

# The Aerospace Industry's Impact on 20th Century American Society

Aniket Martins<sup>1</sup> and Anna Newberg<sup>#</sup>

<sup>1</sup>Fairfield Ludlowe High School

<sup>#</sup>Advisor

## ABSTRACT

Since the dawn of mankind, the stars have been an inspiration for humanity. From the studies of the Greeks and the observations of the Indians and Chinese to Da Vinci's plans and the research of the Wright Brothers, exploring the sky, space and stars has always been at the forefront of human ingenuity. In the United States, the idea of flight exploration began in the early 1900s: a true embodiment of the American dream. This paper examines developments in politics, economics and social movements in 1900s America while contrasting claims with counter arguments and exposing continuities in U.S. history to discuss the impact of the aerospace and defense industry on U.S. society. From Women's Rights and Civil Rights to military and economics, the growth of the aerospace and defense industry paralleled a period of radical growth for American society creating lasting changes in the process.

## **Introduction and Background**

Since the dawn of mankind, the stars have been an inspiration for humanity. From the studies of the Greeks and the observations of the Indians and Chinese to Da Vinci's plans and the research of the Wright Brothers, exploring the sky, space and stars has always been at the forefront of human ingenuity. In the United States, the idea of flight exploration began in the early 1900s and has exploded into new frontiers. A true embodiment of the American dream spirit, space exploration and aerospace have been a driving factor behind developments in America across the 20th century.

The Wright Brothers first flight is widely recognized as the inaugural experiment of U.S aviation. Throughout the 20th century, aviation became a critical component of both World Wars with Russia and Germany leading the world in military aviation research. In contrast, aviators in the U.S used planes principally for sport, and plane races were common. Throughout this time, aviators were seen as innovators at the forefront of human capability. The Space Race with the Soviet Union left an entire generation of Americans captivated by the study and exploration of space. The military industrial complex, a product of this period of competition, remains a powerful body for monetary and military gains across the world. All of this began in the late 19th and early 20th century when two bike-repair brothers grew curious about the final frontier of human exploration: the skies. The growth of aviation, space exploration and development of aerospace in America boosted Women's Rights, Civil Rights and the U.S economy throughout the 1900s, in a manner similar to other movements and societal changes over time.

## **Aerospace in Women's Rights**

Since the dawn of the aviation industry, men and women have been responsible for the increasing popularity of flight. In fact, women in flight were seen as a harbinger of a more gender-equal future. Seeing women aviators

in the sky like Bessie Coleman, the first African American to earn a pilot's license and a legendary athlete, was an inspiration for millions (“Working Women”). Coleman in particular broke both gender and racial stereotypes simultaneously, as she got her pilot's license before any African American *man*. Due to the novelty of flight, racial and gender stereotypes did not limit Coleman as much as other established professions with high demographic barriers of entry. The sky represented a new frontier where the cynicism of racism was not as prevalent as the ground.

Bessie Coleman's achievements represent an important continuity in American history: for widespread change to take hold, society needs an example first. Frederick Douglas put a name and face to the abolition movement with his ability to read, write and speak with eloquence that surprised white audiences. American women who worked on the homefront during WWII also exemplified this spirit (Dubrulle). As they took on heavy industry and business roles vacated by men, social norms shifted away from the association of women with strictly domestic roles. Although women were laid off in the immediate aftermath of the war, their changing role in society marked a huge success for second wave feminism. The additional savings generated from women's work during WWII contributed to the economic prosperity of the 1960s and the presence of women in the workforce set precedent for decades to come (National Archives, 2016). Much like Frederick Douglas led the fight for abolition, Bessie Coleman led the fight for women's rights by leveraging publicity to become a role model and example for her movement (“Frederick Douglass”).

The 1970s were a remarkable time for women in the United States. Inspired by the progress already made during the 1960s, women across the U.S shattered the glass ceiling. In 1978, Sally Ride, Kathryn Sullivan, Anna Fisher, Margaret Rhea Seddon, Judith Resnik, and Shannon Lucid became the first six female astronauts (Wayne). They went on spacewalks, commanded shuttles, and modeled aerospace excellence. After the explosion of media attention their accomplishments got in the 1980s, NASA noted an uptick in the number of women engineers and aerospace employees. Sally Ride has become an American icon, and a Presidential Medal of Freedom recipient. Her story is taught to children in elementary schools along with the Wright Brothers and Neil Armstrong. The inclusion of these women in the space program and their role as astronauts inspired a generation of women in STEM. Their legacy and continued presence in modern education reinforces the success of aerospace engineering as a means to equality.

Although Sally Ride is generally taught secondary to Neil Armstrong in aerospace history, Amelia Earhart, American aviatrix and legend, is a particularly well known figure in aerospace history. Initially considered an understudy to Charles Lindberg, famous American pilot, she proved to be a hero of her own accord. Although she was known as Lady Lindberg and was the first *woman* to achieve many records, she became the first human to fly from Hawaii to California, LA to New Mexico and completed a number of demanding journeys (“Amelia Earhart”). She established herself not only as Lady Lindberg, but as Amelia Earhart: independent and fierce American aviatrix. She brought equality of the genders into the media and public sphere only a couple years after women had even been granted the right to vote. Given the time, it is nearly impossible to consider any field other than aviation that could have given a woman this kind of visibility: yet another indication of aviation and aerospace revolutionizing American life through the Women's Rights movement.

Some might claim that the aviation industry did not actually change society, rather that the aviation industry changed in response to changes in society. A detailed examination of Amelia Earhart's life reveals more nuanced details. In August of 1939, months after she died, The New York Times wrote an article about her career — a summary of a biography written about her, *Soaring Wings*, and it goes into detail about her training and her life. She is celebrated for her work as a woman's rights advocate while being applauded for her femininity. The article states that she was a “graceful, well-bred, lovely woman who could step in evening dress into her plane from the White House dinner table and drive Mrs. Roosevelt without even taking the white gloves off her slender hands” (Katherine Woods [Page 1]). In the modern world, this is an objectifying statement, but at the time, this was revolutionary. Amelia Earhart, someone who would not have had the ability to vote a couple years before, got to meet with the President and drive around with his wife. She used her platform as an

aviator and aerospace pioneer to impact monumental change in the U.S, and history remembers her as a hero for it. A trailblazer of American history, Earhart and aviation impacted American society at the core: her career was not merely the product of a changing society, it was the force behind change itself.

## Aerospace in Civil Rights

The novelty of aerospace provided a platform for the African American Civil Rights movement for decades in American history, beginning with the Tuskegee Airmen of WWII and U.S Air Force General Daniel James all the way to Ms. Katherine Johnson, a NASA aerospace engineer who changed the field of manned space flight.

During WWII, aviation and planes were critical to military success evidenced by German blitzkrieg attacks and Japanese kamikaze. With the development of fighter jets, highly trained military pilots became a necessity. The Tuskegee Airmen were a group of African American air force troops organized in segregated fighter groups: highly trained and highly successful (Newman). With an unmatched safety record and minimal losses (*Tuskegee Airmen Facts* | *Tuskegee University*, n.d.), the Airmen are credited with persuading President Truman to pass Executive Order 9981, which declared that “there shall be equality of treatment and opportunity for all persons in the armed forces without regard to race, color, religion, or national origin” (“Executive Order”). The Tuskegee Airmen were named after the Tuskegee Institute of Alabama, the all-black school founded by Booker T Washington where they were trained. Their expertise, professionalism and brilliant flight coupled with training from an institute founded by a Civil Rights icon illustrates the impact of aerospace engineering on social movements such as Civil Rights and racial equality.

One of the notable figures to come out of the Tuskegee Airmen group was Daniel James, the first African American to attain the rank of Four Star General in the U.S Air Force. Though denied the right to pilot’s education on account of race, he joined the Army Air Corps Cadet program a few years after earning a bachelor’s degree in physical education from the Tuskegee Institute. He trained many of the Tuskegee Airmen and went on to win several promotions in the Air Force, risking his life and career numerous times by participating in sit-ins and peaceful protests for Civil Rights. He later became one of two people in the country who could launch a nuclear weapon, along with the President. His career in the Air Force as a pilot and a trainer gave him access and leverage to officials on the Hill that was unparalleled (Fredriksen). Without his dream of becoming a pilot and the training of the U.S Air Force Corps Cadet program, he may have never fulfilled his dream or made the strides as an African-American role model that he did.

General James’ role in the Civil Rights movement represents a continuity in American history: having leaders with government connections is critical to success for any reform movement. Dr. Martin Luther King is credited with leadership and Congressional access during the Civil Rights Movement, but James brought a certain prestige and legitimacy that was also critical to the movement. This dynamic is analogous to labor unions in the late 1800s and early 1900s. Workers in groups such as the Knights of Labor or American Federation of Labor, much like the African Americans of the Civil Rights movement, knew that unity would contribute to their political legitimacy and ultimately enhance progress towards their goals. Samuel Gompers, leader of the American Federation of Labor, had power and access to the White House and Capitol Hill (Chidester). In a similar way, General James’ leadership commanded legitimacy, power and respect from all social groups during the Civil Rights Movement, and his career in aerospace was the catalyst for this legitimacy.

While Daniel James made an impact in the Air Force, another African American was making strides towards equality in America’s space ventures; Katherine Johnson, a NASA hero and mathematician/physicist who was instrumental in the Apollo 11 mission: the first manned mission to the Moon. A member of the Spacecraft Controls Branch at NASA, she completed a number of complex calculations for the mission trajectory. As an intersectional minority, Johnson illuminated the path towards equality for both African Americans and Women. She was also the first woman ever listed as an author on a NASA peer reviewed paper. She was directly

responsible for the racial integration of NASA: NASA, or NACA (National Advisory Committee for Aeronautics) as it was called previously, did not have integrated bathrooms while she was working there (Watts). Johnson's work paved the way for racial integration at all NASA facilities. Her career in aerospace, at the forefront of manned space missions, impacted such a high level change in American society. Integrating the very facility which united Americans in the exploration of the final frontier was her ultimate legacy, one spurred on by a robust career in aerospace engineering.

Some may argue that aerospace engineering's impact in Civil Rights was too small or insignificant to impact major change in America since aerospace was a relatively niche industry. However, Katherine Johnson's work at NASA inspired the 2016 movie *Hidden Figures* which explored the struggles of being both female and Black in NASA. The movie was viewed millions of times, and remains popular with school teachers since it is academic and entertaining. The movie is the first ever with a major African American female lead cast to be nominated for Best Picture at the Academy Awards. In this instance, the celebration of aerospace both grew the Civil Rights argument at the time and brought attention to an important historical cause decades after it happened. The movie has been watched by millions and remains a large part of Johnson's, and the aerospace industry's, legacy in the U.S.

## **Aerospace in Politics and Economics**

The growth of aerospace and flight in the U.S provided a substantial boost to the economy and changed government policies over time, in a similar manner to previous historical developments in U.S history.

The post-WWII United States saw a period of unprecedented economic growth. As the U.S established itself as a viable trading partner and world power, the economy responded positively to international collaboration. In the 1950s, the aviation research that had been conducted during the war for military purposes was repurposed to commercial aviation. As a result of subsequent civil advancements, Americans were more connected than ever before through fast, accessible, reliable planes. Initially planes were for the wealthy, but the growth of a type of commercial plane ticket marked the democratization of air travel: coach class. Now referred to as economy class, relatively affordable air travel allowed the middle class to expand beyond their horizons ("Air Travel"). Average Americans who lived in postwar communities could hop on a plane and take a vacation, visit relatives, or move to find new work. The further growth of affordable flights expanded opportunities for the American middle class by connecting the world in a manner only previously dreamed of: a vast success for the American aviation industry influencing the course of American history.

The continued growth of commercial aviation parallels a similar continuity in American history: exploration of frontiers. In the 1800s, commercial aviation was scarcely a dream, but the completion of the Transcontinental Railroad provided a connected network for the American economy. Raw materials, goods, ideas and money flowed with much greater ease throughout the country (Olson). Commercial aviation did the same but at greater speeds across greater distances, even across the oceans. Both developments lead to more economic activity for the nation and proved critical to the future of the U.S at their inception.

The postwar U.S aviation and aeronautics industry also has a more corporate side than passenger aviation: defense contractors and private industry. Defense companies like Lockheed Martin and Northrop Grumman have made billions from contracting with U.S (and other) governments. During the Vietnam War, 72% of U.S aeronautics output came from private companies. In the 1980s, the Pentagon estimates that 6 million Americans were directly employed by aerospace contractors. This development led to investment in factories and offices across the United States (Wasniewski). Communities developed around defense contractors thrive to this day. This is a direct impact, not just an ideological shift, brought to millions of Americans and their communities by the aerospace industry.

The growing economic and social prominence of aerospace led to an increased presence of aerospace discourse and policy in politics. The Democratic Party platform is a document that details the vision and hopes

of the Democratic Party for the upcoming election cycle. In 1968, the Democrats included a detail about the aerospace industry to their official platform. The '68 platform includes information about the U.S' planned commitment to "aerospace research and development for their unimagined promise for man on earth as well as their vital importance to national defense" ("Democratic Party") and the importance of finding metals to make commercial aviation more safe. Incidents like a plane crash with the TWA jet and a United DC-7 in air were unacceptable and became of national importance ("Air Travel"). Congress passed the Federal Aviation Act of 1958 as a response which created the Federal Aviation Administration, an executive agency responsible for the oversight and regulation of commercial aviation.

Republican President Richard Nixon took office in 1969 and led America with a renewed interest in space. He formed the Space Task Group early in his administration and directed the beginning of NASA's Space Shuttle program: the longest NASA program to date (Barber, 2015). The continued economic, political and social prevalence of aerospace in United States society has led to growth across space research and commercial aviation safety. This growth has created a new American society where leaders are encouraged and expected to participate in the aerospace and defense industry: a radical departure from politics merely decades ago.

There exists discussion that the aerospace industry in the U.S has contributed to the environment in a negative way: excessive carbon emissions and climate change. While jet fuel contributes to only 3% of national greenhouse emissions (Overton, 2022), improper energy use and agriculture practices contribute magnitudes more to climate change than aviation (Atkins). Further, research is being conducted in the private sector and academia to move forward from the petroleum based gas guzzlers of the 1900s using biofuels or even electric flight. The future looks bright for sustainability and positive environmental contributions, meaning that aerospace will continue to be a friend to American society, not a foe.

## Conclusion

The 20th century was a period of immense change, growth and prosperity for the United States of America. Part of this change was the growth of a robust aerospace and aviation sector in the nation. The novelty of the sky and its departure from the restrictions of the ground provided an important canvas for a number of transitions in US history. Revolutionaries like Astronaut Sally Ride, Pilot Bessie Coleman, and Aviatrix Amelia Earhart embody the importance of aerospace. The legacy of General Daniel James and Medal of Freedom winner Katherine Johnson continues to illuminate the influence of aerospace in America. Aerospace has proven itself a tapestry for human ingenuity and a sphere for societal changes to occur in harmony with cutting edge technological development.

Even in the modern world, aerospace continues to aid social progression. In the ongoing military conflict occurring between Russia and Ukraine, SpaceX's Starlink satellites have provided signal, communications technology and internet access to hundreds of citizens in areas where prior equipment has been destroyed (Iyengar, 2022). The aerospace industry grew 7.8% supporting 2.2 million American jobs in 2022 and federal legislation like the Creating Helpful Incentives to Produce Semiconductors for America Act continues to provide support for high-tech industries critical to the success of aerospace and defense (PricewaterhouseCoopers, 2023). The potential for societal impact through aerospace and defense is going to continue growing, and in an ever-connected world the impacts will be felt across the world.

As the next generation of the American aerospace community taxis for takeoff, their substantial impact across American history has plotted the path for continued success and it is critical that society continue to guide them to a safe flight and brighter future for all Americans.



## References

- "Air Travel in the 1950s." *American Decades*, edited by Judith S. Baughman et al., vol. 6, Detroit, MI, Gale, 2001, p. 87. *Gale eBooks*, link.gale.com/apps/doc/CX3468301799/GVRL?u=s0518&sid=bookmark-GVRL&xid=c4c77f41. Accessed 18 May 2022.
- "Amelia Earhart." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/246731. Accessed 30 May. 2022.
- Atkins, William Arthur. "Aviation Energy Use." *Energy: In Context*, edited by Brenda Wilmoth Lerner et al., vol. 1, Gale, 2016, pp. 34-37. In Context Series. *Gale eBooks*, link.gale.com/apps/doc/CX3627100018/GVRL?u=s0518&sid=bookmark-GVRL&xid=411cc629. Accessed 1 June 2022.
- Barber, C. (2015, March 16). *The Nixon Space Doctrine» Richard Nixon Foundation*. Richard Nixon Foundation. <https://www.nixonfoundation.org/2015/03/the-nixon-space-doctrine/>
- By KATHERINE WOODS. "THE LIFE of AMELIA EARHART: 'SOARIN WINGS ' IS THE STORY of a REMARKABLE CAREER." *New York Times (1923-)*, 1939, p. 1. *ProQuest Historical Newspapers: The New York Times*, www.proquest.com/historical-newspapers/life-amelia-earhart/docview/102893216/se-2?accountid=3825.
- Chidester, Robert. "Unionism." *Reforming America: A Thematic Encyclopedia and Document Collection of the Progressive Era*, edited by Jeffrey A. Johnson, vol. 1, ABC-CLIO, 2017, pp. 332-35. *Gale eBooks*, link.gale.com/apps/doc/CX7357500139/GVRL?u=s0518&sid=bookmark-GVRL&xid=bc9616a5. Accessed 1 June 2022.
- "Democratic Party Platform (1968)." *American Government*, ABC-CLIO, 2022, americangovernment.abc-clio.com/Search/Display/210075. Accessed 31 May. 2022.
- Dubrulle, Elizabeth. "Women Aviators." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/299982. Accessed 17 May. 2022.
- "Executive Order 9981." *American Decades Primary Sources*, edited by Cynthia Rose, vol. 5, Gale, 2004, pp. 296-99. *Gale eBooks*, link.gale.com/apps/doc/CX3490200925/GVRL?u=s0518&sid=bookmark-GVRL&xid=41c4eee9. Accessed 29 May 2022.
- "Frederick Douglass." *Encyclopedia of World Biography*, 2nd ed., vol. 5, Gale, 2004, pp. 85-86. *Gale eBooks*, link.gale.com/apps/doc/CX3404701841/GVRL?u=s0518&sid=bookmark-GVRL&xid=b9977bb1. Accessed 1 June 2022.
- Fredriksen, John C. "Daniel James." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/249727. Accessed 24 May. 2022.
- Harris, Duchess. "Working for Change in the Media." *Sexism in the Media*, Essential Library, 2018, pp. 88-99. Being Female in America. *Gale eBooks*, link.gale.com/apps/doc/CX7692600012/GVRL?u=s0518&sid=bookmark-GVRL&xid=5115e61c. Accessed 1 June 2022.
- Iyengar, R. (2022, November 22). *Why Ukraine Is Stuck With Elon (for Now)*. Foreign Policy. <https://foreignpolicy.com/2022/11/22/ukraine-internet-starlink-elon-musk-russia-war/>
- Lee W. Eysturliid. "Cold War and the Space Race." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/1224485. Accessed 11 May. 2022.
- National Archives. (2016, August 15). *Women in the Work Force during World War II*. National Archives; The U.S. National Archives and Records Administration. <https://www.archives.gov/education/lessons/wwii-women.html>
- Newman, Jason. "Tuskegee Airmen." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/253673. Accessed 17 May. 2022.

- Olson, James S., and Shannon L. Kenny. "Transcontinental Railroad." *The Industrial Revolution: Key Themes and Documents*, ABC-CLIO, 2015, pp. 212-13. *Unlocking American History. Gale eBooks*, link.gale.com/apps/doc/CX6175200195/GVRL?u=s0518&sid=bookmark-GVRL&xid=3c0a5f6c. Accessed 1 June 2022.
- Overton, J. (2022, June 9). *Issue Brief | The Growth in Greenhouse Gas Emissions from Commercial Aviation (2019, revised 2022) | White Papers | EESI*. Wwww.eesi.org. <https://www.eesi.org/papers/view/factsheet-the-growth-in-greenhouse-gas-emissions-from-commercial-aviation#:~:text=EPA%20reports%20that%20commercial%20airplanes>
- PricewaterhouseCoopers. (2023, January). *2019 Aerospace manufacturing attractiveness rankings*. PwC. <https://www.pwc.com/us/en/industries/industrial-products/library/aerospace-manufacturing-attractiveness-rankings.html>
- Tuskegee Airmen Facts | Tuskegee University*. (n.d.). Wwww.tuskegee.edu. <https://www.tuskegee.edu/support-tu/tuskegee-airmen/tuskegee-airmen-facts#:~:text=The%20Airmen%27s%20success%20in%20escorting>
- Wasniewski, Matt. "Military-Industrial Complex." *Americans at War*, edited by John P. Resch, vol. 4, Macmillan Reference USA, 2005, pp. 124-26. *Gale eBooks*, link.gale.com/apps/doc/CX3427300394/GVRL?u=s0518&sid=bookmark-GVRL&xid=73cbc4fd. Accessed 31 May 2022.
- Watts, Tim J. "Katherine Johnson." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/2242956. Accessed 24 May. 2022.
- Wayne, Tiffany K. "Women in Aerospace and Astronautics." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/1570639. Accessed 17 May. 2022.
- "Working Women during World War II." *American History*, ABC-CLIO, 2022, americanhistory.abc-clio.com/Search/Display/1182262. Accessed 01 Jun. 2022.