Making Space: The Training, Recruitment, and Prosperity of NASA's Black Computers, 1941-1970

By

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December 2018

Submitted in partial fulfillment of the requirements for the
Master of Arts in History
Dual-Degree Program in History and Archives Management
Simmons University
Boston, Massachusetts

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Acknowledgements

I would like to begin by thanking my thesis readers, Frances Sullivan and Laura Prieto, for their patience, attention, and guidance. Frances, as my thesis advisor, was particularly helpful in nurturing my fledgling ideas into more solid concepts. I would also like to thank Reynaldo Anderson and Jess Wallis who supplied me with primary and secondary sources that proved invaluable. Special thanks to my friends Bridgett Pride and Sarah Bush for their specific insights as past thesis writers, as well as my sister, Sala White, and my partner, Lena Gluck for their reassurance and their willingness to read my drafts.

Table of Contents

Introduction

After an infancy as the World War I-era National Advisory Committee for Aeronautics (NACA), the United States space program came of age as the National Aeronautics and Space Administration (NASA) in 1958 in the midst of the Cold War. In addition to being a program lauded for its potential to advance the scientific knowledge of humanity, NASA also served as a nationalistic tool for the purpose of competing with the Soviet Union on a global stage. For better or for worse, from the establishment of NASA to the 1969 moon landing, the concept of space exploration inspired immense creative energy, not least of which was the original *Star Trek* series, which first premiered in 1966.

Among the racially diverse cast, an anomaly for the time, there was Nichelle Nichols, who played Lieutenant Uhura, the chief communications officer and representative of the fictional United States of Africa. That a Black[1] woman could play an educated officer who was fourth in command of a spaceship, as opposed to a maid or other stereotypical role, was groundbreaking at the time.[2] It was a stark contrast to the enduring science fiction tradition wherein "the imaginary future [is] a space where the mind can stretch beyond the Milky Way to envision routine space travel, cuddly space animals, talking apes, and time machines," but in which "people can't fathom a person of non-Euro descent."[3] In spite of the significance of this

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[1] My decision to capitalize Black with regard to race is a conscious choice. In the words of journalism professor Lori L. Tharps, "Black with a capital B refers to people of the African diaspora. Lowercase black is simply a color." Lori L. Tharps, "The Case for Black With a Capital B," The New York Times, November 19, 2014, accessed November 11, 2018, https://www.nytimes.com/2014/11/19/opinion/the-case-for-black-with-a-capital-b.html.
I choose not to capitalize white with regard to race, instead opting to capitalize specific European ethnicities where relevant, because of the white supremacist connotation that that capitalization entails.
Luke Visconti, "Why the 'B' in 'Black' Is Capitalized at DiversityInc," DiversityInc, August 10, 2009, accessed November 11, 2018, https://www.diversityinc.com/why-the-b-in-black-is-capitalized-at-diversityinc.

[2] "Star Trek's Uhura Reflects On MLK Encounter," in *Tell Me More*, transcript, National Public Radio, January 17, 2011, accessed on December 15, 2018 https://www.npr.org/2011/01/17/132942461/Star-Treks-Uhura-Reflects-On-MLK-Encounter.

[3] Ytasha Womack, *Afrofuturism: The World of Black Sci-Fi and Fantasy Culture*, (Chicago: Chicago Review Press, 2013): 7.

portrayal, however, Nichols considered abandoning her role after the show's first season to return to her musical theater background.

She changed her mind after a fateful encounter with Dr. Martin Luther King, Jr. at a 1967 civil rights fundraiser for the Los Angeles NAACP. Dr. King announced himself to be Nichols' greatest fan, and upon hearing of her plan to quit, he urged her to remain on the show. He reminded her, "Nichelle, whether you like it or not, you have become a symbol. If you leave, they can replace you with a blonde haired white girl, and it will be like you were never there. What you've accomplished, for all of us, will only be real if you stay."[4] To him, the unprecedented opportunity to represent Black people not only existing in the future but thriving there was one that she ought not relinquish lightly.

Dr. King understood that racial justice, science, and science fiction directly inform one another. By the 1960s, the concept of space exploration was synonymous with the future. Therefore, since NASA was the agency of the space age, the people and ideas affiliated with it became futuristic by association. Similar to how the federal government encouraged participation from all types of citizens in the war effort in World War II, NASA sought employees among a variety of demographics, thus contributing to the diversity of science, technology, engineering, and mathematics (STEM) fields. Although it would take a few decades after the founding of NASA for Black people to become astronauts—Dr. Guion "Guy" Bluford was the first Black man in space in 1983, and Dr. Mae Jemison was the first Black woman in 1992—Black people were already working at NASA at the time that *Star Trek* was airing, and had even worked for the agency's predecessor NACA. A sizeable portion of them were Black women employed as computers at the Langley Memorial Aeronautical Laboratory in Hampton, Virginia.

[4] Rachel Gillett, "How Martin Luther King Jr. Convinced a Trailblazing 'Star Trek' Actress Not to Quit Her Job," *Business Insider,* August 04, 2015, accessed June 30, 2018, http://www.businessinsider.com/martin-luther-king-jr-convinced-star-trek-actress-not-to-switch-careers-2015-8.

As the priorities of Langley Laboratory shifted from aircraft manufacture under NACA to space travel under NASA, the labor of computers contributed to the United States' prowess as a nation and to the advancement of human society as a whole. Consequently, the roles that Black women facilitated in NASA took on a new importance to specific groups of actors. Educators at historically Black colleges and universities (HBCUs) believed that providing graduates for federal positions would elicit recognition from the U.S. government in front of a national audience. After the Soviet launch of *Sputnik* in 1958, U.S. government officials viewed segregated schools as an impediment to efforts to achieve victory in the Cold War and sought to increase the diversity of their employees. Finally, Black computers themselves valued their positions as opportunities for hitherto unimaginable upward economic mobility, not to mention general acceptance in American society.

In this paper, I argue that HBCU presidents and educators, NASA administrators, and Black female computers promoted Black people's participation in the space race through narratives of racial integration and uplift. Each of these three groups of actors had varying rationales for promoting greater diversity in this field, and not all of them were necessarily concerned with altruism or anti-racism. Still, the act of studying interactions between all of them is important for the understanding of the overall struggle for racial equality during this time period. Throughout this thesis, I use an interpretive framework called Afrofuturism, which, in this context, consists of imagining members of the African Diaspora as active shapers of and participants in the future, as opposed to being relegated to a primitive past or a doomed present.

Historiography

This study builds upon scholarly literature relating to science education among Black Americans, Black women in the sciences, the social impacts of the space race, and Afrofuturism.

My scholarly contribution consists of highlighting the close partnerships between HBCUs and NASA, continuing the study of Black women's contributions to math and science fields, and influencing the use of Afrofuturism as an interpretive tool in the study of history.

Science Education

In 1939, W.E.B. Du Bois published an essay entitled "The Negro Scientist," in which he addressed the question of why so few Black people at that time were pursuing employment in the natural sciences. To contradict the prevailing notion that this discrepancy was a result of racial inferiority, Du Bois offered examples of 12 Black men with whom he was personally acquainted, each of whom had talent and training in the sciences, but whose careers did not reach their full potential because of both systemic and interpersonal racism. In his concluding statements, Du Bois lamented that such scientific talent was going to waste, remarking that "there is ability in the Negro race—a great deal of unusual and extraordinary ability, undiscovered, unused and unappreciated."[5] Notably, he drew a link between the struggle for Black Americans to be taken seriously as scientists and the struggle for them to be taken seriously as human beings.

Later, in the 1960s and 1970s, a significant outcome of civil rights activism and the Black Power struggle was the proliferation of Black studies programs at colleges and universities. From the beginning, this discipline has focused on humanities and social sciences, especially history, literature, and sociology. Observing this phenomenon, prominent scholars James Benjamin Stewart and Talmadge Anderson began arguing that science should be included in Black studies pedagogy. In his 1976 article "Black Studies and Black People in the Future," Stewart traced the development of Black studies, from a field that was originally primarily concerned with counteracting negative racial stereotypes to a more mature field whose inherent

[5] W.E.B. Du Bois, "The Negro Scientist," *The American Scholar* 8, no. 3 (1939): 318.

interdisciplinarity made it a model for other fields. Above all, he underscored the necessity of instilling in young students the reality that "modern technological developments and the concerns of Black people are interwoven."[6]

A chapter in a 2007 African American studies textbook entitled "Science, Technology, and the Future of African Americans," co-authored by Stewart and Anderson, recommended an integration of the disciplines of African American studies, Future Studies, and Science, Technology, and Society (STS) Studies. Specifically, they emphasized the importance of teaching "how science and technology have been used historically and currently to suppress people of African descent and secondly to examine alternative liberating technological applications Blacks have attempted to develop and implement."[7] In their view, the most effective strategy for this endeavor would be to highlight the existing legacy of scientists throughout Black history. It is a goal of this present thesis to take up Stewart and Anderson's call.

Black Women Scientists

In the United States, the stereotypical professional in the science, technology, engineering, and mathematics (STEM) fields is a white man. From the 1980s through the early 2000s, the hypervisibility of white men in STEM, coupled with the academicization of movements for women's liberation and civil rights, led scholars of various disciplines to work to uncover stories of scientists and mathematicians who were either not white or not male. The stated motive for this recuperative research, echoed across the works described below, has been to demonstrate that the mere existence of these stories is evidence of the figures' centrality in history. In other words, their stories may be marginal, but their contributions were not.

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[6] James Benjamin Stewart, "Black Studies and Black People in the Future," *Black Books Bulletin* 4, 2 (1976): 24.
[7] Talmadge Anderson and James B. Stewart, "Science, Technology, and the Future of African Americans," in *Introduction to African American Studies: Transdisciplinary Approaches and Implications* (Baltimore, MD: Black Classic Press, 2007), 350.

Historian of science Margaret W. Rossiter has published seminal scholarship on this subject: the three-volume series *Women Scientists in America.* The second two iterations—subtitled *Before Affirmative Action, 1940-1972* and *Forging a New World Since 1972* respectively—are most relevant to this thesis. In the former, Rossiter ponders the question of why the supposed golden age for American science coincided with such obscurity for women scientists. She contends that "the prevailing assumption … was that though some women were present in science, they were at best invisible and at worst an embarrassment."[8] In the latter book, she examines how small, but well-connected groups of women organized and lobbied to remove so many of the sexist policies that had been barriers in the past. The crown jewel of their work, in Rossiter's view was Title IX of the Education Amendments of 1972.[9] This landmark piece of legislation decreed that "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."[10] Throughout this series, Rossiter highlights civil rights achievements, changes affecting HBCUs, and the labor of individual Black women scientists, such as engineer and president of the Aerospace Corporation Wanda Austin and Department of Labor computer specialist Dolores Copeland. Nevertheless, white women are clearly in the foreground in her study.

Other studies on women scientists and scientists of color often took the form of non-scholarly collections of biographies, focusing on either race or gender. Notably, with few exceptions, these books follow the pattern identified by Black feminists in which "All the

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[8] Margaret W. Rossiter, *Women Scientists In America: Before Affirmative Action, 1940-1972* (Baltimore, MD: Johns Hopkins University Press, 1995): xvi.
[9] Margaret W. Rossiter, *Women Scientists In America: Forging a New World Since 1972* (Baltimore, MD: Johns Hopkins University Press, 2012): xv-xvii.
[10] "20 U.S. Code "20 U.S. Code § 1681 – Sex." *LII / Legal Information Institute*, accessed December 15, 2018 https://www.law.cornell.edu/uscode/text/20/1681.

women are white, [and] all the Blacks are men."[11] The 1996 book *Distinguished African American Scientists of the 20th Century* featured biographies of 100 scientists, of which 20 are women.[12] In her 1999 book *American Women Scientists*, author Moira Davison Reynolds named a single person of color—Chien-Shiung Wu—alongside 22 white women.[13] Patricia Clark Kenschaft, a leader within the American Mathematical Society, published a book in 2005 entitled *Change is Possible: Stories of Women and Minorities in Mathematics.* In this book, the representation of women of color in the nineteenth and twentieth centuries amounted to four Black women and one Chicana, out of 35 total women.[14] It is clear that, at the same time that these authors have been laboring to reflect the true diversity of fields long presumed to be exclusively male and white, they have simultaneously neglected the perspectives of women of color. A notable exception from this period is Wini Warren's 1999 book *Black Women Scientists in the United States*.[15] Considering that Warren managed to reveal the stories of 94 Black women from a wide variety of scientific disciplines, using similar archival research strategies as the other authors, the lack of intersectionality displayed in the aforementioned titles is even more damning by contrast.

With more recent scholarship, there has been even greater interest in focusing the spotlight on Black women scientists. Two examples are Diann Jordan's 2006 *Sisters in Science: Conversations with Black Women Scientists on Race, Gender, and Their Passion for Science* and Jeannette E. Brown's 2012 *African American Women Chemists*. Like the books above, they are

[11] This phrase is the title of the 1982 book on Black feminism by Akasha Gloria Hull, Patricia Bell-Scott, and Barbara Smith.
[12] James H. Kessler, J.S. Kidd, Renée A. Kidd, Katherine A. Morin, *Distinguished African American Scientists of the 20th Century* (Phoenix, AZ: Oryx Press, 1996), vii.
[13] Moira Davison Reynolds, *American Women Scientists: 23 Inspiring Biographies, 1900-2000* (Jefferson, NC: McFarland, 1999).
[14] Patricia Clark Kenschaft, *Change Is Possible: Stories of Women and Minorities in Mathematics* (Providence, RI: American Mathematical Society, 2005).
[15] Wini Warren, *Black Women Scientists in the United States* (Bloomington, IN: Indiana University Press, 1999)

both short collections of biographies. In *Sisters in Science*, Jordan, a Black research scientist herself, became inspired to interview Black women scientists after struggling to conduct library research on the subject in preparation for a speech, and she proclaims that she is "passionate about finally telling some of our stories."[16] Meanwhile, Brown sets out to establish a single comprehensive resource on chemists who were Black women, a welcome project given that so much of the information in her book was scattered among multiple resources before.[17] These works suggest that, to avoid forgetting about the scientific achievements of Black women, it is often necessary to center them in a consious manner.

With regard to Black women's presence in the specific field of computing, a traditionally female-dominated field in which people performed complex mathematical calculations by hand before the advent of electronic computers, one must look to the works of Beverly Golemba and Margot Lee Shetterly. Through her 1995 unpublished manuscript "Human Computers: The Women in Aeronautical Research," sociologist Beverly Golemba was the first scholar to make a serious inquiry into the women who worked at various levels of the National Advisory Committee for Aeronautics (NACA).[18] In addition to undertaking archival research, she interviewed 13 former NACA employees, three of whom were Black: Kathryn Peddrew, Dorothy Vaughan, and Mary Jackson. In her study, Golemba examined the overall history of NACA as an institution, recruitment of women, the sexism they faced, and the influential projects to which they contributed. She argued that, contrary to anecdotal popular belief that

[16] Diann Jordan, *Sisters in Science: Conversations with Black Women Scientists on Race, Gender, and Their Passion for Science* (West Lafayette, IN: Purdue University Press, 2006): xi-xii.
[17] Jeannette E. Brown, *African American Women Chemists* (New York, NY: Oxford University Press, 2012): 3.
[18] Sue Bradford Edwards and Duchess Harris, Hidden Human Computers: The Black Women of NASA (Minneapolis, MN: Essential Library, an Imprint of Abdo Publishing, 2017): 93.

women were only becoming scientists during the 1990s, women's participation in STEM fields has a long legacy that deserves recognition.[19]

A book that was significant in increasing the general public'sawareness of Black women computers was *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*. Margot Lee Shetterly, an investment-banker-turned-writer published the book in 2016. *Hidden Figures* was exceedingly influential, earning the Anisfield-Wolf Book Award for Nonfiction in 2017, reaching the top of *The New York Times* Non-Fiction Best Sellers list that same year, and spawning a three-time Oscar-nominated film adaptation by the same name in the year of its publication. Shetterly argued that Langley's West Area Computers deserved "a sweeping narrative."[20] She zeroed in on the career trajectories of Dorothy Vaughan, Katherine Coleman Goble Johnson, Mary Jackson, and Christine Mann, using these individuals' narratives as a point of departure to discuss the broader social contexts of the time. It is the goal of this present thesis to continue the work of centering histories of Black women in the sciences.

Social Impacts of the Space Race

Before examining scholarship on the space race itself, it is necessary to consider the context of the Cold War in which the contest for space exploration played out. For this endeavor, the works of Penny M. Von Eschen, Thomas Borstelmann, and Mary Dudziak are crucial. In 1997, Von Eschen published *Race Against Empire: Black Americans and Anticolonialism, 1937-1957*. In this book, her main argument was that the Department of State and the Truman administration systematically silenced Black anticolonial activists in the postwar period on

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[19] Beverly E. Golemba, *Human Computers: The Women in Aeronautical Research*, unpublished manuscript donated to NASA Cultural Resource Geographic Information System (NasaCRgis) on March 6, 1995, accessed March 14, 2018, https://crgis.ndc.nasa.gov/crgis/images/c/c7/Golemba.pdf, 1-12.

[20] Margot Lee Shetterly, *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* (New York, NY: HarperCollins Publishers, 2016), xviii.

account of the activists' vocal disagreement with the government's foreign policy.[21] In the 2001 book *The Cold War and The Color Line: American Race Relations in the Global Arena*, Borstelmann brings evidence to the truism that "American history in the second half of the twentieth century was also international history" by highlighting the ways in which the civil rights movement, often framed as solely a domestic phenomenon, was significant in the international context.[22] Lastly, Dudziak puts forth the notion that "In spite of the repression of the Cold War era, civil rights reform was *in part* a product of the Cold War" because the Soviet Union and other communist countries seized any opportunity to invalidate the United States' leadership by pointing to instances of racism.[23]After examining these three works, it becomes clear that NASA carried out its activities, especially with regard to racial inclusion efforts, with a global audience in mind.

It is a well-worn debate in both the popular and scholarly literature whether the United States space program was an elitist project or a project with widespread public backing. In 1976, sociologist William Sims Bainbridge published *The Spaceflight Revolution: A Sociological Analysis*, arguing that the formation of NASA and the culmination of its various projects were a result of the will of a small group of scientists who romanticized space and were fanatical about science fiction, rather than being inspired by a groundswell of citizens provoked into uproar by *Sputnik's* launch. In fact, according to his study, most people were not in favor of spaceflight at all. His thesis challenged the assumption that the creation of the United States' space program

[21] Penny M. Von Eschen, *Race Against Empire: Black Americans and Anticolonialism, 1937-1957* (Ithaca, NY: Cornell University Press, 1997): 3.
[22] Thomas Borstelmann, *The Cold War and the Color Line: American Race Relations in the Global Arena* (Cambridge, MA: Harvard University Press, 2001): 7.
[23] Mary L. Dudziak, *Cold War Civil Rights: Race and the Image of American Democracy* (Princeton, N.J.: Princeton University Press, 2002): 12. Emphasis in original.

was an inevitable, popular response to *Sputnik*, stating that the spaceflight revolution "was a revolution that need not have happened."[24]

While historians such as James R. Hansen, author of the similarly titled 1995 book, *Spaceflight Revolution: NASA Langley Research Center from Sputnik to Apollo*, have referred to Bainbridge's work as a "conspiracy theory," others have pointed out the fact that the space program, though inspirational and aspirational, was not universally applauded.[25] In *Hidden Figures*, Shetterly identified that "the decision to prioritize a victory in space over problems on Earth was the most widespread criticism against the space program."[26] Gil Scott Heron's 1970 poem "Whitey on the Moon" vividly illustrated this sentiment, alluding to rent hikes, mounting doctor bills, and rat infestations that made any space-related expenditures appear inexcusably frivolous.[27]

Despite the vitriol that the space program attracted, otherhistorians have noted NASA's role as a unifying force. As Walter McDougall explains in his 1985 book … *The Heavens and the Earth*, the very existence of the United States program is indicative of the social force of technocracy. From his perspective, "technocracy" describes the postwar phenomenon in which powerful governments began taking it upon themselves to create new technology, rather than just reacting to new technologies eminating from other sectors. As it relates to the space race in particular, technocracy was viewed as a means to develop technology in a more centralized and efficient fashion in order to establish "a humanity united in space [that] could be transferred back

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[24] William S. Bainbridge, *The Spaceflight Revolution: A Sociological Analysis* (New York, NY: John Wiley & Sons, 1976), 4.
[25] James R. Hansen, *Spaceflight Revolution: NASA Langley Research Center from Sputnik to Apollo* (Washington, DC: National Aeronautics and Space Administration, 1995), xxxi.
[26] Shetterly, *Hidden Figures*, 241.
[27] Gil Scott-Heron, "Whitey on the Moon," *Genius Media Group*, 2016, accessed May 29, 2018. https://genius.com/Gil-scott-heron-whitey-on-the-moon-annotated.

to earth."[28] Moreover, in the 2015 book *We Could Not Fail: The First African Americans in the Space Program*, Richard Paul and Steven Moss theorize that, in the context of a national legislature resistant to acting on civil rights issues, the reforming of federal hiring policy was the Kennedy administration's most impactful strategy for racially integrating employment in the South. As a federal agency that benefited from great "romantic hyperbole," NASA was a key component in that strategy.[29]

Paul and Moss assert that previous historians have neglected to explore how NASA promoted desegregation and other civil rights aims because of the prevailing assumption that the two subjects are inherently separate.[30] In reality, "NASA's presence weakened or destroyed some aspect of racial segregation" in every community in which it operated, even if the agency did struggle to meet their recruitment goals. Paul and Moss' methodology entails identifying specific Black men who worked at NASA in various capacities—the physicist George Carruthers or the engineers Julius Montgomery, Theodis Ray, and Frank Crossley, for instance—as points of departure to discuss racial, political, and economic contexts surrounding NASA space centers in Cape Canaveral, Florida; Houston, Texas; Huntsville, Alabama; and Hancock County, Mississippi. They reveal that the space program and the popular idealism surrounding it had a unifying and morale-bosting effect for the nation, which was critical in helping to build mainstream support for the concept of racial integration.[31]

These twin arguments—that space exploration was the domain of the privileged few, on the one hand, and that it influenced the masses to come together, on the other—are still relevant

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[28] Walter A. McDougall, *… The Heavens and the Earth: A Political History of the Space Age* (Baltimore, MD: Johns Hopkins University Press, 1997): 9.
[29] Richard Paul and Steven Moss, *We Could Not Fail: The First African Americans in the Space Program* (Austin, TX: University of Texas Press, 2015): 3-5.
[30] *Ibid.*, 226.
[31] *Ibid.*, 81.

to this study. Holding both sides of this dichotomy in mind assists the historical observer in understanding how multifaceted NASA's place in society has been, not only as an entity in the past and present, but also as a harbinger of the future.

Afrofuturism

Media studies scholar Mark Dery is responsible for coining the term Afrofuturism, defining it as "Speculative fiction that treats African-American themes and addresses African-American concerns in the context of twentieth-century technoculture."[32] He arrived at this definition after contemplating the question of why so few Black authors were writing works of science fiction at the time, given that so many science fiction themes (abduction, experimentation on humans, etc.) have parallels in the Black American experience. Taking inspiration from this text, Alondra Nelson, who is now a professor of sociology and gender studies at Columbia University, started an AOL listserv in the late 1990s as a platform for students and artists to discuss social issues, science, and science fiction. Today, a lot of the artists, musicians, and scholars in fields as wide-ranging as Black studies, sociology, political science, and public health who consider themselves Afrofuturists got their start in this listserv. In 2002, Nelson organized several of the listserv participants to contribute to a special issue of *Social Text* whose theme was Afrofuturism. In her introduction, she challenges the philosophy of radical humanism, the idea that the Internet would cause humanity to relinquish their social identities and that this phenomenon would be inherently liberatory. Furthermore, she seeks to expand discussions of Black people and technology beyond the limiting notion of the "digital divide," a term that places "whites on the side of technology and progress and blacks on the side

[32] Mark Dery, "Black to the Future: Interviews with Samuel R. Delany, Greg Tate, and Tricia Rose," in *Flame Wars: The Discourse of Cyberculture*, (Durham, NC: Duke University Press, 1994): 180.

of the primitive and 'soulful.'"[33] Kodwo Eshun was the first author to devote a book to the discussion of Afrofuturism: *More Brilliant Than The Sun: Adventures In Sonic Fiction,* published in 1998. His analysis focuses primarily on Afrofuturism's presence in music and visual art. [34] The works of Dery, Nelson, and Eshun lay important groundwork for Afrofuturist theory by establishing its disruptive nature. For these three, "the power of Afrofuturism is its interventionist dissection of the politics of temporality that keep African Americans locked in a manageable time."[35]

Since the late 1990s and early 2000s, writers following Dery have been offering their own definitions of Afrofuturism. Nelson characterizes it as "'African American voices' with 'other stories to tell about culture, technology, and things to come,'" as well as "'sci-fi imagery, futurist themes, and technological innovation in the African diaspora.'"[36] In the 2011 book *The Black Imagination: Science Fiction, Futurism and the Speculative*, authors Sandra Jackson and Julie Moody-Freeman define Afrofuturism as "a literary and cultural aesthetic which encompasses historical fiction, fantasy and myth, magical realism and draws upon non-Western cosmologies to interrogate and critique current conditions of Black and other people of color to examine the past and envision different futures."[37] Reynaldo Anderson and Charles E. Jones declare in their 2016 book *Afrofuturism 2.0: The Rise of Astro-Blackness* that, given the rapid development of technological advancements in such a short span of time, Dery's original definition is insufficient. As an enhancement, they offer the term Afrofuturism 2.0, "the

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[33] Alondra Nelson, "Introduction: Future Texts," *Social Text* 20, no. 2 (Summer 2002);
Johan L. Munkholm, "Promises of Uncertainty: A Study of Afrofuturist Interventions into the Archive," *Journal of Science Fiction* 2, no. 2 (January 2018): 48.

[34] Anderson and Jones, Afrofuturism 2.0, xi.

[35] Munkholm, "Promises of Uncertainty," 49.

[36] Nelson, "Introduction," 9.

[37] Sandra Jackson and Julie Moody-Freeman, introduction to *The Black Imagination: Science Fiction, Futurism and the Speculative*, ed. Sandra Jackson and Julie Moody-Freeman (New York, NY: Peter Lang Publishing, 2011): 3.

technogenesis of Black identity reflecting counter histories, hacking and or appropriating the influence of network software, database logic, cultural analytics, deep remixability, neurosciences, enhancement and augmentation, gender fluidity, posthuman possibility, the speculative sphere, with transdisciplinary applications."[38] The variance in denotations demonstrates an evolution in the understanding of the concept in a relatively short amount of time. The understanding of the term has shifted from its starting place of literature, art, and music.

Although the term, Afrofuturism is new, the concept is old. Anderson and Jones state that Afrofuturism has a 100-year legacy.[39] As Ytasha Womack points out in her 2013 book *Afrofuturism: The World of Black Sci-Fi and Fantasy Culture*, it was common for nineteenth-century racial justice activists, such as W.E.B. Du Bois to write speculative fiction in order to "hash out ideas about race, re-create futures with black societies, and make poignant commentary about the times."[40] More recently, theorists have been mobilizing Afrofuturism—and science fiction more broadly—as a tool for activism and community organizing. Womack calls Afrofuturism "an intersection of imagination technology, the future, and liberation" defining it as "both an artistic aesthetic and a framework for cultural theory."[41] In the introduction to the 2015 collection of short speculative fiction *Octavia's Brood*, writer, educator, and poet Walidah Imarisha declares that "all organizing is science fiction," given that, as a matter of course, activists and organizers work to conceptualize and bring about new realities.[42] Defining Afrofuturism as "looking forward and backward simultaneously," comic book artist

[38] Anderson and Jones, Afrofuturism 2.0, x.
[39] Reynaldo Anderson and Charles E. Jones. *Afrofuturism 2.0: The Rise of Astro-Blackness* (London: Lexington Books, 2016): viii.
[40] Womack, *Afrofuturism*, 119-120.
[41] Womack, *Afrofuturism*, 9.
[42] Walidah Imarisha, introduction to *Octavia's Brood: Science Fiction Stories from Social Justice Movements,* ed. Walidah Imarisha and adrienne maree brown (Chico, CA: AK Press, 2015): 3.

and professor of media and cultural studies John Jennings observes "Dr. King's mountaintop is a Black speculative political notion."[43]

In the context of this project, I am expanding the definition of Afrofuturism still further to encompass actions taken by real individuals to secure a future for Black people. After all, the assumption that the Black race in the United States has a future in the first place has not always been a foregone conclusion. Through his work with Prudential Life insurance, statistician Frederick Hoffman reviewed data relating to health disparities between Black and white populations and subsequently concluded in 1896 that Black people were doomed to extinction.[44] In light of such an outrageous projection, the act of claiming that Black people have a future, let alone identifying how that future might manifest, is radical.

Scholarly Intervention

One of the motivations for my work is similar to that of Kessler, Kidd, Kidd, Morin, Reynolds, Kenschaft, and Warren: I intend to uplift the narratives of scientists and mathematicians from marginalized backgrounds, focusing on Black women. History offers numerous examples of how Black women have been victims of science. The names that immediately come to mind are Lucy, Anarcha, and Betsy—three slave women who were unconsenting experimental subjects of the father of modern gynecology, J. Marion Sims—and Henrietta Lacks, whose cells were used to create the first immortal cell line without her knowledge. It is important to counterbalance these horrors with the contributions that Black women have made in the sciences, with stories of how they navigated a context of both institutionalized and interpersonal misogynoir.

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[43] John Jennings, "Sequential Sankofa: Critical Nostalgia, Afrofuturism and the Black Comix Archive" (presentation, Afro-Futurism Symposium, Boston, Massachusetts, September 21, 2018.

[44] Christine Herbes-Sommers, writer, "The Difference Between Us," in *Race: The Power of an Illusion*, Public Broadcasting Service, 2003, accessed October 3, 2018, https://simmons.kanopy.com/video/race-power-illusion-0.

Additionally, my analysis makes more apparent the linkages between the space program and historically Black colleges and universities. A person with a casual knowledge of United States history would most likely never have guessed that these two groups would have had anything to do with one another. Shetterly gives a moderate amount of attention to this connection in her book, but my aim is to make this more explicit. I find the political, economic, and global contexts in which they operated quite fruitful indeed.

Lastly, I am contributing to the treatment of Afrofuturism as an academic framework. Although Afrofuturism and the study of history may at first appear diametrically opposed, the former is relevant to the latter when one considers the tradition of social history. The social history movements of the 1960s and 1970s prompted scholars to ask which people were absent in historical discussions and why. Afrofuturism poses these same questions with regard to future studies and speculative arts. Knowing this, I am optimistic that Afrofuturism can be a valuable analytical tool in historical scholarship.

Methodology and Chapter Outlines

The four main groupings of primary sources that I am utilizing for this thesis are oral history interviews from The Historymakers database, articles from the *Journal of Negro Education*, articles from the *Norfolk Journal and Guide*, and materials from the NASA Langley Research Center's online archive.

The Historymakers database features in-depth interviews with Christine Mann Darden and Katherine Goble Johnson, two of the more prominent Black computers who were employed at Langley. There are also oral histories from others affiliated with NASA commenting on Johnson's and Darden's work and influence. The *Journal of Negro Education*, which began in 1932, was the first publication to systematically study the problems of education for Black

people. The scholars who wrote for this journal discussed education at the primary, secondary, undergraduate, graduate, and trade school levels. The publication of this journal continues to this day, and the journal is headquartered at Howard University.[45] *The Norfolk Journal and Guide* is a Black newspaper based in Norfolk, Virginia, a city which neighbors the Langley Research Center in Hampton, Virginia. Originally a publication entitled *The Lodge Journal and Guide*, this newspaper transformed into a financially successful and politically moderate publication by the 1930s.[46] The online archive of the Langley Research Center includes photographs, oral histories, and a thorough run of the laboratory's interoffice newsletter.[47] It also has a succinct summary of racial relations at the laboratory, with plenty of citations to primary documents.[48]

The first chapter of my thesis covers how the contributions that HBCUs made to the World War II effort helped bolster scientific education for Black college students. The second chapter explains the history of NASA and its efforts to diversify its engineering ranks. The third chapter gives background on the careers of Black female computers and how their prosperity influenced their wider community. To conclude, I drive home the relevancy of Afrofuturism to my research question and suggest further avenues for incorporating Afrofuturism as an analytical tool. All of these points lend credence to my assertion that these three groups of actors relied upon rhetoric related to integration and racial uplift in an attempt to diversify the aerospace professions.

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[45] "Mission and History," *Journal of Negro Education*, accessed November 08, 2018, http://www.journalnegroed.org/generalinfo.html.

[46] "The Norfolk Journal and Guide," *PBS*, accessed November 16, 2018, http://www.pbs.org/blackpress/news_bios/newbios/nwsppr/Norfolk/norflk.html.
The reader should note that, at different points in its history, this newspaper has been called *The Journal and Guide*, *The Norfolk Journal and Guide*, and *The New Journal and Guide*. For simplicity's sake, in the body of my text, I will be referring to it only as *The Norfolk Journal and Guide*, but in my footnotes, I will cite more specific names as necessary.

[47] This newsletter changed names a few times: between 1942 and 1944, it was called the *LMAL Bulletin*, from 1945 to 1962, it was *Air Scoop*, and from 1963 through the 1980s, it was called the *Langley Researcher*.

[48] "Racial Relations," *Langley Archives Collection*, July 26, 2016, accessed November 15, 2018, https://crgis.ndc.nasa.gov/historic/Racial_Relations.

Training a Generation of Black Computers

Overview

For much of their existence before World War II, historically Black colleges and universities (HBCUs) struggled to deliver resources for their students' success. As the war advanced, heightening the need for skilled workers in a variety of industries, certain HBCUs quickly seized the opportunity to demonstrate their capacity to feed graduates into the growing labor forces. This chapter begins with an exploration of the prewar status of HBCUs, followed by an examination of the ways in which the federal government invested in HBCU students during World War II, particularly those in the sciences. From there, I will shine a spotlight on the Hampton Institute and its special relationship with the Langley Memorial Aeronautical Laboratory at the National Advisory Committee for Aeronautics (NACA). To conclude, I discuss the mentorship that specific professors provided to students who would go on to work for Langley Laboratory. I argue that HBCU presidents, professors, and administrators capitalized on wartime trends, shifting their pedagogical approaches from influencing their students to be complacent with meager, segregated job prospects to encouraging them to carve out space for themselves in United States society, especially in scientific fields.

A Brief History of HBCUs

Prior to the passage of the 1964 Civil Rights Act, the vast majority of Black students interested in pursuing higher education had to attend what are now known as historically Black colleges and universities (HBCUs). Cheyney University of Pennsylvania, founded in 1837, is the oldest of these schools.[1] Most HBCUs, however, were founded in the South after the Civil War.

[1] "List of Historical Black Colleges and Universities," *The Network Journal*, September 10, 2017, accessed November 04, 2018, https://tnj.com/hbcu-old/.

By the 1930s, there were 121 HBCUs, but today there are only 101.[2] Although the enrollment of most HBCUs has never been exclusively Black—from their very start, children of white abolitionists attended these schools as well—the Higher Education Act of 1965 defines an HBCU as "any historically black college or university that was established prior to 1964, whose principal mission was, and is, the education of black Americans."[3-4] Most HBCUs were coeducational from their founding. Some notable exceptions are Spelman College and Bennett College, which are both womens colleges, and Morehouse College, which is a men's college.[5] Tillotson College, now known as Huston-Tillotson University, was originally a women's college, but it began accepting men in 1931.[6] Compared to their white female counterparts, Black women as a whole did not have as big of a struggle in securing higher education on the basis of gender. Indeed, according to a study on Black women's higher education from 1933 by Lucy D. Slowe, "the assumption that women were not endowed with the capacity to pursue standard college courses had been disproved before the influx of Negro women to college, for those who entered co-educational colleges studied the identical subjects studied by men."[7]

In another 1933 study—this one relating to the status of accreditation, enrollment, and quality of education at HBCUs in 15 Southern states—the *Journal of Negro Education* reported

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[2] Monica Anderson, "Enrollment at HBCUs: A Closer Look," *Pew Research Center*, February 28, 2017, accessed November 04, 2018, http://www.pewresearch.org/fact-tank/2017/02/28/a-look-at-historically-black-colleges-and-universities-as-howard-turns-150/.

[3] Shereen Marisol Meraji and Gene Denby, "Ask Code Switch: School Daze," *Code Switch* (audio blog), September 12, 2018, accessed November 4, 2018, https://www.npr.org/templates/transcript/transcript.php?storyId=646870057.

[4] U.S. Department of Education, "What Is an HBCU?" White House Initiative on Historically Black Colleges and Universities, accessed November 04, 2018, https://sites.ed.gov/whhbcu/one-hundred-and-five-historically-black-colleges-and-universities/.

[5] "List of Historical Black Colleges and Universities."
For reference, Spelman, Bennett, Morehouse, and Tillotson were founded in 1881, 1873, 1867, and 1875, respectively.

[6] "Huston-Tillotson University History," *Huston-Tillotson University*, accessed December 15, 2018 https://htu.edu/about/history.

[7] Lucy D. Slowe, "Higher Education of Negro Women," *Journal of Negro Education 2*, no. 3 (1933): 352-353.

that there were "11.6 times as many white students … in college as Negroes."[8] Moreover, as of that year, only eight HBCUs had received regional accreditation, and none had received recognition from the Association of American Universities, despite two unnamed institutions' repeated attempts to gain entry. According to the author of this study, the lack of financial support from the government that would accompany accreditation severely hindered HBCUs' ability to provide a suitable standard of education to their students. Additionally, the students themselves largely suffered from woefully inadequate primary and secondary education, which left them poorly prepared for the expectations of college.[9] Nevertheless, by the end of the decade, enrollment rates at the undergraduate level were steadily climbing.[10]

The career trajectories of Black college graduates changed dramatically in the first forty years of the twentieth century. In 1912, the four most popular career paths for graduates were "teaching, preaching, medicine, and law—with the first two occupations accounting for 73 percent of the total."[11] By 1935, variance in professions among Black graduates more closely mirrored that of their white counterparts, though the top four career paths still reigned supreme.[12] Although changes in professional aspirations were taking place among both men and women, Slowe lamented that so few Black women were majoring in social sciences, subjects that she saw as instrumental for preparing them for the responsibilities of citizenship. For her, the lack of opportunities that Black female college students had in student government, not to mention the pervasive conservative expectations about women's place in society in general impeded them from developing the capacity for initiative and independent thinking. This deficiency, she

[8] Chas H. Thompson, "Introduction: The Problem of Higher Negro Education," *Journal of Negro Education* 2, no. 3 (1933): 264.
[9] *Ibid.*, 262-265.
[10] Martin D. Jenkins, "Enrollment in Negro Colleges, 1937-38," *Journal of Negro Education* 7, no. 2 (1938): 123.
[11] Charles E. Johnson, "The Negro College Graduate: How and Where He is Employed," *Journal of Negro Education* 4, no.1 (1935): 5.
[12] *Ibid.*

predicted would eventually negatively impact their ability to raise children well-adapted to the modern world.[13]

From the end of the Civil War through the beginning of the twentieth century, HBCUs may have been struggling in many respects, but at the same time, they instilled in students skills that would be valuable for serving their communities. Ultimately, World War II brought unprecedented attention and financial support from the federal government of the United States to HBCUs.

Science Education at HBCUs

Although there have consistently been individual Black scientists in the United States whose talents garnered them personal success—Benjamin Banneker, Madam C.J. Walker, and George Washington Carver are just a few prominent examples—Black scientists as a group often struggled to practice their craft. In the 1939 essay entitled "The Negro Scientist," W.E.B. Du Bois bemoaned the paltry opportunities available to most Black scientists at the time, and how this dearth caused the squandering of their potential. As he observed, the typical Black scientist was doomed to spend a lifetime working as a teacher at an HBCU, being unable to pursue serious research and having to manage a staggering courseload, often in subjects other than the scientist's specialty. Providing 12 examples of personal contacts who had attempted to gain employment at white-owned laboratories and predominantly white universities, Du Bois revealed that most of them had little to no success.[14]

The bleak landscape that Du Bois described transformed into a decidedly more hopeful one following the United States' entrance into World War II. In late 1942, government reports projected that the civilian and military defense industry would need 83,000 engineers by the end

[13] Slowe, "Higher Education of Negro Women," 356-358.
[14] W.E.B. Du Bois, "The Negro Scientist," *The American Scholar* 8, no. 3 (1939): 310-313.

of the following year.[15] To do their part in the war effort, HBCUs such as Howard University in Washington, D.C. and the Hampton Institute in Hampton, Virginia began training students in accelerated-degree and certificate programs in engineering, architecture, chemistry, and other scientific disciplines. Thanks to the sponsorship of the United States Office of Education, in 1942 Howard University expanded the range of courses available at its engineering degree program, in addition to hiring 37 new professors to teach them. At this time, one hundred percent of those who completed this degree program gained employment upon graduation.[16] The year before, Howard advertised free summer courses as part of the National Defense Program, which included such topics as "surveying," "materials and methods of construction," and "chemistry of power and explosives."[17]

At the Hampton Institute, Dr. Bridges Alfred Turner supervised the school's first cohort of female engineering students in 1943. The 11 Black women who participated in this inaugural 10-week course became qualified "for civil service appointments as junior engineers, at $2,000 annually."[18] At the end of the course, four of the women immediately found employment, including Miriam Mann, who became a computer at NACA's Langley Memorial Aeronautical Laboratory.[19]

The zeal with which these HBCUs rose to the challenge of producing as many engineers and scientists as possible is reflective of a broader trend of U.S. colleges and universities striving to do their part for the war effort. Mildred H. McAfee of the *Journal of Negro Education* noted

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[15] "1200 Students Enrolled in Defense Courses at Hampton" [although the title of this article says Hampton, the body of the article only discusses Howard University] *Norfolk Journal and Guide* (Norfolk, VA), October 3, 1942.
[16] *Ibid.*
[17] "Display Ad 17--No Title," *Norfolk Journal and Guide* (Norfolk, VA), June 28, 1941. *The Norfolk Journal and Guide* reported that Howard's engineering courses attracted both Black and white high school graduates, but the author did not specify the percentage of each race. "Both Races in Defense Study at Howard U.: Courses Attract 573; New Semester Opens October 10," *The Norfolk Journal and Guide* (Norfolk, VA), October 4, 1941.
[18] "Paving the Way for Women Engineers," *Norfolk Journal and Guide* (Norfolk, VA), May 8, 1943.
[19] "Four Women 'Engineers' Begin Jobs," *Norfolk Journal and Guide* (Norfolk, VA), May 22, 1943.

in 1942 that women's colleges, which had traditionally isolated their students from the inhabitants in surrounding towns, were especially active in collaborating with the public to organize war-related volunteer services and training programs. She was surprised to find that such colleges were allowing men to enroll in Engineering, Science, and Management Defense Training (ESMDT) programs held on their campuses.[20] Of course, discrimination was still rampant in the war industries. In the first quarter of 1941, for instance, the aircraft industry turned jobseekers of color away from all but 13 of the 8,769 available skilled and semi-skilled posts.[21] In this period, the federal government pivoted sharply from neglect of HBCUs to actively investing in and providing resources to them. True, this new approach stemmed not "from charity, or from benevolence, or from some artificial attempt to give the Negro his 'share,' [but from] a necessity for America's program."[22] That being said this change represented an unparalleled opportunity, particularly among leaders of the Hampton Institute.

The Hampton Institute

Established in 1868, the Hampton Agricultural and Instructional Institute (now known as Hampton University) is an HBCU that plays a central role in this thesis due to its proximity to and contribution of graduates to the nearby Langley Memorial Aeronautical Laboratory. Hampton graduates who secured employment at Langley include Christine Mann Darden, Miriam Mann, Mary Jackson, and many more.

For much of its early history, the Hampton Institute emphasized a pedagogical philosophy known as "the Hampton Idea." The principles of "the Hampton Idea" included prioritizing practical, industrial education in the skilled trades at the expense of encouraging

[20] Mildred H. McAfee, "The War and the Higher Education of Women," *The Journal of Negro Education* 11, no. 3 (1942): 265.
[21] Herman Branson, "The Role of the Negro College in the Preparation of Technical Personnel for the War Effort," *Journal of Negro Education* 11, No. 3 (1942): 297.
[22] *Ibid.*, 298.

critical thinking or political awareness. In the opinion of the founder, white Civil war veteran and abolitionist Samuel Chapman Armstrong, and many Hampton alumni, including Booker T. Washington, Black people needed to fortify their economic stature as a race while complying with segregation for the time being.[23] W.E.B. Du Bois was among the loudest objectors to this philosophy. He criticized it as a covert means for the Black educated elite "to be suppressed and hammered into conformity."[24] In 1906, he railed against this philosophy to a Hampton Institute audience, characterizing the school's messaging as telling "young men not to hitch their wagons to a star, but to a mule."[25] He went on to argue that Black college students must receive instruction in industrial skills alongside grounding in the liberal arts.[26] Having offended and shocked Hampton's administrators, he did not receive an invitation to speak at Hampton again for thirty years.

Despite this drama, Hampton president Malcolm MacLean, knowingly or not, incorporated some of Du Bois' ideas in the school's pedagogy decades later during World War II. Acting as the Institute's sixth president between 1940 and 1942, MacLean was a white progressive and outspoken advocate for racial equity at every level. He stoked controversy by openly demanding that white colleges hire Black professors and by dancing with a Hampton student at a campus mixer. His collaboration with the armed forces was the aspect of his legacy that gave him the most pride. He supervised the sale of a 770-acre parcel of Hampton Institute land that would eventually become part of the Langley Field air base in 1941. The following year, he established a US naval training school at Hampton and organized a war labor

[23] Michael Barker, "Miseducation and the New Slavery," Ceasefire Magazine, October 31, 2011, accessed November 14, 2018, https://ceasefiremagazine.co.uk/corporate-power-4/.
[24] W.E.B. Du Bois, *The Autobiography of W.E.B. Du Bois*, (International Publishers Co., Inc., 1968): 240.
[25] W.E.B. Du Bois, "The Hampton Idea," in *The Education of Black People: Ten Critiques, 1906-1960*, ed. Herbert Aptheker (New York, NY: Monthly Review Press, 2001): 28.
[26] *Ibid.*, 28-31.

conference. His goal was for Hampton to be "the leader of all black colleges in providing … Engineering, Science, and Management War Training (ESMWT) programs." Eager to take advantage of the ESMWT curriculum, "men and women crowded into Hampton Institute classrooms offering instruction in everything from radio science to chemistry."[27] From Maclean's perspective, World War II had the potential to be "the greatest break in history for minority groups."[28]

Obviously, MacLean's initiatives still relied upon the technical training that was Hampton's bread and butter. However, he was also breaking with tradition, in the sense that he was encouraging Black people to claim their place in U.S. society, rather than waiting for a subservient position to be assigned to them. While enthusiastic presidents like MacLean nurtured the environment for preparing Black students for a more hopeful and equitable future, individual professors at HBCUs offered a personal touch that influenced these students to shape that future.

Mentorship

Katherine Goble Johnson and Christine Mann Darden, future computers at Langley Laboratory, were already brilliant intellectuals before meeting their mentors. Johnson began reading at four years of age, and when she enrolled in elementary school, she started in the second grade. She recalled enjoying all of her academic subjects, not just math. She graduated at the top of her high school class, as well as achieving summa cum laude status in college.[29]

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[27] Margot Lee Shetterly, *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* (New York, NY: HarperCollins Publishers, 2016): 45-46. The aforementioned ESMDT program changed its name to the ESMWT program in 1941 following the Japanese attack on Pearl Harbor.

[28] "Workers in War Industry Discussed in Conference, *Norfolk Journal and Guide* (Norfolk, VA), July 4, 1942.

[29] Katherine G. Johnson (The HistoryMakers A2012.017), interviewed by Larry Crowe, February 6, 2012, *The HistoryMakers Digital Archive.* Session 1, tape 1, story 7, Katherine Johnson describes her early school days at White Sulphur Grade School; Session 1, tape 2, story 4, Katherine Johnson remembers attending West Virginia State University High School.

Darden also skipped the first two grades of elementary school. Her childhood aspiration was to be a doctor, and her father often let her help him perform mechanical work on the family car. She loved her geometry class in high school, and when she began college, she was initially interested in pursuing a degree in actuarial science to be able to work in the insurance industry. However, knowing the difficulty that women—especially Black women—encountered in finding employment, her father, who was paying for her tuition, insisted that she get a degree in teacher education instead. Despite this restriction, Darden still excelled enthusiastically. For example, she aced her sophomore trigonometry class, even though her teacher taught poorly and seemed "like she was talking to herself at the board." Many of her classmates, she reported, were overly confident that they knew the material, yet they failed the course anyway.[30]

Johnson completed her undergraduate studies at an HBCU called West Virginia State College (now West Virginia State University) in 1937. Though she had originally planned to become a teacher of French and mathematics, when she met Dr. William Claytor, her aspirations shifted. Dr. Claytor was the third Black American to earn a doctoral degree in mathematics, submitting a dissertation at the University of Pennsylvania on the subject of topology in 1933, just three years after he had enrolled. Despite his scholastic success, he struggled to find work, eventually settling for a professorship at West Virginia State.[31]

As Johnson recalled in a 2012 interview, when she was a freshman, Dr. Claytor insisted that she had the potential to be a research mathematician, even though she had never heard of that job title before. She asked, "Where would I get a job like that?" He replied, "You'll find

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[30] Christine Darden (The HistoryMakers A2013.045), interviewed by Larry Crowe, February 26, 2013, *The HistoryMakers Digital Archive*. Session 1, tape 3, story 1, Christine Darden talks about her family's emphasis on the importance of education and her interests as a child; Session 1, tape 4, story 1-2, Christine Darden talks about her education at Hampton University – parts one and two.

[31] Sibrina Nichelle Collins, "Unsung: William Claytor," *Undark*, November 2, 2016, accessed November 06, 2018, https://undark.org/article/unsung-william-waldron-schieffelin-claytor/.

one."[32] Under Dr. Claytor's tutelage, Johnson took all of the mathematics classes available at West Virginia State, along with additional ones prepared especially for her. Johnson was so well prepared for her eventual employment at Langley Laboratory that her recruiters waived the customary civil service examination for her. In retrospect, she attributed this auspicious launch of her career to the mentorship and attention she received from Dr. Claytor. Before she attended West Virginia State, Johnson had had several female math teachers. She stated that it was not unusual for women to teach math when she was a child. That being said, she remembered that her high school had a mass layoff of teachers due to the financial pressures of the great depression, and all of the teachers who happened to be married women lost their jobs in that layoff. [33]

Darden also emphasized the critical role that mentorship played in her career trajectory. After graduating from the Hampton Institute in 1962, Darden got engaged and initially found employment as a schoolteacher in Portsmouth, Virginia. Her fiancé was pursuing graduate studies at Virginia State University in Plymouth, Virginia, and she enrolled in some math classes there and eventually began looking for work in the area, since Portsmouth was now too far away for her to keep her teaching job. She became acquainted with the math department head, Dr. Reuben Roosevelt McDaniel, who in turn introduced her to physics professor Dr. J. Raymond Hodkinson. Dr. Hodkinson later employed her as a research assistant in aerosol physics, and she herself started a master's degree, writing a thesis on the calculation of light scattering under Dr. Hodkinson's guidance.[34]

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[32] Shetterly, *Hidden Figures*, 73.

[33] Katherine G. Johnson (The HistoryMakers A2012.017), interviewed by Larry Crowe, February 6, 2012, *The HistoryMakers Digital Archive*. Session 1, tape 2, story 9, Katherine Johnson talks about her mentor John F. Matthews; Session 1, tape 1, story 9, Katherine Johnson remembers her favorite teachers.

[34] Christine Darden (The HistoryMakers A2013.045), interviewed by Larry Crowe, February 26, 2013, *The HistoryMakers Digital Archive*. Session 1, tape 4, story 6, Christine Darden describes her master's thesis on

Dr. Claytor passed away at the age of 59 in 1967, after having been disillusioned for years with his exclusion from the full range of academia. Dr. Hodkinson died in a boating accident the year after Darden began her graduate studies. It is both remarkable and heartbreaking that these scholars set their mentees on a path that they themselves could not follow in their time. Moreover, it is important to note how easily Johnson and Darden found male mentors, as opposed to female mentors. From their interviews, it is not evident whether they actively sought female mentors, but from what they *have* said, it is reasonable to infer that women in high-ranking math and science positions were simply few and far between at the HBCUs that Johnson and Darden attended.

Conclusion

It is safe to say that all colleges and universities attempt to train their students for the realities of life after graduation. On the surface, then, HBCUs are not special in this regard. But upon examining the racist context in which they operated, their methods for preparing students for the future have a more nuanced significance. They have consistently had to make the best of meager resources and less than adequate student preparation. Early on, many of their administrators focused on the practical realities of the present, not daring to hope for a markedly different future. Nevertheless, the Hampton Institute and other HBCUs managed to train a generation of mathematicians, scientists, and engineers for the World War II effort, some of whom would go on to perform the calculations that made human space travel possible. This is Afrofuturism in action. Just as these schools had to adapt rapidly to shifting racial dynamics, federal policy, and economic realities in order to make this happen, so, too, would the aeronautical industry.

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calculating light scattering, and her early experience using computers; Session 1, tape 4, story 7, Christine Darden describes her experience at Virginia State College.

Diversifying NASA

Overview

The National Aeronautics and Space Administration (NASA) emerged in 1958 as a Janus-faced organization. On the one hand, it was a civilian agency representing peaceful uses of science and technology. On the other hand, many of the agency's leaders had military backgrounds, and the agency's creation was in direct response to the Soviet launch of the *Sputnik* satellite. On top of this dichotomous foundation, NASA also felt pressure to employ a diverse work force. This chapter begins with the genesis of NASA and its association with all things futuristic. From there, I examine how NASA and other government agencies came to consider inequality in education, particularly where race was concerned, as a threat to national security. I then detail the specific steps that NASA as a whole and the Langley Research Center specifically took to embed themselves in the Black portions of the area of Hampton, Virginia. In light of each of these factors, I argue that NASA characterized racial inclusion and technological advancement as having an inherent link, and that this mindset influenced the agency's administrators to envision a future in which Black people were, if not central, than definitely a priority.

The Dawn of the Space Age

In the first half of the twentieth century, as rocket technology advanced significantly during the first and second World Wars, certain scientists showed interest in using this technology for space travel. For example, Randall Lovelace II, a leader in aviation medicine, went so far as to organize conferences in 1951 to disseminate scientific research on space exploration. However, because most government officials dismissed this subject as, at best, a

passing curiosity, and at worst, a waste of taxpayer money, he disguised the topic of these conferences by alluding to "upper atmosphere" studies.[1]

This stance changed almost overnight when the Soviet Union launched *Sputnik*, the first human-made satellite, into outer space on October 4, 1957. In a Cold War context, *Sputnik* was alarming because it signalled that the Soviet Union was no longer trailing behind the United States in scientific advancements as had been the case with the nuclear bomb and the atom bomb.[2] On the contrary, the United States would now be the nation playing catch-up. Dwight Eisenhower, who was president at the time, was reluctant to waste government funds in a space race with Russia. However, on the campaign trail for the upcoming 1958 presidential election, John F. Kennedy, Lyndon B. Johnson, and other Democrats repeatedly discussed *Sputnik* as an indicator that the United States had fallen behind. Moreover, vocal individuals and interest groups—including Edward Teller, the creator of the hydrogen bomb, Vanevar Bush, the dean of the School of Engineering at the Massachusetts Institute of Technology, General John Medaris, the commander at the Army Ballistic Missile Agency, and Wernher Von Braun, the former Nazi rocket scientist—approached President Eisenhower to urge his support for a space program. President Eisenhower responded by initiating the Office of Presidential Science Advisor, creating the Advanced Research Project Agency (which would eventually go on to invent the Internet), and, on July 29, 1958, signing the National Aeronautics and Space Act into law.[3]

The National Aeronautics and Space Act transformed the National Advisory Committee for Aeronautics (NACA)—which had been the agency responsible for designing, testing, and

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[1] Margaret A. Weitekamp, *Right Stuff, Wrong Sex: America's First Women in Space Program*, (Baltimore: Johns Hopkins University Press, 2006): 32-33.

[2] The United States first exploded atomic bombs in 1945, with the Soviet Union following suit in 1949. The United States exploded the first hydrogen bomb in 1952, and the Soviet Union did the same the next year.

[3] Richard Paul and Steven Moss, *We Could Not Fail: The First African Americans in the Space Program* (Austin, TX: University of Texas Press, 2015): 24-26.

producing aircraft in both World Wars—into the National Aeronautics and Space Administration (NASA). In 1961, John F. Kennedy, now president, delivered a challenge to the nascent agency to put a man on the moon by the year 1970.[4] Given the new mandate for space exploration and a desire to keep pace with the scientific advancements of the Soviet Union, the U.S. government quickly reorganized their priorities, to the point where space exploration became a tangible strategy through which "the United States could demonstrate American strength to the world."[5]

From its very inception, NASA was synonymous with the future, particularly an optimistic future. As Richard Paul and Steven Moss elucidate,

> In its time, the term "Space Age" meant so much more than advances in engineering. This new age of space was for many a panacea—a deus ex machina. Those who invoked it thought it could solve almost any problem. In the early 1960s, many Americans saw the earth as grubby and brown, possibly dying …. Outer space seemed clean and peaceful. The powerful and beautifully designed machines that took humans there were brand new. The Space Age offered unending horizons.[6]

The general public was obviously excited by this explosion of new technologies, being intrigued by what those possibilities could mean for people's daily lives. In 1962, a local television news station reported on a display of a "Space Age kitchen" at the State Fair of Texas, in which housewives watched in awe as a specialist demonstrated gadgets that could prepare food in zero gravity.[7] Government officials shared their hopes for NASA and its inventions, too. The National Academy of Arts and Sciences had reported in the early 1960s that NASA could potentially produce "a new era of equality according to

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[4] John F. Kennedy, "Special Message to Congress on Urgent National Needs," (address before a Joint Session of Congress, Washington, D.C., May 25, 1961), accessed December 14, 2018, https://www.jfklibrary.org/asset-viewer/archives/JFKWHA/1961/JFKWHA-032/JFKWHA-032.

[5] *Ibid.*, 120.

[6] Paul and Moss, *We Could Not Fail*, 71.

[7] WBAP-TV (Television station: Fort Worth, Tex.). [News Script: Space kitchen], item, October 17, 1962; (texashistory.unt.edu/ark:/67531/metadc981547/: accessed December 17, 2018), University of North Texas Libraries, The Portal to Texas History, texashistory.unt.edu; crediting UNT Libraries Special Collections.

ability," and that the agency "might in some way represent a microcosm of the future."[8] Senator Ralph Yarborough imagined that Dallas could one day be the site of a space ship factory.[9] Along with this enthusiasm, though, there was trepidation over whether there would even be enough people qualified to build and operate such space ships.

Race Matters in the Space Race

The launching of *Sputnik* not only served as the catalyst for the founding of NASA, but it also caused many NASA administrators to turn their attention to the subject of inequality in education. The launch laid bare the reality that United States school systems sorely needed to improve their methods for teaching mathematics and science, and since the end of World War II, there had already been a growing concern that schools were stifling the talent of gifted students. The proliferation of both scholarly and popular writing on the subject of gifted students, including a 1958 article from *Life* magazine entitled "The Waste of Fine Minds," put forth the imperative that educators must identify children who tested exceptionally high on IQ tests and give them specialized attention. Failing to do so, so the logic went, would not only result in psychological damage for the children who were unable to fully engage their intellects, but could even be detrimental to national security.[10]

Congress quickly responded to this crisis by introducing the National Defense Education Act (NDEA). The legislation's purpose was twofold. First, it provided special federal support for engineering students, foreign language scholars, and area studies centers, which would in turn

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[8] Raymond A. Bauer, Richard S. Rosenbloom, and Laure Sharp, *Second-Order Consequences: A Methodological Essay on the Impact of Technology* (Cambridge, MA: MIT Press, 1969), 67, 75, 98 as cited in Paul and Moss, *We Could Not Fail*, 48.

[9] WBAP-TV (Television station: Fort Worth, Tex.). [News Script: Senator talks of space age], item, January 19, 1958; (texashistory.unt.edu/ark:/67531/metadc800028/m1/3/: accessed December 17, 2018), University of North Texas Libraries, The Portal to Texas History, texashistory.unt.edu; crediting UNT Libraries Special Collections.

[10] "Crisis in Education, Part III: The Waste of Fine Minds," *Life*, April 7, 1958, 89 as cited in Jim Wynter Porter, "A 'Precious Minority': Constructing the 'Gifted' and 'Academically Talented' Student in the Era of *Brown v. Board of Education* and the National Defense Education Act, *Isis* 108, no. 3 (2017): 582

supply the country with defense-oriented personnel. Secondly, it allocated funds for a National Defense Student Loan program.[11] When NASA's own former Nazi rocket engineer Dr. Wernher von Braun testified before the committee for the National Defense Education Act in January of 1958, he strongly implied that if the country's school system continued catering to the lowest common denominator, the United States would not have the ability to counter the Soviet Union's burgeoning technological prowess.[12] President Eisenhower signed the NDEA into law on September 2, 1958.

Notably, the author of "The Waste of Fine Minds" articulated that gifted children could come from any geographic location, and IQ experts at the time insisted that gifted individuals existed in all races.[13] This statement is poignant considering that, "virtually every review [of the relatively low rates of science and math knowledge in the U.S. population compared to other countries] questioned how much desperately needed brainpower was being squandered by the intentional neglect of America's Negro schools."[14] In 1954, just a few years prior to this article's publication, the Supreme Court's *Brown v. Board of Education* decision had declared segregated schooling to be unconstitutional. Nonetheless, Southern states reacted strongly against this court decision, with the state of Virginia going so far as to chain the doors of the public schools whose administrators attempted to integrate for the entirety of the fall 1958 semester.[15]

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[11] Stephen J. Schwegler, *Academic Freedom and the Disclaimer Affidavit of the National Defense Education Act: The Response of Higher Education.,* PhD diss., Columbia University, 1982.
[12] Porter, "A 'Precious Minority,'" 602.
[13] I was not able to locate the full text of the article "The Waste of Fine Minds." Porter's paraphrasing of this sentiment is as follows: "'The Waste of Fine Minds' held that these [gifted] children could come from anywhere: cities, rural backwaters, or places like Rockwell City, Iowa [where one of the gifted children featured in the article was from]." Porter, "A 'Precious Minority,'" 582; Porter also paraphrases Michelle Brattain's 2007 essay "Race, Racism, and Antiracism: UNESCO and the Politics of Presenting Science to the Postwar Public," stating, that IQ experts believed that "all 'races,' classes, and religions—boys and girls alike—were eligible to produce supranormal intelligence with equal probability." Porter, "A 'Precious Minority," 585.
[14] Margot Lee Shetterly, *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* (New York, NY: HarperCollins Publishers, 2016): 142.
[15] *Ibid.,* 184.

The fear of wasting Black talent due to racial prejudice was not new at this time. At the 1942 Trade Union and People's Victory Conference, Federal Security Administrator Paul V. McNutt lamented that, although there had been progress in incorporating Black labor throughout multiple sectors of the war industry, they were still "not using Negroes enough." In his view, the United States needed to work hard to make up for the fact that there were lower numbers of trained workers than there would have been had discrimination not been so rampant.[16]

The rhetorical connection between racial equality and national security was another idea that preceded the Space Age. The Truman administration became motivated to desegregate the armed forces after a 1947 report by the President's Committee on Civil Rights entitled *To Secure Our Rights.* This report found that the United States' "civil rights shortcomings" undermined the nation's efforts to appear as a "positive influence for peace and progress throughout the world."[17] Following World War II United States was, at this point, a world power, and the messaging it delivered on a global stage needed to model justice and progress in order to contrast the strife of the war and dissuade newly independent nations from becoming communist. Gunnar Myrdal, a Swedish sociologist who studied postwar race relations in the United States, insisted that "America, for all its international prestige, power, and futures security, needs to demonstrate to the world that American Negroes can be satisfactorily integrated into its democracy."[18] Paul Dembling, the chief legal counsel for NACA, wrote in 1956 that maintaining systems of racial inequality would severely undermine the United States' leadership in a world where most people

[16] "Prejudice Must Not Interfere: Use Will Be Made of All Manpower Available in the U.S." *The Norfolk Journal and Guide* (Norfolk, VA), July 4, 1942.
[17] President's Committee on Civil Rights, *To Secure These Rights* (Washington, D.C.: U.S. Government Printing Office, 1947), 139-148 as cited in Mary L. Dudziak, *Cold War Civil Rights: Race and the Image of American Democracy,* (Princeton, N.J.: Princeton University Press, 2002): 80.
[18] Myrdal Gunnar, *An American Dilemma: The Negro Problem and Modern Democracy* (New York, NY: Harper and Rau, 1944): 1015-1016 as cited in Dudziak, *Cold War Civil Rights,* 8.

were not white.[19] It became clear among leaders of the federal government in general and within NASA in particular that the future depended on nurturing every mind, regardless of race.

The pressure for NASA to examine racial issues was not entirely internal. The Black press—especially newspapers such as *The Norfolk Journal and Guide*, *The Pittsburgh Courier*, *The New York Amsterdam News,* and others—frequently took the agency to task on its race relations. In 1957, *Norfolk Journal and Guide* journalist James B. Henderson commented that Black people were virtually unknowable to white people, asserting,"no problem in mathematics or human relations will ever be solved until you know what the unknown factor is."[20] In other words, if this ignorance continued, racism would never abate. In a 1962 article in *The Pittsburgh Courier,* attorney Pal B. Zuber expressed the importance of training Black astronauts, criticizing NASA for not instituting diversity in its space vessels. Representatives from NASA responded that, if there were more Black engineers, Black astronauts would be a more feasible possibility.[21]

Although they were vocal in their judgment of NASA, Black journalists were also quick to recognize the agency's Black workers. Reporting on the the progress of a late 1961 suborbital space flight, Enoc P. Waters, Jr. highlighted the activity of the Project Mercury station in Kano, Nigeria. Housing a 60-man team, half of which was Nigerian, this station was responsible for monitoring the vital signs of the spacecraft and the astronaut inside as they passed directly overhead. After describing this work in detail, Waters pointed out that the members of the team who were from U.S. featured Black American engineers among their ranks. These included air force veteran and maintenance and operations supervisor Joseph White and intercom technician

[19] Paul Dembling to file, July 7,1956, as cited in Shetterly, *Hidden Figures*, 170.
[20] James B. Henderson, "Henderson Speaks: The Negro is Unknown Factor in the Equation," *The Norfolk Journal and Guide* (Norfolk, VA), August 24, 1957.
[21] "Why No Negro Astronauts?" *Pittsburgh Courier* (Pittsburgh, PA), March 10, 1962.

William W. Keating, both Baltimore natives.[22] This article illustrates an example of a foreign policy strategy that Paul and Moss observe, that "the U.S. government often exploited the space program in order to reach out to Third World countries when America wanted to make a good impression. In the case of Africa, it did this in ways that simultaneously allowed NASA to make a good impression on African-Americans."[23]

Even before the founding of NASA, Black newspapers were a site of speculation about the possibility of Black people engaging in space exploration. Beginning on August 19, 1950, *The Pittsburgh Courier* ran a comic strip called *Neil Knight of the Air*. Neil Knight was the first Black astronaut to appear in a comic strip. Until the comic's end in 1955, Knight drew on his background as a former Tuskegee Airman to carry out adventures on far-off planets.[24]

Another noteworthy comic from this time was "Judgment Day!" by artist Joe Orlando and writer Al Feldstein. In this 1953 comic, the Tarlton, a human wearing a full spacesuit, visits the planet Cybrinia to assess whether this planet meets the criteria for joining the Galactic Republic, of which Tarlton is a representative. Cybrinia's inhabitants are all robots, with some having orange sheathing and some having blue. Although the robots are exactly the same despite their color, the blue robots live in squalor, work menial jobs, and must reside in a part of Cybrinia separate from the orange robots. After his tour of the planet, Tarlton declines to include Cybrinia in the Republic. Still, there is hope, he says, "reflecting that "for a while, on Earth, it looked like there was no hope! But when mankind on Earth learned to live together, real progress began. The universe was suddenly ours." Tarlton then removes his space helmet to reveal that he

[22] Enoc P. Waters, Jr., "60 Men at 'Buck Rogers' Installation: American Group Waiting in Colorful Africa for 6-Minute Space Effort," *New Journal and Guide* (Norfolk, VA), November 25, 1961.
[23] Paul and Moss, *We Could Not Fail*, 80.
[24] "Vintage Black Heroes – Neil Knight," *Museum of Uncut Funk*, accessed December 16, 2018, http://museumofuncutfunk.com/2013/12/15/vintage-black-heroes-neil-knight/.

is a Black man.[25] *The Chicago Defender*, a Black newspaper, reviewed this work warmly, stating that "comics have greater mass appeal than most other types of literature and their influence, particularly upon young minds, is infinite."[26]

Of course, it is impossible to know how readers of *Neil Knight* and "Judgment Day!" reacted to them, or whether the comics had any impact on how they would come to interpret the activities of NASA. Nevertheless, the comics are still illustrative of Black people's desire to be present in conversations, policy, and actions related to space.

Recruitment Efforts

On a domestic level, however, in the 1960s and 1970s NASA shifted their approach from being merely tolerant of Black employees, as NACA had been during and directly after World War II, to taking greater initiative to recruit them. A supportive structure that facilitated this ongoing recruitment initiative was the President's Committee on Equal Employment Opportunity (PCEEO). President Kennedy established the PCEEO in 1961 through Executive Order 10925 and chose Vice President Johnson as its head. The PCEEO was a manifestation of Kennedy's campaign promise to combat poverty, an effort which Johnson theorized would also alleviate racism. Johnson identified NASA as one of six government agencies that would be the pioneers in implementing policies for equal employment opportunity.[27]

In addition to targeting racial diversity as a goal to work toward, the Kennedy administration also at least paid lip service to the inclusion of women. President Kennedy invited

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[25] Al Feldstein and Joe Orlando, "Judgment Day!" 1953. Reprinted in *Judgment Day and Other Stories* (Seattle, WA: Fantagraphics Books, 2014), 29 as cited in Michelle D. Commander, "The Space for Race: Black American Exile and the Rise of Afro-Speculation," *ASAP/Journal* 1, no. 3 (2016): 410.

[26] "Comics and Propaganda," The Chicago Defender, February 7, 1953 as cited in Commander, "The Space for Race, 410.

[27] Paul and Moss, *We Could Not Fail*, 5. The other agencies were the Post Office Department, the Veterans' Administration, the Department of Defense, the Atomic Energy Commission, and the General Services Administration.

readers of the December 1961 issue of *American Girl* magazine to consider joining the space effort. His "Message to You from the President" insisted that "the skills and imagination of our young men and women are not only welcome but urgently sought in this vital area."[28] NASA echoed this messaging in its educational programs. In a filmstrip entitled "Equal Opportunity in Space Science" featuring Black schoolchildren asking questions about space, Black pilot and astronaut candidate Ed Dwight announced, "our country is going to need both boys and girls with knowledge, imagination and courage to make it even greater than it is today" in response to a girl who asked whether girls could be in the space program when they grew up.[29]

By the mid-1950s and early 1960s, the Langley Research Center was no stranger to reciprocal visits between NASA scientists and students and teachers from local schools. In 1955, Langley's Air Defense Command (ADC) unit invited representatives from the Hampton Teachers' Association to an open house. This event and others like it allowed Langley scientists to promote greater familiarity with the ADC's safety procedures among the civilian community. Their rationale for selecting teachers for this visit was the assumption that they would be inclined to disseminate the information they had learned to students, parents, and other people in the general area. After all, civilian cooperation would be imperative in the event of atomic war.[30]

Once Congress officially established NASA, a civilian agency, though, the rhetoric surrounding these visits shifted from emphasizing the importance of preparing for imminent warfare to providing examples of jobs that were stable and that allowed people to serve their country. In 1963, Lawrence Brown, a Black aerospace engineer at Langley, promoted the

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[28] E.K. Hopper, "Lots of Room in Space for Women," *American Girl*, December 1961 as cited in Weitekamp, *Right Stuff, Wrong Sex*, 133.
[29] Charles Lang, "Equal Opportunity in Space Science," n.d. Audio from the filmstrip was provided to Richard Paul by Dr. Lang's widow, Angela Lang as cited in Paul and Moss, *We Could Not Fail*, 95.
[30] J.H. Knight, "Hampton Teachers Visit Langley Field ADC Unit," *Norfolk Journal and Guide* (Norfolk, VA), February 26, 1955.

laboratory's apprenticeship program to students at the predominantly Black Huntington High School during the school's career emphasis month.[31] Earlier that year, banker J.H. Wheeler implored students from the HBCU North Carolina College to take advantage of the federal openings that were becoming more abundant thanks to President John F. Kennedy's establishment of the PCEEO. Wheeler cited NASA as one of several federal agencies in which Black employees were enjoying increases to their already relatively high salaries.[32] Students from another Black school, Rosemont Junior High School in Norfolk, received a demonstration in 1966 from NASA science educator F.M. Bell about the history of rocket science, the usage of weather satellites, and the biological stresses that astronauts would face in outer space.[33] Finally, in 1968, a scientist from Langley Laboratory known as David Woods served as a judge for the Huntington High School science fair.[34]

The sum total of these engagements suggests that leaders within Langley Research Center were concerned with embedding themselves within the surrounding community in general and the Black community in particular. Rather than passively awaiting applications from qualified Black students and deigning to employ them in segregated spaces, as had been the case in the past, they actively sought to cultivate the qualified scientists and mathematicians whom they would one day hire.[35] Echoing the NASA representatives mentioned in *The Pittsburgh Courier* article cited above, Dr. Floyd L. Thompson, the director of Langley, lamented that "there is no easy solution to the entire problem of equal opportunity because so much of the problem is

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[31] "Dr. Holloway Speaks at Assembly," *New Journal and Guide* (Norfolk, VA), March 16, 1963.
[32] "Banker Advises Students: Prepare for Opportunity," *New Journal and Guide* (Norfolk, VA), January 26, 1963.
[33] "Visit U.S. Agencies, Too: Rosemont Pupils Given Briefing on Space Age," *New Journal and Guide* (Norfolk, VA), May 7, 1966.
[34] "Science and Math Fair Held at Huntington Hi," *New Journal and Guide* (Norfolk, VA), March 2, 1968.
[35] As I explain in the next chapter, Langley Laboratory complied with non-discrimination measures in hiring, but there were still segregated workspaces, restrooms, and cafeterias within the facility.

related to the need for additional educational opportunities."[36] Consequently, this more active form of recruitment not only took the form of regular facetime with members of the community, but also formal training programs and partnerships with historically Black colleges and universities (HBCUs).

Through a collaboration between NASA and Norfolk State College, physics major Robert B. Lee, II accepted a summer position as a student trainee in 1965.[37] The purpose of this trainee program was to provide up and coming engineers with valuable work experience, in addition to helping them build their professional network. Journalists who commented on this program noted Lee's status as an honors student and declared that "only students of Mr. Lee's calibre will be chosen for this program."[38] The following year, Evelyn C. Dixon, a senior at Elizabeth City State College, another HBCU, secured a summer mathematics job at NASA as well.[39]

By 1972, this individualized trainee program had transformed into a technician apprenticeship program for cohorts of twenty college students at a time. To be eligible for admission into this program, students had to take a competitive two-hour examination. Those who passed the exam and the application process would receive a combination of on-the-job training and classroom instruction and could choose the following career tracks: sheetmetal worker, wood model maker, test facility mechanic, electrician, machinist, aircraft mechanic, and electronic instrument mechanic.[40] For high school students in the Hampton school district's Gifted Students Program, NASA created a paid eight-week summer enrichment experience.

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[36] "Equal Employment Policy Cited," *Langley Researcher* 4, no. 3 (1965): 7, accessed November 12, 2018, https://crgis.ndc.nasa.gov/crgis/images/7/77/LARC1965.pdf.
[37] "Norfolk Stater At Space Center," *New Journal and Guide* (Norfolk, VA), July 3, 1965.
[38] "With Space Agency: Trainee Program Begun in Engineering, Physics," *New Journal and Guide* (Norfolk, VA), July 25, 1964.
[39] "Assistant to Mathematics Major," *Norfolk Journal and Guide* (Norfolk, VA), May 28, 1966.
[40] "Langley to Train 20 Technician Apprentices," *New Journal and Guide* (Norfolk, VA), June 24, 1972.

Participating students assisted technicians in wind tunnels, computer programming, and more, while simultaneously receiving job training.[41]

Throughout the 1970s, NASA worked to strengthen its relationships with HBCUs as institutions, in addition to hiring their graduates. The Langley Research Center hosted a seminar in 1973, in which representatives from 14 "minority colleges" from across six states were in attendance. The organizers of the seminar had three goals: fortifying the relationships between Langley and the colleges, discussing ways to implement equal employment initiatives, and raising awareness about Langley's job opportunities and employment goals.[42] Along with this initiative, NASA offered technological services to certain schools. In 1972, the astrochemistry branch of the Goddard Space Flight Center loaned laboratory equipment to the chemistry department of Morehouse College in Atlanta for projects such as research on interstellar molecules and electron paramagnetic resonance.[43] Later on, NASA aligned itself with North Carolina's A&T State University to develop commercial satellites that they predicted could assist in the process of identifying Black and Chicano students who could potentially become engineers.[44] Moreover, the Langley Research Center hired Hampton University African-American studies professor Alvin F. Anderson as a full-time Equal Opportunity Officer in 1972.[45]

With each of these myriad diversity efforts, NASA administrators invoked the concepts of affirmative action and equal opportunity in their messaging. They framed their initiatives as manifestations of a duty to correct legacies of segregation and general racism. Even so, the

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[41] "Gifted Students Participate in Langley Job Program," *New Journal and Guide* (Norfolk, VA), August 3, 1979. All of the programs listed in this paragraph were open to both male and female students, but the articles do not report the gender distribution of the participants.
[42] "NASA Has Rap Session With Black Colleges," *New Journal and Guide* (Norfolk, VA), November 24, 1973.
[43] "Space Center Equipment at Morehouse," *New Journal and Guide* (Norfolk, VA), April 19, 1972.
[44] "Black Colleges Join NASA in Satellite Project," *New Journal and Guide* (Norfolk, VA), July 30, 1977.
[45] "Job Equality Position to Hampton Prof.," *NEw Journal and Guide* (Norfolk, VA), July 15, 1972.

administrators did not simply perform the bare minimum in approaching this duty. On the contrary, they formulated direct community ties and pipelines that facilitated greater access to employment for Black people.

Conclusion

The Cold War era in the United States is replete with examples of various federal government agencies failing to honor wartime antiracism promises, including mass firings, neglect of schools, and redlining and housing discrimination. Although NASA was by no means a perfect model for racial justice—no agency ever could be—the fact that they made such purposeful and persistent strides to diversify their ranks is certainly noteworthy. These strides bore a modest amount of success over time and mirrored diversification trends taking place in the federal government as a whole. Between 1961 and 1965, there was "a net increase of 50 percent employment in grades GS-5 through 8, 100 percent in grades GS-8 through 11 and 172 percent in grades GS-12 through 18" among workers of color. By 1965, NASA had 92 Black employees in the upper grades.[46] By 1984, 8.4 percent of its engineers were Black, which may not sound like much until one considers that that proportion is just a few percentage points of the proportion of Black people in the U.S. population as of 1980: 11.7 percent.[47-48]

Of course, NASA's implementation of equal employment opportunity policy was not wholly altruistic. Having greater numbers of visible Black employees was crucial for the United States' image abroad, as evidenced by the fanfare surrounding the space station operators in

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[46] Rosemarie Brooks, "Number of Negroes in Top Jobs Still Slight Minority: More Heads Will Roll in Anti-Poverty War Probe," *New Journal and Guide* (Norfolk, VA), December 25, 1965.
The abbreviation "GS" means "General Schedule" and refers to the rank of federal employees.

[47] Shetterly, *Hidden Figures*, xiv.

[48] Cambell Gibson and Kay Jung, "Historical Census Statistics On Population Totals By Race, 1790 to 1990, and By Hispanic Origin, 1970 to 1990, For Large Cities And Other Urban Places In The United States," (Working Paper No. 76, Washington, D.C., 2005), Table A-1.
https://www.census.gov/population/www/documentation/twps0076/twps0076.pdf

Kano, Nigeria referenced above. This use of race to accomplish international relations goals is an example of an idea in Afrofuturism: race (or Blackness) as technology. Social scientists have long accepted that race is a social construct not grounded in biology. This assertion then raises the question: if race is an invention, for what purpose was it invented. Putting forth the concept of race as technology, Afrofuturists argue that, although race has been an instrument for maintaining the social order, through improvisation and a method called "chitlin' hacking"—"using the thing that was supposed to kill you to survive"—race can take on new, more liberatory meanings.[49] Thus, race was a technology that allowed for NASA to help improve relationships abroad, while simultaneously undermining Jim Crow domestically.

Discursively, NASA administrators made it clear that continued scientific progress was not feasible without progress in race relations and inclusion of Black people and other people of color. It was not inevitable that this conceptual link would occur, as Paul and Moss comment, "a country does not end race discrimination by going into outer space and putting an astronaut on the Moon."[50] Rather, the administrators were purposeful in promoting a future in which Black people were not simply tolerated, but treated as an integral and necessary part.

[49] John Jennings, "Sequential Sankofa: Critical Nostalgia, Afrofuturism and the Black Comix Archive" (presentation, Afro-Futurism Symposium, Boston, Massachusetts, September 21, 2018.
[50] Paul and Moss, *We Could Not Fail*, 72.

The Prosperity of Computing

Overview

Between 1941 and 1970, Black women employed as computers witnessed monumental changes in their profession and in national racial politics, all in a relatively short amount of time. The earliest among them toiled in near total obscurity, but as time went on, they found themselves in positions where they could make pivotal scientific and mathematical discoveries. In this chapter, I begin by outlining how Black women began receiving opportunities for employment as computers. Next, I describe how their profession and other federal posts contributed to the economic affluence for their communities and for their personal intellectual fulfillment. After that, I explain how specific computers attempted to recruit members of their community into science professions. My main argument here is that computers had positions that were enriching both financially and from a job satisfaction standpoint, a rarity for Black women in this period.

Early Black Computers at Langley

From the mid-1930s through the 1960s, the National Advisory Committee for Aeronautics (NACA) (and later the National Aeronautics and Space Administration (NASA)) employed computers. In the context of this thesis, the term "computer" refers to a person more often than a device. Specifically, it denotes a person who performs complex calculations in support of engineers. NASA did begin using computers (the devices) in the early 1960s, and the roles of the computers (the mathematicians) increasingly evolved to include programming.[1] Before the invention of computing devices, sea captains, engineers, and writers of almanacs sought the assistance of computers (the people) to free themselves for tasks they deemed more

[1] "Edited Oral History Transcript: Annie J. Easley," *NASA*, July 16, 2010, accessed March 14, 2018. https://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Herstory/EasleyAJ/EasleyAJ_8-21-01.htm.

important. Because of the tedious, repetitive labor involved in the calculations that computers performed, employers have historically undervalued the role.[2] In the United States, women started entering the computing field during the Civil War, taking the place of men who were taking up arms. By the early twentieth century, most computers were women.[3]

NACA began employing Black people as federal employees in 1943, in compliance with President Franklin Delano Roosevelt's 1941 Executive Order 8802, which provided "for the full and equitable participation of all workers in defense industries, without discrimination" and initiated a Committee on Fair Employment Practice to enforce this provision.[4] President Roosevelt issued this executive order partially in response to pressure from civil rights activist A. Philip Randolph. The head of the Brotherhood of Sleeping Car Porters, the biggest Black labor union in the United States at that time, Randolph threatened to organize one thousand protestors to march on Washington in the summer of 1941 if the Roosevelt administration did not act decisively to end discrimination in war-related jobs.[5]

Although Executive Order 8802 did not establish protections against gender discrimination specifically, Black women who would come to work at NACA still benefited. Because NACA's computing pools were already overwhelmingly female, the computer designation was simply the logical title to assign to them. Meanwhile, Black men filtered into engineering positions. Despite the similarity in responsibilities between computers and engineers, engineers received a higher salary.[6] Still, the computing profession was attractive because it provided job opportunities for educated women besides teaching, a profession that, in

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[2] Sue Bradford Edwards and Duchess Harris, Hidden Human Computers: The Black Women of NASA (Minneapolis, MN: Essential Library, an Imprint of Abdo Publishing, 2017): 5.
[3] *Ibid.*, 24.
[4] Exec. Order No. 8802, 3 C.F.R. 1 (1941).
[5] Margot Lee Shetterly, *Hidden Figures: The American Dream and the Mathematicians Who Helped Win the Space Race*, (New York, NY: William Morrow, an Imprint of HarperCollins Publishers, 2016): 5-6.
[6] Edwards and Harris, *Hidden Human Computers*, 59.

the first half of the twentieth century, was the most esteemed position to which women could aspire. For middle-class Black women, teaching was a respectable, professional career that allowed them to engage with their subject expertise. Yet, the women who eventually became computers found that, despite their status as "subprofessionals," their salaries were higher than those of teachers.[7]

The Langley Memorial Aeronautical Laboratory, the headquarters of NACA, had established its first computing pool in 1935 with five white women. Among those initial recruits was Virginia Tucker, who took it upon herself to tour white women's colleges throughout the South in order to recruit even more computers. By 1946, Tucker was the supervisor of the computing department, which now employed approximately 400 women.[8] Although President Roosevelt's executive order made it possible for Black women to be employees at Langley Laboratory, the inside of the facility still had segregated work quarters, cafeterias, and restrooms. After all, the state of Virginia still had statutes dictating separate but equal public spaces.[9] This organization of work allowed for Black computers to contribute to the overall collective labor of Langley Laboratory while remaining mostly out of sight. They would receive instructions from and report to white engineers and head computers above them, keeping the racial hierarchy intact. The West Area section, which was the workspace designated for Black women, doubled the physical size of the Langley facility when completed in 1943.[10] It was not until May 5, 1958

[7] *Ibid.*
[8] Sarah McLennan and Mary Gainer, "When the Computer Wore a Skirt: Langley's Computers, 1935–1970," *NASA*, November 25, 2016, accessed July 27, 2018, https://www.nasa.gov/feature/when-the-computer-wore-a-skirt-langley-s-computers-1935-1970.
[9] Shetterly, *Hidden Figures*, 43-44.
[10] McLennan and Gainer, "When Computers Wore a Skirt."

that NASA disbanded the West Area division, fully integrating Langley and allowing all the computers who had worked there to work in other sections of the facility.[11]

Nearly 50 known Black women were employed as computers at Langley Laboratory between 1943 and 1980.[12] Many Black employees had learned about NACA and NASA through newspaper articles, especially in *The Norfolk Journal and Guide*. These articles took the form of announcements congratulating specific individuals who had secured employment at Langley, as well as general calls for applications. A 1943 article in this publication applauded Pearl Bassette, Yvette Brown, Minnie McGraw, Miriam Mann, and Thelma Stiles for completing the Engineering, Science, and Management War Training (ESMWT) program at Hampton Institute. Among the first female graduates of this program, they acquired civil service jobs just weeks after completing their studies.[13] In 1947, an article calling for applications to a variety of civil service jobs at Langley, mostly involving operating or repairing machinery, appeared. The article's author assured readers that everyone who passed the civil service exam and had relevant experience would receive consideration for the open positions.[14] In wartime, the need for competent workers with backgrounds in the sciences was a nationwide concern, so much so that the United States Civil Service Commission had "modified the requirements for four types of scientific positions in an effort to secure additional qualified persons."[15] Thankfully for NACA, Langley was able to satiate its appetite for educated, industrious workers in no small part because of its location in Hampton, Virginia.

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[11] Shetterly, *Hidden Figures*, 171.
[12] *Ibid.*, xvi.
[13] "Four Women 'Engineers' Begin Jobs," *New Journal and Guide* (Norfolk, VA), May 22, 1943.
[14] "Civil Service Jobs Open at Langley Field," *New Journal and Guide* (Norfolk, VA), July 26, 1947.
[15] "More Scientists for Civilian War Positions Needed," *New Journal and Guide* (Norfolk, VA), July 4, 1942.

Hampton has a legacy of Black prosperity dating back to the antebellum era. Slaves at that time had more freedom than those elsewhere in the country, and they had close bonds with free Blacks. After the Civil War, Hampton became a key regional headquarters for the Freedmen's Bureau, and Northern white missionaries chose the town as the site for the Hampton Institute, which was then a training college for teachers.[16] Between 1880 and 1886, the number of Black professionals there more than doubled.[17] Though this prosperity did start to decline at the turn of the twentieth century due to "Southern white racism, Northern white indifference or hostility, unstable economic conditions, and corrupt political ones," knowing this background is helpful for understanding the foundation on which Langley and its employees stood.[18]

At the height of World War II, almost everyone living in the vicinity of Langley—specifically the cities of Hampton, Norfolk, and Newport News—worked in positions contributing to the war effort in some capacity or serving those that did.[19] Because of the immense need for labor, employers relaxed discriminatory practices. Just one week after Japan officially surrendered, however, private sector industrial firms and retail companies laid off at least 500,000 Blacks across the country. Responding to a slew of war contract terminations, these employers returned to their pre-war policy of accepting applications from white people only. According to the San Francisco chapter of the NAACP, Black ship construction workers at Kaiser Company's Richmond, California shipyards faced the most drastic rate of job loss.[20] By contrast, Langley Laboratory did not follow suit in these race-based firings. As part of a federal agency, it was still adhering to Executive Order 8802. In fact, later on, when NACA transformed

[16] Robert Francis Engs, *Freedom's First Generation: Black Hampton, Virginia, 1861-1890* (University of Pennsylvania Press, 1979): xvii.
[17] *Ibid.*, 199.
[18] *Ibid.*, 200.
[19] Shetterly, *Hidden Figures,* 28-29.
[20] "Jobs Open for Whites Only: 500,000 May Soon Be Jobless; Big Firms Set Up Restrictions," *New Journal and Guide* (Norfolk, VA), September 1, 1945.

into the National Aeronautics and Space Administration (NASA) in 1958, many of the people who had worked for NACA seamlessly transitioned their employment to the new agency.[21]

This job security surely played no small part in the establishment of Black suburban housing developments towards the end of the war. Notable among these is the Mimosa Crescent housing project, begun in 1944 in the Wythe District of Elizabeth County near Newport News, Virginia. The developers Tarsus D. Lane, William R. Walker, Jr., and Dr. Russell E. Reid were interested in "preserving and expanding housing gains for Negroes after the war."[22] Attorneys from the Walker & Walker law firm who acted as legal advisers for the developers delighted in the fact that this housing project was "being developed by Negroes with Negro capital and ideas for Negro occupancy."[23] Just two years after initiating this project, the developers added a second division to it.[24] The near immediate success of this endeavor is evidence of the relative economic stability of the Black inhabitants of the Norfolk, Virginia area. Black computers and other federal employees living there had the good fortune to be able to ascend into a comfortable middle class, put down roots, and create a vibrant community.

Given the "romantic hyperbole" ascribed to NASA, one might assume that the computers were uniformly excited about all things-space related. In reality, there was a range in enthusiasm.[25] On the one hand, Annie J. Easley, of the NASA Glenn Research Center at Lewis Field in Cleveland, Ohio, recalled in a 2001 oral history interview that she and her coworkers felt excited about having the opportunity to put a man on the moon. According to her recollection,

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[21] "Edited Oral History Transcript: Annie J. Easley," *NASA*, July 16, 2010, accessed March 14, 2018. https://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Herstory/EasleyAJ/EasleyAJ_8-21-01.htm.
[22] W.R. Walker, Jr. "Mimoso [sic] Crescent, Post-War Housing Project Started," *New Journal and Guide* (Norfolk, VA), July 15, 1944.
[23] *Ibid.*
[24] "Mimosa Crescent Project Expanded," *New Journal and Guide* (Norfolk, VA), March 23, 1946.
[25] Richard Paul and Steven Moss, *We Could Not Fail: The First African Americans in the Space Program* (Austin, TX: University of Texas Press, 2015): 9.

> I think we were proud and we still are. I say "we." I still talk in the present. I retired a few years ago …. There was a real pride in being able to have talent, resources, and knowing that we could get in here and really, really do something great. I mean, the work that we had been doing here had been not known. Not publicly, but there was a lot of research going on with the quiet, the jet, the pollution. A lot of stuff was going on, but when we became a part of the space effort, there was a real jump in there and we're going to do it.[26]

On the other hand, Katherine Johnson of Langley Laboratory remarked, "We didn't give that too much attention at all," when asked about her interpretation of the nationwide excitement over developments in rocket technology. [27]

Regardless of the degree to which individual computers felt connected to the concept of space exploration, it is clear that many of them made significant strides in their fields. By the time she retired in the 1989, Easley had achieved notoriety for her research in software engineering for launch vehicles.[28] In 1960, Johnson co-authored a scientific paper entitled "Determination of Azimuth Angle at Burnout for Placing a Satellite Over a Selected Earth Position," which outlined the process for figuring out the angle at which to launch spacecraft into orbit.[29] Christine Mann Darden became an expert on minimizing the effect of sonic booms in supersonic flight.[30] Finally, Dorothy Vaughan became the first Black woman to lead a computing pool, and Mary Jackson transitioned to a specialist role in NASA's Equal Employment Opportunity office after years as an aeronautical engineer.[31-32]

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[26] "Edited Oral History Transcript: Annie J. Easley."

[27] Katherine G. Johnson (The HistoryMakers A2012.017), interviewed by Larry Crowe, February 6, 2012, *The HistoryMakers Digital Archive.* Session 1, tape 2, story 7, Katherine Johnson talks about her introduction to aeronautics.

[28] "Edited Oral History Transcript: Annie J. Easley."

[29] Katherine G. Johnson (The HistoryMakers A2012.017), interviewed by Larry Crowe, February 6, 2012, *The HistoryMakers Digital Archive*. Session 1, tape 3, story 7, Katherine Johnson talks about her publications.

[30] Christine Darden (The HistoryMakers A2013.045), interviewed by Larry Crowe, February 26, 2013, *The HistoryMakers Digital Archive*. Session 1, tape 5, story 4-5, Christine Darden describes the sonic boom problem - parts one and two.

[31] Beverly E. Golemba, *Human Computers: The Women in Aeronautical Research*, unpublished manuscript, donated to NASA Cultural Resource Geographic Information System (NasaCRgis) on March 6, 1995, accessed March 14, 2018. https://crgis.ndc.nasa.gov/crgis/images/c/c7/Golemba.pdf.

In several oral histories, Black computers humbly downplayed the impact that they had as elite scientists and mathematicians. Part of this modesty had to do with the classified nature of their projects; for a long time, they probably were not allowed to speak about the specifics of their work. It is also reasonable to infer that gender expectations played a role in their demureness. Even so, Black newspapers were some of the most outspoken cheerleaders of these women. Acknowledging how the pomp and circumstance of the space age tended to obscure the mathematicians whose labor made rockets fly, Alice A. Dunnigan of *The Norfolk Journal and Guide* highlighted Melba Roy and Dorothy Hoover, two Black women who worked at the Goddard Space Flight Center in Greenbelt, Maryland. Her 1963 article outlines the specific tasks that the women performed on a day-to-day basis, their educational backgrounds, professional ranks, and salaries. Dunnigan, a pioneer herself as the first Black woman to be a correspondent for the White House and a recipient of over 50 journalism awards, took care to illustrate Roy and Hoover fully, highlighting their personal hobbies as well as their on-the-job roles.[33] A journalist for the *Pittsburgh Courier* dubbed Katherine Johnson "one of the most brilliant mathematicians of the present era" for her painstakingly accurate calculations of John Glenn's 1962 spaceflight.[34]

Thus, the computing profession not only provided financial security; it also carved out a unique space for Black women trained in science, technology, engineering and mathematics (STEM) disciplines to have intellectual fulfillment and even public recognition. Given these rewarding attributes, some computers could not keep this prosperity to themselves.

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[32] Champine, Gloria R., "Mary Jackson," *NASA*, 2005, accessed November 3, 2018, https://crgis.ndc.nasa.gov/crgis/images/4/4a/MaryJackson.pdf.
[33] Alice Dunnigan, "Two Women Help Chart the Way for the Astronauts," *The Norfolk Journal and Guide* (Norfolk, VA), July 6, 1963.
[34] "The Story of Katherine Johnson: Lady Mathematician Played Key Role in Glenn Space Flight," *The Pittsburgh Courier* (Pittsburgh, PA), March 10, 1962.

In previous chapters, I have discussed the strategies that HBCUs and NASA utilized to encourage Black students to pursue STEM professions. Black computers, too, made efforts to entice their children and members of their community to space-related professions and other science fields, though not necessarily through formal recruitment programs. Even in her retirement, Christine Darden has continued tutoring children in math. Speaking in 2013, she lamented the present state of public schooling, as well as the credentialed math and science teachers who move on to other fields after a year or two. As a leader in her church, she has advocated that her church community adopt struggling schools in the surrounding area.[35]

Mary Jackson, who began as a computer at Langley but was an aeronautical engineer by the 1960s, was exceptionally active in recruitment. She frequently attended career days and similar events at Black schools in her area. In 1963, she partnered with her white coworker Emma Jean Landram to give a speech to members of the junior council of the National Council of Negro Women on the importance of training more women engineers, emphasizing high school and university coursework relevant to this career path.[36]

Later in life, Jackson founded a science club at the King Street Community Center with sponsorship from the National Technical Association. She also advised a group of nine middle and high school children "in the building of a Smoke Tunnel for the study of air flow characteristics around airfoils."[37] When asked about her motivation for being so active in her community, she remarked, "We have to do something like this to get them interested in science.

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[35] Christine Darden (The HistoryMakers A2013.045), interviewed by Larry Crowe, February 26, 2013, *The HistoryMakers Digital Archive*. Session 1, tape 7, story 4, Christine Darden describes her concerns for the African American community and for the current American educational system.

[36] "Girls Group Hears Talk by 2 Women Engineers," *Norfolk Journal and Guide* (Norfolk, VA), February 16, 1963.

[37] "Personnel Profiles," *Langley Researcher* 15, no. 1 (1976): 5, accessed November 14, 2018, https://crgis.ndc.nasa.gov/crgis/images/0/0a/LARC1976.pdf.

Many times, when children enter school they shun mathematics and science during the years when they should be learning the basics."[38]

Darden and Johnson are just two examples of computers who took recruitment into their own hands. No doubt, they recalled the importance that mentorship had played in their own lives and sought to pay it forward. I suspect that there were more computers who were active in their community in similar capacities but who did not receive as much attention. Consequently, an opportunity for further research would be to uncover the influence that computers had outside of their work lives.

Conclusion

Being a computer for NASA was not just any job. The computers described above could have simply clocked in, clocked out, gone home, and paid bills. Instead, some of them felt a sense of responsibility to uplift their communities. For Black women in this specific context, the science fields may not have been a panacea, but they were not uniformly the dead end that W.E.B. Du Bois had described decades prior.[39] The computers did not necessarily receive recognition in their communities as NASA workers; as Shetterly articulates, "The black NASA people spread out among other black professionals, where they were better known as the sorority sister or the member of the church choir or the diehard Hampton institute alum …. Their neighbors might know they worked at NASA but have no concept of exactly what they did."[40] Still, they leveraged those prized personal connections to evangelize a life in STEM as a career path for economic security and mobility.

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[38] *Ibid.*
[39] W.E.B. Du Bois, "The Negro Scientist," *The American Scholar* 8, no. 3 (1939).
[40] Shetterly, *Hidden Figures*, 242.

The life stories of Black computers are relevant not only to United States history, but also to the development of Afrofuturist thought. Ytasha Womack has claimed that Afrofuturism is inherently feminist and womanist, in that it gives a space for Black women to "dig behind the societal remainders of blackness and womanhood to express a deeper identity and then use this discovery to define blackness, womanhood, or any other identifier in whatever form their imagination allows."[41] Moreover, Afrofuturist study helps situate Black computers within a long legacy of Black astronomers, as opposed to assuming that their roles were entirely new at the time. This legacy extends from Dogon, Igbo, Yoruba, and other African tribes, to fugitive slaves who navigated using constellations, to inventors of the industrial revolution, and beyond.[42]

[41] Ytasha Womack, *Afrofuturism: The World of Black Sci-Fi and Fantasy Culture,* (Chicago: Chicago Review Press, 2013): 101.
[42] *Ibid.*, 91-96.

Conclusions

In numerous speeches and interviews, Dr. Mae Jemison, the first Black woman in space, has stated that her initial inspiration for pursuing a career as an astronaut was watching the original *Star Trek* series as a child. In her keynote address to the 2013 Race in Space conference at Duke University, she emphasized how Nichelle Nichols' portrayal of Lt. Uhura influenced her to aspire beyond stereotypical expectations of Black women. To this day, Dr. Jemison uses her platform and notoreity—and has even had opportunities to partner with Nichols—to influence students of color to become interested in science and math.[1]

For the Black computers at NASA, science fiction likely was not a motivator for their career paths as it was for Jemison. They would certainly not have been familiar with the term Afrofuturism. Nevertheless, the process of incorporating Black people into science and math fields as an act of Afrofuturism, even if it was not consciously intended as such. After all, Ytasha Womack and subsequent scholars have also felt comfortable in retroactively identifying historical figures as being pillars of Afrofuturism, namely the musicians Sun Ra and George Clinton, and the writer Octavia Butler.[2]

Within this project, some ideas that come from Afrofuturist thought—Blackness as alien, race as technology, and womanist/Black feminist frameworks—have been vital for analysis. Another aspect of Afrofuturism that is relevant not only to this study, but to other historical scholarship is that of speculation. Filmmaker Cauleen Smith has defined Afrofuturism as "speculating about the past and speculating on the future while reconfiguring the present tense."[3]

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[1] Kat Eschner, "This Groundbreaking Astronaut and Star Trek Fan Is Now Working on Interstellar Travel," *Smithsonian.com*, October 17, 2017, accessed December 17, 2018, https://www.smithsonianmag.com/smart-news/groundbreaking-astronaut-and-star-trek-fan-now-working-interstellar-travel-180965277/.

[2] Ytasha Womack, *Afrofuturism: The World of Black Sci-Fi and Fantasy Culture*, (Chicago: Chicago Review Press, 2013).

[3] *Ibid.*, 137.

Although science fiction and historical fiction have often been the means through which Afrofuturists have used speculation, historians can and have incorporated speculative practices in order to better understand real people, places, and events. For example, in her 2008 article "Finding Fatima, A Slave Woman of Early Modern Spain," Mary Elizabeth Perry introduces an approach that she calls "reading against the grain." This approach involves "looking beneath surface meanings for subtexts and silences" in order to "resuscitate lost voices." Perry developed this strategy in order to compose a biography of a Moor woman—Fatima—for whom there is only one known archival record, a Spanish Inquisition report from 1584.[4] Likewise, in the 2016 book *Slavery's Metropolis: Unfree Labor in New Orleans during the Age of Revolutions*, author Rashauna Johnson incorporates what she calls "informed speculation," in which she considers "multiple possibilities embedded in each scene" of the history that she is constructing. Moreover, while her analysis mainly has basis in archival research, she also consults literature and critical theory, a necessary method given that most of the subjects whom she is studying were illiterate and left no records speaking for themselves.[5]

Of course, the Black computers who worked at NACA and NASA between 1941 and 1970 are not in the same position as the slaves whose narratives Perry and Johnson have brought to light. After all, the computers were well-educated, middle-class, and have varying levels of presence in archival collections. Some, such as Katherine Johnson and Christine Darden, are still alive, as of the writing of this thesis, and have been able to continue providing their perspectives through interviews with journalists and historians. Nevertheless, the legacy of their contributions to the sciences and to racial justice efforts has been and continues to be obscure. After all, as

[4] Mary E. Perry, "Finding Fatima, A Slave Woman of Early Modern Spain," *Journal of Women's History* 20, no. 1 (Spring 2008): 153.
[5] Rashauna Johnson, introduction to *Slavery's Metropolis: Unfree Labor in New Orleans during the Age of Revolutions* (New York, NY: Cambridge University Press, 2016): 19-21.

Norfolk Journal and Guide journalist Alice A. Dunnigan described in 1963, most Americans at the time were "much concerned with the heroic adventures of those brave astronauts who have made history by soaring around the Earth in space" while paying little attention to "the work of the ground force which makes these flights possible."[6] Since NASA as an institution has been synonymous with the names of Neil Armstrong, John Glenn, Buzz Aldrin, and other white male astronauts, the unglamorous and often tedious labor of women in general and Black women in particular in the space race has only recently begun to receive widespread attention. To uncover the Black computers' stories in the first place, speculation, the act of asking, "What if NASA's veneer was not as white and male as it has historically appeared?", has been essential to the research process of others who have come before me, namely Beverly E. Golemba, Richard Paul, Steven Moss, and Margot Lee Shetterly.

Howard Zinn and other social historians of the mid- to late twentieth century have revealed time and time again that the study of history does not simply involve faithfully recording chronologies passed down from on high. On the contrary, historical analysis can feature, and often require, a surprising amount of creativity and experimentation. The constructed nature of history is a topic of discussion not only in the humnities and social sciences, but even in the natural sciences. Dr. Fred Alan Wolf, a quantum physicist who specializes in connections between physics and consciousness, has articulated that "The past is being created as much as the future."[7] This statement takes on an intriguing significance in light of ongoing debates within the field of physics about whether or not time itself is truly linear.[8] As

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[6] Alice Dunnigan, "Two Women Help Chart the Way for the Astronauts," *The Norfolk Journal and Guide* (Norfolk, VA), July 6, 1963.

[7] Fred A. Wolf, "Time, Space, Matter & Quantum Field Theory," interview by Lilou Mace, YouTube, January 27, 2012, accessed December 12, 2018, http://www.youtube.com/watch?v=SqzHGIbSgH0&t=26m12s.

[8] Dan Falk, "A Debate Over the Physics of Time," Quanta Magazine, July 19, 2016, accessed December 13, 2018, https://www.quantamagazine.org/a-debate-over-the-physics-of-time-20160719/.

oxymoronic as it may seem, a future studies discipline like Afrofuturism can help historians grapple with the challenges of interpreting the past.

In this thesis, I have mapped the invigoration of historically Black colleges and universities (HBCUs) in wartime, the genesis and development of the space age in the United States, and the economic prowess of Black computers. It has been a study integrating space history, civil rights history, labor history, and the history of Black women in the United States. The topics represented in this thesis is salient because it helps bring more attention to individuals and interpersonal and organizational connections that have been obscure, yet impactful. Moreover, this work presents an experimental framework that will likely prove useful to others.

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