbances in the area, these combined factors created a natural radio quiet zone that was ideal for research in radio astronomy. “All in all, the astronomers decided, there was no other place in the East where the sounds of the universe would come through quite so clearly.”³⁶

³⁶ “Quiet Zone” *Time Magazine*, Vol. 68, Dec. 3, 1956, 70.

Chapter 5: West Virginia - The New Telescope's Home

West Virginia welcomed the opportunity to host the observatory, hoping that it might help stimulate the economy. In the 1950s, West Virginia suffered an economic decline, due to losses in the coal and agricultural markets, inexpensive imported goods, the increased prices of consumer goods, and high taxes on low-income families.¹ In some counties, the situation was desperate. A school principal in the Second District told Representative Harley O. Staggers, “out of his 100 students, at least 25 boys and girls were coming to school without [a] lunch or lunch money.”² At Staggers’ urging, the federal government sent surplus food into the area to ease the crisis, which helped, but did not solve the problem of massive unemployment.³ During World War II, “farming sections, particularly the Little Kanawha Valley and mountain counties such as Tucker, Pendleton, and Pocahontas” saw significant portions of their population leave.⁴

By the late fifties, West Virginia was in the midst of a serious recession.⁵ The New York Times reported that “in all corners” of the state the economy was the most important issue to local residents in the upcoming 1958 election.⁶ Eisenhower swept West Virginia in the previous 1956 election. However, when economic conditions did not improve, the state swung back to the Democrats. One Charleston resident summed up the feelings of many West Virginians, “We gave them a chance and now things are worse than ever.”⁷ Unemployment remained an issue. Mechanization in the mining industry

¹ U. S. Congress. Representative Staggers speaking for the Record of the 83d Congress, 83rd Cong., 2nd Session., 19 August 1954, Congressional Record 10: 15302-3.

² Ibid., 15303.

³ Ibid.

⁴ Otis K. Rice and Stephen Brown. *West Virginia: A History* (Lexington: University of Kentucky Press, 1993), 280.

⁵ “Recession Clings to the Coal Fields” Washington Post, Feb. 8, 1959.

⁶ “Recession Issue in West Virginia” New York Times, Oct. 18, 1958.

⁷ Ibid.

cost the state thousands of jobs. In 1959, the Washington Post reported, “Nearly 80,000 coal miners have lost their jobs in West Virginia in the last 11 years, 20,000 of them within the past year.”⁸

The second district, where Green Bank was located, was particularly hard hit. Per capita income in the district ranked in the bottom 25% nationally. Residents had roughly three and half years less education than the national average. They were also “four times more likely to live without plumbing”.⁹ The district had a third fewer doctors than the rest of the country and not enough hospitals. There were “190 acceptable hospital beds available to each 100,000 residents, compared to about 415 per 100,000 nationally.”¹⁰ In 1972, in spite of fiscal advances, the town of Elkins (approximately 35 miles from Green Bank) had such critical shortages in health care workers, the National Health Services Corps sent workers to the area.¹¹

The once bustling lumber industry was also in decline. Over cutting at the dawn of the century had robbed the area of most of its old growth, and the new plantings could not sustain the industry indefinitely. In 1925, the peeling mill closed, effectively killing the little town of Spruce, West Virginia, just 22 miles west of Green Bank. According to the Cass Scenic Railroad State park website, “all that is left now is crumbling concrete slabs, rubble and a two-track horseshoe curve of railroad track.”¹² Edwin Mower bought the once prosperous West Virginia Pulp and Paper Company in 1942, but the business soon began to decline. By 1950, the mill in Cass (less than five miles south of Green

⁸ Washington Post, Feb. 8, 1959.

⁹ Cherrill A. Anson. *Harley O. Staggers: Democratic Representative from West Virginia* (Washington, DC: Grossman Publishers, 1972), 7.

¹⁰ *Ibid.*

¹¹ U.S. Department of Health, Education, and Welfare. *Communities Approved for NHSC Health Teams* (Rockville, Maryland Health Services and Mental Health Administration, May 24, 1972), 4.

¹² “Cass Scenic Rail State Park – History” <http://www.cassrailroad.com/history2.html> (accessed 2 February 2010).

Bank) worked only one shift. Four of its once busy big Shay engines were relegated to the rail yard, leaving only three overtaxed engines to do the job. When Mower died in 1955, his family could not keep the business going. On June 30, 1960, it closed its doors forever. Within three months, the rail stock and tracks were sold to Walworth Farms to be dismantled and sold for scrap. It seemed Cass was destined to become a ghost town. Fortunately, investors and others saw its potential as a tourist attraction, which saved the engines, old mill and railroad. In 1977, the West Virginia Department of Natural Resources acquired several company houses, in addition to the tracks, rail stock and the old sawmill. Today, the Cass Scenic Railroad is a popular state park, offering tourists a trip back in time to the heyday of lumbering and railroads. But in 1956, when AUI was scouting out the Green Bank location, things looked grim for the people of Cass.¹³

Government spending lagged far below the national average, especially in defense. Even in 1972, after the NRAO's construction, the Defense Department spent only \$62 per person in the second district compared to a national average of \$285. Forty percent of this funding went to Mineral County, putting the rest of the district (which included Morgantown at that time) even further below the national average.¹⁴

On the positive side, being over 75% rural (populated with mainly small farms), the district actually received \$7 in agricultural funding over the national average which was modest for an area where the majority of the population earned a living from farming. With an unemployment rate of 8.7% in 1960, district residents could look

¹³ Ibid.

¹⁴ Anson, 8.

forward to clean air and less overcrowding, not to mention, “narrow twisting mountain roads” which kept the area “profoundly” isolated.¹⁵

The selection of Green Bank as the location of the National Radio Astronomy Observatory brought West Virginians hope for new industries such as tourism and big science.¹⁶ The NRAO also provided much-needed jobs to local residents.¹⁷ Local resident W.W. Sutton, in a letter to the editor in the Pocahontas Times, eagerly awaited the building of the telescope anticipating:

From what the Times has given us of the nature of this project I am led to believe here is an opportunity for our people to get for our part of the State something permanent, useful: an asset which will be a real help to worthy people in their effort to enjoy the benefits of a progressive civilization ... We greatly need an Enterprize [sic] here in our midst to keep ambitious young men in this county ... And employment for men who are willing to make the county a permanent home ... I hope to see this project put in, and in operation. It will be a lift to our part of the State, and a help to all.¹⁸

Later in 1959, when the first telescope began operations, the Charleston Gazette speculated on the economic impact of the NRAO and the nearby Sugar Grove Naval Station:¹⁹ “In construction, maintenance, payroll and tourist spending, the installations will be handsome sources of state and private income.”²⁰

The NRAO was envisioned as a real moneymaker. The natural beauty of the region already attracted some tourists. Dr. Lloyd Berkner, AUI President, called Deer Creek Valley, “one of the most scenic places I’ve ever seen.”²¹ The West Virginia Industrial and Publicity Commission reported that 1958 was the biggest year in tourist

¹⁵ Ibid.

¹⁶ Jim Millstone, “Radio Astronomy Center Seen As Tourist Mecca” Charleston Daily Mail, Oct. 18, 1957.

¹⁷ *History of Pocahontas County*. (Marlinton: Pocahontas County Historical Society, 1981), 15.

¹⁸ Pocahontas Times, March 29, 1956.

¹⁹ After many delays due to lack of funding and changing technology, Sugar Grove Naval Station opened for operations on May 10, 1969. Al Grobmeier. *Sugar Grove History and its Two CDAAs*. http://coldwar-c4i.net/Sugar_Grove/history.html. (accessed Aug. 28, 2009).

²⁰ “Two Observatories in State Seen as Boost to Economy” Charleston Gazette, Feb. 8, 1959.

²¹ Charleston Gazette, Feb. 8, 1959.

traffic statewide in history. Sixty three percent of travelers came to the state for vacation. The majority of visitors were from Ohio, Pennsylvania, and Virginia. Most listed the scenery as the number one attraction.²² It was hoped that the new radio astronomy center would bring in even more tourists to see the telescopes and to tour the museum and visitor's center.

The region had an interesting heritage, much of it reflected in names. Green Bank got its name from the natural spring that meanders through town and causes the grass to be green nearly year round. Local stories claim people once used to come to the "green bank" for community meetings. People no longer use the springs for meetings, but the name has remained.²³ Adam Arbogast settled in the area, now home to the NRAO, in 1796. When he died at nearly one hundred years of age, he deeded the land to his four sons and five daughters. In 1963, one of his great grandsons, Jerry Sears, worked for the NRAO.²⁴ As more people settled in the area, the town of Arbovale was born: "Arbo" for the Arbogast family and "vale" meaning valley.²⁵ The NRAO facility is physically located in the tiny town of Arbovale. Green Bank houses the nearest post office.

Pocahontas County was named for the famous Indian Princess, Pocahontas, daughter of Chief Powhattan. It was "established in 1821, from parts of Bath, Pendleton, and Randolph Counties (Virginia)."²⁶ It was also known as the "Birthplace of Rivers." "Eight rivers flow out of Pocahontas County- the Greenbrier, Shaver's Fork of the Cheat, Tygart Valley, Williams, Cherry, Cranberry, Gauley, and Elk. No rivers flow into the

²² "Travel Trade Report" *Pocahontas Times*, Feb. 20, 1958.

²³ "Living and Working in Green Bank, West Virginia."

<http://www.gb.nrao.edu/gallery/recruitment/history.html> (accessed 27 January 2010).

²⁴ Lockman, 15.

²⁵ Ibid.

²⁶ Howard J. Myer. *West Virginia Blue Book 1956* (Charleston: Jarrett Printing Company, 1956): 460.

county.”²⁷ The Shawnee Indians, whose permanent home was in Ohio, utilized the area as a hunting ground. The Iroquois also traveled through the county, establishing the “Warriors Road” which was the first trail through Pocahontas County. The trail went from New York to Georgia.²⁸

Knapp Gregory was the first white person to scout out the area. Knapp’s Creek is named in his honor. In 1779, Stephen Sewell and Joseph Marlin camped all winter in a spot they called “Marlin’s Bottom.” The name changed to Marlinton in 1889. In 1891, it was established as the county seat.²⁹ During the Civil War, many local residents sided with the Confederacy. After 1863, county officials for the new state of West Virginia forced taxpayers to pay their taxes in “northern dollars.” Some speculated this was an attempt to punish Confederate supporters. One of the people offended by this “outrage” was Allen Burner who enlisted in the Confederate Army from Green Bank in 1861. In reality, this was just a requirement of the state and federal government. Land changed hands several times throughout this period.³⁰

In Pocahontas County, construction was completed on the first telescope in 1958, which added another reason to visit the state.³¹ By 1957, Dr. Berkner told the Charleston Daily Mail, he expected the center to draw over one hundred thousand visitors a year.

“They can come to work hard and play hard and this is the best atmosphere for developing new ideas,” Dr. Berkner said.³² Plans were already in the making for a museum and visitors center. Hydraulic elevators were to be installed in all the antennas

²⁷ “Living and Working in Green Bank, West Virginia.”

<http://www.gb.nrao.edu/gallery/recruitment/history.html> (accessed 27 January 2010).

²⁸ Lockman, 13.

²⁹ Blue Book 1956, 545.; Paul H. Price. *West Virginia Geological Survey: Pocahontas County* (Wheeling: Wheeling News Litho Company, 1929), 15.

³⁰ Lockman, 15.

³¹ *The Tatel Telescope*. <http://www.gb.nrao.edu/fgdocs/tatel.html>, (accessed Jan. 16, 2002).

³² Charleston Daily Mail, Oct. 18, 1957.

to allow visitors an up close look at equipment while offering them a spectacular view of the area.³³ Dr. R. M. Emberson, Dr. Berkner's assistant at AUI, eagerly awaited the telescope's impact on tourism:

I've got a gleam in my eye, figuring that the place will become quite a tourist attraction. There are millions of people here in the easts who like to get out and drive places especially through the mountains. The installation ought to prove fascinating to them. We could set up a little museum and arrange guided tours.³⁴

The county also hosted a number of historic and natural attractions. Droop Mountain Battlefield Park was the site of the last noteworthy Civil War battle in West Virginia. From the lookout tower located near the main entrance, visitors enjoyed a panoramic view of the entire valley. The park also had two covered picnic areas and playgrounds for children. It also housed a museum, detailing the events of the battle and a number of hiking trails. The Civilian Conservation Corps built all the park buildings in the 1930s.³⁵

Watoga State Park, located just 14 miles south of Marlinton, was also constructed by the CCC. An aerial photograph taken before the 1930s revealed the area had been logged almost to the point of being treeless.³⁶ The young men of the CCC literally built the park from the ground up, constructing the buildings, a small fishing pond, and replanting trees. The park continues to offer travelers overnight camping and cabins, a large swimming pool, fishing, boating and hiking trails, among other things.³⁷ Seneca State Forest, Cal Price State Forest, and part of the Monongahela National Forest also provided many opportunities for outdoor recreation. In addition, the area also hosted

³³ Ibid.

³⁴ "Green Bank Observatory" *Pocahontas Times*, Feb. 28, 1957.

³⁵ "Droop Mountain Battlefield Park <http://www.droopmountainbattlefield.com/> (accessed 1 February 2010).

³⁶ This photograph can be viewed at the CCC Museum on the park grounds.

³⁷ These amenities would have been available in the 1950s as well. "Watoga State Park" <http://www.watoga.com> (accessed 1 February 2010).

Pocahontas Memorial Hospital and Denmark Sanitarium, a state owned facility.³⁸ In 1956, the county had a population of 12,480. Green Bank had a population of about one hundred residents at this time, according to newspaper editor Cal Price.

Prior to the construction of the NRAO, farming was the principal vocation in Pocahontas County. Farmers raised “cattle, sheep, horses, chickens, hogs, mules and goats.”³⁹ Cash crops included “corn, oats, wheat, hay, potatoes, apples, peaches, grapes, and rye.”⁴⁰ Cherry River Boom and Lumber and the Mower Lumber Company produced lumber and paper products. Union Tannery and the Pocahontas Tanning Company exported large quantities of leather goods.⁴¹

In 1929, there were no coal mines in the county. Limestone was quarried primarily for road building. The pure spring water from Minnehaha Springs was only used for swimming. A burgeoning bottled water business was budding.⁴² Today, Pocahontas Spring Water sells water from the springs. In addition to these industries, there was also the Edray State Trout Hatchery.⁴³ Built by the CCC in the 1930s, it is the oldest fish hatchery in the state. Anglers from throughout the state, and across the East, come to enjoy catching trout raised at Edray.⁴⁴

³⁸ Blue Book 1956, 460.

³⁹ Price, 13.

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Ibid, 13-14.

⁴³ Blue Book 1956, 545.

⁴⁴ Laura Ramsburg, “Governor Takes Spring Gobbler, Tours Hatchery” <http://www.wv.gov/org/sec.aspx?id=32&articleid=1518> (accessed 2 February 2010).

Chapter 6: Laying the Groundwork and Rallying the People

Before AUI and the NSF could begin plans to build the radio astronomy center, legislation was essential to protect the Deer Creek Valley area (just outside Green Bank) from further intrusions of man-made radio noise as generated from appliances and other common consumer products. Reducing mechanical and radio noise was essential, because by the time radio signals from space reach Earth, they are very weak and easily overpowered these types of generated signals. This required the considerable support of local residents as well as the state government. On April 1956, Dr. Bart J. Bok and Dr. Richard M. Emberson, AUI representatives, met with Governor William Marland, State Senator and President Pro Tempore of the Senate Fred Allen, Delegate Frank P. McLaughlin, Attorney Richard F. Currence, and other interested parties to discuss the proposed observatory. Marland enthusiastically supported the project. “West Virginia will cooperate fully with whatever it takes to make the State into the radio Center of the World. [sic].”¹

Marland, eventually best known as the “taxi driving governor,” had received his law degree from West Virginia University. He began his political career as the state Assistant Attorney General. He was later appointed Attorney General and was elected to the post in the following year. In 1952, he was elected governor; however, his ‘honeymoon’ period ended just three days into his term when he ran afoul of the coal industry. He supported desegregation of public schools, improved employment and

¹ “Radio Astronomy Center” Pocahontas Times, April 5, 1956.

encouraged industries other than coal. In many ways, Marland was ahead of his times and greatly disliked for it.²

Before any legislation or further action could be taken on the project, an in-depth geological survey had to be completed. Dr. Paul Holland Price, the state geologist, conducted a thorough survey of Pocahontas County in 1929. At that time, he was probably the most knowledgeable person alive on the geology of Pocahontas County.³ Dr. Price was one of the most important West Virginians involved in the project. He received his BA (1923) and Master of Science (1926) degrees at West Virginia University. He received his PhD. from Cornell in 1930. Dr. Price taught geology at WVU for a number of years. He was Head of the Geology Department from 1938 to 1946. In addition, he served as the West Virginia State Geologist for twenty-five years from 1934 to 1959.⁴ Price called his work with the NRAO project, “one of my most interesting and rewarding experiences.”⁵

In the spring and summer of 1956, Dr. Price conducted another survey of Deer Creek Valley in Pocahontas County for the NSF, AUI and the State of West Virginia.⁶ He worked closely with the NSF and local government.⁷ His efforts were one of the critical factors in the selection of the Green Bank site.⁸

The one doubtful factor was the requirement of a bed-rock foundation on which to erect the very heavy structures. Because the surface area consisted of a blanket of

² *William Casey Marland – Compiled by the West Virginia State Archives.*
<http://www.wvculture.org/history/marland.html>. (accessed Jan. 27, 2002).

³ Telephone interview with Steve McClelland, West Virginia State Geologist Office, Morgantown, West Virginia, March 28, 2002.

⁴ Oscar Lambert. *West Virginia: It's People and It's Progress*, 1958. (Charleston: Historical Record Association, 1959), 600.

⁵ Paul H. Price *A Geologist At Large in Appalachia, 1923-1969* (Morgantown: Pioneer Press, 1978), 47.

⁶ *Pocahontas Times*. June 28, 1956.

⁷ “Radio Astronomy Center” *Pocahontas Times*, April 5, 1956.

⁸ *Pocahontas Times*. January 30, 1958. Annual Report of the Director and State Geologist of the West Virginia Geological and Economic Survey Commission for the Year Ending June 30, 1957.

some 14 feet of stream sand and gravel, it would be necessary to core the site. Our Geological Survey had its own drilling equipment and crew, which had been used extensively in a similar core testing and mapping of the Monongahela Lake sediments in and around Morgantown. We carried out a similar program at Green Bank. Following extensive compression tests on the recovered cores, under the supervision of Dean R. P. Davis at West Virginia University, the Green Bank site was found to be the best location in the eastern United States for the National Radio Astronomy Observatory.⁹

According to geologist Steve McClelland, geotechnical engineering is a subset of geology that studies the ability of soil to hold different structures. A geotechnical engineer determines whether or not the land in any given area is strong enough to support a given structure without sinking or cracking. For example, geotechnology allows a geologist to determine where to build and how large a cement pad needs to be to support a two hundred and ten ton antenna¹⁰ for the next 100 plus years without shifting, while continuously viewing the same section of space for the entire time.¹¹

Although the survey was critical to the selection of the Green Bank site, NSF officials, and especially West Virginia politicians, had to rally support among local residents. On January 23, 1956, Governor Marland met with AUI representatives, Dr. Bok and Dr. Emberson, for the first time in Washington, D.C. to discuss the tentative results of the feasibility study AUI had done the previous year. They decided to wait until April to make any public announcements about the project.¹²

On January 16, President Dwight D. Eisenhower proposed to Congress an appropriation to establish “the nation’s first major radio astronomy center” and for the construction of “necessary research equipment.”¹³ It was apparent that Marland and the

⁹ Price, *Geologist at Large*, 50.

¹⁰ Actual weight of the Tatel telescope.

¹¹ Interview with Steve McClelland, 28 March 2002.

¹² “Radio Astronomy Center” *Pocahontas Times*, April 12, 1956.

¹³ *Pocahontas Times*, April 12, 1956.

state's support were vital to the success of this project.¹⁴ In Washington, Congressman Harley Stagers pushed hard on behalf of the NRAO to locate the facility in West Virginia.¹⁵ Stagers graduated from Emory and Henry College in 1933. Following graduation, he taught high school science for two years in Norton, Virginia. He received his graduate degree from Duke in 1935. He held various jobs before the war, including head coach for Potomac State College, sheriff of Mineral County, West Virginia, and right-of-way agent for the State Road Commission. In 1942, he was West Virginia State Director, Office of Government Reports (later Office of War Information). From 1942 to 1946, he served as a "lieutenant commander in the United States Naval Air Corps with service as a navigator in the Atlantic and Pacific Theaters of War."¹⁶

Stagers was elected to Congress as the representative for West Virginia's second district in 1948. He was known for his extreme honesty in a state known for political scandal and election fraud that sent more than one governor to jail in the years following the 1950s. West Virginia University political science professor Dr. O. B. Conway once said, "[Stagers] is considered to be wholly and incorruptibly honest."¹⁷ He was also fortunate to be from a rural area with very few mining interests and was therefore able to avoid confrontations concerning mining issues. In addition to his efforts in bringing the NRAO to Green Bank, Stagers listed establishing Harper's Ferry as a national park and the "people mover" at WVU among his most notable accomplishments.¹⁸ Since his home was only a two-hour drive from Washington, D.C., he was able to visit his constituents

¹⁴ Ibid.; "Eisenhower Backs Radio Astronomy" *New York Times*, Jan. 17, 1956.

¹⁵ Lockman, xi.

¹⁶ Stagers, Harley Orrin, (1907-1991) <http://bioguide.congress.gov/scripts/biodisplay.pl?index=s000778> (accessed 22 January 2010).

¹⁷ Anson, 6.; Stagers backed Dr. Conway for the President's Advisory Council on Inter-Governmental Personal Relations. Ibid.

¹⁸ Ibid.

frequently and returned home every weekend. He was very popular in his district, seldom winning elections with less than sixty percent of the vote.¹⁹

From the beginning, Staggers urged that the new observatory be located in West Virginia, preferably in the second district which he represented.²⁰ In a press release dated February 13, 1956, he invited NSF officials to inspect the second district for possible consideration for the project.²¹ Staggers showed his enthusiasm for the proposal: “I am confident that my state of West Virginia can meet the requirements of what will be the nation’s first major radio astronomy center.” The next day, he announced in a press release that the nation’s first radio astronomy observatory would indeed be located in the second district, but refused to pinpoint the exact location.²²

In March 1956, Congressman Staggers sent a telegram to Calvin Price, editor of the Pocahontas Times. In it, he assured local residents that no explosives would be used at the proposed radio astronomy facility.²³ As nuclear missile silos were being built throughout the Great Plains and atomic bombs had been dropped on Japan slightly more than a decade before, residents had a legitimate concern that destructive weapons or a military project might be coming to their area.²⁴ This fear was unfounded. The NRAO continues to be funded by the National Science Foundation and managed by the university cooperative Associated Universities, Inc. It has never had any connection to

¹⁹ Ibid, 7.

²⁰ “Green Bank Observatory” Pocahontas Times, Nov. 1, 1956.; Staggers was sometimes accused of using his power too much for his district. While denying this statement, he said, “I think I’ll have left my mark on the district.” Anson, 6.

²¹ Pocahontas Times, Feb. 13, 1956.

²² Press Release, Harley O. Staggers Office, Feb. 14, 1956, Box 78, A&M 913, Harley O. Staggers Papers, West Virginia Regional Collection, Morgantown, WV.

²³ Telegram, Harley O. Staggers Office, West Virginia Collection.

²⁴ Sugar Grove Naval Station located near Franklin, WV, is an intelligence gathering facility for the U. S. Navy.

the U. S. military. It is an entirely academic venture as it always has been. Stagger's telegram promised:

Residents of the Green Bank-Arbovale Valley who have expressed concern about the type of research work that would take place in the projected facilities need have no fear whatsoever about the safety of the community. I have checked into the matter very carefully and can promise that no hazardous activities of any kind would be carried out. Any fears about the possibility of using the site for work other than in radio astronomy research are also without foundation.²⁵

Staggers emphasized the importance of keeping radio noise to a minimum in the Deer Creek Valley area. He further urged support for the proposed facility, "The project would be extremely beneficial not only to the Green Bank [and] Arbovale area but to the State of West Virginia as a whole."²⁶ The telegram was reprinted in its entirety on March 8, in the Pocahontas Times.²⁷

A series of open meetings were held to convince residents to support the proposed facility and to accept the restrictions that the 13,000 square mile radio quiet zone placed upon them. These restrictions included one which prohibited fixed transmitters from being installed. No radio or television stations could be established in the area for perpetuity.²⁸ For amateur radio operators, it would dictate the types of equipment used, frequencies available for transmissions and a time table for when they could operate their equipment.²⁹

It also meant that no radio stations could be built in the area and made commercial radio reception very difficult. In the early years, before the invention of the internet, this meant anyone wanting to listen to the radio had to buy a short wave radio

²⁵ Ibid.

²⁶ Ibid.

²⁷ "Green Bank Radio Observatory: Special Dispatch from Congressman Staggers" Pocahontas Times, March 8, 1958.

²⁸ "Radio Astronomy Observatory: Proposed for Green Bank to be Explained by Scientist in Public Meetings" Pocahontas Times, April 19, 1956.

²⁹ *National Radio Quiet Zone*. <http://www.gb.nrao.edu/nrqz/>. (accessed Sept. 4, 2009).

set. Radio reception continues to be a problem. Long time resident Peggy McClanahan, said she still has many difficulties receiving her favorite radio programs, in spite of buying a top of the line radio and strategically placing her radio in her home, particularly on days when NRAO scientists are running special projects. She and her family live next to the NRAO in the most restricted tier of the Radio Quiet Zone.³⁰

Obviously, these limitations chafe more now with the advent of cell phones, digital cameras, the internet, and other conveniences that modern Americans take for granted than they did in the 1950s. In recent years, the lack of wireless communications has proved to be a particularly difficult problem. According to the Green Bank Observatory, even radio tags used to track wild animals can wreck havoc.³¹

Wireless communication is the transfer of information over a distance without the use of electrical conductors or 'wires'. The distances involved may be short or long transmitters. Electric fences and other radio wave emitters have caused great trouble for the astronomers in Green Bank technology and microprocessors in everything from cameras to cars it is difficult to keep the sites free of radio interference. To aid in limiting outside interference, the area surrounding the Green Bank observatory was at one time planted with pines characterized by needles of a certain length as to 'block' electromagnetic interference at the wavelengths used by the observatory. At one point, the observatory faced the problem of North American flying squirrels tagged with US Fish & Wildlife Service telemetry transmitters. Electric fences and other radio wave emitters have caused great trouble for the astronomers in Green Bank.³²

Dr. Emberson spoke to high school students on April 24, 1956, at Green Bank High School. He addressed economic and cultural issues, the impact of the proposed facility on the scientific community and the facility's value to the local community. That evening he addressed the entire Green Bank community. The next day, he spoke to a

³⁰ Peggy McClanahan. Pocahontas Senior Center Interviews. Interviewed by Lenora Kenwolf, Feb. 4, 2010, Green Bank, West Virginia.

³¹ *National Radio Astronomy Observatory*.

http://www.absoluteastronomy.com/topics/National_Radio_Astronomy_Observatory. (accessed Aug. 28, 2009).

³² *Ibid.*

group of Marlinton High School students in the afternoon and later that evening, another meeting was held for the general public.³³ He did not fail to impress. Local residents listed these meetings with Emberson and NSF representatives as being a major factor in their acceptance of the project.³⁴ Over time, however, they began to feel the scientists had not been completely honest about the number of farms that would be needed for the project.³⁵

David Smith, 93, of Green Bank, told an interesting tale of his experience with the NRAO. A WVU graduate with a master's degree in Vocational Agriculture, Smith taught this subject at Marlinton High School for many years, and was considered to be one of the finest agricultural instructors in the state. He was also influential in his church and the community.³⁶ At one time, he worked for the NRAO and rented a house from them. First, he was told, they would need his house where he had lived for 18 years. (The recreation center is now located where Smith's home once stood.) So, he bought a farm where he raised cattle. Then, they told him they would also need his farm, which he sold to them at a healthy profit.³⁷

At first, farmers were allowed to continue farming on NRAO property. On November 5, 1958, Emberson wrote in his personal log that since July of that year, the site had earned \$1,000 from renting land to area farmers for grazing cattle and raising hay. Some winter grazing was also allowed.³⁸ According to the NRAO Visitor Center staff, this practice did not continue for long.

³³ Ibid.

³⁴ Pocahontas County Senior Center Interviews. Interviewed by Lenora Kenwolf. Feb. 4, 2010. Green Bank, WV.

³⁵ Ibid.

³⁶ David Smith. Pocahontas County Center Interviews. Feb. 4, 2010.

³⁷ Ibid.

³⁸ Lockman, 28.

Emberson also met with state lawmakers to discuss the proposed facility. He told legislators, if they moved quickly to pass the required zoning laws, the U.S. Congress might “be inclined to act speedily on the appropriation.”³⁹ He assured lawmakers that the \$30 million project was not a top-secret military installation nor was it connected in any way to the naval station at Sugar Grove, Pendleton County. In addition, he explained the implications of the new zoning law which would include both the Green Bank and Sugar Grove areas. Man-made static was expected to increase as time progressed; however, the Green Bank area had to remain as quiet as possible. Certain limitations on business would also be enforced. For example, no radio stations would ever be allowed to broadcast in the Green Bank area.⁴⁰

Dr. Emberson’s work with the West Virginia legislature and the local community was just one part of a larger effort by West Virginia lawmakers and Pocahontas Times newspaper editor Calvin Price to promote the telescope. Governor Marland began meetings with NSF and AUI representatives in March of 1956. Representatives from the legislature included new President of the Senate Ralph Bean, Speaker of the House W.E. Flannery, Senator Fred Allen, and Delegate Frank P. McLaughlin. They also met with representatives from the West Virginia Industrial and Publicity Committee, the Attorney General’s office, and the Arthur D. Little Company.⁴¹ The NSF was impressed by the willingness of West Virginians to work with them and the fitness of the state for the site.⁴²

³⁹ *National Radio Astronomy Observatory*.
http://www.absoluteastronomy.com/topics/National_Radio_Astronomy_Observatory. (accessed Aug. 28, 2009).

⁴⁰ *Ibid.*

⁴¹ “Radio Astronomy Center” Pocahontas Times, March 29, 1956.

⁴² *Ibid.*

On March 15, the Pocahontas Times reported 4,000 acres were under option by AUI. However, property owners of nearly 300 acres in the area were holding out. Many had owned and worked their farms for several generations. Selling the ancestral family farm pained them deeply. Generations of their families had grown up on these farms. They gave their hearts to the land and letting go of it was a bit like losing a part of themselves.⁴³ It was as hard for these men and women to give up their farms and homes as it would be for academics to suddenly be requested to give up all memory of everything they had learned throughout their careers.

Paul Haddock, editor and publisher of the Marlinton Journal, the Republican paper, wrote a single editorial concerning resident anxieties about bringing the NRAO to Green Bank. He stated there were so many rumors circulating “about what the residents would be expected to do in that area and so many other stories that IBM would have trouble keeping track of them all.”⁴⁴ The NSF and AUI remained hopeful in their efforts to secure these properties.⁴⁵

When Haddock interviewed Richard Currence, the local attorney securing the properties for AUI, about the various rumors and locals’ uncertainties, Currence refused to make a public statement until everything was “sewed up.”⁴⁶ At this remark, Haddock pointed out to Currence and Arden Curry, assistant to Governor Marland, who was working with him, that more information on the subject would calm people’s fears.

⁴³ Pocahontas County Senior Center Interviews. Feb. 4, 2010.

⁴⁴ Paul W. Haddock. “Letter from the Editor,” Marlinton Journal, May 2, 1956.

⁴⁵ “Green Bank Observatory” Pocahontas Times, March 15, 1956.

⁴⁶ Marlinton Journal, May 2, 1956.

Currence retorted, “Those who deserve the truth know it.” Curry responded by telling a joke.⁴⁷

According to Haddock, those who “did not deserve to know the truth” were the same farmers who were holding out selling their land. “Finally, through the advice of [local resident] Summers Sharp and others, the hold outs were convinced that they were getting a square deal and signed ... Of course, there are still many folks in the county who are ‘agin’ the project because they think it will harm them in some manner.”

Although, Haddock felt shut out in news “black out”, he was generally supportive of the project with reservations due to what he felt was a lack of information.⁴⁸ Residents had an intense fear that AUI would take their properties by force. This fear was so strong that it remains in the residents’ collective memory today as stories of the NRAO simply bulldozing farms and homes while the residents were at work. However, there is no evidence that this actually occurred. To the contrary, most residents today have positive feelings towards the NRAO.⁴⁹

On April 12, 1956, Dr. Bart J. Bok and Dr. Richard M. Emberson discussed AUI’s feasibility study with local lawmakers and interested parties. Once again, Speaker of the House Flannery, the Attorney General’s Office and Arthur D. Little were present. “During the discussion it was indicated by those making the study that considerable attention has been given to a possible site at Green Bank, West Virginia,”⁵⁰ AUI representatives also discussed legislation to protect the Deer Creek Valley area from manmade radio emissions in the future. “Drs. Bok and Emberson expressed their

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ Pocahontas County Senior Center Interviews, Feb.4, 2010.

⁵⁰ Pocahontas Times, April 12, 1956.

appreciation of the exceedingly sympathetic reception they received from State Officials.”⁵¹

On May 10, the Pocahontas Times published an announcement by Assistant Attorney General Harold A. Bangert, Jr. “There will be absolutely no radio or television interference.”⁵² In an earlier statement, Dr. Emberson, AUI representative, had also assured local residents that there was no reason for alarm about losing their radio and television reception in Pocahontas County or anywhere else. Bangert told readers that no additional information was available. The NSF was still waiting for Congress to appropriate funds for construction of the twenty-five to thirty million-dollar facility. Interim committees of the state legislature recommended passage of zoning legislation for the Green Bank area in a special session set tentatively for June or July.⁵³

By the end of July, things began moving very quickly. The Green Bank site was selected at a meeting of an advisory panel of leading American scientists and astronomers in Ann Arbor, Michigan, on July 23.⁵⁴ The following day, Congressman Staggers and Dr. Alan T. Waterman, Director of the NSF, announced the location of the nation’s first radio astronomy center. However, this decision was conditional; it was subject to passage of zoning legislation that would keep the Green Bank area forever silent to manmade radio noise. The entire project hinged on Governor Marland and the West Virginia legislature. The Governor would have to call a special session of the legislature which he was more than willing to do, to ensure the success of this project.⁵⁵

⁵¹ Ibid.

⁵² “Astronomy Center” Pocahontas Times, May 10, 1956.

⁵³ Ibid.

⁵⁴ Press Release. Harley O. Staggers Office. July 24, 1956. Box 78. West Virginia Collection.

⁵⁵ Ibid.

The project suffered another near miss when Congress threatened to cut its funding.⁵⁶ Some Congressional Representatives like Congressman Albert Thomas (D-Texas) felt the National Science Foundation was growing too quickly and did not require an increase in funding because it did not operate a laboratory.⁵⁷ Congressman Brazilla Reece (R-Tennessee) was concerned that some of the NSF funded research was frivolous and did not relate to the expressed goals of President Eisenhower's executive order, which stated the money was to be used for 'hard' science instead of the social sciences.⁵⁸ An example of one of the projects Congressman Reece had a problem with was a grant to study "the arrangement of and the space required for efficient storage of home sewing equipment."⁵⁹ Congressman Staggers was instrumental in restoring NSF funding and the \$3.5 million that was earmarked for this special project.⁶⁰ For the previous two years, he had worked closely with NSF and AUI officials on the planning and development stages of the project whose costs were to run into the millions.⁶¹

Governor Marland visited Marlinton on July 31 for an Industrial Development meeting. The event included an industrial fair sponsored by the West Virginia Industrial and Publicity Commission and representatives from Arthur D. Little.⁶² Naturally, the biggest item of interest was the proposed radio astronomy center that was now assured for Deer Creek Valley.⁶³ The Governor announced a special session of the legislature on

⁵⁶ U. S. Congress. Senate. Letter from Dr. Alan T. Waterman. Activities of the National Science Foundation: Introduction. 84th Congress. 2nd sess., 11 June 1956, Congressional Record. 102: 9636.

⁵⁷ U.S. Congress. House. 84th Congress. 1st sess., 30 March 1955. Congressional Record. 101: 4068.

⁵⁸ U.S. Congress. House. 84th Congress. 1st sess., 16 June 1955. Congressional Record. 101: 8466-8467.

⁵⁹ Ibid.

⁶⁰ Congressional Record, 84th Congress. 2nd sess., 11 June 1956, 102: 9636.

⁶¹ Ibid.

⁶² "Industrial Development Meeting at Marlinton on Tuesday Afternoon, July 31" Pocahontas Times, July 19, 1956.; "Gov. Marland Comes to Town" Pocahontas Times, Aug, 2, 1956.; Arthur D. Little was an industrial consulting firm that had recently conducted a survey to improve the state's industrial potential.

⁶³ Pocahontas Times, Aug. 2, 1956.

August 9. Two items were to be discussed and voted on – zoning for the Green Bank area and a bill to appropriate funds for engineering equipment at West Virginia University.⁶⁴

In addition to West Virginia lawmakers, Calvin Price, owner and editor of the Pocahontas Times, was an important figure in convincing the local populace to accept the restrictions imposed upon their lives by the proposed radio astronomy observatory for the betterment of the community. Price was once called one of Pocahontas County’s “best loved citizens.”⁶⁵ Calvin Price State Park was named in his honor. In a speech for the Pocahontas County Beautiful dedication, Richard F. Currence said,

In years to come, and when in full bloom, strangers may exclaim in admiration of the beauty of these [dogwood] trees. Each of you who knew Cal Price will heartily add that they are no more beautiful than the whole life of the man to whom they are dedicated.⁶⁶

Towards the end of his long sixty-one year career, Cal Price said, “If I had my life to live over again — I’d still go in the newspaper business.”⁶⁷ He was once called, “one of America’s well known country editors.”⁶⁸ In 1942, he received an honorary doctorate from West Virginia University.⁶⁹ At his induction to the West Virginia Journalism Hall of Fame, Aubrey Ferguson, editor of the Ritchie Gazette said, “He was one whom goodness was innate. It revealed itself in the commonplace ... He believed in people-all kinds of people.”⁷⁰ Upon his death in June 1957, he was remembered fondly by newspapers statewide: “He had the happy quality of remembering names and for years he knew every resident of Pocahontas County and was genuinely interested in all whom he

⁶⁴ Ibid.

⁶⁵ “Pocahontas Beautiful Parade and Dedication Saturday” Pocahontas Times, May 1, 1958.

⁶⁶ Richard F. Currence “Dedication May 3, 1958” Pocahontas Times, May 8, 1958.

⁶⁷ “Veteran Newspaperman: Dr. Calvin W. Price” Pocahontas Times, July 11, 1957.

⁶⁸ Pocahontas Times, May 1, 1958.

⁶⁹ Pocahontas Times, June 20, 1957.

⁷⁰ “Hall of Fame,” Pocahontas Times, Oct. 22, 1959.

met.”⁷¹ Readers enjoyed his “homespun philosophy, comments on nature and wildlife, and the unique manner in which he expresses himself.”⁷²

Paul Haddock, editor of the rival Marlinton Journal, had this to say about Cal Price, “Someday ... I may be able to put into words my many memories of this most loved man. Until then I can only say that I have suffered a great personal loss and that this feeling is shared by every member of the Journal family.”⁷³ Following Price’s death, Haddock’s articles in the Journal became much more favorable towards the NRAO. It is difficult to say with certainty that Price’s death precipitated the change in focus.

The Pocahontas Times ran articles almost every week about some aspect of the radio observatory. On weeks when no news was available, Price reprinted articles from the Charleston Gazette, Readers Digest, Science News Letter, and Time Magazine. Price gave attention to every aspect of the project, from public meetings, press releases from Congressman Staggers, and updates on the NSF and AUI decisions, to every visit Dr. Paul Price made to the area for his soil analysis. Cal Price’s articles were always very favorable towards the project. When efforts to secure land for the proposed facility hit a snag with local property owners, Cal Price told his readers:

Some of the tracts not yet under option are so situated that failure to secure them might endanger the establishment of the observatory. That would be a calamity, indeed.⁷⁴

It is impossible to know what influence his article had on those last few property owners. According to local memory, Price’s articles did sway public opinion in favor of the NRAO. Without his efforts on behalf of AUI and the project, those few remaining

⁷¹ “The Sage of Pocahontas,” Pocahontas Times, June 27, 1957.

⁷² Ibid.

⁷³ Paul Haddock. “30,” Marlinton Journal, June 20, 1957.

⁷⁴ Pocahontas Times, March 15, 1956.

property owners might not have been convinced to sell. Pocahontas County Senior Center members mentioned Cal Price and the Pocahontas Times as one of the biggest factors that influenced their opinion on bringing the NRAO to Green Bank. They were impressed by the scientists' speeches, but they trusted Cal Price and valued his thoughts on the subject.⁷⁵

In August, the West Virginia legislature debated and passed the proposed radio quiet zone. Shortly afterward, the Army Corps of Engineers opened a field office in Marlinton to purchase land and begin construction on what became the nation's first radio astronomy observatory.

Previously, historians have examined the contributions to big science and the NRAO from a strictly scientific perspective. These writings have focused primarily on the scientists and the science involved with very little consideration given to how these programs affected local people, or what efforts state and local politicians made in the process. Often, local residents appear to simply not have been asked how they felt about these projects.

In the case of the NRAO, support of the local people was critical to the creation of, and to the continuing mission of, the NRAO at Green Bank. If AUI could not ensure permanent radio silence, there was no point in building the facility at Green Bank. This could not have been achieved without the cooperation of the state and local government and the consent of area residents. Furthermore, AUI is a conglomeration of universities, not a military department. They wanted to work with the local people, not simply run

⁷⁵ Pocahontas County Senior Center Interviews. Feb. 4, 2010.

roughshod over them. In fact, “a condition of locating the center there ... [was] that the owners of the land ‘must sell the property willingly.’”⁷⁶

Without the expertise of Dr. Paul Price, the political savvy of U.S. Congressional Representative Harley Staggers, the enthusiasm of Cal Price, the insight of Governor William Marland, and other West Virginians – the project would not have been successful. Even today, residents of both Pocahontas and Randolph counties speak fondly of Staggers. He was popular, educated and well liked. He was seen as an honest person, someone people could trust. Residents put a lot of stock in what he had to say.⁷⁷

Only seventeen months elapsed between the time when the idea was first proposed to the people of Pocahontas County, in February 1956, to ground breaking on the first radio telescope in July 1958.⁷⁸ By its dedication in October 1958, the first telescope, an 85 foot antenna named the Tatel Telescope after the late radio astronomer Howard E. Tatel, was nearly complete.⁷⁹ When compared to the 21 years it took to build the 200 inch optical telescope at Palomar Observatory, which was funded and managed in a similar way by CalTech University,⁸⁰ the speed at which the NRAO was established and the first antenna built is impressive. If compared to the time it has taken the state to complete Corridor H, it was lightning fast.

⁷⁶ “Astronomy Center” Charleston Gazette, Feb. 19, 1956.

⁷⁷ Pocahontas County Senior Center Interviews. Feb. 4, 2010.

⁷⁸ Lockman, 27.

⁷⁹ Ibid, 33.

⁸⁰ "The Early History of Palomar Observatory." <http://www.astro.caltech.edu/palomar/history.html> . (accessed 25 January 2010).; It would be next to impossible to find an exact comparison, since there is only one radio quiet zone in the United States. In many ways, Green Bank is home to a unique facility when compared to other telescopes built at close to the same time. Both the NRL and the Sugar Grove radio telescopes were built for the U.S. Navy. In the case of Sugar Grove, near Franklin, WV, its primary function is intelligence gathering rather than radio astronomy.

Chapter 7: Epilogue

The National Radio Astronomy Observatory has seen many changes over the past fifty years. It has expanded to several new locations across the U. S. and around the world. Two NRAO facilities – the Very Large Array located in Socorro, New Mexico, and the Arecibo Observatory in Arecibo, Puerto Rico, have served as locations for several feature films, including the movie “Contact”. However, it is not all fun and games at the NRAO. NRAO scientists and engineers working for the Central Development Laboratory (CDL) have led development efforts in new technologies to improve radio astronomy. These developments have included low-noise cryogenic amplifiers and digital correlators. MIT initially designed the correlators, but the NRAO improved upon this technology. NRAO innovations have strongly influenced R&D efforts at other observatories and universities. “CDL designs are being used in radio astronomy observatories worldwide” In addition, every year the NRAO enables more than one thousand astronomers worldwide to conduct scientific research in radio astronomy. This number is expected to increase significantly in the next ten years.¹

Today, the Green Bank site is:

A leader in the scientific study of pulsars, dense neutron stars that serve as laboratories in which astronomers study the physics of extreme states of matter and enormous magnetic fields. The GBT can also detect the fingerprints of atoms and molecules far into the distant Universe, yielding new knowledge about star formation, the structure and motions of gas in galaxies, and Nature's fundamental constants.²

¹ K.Y. Lo, “The Impact of the National Radio Astronomy Observatory: State of the Profession White Paper,” http://www.nrao.edu/A2010/whitepapers/NRAO_AS2010_SoP_paper.pdf (accessed March 22, 2010).

² “Robert C. Byrd Green Bank Telescope (GBT)” <http://www.nrao.edu/index.php/about/facilities/gbt> (accessed March 24, 2010).

Recent discoveries made at Green Bank include a “unique double pulsar that tests Einstein’s theory, [a] star cluster buzzing with pulsars and cold sugar in space [that] provide[s] clues to the molecular origin of life.” These are but a few of the many discoveries found using the Green Bank telescopes.³

Since the construction of the NRAO at Green Bank, the economic situation on the Eastern Ridge of West Virginia has actually gotten worse. Although in the 1950s, residents may have felt they were living in a recession, things were actually better than they are today.⁴ Ironically, at the time, residents felt they had not caught up with the prosperity the rest of the country was enjoying. The town of Cass, WV, elegantly illustrates this decline. When the lumber mill in Cass shut down, the town slowly died. Today, the entire town is owned by the state park service. An excerpt from the park’s website describes it best:

Back in 1911, West Virginia led the nation with more than 3,000 miles of logging railroad line. All is gone now, except for the 11 miles at Cass, restored just as it was in the early 1900's, making Cass Scenic Railroad State Park America's authentic operating museum of lumber railroading ...⁵

Visitors to Cass Scenic Railroad State Park can ride the old lumber routes in open cars with steam and smoke blowing in their faces as a fireman hand shovels coal into the firebox and keeps track of the boiler so the train won’t explode. Time has made one change. The train had an African American woman working as fireman the day my family rode the train. The folks of 1911 or even 1955 would certainly be shocked at that! Company houses, which were once home to West Virginia Pulp and Paper Company workers, have been restored and can now be rented out to travelers. The company store

³ “Discoveries Made With the Green Bank Telescope” <http://www.gb.nrao.edu/epo/GBT/data.html> (accessed March 24, 2010).

⁴ Carman Metheny. Elkins City Council Interviews. Interviewed by Lenora Kenwolf, March 2010.

⁵ “Why Cass Exists Today” <http://www.cassrailroad.com/history.html> (accessed March 24, 2010).

has become a gift shop and home to the town's only restaurant. In 1957, Cass was an incorporated town with a mayor, police chief and a street commissioner.⁶ Today, 360 residents still live in the quiet little town, where only the occasional whistle from the daily excursion train breaks the silence.⁷

The NRAO brought many changes to the area and not just Pocahontas County. For residents of nearby Randolph County, one of the biggest changes was strict Federal Communications Commission enforcement of radio regulations. Before the NRAO came completely online, the surrounding counties had a large number of illegal radio operators. Elkins' City Council members Carman Metheny, Robert Malcolm and Thomas Hensil told several stories about substantial amounts of illegal radio and television broadcasting.

This area of West Virginia has never had open air television transmissions freely available to the people. Instead, residents paid for cable services. In the 1950s, one local teenager decided to remedy this situation by placing several batteries and a transmitter on a high mountain where he retransmitted a Pittsburg television station for the entire town of Elkins. He was the talk of the town. Unfortunately for this young man, word reached the ears of the Federal Communications Commission who gave him a warning and destroyed his equipment.⁸

Area citizens' band (CB) and amateur radio enthusiasts got a big surprise one day when the FCC enforcement officers arrived with a long list of local offenders to prosecute.⁹ Robert Malcolm, who would later serve for many years on the Elkins City

⁶ J. Howard Myers, *West Virginia Blue Book 1957* (Charleston: Jarrett Printing Company, 1957) p. 606.

⁷ *Cass, WV* <http://www.zip-codes.com/city/WV-CASS.asp> (accessed 6 Feb 2010).

⁸ Carman Metheny, Thomas Hensil and Robert Malcolm in discussions with the author in March 2010.

⁹ At that time (and still today), Elkins was the center of all state and federal legal activities for several surrounding counties. The people on this list were from all over, not just from Elkins.

Council and still represents the Third Ward on the council today, was one of those on this list. Malcolm related his experience with the FCC:

They stayed up here [in Elkins] at the motel ... We had to come up there to the motel. The motel is gone. It was called Kays. I had to go up there ... There was no need to lie about it. We were all using them [radios] illegally.¹⁰

His CB radio transmissions were so strong that he was interfering with a business in California which turned him in. He was asked to turn off his 100 watt amplifier, and he complied immediately.¹¹ From then on, he obeyed FCC regulations in every way and never had additional trouble. Others were fined and/or equipment destroyed.¹²

Malcolm was one of the minor transgressors. Thomas Hensil's father-in-law was one of the more serious offenders. Hensil told this story about his father-in-law's radio equipment. One day, his father-in-law asked him to hang a circular neon bulb about ten inches in diameter on a fence pole about 150 feet from the house. "Watch that bulb light up when I key this mike," his father-in-law said. The light turned on.¹³ By far the worst offender was William Currence.¹⁴ He worked for Western Maryland Railroad, repairing radio and television equipment. One day, he decided to mess with Thomas Hensil and other residents who enjoyed watching football on television. Currence broadcast a signal so intense that it overlapped the cable television signal, forcing everyone in town to look at a picture of his granddaughter.¹⁵

In another instance, Thomas Hensil wanted to play a joke on his neighbors by broadcasting over their home radio that they had won \$500 and to call a certain telephone

¹⁰ Robert J Malcolm in discussions with the author March 2010.

¹¹ According to Malcom and Metheny, the highest output of CB radio was five watts at that time. More power required a different license than Malcolm had.

¹² Robert J. Malcolm, Elkins City Council Interviews, March 2010.

¹³ Thomas Hensil in discussions with the author March 2010.

¹⁴ No relation to attorney Richard Currence mentioned earlier.

¹⁵ Elkins City Council Interviews, March 2010.

number. He asked Currence to build him a device that would allow him to interrupt his neighbor's radio program. Currence did so in about an hour, then called Hensil and told him to go out to his car and turn on the radio to a specific frequency. Hensil followed these instructions. Currence said over the car radio, "Well, I got your radio built for you." When Hensil went to pick up the radio, Currence had already disassembled it because it was illegal.¹⁶

Although Currence frequently enjoyed obstructing residents' television viewing, this was not what landed him in serious trouble. One of his favorite pastimes was getting drunk and using profanity over the CB radio, which he would blast at about 500 watts with a linear antenna. This caused him problems including fines, but this was not his worst offence. It was when he got very drunk and broadcast over the CB at 500 watts, "Hey Kowalski [an FCC attorney that had prosecuted him before], are you listening you communist [expletive]? [Followed by more profanity]" The FBI arrested him. Somehow, he was able to keep his HAM and CB licenses and was able to avoid serving jail time; however, he did have to pay an exorbitant fine. This marked the end of William Currence's illegal radio activities.¹⁷ After these incidents, local radio enthusiasts made no more trouble for the FCC.¹⁸

At least one local resident, Diane Schou, moved into the area because of the Radio Quiet Zone.¹⁹ She suffers from electro-hypersensitivity [EHS] "which means [s]he has severe physical reactions to the electromagnetic radiation produced by common

¹⁶ Thomas Hensil Interview. Elkins City Council Interviews, March 2010.

¹⁷ Ibid.

¹⁸ Elkins City Council Interviews, March 2010.

¹⁹ Suzanne Stewart, "Allergic to Electricity in the Electronic Age" Pocahontas Times, February 12, 2009.

consumer technologies, such as computers, televisions and cellphones.”²⁰ She says common household items like televisions, microwaves, and fluorescent lights give her headaches.²¹ Sweden is the only nation in the world that recognizes electromagnetic sensitivity as a “functional impairment.” The San Francisco Medical Society has the following to say about EHS:

Treatment is not well established, since there is little to no agreement about whether this is a true medical syndrome. Patients report that eliminating exposures to EMF/RFR is the primary way they deal with their symptoms. Occupational exposures that result in chronic symptoms generally cannot be treated without a change in work environment. Some researchers find that antioxidants can retard or eliminate RFR effects in cellular studies (probably by reducing free-radical damage or cellular stress known to occur with RFR exposure).²²

Most scientists agree that the extremely low-frequency radiation emitted from common household items is harmless.²³

John Walls, Vice President of Public Affairs at CITA-The Wireless Association, the international industry body said: ‘There is no known mechanism for [EMFs] within the limits established by the FCC to cause any adverse health effects.’ A host of major institutions – including the U. S. Food and Drug Administration, the International Commission on Non-Ionizing Radiation Protect (ICNIRP), the American Cancer Society and the World Health Organization – agree with this assessment.²⁴

In an article published last year in BioElectronics, researchers “found no evidence that hypersensitive individuals had an improved ability to detect EMFs, and the study reported evidence of the nocebo effect in the same people.”²⁵ The nocebo effect is defined as “the expectation that something will make you sick actually does make you

²⁰ James Geary, “Disconnected” *Popular Science* (March 2010), 56.

²¹ Pocahontas Times, Feb. 12, 2009.

²² Cindy Sage, “Microwave And Radiofrequency Radiation Exposure: A Growing Environmental Health Crisis?”

<http://www.sfms.org/AM/Template.cfm?Section=Home&template=/CM/HTMLDisplay.cfm&ContentID=1770> (accessed March 5, 2010).

²³ *Popular Science* (March 2009), 56.

²⁴ *Ibid*, 56-57.

²⁵ *Ibid*, 56.

sick.”²⁶ Psychologically based or not, Schou and others like her are finding relief within the radio quiet zone. This condition has become a topic of local interest with citizens lining up on both sides of the issue.²⁷

While the rest of the county has declined in numbers, Green Bank has experienced a population explosion when compared with its neighbors. In 1957, approximately a hundred people, mostly farmers, lived in Green Bank. While remaining unincorporated, the greater Arbovale-Green Bank area is now home to 521 people. The average householder makes \$7,000 a year more than his fellow West Virginians and lives in a house over fifteen years newer.²⁸ According to Jay Miller, Pocahontas County Coordinator, the median family income in the county is about \$26,000, although, NRAO employees earn more. In an e-mail to the author, Miller said, “The Green Bank area of the county ... [has] the largest concentration of college-educated people ... Without the NRAO, there would be far less need for college graduates for the remaining jobs.” Once upon a time, the town had only a small general store and service station. Today, it has two restaurants and the new NRAO Visitor Center for local residents and visitors to enjoy, as well as a new Dollar General and several other businesses.

Unbeknownst to the residents of Green Bank at the time, the sheep industry, which was one of the primary forms of income in the area, peaked in 1942. By the mid 1950s, sheep inventories had decreased by nearly half their 1940s levels across the country. This trend continues today. In 1942, there were 56 million sheep nationwide.

²⁶ Ibid.

²⁷ Pocahontas County Senior Center Interviews, Feb. 4, 2010.

²⁸ “Green Bank Private Schools.”

http://www.privateschoolreview.com/town_schools/stateid/WV/townid/8225 (accessed 6 Feb 2010).

Today, levels have dropped to 6.2 million.²⁹ The family cattle farm has not fared much better than the sheep industry. West Virginia livestock auctions peaked in the 1950s. The first livestock auction in West Virginia opened for business in 1932. By 1950, there were 22 stockyards throughout the state. The decline of the livestock business started in the 1950s. By 1971, four stockyards had closed.³⁰ The small family farm gave way to large farms or corporate farming.³¹

In January 2010, the Elkins Stockyards closed its doors forever after 64 years in operation. The last livestock sale was held in July 2008. During its heyday in the 1950s, local radio station WDNE broadcast weekend sales over the radio. Livestock sales would often last late into the night. One sale started at 8 pm on a Friday evening and lasted until 4:30 am the next morning. In addition, the stockyards had a restaurant with a seating capacity of one hundred. Today, the stockyard sits crumbling, awaiting demolition. Of the nearly thirty auctions throughout the state, that operated at the height of the livestock trade, only nine are still in operation.³²

Many farmers in Pocahontas County are no longer able to make a living solely from farming. Often, they have other jobs to supplement their income. According to an e-mail by Jay Miller, Pocahontas County Commissioner, farming is still a significant source of income for a few residents who ship their calves to feedlots out of the area.³³ However, there are no dairy farms in the area anymore. Although some farmers have survived the decline of the family farm, without the NRAO, the area was sure to have

²⁹ "Development and Structure of the U.S. Sheep Industry" Board on Agriculture and Natural Resources. Vol. 1, No. 1 (2008): 16.

³⁰ John P. Kuehn, "Summary." *West Virginia University Experiment Station*. May 1971, 2.

³¹ *Ibid*,1.

³² Grant Jones. "Elkins Stockyard Scheduled For Demolition," *Intermountain*. 27 January 2010.

³³ Cattle which are not used as breeding stock or in the dairy industry are often called calves regardless of age. The calves referred to in this paragraph are adult animals.

been hard hit by the sudden and sharp decline of the livestock industry that was once its lifeblood.

Today, what were the county's biggest employers in the 1950s have almost all either closed or run in severely reduced circumstances. The tanneries are all gone now. The once bustling Western Maryland Railroad has moved on. Once the source of many families' livelihoods, the sawmills and lumber companies sit rusting. The population of Pocahontas County has dropped from 12,480 in 1957³⁴ to 9,131 in 2004.³⁵

In an e-mail, from Michael J. Holstine, Business Manager for the NRAO, the current top five employers in the county are: the Snowshoe Mountain Resort, the Pocahontas County Board of Education, the Silver Creek Resort, Inter-State Hardwoods and the NRAO. Although there is some disagreement on this list, Jay Miller from the County Commission states the largest employers are the state and local government, followed by Snowshoe and "Beckwith Lumber in Slaty Fork and a few other timber related businesses ... Tourism and hospitality [hotels, motels, and restaurants] are the largest industry sector, with Snowshoe dominating." Both men would agree the NRAO is an important source of income for area residents.

Fortunately, the NRAO picked up some of the slack caused by the decline of Pocahontas County's businesses and industries; today it provides employment for over 120 people, making it the fifth largest employer in the county. Holstine said 55% of NRAO employees are from the local area. "Having [the] NRAO in Pocahontas County contributes a very welcome \$22.2 million to the economies of the County and the state." This figure includes employee salaries and tourism dollars. The facility has turned into a

³⁴ Myers, *West Virginia Blue Book 1957*, 540.

³⁵ Darrel Holmes, *West Virginia Blue Book 2004*. (Charleston: Chapman Printing, 2004), 693.

real blessing for the area, creating good times out of what could have very well been disaster.

Residents continue to have concerns that the NRAO is doing military experiments or has some secret connection to the military.³⁶ In spite of AUI President Lloyd Berkner's high hopes that radio astronomy would one day have military applications, this has proved to be almost entirely untrue. Dr. Harold "Doc" Ewen researched this subject for the Department of Defense.³⁷ He stated in his essay "Two Roads that Crossed in the Woods," there were only two military innovations that had any impact on radio astronomy and only one unsuccessful attempt to use radio astronomy for the military.

One success was a radar perimeter fence located in Alaska called "White Alice." It is a series of radar stations maintained by the Air Force which has patrolled and protected the area since the 1950s.³⁸ According to Ewen, "the timely product of White Alice for the radio astronomy community was low noise receiver technology and affordable computers."³⁹

The Semi-Automatic Ground Environment (SAGE), popularly known as the "Texas Towers," was located one hundred miles off the coast of New England. "SAGE was the most ambitious computer project ever undertaken. The Project required over 800 programmers and the technical resources of some of America's largest corporations... It remained in continuous operation until 1983, over 20 years."⁴⁰ It was a U. S. Air Force program that provided air defense for the East Coast of the United States. "For

³⁶ Pocahontas County Senior Center Interviews, Feb. 4, 2010.

³⁷ Harold "Doc" Ewen. "Doc Ewen: The Horn, HI, and Other Events in Radio Astronomy" http://www.nrao.edu/archives/Ewen/ewen_top.shtml (accessed 31 August 2009).

³⁸ "A History of the White Alice Communications System" <http://www.whitealice.net/history/history.html>. (accessed 22 February 2010).

³⁹ Ewen, "Doc Ewen: The Horn, HI, and Other Events in Radio Astronomy" (accessed 31 August 2009).

⁴⁰ "SAGE Computer System (developed in the 1950's, operational by 1963)" <http://www.computermuseum.li/Testpage/IBM-SAGE-computer.htm> (accessed 22 February 2010).

TV viewers, the high power transmitter developments ... opened up the UHF TV spectrum.”⁴¹

In the 1960s, the U. S. Navy hoped to build a 600 ft. steerable antenna. It was a rather ambitious idea that was heavily researched but never completed. However, it produced a great deal of data that was “an invaluable fund” of information for designing large scale antennas. This information came in very handy when the NRAO built first the 140 ft, and then the 210 ft antennas at the Green Bank site.⁴²

Radio astronomy has only ever made one contribution to military science – the Polaris Submarine Sextant. The idea was to use the radio signals from the sun or the moon in submarine navigation systems. Problems arose from the start. Although there were other complications with the waveguides and antennas, the show stopper turned out to be an intelligence matter. The antenna’s movement underwater compromised the submarine’s invisibility to hostile forces. The project was scrapped in 1959.⁴³

Once again the military greatly improved knowledge in several areas of radio astronomy.

Contributions included improved knowledge of solar, lunar and radio star phenomenology. The Polaris initiative also contributed to advancements in the associated instrument technology such as maser amplifiers, low noise broadband traveling wave tubes, closed cycle cooling systems, and techniques like the sky horn and RF noise balancing.⁴⁴

The Department of Defense has historically given much more to the field of radio astronomy than any information gathered by radio astronomy has ever helped the

⁴¹ Ewen, “Doc Ewen: The Horn, HI, and Other Events in Radio Astronomy” (accessed 31 August 2009).

⁴² Ibid.

⁴³ Ibid.

⁴⁴ Ibid.

military. In effect, radio astronomy has made no publicly acknowledged significant contributions to developing weapons systems or any defense program.⁴⁵

Most people would find the restrictions of living in the only National Radio Quiet Zone quite miserable. After all, there is no texting, no cell phones and no wireless service, but Green Bank residents don't seem to mind. Thanks to the laws governing radio transmissions in the area, area residents have been able to hold back time so to speak. Neighbors still rely on neighbors.

Tony Byrd and his wife moved to the Green Bank area in 1959 where they continue to farm and raise cattle. Byrd speaks of the difficulty he had fitting into the community at first, where most of the residents have lived in Pocahontas County for generations and are somewhat leery of "newcomers," something that the NRAO scientists also experienced. Whereas the Byrds found friendship and fellowship in their church, the NRAO decided to move its headquarters to Charlottesville, Virginia, to the University of Virginia in late 1965.⁴⁶ The move was traumatic for the Green Bank crew, but it "foreshadowed" the NRAO's expansion to several more sites throughout the U. S. and its territories.⁴⁷

Byrd speaks of the family atmosphere in the Green Bank area, which he and his wife have grown to love. There residents are more than neighbors, they are like extended family. He spoke of caring for neighbors' children, even picking them up from school when necessary, or stopping to put a neighbor's cow in the barn. His son makes a homemade ice rink in his backyard every year, where local kids play hockey.⁴⁸ Local

⁴⁵ Contributions for NASA should be considered more scientific in scope.

⁴⁶ Lockman, 529.

⁴⁷ Ibid.

⁴⁸ Tony Byrd. Pocahontas County Senior Center Interviews, Feb. 4, 2010.

seniors, who most likely know very little about soccer, will proudly tell the visitor to their community how their team won the state championships last year, as if it were their own children playing.⁴⁹

It is easy to see, when visiting the NRAO at Green Bank, how this family atmosphere has rubbed off on the facility. Many former employees tell stories of whole families who have worked there at one time or another. Employees often retire from the NRAO after many years of service. One engineer worked there for over 44 years, maintaining and repairing the antennas and other equipment.⁵⁰

To the outsider, life without instant messaging and wireless modems may be unfathomable, but the folks at Green Bank like life a little slower. Erin Baldwin is the Sales and Grant Coordinator for the Pocahontas County Convention and Visitors Bureau and a Green Bank resident. “The grounds of the NRAO are accessible to the public,” she says in an e-mail, “and it is a great place to run and walk my dogs under the shadow of the scopes. A[t] times it can be a slight inconvenience, as we have no cell phone service and are asked not to have wireless internet as both can interfere with the research [done there].” These same restrictions, in effect, keep the area frozen in time where Mayberry U.S.A. is still possible, where kids safely ride their bikes across town, and neighbors help one another. To the people of Green Bank, they have a little piece of paradise – almost heaven, West Virginia.

⁴⁹ Pocahontas County Senior Center Interviews, Feb.4, 2010.

⁵⁰ Ibid.

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Jane Sharp (former Editor Pocahontas Times) in discussions with the author Feb. 2010.

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Robert J. Malcolm (HAM Radio Operator, Local Professional Entertainer, retired Railroad Worker and Third Ward Representative to the Elkins, WV City Council) in discussions with the author March 2010.

Steve McClelland (former Geologist at the West Virginia State Geologist Office) in discussions with author March 2002.

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