ABSTRACT

Title of Thesis:	MOSQUITO BEATERS AND ROCKETS: CAPE CANAVERAL'S PEOPLE AND TECHNOLOGY FROM ORANGE GROVES TO APOLLO
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The Kennedy Space Center on Cape Canaveral holds a unique place in American memory as the launch site for the National Aeronautics and Space Administration (NASA), but the space center was not constructed out of a wilderness. This thesis looks at the communities that called North Merritt Island home prior to the arrival of NASA in the early 1960s, in particular the citrus workers and growers who were displaced via eminent domain to make room for the space center. It examines the technology-in-use as employed by citrus workers alongside the technology of the Apollo Program, and considers the implications on the broader community in Brevard County.

MOSQUITO BEATERS AND ROCKETS: CAPE CANAVERAL'S PEOPLE AND TECHNOLOGY FROM ORANGE GROVES TO APOLLO

by
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Introduction

When it was established in 1961 on North Merritt Island in Florida, National Aeronautics and Space Administration's Launch Operations Center, soon to be renamed the Kennedy Space Center, stood in sharp contrast to its surroundings. The communities and the environment that had existed on the island and the neighboring areas prior to its arrival present an antithetical image to the one that the nation and the world would come to associate with the Space Coast.[1] Whereas the promise of human exploration of space represented for many the next step in technological progress, local communities on Cape Canaveral sent their children to one-room schoolhouses, picked oranges in citrus groves, and made their living by fishing in the lagoons. Viewed as a backwater area with more alligators than people, the land had remained largely underdeveloped, marshy, and as many of the histories of the Kennedy Space Center are apt to point out, mosquito ridden.[2] Beyond this initial image, however, is a much more complex story of an area with a rich local memory and tradition of agricultural development and technology.

The unique location of Merritt Island showcases a dramatic juxtaposition between technology capable of landing humans on the Moon and the everyday technology of agricultural laborers. This thesis will examine the contrast between the powerful institutional technology emerging from the Kennedy Space Center (KSC) in the early 1960s, and that of the community that existed both before and after the center was

[1] The land that is referred to as Merritt Island is actually a peninsula that extends south from the mainland and is bordered to the west by the Indian River and to the east by the Mosquito Lagoon estuary. Throughout this paper, the landmass will be referred to as an island, as that is what is used locally. See Susan Parker, *Canaveral National Seashore: Historic Resource Study*, ed. Robert Blythe (Titusville, FL: National Park Service, 2008), 1.

[2] Charles Benson and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, The NASA History Series, NASA SP-4204 (Washington, D.C.: National Aeronautics and Space Administration, Scientific and Technical Information Division, 1978).

established. I will argue that while the US space program brought great changes to the Cape Canaveral area, rocketry constitutes only one of many technologies found on Merritt Island throughout its history. The process of growing citrus represents a form of agricultural technology that, though overshadowed and in some cases displaced by the Kennedy Space Center, continued to occupy a consequential role in the identity of the area long after the final Apollo spacecraft had left the moon. While the Apollo Program was an unquestionably impressive example of technological and organizational achievement, its launch operations and personnel on Merritt Island did not exist in a vacuum. For old residents of the area, the role of the space center, though oversized in the broader imagination, takes a backseat to memories of local activity and industry. This phenomenon that played out on Merritt Island and Brevard County in the early 1960s raises questions about NASA's perceived and actual societal impact in terms of use and memory within the community known as America's Spaceport.

Evidence of traditional knowledges still in use in the area into the twentieth century can be traced back to pre-settlement era Merritt Island, when Native Americans developed strategies for navigating difficult terrain and protecting themselves from pests. White settlers in the nineteenth century, even while fighting wars with the Seminole groups and pushing them from the land, took note of their use of small boats for portaging as well as the functional benefits of natural features like the palmetto tree for building structures. As more homesteaders arrived and began to take advantage of the land along the Indian River – land suited perfectly to citrus growing - the area came to represent the epitome of Florida citrus success. Oranges with the label Indian River Citrus enjoyed a surge in popularity nationwide, reaching northern markets and attracting

tourists who ventured to the area for its climate and a taste of frontier life located a short distance from bigger cities. By the twentieth century, despite multiple devastating freezes, citrus production on Merritt Island remained a key industry. But soon it would have a much noisier neighbor.

With the advent of World War II, the Navy established a small base on a barrier island across the Banana River to the east of Merritt Island, which the Air Force took over and expanded into the Joint Long Range Proving Ground (JLRPG). This installation, which still stands on the Cape, served as the main launch site for what was known at the time as the Atlantic Missile Range (now simply called the Eastern Range). The island provided a favorable location for rocket test launches because its general proximity to the equator gave missiles an advantage aided by the faster rotation of the earth.[3] In addition, the Atlantic Ocean acted as an eastern buffer zone for falling debris, and inland waterways provided easy boat access for transporting rockets. In 1961, when John F. Kennedy announced to Congress his commitment to landing humans on the moon by the end of the decade, the northern portion of Merritt Island just next door, stood out as an obvious choice for a launch site.

Unfortunately for NASA, landing on the moon was not as simple as getting a satellite into orbit, and the launch pads already built in the Air Force complex were not adequate for either the Saturn rockets or the massive Nova rocket that would have been necessary for the direct lunar ascent method being considered at the time. With the

[3] At 28.5 degrees latitude, rockets launched east from Cape Canaveral receive an initial assist from the tangential velocity of 1471.5km/hr (914.3 mph), which is calculated by multiplying the rotational velocity at the equator (1674.4km/hr) with the cosine of the latitude; Peter Redfield, *Space in the Tropics: From Convicts to Rockets in French Guiana* (Berkeley: University of California Press, 2000); David Hitt and NASA Educational Technology Services, "Launching From Florida: Life in the Fast Lane!" NASA Education, October 2, 2006. https://www.nasa.gov/pdf/142825main_Bobsled_Launch.pdf.

backing of Congress and the facilitation of the Army Corps of Engineers, NASA used eminent domain to acquire over 80,000 acres of land adjacent to the proving ground, displacing the families and industries that had called the island home for generations. An additional 55,000 acres purchased from the State of Florida to make up a northern buffer zone within the Mosquito Lagoon, parts of which were later made into the Canaveral National Seashore and the Merritt Island National Wildlife Refuge. [4] This land is still owned by NASA but now operated by the National Park Service and the U.S. Fish and Wildlife Service respectively.[5]

What many in 1961 saw as a boost for the local economy also became the loss of livelihood and way of life for others. For Brevard County, the fastest growing county in the United States during this time, the space industry brought in thousands of new jobs, however, the skilled work was for new arrivals like engineers, scientists, projects managers, leaving many citrus grove laborers and fishermen to take employment within the space industry as janitors and food service workers. Although they engaged in physically demanding work, former citrus grove workers describe with pride the technical skills and understanding needed to cultivate the crops and ensure successful harvests each year. Residents of North Merritt Island who were displaced also reminisce about their experiences growing up in the rugged Florida swampland, recalling their own technologies and generational knowledge needed to survive and thrive.

Chapters one and two of this thesis will provide a background to the area around Merritt Island and the people who called it home prior to the arrival of NASA. Local

[4] National Aeronautics and Space Administration, *Kennedy Space Center Story* (Kennedy Space Center, Florida: National Aeronautics and Space Administration, 1972).
[5] U.S. National Park Service, "Associated Properties," Canaveral National Seashore, n.d., accessed September 12, 2020, https://www.nps.gov/cana/learn/historyculture/ap.htm.

histories of Merritt Island and the surrounding area, newspapers, as well as oral histories of former residents and their descendants give voice to the people of Cape Canaveral and the environment of the region. As white settlers began homesteading the island in the mid to late nineteenth century, a picture emerges of a wild, frontier-like setting. This image lasted into the twentieth century, even as more industry and development emerged in the surrounding towns and the island's fruit, a product of careful cultivation, was enjoyed by people around the country. Chapter two focuses on this citrus industry and provides a case study into the area's history of using and adapting agricultural technology. Using interviews done with grove workers, commonly called "pickers," as well as government surveys and census records, it will examine the operations and demographics of the citrus industry on and around Merritt Island. Most importantly, this means looking at the hazards to the citrus industry and the creative solutions used by workers, including practices like grafting and freeze prevention. Through these and other measures, grove workers consistently found ways to preserve their crops and ensure the survival of the fragile trees. Placing the former residents of the island in the context of their surroundings and history will bring them into focus as more than obstacles in the way of the perceived technological progress brought by the space program.

Chapter three will look at the institutional side of how Cape Canaveral came to be chosen as the site for America's "spaceport," the process of acquiring the land, and the effect of the acquisition on some of the former residents. Although NASA's decision to build on Merritt Island is widely written about, the narratives usually focus on institutional decision making, technical considerations, and political factors, largely writing the local out of the story. When many residents were informed that their land was

being seized for rocket launches, they did not necessarily consider it a sacrifice for the good of the country. Rather, they saw their lives being upended by the government. The use of eminent domain is not rare or unexpected for a national program such as NASA, and as seen in most histories of KSC, it is often relegated to a footnote in the story of the space center. However, the construction of military bases and missile ranges, particularly in the tropics, has a distinct history rooted in colonialism. As Peter Redfield shows in his anthropological look at the French space center in Guiana, colonial powers into the twentieth century sought advantageous positions from which to launch rockets, and the benefit of launching near the equator made building in their tropical colonies a logical choice.[6] For the United States, Florida presented a compromise between ease of access and the geographically superior alternatives, namely Christmas Island in the Pacific, Hawaii, and the Bahamas. As I will explore in this chapter, the use of eminent domain on Merritt Island, though done within the borders of the United States, echoes the motives and methods of colonial powers in setting up their launch sites. The erasure of local history from most official histories sets the space program apart as a separate entity operating with goals and tools different from those of the residents that it displaced. The Apollo Program's status as a national priority ensured that the citrus workers and the groves discussed in chapter two became collateral for rocket engineers and lunar modules.

In the final chapter, I will look more generally at the ramifications of the arrival of KSC for former residents of Merritt Island and the other communities on Cape Canaveral. With the influx of skilled workers because of the space center's needs, towns like

[6] Redfield, *Space in the Tropics.*

Titusville, Cocoa, and Melbourne changed dramatically during the 1960s. Preexisting industries and their workers stood in stark contrast to the work of newly arrived engineers, scientists, astronauts, contractors, and their families. Citrus production, while remaining a crucial industry in the area, declined as residential areas expanded and competition for resources grew. A revealing report by Florida State University in 1966 depicts an area in the midst of turbulent demographic and economic changes contributing to noticeable divisions between traditional community institutions and the incoming class of missile personnel. Oral histories with residents who lived in the area prior to NASA's arrival often mention or allude to this transitionary period of the 1960s, but their accounts do not emphasize the influence of the space center. The residents' peripheral relationship to the space center suggests their continued focus on local industries like citrus growing, which continued to adapt and evolve in the face of new challenges.

Historiographical Framework

The seemingly disparate historiographies of citrus growing and NASA find common ground on Merritt Island. This thesis seeks to put these histories in conversation with each other to better understand how certain technologies and their users are legitimized and prioritized while others are more quickly forgotten. As with the memories of residents who lived through the transition of life on the Cape, these histories are rarely intertwined, despite their proximity and interdependence.

This research in part draws from a portion of the vast and varied literature available on the history of the American space program, which includes countless biographies, memoirs, space center histories, and technical accounts. It looks most closely at official histories of the Kennedy Space Center and the Apollo Program

commissioned by NASA since the 1960s, as well as popular accounts of Apollo that have a strong focus on NASA's presence in Florida. While to an extent these histories cover the topic of citrus or other local industries and their importance to the area, they are sharply focused on how outside factors like the citrus industry had implications for the space administration's progress. This traditional literature of NASA does what it sets out to do: tell the story of an incredible feat of human engineering and the organizational power of a national campaign to accomplish something big. Several hundred displaced citrus workers and fishermen do make the occasional appearance, but they are understandably not the focus, and are eventually absorbed into the new community rebranded the Space Coast.

Popular works on Apollo focus almost exclusively on the technical aspect of the space program, mentioning the setting only in passing. For example, Charles Murray and Catherine Bly Cox's 1989 work *Apollo*, goes into detail about the many engineering achievements, unsung heroes, and exciting anecdotes of the space program in the 1960s and 70s. However, the engineers and other space personnel exist only in the context of their offices and workshops, outside of the larger community. Only one passing reference to struggles with mosquitoes and Florida humidity belies the vision of a modern hub of productivity and innovation.[7] Biographies and autobiographies of astronauts, engineers, and contractors involved in the space program during this period fall into the same pattern, setting NASA personnel apart from the rest of the residents in the area as well as the land on which they worked.

[7] Charles A Murray and Catherine Bly Cox, *Apollo* (Burkittsville, MD: South Mountain Books, 2004), 43.

Often, the natural environment features more prominently than the pre-existing industries and agricultural technologies of the area, often described in evocative language meant to contrast the Florida coastal wilderness with the space center's operations. In Tom Wolfe's classic account of the first astronauts, for instance, the area is described bleakly as "one of those bleached, sandy, bare-boned stretches where the land that any sane man wants runs out… and the government takes it over for the testing of hot and dangerous machines."[8] One book on the subject published before Apollo, which detailed the early activities on the Cape, also remarks on the "primitive" nature of the location, where the "lonely, wind-swept expanse of palmetto scrubland" had once been a place where "the nearest thing to the rocket age and about the most complicated technical gadget you could buy was an electric space heater."[9]

The comprehensive *A History of the Kennedy Space Center* by Kenneth Lipartito and Orville Butler features a more nuanced look at the history of Merritt Island, but largely focuses on NASA's pioneering role in the area. In their account, the Saturn V, a "beast of a rocket" that was "pounded into shape by engineers" towers above an environmental setting with interesting parallels: a complex that had been "carved out of the Florida scrub only five years before."[10] This picture of a previously underdeveloped landscape interrupted by technological might and institutional order is a theme running through the early chapters of the work. More important than environment, however, is the main argument of this account, which places the spotlight on the workings of the

[8] Tom Wolfe, *The Right Stuff* (New York: Farrar, Straus, and Giroux, 1979), 128.
[9] William Shelton, *Countdown: The Story of Cape Canaveral* (Boston: Little, Brown and Company, 1960), vii; 26.
[10] Kenneth Lipartito and Orville R. Butler, *A History of the Kennedy Space Center* (Gainesville: University Press of Florida, 2007), 1.

organization and ultimately claims that the history of the Kennedy Space Center is best analyzed by looking at the tensions between operational culture and design culture at NASA. Despite this technical focus, Lipartito and Butler take a closer look at the land and communities that existed on Merritt Island and Brevard County prior to government development. Their second chapter, titled "Rockets and Alligators," juxtaposes the natural topography of the Cape with the missiles being launched in the 1950s. A particularly illustrative scene describes the first rocket test on the Cape, during which it imagines "birds scattered, and alligators lifted their heads to a sound they had in their millions of years on earth never heard before."[11] In this account, although people and industry exist in the broader community, growth and community identity are driven by the technological and organizational advances of NASA, as one expects from an institutional history of the center.

While Lipartito and Butler briefly touch on the citrus industry in the area, an official NASA history of the Kennedy Space Center published in 1972 describes the groves on the island in more detail. The tone of the text is interesting, however, as the authors describe one arrangement, a part of NASA's "good neighbor policy" with the community, where former landowners had the "privilege" of renting back their groves at a cost.[12] The history details the 185,000 citrus trees, as well as the importance of their cultivation to the larger community, describing how, in the early 1970s, "of the 839,404 acres within the County, 20,131 acres [were] intensively cultivated to produce famed Indian River oranges and grapefruit."[13] Several years after the final Apollo mission,

[11] Lipartito and Butler, *A History of the Kennedy Space Center*, 38.
[12] National Aeronautics and Space Administration, *Kennedy Space Center Story*, 5.
[13] National Aeronautics and Space Administration, 266.

NASA commissioned another history of the Apollo Program at the Kennedy Space Center, a lengthy work called *Moonport: A History of Apollo Launch Facilities and Operations* by Charles Benson and William Faherty, which built on the 1972 volume. In the foreword remarks written by the director of KSC, the reader is promised not only a thorough telling of the management techniques, innovations in technology, and process of testing, but also "something of the impact of the Apollo program on the citrus groves and quiet beaches of Florida's east coast."[14] Benson and Faherty accomplish all these aspects to some extent, and unlike in the other histories considered here, their discussion of the eminent domain process, while brief, places citrus growers at the forefront of protests.[15] Despite this, the majority of this work also remains firmly focused on the operational and administrative history of how the Kennedy Space Center came to be.

What these institutionally focused histories often do not address are the social and cultural shifts happening alongside and often in opposition to the space program of the 1960s. Although the aim of this thesis is not to portray former residents of Merritt Island as opponents of the Kennedy Space Center – indeed, many expressed great pride in their community's contribution to the space program – it does call upon a growing literature of social histories of NASA that reject the narrative of the Apollo Program as merely an "accomplishment of middle America."[16] One work addressing this gap, Neal Maher's *Apollo in the Age of* Aquarius, brings race and gender to the forefront of the space race by arguing against the over-mythologization of the NASA.[17] Maher writes about the Apollo

[14] Charles Benson, and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations* (Washington, D.C.: National Aeronautics and Space Administration, 1978), ix.
[15] Benson and Faherty, *Moonport,* 143.
[16] Matthew Tribbe, *No Requiem for the Space Age: The Apollo Moon Landing in American Culture* (Oxford: Oxford University Press, 2014), 133.
[17] Neil M. Maher, *Apollo in the Age of Aquarius* (Cambridge, MA: Harvard University Press, 2017).

Program through the lens of several outsider groups, including African Americans in opposition to government spending on a project that did not benefit them, as well as women who also found themselves excluded from both spacecrafts and technical jobs. He argues that their opposition spurred conversation and direct action for change within NASA, although the results were minimal and largely ineffective.

Another recent addition to this scholarship is *NASA and the Long Civil Rights Movement*, edited by Brian Odom and Stephen Waring, which brings together a collection of essays to explore the intersection of NASA, race, social movements, economic upheaval, and politics.[18] In the same vein as social histories that examine the American space program, Peter Redfield's *Space in the Tropics* paints an international parallel by examining the location of the former French Guianan penal colony that became the French space program's main launch site. Just as other accounts do for the Kennedy Space Center, Redfield portrays the Guiana Space Center at the edge of wilderness and juxtaposed against the "technological might of pure machinery."[19] Redfield poses critical questions about the importance of location and the lingering influence of colonial exploitation on existing residents that often accompanies the technical aspects of launching rockets in the tropics.

These works, as well as others in the expanding historiography of what former Chief Historian of NASA, Roger Launius termed the "New Aerospace History," form a supplemental literature to the traditional institutional histories, by renegotiating who can claim a part of the story of the space program.[20] This new bulk of emerging scholarship

[18] Brian C. Odom and Stephen P. Waring, eds., *NASA and the Long Civil Rights Movement* (Gainesville: University Press of Florida, 2019).
[19] Redfield, *Space in the Tropics*, xiv.
[20] Odom and Waring, *NASA and the Long Civil Rights Movement*, 2.

promises, among other avenues of scholarship, to facilitate a comparative look at NASA alongside outside technologies in its sphere of operations like the ones found on Merritt Island.

The volume of work about citrus farming is less extensive than that of the space program. Fitting into the larger story of agricultural history, writings about citrus are more likely to be found in a journal about agronomy or in a crop market research study than in an academic history journal. But as trends in agricultural history experience a renewed push toward the intersection of agriculture and the history of science and technology, scholars have begun to more closely examine historical agricultural actors and their contribution to knowledge and technology production. The journal *Agricultural History* provides a forum for conversations that explore these issues, with a roundtable discussion in 2018 addressing the gap in scholarship surrounding use and technology. [21] In a field that more readily categorizes the biological and chemical aspects of agriculture as a science, contributors argue for explicitly reexamining the label of technology with respect to agricultural equipment and practices. As the article states, this avenue of research builds on a "long-standing interest in the intersection between the history of science and agricultural history," but is also reflects new questions about how historical actors have used and contributed to knowledge about the material world. Although the journal's literature on the citrus industry specifically does not yet touch on the role of workers in the development of the fruit, this roundtable provides a framework for future work on citrus workers.

[21] Deborah Fitzgerald et al., "Roundtable: Agricultural History and the History of Science," *Agricultural History* 92, no. 4 (2018): 569, https://doi.org/10.3098/ah.2018.092.4.569.

Written by popular natural science author John McPhee in 1966, *Oranges* serves as an example of a work that does address to some extent the contributions of grove workers. Apocryphal in parts and romanticized in others, McPhee's engaging work traces the history of the orange and its place in popular culture around the world.[22] His interviews with orange pickers and descriptions of the grove technologies used, including grafting and freeze prevention on Merritt Island and elsewhere, provide examples of use and development of tools and techniques that have endured for hundreds of years. As argued by historian of science and technology, David Edgerton, the linear timeline of technological progress becomes muddied when the definition of technology is broadened to include use and maintenance rather than the usual narrative centered on innovation and invention.[23] For Edgerton, broadening the scope and timeline of what can be considered valuable technology opens the door to a more varied and inclusive subset of tools and practices that may have been once dismissed as industrial craft or agricultural groundwork.[24] Transformative technologies like rockets and atomic power, which Edgerton claims are "likely to have made the world poorer rather than richer," take a secondary role to the old and mundane technologies that have often had more influence on history than their more widely covered counterparts.[25]

There are no Neil Armstrongs of the citrus industry, but accounts from citrus grove workers nevertheless illustrate the ingenuity and adaptation they needed in order to ensure successful harvests each year. While oranges have gone through thousands of

[22] John McPhee, *Oranges* (New York: Farrar, Straus and Giraux, [1966] 2000).
[23] David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford; New York: Oxford University Press, 2011).
[24] For further reading on the gendered nature of technology and craft traditions, including agricultural work, see: Ruth Oldenziel, *Making Technology Masculine* (Amsterdam: Amsterdam University Press, 1999).
[25] Edgerton, *The Shock of the Old*, 6.

years of human adaptation, and Florida orange juice reached the homes of millions of Americans during this time, no one has written the biographies of the orange growers and pickers responsible. By looking at both the institution and personnel of NASA in relation to the existing community and its industry, I hope to bridge a part of the local and national. NASA's ability to seize the land on Merritt Island was based in the technology that they wielded and the government's decision to privilege that technology over others. The Kennedy Space Center had a profound impact on the economy and the population of Merritt Island and the surrounding area, yet the way in which the center is written about largely takes the preexisting community out of the conversation. If instead the story centers on the local existing alongside the space program, a clearer picture emerges of how some technologies are remembered and some are taken for granted.

Chapter 1: North Merritt Island before the Kennedy Space Center

Writings on the history of Brevard County and Merritt Island are rich with family lore, personal memories, and an almost mythological narrative of intrepid pioneers. Although they sit distinctly separate from the literature on the space program, the two stories are unquestionably intertwined, and the same emphasis on personal memory and creation of community that run through the local history are also very much present in the literature of NASA and the American space program. This chapter will briefly examine a portion of this local history, introducing the people, environment, and industry that existed in the area prior to arrival of rockets. It aims to show the diversity of communities and technologies that once called the island home, and center them within the larger history of a region now known more for its astronauts than its fishermen.

The land that is now Brevard County can trace evidence of its first inhabitants to around 8000 BCE, when early hunter-gatherers began to establish semi-permanent villages along waterways like the St. Johns River to the west and the Indian River to the west.[26] Archeology along the Indian River, a lagoon that separates Merritt Island and a string of other barrier islands from the mainland and flows into the Atlantic Ocean, has found evidence of fiber-tempered pottery, fishing villages, middens, and great shell mounds.[27] In Lipartito and Butler's *A History of the Kennedy Space Center*, the authors point to the stark juxtaposition of "prehistoric technology of tools made of bones and clay

[26] Jerrell H. Shofner, Jim Ball, and Vera Zimmerman, *History of Brevard County* (Melbourne, Fla.: Brevard County Historical Commission, 1995), 18.
[27] Robert I. Davidsson, *Indian River: A History of the Ais Indians in Spanish Florida*, Ais Indian Project Publication (West Palm Beach, Fla.: Ais Indian Project, 2004), 8, http://purl.flvc.org/fcla/tc/fhp/UF00025088.pdf.

vessels close by the wonders of the space age."[28] They note that hundreds of these mounds can be found around the Cape, including some only a few hundred yards from launch facilities. In the early 1500s, the indigenous Ais groups living in the area encountered Spanish explorers searching for gold and setting up trading routes along the coast. Writings by Spanish negotiators that date from around 1605 document the Ais settlements on Merritt Island by describing several villages near what is now the Haulover Canal, as well as fishing camps on the Banana River that appeared to be inhabited only during winter times when insects became less of a concern.[29]

Figure 1: Brevard County – Northern portion, 1888[30]

[28] Lipartito and Butler, *A History of the Kennedy Space Center*, 27.
[29] Shofner, Ball, and Zimmerman, *History of Brevard County*, 25.
[30] "Brevard County - Northern Portion, 1888," http://fcit.usf.edu/florida/maps/pages/10200/f10227/f10227.htm.

By the nineteenth century, a series of wars between colonial powers and Native Americans in Florida had scattered and all but decimated the population of Ais, with some fleeing to Cuba and others joining forces with larger Seminole tribes.[31] With the introduction of an 1842 act of Congress that anticipated the Homestead Act by twenty years, the government gave any head of household the opportunity to acquire 160 acres of land if they met certain conditions, with the intention of enlisting them to defend the land against its original inhabitants if necessary. This legislation, called the Armed Occupation Act, allowed white families to lay claim to land if it was within two miles of a military post, provided that they lived on it for five years, built a house, and cleared at least five acres.[32] It was these conditions that led to the first large white settlements in Brevard County, including at least six claims for land on Merritt Island.[33] These settlers joined the small but growing population of people on the island that included prominent businessman Douglas Dummett, who had planted the island's first orange grove in 1830.[34]

In 1837 as infrastructure for the Second Indian War, American troops constructed Fort Ann on the eastern shore of the Indian River at the narrowest point separating the Mosquito Lagoon and the Indian River. This strategic spot along the route had been used for centuries as a "haulover" point for Native Americans, who portaged canoes there from one body of water to the other. As European and American troops arrived in the area, they copied this practice for easier access, but the economic and military desire to

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[31] Davidsson, *Indian River*, 137.
[32] *An Act to Provide for the Armed Occupation and Settlement of the Unsettled Part of the Peninsula of East Florida*, Public Law, *U.S. Statutes at Large* 2 (1842): 502-504, https://www.loc.gov/law/help/statutes-at-large/27th-congress/session-2/c27s2ch122.pdf.
[33] Shofner, Ball, and Zimmerman, *History of Brevard County*, 47.
[34] McPhee, *Oranges*, 61. Note: Lipartito and Butler put this date at 1828, and the spelling of Dummett (Dummitt) is not consistent in the literature.

connect transportation infrastructure for these settlements and others along the Indian River led military leaders stationed in the area to propose the construction of a canal. The officer in command of the fort in 1843 wrote a letter to his superior in St. Augustine to lament the cost and effort put into transporting materials and people by boat then by wagon, then by boat again. He estimated that the construction of canal would cost around $4000 and be completed in two months given the proper consideration[35] This would of course not be the last ambitious engineering project proposed for the island, but the canal does represent an important technological advancement that would play a crucial role in the success of NASA infrastructure a century later. It was through a system of canals and waterways like the one at Haulover that Apollo Program engineers were able to transport massive rocket stages from the manufacturing plants in California to the Cape, since they were too large to fit under train or highway bridges.[36]

Although the Haulover Canal would not be built until 1852, incoming settlers along the Indian River had begun altering their environment decades earlier by cutting narrow inlets to allow for deeper fishing waters and easier navigation. The settlers were largely independent from larger towns and cities in the vicinity, and they relied heavily on fishing, hunting, and trapping, as well as on small-scale subsistence farming.[37] Houses were constructed from the wood and palmetto leaves gathered after clearing the land as well as from wood and cargo washed ashore after hurricanes.[38] One account petitioning Congress for a road from St. Augustine to St. Lucie Sound described conditions full of

[35] Jacob E. Blake to William J. Worth, "Jacob E. Blake to William J. Worth in The Territorial Papers of the United States, Volume 26," December 11, 1843.
[36] Roger E. Bilstein, *Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles.*, The NASA History Series (Washington, DC: National Aeronautics and Space Administration, 1996), 309.
[37] Shofner, Ball, and Zimmerman, *History of Brevard County*, 48.
[38] Roz Foster, "Explore Your History: Lost Communities of North Merritt Island," *The Journal of The Brevard County Historical Commission* XII, no. 1 (Spring / Summer 2013): 21.

"incredible privations and hardships," but food was not scarce for those who were able to fish or hunt wild turkeys, quail, ducks, and deer, which were plentiful in the area.[39]

In 1862, the Homestead Act made it possible for even more settlers to claim land, and by 1900, the island had grown to include around two dozen small white communities. However, while across the Indian River, towns like Titusville and Mims were gaining access to new railroad services, electricity, and other modern conveniences, Merritt Island remained inaccessible except by boat and was not connected to the electricity grid.[40] Families continued to rely heavily on their own hunting and fishing for survival, and tourists from outside of Florida flocked to the area for the chance to experience the climate and its supposed healing properties, and to take advantage of opportunities for wild game hunting and excellent fishing.[41] Families on the island catered to these tourists by setting up attractions like the Happy Creek Hunting and Fishing Camp, with one woman earning the nickname "Alligator Lena" because of her practice of catching alligators to sell to the visitors at the camp.[42] It wasn't until 1923 that a bridge to the mainland was built, and Lipartito and Butler describe pre-World War II Merritt Island as a collection of "beach houses, fishing piers, a parlor-sized general store, and something that passed for a hotel," with more alligators than inhabitants.[43]

Nevertheless, the residents of the island and their descendants remember fondly the experience of living in a frontier environment, even into the 20th century. In *Memories of Merritt Island,* a descendent of the Briggs and Benecke families presents a collection of

[39] Shofner, Ball, and Zimmerman, *History of Brevard County*, 47; Foster, "Explore Your History: Lost Communities of North Merritt Island," 21.
[40] Lipartito and Butler, *A History of the Kennedy Space Center*, 29.
[41] Lipartito and Butler, 29.
[42] Gail Briggs Nolen, *Memories of Merritt Island: Birthplace of Kennedy Space Center* (Sylva, N.C: Ammons Communications, 2004), 44.
[43] Lipartito and Butler, *A History of the Kennedy Space Center*, 29.

photographs and writings from the families who homesteaded on land located near to where the Vehicle Assembly Build (VAB) and Launch Pad 39B now stand. In the collection, family photographs and diaries paint pictures of close-knit communities where children were taught in one-room schoolhouses or not at all, and recreation included bird hunts and rowing down the creek. Rose Caudill, who grew up the youngest of six children on a Merritt Island homestead, wrote about her school days in the early twentieth century, describing how the children in the area went without a teacher for several years. After a school was established nearby, she would walk the two miles there and back through muddy waters rife with snakes, bears, panthers, and alligators.[44]

Despite precarious conditions, these families and others were not cut off completely from the mainland, and families like the Beneckes were able to purchase more expensive items such as pianos and automobiles.[45] In the town of Shiloh, where the Kuhl family settled in 1884, mail deliveries and other traded goods came by a delivery system of sailboat and mule team three times a week.[46] Another woman living on the island in the early twentieth century went twenty miles by bicycle to work at a fish packing house in the town of Cocoa, only to return to her palmetto hut on the island where she boiled clothes over an open fire as her husband and sons repaired fishing nets by the light of oil lamps.[47]

The mosquitos that would plague NASA later in the century were, as one history of the Kennedy Space Center notes, a problem on the scale that was "at first almost

[44] Nolen, *Memories of Merritt Island*, 40.
[45] Nolen, 66.
[46] Roz Foster, "Explore Your History: Lost Communities of North Merritt Island - Clifton," *The Journal of The Brevard County Historical Commission* XIV, no. 2 (Fall/Winter 2015): 20.
[47] Foster, 28.

unbelievable to all but former residents of the area."[48] Before methods of pest control appeared later in the 1960s in what the *Spaceport News* called NASA's "War on Mosquitoes," residents took their own mosquito precautions. Using "mosquito beaters," a term for palmetto frond swatters, as well as a smoldering kind of insecticide called "smudge powder," locals could temporarily keep the swarms of insects at bay.[49] In a 2000 panel conversation with members of the Mosquito Beater organization in Cocoa, one speaker born in 1922, described memories of the insects becoming so ubiquitous in the summer months that if she put her hand to a screen door and moved it away quickly, the imprint of her hand would remain.[50] Another panel member recounted memories from World War II, when Navy planes from the newly established Navy base on Cape Canaveral would fly low over the island spraying DDT, with no prior warning to residents. These measures were highly effective in curbing the mosquito population and, coupled with additional steps taken by NASA in the 1960s, the role of mosquitos shifted from everyday scourge to mere annoyance, an indication of the way that technology was beginning to change life on Merritt Island.

While white homesteaders made up the majority of the population of North Merritt Island, following the Civil War (1861-1865), formerly enslaved African Americans also sought land on the island. Frontier spaces appealed to African Americans who wished to escape the systems of discrimination and racial barriers to opportunity found on the Florida mainland and across the South. During this time, "freedom colonies" became

[48] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 298.
[49] "Mosquito Beaters Memories," *Florida Frontiers* (Public Broadcasting Service, May 6, 2018), https://www.pbs.org/video/mosquito-beaters-memories-7mk7pf/.
[50] Robert Cowart, Marion Jackson, and George "Speedy" Harrell, Mosquito Beaters Panel: Cocoa, FL, Video, April 8, 2000, Brevard County Historical Commission, https://youtu.be/DgE7LhGsPng.

enclaves of hope and freedom for Black Americans, and on Merritt Island, the small towns of Clifton and Allenhurst have their roots in this movement. In one history dedicated to a freedom colony in California, early founders of the town are referred to as pioneers with their priorities set on education and land ownership.[51] The same was true for the settlements on Merritt Island, and after purchasing land there in the 1870s, several Black families banded together to establish a schoolhouse for the children in the community. For this and many other rural Black schools, classes were held in the summer so that students would be free to help harvest citrus during the winter months. In spite of these restrictions, Clifton Colored School welcomed nine students in 1891, and in 1892 a (presumedly white) visitor described the end-of-year examinations in an article published in the *Indian River Advocate* newspaper, writing that they were "much surprised, indeed, to find such an advanced school."[52]

The majority of Black families on North Merritt Island around the turn of the twentieth century clustered on homesteads in the northernmost part of the peninsula around the towns of Clifton and Allenhurst, around and south of the Haulover Canal. On the 1900 census, the total population of the Merritt Island precincts of Canaveral, Merritt, and Haulover was recorded at 358 people, with 77 African Americans and 281 white residents.[53] Despite the proximity and similarities in living conditions, few local histories describe mixing or socializing between the two groups, with families attending segregated churches and school, even while teachers were in short supply and often

[51] Alice C. Royal, Mickey Ellinger, and Scott Braley, *Allensworth, the Freedom Colony: A California African American Township* (Berkeley, Calif: Heyday Books/BayTree Books, 2008), xiii.
[52] "Closing Exercises of the Clifton Colored School"," *The Indian River Advocate*, October 5, 1892.
[53] United States Census Bureau, "Merritt Precinct 14; Canaveral Precinct 15; Haulover Precinct 16," Schedule No. 1 - Population (Brevard County, FL, June 5, 1900), National Archives and Record Administration.

unable to accommodate the small number of children in the region. Oral histories give more indication of interactions, and one former white resident even reported that when she first arrived to the area, everyone on the island attended church together in an integrated service because it was the only church in the vicinity.[54]

Another account describes an area near Allenhurst called Laughing Water, which was the homestead of Butler Campbell, a former officer in the United States Colored Troops during the Civil War. During a time when it was rare for a white-owned company to buy land from African Americans, the Indian River Fruit Company bought property from Campbell, showing evidence of interaction and cooperation, particularly when it came to citrus.[55] Even as society itself remained segregated, the professional lives of many people on Merritt Island overlapped in significant ways because of the centrality of the citrus industry. It would be this industry and the people behind it who would shape the island in the years to come.

[54] Marian Grant, Interview with Marian Grant, interview by Nancy Yasecko, Video, February 6, 1994, 13, Brevard County Historical Commission, https://youtu.be/AMF2i7du_WA.
[55] Richard Paul and Steven Moss, *We Could Not Fail : The First African Americans in the Space Program* (Austin: University of Texas Press, 2015), 35.

Chapter 2: Citrus Farming as a Technology

Perhaps no industry in the public imagination is as synonymous with Florida as the citrus industry, and Brevard County during the nineteenth and twentieth centuries presented a model for successful citrus production. In particular, Merritt Island and the land around the Indian River played a crucial role in the popularization and preservation of orange growing in the state, as well as the types of adaptations necessary to make those possible. Like all agricultural products consumed by modern humans, citrus fruits have gone through countless changes through intentional selection and cultivation. Even during its relatively short time in Florida, the orange has witnessed significant changes in the process of its growing, its taste, and its importance to the diets of millions of Americans. The process of use and adaptation cannot be separated from those directly responsible for this evolution, namely the grove workers and growers in places like Brevard County.

Within David Edgerton's framework from his work *Shock of the Old*, the history of users-as-innovators differs from his concentration on the history of technology-in-use, but his thoughts on expanding what can be considered "legitimate" history of technology are useful when looking at orange production.[56] As he notes, "in the innovation-centric account, most places have no history of technology. In use-centered accounts, nearly everywhere does."[57] In contrast to many accounts, technology existed on North Merritt Island before NASA arrived, although it looked different from the technology in most other parts of the country. The tools necessary to survive in difficult surroundings,

[56] Edgerton, *The Shock of the Old*, 213.
[57] Edgerton, *The Shock of the Old,* x.

including things like preventative measures for mosquito control and defense against wild animals, represent technology separated from public spectacle or significance, yet of vital importance to the people who use them. By focusing on citrus production, one of the most important facets of life on Merritt Island and the surrounding area, this chapter will explore how the process of growing citrus evolved, and what that meant for grove workers, who often have been marginalized in the historical record on lines of race and class. By looking at the horticultural advancements made by citrus operations as legitimate and important technological contributions, it will be easier to see in them in the context of rocket launches and feats of engineering already deemed impressive.

2.1 Engineering the Orange

The orange most likely originated in what is modern-day China, northeastern India, or southeastern Asia, and was introduced to the Mediterranean by traders around the fifteenth century.[58] Within a hundred years, Spanish explorers had brought the fruit to newly claimed land in the Western Hemisphere, with some accounts asserting that oranges were included in the cargo on Columbus's second trip to the Caribbean in 1497.[59] At the Spanish town of St. Augustine in Florida, missionaries began planting orange trees, whose fruit they traded with Native Americans in the area whom they wished to convert to Christianity. Orange trees became more widespread as Native Americans embraced the fruit, and by the late 1700s, incoming botanists believed the

[58] Julia F. Morton, *Fruits of Warm Climates* (Miami, FL: Julia F. Morton, 1987), https://hort.purdue.edu/newcrop/morton/index.html.
[59] Carita Doggett Corse, *The History of Citrus in Florida*, Stories of Florida (Jacksonville, FL: Federal Writers' Project, Works Progress Administration, 1938), 1, https://exploreuk.uky.edu/catalog/xt7nk9314n7q.

species to be indigenous to the area because of its ubiquity.[60] An installment of the 1938 Federal Writers' Project, *Florida: A Guide* led by Carita Doggett Corse, fully cemented the place of the orange in Florida mythology, presenting a "pastoral Florida of bucolic groves and colorful farmers."[61] Corse, a Jacksonville native and the only female editor for the 48-state series, researched extensively for the installment, establishing relationships with Florida's Commission of Agriculture and others in the citrus industry. In her history, which traces the oranges journey from early European expansion throughout the American south from Florida to California, she boldly states that "one may safely say there is no fruit which is so closely woven into American expeditionary history as the orange."[62] In the subsequent decades as American history extended upwards to include space exploration, the orange did indeed again have another front row seat to the country's expeditionary efforts.

The orange industry took off in Florida after the territory became part of the United States in 1821, with a widening market and gradually improving transportation network. Along the Indian River, a modest number of groves began to pop up by the 1830s, including that of Douglas Dummett, a young man who set up his grove on North Merritt Island. Born in Barbados in 1806, Dummett and his family moved to the United States with dozens of slaves following the British abolition of slavery when he was a year old. His father, a wealthy sugar cane plantation owner, settled near St. Augustine, and around 1830 Dummett planted an orange grove on a piece of elevated land around two and a half miles south of the Allenhurst Canal. With soil rich in shell marl - a type of alkaline soil

[60] Corse, *The History of Citrus in Florida*, 2.
[61] Scott D Hussey, "The Sunshine State's Golden Fruit: Florida and the Orange, 1930-1960" (University of South Florida, 2010), 46.
[62] Corse, *The History of Citrus in Florida*, 3.

containing large counts of limestone - the land was ideal for citrus production.[63] Modern horticultural studies have shown the benefits of this soil consistency, pointing to orange trees grown in calcium deficient soil as suffering from smaller leaves, thinning foliage, decreased fruit production, and undersized fruit. Accordingly, a common practice in deficient areas is to reintroduce calcium through foliar spraying (applying fertilizer directly onto the leaves) and fertilizing the soil with gypsum or farmland manures.[64] When Dummett established his plantation, however, the reason for this advantageous land was not yet known, as the first recorded soil test would not happen until 1845 and not become more widespread until the early 1900s.[65]

Dummett used wild sour orange trees as the base for his grove, and in an enterprising move, he acquired sweet orange budwood from a grove to the north in New Smyrna, which he used to either graft or bud to his existing grove. While the processes of grafting and budding were not innovations at the time, Dummett is reported to have been the first person to use the technique on citrus in Florida.[66] Instead, most citrus growers until around the 1880s preferred starting their groves from seeds, which allowed for more controllable reproduction of the parent tree to seedlings.[67] Grafting and budding, however, also offer a variety of advantages, and represent an agricultural technology that has been practiced for millennia, with descriptions of grafting dating back to Ancient

[63] McPhee, *Oranges*, 61.
[64] Mongi Zekri and Tom Obreza, "Importance of Nutrients for Citrus Trees," *Citrus Industry* (2012), 3.
[65] M. S. Anderson, "History and Development of Soil Testing," *Journal of Agricultural and Food Chemistry* 8, no. 2 (March 1960): 84–87, https://doi.org/10.1021/jf60108a001.
[66] Louis W. Ziegler and Herbert S. Wolfe, *Citrus Growing in Florida* (Gainesvilles: University of Florida Press, 1961), 64, http://hdl.handle.net/2027/mdp.39015030625639; Hussey, "The Sunshine State's Golden Fruit: Florida And The Orange, 1930-1960," 10.
[67] Ziegler and Wolfe, *Citrus Growing in Florida*, 64.

Greece and Rome.[68] In one text attributed to the followers of Hippocrates from around 424 BCE, the writer mentions how some trees "grow from grafts implanted into other trees: they live independently on these, and the fruit which they bear is different from that of the tree on which they are grafted."[69] An English publication from 1572 by Leonard Mascall praises the technique: ''among all sciences…there is none…that more doth refresh the vital spirits of men, nor more engender admiration in the effectes of nature, or that is cause of greater recreation to the wearie and traueyled spirite of man, or more profitable to mans life, than is the skil of planting and graffing."[70]

Despite this long history, grafting and budding in orange groves went out of favor in Spain and Italy by the eighteenth century because growers favored the larger and more productive seedling trees.[71] In their *Citrus Growing in Florida*, Ziegler and Wolfe speculate that this development was the reason for the slow adoption of grafting in the Florida citrus industry, making Dummett's decision fairly unusual for the time but in line with a long progression of adaptations to the technology. Most sources report that Dummett used the budding process, a type of graft that involves taking a bud from a donor plant and attaching it via a small notch on the rootstock, or original plant.[72] In contrast, general grafting involves more mature "scion" offshoots from the donor plant being attached to the rootstock by any number of methods, including underneath the bark, by clefts in the trunk, and splicing and replacing the original upper growth. Both methods

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[68] Ken Mudge et al., "A History of Grafting," in *Horticultural Reviews*, ed. Jules Janick (Hoboken, NJ, USA: John Wiley & Sons, Inc., 2009), 462, https://doi.org/10.1002/9780470593776.ch9.
[69] Hippocrates, *The Hippocratic Treatises, "On Generation", On the Nature of the Child, "Diseases IV": A Commentary*, trans. Iain M. Lonie (Walter de Gruyter, 2011), 17.
[70] Leonard Mascall, *A Booke of the Arte and Maner, Howe to Plant and Graffe All Sortes of Trees Howe to Set Stones, and Sowe Pepines to Make Wylde Trees to Graffe on, as Also Remedies and Mediicnes*, 1572.
[71] Ziegler and Wolfe, *Citrus Growing in Florida*, 64.
[72] Hussey, "The Sunshine State's Golden Fruit: Florida And The Orange, 1930-1960," 10; Corse, *The History of Citrus in Florida*, 4; McPhee, *Oranges*, 61.

involve a great amount of skill and precision to ensure a successful "take" the following year, but the payoff is significant from a grower's standpoint. In addition to being able to produce fruit after only a year from the time of budding (compared to a wait of five to ten for seedlings), grafted trees also boast earlier and more regular seasonal yields and fewer thorny branches.[73]

Even more crucial, however, is the flexibility that grafting allows growers with regard to modifying the trees to withstand environmental threats. When a long, catastrophic freeze hit Florida in February 1835, killing nearly every orange tree in the territory, Dummett's trees were by most accounts the only sweet orange specimens left undamaged. A combination of the hardier sour orange species used as rootstock coupled with the favorable location of the grove in a tidal lagoon showed the benefits of budding and anticipated the mass adoption of the practice later in the century. The survival of this early Merritt Island grove ensured that orange growing in Florida could be revived through budding and reseeding, and it secured the island's reputation as a bastion for citrus. Dummett, who also would go on to serve in the Florida House of Representatives, lived until 1873, by which time his grove was one of the largest and most respected in the state. [74]

With the emergence of Dummett's strain of sweet orange in the region, the Indian River citrus label's popularity grew as the century progressed. After the Civil War, oranges from his grove fetched prices of a dollar per box more than their competitors in northern markets like New York City.[75] According to the popular non-fiction writer and

[73] Ziegler and Wolfe, *Citrus Growing in Florida*, 65; Alissa Hamilton, *Squeezed: What You Don't Know about Orange Juice*, Yale Agrarian Studies Series (New Haven: Yale University Press, 2009), 8.
[74] McPhee, *Oranges*, 61; Hamilton, *Squeezed*, 5.
[75] McPhee, *Oranges*, 64.

journalist John McPhee, writing in 1966, Indian River oranges contain about 25 percent more sugar than the same types of oranges grown elsewhere due to the "heavy" soil that holds nutrients and moisture.[76] Tourists, associating the brand with a specific type of orange rather than where it was grown, would often ask for Indian River fruit at roadside stands all over the state. Other groves around the state even began to brand themselves under the "Indian River" name in order to boost sales, leading to a 1930 cease-and-desist order by the Federal Trade Commission and the creation of the Indian River Citrus League. The area's reputation for citrus was so widespread at the turn of the century that references to Indian River Citrus can be found in newspapers across the country, from an 1873 article published in a Maine paper describing it as "the finest fruit that grows," to a German language paper in Davenport, Iowa extolling the virtues of the fruit in 1917.[77]

By the time McPhee visited the area in 1966 to write his piece for *The New Yorker*, NASA had already acquired the land on North Merritt Island, including the old Dummett grove. One of Dummett's grandsons, Robert Hill, however, continued to manage a grove on an area of the island south of the space center. McPhee evocatively described how the "narrow roads wind through Merritt Island between high walls of orange trees, which are interspersed with numerous houses of growers."[78] Hill's property, located on a high mound, was surrounded by the tall native pine trees that once covered the island, which were prized for their fine timber before most of them were cleared to make way for citrus groves as settlers moved in. Many of Hill's own orange trees had been planted by his

[76] McPhee, 69.
[77] "East Florida," *Daily Kennebec Journal*, March 27, 1873, https://chroniclingamerica.loc.gov/lccn/sn82014248/1873-03-27/ed-1/seq-1/; "Indian River Farms Zu Vero, Florida," *Der Tägliche Demokrat*, November 11, 1917, https://chroniclingamerica.loc.gov/lccn/sn84027107/1917-11-11/ed-1/seq-6/.
[78] McPhee, *Oranges*, 71.

father and grandfather, but his son, who worked for RCA, had little inclination to carry on the family business. With the expansion of NASA and need for more residential housing, McPhee correctly predicted that within a few years the remainder of North Merritt Island groves like the one owned by Hill would be wiped out due to development.

2.2 Citrus Workers

As evidenced by the intricacy of the budding and grafting process, work in citrus groves was and continues to be a labor-intensive and precise practice. McPhee characterizes citrus workers with considerable admiration, writing that "the work they do is so hard that only people of considerable toughness of body and spirit last very long in the groves. Weak, slow, or lazy people make almost no money picking oranges, because their pay is measured by the amount of work they do."[79] An employee of the Silver Springs Land Company whom McPhee interviewed shared a similar opinion, saying that growing oranges "is no dead level of monotonous exertion, but one that affords scope for the development of an ingenious mind."[80] Yet, like much of the history of agricultural labor, recognition and documentation of the lives of workers involved has not always been so precise. For example, in McPhee's account of Dummett's grove, the entrepreneur is described as putting in a minimal amount of work to achieve his success, instead spending most of his time "fishing or hunting wildcats on the mainland with his pack of dogs."[81] There is no mention of how many people he employed or who those workers were, but some clues paint a picture of the workers in his and other groves, and in fact

[79] McPhee, *Oranges*, 39.
[80] McPhee, *Oranges,* 66.
[81] McPhee, *Oranges,* 64.

McPhee is one of the few writers covering the citrus industry who remarks on the demographics of workers, which was largely African American.[82]

The 1961 *Citrus Growing in Florida* makes no mention of pickers anywhere but references growers copiously throughout. Outlining the major players in the citrus industry, the authors list large-scale growers, caretaking organizations, corporations, and home gardeners, conspicuously erasing the labor that enables the large and small growers alike to operate. Even in Alissa Hamilton's 2010 work *Squeezed: What You Don't Know About Orange Juice*, which claims to touch on present-day citrus pickers (almost exclusively migrant laborers), the subject is never broached outside of the preface, instead centering the story on growers and juice companies.[83] Hamilton, a food policy analyst, argues that government inaction has allowed the orange industry to morph into a potentially dangerous force for misinformation. However, when talking about both Florida and Brazil, where the majority of orange juice consumed in the United States now originates, she takes a largely political approach, focusing on the advertising campaigns of companies like Tropicana and Minute Maid, while foregoing discussion of workers.

In *The Florida Star* newspaper published in Titusville in the early 1900s, pickers are rarely mentioned, and only in unnamed groups affiliated with a named grove owner. For example, in the October 8, 1909 issue of the newspaper, a relatively lengthy account is dedicated to the proceedings of a congregate meeting of various local Citrus Associations, including the Indian River Citrus Growers' Association. In a much smaller blurb further down the page, wedged between a typhoid fever death notice and an account of a recovering fever sufferer, readers learn about Mr. S. M. Stephens of

[82] McPhee, *Oranges*, 40.
[83] Hamilton, *Squeezed*.

Lakeland, an orange buyer, and his "large force of orange pickers and packers."[84] Two months later, readers would learn a bit more detail about Mr. Stephen's workforce, which numbered about sixty people and which was able to pack as many as one thousand boxes of citrus per day.[85] Advertisements often targeted growers, such as one excited blurb from a lumber company in 1908 announcing "Ladders! Ladders!!" for use by pickers in groves.[86] Another notice, this time urging growers to apply fertilizer in November, was accompanied by the company's brochure helpfully titled "Why Fertilize Citrus Trees in the Fall," followed up several months later by another ad assuring "spring fertilizing for profit."[87] Countless promotions for orange buds dotted the pages of the paper, including a 1909 announcement by a J.W. Griffis in Shiloh on Merritt Island, who offered one-to two-year-old buds free of white fly (a small winged pest) for 25 to 35 cents.[88] Conspicuously missing, not only from advertisements but also from general life announcements and anecdotes found in papers of the time, is mention of the people who would have been using the ladders, applying the fertilizer, and budding the trees.

The answer to why that omission might have been made lies in the demographics of citrus pickers, a group which was majority non-white, poor, and under-educated. McPhee's journalistic approach led him to interview pickers in the groves, and he paints an animated picture of the lives of several workers. One man, an "amiable but untalkative, hardworking orange picker" nicknamed Bird Man, worked alongside his wife and three-year-old child, who played nearby. Together, the couple gathered an average of

[84] *The Florida Star*, October 8, 1909, https://ufdc.ufl.edu/UF00075901/00722.
[85] *The Florida Star*, December 10, 1909, https://ufdc.ufl.edu/UF00075901/00731.
[86] *The Florida Star*, September 25, 1908, https://ufdc.ufl.edu/UF00075901/00668.
[87] "Ideal Fertilizers," *The Florida Star*, November 19, 1909; "Ideal Fertilizers," *The Florida Star*, January 7, 1910.
[88] *The Florida Star*, August 20, 1909, https://ufdc.ufl.edu/UF00075901/00715.

about eighty boxes of oranges a day, which at twenty-five cents a box, earned them about twenty dollars a day. Another picker, twenty-nine-year-old Doyle Waid, averaged around one hundred boxes a day and worked six to seven days a week to support his wife and five children. The day he was interviewed, Waid had managed to fill one hundred boxes despite taking off early because of a cut caused by the strap of his heavy picking bag. This was a testament to his skill at removing the fruit, which McPhee describes as requiring a "fast turn of the wrist that is similar to the motion used by a baseball pitcher throwing a curve."[89]

New workers from out of state rarely lasted long, even as busloads of workers were recruited through U.S. Department of Labor initiatives to reduce unemployment nationwide. Deterred by the physical endurance and the agility needed to succeed as a picker, many migrant agricultural workers from out of state were less likely to return for subsequent harvests.[90] In a 1970 report done for the U.S. Department of Commerce that surveyed 55 crews totaling 512 workers from around the state of Florida, roughly twenty-nine percent of the citrus workers were interstate migrants, with that number increasing to fifty percent at peak harvest times. However, the Florida Citrus Harvest Survey from the 1967-1968 season indicated that of migrant interstate workers, forty-one percent had fewer than two years of experience and the vast majority (nearly eighty percent) had been working in the field for fewer than four years.[91] Compared with locally based pickers, a group where sixty percent had worked with citrus for ten years or more, interstate

[89] McPhee, *Oranges*, 40.
[90] J.K. Dow, "Historical Perspectives of the Florida Citrus Industry and the Impact of Mechanical Harvesting on the Demand for Labor" (Gainesville: University of Florida, Dept. of Agricultural economics, 1970), 11.
[91] Dow, "Historical Perspectives of the Florida Citrus Industry and the Impact of Mechanical Harvesting on the Demand for Labor," 11.

workers in general did not have the breadth of experience and knowledge that locals did, or the reliance on the industry to sustain their families and communities.

Race also helped to predict the average citrus picker's level of experience. The 1970 survey confirmed McPhee's estimate of the racial make-up of citrus workers, reporting that pickers were approximately eighty-five percent non-white and over ninety percent male.[92] Of these non-white men, fifty percent had ten or more years of experience, compared to only around twenty percent of white men. The gap was similar for female pickers, showing that twenty-nine percent of non-white women had ten or more years of experience while no white women fell into that category. Racial barriers to upward mobility meant that African Americans were more likely to become employed in what was considered an unskilled occupation, and more likely to continue working as citrus pickers throughout their lives. A segregated and restrictive education system coupled with less economic stability often incentivized young African Americans to take jobs as manual laborers, including in citrus groves. Nearly eleven percent of pickers had less than a third-grade education, around forty percent left school between third and fifth grade, and just 0.6 percent had received more than a high school education.[93] The USDL study notes that this percentage was significantly higher for white workers, with the largest number of workers (forty-one percent) falling into the Grade 6-9 category compared to non-white workers, for whom the average education level reached was Grade 3-5. Interestingly, the few workers who had gone on to study beyond high school

[92] Dow, "Historical Perspectives," 10.
[93] Dow, "Historical Perspectives," 10.

were all non-white, suggesting professional barriers even for African Americans with high degrees.[94]

This dynamic was also evident on Merritt Island, and while both white and black citrus workers lived on island, African Americans were much more likely to be employed in the citrus industry, and a far larger percentage depended on grove work for the livelihoods. On the 1940 census for the precincts covering the North Merritt Island unincorporated towns of Haulover and Wilson, the register recorded a total of 208 residents.[95] Of the eighty-three white residents with occupations listed, twenty-four of them (twenty-nine percent), were associated with citrus farming, with a diverse set of titles including "Proprietor," "Farmer," "Nurseryman," "Laborer," "Packer," and "Tractor driver." Conversely, of the twenty African Americans with occupations, nine of them (forty-five percent) had ties to citrus jobs. Unlike their white counterparts, however, these workers were listed exclusively as "Laborer" or "Farmer."

The African American presence in the citrus industry on the island can be traced at least as far back as 1866, when Andrew Jackson, a formerly enslaved man from Georgia, moved to the area south of Allenhurst and began working for Douglas Dummett. In a 1926 journal article by the Florida Horticultural Society, Jackson was interviewed about Dummett and the history of the grove, in which he confirmed the budding process used and the origin of the sweet orange variety that Dummett grafted to his rootstock.[96] What is left unsaid, however, is the nature of Dummett's workforce, which consisted of slave

[94] Dow, "Historical Persepctives," 96.
[95] Department of Commerce - Bureau of the Census, "Wilson Precinct 14; Haulover Precinct 12; Shiloh Precinct 12," Population Schedule (Brevard County, FL, April 24, 1940), National Archives and Record Administration.
[96] C.A. Bass, "Historical Sketch of the D.D. Dummit Grove at Allenhurst, Which Is Supposed to Be the Oldest Grove in Florida," *Florida State Horticultural Society*, January 4, 1926.

labor until just before the Civil War. The article also fails to mention that Jackson was married to Dummett's daughter, Kate, who was one of three children that Dummett had with his slave Leandra Fernandez.[97] It is unclear how many enslaved workers and laborers worked for Dummett before or after the Civil War, but it was enough to ensure a relatively leisurely life for the grower. Instead of inquiring into these issues, the focus of the journal article is Dummett's skill as an innovator and manager, with the authors giving him credit for keeping the grove well maintained and pruned. Despite this, it is easy to imagine a similar scene to the one painted by Emma Hardee, the daughter of a citrus planter near what is now Cocoa, when she wrote about her father's prosperity, saying that "there was plenty of money and Negroes to do the work and a big house to entertain his guests in."[98]

Similar to the focus on Dummett's role in innovating the citrus industry through grafting, growers looking to solve the problems caused by freezes sought a technological solution. In the late 1800s, confidence in the ability of innovation to find a solution to the problem was high, and as McPhee writes, "it was an era of scientific advances in which triumph over nature seemed not only possible but inevitable."[99] In the December 21, 1900 issue of the *Florida Star* newspaper, a full page spread highlights William H. McFarland, a man dubbed the "Father of Protection," who came up with a new way of shielding trees from damaging frosts.[100] His idea was a simple tent that could be quickly assembled, durable, and made at a reasonable price so that it would be practical for

[97] Roz Foster, "Explore Your History: Lost Communities of North Merritt Island: Dummett's Grove," *The Journal of The Brevard County Historical Commission* XIII, no. 1 (Spring / Summer 2014): 21.
[98] John Eriksen, *Brevard County, Florida: A Short History to 1955* (Florida Historical Society, 1994), 24.
[99] McPhee, *Oranges*, 67.
[100] "The Father of Protection," *The Florida Star*, December 21, 1900.

growers with hundreds of trees to purchase. For this invention, the paper compared McFarland to George Washington through whose "genius and energy…the hopes of the nation were crystallized into form and a practical method of protecting the liberties of the people were established." After these high accolades, however, the paper goes on to acknowledge that McFarland was not the originator of the idea of protection and was in fact "not even alone in devising means for the protection of orange trees." His claim, then, is to one of the many attempts at solutions being tried by growers, grove workers, and entrepreneurs alike. Nevertheless, McFarland's tent was never widely adopted, and freezes continued to be a problem as they had for centuries.

One such freeze - a huge cold blast that struck the northeastern part of the state in 1895 - was particularly damaging for the citrus in the area. In February, temperatures stayed well below freezing overnight, and by some accounts when some orange growers were told about the situation, they got up from their dinner tables and then left the state altogether.[101] In 1894, the state exported more than a billion oranges, but by the following year that had declined by ninety-seven percent, sparking an exodus from major citrus growing areas of Florida. Orlando, whose population was 10,000 in 1890, recorded in 1900 a population of only 2,000 people.[102] Although most of the trees in Douglas Dummett's grove survived the freeze, including six of the original trees planted in 1830, not all groves on Merritt Island were so lucky. One twenty-acre grove near Shiloh, planted by the Pattillo family in 1889, was ruined in the big freeze, after which they immediately replanted, knowing that they would have to wait several more years to see a

[101] McPhee, *Oranges*, 34.
[102] McPhee, *Oranges,* 68.

return on their investment. Eventually the family did very well for themselves and lived in a three-story house with electricity located on a 300-acre estate with many tenants.[103]

Another Merritt Island grove owner affected by the 1895 freeze was James Taylor and his family, who had worked hard to start a five-acre grove in a mosquito infested area only to see it frozen to the ground two years later. The $1,800 that he had invested in the trees gone, he mortgaged his land to finance more land and new trees, from which he did not see a profit until ten years later. Norris Andrews, another former resident, remembered his grandmother vivid account of the 1895 freeze, when all her family's trees were killed.

> Just about the time this was happening and the new little shoots were coming out the hard freeze came in February. She said it sounded like cannon fire going off. When the trees would burst open, when the sap would freeze - it sounded just like cannons going off all over. They had a really, really rough time…[104]

Coping with freezes remained a major problem into the twentieth century, and although inventors like McFarland attempted to market their solutions, there was no widely accepted way to prevent this particular disaster. In December 1962, the same year that NASA began acquiring land on Merritt Island, an Arctic blast hit the region, resulting in a loss of around 8 million oranges and enough damage to trees to cause the state's production to drop by half the next year.[105] Although grove owners had several options for preventative measures, the four-night freeze overwhelmed even well-protected groves. All three of the most popular measures at the time were labor-intensive and required extensive coordination with a workforce double the number that were

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[103] Roz Foster, "Explore Your History: Lost Communities of North Merritt Island: Shiloh," *The Journal of The Brevard County Historical Commission* XIV, no. 1 (Spring / Summer 2015): 26.
[104] Norris Bliss, Interview with Norris (Andrews) Bliss, interview by Nancy Yasecko, Video, January 16, 1994, Brevard County Historical Commission, https://youtu.be/KnbCi-X1nXc.
[105] McPhee, *Oranges*, 35.

usually employed, with freezes often falling during a time that groves already operated around peak employment. One of the methods, called temperature inversion, required expensive wind turbines mounted on towers that were designed to mix the colder air towards the ground with the warmer air higher up. This option was limited, however, because it was effective only for mild freezes, and the propellers required a breeze, making them useless on windless nights.[106]

Another option for preventing freezes, used primarily in the 1960s, was what was dubbed "firing the grove," which involved warming the groves with a heat source. McPhee describes the various methods employed, including oil heaters, wood fires, coke (a type of coal) fires, and even burning car tires.[107] In an oral history with three current and former Brevard County citrus pickers - Alfonso Wilson, Coleman Mitchell, and John Moorer - the men talk about this method of protection and outline the process that they used in greater detail, emphasizing the urgency and scale of the workforce needed to ensure a safe crop. For freezes that lasted a span of days, workers had to attend to the groves all night and then go back the next day to repeat the strenuous operation. In the early days, they remembered using just wood, placing small campfires down the middle of the grove and replenishing the flames all night.[108]

As the technology changed, grove workers began to adapt to new firing methods, including the use of diesel grove heaters like the one shown in Figure 2. These devices would be situated between two rows of trees and refueled daily by tractors with fuel tanks and hoses, with enough fuel to last around twenty-four hours. The goal was to salvage the

[106] McPhee, *Oranges,* 35.
[107] McPhee, *Oranges,* 35.
[108] Coleman Mitchell, Alfonso Wilson, and John Moorer, Firing the Groves, interview by Roz Foster, Video, October 5, 2004, Brevard County Historical Commission, https://youtu.be/PlEg5IvGZ2Y.

grove by keeping the trees above twenty-seven degrees Fahrenheit because, as Wilson explains, dropping down further could lead to a loss of trees, which could take as many as ten or more years to recoup. Losing the fruit from a tree was undesirable, but if the crop was lost at the expense of saving the tree, then years of cultivation would be preserved.[109] However effective "firing the grove" was for groves, its use was soon banned by the Environmental Protection Agency (EPA), which determined that they were overly polluting the air. In addition to that, Mitchell and Wilson describe how the heaters were also a strain on the wallet of grove owners. Since each grove needed thousands of the heaters to effectively stave off the cold, the cost of diesel could run as high as $10,000 per night depending on the size of the grove, making them a costly investment.

Figure 2: Brevard County Historical Commission - "Firing the Groves"
Coleman Mitchell demonstrating a diesel grove heater

[109] Mitchell, Wilson, and Moorer.

Following the EPA ruling about the grove heaters, another, riskier option became to spray the trees with a coating of water that would freeze and subsequently release heat to protect the bark from splitting. Wilson describes how the insulation of water created an "overcoat" for the trees that came from the warmer rising ground water. There were limits to this option as well, as Wilson explained, even though the trees might be saved, the frozen fruit had to be quickly harvested afterwards before they thawed and were spoiled, resulting in a loss of product. In addition, each grove owner needed to pump water from their own drilled wells, which took up water resources also coveted by expanding residential areas like condominiums. Wilson remembers one politician who remarked to him that "orange trees don't vote, and people do," when discussing water rights and the future of orange groves near urbanizing areas. Perhaps thinking beyond just water battles to the general changing landscape of Brevard of the 1960s, Wilson laments that "people decided that it is more profitable to raise houses than it is to raise trees." As the next chapters will discuss further, for citrus workers like Wilson, Mitchell, and Moorer, the coming of the Kennedy Space Center brought drastic changes in their industry. With the opportunities at the space center, many pickers moved over to work for NASA, and others like Moorer continued as pickers, a decision that he recollected on with some regret.

Despite these shifts, before and after the arrival of the space program, citrus production along the Indian River continued to adapt to environmental challenges, with workers and grove owners at the forefront of adaptation. After World War II, the introduction and widespread consumption of frozen concentrate nationwide led to a significant expansion of the Florida citrus industry, and by the late 1950s, the popularity

and demand for chilled citrus juice spurred an even wider market for growers.[110] In 1950, the per capita consumption of processed orange juice (canned, pasteurized, and frozen concentrate) came to around eight pounds, and by 1960, that figure had skyrocketed to 20.29 pounds, the equivalent of 2.33 gallons per American.[111] From 1957-58, Florida orange and grapefruit juice sales alone exceeded 37.5 million gallons, distributed across the country.[112] A staple in the American household, oranges have gone through a number of developments in all stages of their journey from grove to table, which most Americans take for granted. While it may seem disingenuous to compare the engineering that went into an Apollo moon landing with citrus grove work, for millions of Americans, including many in Brevard County, the orange had a much more tangible presence in their everyday lives than the space program.

[110] Roy Leland Lassiter, "Economic Characteristics of the Florida Chilled Citrus Juice Industry," Marketing Research Report (United States Department of Agriculture; University of Florida, March 1959), 5.
[111] Hamilton, *Squeezed*, 25.
[112] Lassiter, "Economic Characteristics," 12.

Chapter 3: Uprooting the Groves

In 1968, 2,500 miles to the south of Cape Canaveral, a French Véronique rocket lifted off from the newly built space center in Kourou, Guiana. In an opportune coastal setting on the equator, the French space agency followed on the heels of the Soviet and American space programs, both in technology but also in means of expansion. Peter Redfield's anthropological study of the Guiana Space Center looks at the French space agency, the Centre national d'études spatiales (National Center for Space Studies or CNES), and focuses on a dilemma faced by space agencies then and now: the need to find and control a location close to the equator with a technically-minded workforce. So while the countries with the rocket technology could be found in the northern hemisphere, their preference of launching from the tropics meant that formerly undesirable land suddenly became highly prized. As Redfield notes, "when one is seeking to leave the globe, wasteland becomes valuable, and underdevelopment can appear a virtue."[113]

Of the three countries first to launch their own satellites, the United States was the only one to launch from a location situated within its own mainland borders.[114] Because of this, it is easier to identify the CNES presence in French Guiana as an exploitative extension of French colonialism and by comparison celebrate the success of the American space program as the product of a home-grown effort. In actuality, the parallels

[113] Redfield, *Space in the Tropics*, 125.
[114] For a discussion on the Soviet space program and its decision to launch from rural Kazakhstan, where the nearest town was described as "a couple of two-story houses for the railwaymen, a couple of dozen small mud-plastered houses, and the tents of geologists prospecting for oil," see: Asif Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race*, The NASA History Series, NASA SP-2000-4408 (Washington, D.C., National Aeronautics and Space Administration, 2000), 133-135.

of the stories behind the two centers are subtle but undeniable, particularly when one looks at NASA's use of eminent domain to build the Kennedy Space Center and the economic upheaval caused by a dramatic influx of the new technically skilled labor force. This chapter will cover the early history of rocket launches on Cape Canaveral, the process of choosing Merritt Island as the site of NASA's Apollo launch site, and the experience of some of the citrus workers and other residents who depended on the land that was included in the acquisition.

3.1 The Road to the Kennedy Space Center

Previously, the area around Cape Canaveral had gone through a series of changes beginning in 1938 with the U.S. military's initial construction of defense facilities on the coast.[115] Located on a barrier island called the Canaveral Peninsula, the area in question juts into the Atlantic and connects to Merritt Island in the north, with the Banana River separating the two landmasses to the west. Taking advantage of the existing defensive infrastructure just to the south of this point, the Navy opened the Banana River Naval Air Station during World War II, which was used to train pilots and send out patrols searching for German submarines. The Cold War with the Soviet Union soon followed, and with it the need for missile testing ranges. In 1949, the Air Force took charge of the facility and renamed it the Patrick Air Force Base. To the north of the base on the promontory itself, the Air Force also constructed the Joint Long Range Proving Ground, situating the launch pads along the beach and establishing the first point in a series of tracking stations called the Atlantic Missile Range. A team of rocket scientists from the

[115] Lipartito and Butler, *A History of the Kennedy Space Center*, 30.

Army's Redstone Arsenal in Huntsville, Alabama launched the first rocket from the range in July 1950, marking a new era for the small military station.

Throughout the 1950s, the base became host to an increasing number of rocket launches by the Army and Air Force. In 1955, as part of the 1957-58 International Geophysical Year (IGY), the Naval Research Laboratory's Project Vanguard was selected to launch the country's first earth-orbiting satellite. Over the protests of the Redstone team in Huntsville, which would have likely been able to launch a successful satellite sooner, this decision brought even more traffic to the Cape.[116] The short IGY timeline was not long enough for the Navy team, however, and the Soviet launch of Sputnik in October 1957 provoked politicians in U.S. to call for an accelerated satellite effort. After the launch failure of the rushed Vanguard rocket, President Dwight Eisenhower gave the Army team from Redstone permission to launch their Explorer satellite, which they successfully did from Cape Canaveral in late January 1958. Nevertheless, the delayed effort shattered a belief in American technological superiority and created an urgency within the government to commission an organization designated to exploring space. Less than a year after Sputnik launched, Congress created the National Aeronautics and Space Administration, a peaceful, civilian agency whose mission would be, in part, the "expansion of human knowledge of phenomena in the atmosphere and space."[117]

NASA grew out of the existing National Advisory Committee for Aeronautics and would soon balloon to include the Army rocket arsenal in Huntsville as well as the model

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[116] Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1997).
[117] *National Aeronautics and Space Act of 1958*, Public Law 85–568, *U.S. Statutes at Large* 72 (1958): 426-438, https://www.govinfo.gov/content/pkg/STATUTE-72/pdf/STATUTE-72-Pg426-2.pdf.

of contracting and project management designed by the Air Force, making the administration a nationwide effort.[118] Added to this dynamic was an international element, since the Redstone team consisted in large part of German rocket engineers brought to the United States after World War II through its secret program "Operation Paperclip." Led by Wernher von Braun, the newly renamed Marshall Space Flight Center (MSC) in Huntsville merged the Air Force's contracting tradition with the system used by the Germans at the Nazi military research center Peenemünde, which had relied on building and testing in-house in order to develop the V-2 rocket during the war.[119] But as NASA increased its testing, the limited facilities at the Cape struggled to accommodate both its needs and those of the military, resulting in a bottleneck of civilian and military rockets.[120] These rockets grew in size as well as number, further complicating the situation due to longer assembly times and the need for bigger and more distant launch pads. By the end of the decade, so many launch towers had been constructed, that one account described the scene as resembling "a Gulf Coast oil field."[121] In 1960, NASA created an office at the Cape that would establish a permanent home for the Launch Operation Directorate out of MSC and improve the logistical efficiency of launches, ensuring strong ties to the military's Atlantic Missile Range. But even with the flurry of rocketry at the Cape, by the time the Soviet Union launched Yuri Gagarin in April 1961 to become the first human in space, it was clear that the United States needed to do

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[118] Lipartito and Butler, *A History of the Kennedy Space Center*, 48.
[119] Lipartito and Butler, *A History of the Kennedy Space Center*, 47; For more on the former Nazi rocket scientists and their role in NASA's early programs, see: Monique Laney, *German Rocketeers in the Heart of Dixie: Making Sense of the Nazi Past during the Civil Rights Era* (New Haven, CT: Yale University Press, 2015); Michael Neufeld, *Von Braun: Dream of Space, Engineer of War* (New York: Alfred A. Knopf, 2007).
[120] Lipartito and Butler, *A History of the Kennedy Space Center*, 51.
[121] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 96.

something spectacular if they wanted to stay in the space race. A month later, President Kennedy announced the decision to go to the moon, setting in motion steps that would greatly expand the scope of NASA and culminate in the Apollo Program.

Despite its history of rocket launches and NASA's existing presence in the area, Cape Canaveral was not the only launch site option considered for the Apollo Program. Even as facilities and infrastructure around the Cape expanded during the 1950s, the location remained underdeveloped, and the existing workforce was not sufficient to do work on the scale that would be required to land a man on the moon.[122] The preexisting infrastructure that supported intercontinental ballistic missile (ICBM) and smaller rocket launches, while a useful starting point, was nowhere near large enough to support launches on the scale proposed by NASA. Although the method of reaching the moon had not yet been determined, the anticipated liquid fuel Nova rocket, which would have been used for a direct ascent mission, measured a massive 13.4 meters in diameter and weighed 4.3 million kilograms, far too large to safely launch from one of the existing pads.[123] Even the Saturn V rockets (weighing a measly 2.86 million kilograms or 2,860 metric tons) proposed for use in the earth-orbit and lunar orbit rendezvous methods took rocketry to a level never before seen at the Cape, or for that matter, anywhere in the world. In addition to these considerations, the area faced weather challenges, including oppressive humidity and salty air, which had the potential to corrode metal over time.[124] Frequent yet unpredictable bad weather like lightning, rain, and strong winds also created

[122] Murray and Cox, *Apollo*, 87.
[123] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 116.
[124] Murray and Cox, *Apollo*, 87.

a less-than-advantageous environment for carefully crafted rockets that would need to sit in the open on launch pads.

NASA officials understood the importance of quickly choosing a launch site, since the construction of adequate facilities was considered a pacing factor in getting to the moon before the end of the decade.[125] In 1961, the selection process began with a directive from NASA's Associate Administrator, Robert Seamans, which tasked Kurt Debus, one of von Braun's collaborators from Marshall, and Air Force General Leighton Davis with recommending a launch site. Their report narrowed the search down to eight potential sites: Cape Canaveral, Offshore from Cape Canaveral, Mayaguana Island in the Bahamas, Cumberland Island (Georgia), Brownsville (Texas), White Sands Missile Range (New Mexico), Christmas Island (Kiritimati), and South Point on the island of Hawaii.[126] All the proposed sites were located in southerly locations and almost all had a water buffer to the east so as to take advantage of the earth's rotational velocity at launch. Cape Canaveral was not the most geographically strategic choice, but Kiritimati, the closest option to the equator, as well as the other islands considered, came with even greater logistical difficulties and construction costs.[127] The Brownsville location posed potential fly-over risks for the southeastern United States, and White Sands, which would have likely cost the least to develop and operate, was also discounted based on its landlocked position and lack of access to water transportation.[128] The final alternative,

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[125] U.S. Congress. House, Committee on Science and Astronautics, *1963 NASA Authorization: Hearings before the Committee on Science and Astronautics*, 87th Cong., 2nd sess., February 27-28, April 12, and May 3, 1962, 623.
[126] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 126.
[127] An atoll located in the South Pacific, Kiritimati was used by the UK and US for nuclear testing in the 1950s and 1960s.
[128] Although the lack of overflight hazard was given as a strength for the Cape Canaveral site, launching rockets from Florida with a southeastern trajectory was not without overflight risk. An early account of

Cumberland Island, held similar advantages to Cape Canaveral, but while the site was accessible via deep water transport, it did not possess the communications network that had already been developed in Florida.

More by process of elimination rather than merit, Debus and Davis favored Cape Canaveral as the launch site, although several factors did strengthen the Cape's case, including the growing and "dynamic" surrounding area of Titusville-Cocoa-Melbourne. The report exaggerated the presence of rocket personnel, saying that "practically the entire local area population [was] missile oriented," and they anticipated a "minimum of public relations type problems due to missile hazards and inconveniences."[129] Already in the early hypothetical planning stages of expansion on the Cape, the gap between newcomers and those residents who already resided there began to show, with concerns of the non-missile labor force being excluded from the conversation. Debus was reportedly "keenly aware" of the strain on Brevard County caused by NASA's expansion, and in the report, he expressed concern about the danger of the area being "swallowed up by the existing organization."[130] But despite these concerns, the Cape was the clear frontrunner in the report, and NASA had little time for lengthy deliberations about the concerns of locals as the deadline for a successful moon landing loomed.

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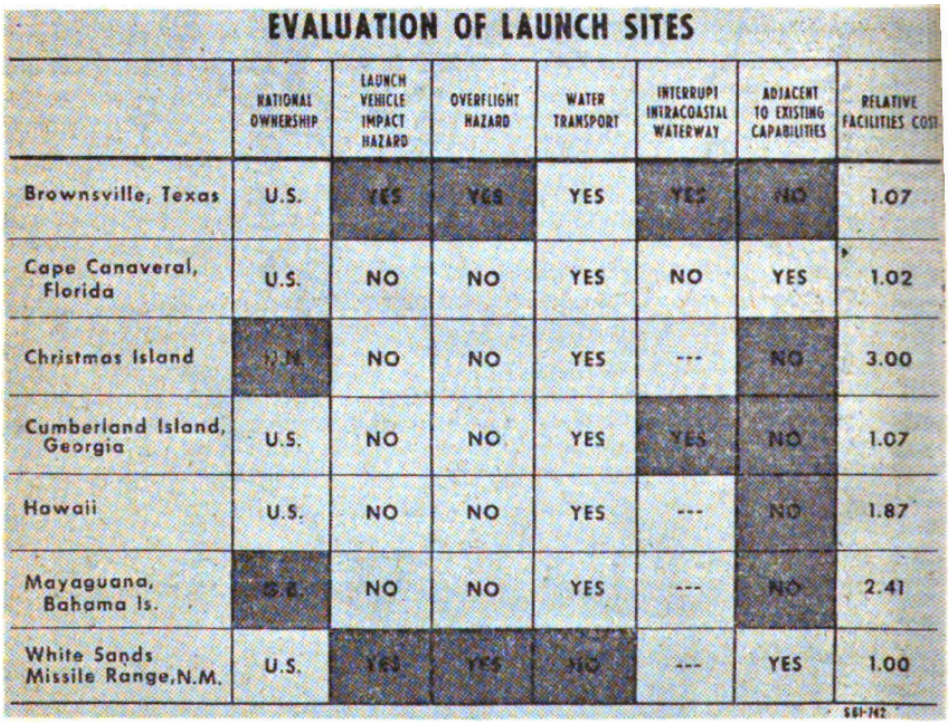
launches from the Cape describes how residents of Caribbean islands from the Bahamas to the Lesser Antilles collected debris from missiles that had fallen on their land – missiles that it claims were "harmless if certain safety precautions were followed." Shelton, *Countdown: The Story of Cape Canaveral*, 28.

[129] NASA-DOD, "Joint Report on Facilities and Resources Required at Launch Site to Support NASA Manned Lunar Landing Program," July 31, 1961, 19.

[130] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 127.



EVALUATION OF LAUNCH SITES

	NATIONAL OWNERSHIP	LAUNCH VEHICLE IMPACT HAZARD	OVERFLIGHT HAZARD	WATER TRANSPORT	INTERRUPT INTRACOASTAL WATERWAY	ADJACENT TO EXISTING CAPABILITIES	RELATIVE FACILITIES COST
Brownsville, Texas	U.S.	YES	YES	YES	YES	NO	1.07
Cape Canaveral, Florida	U.S.	NO	NO	YES	NO	YES	1.02
Christmas Island	U.K.	NO	NO	YES	---	NO	3.00
Cumberland Island, Georgia	U.S.	NO	NO	YES	YES	NO	1.07
Hawaii	U.S.	NO	NO	YES	---	NO	1.87
Mayaguana, Bahama Is.	U.K.	NO	NO	YES	---	NO	2.41
White Sands Missile Range, N.M.	U.S.	YES	YES	NO	---	YES	1.00

Figure 3: Evaluation Criteria for Apollo Launch Sites[131]

Debus and Davis presented their report to Seamans in July 1961, just a month after beginning their analysis. Some deliberations at NASA Headquarters centered around convenience for aerospace personnel, particularly when it came to cooperating with the Air Force at the Cape. For some, Cumberland Island in Georgia represented what could be a fresh start for NASA away from the influence of the Air Force. One official argued that missile personnel currently residing in Jacksonville, Florida, would be able to reach the proposed Georgia site just as quickly if not quicker than they were able to get to Merritt Island.[132] A *Washington Post* article from August 1961 worried that the "size, power, noise, and possible hazards of Saturn or Nova rockets would require greater isolation for public safety than current NASA launch sites offered."[133] Historians Faherty

[131] NASA-DOD, "Joint Report on Facilities and Resources Required at Launch Site to Support NASA Manned Lunar Landing Program."
[132] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 128.
[133] Benson, Charles and Faherty, William Barnaby, 128.

and Benson report that these concerns were also found in NASA's deliberations, however, in the end, the decision came down to a variety of factors, none of them directly addressing local considerations.

Instead, according to Rocco Petrone, a member of the committee that helped study the issue, the final selection was based primarily on financial advantages and access to existing infrastructure, including the crucial Atlantic Missile Range tracking system, a series of support stations running southeast from the Cape.[134] Figure 3 shows the comparison of these factors alongside the other factors considered. Two of the categories, "Overflight Hazard" and "Launch Vehicle Impact Hazard," show evidence of concern for local populations and those in the flight path of exploding rockets. However, these categories focus on physical risks of the rockets rather than ask about the societal impact of a large new workforce and industry that would be needed to support them. On August 24, several days after NASA Deputy Administrator Hugh Dryden voiced his support for the Cape Canaveral site, the Administration announced plans to acquire the land on Merritt Island. A *New York Times* article about the decision cited potential concerns of residents of the area, reporting that some worried that rockets would "menace cities and towns for miles around," and that the "noise alone would damage windows and other structures, not to mention what it would do to people's nerves."[135] The article goes on to report that NASA believed the risk of noise and blast damage would be "neutralized" by the ten miles that separated the launch sites from populated areas. At this distance, a

[134] Benson, Charles and Faherty, William Barnaby, 129.
[135] Richard Witkin, "Cape Canaveral Rocket Base To Be Expanded 5 Times in Size," *The New York Times*, August 25, 1961.

twenty million pound thrust rocket would generate approximately 120 decibels of noise, which they claimed was "well below" the danger level of 135 decibels.

By September 1, NASA had requested from Congress the funds to purchase approximately 80,000 acres (324 square kilometers) of land northwest of the Cape Canaveral launch area. While NASA needed only a fraction of this area for operational purposes, the nature of rocketry requires that launch sites keep a wide berth in case of unexpected explosions or stray missiles. In his statement before the Senate Committee on Aeronautics and Space Sciences, NASA's Administrator, James Webb, argued that the acquisition was "an urgent requirement for the timely conduct of the expanded space program," and that construction must begin immediately if the administration was to accomplish their goals in the timeframe given.[136] The bill proposed that Congress authorize an additional $60 million on top of the initial $1.78 billion total budget that had been approved in July, to fund the purchase of the land on Merritt Island.

During the hearing on the budget amendment, Webb and Dryden laid out the case for the location and answered questions from committee members, including some on the topic of housing facilities and citrus groves. One Senator, Howard Cannon from Nevada, pointed out already existing housing constraints on the Cape. He agreed that the land should be taken from current residents but wondered if the land and houses could be repurposed and given to missile personnel who might be more willing to cooperate with evacuation orders at launch time. Following this discussion, Florida Senator Spessard Holland spoke up to say that he had not heard any complaints from homeowners on

[136] U.S. Congress, Senate, Committee on Aeronautical and Space Sciences, *Amending the NASA Authorization for the Fiscal Year 1962: Hearing before the Committee on Aeronautical and Space Sciences,* 87th Cong., 1st sess., September 1, 1961, 3.

Merritt Island, who were "sorry to lose their homes, but they feel that if this is the preferred site and something to be done in the Nation's interest, they will have to accommodate themselves to it."[137] Whether he had directly heard this opinion from homeowners or if their silence had merely led him to this conclusion is uncertain, but it is clear that he differentiated the voices of homeowners, most of whom were laborers, from the voices of larger-scale citrus grove owners.

Concerning citrus groves within the proposed area of expansion, Senator Holland described the nearly 500 acres of "premium acreage" for Indian River fruit that would be lost. While he acknowledged that it was not an overly large area, the value of the fruit in both quantity and quality merited consideration from NASA which it was not being given. Holland argued for an option of easement for owners and developers, who would otherwise lose not only their land, but also the investment of years of growing and cultivating the trees. This solution would have allowed growers to maintain ownership of their groves but be required to evacuate or use caution during launches. It seems evident from the transcript, however, that citrus groves had not been at the forefront of NASA's analysis when comparing launch sites. Webb skirted around the issue by saying that "to make a statement that would affect the property rights of people here, or raise their expectation, might not be wise at this point." Holland pushed back at the equivocation, again reiterating that although there was no objection to the taking itself, residents of the area, who were "vitally affected," deserved to know which areas would be included, the timeframe of the taking, and ultimately the effect that it would have on their livelihoods and homes.

[137] U.S. Congress, Senate, Committee, *Amending the NASA Authorization for the Fiscal Year,* 17.

In addition to the location decision, another major pacing question prevented Webb from making a more definitive statement: how exactly NASA was going to get to the moon. The direct ascent method of lunar landing, which would have required the massive Nova rocket, was still very much in consideration at the time that Cape Canaveral was selected, and the buffer needed for such a rocket dictated how much total land NASA needed to acquire. In May, after the initial frenzy of Kennedy's moonshot announcement, many NASA leaders assumed that direct ascent was the most practical method, as it required just one rocket carrying a spacecraft with the capability of landing on the moon and returning to earth.[138] It was not until later that NASA debated the competing mode options more seriously, creating interagency issues that threatened to jeopardize the timeline of the lunar program. Of the two other serious contenders, Earth orbit rendezvous mode was preferred by the rocket experts at the Marshall Space Flight Center, who saw job security in the increased number of rockets that the method would require, and argued that the step from current technology to the Nova rocket would be too ambitious.[139] The final contender, lunar-orbit rendezvous, was a latecomer to the debate, but would be the method that NASA eventually settled on in July 1962, just over seven years before the first successful moon landing. It was in large part due to these internal deliberations that Senator Holland and his constituents on Merritt Island were unable to identify exactly when (if ever) their land would be taken, and what their options were for retaining possession or use of their citrus groves.

Deliberations on how to get to the moon persisted for another year, during which time the concerns of citrus growers and other residents grew as the Army Corps of Engineers

[138] Murray and Cox, *Apollo*, 83.
[139] Murray and Cox, *Apollo,* 112.

began to appraise their land. In late 1961, a lawyer for the Florida Citrus Mutual, an industry trade group in the state, pressed NASA leaders for guarantee of a fast and fair decision on the land still being considered, to which the space administration promised goodwill and a quick decision. But by an April 1962 hearing before the Senate Committee on Appropriations, Holland again questioned NASA on behalf of his constituents, who had expressed "great anxiety" at the uncertainty surrounding the future of their property. Here, Holland estimated that the affected citrus groves totaled around 2,000 acres owned by "good people [who were] entitled to a decision on this a long time ago."[140] In response, the NASA representatives at the hearing shifted blame for the delay onto the Army Corps of Engineers, claiming that the Corps had received no recent complaints from landowners. Holland pressed once more, asserting that he had personally passed along complaints to Administrator Webb and again outlining some of the technical considerations that citrus growers needed to take into account. For grove owners, these concerns included whether to spray, fertilize, and work the groves, which, as Holland noted, was an expensive and time-consuming process. In a hearing focused on winning funding for rocket launches, the Florida senator's convincing argument puts citrus rather than space technology at the forefront, explaining that residents "have been very patiently awaiting that decision and have spent a whole lot of money continuing to keep up their groves in the hope that they may have that privilege that they want." Congress granted the land appropriation with the stipulation that the Department of

[140] U.S. Congress, Senate, Committee on Appropriations, *Second Supplemental Appropriation Bill For 1962*: *Hearings before the Committee on Appropriations,* 87th Cong., 2nd sess., April 4, 1962, 155.

Defense would have access to future facilities and capacities, and the Army Corps of Engineers began purchasing land directly from residents later in 1962.[141]

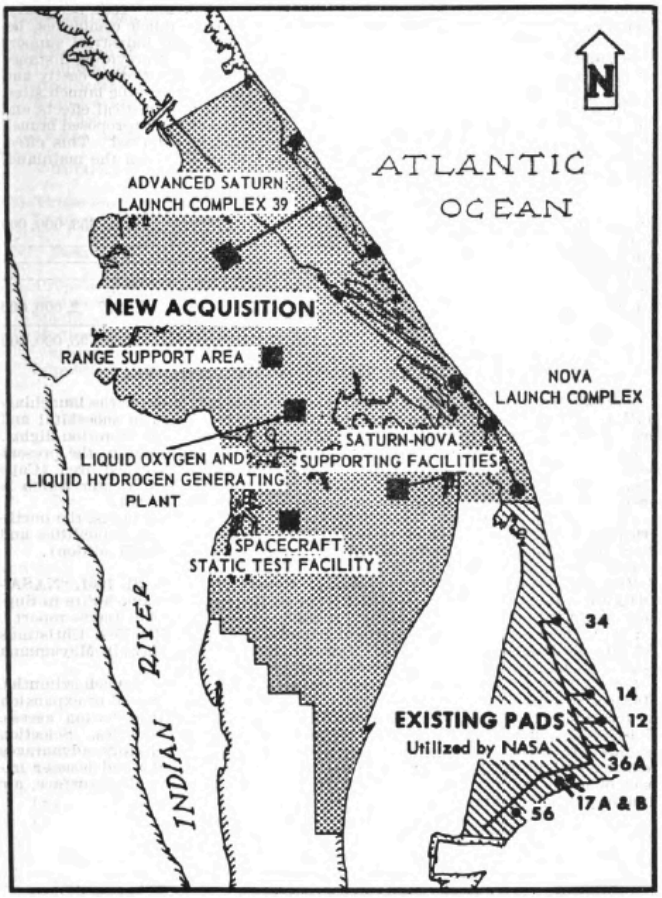


Figure 4: Merritt Island Land acquisition area and proposed launch sites[142]

3.2 North Merritt Island Responds

According to a local historian, at the time that NASA acquired North Merritt Island, approximately seventeen communities, settlements, and towns, with around 400 residents in total called the area home. She describes the formerly occupied buffer areas as "moss

[141] Lipartito and Butler, *A History of the Kennedy Space Center*, 87.
[142] U.S. Congress, Senate, Committee, *Second Supplemental Appropriation Bill For 1962*.

covered oak trees and overgrown graveyards" near to the "remains of crumbling foundations and coquina driveways, abandoned citrus groves and shrubs gone wild from neglect."[143] Despite what Spessard Holland had assured NASA when advocating for citrus grove owners in Congress, not all of the former residents of the acquired land were happy to turn their property over to the government, even for a fair market price and the chance to contribute to a groundbreaking national project. David Allan Taylor, a former resident who started working in the orange business around the age of six or seven, described the shock caused to older landowners specifically, saying that his mother and father lived less than a year more after their land was taken.[144] For Taylor and others, the move was a devastating blow to not only their businesses, but also to their memories and sense of place.

Many locals worried specifically about the transparency involved in the Army Corps of Engineers' efforts. Residents who refused the government's offers on the basis of "rumors" about neighbors getting better prices found themselves faced with condemnation proceedings to expedite the process. When residents fought their low payments, almost all eventually lost in court cases, with some cases going on for nearly two decades.[145] Further pushback described as a "public relations nightmare," hit as NASA soon expanded an additional 15,000 acres to the north in order to comply with studies recommending an even larger buffer radius for Saturn rocket launches.[146] With this buffer land deemed too dangerous for habitation, the government created the

[143] Foster, "Explore Your History: Lost Communities of North Merritt Island," 20.
[144] U.S. Fish and Wildlife Service, "The Merritt Island Adventure," November 17, 2014, video, 25:05. https://youtu.be/22IlBi3cR2I.
[145] Lipartito and Butler, *A History of the Kennedy Space Center*, 87.
[146] Lipartito and Butler, *A History of the Kennedy Space Center,* 99.

National Wildlife Refuge on Merritt Island. Framed as a measure to assuage the protests, it is unclear whether turning the once-inhabited land into a wildlife reserve placated local concerns about government overreach.

A case study in Richard Paul and Steven Moss's *We Could Not Fail: The First African Americans in the Space Program* highlights Theodis Ray, an African American man who had grown up in Allenhurst, the Merritt Island freedom colony founded after the Civil War. From a young age, he worked as a fisherman around the area where NASA's giant Vehicle Assembly Building now towers over the landscape, packing and hauling fish with his father to be sold in Titusville.[147] Ray's memories of the acquisition were based on his own lived experience. "When the government came in and bought all this land, it wiped us out. I mean, you had these fishermen, that was their livelihood. Most of them didn't have education and all they did was fish." He also mentions the many Black-owned orange groves in the area, a rarity during a time when land ownership for African Americans in Florida was not widespread. For the displaced African American grove workers and fishermen like Ray, employment options were limited, and many scrambled to claim the competitive janitorial and construction positions opening at NASA.[148] In Ray's case, the truck that he drove for a construction crew passed through very familiar territory as he worked to help erase the physical memory of his old community for the benefit of the space program.

As for the future of the affected citrus on the island, the acquisition targeted a grove area of 3,206 acres containing 185,000 trees, an amount that far exceeded Senator Holland's 1962 estimate of 2,000 acres. Eventually, the two sides agreed on a deal that

[147] Paul and Moss, *We Could Not Fail,* 35.
[148] Paul and Moss, *We Could Not Fail,* 37.

gave original grove owners in the buffer zone the ability to lease the land until 1968, with an option after that to renew the lease for five more years.[149] NASA's official 1972 history of the space center notes that the groves were "leased to their former owners who cared for the trees and harvested fruit. In return for this privilege, they paid annual fees to the U.S. Treasury."[150] This "privilege" was very likely not what citrus growers originally envisioned - the prospect of easement proposed back in the initial September 1961 appropriations hearing had been abandoned for a system in which NASA leased land back to its former owners. After this, not only did growers and pickers have to contend with longer commutes, but they were also not allowed to store their equipment near the groves.[151]

In a 2016 interview, Cocoa resident Frank Sullivan, whose family was heavily involved in the Brevard County citrus industry, described with distaste NASA's decision to acquire, and then lease the land back to its former owners. Sullivan echoed Holland's concerns in 1962, calling Merritt Island some of the best citrus land in the country, which he said would have benefited from the implementation of a system of easement that permitted continued use.[152] Compared to larger groves around the state, those on Merritt Island tended to be smaller, family-owned and worked, which made this arrangement even more devastating. According to Sullivan, the leasing system was only intended to last three or five years, after which the new owner consolidated smaller plots into 250-

[149] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 144.
[150] National Aeronautics and Space Administration, *Kennedy Space Center Story*, 5.
[151] McPhee, *Oranges*, 71.
[152] Frank Sullivan, Interview with Frank Sullivan, interview by Griffin Bixler and Boonstra, Michael, Video, July 21, 2016, Brevard County Historical Commission, https://youtu.be/D2SdBSG3ix4.

acre blocks that could then be leased out to the highest bidder.[153] This marginalized and created bitterness among smaller growers, who had no chance to compete with bigger citrus operations. To make matters worse for the new lessees, the Department of the Interior soon came out with updated guidelines for the area that was also part of the wildlife refuge, which banned the cultivation of non-native species, including oranges. For Sullivan, this seems to represent the height of federal disrespect for the area and its industry.

> I hope they're happy, because there are a lot of dead trees up there and the birds have been sitting in them, dropping the Brazilian pepper seeds, so they got Brazilian peppers everywhere. That's a long way from a native plant. Serves them right. It was kind of sad. There was good employment, it was good for the environment, there was a lot of labor, there was hundreds of people working up there. It didn't matter. They were going to get rid of it.[154]

Other small-scale grove owners on the island chose to sell their land outright at the low amounts offered and then faced the challenge of trying to relocate nearby, where the cost of land had skyrocketed with the growing demand. One woman recounted how she received only $244 per acre for her land from the Army Corps of Engineers, and was shocked to see that a year later, land on South Merritt Island was selling for as high as $3,000 per acre.[155] In a short documentary done by the Fish and Wildlife Service, one man shared his own experience with the lawsuits brought by families who objected to the low offers from the Corps, relating how his family and others fought for more money in the courts. But despite winning their case, the man noted wryly that by the time his

[153] It is worth noting that this differs slightly from the details given by Frank Sullivan in his oral history interview, and it is possible that some plots of land were treated differently depending on whether they laid within the bounds of the wildlife refuge or if they were part of the land controlled directly by NASA.
[154] Frank Sullivan, Interview with Frank Sullivan.
[155] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 143.

family had paid the lawyers, the amount that they received was about the same as the total originally offered.[156]

From the time that Kennedy tasked NASA with going to the moon, the Administration knew that it would need to displace some people on their way to the moon. Eminent domain itself is a routine procedure for many government projects that require land, and it has organized systems in place for carrying out the job. In a history of the Jacksonville District U.S. Army Corps of Engineers, the branch initially responsible for the acquisition on Merritt Island, eminent domain is never mentioned, even when talking about NASA's expansion in 1963.[157] The widespread use of this governmental prerogative that is written into the Constitution often makes it easy to overlook the lives that it affects, especially when those lives are under-documented on lines of class or race.[158]

NASA's overall process of choosing a launch site reflects a general disregard for the local. While they strongly favored launch sites on land owned by the United States, the shortlist of options included two: Christmas Island and the Bahamas, which did not meet these criteria but were nevertheless considered. Questions of outdated colonial overreach do not appear to have been a topic of conversation as NASA made its decision, nor is it a theme explored in the well-known literature about the space program. Comparatively, the French search for a launch site mentioned at the beginning of this chapter, left little doubt about the unavoidable links between equatorial locations,

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[156] U.S. Fish and Wildlife Service, "The Merritt Island Adventure."

[157] George E. Buker, *Sun, Sand and Water: A History of the Jacksonville District U.S. Army Corps of Engineers, 1821-1975* (Jacksonville: U.S. Army Corps of Engineers, 1981).

[158] For more discussion on race and eminent domain in Florida, see: N. D. B Connolly, *A World More Concrete: Real Estate and the Remaking of Jim Crow South Florida.* (Chicago: University of Chicago Press, 2016).

colonialism, and favorable conditions for rocketry. In 1967, finding themselves without a launch site after their Algerian colony gained independence, the newly formed National Centre for Space Studies looked elsewhere. Of the fourteen locations that the French space program considered, none were near mainland France and the majority were either former or current colonies and territories.[159] Similar to the approach by NASA, however, the decision to situate the French space center in an underdeveloped area that would require a large, imported workforce, was made independently or even contrary to local opinion. Space technology, deemed a national priority in both the United States and France, had the pick of the land and the ability to take for granted that wherever they wanted to build, they would have the power of the government behind them. NASA's decision to use Merritt Island came down to issues removed from local concerns, and in the end, tracking capabilities, cost, and resource redundancy meant more than the future of citrus groves or fishing docks.

[159] Redfield, *Space in the Tropics*, 125.

Chapter 4: The Changing Face of America's Spaceport

With the shifting demographics brought on by the Kennedy Space Center, old residents of Brevard County had to adjust to the rapidly growing community, and newcomers struggled to find a place for themselves in their new home. From 1950 to 1960, in large part due to the expansion of military and NASA operations on Cape Canaveral, Brevard became the fastest growing county in the country. The population increase during this period (371.1 percent) dwarfed the Florida average growth (78.7 percent) as well as the population growth in the country as a whole (18.5 percent).[160] This area, which supported 23,653 people in 1950, ballooned to a population of 111,435 in 1960 and more than doubled to 230,006 by the end of the decade.[161] As a report compiled in 1966 by the Institute for Social Research at the Florida State University showed, in many areas of society in the county, tensions between the two groups could be seen in both shared activities as well as in general expressions of community values. In venues like churches, schools, and community groups, attitudes toward social responsibility clashed, as newcomers participated less or created separate and exclusionary groups related to their professional connections. This chapter will look at these societal changes from the perspectives of both incoming and established residents and then examine those changes in relation to broader relationships of technology and community.

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[160] "Summary Report: NASA Impact on Brevard County" (Tallahassee: Institute for Social Research, Florida State University, 1966), 10.
[161] Richard L Forstall, *Population of States and Counties of the United States: 1790 to 1990* (Washington, DC; Springfield, Va.: U.S. Dept. of Commerce, Bureau of the Census, Population Division, 1996), 30, https://www2.census.gov/library/publications/decennial/1990/population-of-states-and-counties-us-1790-1990/population-of-states-and-counties-of-the-united-states-1790-1990.pdf.

4.1 Shifting Population

In the 1966 Florida State University report, compilers highlight population growth trends, education system changes, government responsibilities, and critically, surveys that gauged community involvement, satisfaction, and perceptions of power structure. The report includes ten separate studies submitted under a NASA grant, which attempt to answer questions about NASA's impact on the Brevard County community. Noticeably missing from the studies are the voices of African American families in the area, who were deliberately excluded from the institute's surveys due to limited representation in the space industry and the low number of African American migrants to the area during the time being studied.[162] At the same time that the population of Brevard County as a whole had boomed during the previous decade, the African American population remained steady, causing the group to decline significantly as a percentage of the population, from twenty-five percent in 1950 to only eleven percent by 1960.[163] The lack of African American representation in the report means that it is difficult to gauge non-white perspectives on issues that concerned all community members, including general satisfaction and involvement in community groups and local government. The sampling that was done included cases from three of the largest cities in the county: Titusville (248 cases), Melbourne (620 cases), and Cocoa (225 cases), accounting for 4.5 percent of the white families in each community. This meant that in addition to excluding African American families in the cities represented, survey results also do not give an idea of

[162] "Summary Report: NASA Impact on Brevard County," 100.
[163] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 377.

smaller communities and rural residents. Nevertheless, the results collected offer a selective picture of middle-class residents from these cities.

The rapidly expanding education system in Brevard county is perhaps one of the clearest pieces of evidence for how the demographics of the area shifted during this time. Between the 1951-52 and 1962-63 school years, the average daily attendance in Brevard schools increased by 857.8 percent, from 4,163 students to 39,873, and the number of classrooms also skyrocketed from only 117 to nearly 1,500.[164] In an oral history done with NASA engineer Sam Beddingfield, who moved to the area with his family in September 1959, Beddingfield describes the incredible growth and transformation of the school system in Titusville, noting that his daughter was shuffled around to three different schools before he put in a complaint to request she be allowed to stay at one.[165] He repeats several times the claim that at one point, the population was expanding so rapidly that they needed a new classroom every other day to keep up, causing strains on the limited infrastructure and existing population. In the early days of the boom, Beddingfield describes the difficulties for young families with babies who had to travel to Orlando, some forty miles away, just to find diapers.

While not all of the growth can be accounted for by looking at NASA families, it is significant that between 1950 and 1964, the percent of school children from families with federal employees climbed from only ten percent to nearly fifty percent.[166] Although the report warns that it is difficult to measure the impact of "war babies" compared with the children of incoming space personnel because of the interconnected nature of the data, it

[164] "Summary Report: NASA Impact on Brevard County," 51.
[165] Sam Beddingfield, Interview with Sam Beddingfield, interview by Nancy Yasecko, Video, January 15, 1994, Brevard County Historical Commission, https://youtu.be/5-IHqqZknEA.
[166] "Summary Report: NASA Impact on Brevard County," 52.

is fair to say that without the newcomers brought by the space industry, the educational landscape of Brevard County would not have expanded so rapidly and dramatically. Quite telling is the change in average number of classrooms per school, which was only 9.8 in 1950 but grew to thirty-two classrooms per school by 1964. Meanwhile, the average number of students per classroom decreased during this time, from 33.4 students to 25.7 students. Both of these numbers reflect the prevalence of small rural schools like the ones on Merritt Island, which served a larger number of students in fewer mixed-age classrooms.

Another area highlighted in the report that begins to show the divide between what the authors dub "newcomers" and "old timers" is the participation in community organizations. Where original residents placed high value on institutions likes churches, volunteer organizations, and Parent Teacher Association (P.T.A.) groups, newcomers found a stronger common bond in work relationships and activities.[167] Even among personnel on the Cape there were further segments and social groups, with employees largely staying close to their own divisions or contractors and rarely socializing outside of those circles.[168] The report found that while hobby, cultural, and recreational groups related to specific shared interests such as bowling and music or theatre groups, grew proportionally to the population, more established economic and service groups such as the Rotary Club, Kiwanis, and the Chamber of Commerce did not experience comparable growth, suggestion a "different value orientation and with less commitment to the economic and social life of the community" from the incoming residents.[169] The report

[167] "Summary Report: NASA Impact on Brevard County," 19.
[168] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 379.
[169] "Summary Report: NASA Impact on Brevard County," 86.

also notes that despite a reasonably large enrolled membership in these organizations by missile personnel, poor participation and attendance indicated overall low levels of interest in traditional community affairs.

For the engineers (mostly men) who worked on the Cape, work hours were long and often included weekends, leaving little time for active participation in community affairs, which can help to explain the appearance of apathy toward the broader community. Their wives, while more active in traditional women's community groups such as Women's Clubs and Garden Clubs, also seemed to prefer profession-based groups with the wives of other NASA personnel. In the interview with Sam Beddingfield, he talks about the heavy work schedule, lamenting the few days that he was able to spend with his family and commenting on the large number of divorces during the Apollo Program in particular, when families were separated for long periods of time due to work and travel.[170] A *Time Magazine* article from 1969 highlighted these difficulties, tying them to the nature of the engineering profession, which it claimed valued "scientific precision" and the "technical world" over social considerations and community.[171]

In another account about the creation of the Apollo Lunar Module, chief engineer Tom Kelly describes the incredible amount of effort that NASA personnel and contractors like the ones that he directed at Grumman, put into scheduling and planning.[172] With hundreds of thousands of people involved in the space effort from across the entire country, the engineers developed elaborate configuration management

[170] Beddingfield, Interview with Sam Beddingfield.
[171] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 380.
[172] Thomas J. Kelly, *Moon Lander: How We Developed the Apollo Lunar Module*, Smithsonian History of Aviation and Spaceflight Series (Washington, [D.C.]: Smithsonian Institution Press, 2001), 101.

and scheduling systems based in methods and computer software adopted from the Air Force and Navy. According to Kelly's account, the engineer in charge of NASA's program schedulers, Larry Moran, "drove himself and his team relentlessly," to the point that Moran, "smoking heavily and living on coffee and junk food while keeping long hours on the job" fell ill with an infection and died shortly after, which Kelly attributed to his overwork.[173] In contrast to this fast-paced and highly stressful work environment, for middle class members of the community who were not employed on the Cape (predominately local businesspeople), their more predictable work schedules allowed for regular meeting hours that would not have accommodated the missile personnel.[174]

Even for organizations such as churches and P.T.A. groups that missile personnel and their families joined at higher rates, the old-timers voiced mild displeasure at a lack of participation. One concern raised by newcomers was a lack of job certainty, assumedly primarily for contractors, which led to a reluctance to fully engage in organizations when another move might be close on the horizon.[175] Church leaders expressed similar discontent, with several remarking that "that there seemed to be no way in which the newcomers could be made an integral part of the church community."[176] More specifically, the ministers noted that while the newcomers did attend services regularly, there was no general commitment to the "total church program" with specific reference to financial contributions.

In these ways, missile personnel during the course of the Apollo Program had more in common with citrus workers than one might think. With long, unpredictable hours

[173] Kelly, 152.
[174] "Summary Report: NASA Impact on Brevard County," 88.
[175] "Summary Report: NASA Impact on Brevard County," 93.
[176] "Summary Report: NASA Impact on Brevard County," 87.

dictated by factors largely out of their control (weather and the readiness of rocket parts respectively), both groups fell outside of the established middle-class society in Brevard. In the case of grove workers, categories of race and class played heavily into these exclusions, as well as the migratory nature of a large proportion of grove work, which sometimes prevented full attachment to a single community. Engineers, sensing career fluctuations and potential moves in the future, were also insecure about their futures, according to the 1966 report. Similarly, because of the expanding space-related industry and the increasing marginalization of citrus in the area, these laborers also experienced uncertainty in their future job security. In the case of the children of grove workers and the owners of smaller-scale groves, many were removed from traditional school systems because of the seasonal need for extra labor, which strained their education and development. Children of engineers, who by contrast had secure and quality educations, nevertheless experienced high levels of stress attributed to familial tensions, which one doctor at the time claimed led to an elevated number of children in the area developing ulcers.[177]

Instead of more traditional community-building organizations, missile personnel also relied on proximity of work and importantly, neighborhood. As the population rapidly expanded, housing communities sprang up along the coast, with developments settled largely along occupational lines on the basis of company or contractor.[178] A 1965 survey of 16,000 space-related personnel showed that families flocked to certain geographic areas depending on their source of employment, ultimately leading to a self-selected

[177] Benson, Charles and Faherty, William Barnaby, *Moonport: A History of Apollo Launch Facilities and Operations*, 380.
[178] "Summary Report: NASA Impact on Brevard County," 87.

segmentation within social circles and community groups, which both excluded outsiders from entering, and excluded members from broader city-wide organizations. In October 1963, Titusville's first high rise apartment complex obtained a permit, and new developments like Satellite Beach formed to accommodate newcomers, and between 1950 and 1969, the number of housing units in the county grew from just over 9,000 to nearly 80,000, with property investment increasing from around $22 million to over $2 billion during the same time period.[179]

Communities that had been largely self-sufficient and self-contained made way for suburbs where vehicles became necessary, something reflected in the number of motor vehicle registered between 1950 and 1969, which surged from 4,163 to 61,824. While these numbers reflect the effects of the expanding population, they cannot be fully explained by just population growth, but instead reflect the incoming wealth and difference in social class between old and new residents. For example, while the population grew by approximately nine times, the number of cars in the county grew by fifteen times, with the total property investment increasing by ninety-one times its 1950 amount.[180] Residents of previously undesirable areas, in many cases African American, were excluded from the prosperity and their now-coveted land taken. In Cocoa, the Brevard County Housing Authority seized land from predominantly Black neighborhoods in order to build "white-only" housing, while pushing former residents to the city outskirts in what was described by one reporter as a "snake swamp."[181] Many of those

[179] "Consolidation, Growth Highlighted Area News in '63," *Star-Advocate*, January 1, 1964, sec. Front Page, https://ufdc.ufl.edu/UF00086744/00001?search=star+=advocate; National Aeronautics and Space Administration, *Kennedy Space Center Story*, 267.
[180] National Aeronautics and Space Administration, *Kennedy Space Center Story*, 267.
[181] Paul and Moss, *We Could Not Fail*, 44.

who were evicted found themselves living far away from their places of employment, but unable to qualify for public housing without leaving their jobs. NASA had created jobs for these workers away from the citrus groves where many had previously worked, but in doing so, they set in motion the unintended consequence of widening the population's wealth gap, often along racial lines.

With the growing population also came major changes to the economy of Brevard County. As an increasing number of skilled labor moved into the area, average per capita income shot up between 1950 and 1960, from $1,018 to $2,457, an increase of 141.4 percent as opposed to the fifty-nine percent increase seen in Florida and the rest of the nation during this time.[182] Compared to other parts of the country, where property tax was diminishing in importance and lagging behind population increases, Brevard County saw the opposite, with the additional properties and rising income linked directly to higher tax revenue. The scope of this is made all the more significant when considering that the large amount of land acquired by the government ultimately decreased the amount of taxable property in the county. Even with approximately 16 percent of the total area in the county (140,000 acres) made untaxable through NASA and Department of Defense actions, the rising value of property and land in the area during the early space boom more than made up for the loss.

As incomes and tax revenues rose, however residents of the county began to wonder about the role of the federal government in a county that it had helped to transform so quickly. With a large percentage of tax revenue going to improving infrastructure connected to the Kennedy Space Center, old residents felt that their money was going

[182] "Summary Report: NASA Impact on Brevard County," 12.

toward projects from which they would never benefit. In a survey of several municipalities' officials, results found a "thesis of federal responsibility in the Cape Kennedy area and similar support was given that of state responsibility in this area," but they went on to report that there was "no clear cut answer as to what such responsibilities might be."[183] Federal assistance for some of the most pressing needs, water and sewage systems to the Cape, took the form of non-interest-bearing loans, which placed the burden on the city of Cocoa in particular to manage the projects. Despite the federal loans, costs for the construction became "almost prohibitive" for the city. Like the communities displaced on North Merritt Island, the lives of residents of the area had been disrupted by direct government actions, and they expected the government to compensate them and fund the ongoing changes.

4.2 Economic Aftershocks

As residents of the Space Coast soon would learn, however, it is one thing to fund a sewer line and another to manage the broader economic ramifications of something like the Apollo Program. One way that the locals took advantage of the boom was through the support and creation of a robust tourism industry centered around the space hype. In 1961, a *New York Times* headline read "Canaveral Boom in Missiles, Tourism," and detailed the expected influx of tourism with the acquisition of the additional land on Merritt Island.[184] According to the article, the area could look forward to a "flood of businessmen" looking to capitalize on the tourism with hotels and other attractions. Interestingly, alongside the obvious tourist attraction of rocket launches, the second

[183] "Summary Report: NASA Impact on Brevard County," 16.
[184] C E Wright, "Canaveral Boom in Missiles, Tourism," *The New York Times*, November 5, 1961.

biggest draw for prospective visitors highlighted in the article was the pristine fishing opportunities. As for the early tourists to the area in the nineteenth century, the coast was seen as a place of wilderness and escape from city life. The only difference was that instead of encountering homesteaders on Merritt Island, fishing tours could now troll for trout within sight of launch pads that would send people to the moon.

In a surprising move in late 1963, "space-age tours" of Cape Kennedy became available to the public. These tours consisted of short drive-throughs of the launch operations area, where motorists could go past ICBM row and the missile-testing area at a continuous pace of twenty-five miles per hour. A *New York Times* article from the time described the expected high initial turnout, which would be primarily fueled by residents in the area who had never been inside the restricted area despite living near the military and subsequent NASA presence for over two decades.[185] Interest in touring the site was not a new phenomenon, with "thousands upon thousands" of applicants writing for permission in the preceding years. This evidence of curiosity and engagement on the part of the public to interact with the new installation contrasts with the barriers of secrecy associated with new technology like that being developed on the island. The opportunity to take part in drive-by auto tours of the facility showed NASA's efforts to convince the American public and international audiences of their peaceful, civilian-led effort. By 1964, Cape Canaveral welcomed a quarter of a million visitors on these self-driven tours, providing access to locals as well as high-ranking politicians whose job it was to decide the fate of the center's budget.[186] Within a few years, the island had gone from hosting

[185] C E Wright, "Space-Age Tours: Cape Kennedy Will Open Its Doors to Public for the First Time Today," *The New York Times*, December 15, 1963.
[186] Lipartito and Butler, *A History of the Kennedy Space Center*, 107.

tourists primarily interested in fishing-based getaways to presidents and members of Congress.

The responsibility for the broader infrastructure projects like better highways, bridges, beach areas, and opening up "almost unused land for residential and tourist facilities" fell on the local and state governments, which did not have the funds to finance it all, but still acknowledged the importance of developing the area. In an early official history of the Kennedy Space Center published by NASA in 1972, the account describes how NASA and the Air Force "contributed directly to solving some problems," including bottlenecks on bridges over the Indian and Banana Rivers between Cocoa and Cocoa Beach.[187] Of course, what this fails to acknowledge is that the reason these bottlenecks existed at all was the new presence of the space administration. Federal assistance subsidized many of the emerging infrastructure and population needs, but did leave significant financial burdens on the local economy, the blurring lines between local and national need, and local and national responsibility.

In much the same way, the $500 million annual payroll for NASA and military personnel on the Cape fed back into the economy to support expansions that would have been unnecessary just a few years prior. With the local economy and tax revenue dependent on incoming high-paying technical jobs, the area would realize the volatility of their position within the decade, as NASA funding plateaued and then quickly declined, taking thousands of jobs with it. In an NPR interview done in 1971 at the tail end of Apollo, one local reported that "with each moonshot, the contractors in the area of the

[187] National Aeronautics and Space Administration, *Kennedy Space Center Story*, 268.

cape have laid off…averaging around 500 [workers]."[188] Alluding briefly to these issues, NASA's 1972 account describes a frankness surrounding budget concerns on the part of NASA leaders, in particular the director of KSC, Kurt Debus, which "contributed to maintaining an effective, amicable relationship between the Space Center and towns where its employees reside."[189] It goes on to describe the ways in which Brevard County sought to stabilize the economy, including attracting industry outside of the aerospace sector, motivating seniors to move to the area and purchase surplus housing, and heavily promote tourism.

What this official history glosses over, however, is the effect that the economic fluctuations played on non-NASA residents. While many NASA personnel and contractors had anticipated temporary work assignments and frequent moves, local residents found themselves unprepared for the wave of changes that came during the 1960s and early 1970s. A 1968 housing market analysis for Brevard County acknowledged the challenge with predicting future trends in the area, stating that any extrapolations would be "subject to the increasing possibility of major changes in national space goals and objectives."[190] Having an economy reliant on the space program meant that as engineers and technicians made an exodus from the area, retailers, construction workers, and others, saw a drop in sales and business.[191] Though the area experienced another boom in the 1970s with the advent of the Space Shuttle Program, the

[188] Mike Waters, Phil Miller, and Doug Terry, *All Things Considered,* National Public Radio, July 28, 1971.
[189] National Aeronautics and Space Administration, *Kennedy Space Center Story*, 270.
[190] Field Market Analysis Service, "Analysis of the Brevard County, Florida Housing Market" (Federal Housing Administration Department of Housing and Urban Development, February 1, 1968), 3.
[191] Shofner, Ball, and Zimmerman, *History of Brevard County*, 212.

uncertain future of high profile aerospace technology means that Brevard County is perpetually at the mercy of political and administrative choices.

4.3 Diverging Memories

Although the newcomers and old residents existed in a co-dependent environment, their individual perceptions of this relationship are not always evident in memories of the early days of the space program. For many non-NASA residents, the Kennedy Space Center and its operations existed on the periphery of their lives, even as it was shaping the community in very significant ways. In many interviews with "old-timers" who grew up in the area, the space program came secondary to other concerns. During one 1994 interview lasting over ninety minutes, native Brevard County resident Kitty Bates, described extensively her childhood and experience growing up in the region, but never directly mentions NASA or the space center by name. Several times, she alludes to a more peaceful time in the region, almost disdainfully referencing the activity in Titusville and on the Indian River and lamenting that the "paradise" she once knew was gone.[192]

Even Kathryn (Campbell) Bouie, who had family with land on Merritt Island in the area around Clifton and Allenhurst, and whose husband was a maintenance worker for the NASA contractor PanAm, was not overly preoccupied with the space administration's presence in her life. Instead, she focuses her stories on the turpentine industry, childhood memories, church, college, and raising a family.[193] Like many of the interviews done by

[192] Kitty Bates, Interview with Kitty Bates, interview by Nancy Yasecko, Video, February 5, 1994, Brevard County Historical Commission, https://youtu.be/r92OnJdcUXw.
[193] In addition to the orange industry in Brevard County, the turpentine camp in Mims was also an important source of employment for many African Americans. Turpentine is made by harvesting and boiling the resin from pine trees, and is primarily used for tar, oil, and medicine purposes. In Brevard and elsewhere in Florida, turpentine was often harvested by forced convict labor. Kathryn Bouie, Interview

the Brevard County Historical Commission, the interviewer prompts Bouie on the topic of mosquitoes and the various methods of pest deterrence. Compared to the space center, mosquitos presented a more immediate and pressing concern for residents, who relied on tools like smoke smudges, palmetto swatters, and sprays to protect themselves.

In her interview, Bouie's cousin, Sandra McMillan, provides more insight into the family's history in Allenhurst. She describes one aunt named Eugenie, who owned and worked her own orange groves on the island, budding stock and making a living from shipping her fruit to New York in addition to working at the Allenhurst Hotel as a cook.[194] During a time when membership in the NAACP was often an invitation for white backlash and Jim Crow restrictions made it difficult for African Americans to vote, Eugenie had been a proud voter and member of the NAACP.[195] Perhaps at least in part, this confidence and determination to exercise these rights can be tied to the nature of the independent community found in Allenhurst, which gave African Americans the ability to own land and cultivate business. While, as Theodis Ray, the Merritt Island fisherman turned NASA employee, emphasized, living in Allenhurst meant that he and his community were independent and free to some extent, they understood the limitations of their situation.[196] In Ray's account, the erasure of Allenhurst and the settlements on

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with Kathryn Bouie, interview by Roz Foster, Transcript, May 17, 1996, Brevard County Historical Commission.

[194] Sandra McMillan, Interview with Sandra McMillan, interview by Roz Foster, Video, August 27, 2004, Brevard County Historical Commission, https://youtu.be/LgI-2SnbmO8.

[195] In Mims in 1951, Harry T. Moore, the president of the state chapter of the NAACP, was assassinated when the KKK bombed his house on Christmas night in a blast that also killed his wife, Harriette. Moore's house was surrounded by a young orange grove which he cultivated and hoped to live off in his retirement. Moore's murder represents for some the beginning of the Civil Rights Movement in Florida. For more on Moore, see Ben Green, *Before His Time: The Untold Story of Harry T. Moore, America's First Civil Rights Martyr* (New York: The Free Press, 1999).

[196] Paul and Moss, *We Could Not Fail*, 40.

Merritt Island in both a physical sense and in the public memory, represent a disregard for the work of the fishermen and citrus workers that had called it home.

In contrast with the interviews done with "old timers," those done with NASA personnel and contractors focused much more extensively on details of their work on the Cape rather than their lives in the community. Even in the case of JoAnn Morgan, who grew up in nearby Titusville and worked her first launch as an assistant engineer for the Army at age seventeen before going on to become an instrumentation controller in the Apollo 11 firing room, interviews rarely mention the outside community or non-NASA personnel.[197] Morgan's experience would have no doubt intersected with the education system and community groups, and she would have seen firsthand the effect that the space boom had on the Cape, but these are not central to her narrative. In an interview with longtime Director of Flight Operations at KSC, Walt Kapryan, the distance between the NASA community and the broader public is more explicitly spelled out. He mentions his transfer from Houston to the Cape in either 1963 or 1964, describing it as a "heart rendering (sic) separation," but the difficulty of the move seems to have had more to do with work culture than attachment to Houston or antipathy to the Cape.[198] When asked about his perspective on contemporary events like the Vietnam War, Kapryan replied to say that his life almost exclusively revolved around his family and the space program during those years. NASA personnel "ate together, [h]ad dinner together and partied together," in the closed world of KSC on Merritt Island.

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[197] Billy Watkins, "JoAnn Morgan: Instrumentation Controller, Apollo Launch Control," in *Apollo Moon Missions: The Unsung Heroes* (Westport, Conn.: Praeger Publishers, 2006), 91–103.; David Kamp, "Tracking Down JoAnn Morgan, a Semi-Hidden Figure of U.S. Space History," Vanity Fair, accessed March 14, 2021, https://www.vanityfair.com/hollywood/2018/12/joann-morgan-nasa-apollo-11-interview.
[198] Walt Kapryan, Interview with Walt Kapryan at his Home for the History of the Kennedy Space Center, interview by Kenneth Lipartito, Transcript, April 7, 2003, https://web.archive.org/web/20130216221355/http://kscoralhistory.ksc.nasa.gov/documents/wkapryan.pdf.

This disconnect within the community can be seen when returning to the surveys of residents conducted in 1966. One significant point of tension between new families and well-off established families was the battle for influence in the community. As discussed above, newcomers often avoided traditional community involvement and instead preferred groups associated with work colleagues and friends. These surveys suggest that the lack of involvement, however, may have been in part due to the general belief, especially in Titusville, that businessmen had undue influence in the community, leaving newcomers to feel shut out with little opportunity to contribute.[199] Additionally, compared to similar surveys done in several cities in North Carolina (Greensboro and Durham), the analysts found that overall community satisfaction in Titusville, Cocoa, and Melbourne was significantly lower and directly correlated to length of time lived in the area.[200] New, out-of-state transplants who had lived in Titusville for less than two years contributed to a staggering thirty-two percent of the population, more than double that number in Greensboro. And with a significantly higher percent of residents from outside the southern region of the U.S. than their North Carolina counterparts (forty percent vs. fourteen percent), cities in Brevard county struggled to create communities where people wanted to live voluntarily rather than move to simply because their aerospace company transferred them. Predictably, while long-term residents of the area had a pride and satisfaction with their home that stemmed from shared community experiences and history, newcomers associated with the space program took longer to acclimate themselves to the area, which further accentuated the divide between the two groups.

[199] "Summary Report: NASA Impact on Brevard County," 114.
[200] "Summary Report: NASA Impact on Brevard County," 122.

During this transition, the citrus industry in Brevard County did not disappear, but it did change. Newspapers that in the early 1900s prominently advertised fertilizer or citrus buds, by the 1960s had few references to the fruit that still remained one of the area's largest and most well-established products. In a 1970 Congressional subcommittee hearing on the future of the space program on the Cape, a local newspaper publisher described with pride the shift in industry. In a county that had a stake in "growing oranges and grapefruit and very little else," NASA had transformed the "23,000 orange growers of 1950 [into a] sophisticated population with over a quarter million persons engaged in some of the most complex technology known to man."[201] This exaggerated description both ignores the grove workers who had continued with their work, and undervalues the complexity of knowledge that goes into growing citrus. In the oral history with longtime citrus pickers Coleman Mitchell, John Moorer, and Alfonso Wilson, Moorer describes the choice that many pickers made after KSC was built.

> [W]hen the Space Center came in, I would say, forty or fifty percent of the grove workers went over and got jobs, you know. With benefits and better pay, you know. But there were some that couldn't go over there and get a job, some of them was too old, and some of them didn't even want that kind of job because see they done did this kind of work so long, and they've got addicted to it.[202]

Moorer, who opted to keep working in the groves, felt the pinch of economic fluctuations along with the rest of the community. The citrus industry found itself forced to adapt to new housing developments, the ongoing menace of freezes, and incoming neighbors who increasingly valued engineering prowess over agricultural efforts.

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[201] U.S. Congress, House, Subcommittee on Manned Spaceflight, *Future Utilization of The Kennedy Space Center, Cape Kennedy, Florida: Hearings before the Subcommittee on Manned Spaceflig*ht, 91st Cong. 2nd sess., April 10, 1970, 28.
[202] Mitchell, Wilson, and Moorer, Firing the Groves, 25.

Backing by the national government lent credibility and power to the technology of NASA, creating structures that privileged larger sociopolitical factors over local considerations. In his 1969 work *Second-Order Consequences*, Raymond Bauer theorizes about the unforeseen complexity of technology's impact on society and questions whether progress can be defined by technical milestones. He singles out the early space program as a discretionary and symbolic phenomenon, one that, unlike programs like the military, has a "relatively narrow over-all public impact."[203] While that claim can certainly be challenged by evidence of the value of NASA's technology for commercial "spinoffs" as well as broader scientific implications, certainly few people have felt NASA's impact as directly as residents of Brevard County.[204] As the population rapidly grew and changed, the consequence was community displacement and disruption of existing structures, for good or ill. For some residents, the space center brought welcome new job opportunities and the chance to participate in a unique national effort. But for others, NASA existed on the sidelines of their lives, acting as a sometimes unnamed but significant catalyst for loss of land and livelihood.

[203] Raymond S. Bauer, *Second Order Consequences: A Methodological Essay on the Impact of Technology* (Cambridge, MA: The MIT Press, 1969), 21, 98.
[204] "Home | NASA Spinoff," accessed March 17, 2021, https://spinoff.nasa.gov/.

Conclusion

Apollo 16 astronauts John Young and Charlie Duke rested in the Lunar Module *Orion* after becoming only the ninth and tenth people to walk on the Moon. Young felt his stomach turn as the steady intake of orange juice during the trip to the moon caught up to him.

"I'm gonna turn into a citrus product is what I'm gonna do," he complained.

Mission control in Houston piped back, "Oh, well, it's good for you, John."[205]

After the Apollo 15 mission, which saw astronauts afflicted with heart irregularities attributed to low levels of potassium, NASA physicians added electrolytes and potassium to the crew's food, most noticeably in the orange juice, which they were instructed to drink often. Earlier in the mission while the crew prepared for the lunar landing, Duke had his own run-in with the drink when the valve on the drink bag in his helmet accidentally opened and he found himself with a helmet full of juice and orange hair.[206] Replacing the drink mix Tang (called "orange drink" by NASA) that astronauts had previously brought to space, this mixture consisted of natural orange juice crystals developed by the Department of Agriculture in response to complaints by Florida citrus growers, who saw the artificial product as competition.[207] The fruit so entangled with the space program's launch site back on earth had made its way to space.

A common narrative found within NASA histories is that "what generations of Native American, Spanish, English, and American settlers had failed to do, new technology did:

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[205] "Debrief and Goodnight," Apollo 16 Lunar Surface Journal, accessed March 17, 2021, https://www.hq.nasa.gov/alsj/a16/a16.debrief1.html.
[206] Andrew Chaikin, *A Man on the Moon: The Voyages of the Apollo Astronauts* (New York, N.Y: Viking, 1994), 475.
[207] Roger Simmons, "Apollo 11 took Tang to the moon, much to the chagrin of Florida orange growers," *Orlando Sentinel,* July 4, 2019, https://www.orlandosentinel.com/space/apollo-11-anniversary/os-ne-apollo-11-tang-20190704-ahrgsi5hmfdunfy4ldazrgvkr4-story.html

make Cape Canaveral a household name to millions of people around the world."[208] While the scale of this statement might be true, the space program was not the first industry to make a name for the region, and it overlooks the interweaving layers of other technologies that had been in use for hundreds of years prior to NASA's arrival. By erasing the pre-NASA significance of citrus growing, a linear story of rocketry, engineering, spaceflight, and moon landings can too easily become the only narrative for Merritt Island. A more holistic account of the region's history includes not only the impact of the widely documented space program, but also the importance of the citrus industry, its workers, and their technologies.

In *Space in the Tropics*, Redfield asks if it ultimately matters where things happen - "or more precisely, what might it reveal that different things happen in the same place?"[209] In the case of Merritt Island and the Kennedy Space Center, the interconnected yet distinctly separate histories of the national and the local are representative of many places in the United States affected by actions such as eminent domain. At the same time that NASA began proceedings to acquire land in Florida, a remarkably similar effort to secure land for what was then called the Mississippi Test Operations (now Stennis Space Center). In that instance, the space program displaced some 660 families from an area of 13,500 acres plus a "limited-access acoustical buffer zone of 128,000 acres," equating to 40 percent of the surrounding county's land area.[210] These particular case studies stand out by virtue of the space program's mythological place in American memory, but there

[208] Lipartito and Butler, *A History of the Kennedy Space Center*, 31.
[209] Redfield, *Space in the Tropics*, xiv.
[210] Stuart Simms, "In the Shadows of Apollo: The Space Age Legacies of Dispossession in Hancock County, Mississippi" (University of Kentucky, 2020), https://uknowledge.uky.edu/history_etds/63/; Loyd S. Swenson, "The Fertile Crescent: The South's Role in the National Space Program," *The Southwestern Historical Quarterly* 71, no. 3 (1968): 385.

are countless other cases of government land acquisitions where residents were displaced to make way for highways, stadiums, parks, and other projects deemed to be best for the public good. In all of these places, the disrupted communities consisted of people, industry, and technology deemed less valuable than what replaced them. Brevard County citrus groves showcase one example of a local industry reliant on an agricultural technology with a long history of use and adaptation. It matters that orange groves and rockets both existed on Merritt Island because it brings into higher contrast their surprising similarities, contributions, and places in history.

When they are mentioned in accounts, the unintended consequences of technological progress as seen in Brevard County during and after NASA's expansion are often portrayed as unavoidable sacrifices for a common or national good. Historically, in NASA's vision of the Kennedy Space Center, it serves as a shining, almost-civilizing entity that turned a formerly backwards region into the home of some of the most advanced technology of its day. Locals who lived through the events of the early 1960s remember differently, largely focusing on individual experiences within the community rather than their connection to the operating space center. Whereas larger trends show rapid and extreme economic and demographic changes, many locals clung to familiar traditions and histories to set themselves apart from the newcomers and retain a claim an important piece of the history of the area. Within the sphere of the space center, engineers and other space personnel also created a separate universe of traditions and memory - one that has been told in different forms many times by former employees and NASA historians. But in the story of technological progress culminating in the successful moon

landing, this success comes at the tacit expense of both elements of the local population as well the families and health of NASA workers, all of whom inhabited the same space.

Despite the apparent degrees of separation between NASA and local technologies like those associated with orange growing, neither existed in a vacuum. For orange growers and other preexisting industries, the relationship between themselves and the space industry was clearer, as they found themselves increasingly pushed to the periphery in both a geographic and cultural sense. Though sidelined in most discussions of the space center, when examined through a use-centered lens, the technology involved in growing citrus around Cape Canaveral, including operations like grafting and freeze mitigation, boast extraordinary durability and capacity for adaptation. As Edgerton notes, "in use-centred history technologies do not only appear, they also disappear and reappear, and mix and match across the centuries."[211] From the early use of grafting on Merritt Island that helped to save the Florida citrus industry in the mid-nineteenth century, to the emergence of the world-famous Indian River Fruit and the explosion in popularity of orange juice and concentrate in the mid-twentieth century, citrus farming presents a clear case of use-centered technology. While its development can be written in a linear fashion, this history also represents the cyclical patterns that Edgerton observed. Techniques like grafting, which have been in use worldwide for thousands of years, experience spans of disuse, rediscovery, and repurposing. Threats like freezes precipitated innovation and new ideas to protect trees, but they also prompted inventiveness that was based in existing methods.

[211] Edgerton, *The Shock of the Old*, xii.

Since 2005, the citrus industry in Florida and across the country has been besieged by a new threat: a bacterial disease called Huanglongbing (HLB), which causes the sensation known as citrus greening. Transferred between trees and groves by an invasive insect called the Asian citrus psyllid, the disease causes small, malformed fruit and the eventual loss of the affected trees.[212] Although there is no outright cure, grafting offers hope for citrus growers, who have watched as their crops are decimated by HLB. In much the same way that Douglas Dummett grafted one kind of orange onto the more resistant rootstock of another, scientists in California have discovered ways to breed the affected citrus with HLB-resistant species and graft the resulting buds onto trees in the field to create a more resilient plant.[213] Back on Merritt Island in 2017, a two-acre USDA test grove located just south of the Kennedy Space Center contained five different varieties of citrus trees grafted onto ten different root stocks, an experiment aimed at addressing HLB.[214] Since the arrival of citrus greening in Florida, Brevard County had been hit particularly hard – between 2008 and 2017, production fell by eighty-seven percent. For the owner of the grove, a local resident whose family has been in the citrus business for five generations, the experiment represents an opportunity to curb the decline of citrus in the area.

More often written about as an example of innovation and progress, the story of space technology also has a place in the history of technology-in-use. Alongside the revolutionary new rocket engines and elaborate communication systems, what might be

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[212] "Huanglongbing (HLB or Citrus Greening)," Center for Invasive Species Research, accessed March 17, 2021, https://cisr.ucr.edu/invasive-species/huanglongbing-hlb-or-citrus-greening.
[213] "Citrus Clonal Protection Program," nd, accessed March 17, 2021, https://ccpp.ucr.edu/.
[214] Dave Berman and Wayne Price, "As Brevard's Citrus Industry Declines, Growers Are Feeling the Squeeze," *Florida Today*, November 10, 2017, accessed March 17, 2021, sec. Local, https://www.floridatoday.com/story/news/local/2017/11/10/brevard-county-florida-citrus-growers-feel-the-squeeze-oranges-grapefruits/840813001/.

considered the mundane also played an important role in NASA's accomplishments. Central to the story that I have told here, former citrus pickers and other laborers from the area were vital to ensuring that the Kennedy Space Center was built, maintained, and staffed. Seamstresses at the Platex company in Delaware who were accustomed to sewing bras and girdles, handcrafted the Apollo spacesuits because of the precision and attention to detail that the suits required.[215] Prior to landing on the moon, astronauts from several Apollo missions spent a significant amount of time learning about rock identification and collection from a geologist who specialized in lead and zinc deposits in mines.[216] And it was after several unsuccessful spacewalks that NASA thought to turn to underwater training using scuba equipment in a school swimming pool to simulate the weightlessness found in space. The allure of NASA's history is due in part to the extraordinary nature of the organization's accomplishments, but it also benefits from an examination of the technologies and communities that contributed in ways that have previously been overlooked or undervalued.

As Joy Parr notes in her history of a series of disruptive Canadian state-run megaprojects, "no place is merely local."[217] Similarly, no place is only national. For the area known as America's Spaceport, the local rapidly became national, but neither can be privileged over the other. The changes on Cape Canaveral should not be viewed through a black and white lens, since many developments that can be seen as advantageous for

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[215] Nelson, Sue, "The women who sewed the suits for the space race," *BBC*, December 19, 2019, accessed April 24, 2021, https://www.bbc.com/future/article/20191219-the-women-who-sewed-the-suits-for-the-space-race.
[216] El-Baz, Farouk. Interview with Farouk El-Baz. Interview by Rebecca Wright. November 2, 2009. NASA Johnson Space Center Oral History Project. https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/El-BazF/El-BazF_11-2-09.htm.
[217] Joy Parr, *Sensing Changes: Technologies, Environments, and the Everyday, 1953-2003 (*Vancouver: UBC Press, 2010), 3.

some areas of life, such as improved infrastructure and job opportunities, came at the cost of less desirable changes such as upheaval of community memory. Some interviews with residents who lived through these changes document the dispossession of land and business, as well as the disappointments and frustrations of that experience, but others also illustrate the emergence of local pride in being host to the nation's launch site. The complex relationships between nationally backed technological forces and people in the areas that they desire, are not even exchanges. As Parr notes, locals are often "obliged to cede their habitats to unquestioned priorities of modern statecraft."[218] Despite this, local memory and technology should be studied – not in an effort to create an argument for the moral superiority of local experience or to discount the achievements of national projects like the Apollo Program, but instead to recognize the value of each.

In 2020, a familiar story with a twist made headlines - the private space company SpaceX, which had set up operations near the small, unincorporated Texas village of Boco Chica in 2012, was in the middle of a campaign to buy-out residents in the town. What was original billed as a project to turn the area into a "21st-century space city" the equivalent of a "commercial Cape Canaveral," SpaceX's plans seemingly did not intend to include those who already lived in the area. The decision to set up near Boco Chica seemed obvious to SpaceX leaders, just as Merritt Island had to NASA, because of the location's reputation as a "coastal paradise, contentedly dislodged from civilization."[219] For Elon Musk, the company's controversial leader, even before residents of the village had started moving out, the area represented a blank slate for his vision of technological

[218] Parr, *Sensing Changes*, 3.
[219] Marina Koren, "Why SpaceX Wants a Tiny Texas Neighborhood So Badly," *The Atlantic*, accessed March 17, 2021, https://www.theatlantic.com/science/archive/2020/02/space-x-texas-village-boca-chica/606382/.

progress. As Musk blindly put it: Boco Chica was “a lot of land with nobody around, so if it blows up, it’s cool.” It is impossible to ignore the similarities between this recent acquisition and the one on Merritt Island in 1962. While there are real differences between the two (most noticeably is that SpaceX is a private company), the use of space technology as justification for displacing communities has long precedent. Here, as on Merritt Island, the displacement comes at the cost of identity and industry that does not follow a clear line of technological progress but is nevertheless worthy of consideration.

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