

The “Giant Drunk” of Boone, North Carolina:  
A Historical Examination of the Mod-1 Wind Turbine

By  
Natasha Thompson

HIST 452  
Dr. Tracey Rizzo  
21 November 2003

In 1979, a columnist for the *Charlotte Observer* alleged that a “giant drunk” plagued the town of Boone, North Carolina, attempting to flag down rides from vehicles on the highway.<sup>1</sup> The writer referred not to a literal inebriated hitchhiker, but instead to the world’s largest wind turbine at that time, the product of a government wind energy project cosponsored by NASA and the Department of Energy, known as the Mod-1 wind turbine. Reactions to the turbine varied, ranging from positive, to negative, to mocking, to apathetic. Lauded for its role in the research of wind energy as a renewable method of generating electricity, it also faced sharp criticism due to malfunctions and inefficiency. By the time of its dismantling in 1983, stories surfaced in newspapers that described the turbine as a failure and a waste of tax dollars. Such an assessment, however, completely ignores the experimental nature and value of the Mod-1. Despite the problems that plagued the project, along with the turbine’s inability to consistently produce significant quantities of electricity, the Mod-1 project did not deserve its reputation as a complete failure. The machine provided scientists with important information on the feasibility of using wind turbines to generate electricity.

Few, if any, scholarly sources exist that deal exclusively with the Mod-1 wind turbine, or NASA’s Mod project. However, some scholarly sources relating to alternative energy development or environmental movements in the twentieth century provide limited information. This information may mention the Mod-1 specifically, or just movements toward wind energy at the time of the Mod-1’s development.

Environmental historian Ted Steinberg’s book, *Down to Earth: Nature’s Role in American History*, provides useful information concerning the environmental movement

---

<sup>1</sup> Pat Jobe. “The Gimmicks, my Friend, are Blowing in the Wind” *Charlotte Observer*, 24 August 1979.

in the United States during the 1970's, focusing some sections on the decade's movement to develop energy alternatives to petroleum.<sup>2</sup> In environmental historian Hal Rothman's book, *Saving the Planet: The American Response to the Environment in the Twentieth Century*, includes a section describing the oil embargo of 1973 that increased interest in developing alternative forms of energy.<sup>3</sup> Presidential policy researcher Dennis L. Soden's compilation of essays, *The Environmental Presidency* provides information on the environmental policies of presidential administrations during the time of the Mod-1's design, operation, and dismantling.<sup>4</sup>

Technology historian Carroll Pursell's journal article, "The Rise and Fall of the Appropriate Technology Movement in the United States, 1965-1985," discusses some of the ways that the Reagan administration sought to reverse policy's of the Carter administration in regard to alternative energy research.<sup>5</sup> Political scientists Michael E. Kraft and Regina S. Axelrod also provide information on the switches in environmental policy from Carter to Reagan in their article, "Political Constraints on Development of Alternative Energy Sources: Lessons From the Reagan Administration."<sup>6</sup>

Also, several scholarly sources exist with information on the development of wind energy technology in general. *Wind Energy in America: A History*, by wind energy historian Robert W. Righter, examines the uses of wind turbines throughout U.S. history before and during the twentieth century. This book also touches specifically on the role

---

<sup>2</sup> Ted Steinberg, *Down to Earth: Nature's Role in American History*, (New York: Oxford University Press, 2002).

<sup>3</sup> Hal K. Rothman, *Saving the Planet: The American Response to the Environment in the Twentieth Century*, (Chicago: Ivan R. Dee Publishing, 2000).

<sup>4</sup> Dennis L. Soden, ed. *The Environmental Presidency*, (Albany: State University of New York, 1999).

<sup>5</sup> Carroll Pursell, "The Rise and Fall of the Appropriate Technology Movement in the United States, 1965-1985," *Technology and Culture*, 1993 34 no. 3.

<sup>6</sup> Michael E. Kraft and Regina S. Axelrod, "Political Constraints on Development of Alternative Energy Sources: Lessons From the Reagan Administration," in *Policy Studies Journal*, 1984 13 no. 2

that NASA's Mod program played in the development of modern wind turbines. Wind power historian Paul Gipe's *Wind Energy Comes of Age* deals primarily with wind energy developments in the second half of the twentieth century. His book also contains a section devoted to NASA's Mod program. Wind energy researcher Matthias Heymann's journal article "Signs of Hubris: The Shaping of Wind Technology Styles in Germany, Denmark, and the United States, 1940-1990," published in *Technology and Culture* compares wind energy developments in the three countries over fifty years. The article goes into detail about the Mod program and the Mod-1. It also provides information on how this program rated against international programs of the time.<sup>7</sup>

NASA historian Howard E. McCurdy's book, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program*, provides information on the motives behind NASA's decision to implement the Mod program. It also gives insight into the reasons for the program's decline, explaining factors like budget cuts in more detail than sources focusing more on the program than on NASA.<sup>8</sup>

Available information regarding energy issues of the period provides some explanation as to why NASA chose to build a wind turbine with a tower 140 feet tall,

---

<sup>7</sup> Robert W. Righter, *Wind Energy in America: A History* (Norman, OK: University of Oklahoma Press, 1996);

Howard E. McCurdy, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program* (Baltimore: Johns Hopkins University Press, 1993); Matthias Heymann, "Signs of Hubris: The Shaping of Wind Technology Styles in Germany, Denmark, and the United States, 1940-1990," *Technology and Culture* 39, no. 4 (1998) 641-670 [journal on-line]; available from [http://0-muse.jhu.edu.wncln.wncln.org/journals/technology\\_and\\_culture/v039/39.4heyman.html](http://0-muse.jhu.edu.wncln.wncln.org/journals/technology_and_culture/v039/39.4heyman.html); Internet; accessed 19 September 2003.

<sup>8</sup> Howard E. McCurdy, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program* (Baltimore: Johns Hopkins University Press, 1993).

blades spanning 200 feet in diameter and weighing 327.5 tons.<sup>9</sup> A variety of factors influenced demand for alternative forms of energy, including an oil embargo, changing national attitudes toward the environment, and NASA's need to find a new purpose after the decline and eventual demise of the Apollo Program.

As electric consumption grew within the United States, the nation needed fuel to produce enough electricity to meet the demand. Unable to acquire all of the petroleum necessary to run its oil-burning power plants, the country turned to importing oil from other nations, with most of this oil coming from Arab countries. In 1973, the Organization of Petroleum Exporting Countries (OPEC) initiated an oil embargo against the United States in response to U.S. support for Israel, a nation at war with Egypt at that time. This embargo lasted exactly six months, reminding people of the America's dependence on foreign oil.<sup>10</sup> Interest in alternative forms of energy production grew as the U.S. government sought ways to escape this dependence on other nations. Escalating oil prices also contributed to the rise in the public's interest in speculative methods for producing electricity. Researchers pursued possibly less expensive forms of energy.<sup>11</sup>

Motives behind the environmental drive of the 1970's varied. Besides presidential administrations, historians consider natural disasters, documented cases of blatant corporate abuse of the land, the rise of feminism and even the moon landing as instigating factors for the rise of environmentalism in the 1970's. Environmental

---

<sup>9</sup> John L. Collins and others, *Experience and Assessment of the DOE-NASA Mod-1 2000-kilowatt Wind Turbine Generator at Boone, North Carolina* (Washington, D.C.: U.S. Department of Energy, Conservation and Renewable Energy, Division of Wind Energy Systems, 1982), 3, DOE/NASA 20366-2.

<sup>10</sup> Rothman, 93.

<sup>11</sup> Righter 150, 152-153.

historian Ted Steinberg suggests that pictures of the Earth from space emphasized the small size of the planet and the need to protect it.<sup>12</sup>

Budget cuts also fueled NASA's research into wind energy technology. NASA's popularity, along with its budget, flourished as the agency sent humans to the moon. In 1973, however, these expeditions ended and NASA's budget declined, along with public opinion regarding the agency. Between 1965 and 1975, NASA's budget declined from over \$15 billion annually, to just over \$5 billion. In 1965, 33 percent of Americans felt that the government spent too much money on NASA; this percentage rose to 59 percent in 1973. NASA historian Howard E. McCurdy attributed this decline to a change in concerns among Americans who were more interested in domestic issues than outdoing the Soviet Union in a space race.<sup>13</sup>

Budget cuts to the agency forced NASA to reduce the scope of its efforts. NASA lost several of its research facilities at this time. In fact, the Lewis Research Center, responsible for overseeing the Mod program, almost fell victim to budget cuts. In an effort to justify its existence and its budget, NASA sought to develop more programs relevant to improving and enhancing life on Earth. NASA researched tools to measure air quality, new automobile engines, and under the Mod program, economical electricity produced using wind.<sup>14</sup> Without these budget cuts and NASA's new need to be 'useful,' the Mod program might never have existed.

NASA collaborated with another government agency for research and development of the new wind project. In 1973, the National Solar Energy Program, part

---

<sup>12</sup> Steinberg, 247-249.

<sup>13</sup> McCurdy, 102-104.

<sup>14</sup> Ibid., 126.

of the National Science Foundation, created the Federal Wind Energy Program.<sup>15</sup> The department expressed an interest in developing large-scale wind turbines. As early as 1973, NASA and the Federal Wind Energy Program began designing the first of the Mod wind turbines, the Mod-0 wind turbine, a 100-kilowatt wind turbine with blades spanning 125 feet in diameter.<sup>16</sup> NASA's Lewis Research Center constructed this wind turbine near its home in Sandusky, Ohio, in 1974.<sup>17</sup>

Design and construction of the Mod-0A wind turbines followed the Mod-0. NASA built four of these turbines through 1978 in Clayton, New Mexico; Culebra Island, Puerto Rico; Black Island, Rhode Island; and on Oahu, Hawaii, on Kahuku Point. These wind turbines possessed the ability to produce up to 200 kilowatts of electricity.<sup>18</sup> Although they gained much knowledge from these smaller-scale wind turbines, researchers sought to develop wind turbines larger in size and electrical production capacity.

In addition to the Mods -0, -0A, and -1, NASA also constructed several other wind turbines based on two other designs. Designed while the Mod-1 operated, the Mod-2 machines began operating in December 1980. The Mod-2s possessed the ability to produce up to 2.5 megawatts of electricity, compared to the Mod-1's original capacity of 2 megawatts. Instead of having only stand-alone Mod-2s, NASA constructed three of the machines close together in Goodnoe Hills, Oregon. Here NASA experimented with a

---

<sup>15</sup> Forrest B. Green and J. Linn Mackey, eds., *A Study of the MOD-1 Wind Turbine in Boone, NC, and its Future Options: a Project by the College of Business Production and Operation Management Class and by the Watauga College Earth Studies Preparation Class* (Boone, NC: Appalachian State University, 1982), 24.

<sup>16</sup>NASA, *Wind Developments in the Twentieth Century* (Cleveland:NASA, 1981), 5.

<sup>17</sup> Green, 25.

<sup>18</sup> *Ibid.*: Paul Gipe, *Wind Energy Comes of Age* (New York: John Wiley & Sons, Inc., 1995), 102.

mini-wind farm of giant windmills.<sup>19</sup> Unlike the single Mod-1, NASA constructed four Mod-2s, all of which were dismantled by the late 1980's.<sup>20</sup>

As the Mod-2s went down, the next and final Mod prototype, the Mod-5B, went up. Rated to produce 3.2 megawatts of electricity, the Mod-5B outdid all its predecessors. Wind historian Paul Gipe considered the Mod-5B NASA's most successful Mod wind turbine, citing not only its ability to produce larger quantities of electricity, but also because it operated for the most hours out of any Mod turbine. A Mod-5B turbine operated through the mid-1990's in Hawaii. NASA dismantled this one as well.<sup>21</sup>

Fortunately for the Mod-0 and the Mod-0A, their construction took place during a time when the federal government showed a commitment to environmental issues, providing a supportive environment for the development of wind energy technology. During the first term of Richard Nixon's presidency, 1968-1972, much environmental legislation passed, including the National Environment Policy Act (1970), the Clean Air Act (1970), and the Water Pollution Control Act (1972).<sup>22</sup> This reflected environmental concern not only on the part of Nixon, but also on the Democrat-controlled Congress of the time. Nixon showed his support of environmental initiatives (and perhaps for the votes such initiatives might generate) by readily signing environmental legislation in to law. He also used a pro-environmental stance during his successful re-election campaign of 1972.<sup>23</sup> The passage of such acts reflected a growing environmental movement within

---

<sup>19</sup> James L. Schefter, *Capturing Energy from the Wind* (Washington, D.C.: NASA, Scientific and Technical Information Branch, 1982), 66-67, NASA SP-455.

<sup>20</sup> Gipe, 104.

<sup>21</sup> *Ibid.*, 105.

<sup>22</sup> Steinberg, 250-251.

<sup>23</sup> Raymond Tatalovich and Mark J. Wattier, "Opinion Leadership: Elections, Campaigns, Agenda Setting, and Environmentalism," in *The Environmental Presidency* ed. Dennis L. Soden, (Albany: State University of New York Press, 1999), 166-167.



the United States.<sup>24</sup>

Due largely to budget cuts, NASA needed to outsource much of the construction of several of its wind turbines to private corporations. Several components of the Mod-1 came from these outside contractors. NASA regularly offered contracts to companies engaged in aircraft construction and technology. NASA researchers believed that many of the concepts necessary for building airplanes might also prove relevant in constructing large wind turbines.<sup>25</sup>

In 1976, NASA offered General Electric a contract to design and construct a new wind turbine, the Mod-1.<sup>26</sup> NASA also offered a contract to Boeing to build the blades for the Mod-1. Both corporations accepted these offers. General Electric then offered its own contract to Philadelphia Gear to construct the gearbox. In many cases, General Electric used pre-existing parts and technology in an effort to save money. General Electric constructed the turbine's generator in Philadelphia.<sup>27</sup>

The actual construction and some of the Mod-1's operation took place during a presidential administration committed to ensuring the growth and development of alternative methods of generating electricity. Jimmy Carter entered office when the oil crisis lay, once again, on the minds of the people and the politicians. During his administration, which lasted from 1977-1981, he actively supported research and development of a variety of alternative energy sources, including wind energy.<sup>28</sup> Carter pumped large amounts of funding into alternative energy research, attempting to make

---

<sup>24</sup> Steinberg, 250-251.

<sup>25</sup> Heymann.

<sup>26</sup> National Aeronautics and Space Administration, *Wind Developments in the Twentieth Century* (Cleveland:NASA, 1981),15.

<sup>27</sup> Green, 25.

<sup>28</sup> Dennis L. Soden and Brent S. Steel, "Evaluating the Environmental Presidency," in *The Environmental Presidency* ed. Dennis L. Soden, (Albany: State University of New York Press, 1999), 332-333.

such developing technology “... a competitive alternative to conventional sources of energy.”<sup>29</sup>

As the construction of the wind turbine progressed, researchers looked for an appropriate site for their project. Developers needed to find a spot with the correct amount of wind at appropriate speeds to generate electricity for the Mod-1. The Energy Research and Development Administration, the newly-formed department with jurisdiction over the Federal Wind Energy Program,<sup>30</sup> studied sixty-five possible locations for the Mod-1 throughout the United States, placing a monitoring station on Howard’s Knob, a mountain peak located in Boone, North Carolina. Scientists left the monitoring station in place for a full year in order to determine if the Watauga County location produced favorable and consistent wind speeds.<sup>31</sup> By December 1977, scientists working on the project chose Howard’s Knob as the site for the Mod-1.<sup>32</sup> In addition to the strong breezes recorded at the site, Howard’s Knob possessed the added benefit of belonging to Watauga County, which leased the land to the government for six years.<sup>33</sup>

In order to make the journey from Philadelphia to Howard’s Knob, General Electric had to deconstruct the generator into its component parts. Even when disassembled, some pieces of the generator remained “boxcar-size.”<sup>34</sup> Crews started construction of the tower on Howard’s Knob to hold the generator in June 1978.<sup>35</sup>

The blades created some difficulty as early as the production stage. Boeing, the

---

<sup>29</sup> Michael E. Kraft and Regina S. Axelrod, “Political Constraints on Development of Alternative Energy Sources: Lessons From the Reagan Administration,” in *Policy Studies Journal*, 1984 13 no. 2, 319.

<sup>30</sup> *Ibid.*, 24.

<sup>31</sup> “On Howard’s Knob: Blowin’ in the Wind,” *Carolina Country* April 1977.

<sup>32</sup> “Cooperative to Operate Wind-Powered Generator,” *Carolina Country* December 1977, 7.

<sup>33</sup> Wake Bridges, “Boone Windmill Nears Completion,” *Hickory (NC) Daily Record* 3 November 1978.

<sup>34</sup> “Windmill Generator is Behind Schedule,” *Winston-Salem Journal* 27 October 1978, 27.

<sup>35</sup> *Ibid.*

company manufacturing the blades, encountered problems with the first blade it produced, as the blade curled while under production. Boeing then built two more blades.<sup>36</sup> After construction, the issue of transporting the blades from Boeing's plant in Seattle, WA, to North Carolina arose. The blades, each 100 feet in length, needed to stay assembled during transport, so Boeing shipped them by two extra-large trucks, which arrived in Boone on 26 April 1979. The trucks possessed "... two steering mechanisms..." with one driver "... in a cab on the front...and another rid[ing] in a cab midway along the truck."<sup>37</sup>

By the end of construction, the Mod-1's costs added up to roughly \$6 million. Researchers anticipated that the Mod-1 would produce enough power to the area to service 400 homes. NASA also planned to eventually turn ownership of the windmill over to a local utility company if operations proved successful.<sup>38</sup> Mod-1 developers anticipated a thirty-year life span for the windmill.<sup>39</sup>

Workers completed construction and test runs on the windmill in time for its dedication on 11 July 1979. The residents of Boone treated the dedication day like a holiday, holding sidewalk sales in the downtown area, along with performances by bands and performers from local theme parks.<sup>40</sup> In addition to the fair-like festivities, government officials made speeches at a reception held at Appalachian State University. The "director of the Energy Division of the state Department of Commerce," Brian Flattery, praised the windmill, expressing a belief that developments in alternative energy

---

<sup>36</sup> Ibid.

<sup>37</sup> "Wind-Powered Generator: Windmill Blades Arrive," *Winston-Salem Journal* 27 April 1979.

<sup>38</sup> "Biggest Windmill to Supply Electric Power in Boone Area," *North Wilkesboro (NC) Journal-Patriot* p. 1, 8.

<sup>39</sup> "Officials to Dismantle and Abandon Windmill," *Asheville Citizen-Times*, 6 November 1982.

<sup>40</sup> Charlene Havnaer, "Windmill Turns at its Dedication," *Winston-Salem Journal* 12 July 1979.

sources could provide America with domestically produced fuel.<sup>41</sup> Dr. Bennett Miller, a representative from the Department of Energy, spoke on the need to develop more solar and wind energy systems in order to shake dependence on imported oil, declaring that “... we must look to sunshine and wind power.”<sup>42</sup> Although the dedication occurred in July, NASA planned to continue testing the windmill before integrating it with the local electric grid.<sup>43</sup>

Because the Mod-1 constituted an experiment for NASA and the Department of Energy, the department now supervising the Federal Wind Energy Program,<sup>44</sup> NASA desired more from the wind turbine than just the production of electricity. NASA had several goals for the Mod-1. Since researchers hoped to eventually develop machines to benefit many individual electric companies, the Mod-1 scientists needed to see the results of a local power company operating their windmill. They chose Blue Ridge Electric Membership Corporation (BREMCO), a company based out of Lenoir, North Carolina, that until the inception of the Mod-1 never generated its own power but instead bought it from outside companies. This company supplied Boone and surrounding areas with electricity.<sup>45</sup>

Not only did researchers want BREMCO to operate the machine, but they also wanted the company to conduct the operation at a remote location, from BREMCO’s headquarters in Lenoir. Designers built safety mechanisms into the Mod-1 so that upon detection of a problem, blades ceased spinning and its computer alerted BREMCO’s

---

<sup>41</sup> “Windmill Brings Power to Carolina Mountains,” in *The New York Times* 12 January 1979, sec. D, p. 6.

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Green, 24.

<sup>45</sup> Schefter, 63-64.

control station. Developers also installed a control station at the Mod-1 site for maintenance and testing purposes.<sup>46</sup>

Besides the need to train local utility employees to operate the Mod-1, researchers also needed to solve the problem of integrating power from the Mod-1 with the local electric grid. Since wind speeds shift often, the amount of electricity produced by the windmill varied depending on the day's conditions. Maintaining a steady amount of power production allowed for a "smooth" integration between the windmill and the grid.<sup>47</sup> Mod-1 research teams decided on limiting operation of the windmill to times when the wind blew between 11 and 35mph. Slower winds lacked enough force for turning the blades. Faster winds generated too much energy and ran the risk of damaging the machine. The Mod-1 needed a speed of 25.5mph for optimal power generation.<sup>48</sup>

In addition to gaining information on operating and maintaining the Mod-1, the program also investigated public reactions to the windmill. An assortment of responses surfaced during the years the Mod-1 operated. Often, negative feedback resulted from problems with the machine.

Noise and television interference produced by the Mod-1 constituted the bulk of the local population's complaints, with most of these related to television reception. A 1982 report released by NASA indicated that, out of Boone's 12,000 residents, 35 homes complained about problems with television reception, while 10 homes complained about excessive sound.<sup>49</sup> These complaints came from residents calling in to BREMCO's

---

<sup>46</sup> Collins, 4, 8.

<sup>47</sup> Schefter, 20-21.

<sup>48</sup> Green, 28-30.

<sup>49</sup> Collins, 12.

offices.<sup>50</sup> Although the numbers of complaints were low in proportion to the overall population of Boone, NASA researchers set out to correct these problems. After all, the Mod-1's primary purpose was experimentation so that scientists could know more about the benefits and problems of similar machines.<sup>51</sup>

Residents complaining about television reception often mentioned distortions of television signals. NASA and the Department of Energy called upon the University of Michigan's Department of Electrical Engineering to investigate this problem. The Michigan team discovered that the blades of the Mod-1, whether spinning or still, slightly altered television signals broadcast to the area. However, interference greatly increased when the blades rotated. Upon learning this in 1980, NASA stopped operating the Mod-1 during primetime television hours. This provided a temporary solution, but did not promote efficient production of electricity. The Michigan team proposed other possible solutions, including the installation of cable television or the building of more transmitters in the area to rebroadcast signals. NASA and the Michigan researchers both agreed on the installation of cable television as the easiest and cheapest solution to the problem. NASA also suggested that the implementation of fiberglass blades on the Mod-1 might also reduce interference, although this solution was never implemented.<sup>52</sup> In the 1982 report, NASA suggested that even before the construction of the windmill, the Boone area suffered from "poor" television reception,<sup>53</sup> indicating that the Mod-1 did not deserve all the blame for low-quality television signals in the area.

As early as 1979, NASA received complaints about noise produced by the Mod-1.

---

<sup>50</sup> Schefter, 64.

<sup>51</sup> Green, 27.

<sup>52</sup> Schefter, 65.

<sup>53</sup> Collins, 13-15.

Although NASA experienced television complaints with earlier Mod generators, no residents indicated noise problems at any of the Mod-0 or Mod-0A sites. Complaints in Boone consisted primarily of reports of “thumping” sounds. Studies indicated these sounds resulted from a build up of pressure behind the blades as they rotated in front of the tower. Spinning past the tower released the pressure, resulting in the “thump.”<sup>54</sup> Residents living closest to the Mod-1 also reported a “whooshing” sound as the blades turned.<sup>55</sup>

NASA set out to develop a solution to the noise problem. After much consideration, scientists decided to slow the Mod-1. Noise complaints occurred while the Mod-1 spun at 35 revolutions per minute, a speed necessary for the production of 2 megawatts of electricity. NASA removed the original generator in the turbine and replaced it with one capable of producing only 1.5 megawatts of electricity. This slowed the Mod-1’s speed to 23rpm, and eliminated noise complaints.<sup>56</sup>

Other problems with the windmill, although not affecting local residents as dramatically as television and sound problems, also contributed to an overall negative image of the windmill in the eyes of the public. A general lack of operating time contributed greatly to the difficulty the Mod-1 faced in winning a positive response from the public. Although optimism towards the windmill was present at the Mod-1’s dedication,<sup>57</sup> a motionless windmill could hardly inspire confidence the belief that the Mod-1 effectively contributed to wind energy technology. Several factors contributed to

---

<sup>54</sup> Green, 44-47.

<sup>55</sup> Winston Cavin, “Worrisome Windmill: Experiment Costs Peace, Quiet,” *Greensboro Daily News* 6 April 1980, sec. A, p. 1, 13.

<sup>56</sup> “Boone Windmill Slowed to Reduce Noise,” *Asheville Citizen-Times* 20 November 1980.

<sup>57</sup> “Windmill Brings Power to Carolina Mountains”

the Mod-1's inactivity.

The solutions to noise and television problems led to an idle windmill. The windmill stopped operating during primetime television hours. Until the installation of the slower generator, windmill activities also ceased at night to allow a quiet sleep environment. Installing the new generator itself also put the windmill out of commission for a month to allow for completion of the work. Even after the installation of the new generator, NASA needed time to test the Mod-1 operating at the new speed before production of electricity could resume.<sup>58</sup>

The Mod-1 often needed maintenance and updates. Since no wind turbine existed like the Mod-1, new modifications often came under development, and it took time to implement such additions. In May 1980, maintenance crews added ice detectors to its blades. NASA wanted the Mod-1 to cease its operation in icy weather, citing the experimental nature of the machine as the reason for stopping it in such conditions. The implementation of such detectors, along with stops in the winter due to ice, left the Mod-1 standing idle. In addition to modifications, crews also performed routine maintenance.<sup>59</sup> This maintenance also took time and prevented the turbine's continuous operation.

A lack of adequate wind created an unanticipated problem without a solution. Preliminary tests conducted by the Federal Wind Energy Program in 1977 indicated that the Howard's Knob location provided enough suitable winds for supplying the windmill with an adequate amount of wind. However, the study also discovered that wind levels

---

<sup>58</sup> Collins, 15.; "Windmill Undergoing Changes," *Hickory Daily Record* 17 September 1980.

<sup>59</sup> "Windmill is Undergoing Maintenance, Modification," *North Wilkesboro (NC) Journal-Patriot* 15 May 1980.



varied in different seasons, with peak winds blowing in the winter, while the slowest winds occurred in the summer and fall. Therefore the majority of the Mod-1's electric production occurred in winter, presenting an image to the public of a windmill with limited operational capabilities.<sup>60</sup> The winter of 1979-1980 produced slower winds than anticipated, resulting in even less operation of the Mod-1, raising doubts of its effectiveness.<sup>61</sup>

These factors led to a further increase in negative public opinion regarding the Mod-1. Exaggerations about the windmill's problems, such as a line in a Salisbury, North Carolina, newspaper estimating the number of homes with windmill-related television problems in the thousands, did nothing to help its image.<sup>62</sup> Wind power historian Robert W. Righter felt that the general public lacked the knowledge to make informed decisions about the success of wind experiments like the Mod-1, and that such ignorance also led to negative opinions of such projects. He said, "... [the] public did not always understand that inoperative machines could still provide knowledge. Many people saw them [experimental wind turbines] as a symbol of the unworkability of wind power."<sup>63</sup>

Not everyone reacted negatively to the Mod-1. In 1981, Watauga County Parks and Recreation opened a park at the base of the windmill that included picnic areas and walking trails.<sup>64</sup> Even before the park's completion, people visited the site. In 1982 NASA reported site workers distributing 4,000 brochures each year to visitors eager to

---

<sup>60</sup> Green, 13.

<sup>61</sup> "Follow-Up on the News: Wind Power," *New York Times* 9 March 1980, p. 41.

<sup>62</sup> Bill Jackson, "\$30 Million Left Blowin' in the Wind," *Salisbury (NC) Evening Post* 13 August 1982.

<sup>63</sup> Righter, 159.

<sup>64</sup> Randy Johnson, "Windmill Park, Earth Studies Center Invite a Look at Alternative Energy," *Charlotte Observer* 5 June 1981, sec B, p. 2.

learn more about the Mod-1, with international visitors from Asia, South America, and Europe. NASA also indicated that at times the volume of visitors and tour groups interfered with operations crews trying to study and maintain the Mod-1.<sup>65</sup> Possibly motivating an increase in visitors, the 1981 Knoxville, Tennessee, World's Fair gave the Mod-1 the status as a "stopover point" of the fair.<sup>66</sup> According to a 1982 survey conducted by Appalachian State University students in a business class, 73% of Watauga residents felt that the Mod-1 boosted tourism to Boone. While no statistics exist to support this belief, it does indicate that Watauga residents held the windmill in a positive light.<sup>67</sup>

Perhaps the strangest reaction to the Mod-1 involved a group of Appalachian State University students who formed a group called the Pangalactic Unification Church and Restaurant, otherwise known as the Cult of the Wooshies, the name based on the "wooshing" sound made by the windmill.<sup>68</sup> This supposed cult started as a class video project of two graduate students attending the university. They produced a short film parodying the CBS show "60 Minutes." Their "spoof" presented an examination of a fictitious group of people devoted in worship to the Mod-1. Newspaper accounts of the Wooshies reported the stunt gained international fame, with small pockets of people in England, Canada, France, and Germany knowing of the Wooshies.<sup>69</sup> Although perhaps not the public reaction NASA sought, the Wooshies provided interesting publicity for the machine.

---

<sup>65</sup> Collins, 21.

<sup>66</sup> Johnson.

<sup>67</sup> Green, 53.

<sup>68</sup>"Windmill a White Elephant," *Morganton (NC) News Herald* 25 February 1980.

<sup>69</sup> Sandra Shook, "Bizarre Cult Worships Windmill?," *Boone (NC) Weekender* 24 July 1980, p. 13.

Less than two years after its dedication, the Mod-1 encountered structural problems that eventually led to its sale and dismantling. Twenty-two bolts in the drive train fractured on 20 January 1981. The failure of these bolts made operation of the Mod-1 impossible. Investigations into the fractures revealed that high amounts of stress placed on the bolts, along with their improper installation, led to the breakage and that the metal composing the bolts lacked any defects.<sup>70</sup>

Ronald Reagan's election as president signaled a change in the way the federal government addressed environmental issues. Reagan worked to undo much of the environmental legislation passed during the 1970's. He appointed individuals to environmental posts that lacked concern for environmental issues. Reagan's administration also significantly reduced the budgets of environmental departments and those departments researching environmentally friendly technology.<sup>71</sup> Indicating a shift away from environmentally friendly policies, Reagan removed solar panels from the roof of the White House. Jimmy Carter had these panels placed on the roof during his presidency as part of his commitment to alternative energy policies.<sup>72</sup>

Reagan's election, along with his policies regarding environmentalism and alternative energy research, signaled a change in the priorities of Americans away from an emphasis on environmental protection and toward correcting an ailing economy. During 1980, the year of Reagan's election, letters to the editor of the newsmagazine *Time* further indicated this shift. One such letter expressed a faith that Reagan would

---

<sup>70</sup> Collins, 19-20.

<sup>71</sup> Long, 210-211.

<sup>72</sup> Pursell, 633.

“...do something about the economy and give the workingman a chance for a decent life.”<sup>73</sup>

In the end, federal budget cuts for wind energy programs associated with the Reagan administration led to the demise of the Mod-1. Officials estimated the price of repairing the damaged bolts at \$500,000. 1981's wind energy budget allotted \$80 million for research. For the 1982 budget, wind energy only applied for \$19.4 million. Repairing the Mod-1 clearly lay out of reach for the Federal Wind Energy Program, as it also needed to maintain its other, newer machines throughout the country.<sup>74</sup> Without the massive budget cuts, the Mod-1 might have been repaired so that further knowledge could be obtained from its experimental run.

Deciding that it cost too much to repair the Mod-1, NASA then chose to get rid of it. Watauga County officials hoped that the government would offer the windmill to the county free of charge,<sup>75</sup> although such an offer never materialized. NASA also offered ownership of the Mod-1 to BREMCO, which also chose not to purchase it due to the high costs of operating it. NASA encouraged General Electric to contact other U.S. utility companies that might have an interest in purchasing the Mod-1 for energy production. Although a company in Hawaii considered purchasing the windmill, in the end, none wanted it.<sup>76</sup>

The General Services Administration, the government department responsible for liquidating unwanted federal property, opened bidding in 1983 to any person or company

---

<sup>73</sup> Scott Hillesland, Letter to the editor of *Time*, *Time* 3 November 1980, 4.

<sup>74</sup> Tim Wheeler, “Wind Generator Near Boone may Close,” *Winston-Salem Journal* 15 March 1981, sec. A, p. 11.

<sup>75</sup> “Watauga Negotiating for Windmill Ownership,” *Asheville Citizen-Times* 30 September 1982.

<sup>76</sup> Jim Dumbell, “NASA Experiment Over: Hawaiian Electric may Buy Windmill,” *Charlotte Observer* 30 September 1981, sec. C, p. 1,2.

seeking to buy the windmill. The GSA placed no stipulations on the minimum bid, but did require all bidders to place a \$2,500 deposit, returned to those who lost the auction.<sup>77</sup>

The auction ended with McBess Industries, a Lincoln County, North Carolina, yarn company, placing the winning bid of \$51,600. McBess intended to use the generator from the Mod-1 in a small hydroelectric power plant it owned and operated in Lincoln County. In exchange for tax benefits, McBess also donated the Mod-1's tower to Georgia Tech, which the school used in radar experiments.<sup>78</sup>

Boone residents, upon learning of the winning bid, began a drive to keep the bid from finalization and the Mod-1 on Howard's Knob. U.S. Senators Jesse Helms and John East and Representative James T. Broyhill heard concerns from Boone residents. A Hickory, North Carolina, newspaper reported these politicians pledged support for keeping the Mod-1 in Boone.<sup>79</sup>

The push to keep the windmill on Howard's Knob failed. The GSA informed Watauga County residents that they missed early opportunities to obtain ownership of the windmill. Since the county failed to show interest in acquiring the windmill when it had the chance, the GSA saw no reason to make special concessions to the county after McBess followed proper guidelines for purchasing the Mod-1.<sup>80</sup>

McBess offered the two blades of the Mod-1 free of charge to Watauga County for placement in a monument at the Howard's Knob Park. The Watauga County Board of Commissioners indicated that no county funds could be spared to build a site for the

---

<sup>77</sup> Jim Dumbell, "For Sale: One Slightly Used, World-Class Windmill," *Charlotte Observer* 27 April 1983, sec. C, p. 1, 4.

<sup>78</sup> Joan L. Murphy, "Boone Residents: Don't Sell Our Windmill," *Hickory (NC) Daily Record* 6 May 1983, sec. A, p. 1, 8.

<sup>79</sup> *Ibid.*

<sup>80</sup> Bruce Henderson, "Yarn Factory Wins Contract to Cart Away Fated Windmill," *Charlotte Observer* 1 July 1983, sec. C, p. 4.

blades. When the county attempted to collect donations from residents for construction of the site, only one person, Mary Jo Walsh, contributed money to the fund. She gave \$50, which the county returned to her.<sup>81</sup> Watauga County instead chose a plaque to remember the Mod-1 while the blades traveled to another North Carolina location, Forsyth County's Nature Science Center, where they still stand at the entrance of the center.<sup>82</sup>

Before the sale of the Mod-1 finalized, criticism of the wind project appeared in several newspapers, contributing to the image of the Mod-1 as a failed project. The *Atlanta Constitution* described the Mod-1 as "A \$30 million experiment that failed," and exaggerated the extent to which the noise and television interference from the machine bothered local residents.<sup>83</sup> A *Charlotte Observer* writer described the windmill as "... motionless like some multimillion-dollar monster constantly scrutinizing downtown Boone."<sup>84</sup> The *Richmond Times-Dispatch* reported that Boone residents mainly responded with disdain toward the Mod-1,<sup>85</sup> despite the fact that other sources indicate those living in Boone held an appreciation for the windmill.

Critics of the Mod-1 had many complaints about the experimental machine. Its costs ran close to \$30 million and it operated only a small fraction of the time it stood on Howard's Knob, only 330 hours out of a possible 29,112.<sup>86</sup> The Mod-1 produced only 75,000 kilowatt hours of electricity out of a possible 43,668,000. It incurred massive

---

<sup>81</sup> "Giant Windmill Coming Down; Monument Out," *Salisbury (NC) Evening Post* 18 August 1983.

<sup>82</sup> Bruce Henderson, "Windmill Blades Stir Interest in Center," *Charlotte Observer* 12 January 1984, sec. B, p. 1.

<sup>83</sup> Gail Epstein, "A \$30 Million Experiment that Failed-NASA Windmill up for Sale: It's Cheap," *Atlanta Constitution*, 28 April 1983.

<sup>84</sup> Jim Dumbell, "For Sale: One Slightly Used, World-Class Windmill."

<sup>85</sup> "\$5 Plus Expenses May Buy Windmill," *Richmond Times-Dispatch* 28 April 1983.

<sup>86</sup> "Officials to Dismantle and Abandon Windmill."

repair bills. It created problems with excessive noise and interfered with television reception.<sup>87</sup> The Mod-1 lacked efficiency.

Still, the project did not result in total failure. Scientists researching the possibilities of implementing wide scale production of power from wind gained new knowledge from the Mod-1 program. Researchers on the Mod-1 project established the fact that a local utility company could operate such a machine. They discovered problems faced by megawatt windmills, like excessive noise, and developed solutions for these problems, like slowing the blades. Researchers also discovered how to effectively integrate electricity from such a machine into a local power grid and how to operate one from a remote location. NASA left the Mod-1 project optimistic about the future of producing electricity from wind, with one official telling a Hickory, North Carolina, newspaper that in regard to allegations that the Mod-1 failed, “It was not the kind of failure that makes us worry about whether wind turbines are going to work.”<sup>88</sup>

Although the Mod-1 did not lead to a massive shift toward wind power in the United States, it did provide useful insights into the development of future wind energy technology. Because of information gained from this project, the Mod-1 deserves no label as a failure. It did exactly what its designers had intended: it gave researchers insights into the difficulties and feasibility of operating a megawatt windmill on a pre-existing power grid.

The Mod-1 also represented a time when the people and leaders of the nation chose to focus on developing more non-fossil fuel based, environmentally friendly

---

<sup>87</sup> Murphy.

<sup>88</sup> Ibid.

methods of energy production, either out of a love for the environment, or due to a desire to break free from dependence on foreign oil. The changing political and cultural attitudes of the 1980's, shifting to a focus on the economy over the environment, cut short the life of the Mod-1.



## Works Cited

### Primary Sources

Collins, John, et al. *Experience and Assessment of the DOE-NASA Mod-1 2000-kilowatt Wind Turbine Generator at Boone, North Carolina*. Washington, D.C.:NASA, 1982.

This 1982 NASA report provides much information on the design of the Mod-1 and the goals the developers had in mind for the wind turbine. It also contains much information on the technical aspects of the windmill.

“Follow-Up on the News: Wind Power.” *New York Times*, 9 March 1980, p. 41.

This article provides information on how Boone residents were reacting to the windmill almost a year after its dedication.

Green, Forrest B. and J. Linn Mackey, eds. *A Study of the MOD-1 Wind Turbine in Boone, NC, and its Future Options: A Project by the College of Business Production and Operation Management Class and the Watauga College Earth Studies Preparation Class*. Boone, NC: Appalachian State University, 1982.

This report compiled by two Appalachian State University Classes provides information on the technical aspects of the windmill, along with information on the reaction of Boone residents to the machine.

Hillesland, Scott. Letter to the editor of *Time*. *Time*, 3 November 1980, 4.

This letter provides an example of a shift of public opinion more focused on economic issues rather environmental ones.

NASA. *Wind Developments in the Twentieth Century*. Cleveland: NASA, 1981.

This book provides information on wind energy technology developed in the twentieth century, with information on NASA’s Mod Program.

Schefter, James L. *Capturing Energy from the Wind*. Washington, D.C.: NASA, Scientific and Technical Information Branch, 1982, NASA SP-455.

This book provides information on the science behind wind energy technology, along with some examination of the Mod program.

“Windmill Brings Power to the Carolinas.” *New York Times*, 12 July 1979, sec. D, p. 13.

This article provides information on festivities on the dedication day of the Mod-1.

### Appalachian State University Clippings File-Windmill Boone, NC

“\$5 Plus Expenses May Buy Windmill.” *Richmond Times-Dispatch* 28 April 1983.

This article provides information on the conditions of the sale of the sale of the windmill after NASA decided to abandon it.

“Biggest Windmill to Supply Electric Power in Boone Area.” *North Wilkesboro (NC) Journal Patriot* 8 July 1979, p. 1, 8.

This article provides information on the goals that NASA had for the Mod-1.

Bridges, Wake. “Boone Windmill Lacks Only Blades to Generate Juice.” *Hickory (NC) Daily Record*, 3 November 1978.

This article provides information on the delays faced with the construction of the Mod-1’s blades.

“Boone Windmill Slowed to Reduce Noise.” *Asheville Citizen-Times*, 20 November 1980.

This article provides information on NASA’s attempts to reduce noise generated by the Mod-1 by slowing its blades.

Cavin, Winston. “Worrisome Windmill Costs Peace, Quiet.” *Greensboro Daily News*, 6 April 1980.

This article provides information on the Mod-1-related noise problems faced by some Boone residents.

“Cooperative to Operate Wind-Powered Generator.” *Carolina Country*, December 1977.

This article provides information on Blue Ridge Electric Membership Cooperative’s role in being the local utility company to operate the Mod-1.

Dumbell, Jim. “For Sale: One Slightly Used, World-Class Windmill.” *Charlotte Observer*, 27 April 1983, sec. C, p. 1, 4.

This article provides information on the sale of the Mod-1.

\_\_\_\_\_. “NASA Experiment Over: Hawaiian Electric may Buy Windmill. *Charlotte Observer*, 30 September 1981, sec. C, p. 1, 2.

This article provides information on NASA’s abandonment of the Mod-1 and the possibility of its sale to a Hawaiian Electric Company.

Epstein, Gail. “A \$30 Million Experiment that Failed-NASA Windmill for Sale: It’s Cheap.” *Atlanta Constitution*, 28 April 1983.

This article provides information on the sale of the Mod-1, along with criticisms of the windmill.

“Giant Windmill Coming Down: Monument Out.” *Salisbury (NC) Evening Post*, 18 August 1983.

This article provides information on the dismantling of the windmill, along with a report on Watauga County’s decision to not build a monument for the windmill.

Havnaer, Charlene. “Windmill Turns at its Dedication.” *Winston-Salem Journal* 12 July 1979.

This article provides information on the dedication of the windmill, along with public reaction to the Mod-1.

Henderson, Bruce. "Wataugans Wax Fond of Windmill After Auction." *Charlotte Observer*, 11 May 1983.

This article provides information on the push by Watauga County residents to retain the Mod-1 after it had already been sold in a government auction.

\_\_\_\_\_. "Windmill Blades Stir Interest in Center." *Charlotte Observer*, 12 January 1984.

This article provides information on the placement of the Mod-1's blades at Forsyth County's Nature Science Center.

Jobe, Pat. "The Gimmicks, my Friend, are Blowing in the Wind." *Charlotte Observer*, 24 August 1979.

This article provides an example of criticism of the windmill.

Johnson, Randy. "Windmill Park, Earth Studies Center Invite a Look at Alternative Energy." *Charlotte Observer*, 5 June 1981.

This article provides information on the park built at the base of the Mod-1.

Murphy, Joan L. "Boone Residents: Don't Sell Our Windmill." *Hickory (NC) Daily Record*, 6 May 1983, sec. A, p. 1, 8.

This article provides information on the opposition of Boone residents to the sale of the Mod-1.

"Officials to Dismantle and Abandon Windmill." *Asheville Citizen-Times*, 6 November 1982.

This article provides information on NASA's decision to scrap the Mod-1 project.

"On Howard's Knob: Blowin' in the Wind." *Carolina Country*, April 1977.

This article provides information on the tests scientists conducted before deciding that Howard's Knob would be chosen for the site of the Mod-1.

"Watauga Negotiating for Windmill Ownership." *Asheville Citizen-Times*, 30 September 1982.

This article provides information on Watauga County's attempts to keep the windmill after NASA abandoned it.

Wheeler, Tim. "Wind Generator Near Boone May Close." *Winston-Salem Journal*, 15 March 1981, sec. A, p. 11.

This article provides information on NASA's tentative (at the time) plans to shut down the Mod-1 after crucial bolts broke on the machine.

"Windmill a White Elephant." *Morganton (NC) News Herald*, 25 February 1980.

This article provides information on the farcical "Wooshie" cult that supposedly

worshipped the Mod-1.

“Windmill Generator is Behind Schedule.” *Winston-Salem Journal*, 27 October 1978, p. 27.

This article provides information on the delays experienced in the construction of the Mod-1.

“Windmill is Undergoing Maintenance, Modification.” *North Wilkesboro (NC) Journal-Patriot*, 15 May 1980, sec. C, p. 1.

This article provides information on maintenance performed on the Mod-1.

“Windmill Undergoing Changes.” *Hickory (NC) Daily Record*, 17 September 1980.

This article provides information on maintenance for the Mod-1.

“Wind-Power Generator: Windmill Blades Arrive.” *Winston-Salem Journal* 27 April 1979.

This article provides information on the shipping of the Mod-1’s blades.

#### **Appalachian State University Clippings File-Howard’s Knob Boone, NC**

Jackson, Bill. “\$30 Million Left Blowin’ in the Wind.” *Salisbury (NC) Evening Post*, 13 August 1982.

This article provides an example of exaggerated claims of Mod-1 interference with TV reception.

#### **Appalachian State University Clippings File-Howard’s Knob**

Shook, Sandra. “Bizarre Cult Worships Windmill?” *Boone Weekender*, 24 July 1980, p. 13.

This article provides information on the farcical “Wooshie” cult that supposedly worshipped the Mod-1.

#### **Secondary Sources**

Gipe, Paul. *Wind Energy Comes of Age*. New York: Johns Wiley & Sons, Inc., 1995.

This book provides a comprehensive history of wind energy in the twentieth century.

Heymann, Matthias. “Signs of Hubris: The Shaping of Wind Technology Styles in Germany, Denmark, and the United States, 1940-1990.” *Technology and Culture*. 39, no. 4 (1988) 641-670 [journal on-line]; available from [http://0-muse.jhu.edu.wncln.wncln.org/journals/technology\\_and\\_culture/v039/39.4heyman.html](http://0-muse.jhu.edu.wncln.wncln.org/journals/technology_and_culture/v039/39.4heyman.html); Internet; accessed 19 September 2003.

This article provides information on the Mod program, along with some of the difficulties Mod researchers encountered.

- Kraft, Michael E. and Regina S. Axelrod. "Political Constraints on Development of Alternative Energy Sources: Lessons From the Reagan Administration." *Policy Studies Journal*, 1984 13 no. 2.  
This journal article provides information on the differing environmental policies of the Carter and Reagan presidential administrations.
- Long, Carolyn, et al. "The Chief Environmental Diplomat: An Evolving Arena of Foreign Policy." In *The Environmental Presidency*. Ed. Dennis L. Soden. Albany: State University of New York Press, 1999.  
This essay provides information on environmental policies during the presidencies of Gerald Ford and Ronald Reagan.
- McCurdy, Howard E. *Inside NASA: High Technology and Organizational Change in the U.S. Space Program*. Baltimore: John Hopkins University Press, 1993.  
This book provides a history of NASA, along with information on the budget cuts that compelled it to begin new projects like the Mod Program.
- Pursell, Carroll "The Rise and Fall of the Appropriate Technology Movement in the United States, 1965-1985." *Technology and Culture*, 1993 34 no. 3.  
This journal article provides information on some of the steps taken by Reagan to undo environmentally friendly practices implemented by Carter.
- Righter, Robert W. *Wind Energy in America: A History*. Norman, OK: University of Oklahoma Press, 1996.  
This book provides information on the development of wind energy technology in the United States. It also provides insights as to why the Mod-1 had a poor reputation in the eyes of the public.
- Rothman, Hal. *Saving the Planet: The American Response to the Environment in the Twentieth Century*. Chicago: Ivan R. Dee Publishing, 2000.  
This book provides information on the 1973 OPEC oil embargo against the U.S.
- Soden, Dennis L. and Brent S. Steel. "Evaluating the Environmental Presidency." In *The Environmental Presidency*. Ed. Dennis L. Soden. Albany: State University of New York Press, 1999.  
This essay provides information on environmental policies during Jimmy Carter's presidency.
- \_\_\_\_\_. Ed. *The Environmental Presidency*. Albany: State University of New York, 1999.  
This book contains essays regarding the environmental policies of presidents governing during the years the Mod-1 was in planning, operation, or dismantling.
- Steinberg, Ted. *Down to Earth: Nature's Role in American History*. New York: Oxford University Press, 2002.

This book provides a useful synopsis of the energy crisis of the early 1970's.

Tatalovich, Raymond and Mark J. Wattier. "Opinion Leadership: Elections, Campaigns, Agenda Setting, and Environmentalism." In *The Environmental Presidency*. Ed. Dennis L. Soden. Albany: State University of New York Press, 1999.

This essay provides information on Richard Nixon's environmental policies.