FLIGHT

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The history of flight presents a seemingly straightforward linear narrative. Before the eighteenth century, humans could only aspire to fly—an unfulfillment that promoted a rich mythology in antiquity that includes, most famously, the Hellenic warning against Icarian hubris. What followed were centuries of tinkering by eccentric geniuses such as Leonardo da Vinci—experiments that proved practically unfeasible but nevertheless indicated a rationalization of the aerial milieu. Then, in 1783, the invention of the hot-air balloon by the Montgolfier brothers in France allowed humans to ascend into the sky for the first time. However, this form of flight proved to be a dead end, for people soon realized it was not possible to steer a balloon. The real triumph, then, came only on December 17, 1903, when Wilbur and Orville Wright flew the heavier-than-air *Flyer* above the sand dunes of Kitty Hawk. This event, according to the usual narrative, marked the "invention of the aerial age" (as the Smithsonian National Air and Space Museum labeled its exhibit on the Wright brothers). In the ensuing decades, aviation took the world by storm—first with the pre-war meets, then with the military uses of the airplane during World War I, then with the heroic transatlantic flights and raids in the interwar years. World War II marked another turning point, inaugurating not only new forms of aerial warfare and destruction, but also laying the foundations for the age of industrialized mass flight that would soon follow. As such, while for millennia human flight remained the stuff of myths, in just over a century it progressed from fantastic accomplishment to mundane experience. Seen from this perspective, the history of flight neatly maps on to the commonplace narrative of modernity as the triumph over nature and the disenchantment of the world.

There is much to be said for this general sketch. It renders the history of flight coherent by tethering it to well-known individuals and prominent historical moments. It also resonates with our contemporary experience of flying, which seems to bear little resemblance to the glamour and excitement of the early twentieth century. But the commonplace narrative also centers the history of flight in the "West" while simultaneously reducing the socio-cultural experience to a teleology of technical progress.

This reductionist vision was reinforced by how the history of flight was written for much of the twentieth century. Until the late 1980s, with few exceptions, books on flight tended to be either passionate accounts of the technical changes in airplanes or fawning biographies of pilots. The situation was such that in 1989 James Hansen, then a professor at Auburn

University and the historian for NASA's Langley Research Center, regretted that "aviation history ha[d] fallen behind other fields of history (including space history), wherein broadly synthetic, contextual, and interdisciplinary studies explore[d] the meaning of a particular field of history in terms of what it mean[t] to others."[1] Hansen's article, "Aviation History in the Wider View," argued that the field could be revivified by non-specialists who might escape the narrow confines of technical progress and heroic biographies and instead approach aviation history in a more critical vein, unpacking the specific social and cultural contexts that shaped and were shaped by flight. In other words, we should relegate the machine from the foreground to the background, deprive it of its "animism" and focus instead on people and institutions.

In the years that followed, "Aviation History in the Wider View" emerged as a dividing line. The state of flight historiography today is much more diverse and expansive than when Hansen initially surveyed it. Historians of flight now look to maintain a critical engagement with broader historiographical questions in the history of technology and other allied fields. As such, this essay follows a loosely chronological narrative of the history of flight (from balloons to the jet age), with special emphasis given to themes that have benefited from the more critical approaches of this "New Aviation History."[2]

LIGHTER-THAN-AIR FLIGHT

The classic distinction in flight is that between "lighter-than-air" and "heavier-than-air," with balloons and airplanes serving as the paradigmatic examples of each. Etymologically speaking, the term *aviation* has its origins in the writings of Gabriel La Landelle, a French naval officer who, alongside the photographer Nadar and other eccentric figures, became an obstinate proponent of heavier-than-air flight in the second half of the nineteenth century. He coined the neologism in *Aviation ou navigation aérienne*, and the term became primarily associated with heavier-than-air flight. According to La Landelle, the term is a combination of the Latin *avis* (bird) and *actio* (action), and practical flight—that is to say, steerable flight—would only be possible through the heavier-than-air approach.[3]

Before aviation there was *aérostation*, which referred to lighter-than-air variants. In fact, from their invention in 1783 until the early twentieth century, balloons and related technology like dirigibles remained the only available means for humans to fly. As such, lighter-than-air

1 Hansen, "Aviation History in the Wider View," 643.

2 The term was coined by Roger D. Launius, who compared this new approach to movements like the "New Western History" and "New Social History" and described it as "mov[ing] beyond a fetish for the artifact to emphasize the broader role the airplane and, more importantly, the whole technological system, including not just the vehicle but also the other components that make up the aviation climate, as an integral part of the human experience." Launius, "Introduction: Patterns of Innovation in Aeronautical Technology," in *Innovation and the Development of Flight*, 14.

3 De La Landelle, *Aviation ou navigation aérienne*.

technologies have fundamentally shaped the human flight experience—the discourses, cultural practices, and institutions that then framed our understanding of the airplane.

Research on lighter-than-air flight has overwhelmingly focused on the early history of ballooning—from the Montgolfier brothers' invention of the hot-air balloon in 1783 to the end of the European enthusiasm for this mode of flight (or, as the English writer Horace Walpole put it, "balloonomania") in the early nineteenth century.[4] Even though his title unfortunately connects the Montgolfiers' invention to "aviation" rather than "aerostation," Charles Coulston Gillispie's *The Montgolfier Brothers and the Invention of Aviation, 1783-1794* remains the authoritative study of the balloon's origins.[5] It is unsurpassed in its attention to technical detail, and reveals just how much the technology owes to the Montgolfiers' background as industrialists in Annonay. Joseph, in particular, was obsessed with theories of heat and motion, which he saw as the path for greater efficiency in their paper mill. Meanwhile, the more worldly Étienne navigated the sinews of power in Paris to secure recognition for their invention, for while the brothers might have been the first to launch a balloon, they had competitors. Its invention and subsequent embrace by the public was also a product of the way in which eighteenth-century chemical science was defined by an obsession with the properties of fluids and enthralled by spectacular displays of scientific practice. Shortly after the Montgolfiers presented the public with their hot-air balloon, Jacques-Alexandre Charles, one of Paris's most popular lecturers on physics, unveiled his hydrogen balloon (known by contemporaries as the *charlière*).

4 Walpole, *Letters of Horace Walpole*, 576.

5 Gillispie, *The Montgolfier Brothers and the Invention of Aviation*.

Figure 1: 1783 Print showing the launch of a balloon by the Montgolfier brothers in front of the royal family at the Palace of Versailles, France. Source: Library of Congress.

The ensuing competition between these two lighter-than-air technologies—the hot air *montgolfière* and the hydrogen *charlière* each had its own faction within the French court—reveals how artifacts are infused with politics. Ballooning was also a social phenomenon, tied to the expansion of dense urban networks as elites in other cities sought to emulate what was happening in Paris.[6] By hosting an ascent, a city or a town acquired both real and symbolic capital—the former through the economic benefits brought by curious visitors, the latter through projecting its modernity by celebrating a local patriotism inscribed within the Enlightenment's universalist logic. The press played a critical role in this process, for it facilitated the balloon's transformation from invention into event (the new field of "aérostation" made up 49 percent of all articles published in the *Journal Général de France*

6 Thébaud-Sorger, *L' aérostation au temps des Lumières*.

under the heading "mathematic, physics, natural history" in 1784).[7] So did a burgeoning consumer culture, with the balloon finding its way as a motif into furniture, clothing, and even haircuts.

Although they featured a significant degree of social and gender diversity, most ascent audiences were segregated. The "public" was separated from the "people" by an enclosure available only to those who paid the subscription. Even so, because of its eventual ascent, observing a balloon in action was part of the transformation of the public sphere, a democratic experience available to just about anyone who wished to watch, thus bringing together the subscribing elites and the excluded masses (in Paris, crowds surpassed 100,000). Some scholars have argued that the early ascents weakened the French monarchy's authority, for they disrupted hierarchical orders and undermined the monarchy's authority over spectacle and the production of symbolic capital.[8]

The functional dirigibles from the turn of the twentieth century were also objects of popular fascination (especially the Zeppelin) and have similar political and social links to the early twentieth century German context. Dirigibles represented both distinct national technical styles (German lighter-than-air models tended to have rigid structural frameworks while French models used semi-rigid) and functioned as nationalist symbols.[9] However, they also had the ability to transcend nations, particularly through the short-lived culture of transatlantic dirigible travel.[10]

7 Thébaud-Sorger, *L' aérostation au temps des Lumières*, 32.

8 Kim, *The Imagined Empire*.

9 De Syon, *Zeppelin!*; See also Chapter 1, "Giant Airships and World Politics," in Fritzsche, *A Nation of Fliers*, 9-58.

10 Alexander Rose's *Empires of the Sky*, a detailed narrative history of the Juan Trippe's Pan American Airways and Hugo Eckener's DELAG, offers a starting point for those interested in developing more analytical approaches to the brief era of transatlantic dirigible travel.

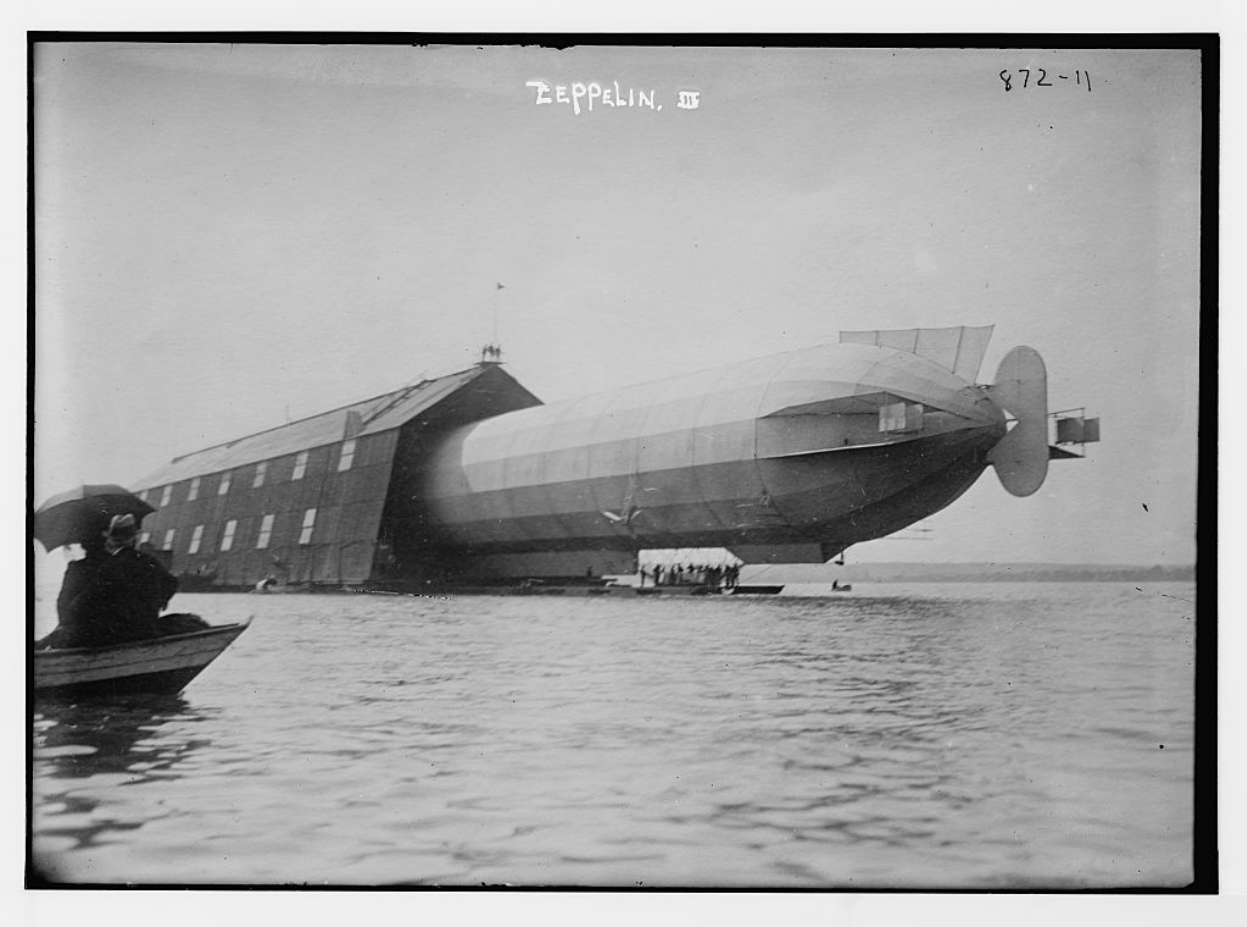

Figure 2: Zeppelin No. 3, shown in shed on water, c. 1900. Source: George Grantham Bain Collection (Library of Congress).

Some of these important political and technological dimensions have been obscured by the attempt to force a sharp divide between lighter- and heavier-than-air technology. However, more recent work in the field has emphasized how treating airplanes as a major break "obscures the long-term cultural construction of aerial practices, which now includes more than two centuries of experiments and achievements."[11] Much of what we know about eighteenth and nineteenth century history of flight can help frame the supposed pivotal break that occurred with the onset of early aviation in the twentieth century.

EARLY AVIATION

The period of early aviation has arguably received the most attention from historians, almost to a fault. Books on the Wright brothers abound, from popular accounts that read more as

11 Roseau and Thébaud-Sorger, "Les empreintes du vol," in *L'Emprise du vol de l'invention à la massification*, 9.

uncritical celebrations of their genius to serious academic studies that range from using the biographical genre to weave a tapestry of the social forces that shaped their careers to detailed analyses of their invention process.[12]

Ask any American school child who invented the airplane and they will answer the Wright brothers. Indeed, the *Flyer* was a major achievement—one that both shaped future designs and infused the field of aeronautics with new energy. Wilbur and Orville, who operated a bicycle shop in Dayton, Ohio, developed a critical insight as they worked on their first gliders. For the most part, inventors had obsessed over the pitch axis (vertical movement) and the yaw axis (horizontal movement). But drawing from their experience in manufacturing bicycles, the Wrights realized that to maintain stability in turning one also had to consider the roll axis (like the banking a cyclist will do when turning). As such, the brothers developed a "wing warping" technique that became the keystone to their patent. Aware of the importance of this insight, they kept their designs under wraps, an attitude that ran counter to how flight research had been pursued up until then. This explains why most in the global aeronautical community did not take their claims seriously.

12 David McCullough's *The Wright Brothers* is a recent example of folkish Americana. Tom D. Crouch's *The Bishop's Boys* remains the definite critical biography of the brothers. Peter L. Jakab's *Visions of a Flying Machine* takes a closer look at how the Wrights went about in incrementally researching, designing, and constructing the *Flyer*. Although he overstretches the claim that the Wrights had a distinct method of invention, the study sheds light on their visual thinking abilities and demystifies the famous wind tunnel experiments. Both Crouch and Jakab had thriving careers as researchers and curators at the Smithsonian National Air and Space Museum.

Figure 3: Orville Wright is at the controls while Wilbur runs alongside during the first flight, December 17, 1903 at Kitty Hawk, North Carolina. Source: Library of Congress.

But if the *Flyer* can be conceived as a revolutionary break in aircraft design, it is also the product of deep continuities. In the United States, the Wrights communicated with and learned from people like the Smithsonian's secretary Samuel Pierpont Langley. The professionalization of engineering contributed to the achievement of heavier-than-air flight, with much of the relevant technical studies reported and discussed in engineering journals and conferences.[13] But even more important were the French networks of knowledge that the Wrights were able to tap into. The French-born Octave Chanute, who moved to the United States as a child and had a thriving career as a civil engineer, was the most important node in this network, indefatigably collecting and disseminating aeronautical knowledge back and forth across the Atlantic world. He wrote articles on flight experiments for *The Railroad and Engineering Journal*, subsequently publishing them in an influential book titled *Progress in Flying Machines* (1894). One can only imagine how much longer the Wrights would

13 Crouch, *A Dream of Wings*.

have taken to perfect the *Flyer* had they not benefited from such a comprehensive survey. Chanute also was the first to inform Europeans of the Wrights' promising experiments, and helped the brothers establish connections with the French aeronautical community, which by and large showed much more interest in them than Americans.

Chanute is a key mediating figure that reveals the extent to which the airplane emerged from a vast network of knowledge exchange, rather than as the product of singular genius. Some have even gone as far as labelling the airplane an "open-source invention," although the term is anachronistic.[14] While popular understandings of the history of flight are still shaped by the competition of what nation can claim the airplane as its invention (the Wrights in the USA, Clément Ader in France, Alberto Santos-Dumont in Brazil), scholars have largely moved beyond the "who was first" question, which is now seen as being more revealing of nationalist anxieties than of the forces that shaped the technology's development.

Finally, while the December 17, 1903, Kitty Hawk flight has been inscribed into our collective memory, arguably the real turning point was August 8, 1908, when Wilbur made the first public demonstration of the *Flyer* near Le Mans, France. It was only then that the Wright brothers crushed the justified skepticism people had regarding their claims. That this event happened in France is revealing of how France's more established culture of flight and institutions like the Aéro-Club de France were central to the assimilation of the *Flyer* as a technological artifact into the socio-cultural realm. In fact, following years of unsuccessful negotiations, the Wrights eventually secured contracts for public demonstrations with both a French syndicate and the U.S. Army (Wilbur conducted the French demonstrations while Orville took care of the American ones). This only happened because the brothers became more flexible in their terms, since they worried that the public flights conducted by the likes of Alberto Santos-Dumont in Paris would diminish the value of their invention.

While both the U.S. Army and the French syndicate were duly impressed, the flights in France had a more resounding impact on the development of early aviation culture. In the following years, France became the undisputed center for aviation pursuits—a period that was marked by heroic feats like Louis Blériot's crossing of the English Channel on July 25, 1909, and spectacles like the Grande Semaine d'Aviation de la Champagne near Reims in August of that same year. In this fiercely competitive environment, French manufacturers quickly adopted the Wrights' insights and soon overtook them in design innovation, with the brothers losing valuable time and resources going after patent pursuits. To put it rather simplistically, the first functional airplane was born in the United States, but the technology really came of age in Europe.[15]

14 Meyer, "The Airplane as an Open-Source Invention."

15 Wohl, *A Passion for Wings*.

Figure 4: Poster advertising the Champagne meet in 1909. Source: Wikimedia Commons.

NATIONAL AIRMINDEDNESS AND EMPIRE

The question of internationalism and nationalism is not confined to the passionate debates about who invented the airplane. One productive way historians have approached this question is "airmindedness," a term whose origins go back to the interwar years, when it was mobilized by authorities concerned with developing air power to foster public enthusiasm for the airplane. Historians of flight have repurposed the term as an analytical category that refers "to the particular set of cultural traditions, symbols, and markers that, combined with exiting political culture and social institutions, constitute a given nation's response to the airplane"—in other words, national cultures of aviation.[16] The three major studies that take this approach focus on the United States, Germany, and Russia. In *The Winged Gospel*, a

16 Palmer, *Dictatorship of the Air*, 2.

groundbreaking book that preceded Hansen's article by six years, Joseph J. Corn defines American airmindedness as "having an enthusiasm for airplanes, believing in their potential to better human life, and supporting aviation development."[17] Corn argues that the optimistic response that most Americans had toward the airplane stemmed from a current of "technological messianism" that drew from Christian associations of flying with the divine, an individualist ethos, and democratic values. Meanwhile, Peter Fritzsche's *A Nation of Fliers* analyzes German aeronautical culture from the Wilhelmine period to the early years of the Nazi regime and explains how airmindedness could also develop in a darker direction as it fused with modern forms of nationalism, as exemplified by the Nazi slogan "We must become a nation of fliers."[18] Finally, Scott Palmer's *Dictatorship of the Air* identifies remarkable continuities in Russian airmindedness from the Imperial Era to the Soviet Period, in particular the enduring dependence on Western technology and "a deep-seated faith that a single, transcendent event would transform Russia from its current state of underdevelopment and dependence into a position of dominance as the world's leading air power."[19] As with Corn, Palmer sees in religion a key to understanding Russian responses to the airplane, with the technology operating as a kind of Eastern Orthodox icon that simultaneously represented a rapturous future and operated as an engine of salvation.

Though other nations' "airmindedness" has been studied—including England, Canada, and Peru—thinking about the history of flight from this perspective has limitations, particularly in the choice to exclude lighter-than-air technology from the discussion.[20] More important, the focus on the nation fails to take into account the important role of flight for empires to manage far flung populations.

English Prime Minister Winston Churchill, for instance, promoted using the Royal Air Force for the "air policing" of colonial territories during the interwar period, something that worked in deserts and more remote regions like Kurdistan but was not efficient in more populated areas like Palestine.[21] Flight was part and parcel of the management of populations, and the British state acted in the interwar years to secure and protect the necessary infrastructure—

17 Corn, *The Winged Gospel*, 12.

18 Fritzsche, *A Nation of Fliers*, 5. See also Esposito, *Fascism, Aviation and Mythical Modernity*, a close reading of how Fascist texts in Italy and Germany appropriated the airplane, making it a symbol of a "mythical modernity" that would serve as the foundations for national renewal. In France, the Croix de Feux (a militant nationalist league) and the Parti Social Français (the political party that emerged from it) also flirted with aviation in a similar manner. See Kennedy, "The Croix de Feu."

19 Palmer, *Dictatorship of the Air*, 34.

20 For other countries' efforts: Canada: Vance, *High Flight*; England: Edgerton, *England and the Aeroplane*; Peru: Hiatt, *The Rarified Air of the Modern*; France: De Oliveira, "The Ascending Republic."

21 Omissi, *Air Power and Colonial Control* and Satia, "The Defense of Inhumanity."

from runways to weather services—for the expansion of civil aviation in Africa and Asia.[22] European powers also competed amongst themselves for air routes, as seen in the case of the Anglo-Dutch rivalry to connect Southeast Asia and Australia, regions where Great Britain and the Netherlands sought to preserve some of the last vestiges of their dwindling imperial possessions.[23] Prestige was a driving factor in these expansions, given that governments had to subsidize airlines that were incredibly unprofitable. The expansion of commercial air routes was also seen as a conduit for the extension of empire without having to resort to older forms of imperial conquest, as in the case of the intimate relationship between Pan Am Airways and American foreign policy. Hollywood was involved as well: 1933's *Flying Down to Rio* (the first movie starring Fred Astaire and Ginger Rogers together), enthralled viewers with images of chorus girls on top of airplane wings flying above Rio de Janeiro's iconic landscape.[24] The airplane and cinema emerged at around the same time, and from their early beginnings have served as powerful technologies of diplomacy and empire.

But aviation was more than just a tool of European and American empires. In the Far East, Japan engaged in technological and cultural exchanges with France, Britain, Germany, and the United States that were critical to the development of its own aviation industry.[25] This contrasts with the situation in Thailand, where political leaders were justifiably wary of foreign involvement, given that it was the only territory in Southeast Asia to maintain its independence from Western powers. Thus, the Thai sought to develop their industry along more indigenous lines that prioritized a defensive Air Force to protect its sovereignty. They had to cope with limited resources, but the strategy proved successful until the postwar years.[26]

Although no longer a colony by the early twentieth century, Peru also offers a fascinating case study of how the airplane acquired various meanings in a society marked by colonialism. Even though Peruvian modernizing elites mobilized the airplane as a universal agent of progress that would help explore natural resources in the jungle, in practice the technology's fragile performance ended up generating a sense of inferior modernity.[27] Crashes were common, and ironically there were cases where natives in their "backwards" canoes had to come to the rescue of survivors. Furthermore, while coastal elites based in Lima saw in aviation a pathway toward greater national integration, the technology highlighted and reinforced regional divisions. For instance, Cuzqueños' celebration of

22 Pirie, *Air Empire*, 155. See also George, "Airborne Colony."

23 Dierikx, "Struggle for Prominence."

24 Van Vleck, *Empire of the Air*; Schwartz, *Flying Down to Rio*.

25 Melzer, *Wings for the Rising Sun*.

26 Young, *Aerial Nationalism*.

27 Hiatt, *The Rarified Air of the Modern*.

Alejandro Velasco Astete—a Quechuan-speaking pilot who flew across the Andes in 1925 and died in a crash a few months later—connected aviation to an idealized Incan past. In doing so, these highland *indigenistas* presented an alternative vision of flight to the Limeños' Western-oriented narrative while simultaneously challenging the latter's aspirations for greater centralization and national hegemony.

Unfortunately, historians have barely scratched the surface when it comes to African experiences and perspectives of aviation's expansion.[28] Chandra D. Bhimull's *Empire in the Air*, which elegantly blends anthropology and history, takes a post-colonial approach and homes in on the West Indies to trace a genealogy of the prejudices and forms of racial oppression that members of the African diaspora today face while flying back to the imperial origins of large-scale commercial aviation.[29] The Imperial Airways Transport Company and its successors (the British Overseas Airway Corporation, which then became British Airways) advertised that they were "Speeding Up the Empire," but access to speed was shaped by racial and spatial hierarchies that prioritized white settler colonies. We are still living in a world shaped by that legacy, and Bhimull makes that poignantly clear from the very start. In the prologue she retells two stories. The first vignette describes how, when Floresa Eglantine Varlack died in Anegada in 1989, four of her seven children had to grieve her death from a distance because the logistics of reaching the British Virgin Islands by air were insurmountable. The second is a short account of Jimmy Kalenda Mubenga's death inside a British Airways flight that was about to travel from Heathrow to Luanda on October 12, 2010. Mubenga, who had lived in Britain for the past 16 years, was being deported to Angola against his will. The plane never left the runway. Three private security officers hired by the Home Office restrained Mubenga as he repeatedly cried out "I can't breathe."[30]

WAR

People started thinking of how to put flying machines into military use even before human flight became feasible in 1783. The English produced numerous satirical images of the French crossing the Channel by air, which expressed a sense of territorial anxiety, even as the tone was mocking.[31] The French did briefly experiment with balloons in the military context, creating a "Compagnie d'Aérostiers" that was used for battlefield observations during the Revolutionary Wars, but the technology was quickly dismissed as not being all that useful.[32] During the ensuing decades, governments everywhere shunned aeronautics

28 Pirie's *Air Empire* focuses on European actors.

29 Bhimull, *Empire in the Air*.

30 The three private security officers involved in Mubenga's death were found not guilty of manslaughter in 2014.

31 Carroll, *An Empire of Air and Water*, 115–45.

32 Godechot, "L'aérostation militaire sous le Directoire"; Bret, "Recherche scientifique."

as the province of crank inventors and entertainers, and it was only in the last third of the nineteenth century that the balloon reappeared in a military context. Balloons were used by the Union during the American Civil War. They were also used during a mixed civilian-military initiative by the French during the Franco-Prussian War, with tethered balloons rising above the Parisian sky to observe movements of the Prussian siege. During that conflict they proved to be much more successful as mail carriers, with more than sixty globes breaching the Prussian iron belt. Even if the balloon's usefulness in battle remained minimal, by the end of the century there had been significant momentum toward imagining the sky as an important dimension in military conflict, and the 1899 Hague Convention featured articles prohibiting the discharge of projectiles and explosives from balloons.[33]

Figure 5: Lithograph showing a balloon in use during the 1870 Siege of Paris. Source: Smithsonian National Air and Space Museum.

By the time the airplane appeared on the scene, there had been plenty of discussion about how flight would fundamentally transform military conflict. As with other potentially destructive technologies, more sanguine figures imagined that flight would render warfare

33 "Declaration (IV, 1), to Prohibit, for the Term of Five Years, the Launching of Projectiles and Explosives from Balloons, and Other Methods of Similar Nature. The Hague, 29 July 1899," *International Committee of the Red Cross*, https://www.icrc.org/applic/ihl/ihl.nsf/Article.xsp?action=openDocument&documentId=C372920FFD61039AC12563CD00516126

obsolete by producing a balance of power between different nations. Although the conservatism of military hierarchies produced some resistance against the airplane's adoption, by the early 1910s armies were embracing it as a scouting technology.[34] More well-known are the World War I aces, figures who have fascinated their contemporaries and generations since. For observers, airplane pilots stood in stark contrast to the anonymous soldiers in the trenches, and air combat came to represent a more "civilized" form of warfare compared to the barbarous industrial destruction that devastated places like the Somme. Pilots such as Manfred von Richthofen (the "Red Baron") and Georges Guynemer became heroes thanks to a concerted effort of government propaganda, newspapers, and books that cultivated an aristocratic image of aces as modern chivalrous knights of the air.[35] Several studies have unpacked the construction of this myth, which, of course, was infused by classist and gendered notions of technology and civilization.[36] However, we lack a more comprehensive social history of World War I fighter pilots that systematically analyzes their trials and tribulations, which included unrelenting diarrhea caused by toxic fumes, specific kinds of nervous disorders, and high casualty rates.[37]

In World War II, the attention of contemporaries and subsequent historians largely shifted away from pilots and toward the role planes themselves played in wartime strategy.[38] With the advent of "strategic bombing" and "air power doctrine," the image of the airplane as a mechanical steed of a skilled modern aristocrat faded and gave way to that of an impersonal engine of destruction.[39] One of the remarkable features of strategic bombing, a military strategy that championed aerial bombardment as a way to demoralize the enemy and destroy its economic capacity, is just how much its reality diverged from the rhetoric of its proponents. The optimism that strategic bombing would help end wars quickly was informed

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34 Henning, *Harnessing the Airplane*, 6.

35 For a contemporary example of that kind of celebratory literature see Anderson, *The Romance of Air-Fighting*.

36 See, for instance, Paris, "The Rise of the Airmen"; Wohl, *A Passion for Wings*, 203-251; Fritzsche, *A Nation of Flyers*, 59-101; Linda Raine Robertson, *The Dream of Civilized Warfare*.

37 A starting point is Kennett, *The First Air War*, which dispels many of the myths that have been built around the aces (like the false notion that most aircrew came from the upper-classes). Those interested in the topic should also check out Hynes, *The Unsubstantial Air*, which chronicles the experience of World War I pilots based on letters, diaries, and memoirs the aviators produced. For a broader context, readers should consult Morrow, *The Great War in the Air*, which offers a survey of how each of the major participants engaged in the air war—from the organization of their forces to the manufacturing of airplanes.

38 One prominent exception is Francis, *The Flyer*, which explores cultural representations (and, to a lesser extent, the lived experiences) of British airmen during World War II.

39 A good starting point on the history of air power is Buckley, *Air Power in the Age of Total War*. For an overview that focuses on changes to American air power from Vietnam to the end of the twentieth century see Lambeth, *The Transformation of American Air Power*. For essays addressing the bombing of civilians across the twentieth-century world see Tanaka and Young, eds., *Bombing Civilians*.

by the memory of languishing trench warfare and an overestimation of technological capabilities to hit targets. Air force generals in the United States and Britain also gave it a hard sale because it helped justify their independence from other military branches. The results were tragic, with civilian casualties increasing as the effort for precision targeting of infrastructure gave way to wholesale area bombing seeking to demoralize the enemy.[40] World War II saw the crystallization of the idea that bombing was not limited to military objectives but could also fulfill political ones—a move that gave new meaning to the notion of "Total War." For many in the Western world (for the shift was already clear in the colonial context), the first major demonstration of this new approach was the 1937 bombing of Gernika by German and Italian air forces at the behest of Spanish Nationalist Francisco Franco.[41] Between 1940 and 1945 aerial bombing killed approximately 600,000 and injured millions of civilians in Europe alone. But its results were mixed. Aerial bombing could be profoundly demoralizing, but it could also make those being bombed more dependent on the state and less likely to revolt.[42]

The experience with aerial bombarding brings to sharp relief that the history of flight is also the history of those who remained on the ground. The Blitz has become a mythic symbol of British resilience during World War II—epitomized in the propaganda poster "Keep Calm and Carry On" (a poster that actually never circulated during the war).[43] But even though the scale of destruction was much larger during the Blitz, the civilian experience of aerial warfare was still one of continuity. As Susan R. Grayzel explains, the German air raids against Britain in World War I and the discourse about them in the years leading to World War II "transformed the relationship between combatants and civilians and, more important, between the state and the home."[44] As the war unfolded, air raids were "domesticated and normalized in daily life,"[45] which meant that it no longer made much sense to think of a strict separation between the "war front" and the "home front," an experience that the British were able to draw from when they were confronted by the terrors of the Blitz.

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40 Biddle, *Rhetoric and Reality in Air Warfare*. See also Holman, *The Next War in the Air*.

41 Patterson, *Guernica and Total War*.

42 Overy, *The Bombers and the Bombed*.

43 Calder, *Myth of the Blitz*.

44 Grayzel, *At Home and under Fire*, 2.

45 Grayzel *At Home and under Fire*, 91.

Figure 6: 1940 aerial photograph of a German plane over London's Dockland during the Battle of Britain. Source: Australian War Memorial.

As it became clear that flying technologies would play an important role in warfare, militaries started to develop air power doctrine—that is to say, a set of principles that would help orient military action in this new space for warfare. One major example was the concept of the aerial "knock-out blow," a sudden bombardment that would cause enough destruction to force Britain's surrender in a war. The idea first emerged amongst civilians writing about

airpower at the dawn of the airplane and writers of speculative fiction (H. G. Wells's 1908 *The War in the Air* being the most prominent example). But it was only after World War I that British military theorists started to develop the concept.[46] Although practical experience in warfare showed the impossibility of the "knock-out blow," the idea remained remarkably resilient in the popular imaginary, with the press contributing to several "air panics" during the interwar years.[47]

Airplanes also played important wartime roles outside the European theater, particularly between the United States and Japan. From the attack on Pearl Harbor to the firebombing of Japan and the dropping of the atomic bomb by the Enola Gay, aviation looms large in our image of the Pacific war.[48] Perhaps the most famous image of the wartime pilot, however, was that of the kamikaze ("divine wind"), the Japanese aviators that engaged in suicide attacks against Allied forces in the Pacific. Historians have begun to move away from the Orientalist depiction of the youth aviator turned nihilistic kamikaze, and instead emphasize their situatedness in a broader nationalistic ideology.[49] After all, many of the men who made up the *Tokubetsu Kōgekitai* (Special Attack Unit, as the kamikaze were formally called) had been students at prestigious universities, and therefore were familiar with Western culture and various ideologies that ran counter to the cult of the emperor. Some of the pilots were undoubtedly deeply sensitive men who struggled with their decision—men who were driven more by an idiosyncratic patriotism in defense of their country than by subscribing to the emperor's top-down nationalism. Though scholars have enhanced our understanding of the kamikaze pilot, we know less about how the transformation of the fighters and bombers into weapons of self-destruction shaped the pilots' and broader public's relationship with the technology.

The early 1950s also furnished an example of early Cold War machinations in the mobilization of the People's Liberation Army Air Force (PLAAF) in the Korean Air War.[50] Not only did the war accelerate the expansion of China's air force into a world power, but the expansion was quietly supported by the Soviets. In fact, it is worth noting the extent to which aviation technology was a major point of contention during the early Cold War, pitting traditional allies like the United States and Britain against each other in the shaping of global aviation policy and the pursuit for aerial supremacy (Britain saw the exporting of aviation

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46 Holman, *The Next War in the Air*.

47 Bialer, *The Shadow of the Bomber*; Haapamaki, *The Coming of the Aerial War*; Süss, *Death from the Skies*.

48 On the debate on how fully planned the campaign was, see Searle, "'It Made a Lot of Sense to Kill Skilled Workers'"; and Ralph, "Improvised Destruction." On the experience of Tokyoites and the subject of memory see Karacas, "Place, Public Memory, and the Tokyo Air Raids"; and Fisk and Karacas, eds., "The Fire Bombing of Tokyo."

49 Ohnuki-Tierney, *Kamikaze, Cherry Blossoms, and Nationalisms*; Uchiyama, *Japan's Carnival War*, Chapter 5: "The Youth Aviator," 202-252.

50 Zhang, *Red Wings over the Yalu*.

technology as being key to its survival, while the United States sought to restrict technological dissemination).[51]

THE JET AGE AND AIRPORTS

The early 1950s was the last time that airplanes were primarily associated with war and not with mass travel, and much of this has to do with the advent of the Jet Age. Earlier histories have tended to characterize the invention of the turbojet as a revolutionary break with the piston engine-propeller engine. According to this narrative, since the 1920s, theoretical physicists had surmised that improved streamlining could result in much higher airspeeds than what was then possible, but most engineers continued to focus on improving existing systems. Thus, the turbojet revolution originated amongst young outsiders like Frank Whittle in Britain and Hans von Ohain in Germany, trained in the newest physical theories and not willing to settle for existing propeller technology.[52] More recent research, however, emphasizes that Germany's leadership in jet engine production during World War II had less to do with its superiority in theoretical physics than with its need to find a replacement for expensive piston engines and its immense supply of slave labor. Meanwhile, because manufacturers in Britain and the United States were more embedded in the aero-engine industry, they were able to develop more robust turbojet engines and promote a slower but more efficient transition. In other words, industrial context (production) was just as important as research laboratories (invention and development) in the advent of the jet engine.[53]

But the so-called turbojet revolution was not simply about the technology. While the first turbojet aircraft flew in 1939, it was only in 1958, when Pan Am adopted the Boeing 707 to fly its New York-Paris route, that the Jet Age truly began. From thereon passengers could zoom over the Atlantic at speeds of up to 600 miles per hour, with a trip from the United States to Europe taking a mere seven hours—half of what it took before. The turbojet airplanes could also carry many more passengers than what was previously possible, which produced a decline in ticket prices. As these sleek new machines pierced the clouds, airlines and cities invested vast sums of money in leading architects to design avant-garde airports that could cater to these new, larger aircrafts and the greater number of people traveling in them.

51 Engel, *Cold War at 30,000 Feet*.

52 Constant, *The Origins of the Turbojet Revolution*.

53 Giffard, *Making Jet Engines in World War II*.

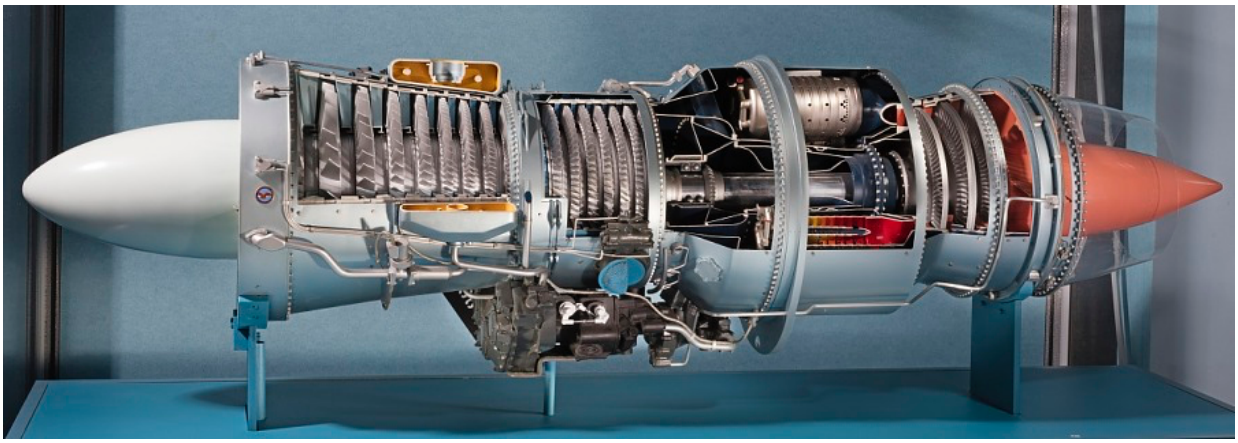

Figure 7: Quarter-scale model of a Pratt and Whitney JT3C (military designation J57) turbojet engine. Source: Smithsonian National Air and Space Museum.

In fact, what defined the Jet Age was not the new speeds in which one could travel, but fluidity. As Vanessa Schwartz puts it, the Jet Age offered a new kind of subjective experience: "that of going far and fast while seeming to go nowhere at all—fluid motion and sensationless travel."[54] The jet in itself was not sufficient to produce a "jet age aesthetic"—it also needed a vast infrastructural network. Especially important was the transformation of airports, which transitioned from underdeveloped airfields into iconic modernist buildings in their own right. It was in the mid-1950s and early 1960s that structures like the Trans World Flight Center at New York International Airport (renamed the John F. Kennedy International Airport in 1963) and the Theme Building at Los Angeles International Airport appeared as quintessential examples of the new jet age aesthetic. Airports were originally envisioned as icons of planned obsolescence that would be flexible enough to adapt to the speed and growth encouraged by consumer society. Whether or not they succeeded in that is another story.

54 Schwartz, *Jet Age Aesthetic*, 10.

Figure 8: Interior of the Trans World Airlines Terminal, John F. Kennedy (originally Idlewild) Airport, New York, New York, 1956-62. Source: Library of Congress.

Airports in the United States occupy a hybrid position—they are owned and operated by municipalities but substantially funded and regulated by the federal government. How did this seemingly awkward arrangement come about? Until 1947, the initial spread of airfields was irregular and depended on lobbying from the Post Office and the military, Progressive Era municipal boosterism, and a growing sense of popular airmindedness, for the state and federal governments were hesitant to invest in what was then a money-draining initiative. But the airport boom really took off after the 1925 Air Mail Act, which allowed the Post Office to contract private airlines as mail carriers. Municipalities not wanting to miss out on being

a central node in the mail grid constructed airfields but had to bear the cost of maintaining them, given that the 1926 Air Commerce Act prohibited the use of federal dollars for such purposes (the reasoning being that just as it was with docks, airports should be maintained at the local level). The New Deal started reversing this situation, with an inflow of capital (and regulations) coming in through federal relief programs, but the spigot only really opened during World War II. During those years the military took over numerous airports, expanding and improving them. The wartime experience helped set the table for the 1946 Federal Airport Act, which preserved local ownership but established continuous federal funding.[55]

But iconic structures like Los Angeles International and Paris Orly are products of the Jet Age, which is when architects like Eero Saarinen (who conceived the Dulles Mobile Lounge) started conceptualizing airports as more than just spaces for airplanes to depart and arrive. Instead, they were to be spaces of continuous fluid movement, with passengers seamlessly transitioning between the terrestrial and the ethereal.[56] As such, they are efforts at deterritorialization, which is why the tens of thousands of airports all around the world feel eerily similar. One concept that has become especially prominent in characterizing airports is the "non-place"—a space of liminality and anonymity where transience is more defining than identity.[57] Hence, according to some critics, the airport's alienating nature.

Mid-century designers were sensibly concerned with fluidness, but they probably could not imagine and plan for the increase in passenger traffic in the ensuing decades (in the United States, slightly over 19 million in 1950; almost 297 million in 1980; close to 720.5 million in 2010). Although the jet enabled an unprecedented era of global mobility, decisions about how to respond to these changes continued to happen at the local level.[58] The 1978 Airline Deregulation Act in the United States resulted in cheaper tickets, but it also prompted municipalities to expand and upgrade their airports into "aerotropolises" that would be dignified enough to become hubs.[59] The competition produced few winners and many losers, for ironically in the decades after deregulation the number of airlines fell dramatically and those that survived concentrated in only a few hubs, such as Atlanta and Dallas. The construction of mega airports also produced local conflicts between business and residence

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55 Bednarek, *America's Airports*.

56 Pascoe, *Airspaces*, 15.

57 Augé, *Non-Places*.

58 Bednarek, *Airports, Cities, and the Jet Age*.

59 The idea of the "aerotropolis" has been developed to its fullest extent in Kasarda, *Aerotropolis*, which argues that urban development and economic growth should be planned around airports. Critics have argued that such an approach is not sustainable in the long run given the prognosis for peak oil, concerns about infrastructure security and resilience, and the continuing importance of maritime trade. See Charles, Barnes, Ryan, and Clayton, "Airport Futures." For a more sophisticated analysis of how city planning and airport development have mirrored each other since early in the twentieth century see Roseau, *Aerocity*.

interests, especially concerning property values and noise pollution, and the question of whether a major airport contributes to long-term economic growth is still very much unresolved.

Today, when airlines serving the United States carry more than one billion passengers and airports struggle to deal with capacity and security, the glamour of the Jet Age has largely disappeared from air travel.[60] Instead, taking a flight is the kind of ordeal that prompts sociologists to publish books with recommendations on "surviving the new culture of air travel."[61] An alternative future did seem to start crystalizing in the 1970s, when supersonic transport (SST) promised a new transportation revolution with the British-French Concorde traveling from New York to Paris in just under 3.5 hours.[62] That future never materialized, grounded by bureaucratic budgetary disputes and a lack of support.[63] Meanwhile, the Concorde itself was barely ever profitable. Ticket prices were so expensive that it had trouble filling all its seats even though its capacity was much smaller than that of jetliners. Its endurance until 2003 is at least partially explained by its significance as a proud and stubborn symbol of technological modernity to France and Britain.[64]

In the twentieth first century, airports and flight are associated less with the "jet age" and more with the reality of global terrorism and the national security state. The late 1960s and early 1970s marked the highpoint of airplane hijackings, with more than 130 taking place in U.S. airspace alone. But the hijackings rarely ended in violence, and the Federal Aviation Administration resisted introducing new security measures, arguing that it would instill unnecessary psychological fear in passengers. It was only in 1974 that the Air Transportation Security Act required U.S. airports to adopt universal physical screening and metal detectors.[65] The 9/11 terrorist attacks were a much more defining moment in the transformation of the airport into a highly securitized space. With the rise of the national security state, the idea of the airport as a space of fluid anonymous mobility seems like a distant dream. However, even in the mid-twentieth century that idea only went so far. The jet set and those who aspired to be like them were overwhelmingly white and from the metropoles (i.e. France rather than Algeria), and institutionalized airport segregation

60 "2019 Traffic Data for U.S. Airlines and Foreign Airlines U.S. Flights - Final, Full-Year | Bureau of Transportation Statistics," accessed September 14, 2020, https://www.bts.dot.gov/newsroom/final-full-year-2019-traffic-data-us-airlines-and-foreign-airlines-us-flights.

61 Gottdiener, *Life in the Air*.

62 The Soviet Tupolev Tu-144 was also operational from 1968 to 1999, although it was much less reliable than the Concorde.

63 Horwitch, *Clipped Wings*; Conway, *High-Speed Dreams*.

64 Owen, *Concorde and the Americans*.

65 Koerner, *The Skies Belong to Us*.

persisted in the American South until 1963, when the passenger terminal in Shreveport, Louisiana, became the last to integrate, which is not to say that informal discrimination ended.[66] In the present, mobility inside a place like JFK is very much shaped by whether one is from Europe or from the Global South. In fact, it is difficult to think of a space where interpellation is more rigorous and recurring than the airport—from immigration to security, identity is central to mobility in the terminal.

GENDER AND RACE IN FLIGHT

As in other fields in the histories of science and technology, early works on gender and race in the historiography of flight focused on identifying female and non-white aeronautical pioneers and inscribing their contributions into the historical record. (See "Gender.") Thanks to this important move, we now have rich accounts of aviatrixes and African American pilots that have helped us paint a fuller picture of flight in both military and civilian contexts.[67] But thinking of flight through the lenses of race and gender is not just a matter of representation, for these are also rewarding analytical categories.[68]

Although there is no book that focuses singlehandedly on the question of gender and ballooning, gender was constitutive in the construction of human flight from the very start. If the first professional aeronauts in France had all been men, between 1802 and 1848 twenty out of the fifty new members of that select class were women.[69] One possible explanation for women making up a substantial proportion of aeronauts in the first half of the nineteenth century is the fact that ballooning shared similarities with another form of popular entertainment: the circus. The practice of fairgrounds ballooning was dominated by family dynasties like the Blanchards, Garnerins, Godards, and Poitevins that jealously guarded their *savoir faire*, and women played an important role in passing down these skills to younger generations (they were also some of the period's most famous performers). However, when the balloon was rediscovered in the 1860s as a technology that could contribute to the

66 Ortlepp, *Jim Crow Terminals*.

67 The United States Women in Aviation series, published as part of the Smithsonian Studies in Air and Space, was a pathbreaking initiative. The first three volumes, which include Oakes, *United States Women in Aviation through World War I*, Brooks-Pazmany, *United States Women in Aviation, 1919-1929*, and Oakes, *United States Women in Aviation, 1930-1939*, took a more standard recovery approach. The final volume (Douglas, *United States Women in Aviation, 1940-1985*) approached the topic more from the perspective of gender as a category of analysis and was expanded into Douglas, *American Women and Flight since 1940*. For a survey of pioneering aviatrixes see Lebow, *Before Amelia*. The most important account of pioneering African American pilots is Moye's *Freedom Flyers*. See also Jakeman, *The Divided Skies*. Bessie Coleman presents a fascinating case study where the two identities—female and African American—intersected. See Bix, "Bessie Coleman."

68 For an edited collection that presents research using gender as a category of analysis to make sense of aviation see Mills, Neal-Smith, and Bridges, eds., *Absent Aviators*.

69 Robène, *L'homme à la conquête de l'air*, vol. 1, 284-286.

emerging field of meteorology, women were pushed to the sidelines, and the new "scientific aeronauts" constructed their identity as a disciplined and self-abnegating class that contrasted with traits they ascribed to frivolous female ballooning. The marginalization of women as aeronauts would continue until the turn of the century, when ballooning became a form of aristocratic leisure. Women skillfully negotiated their positions inside prestigious associations like the Aéro-Club de France, creating "sister associations" like the Aéroclub féminin la Stella. Even so, there were obvious distinctions in the ways male and female ballooning were conceived, with the latter being taken much less seriously by the press.[70]

Figure 9: Luigi Rados's 1811 portrait of French balloonist Marie-Madeleine-Sophie Armand Blanchard, standing in the decorated basket of her balloon during her flight in Milan, Italy. Source: Library of Congress.

Yet the construction of flight as an adventurous masculine activity has proved remarkably resilient.[71] This masculine culture of flight is most obvious in the military context, where

70 De Oliveira, "The Ascending Republic."

71 Courtwright, *Sky as Frontier*.

books like Tom Wolfe's *The Right Stuff* (1979) and films like *Top Gun* (1986) crystalized the image of the fighter pilot as an aggressive risk taker who thrived through his machismo (an image that then bled into the space program and kept American women excluded from "the final frontier" for decades).[72] That same image has also been historically prominent in the world of private aviation.[73]

That being said, the 1920s and 1930s marked a period of increased visibility for women pilots, with Amelia Earhart being the quintessential example.[74] During this period, emerging airlines sought to transform the airplane's image from an exciting yet dangerous toy into a safe and reliable means of transportation. In short, the marketing of women pilots would help erase the image of pilots as risk-taking barnstormers and make the larger public more willing to adopt the technology—it was a domestication strategy.[75] The complexities of imperial airspace also presented women with opportunities to fly in certain contexts. For instance, while women in England were able to secure flying lessons from government-subsidized aeronautical clubs, those in New Zealand were not as successful, which indicates how the gendering of private airspace was shaped by local contexts. Meanwhile, commercial airspace proved to be inaccessible to women everywhere in the British Empire, for between 1924 and 1927 the International Commission on Air Navigation's restricted commercial pilot licenses to men (the organization drew from the biological sciences to find reasons why women should not fly—one supposedly could not trust menstrual bodies with such responsibilities). Even so, celebrity aviatrixes like the New Zealander Jean Batten offered women an alternative vision to the Depression-era heteronormative discourse of female dependence by refusing to get married and dazzling the public with record-breaking flights.[76]

World War II profoundly changed the nature of women's involvement in flight. During the conflict, the U.S. government created the Women Airforce Service Pilots (WASPs).[77] Comprised of civilian female pilots, the WASPs transported and tested aircrafts for the military until late 1944, when it was disbanded (it is worth pointing out, though, that due to necessity and more progressive gender politics, the Soviet Union actually marshalled female fighter pilots during the conflict). But female pilots were only one part of the story. According to Deborah G. Douglas, "if in 1940 only a thousand women were involved in any aspect of

72 Weitekamp, *Right Stuff, Wrong Sex*.

73 Meyer, *Weekend Pilots*.

74 Ware, *Still Missing*.

75 Corn, *The Winged Gospel*, 71–90.

76 Millward, *Women in British Imperial Airspace*.

77 On the WASPs see Merryman, *Clipped Wings*; and Landdeck, *The Women with Silver Wings*.

aviation, five years later there were half a million."[78] One despairing statistic is that while the share of American civilian women pilots in 2000 was double of that in 1940, it still stood at a paltry 5.9 percent.[79] One challenge in increasing female participation in flight is intimately connected with persisting ideas of what qualifies as technology—aviation and computers do, sewing and cooking do not. This division stems from a shift at the turn of the twentieth century when technology and masculinity became interlinked (just as the airplane was making its appearance).[80]

Figure 10: Four members of the United States Women's Airforce Service Pilots (WASPs), 1942-1945. Source: National Archives.

78 Douglas, *American Women and Flight since 1940*, 10.

79 "Appendix 1: Women Pilots, 1940-1945, 1960-2000, in Douglas, *American Women and Flight since 1940*, 266–268. In the case of military pilots, the percentage grew from 1.55 percent in 1985 to 3.68 percent in 2001 ("Appendix 2: Women Military Pilots, 1985-2000," in Ibid 269-271). With aerospace industry workers it went from 15 percent in 1959 to 22.6 percent in 2000 ("Appendix 7: Women Aerospace Industry Workers, 1959-2000," in Ibid, 278-279). Women represented 7.5 percent of aerospace engineers in 1983 and 10.3 percent in 2000 ("Appendix 8: Women Aerospace Engineers, 1983-2002," in Ibid, 280).

80 The literature on technology and gender is vast, but as starting points readers should consult Cowan, *More Work for Mother*; and Oldenziel, *Making Technology Masculine*.

In fact, this gendering of technology helps explain why the one aviation profession where women have been overrepresented is that of flight attendant. As the idea of flight became naturalized within the popular imagination and air travel expanded, airlines adopted the image of the friendly "stewardess" who would make the cabin feel more like home. This desire for domesticity partially explains how even though flight attendants were originally conceived as a profession for African American males (modeled after the Pullman porters on commercial trains), it became a field for young white women.[81] As airlines marketed a sexualized and commodified image of female labor, these women organized and joined unions to fight discriminatory practices, such as forced retirement at thirty-two. But that is not to say that men were never a part of the picture. In fact, major airlines like Pan Am did not start hiring women as flight attendants until the World War II labor shortage, and there were significant numbers of "stewards" well into the 1950s, when limiting the profession to young women helped cut labor costs while simultaneously erasing the dapper male steward, whose presence in a space idealized as feminine fomented homophobic anxieties. In the late 1930s men made up one-third of flight attendants in the United States, but by the late 1960s their share had dropped to a meager 4 percent.[82] It was only in the 1970s, after Celio Diaz mobilized the 1964 Civil Rights Act to sue Pan Am, that the profession started accepting men again.

The role of the stewardess, in short, became an important site for the gendering of flight, combining stereotypically feminine attributes and middle-class consumerism with labor politics and careerism.[83] Outside the United States, stewardesses were also sites for negotiating gendered and racial labor.[84] Pan Am created the "Japanese-language position" (which eventually grew to include other Asian languages) in 1955 to compete with Japan Air Lines, and these women became a critical piece to Pan Am's global marketing strategy, becoming icons of Jet Age cosmopolitanism as the airline sought to expand its frontier. Stewardesses were never just agentless marketing ploys, but agents who took advantage of career opportunities to escape provincial backgrounds and seek upward mobility.

Unlike the case with stewards, most of the scholarship focusing on the African American experience with flight has focused on the military sphere. Here, as with gender, World War II is a watershed moment. As J. Todd Moye explains in *Freedom Flyers*, "[d]uring the war blacks forced their way into an institution [the U.S. Army Air Corps, which in 1941 became the U.S. Army Air Forces] whose leaders, the evidence shows, if left to their own devices would never

81 Barry, *Femininity in Flight*; Vantoch, *The Jet Sex*.

82 Tiemeyer, *Plane Queer*, 3.

83 Vantoch, *The Jet Sex*, 2.

84 Yano, *Airborne Dreams*. Yano places "Nisei" in inverted commas for most of these women were not actually second-generation Japanese Americans.

have accepted African Americans as equals."[85] As war spread across the world, the Roosevelt administration saw the need to expand and strengthen the Army Air Corps, and Blacks all over the country began calling for the right to participate in this effort. This movement first secured allowances for Black participation in the Civilian Pilot Training programs (established by Congress in 1939). The move toward training Black military pilots came in part as a response by the Roosevelt administration to assuage the NAACP's calls for desegregating the military. The government was unwilling to go all the way, instead adopting a "separate-but-equal" approach to military training. Thus, the Tuskegee Army Flying School in Alabama was born (much to the NAACP's disappointment).

The wartime feats of the Tuskegee Airmen advanced the cause for desegregating the armed forces and became a site of memory that civil rights activists could work with to promote their goals. Although it was almost dissolved by the War Department, the school endured throughout World War II, graduating almost one thousand pilots and testifying to the fact that the military is indeed a "sociological laboratory."[86] But that was far from the end of the story. Black airmen had to continue fighting for full integration in the subsequent years. The Tuskegee Airmen undoubtedly have played an important role in publicizing the participation of African American pilots in the "Good War," but the relative emphasis on them as the primary example of Black pilots has created a powerful mythology.[87]

85 Moye's *Freedom Flyers*, 18.

86 Contra the War Department's 1941 statement that "The Army is not a sociological laboratory." Quoted in Moye, *Freedom Flyers*, 171.

87 The mythology includes the unfounded claim that the 332nd never lost a bomber: Haulman, "The Tuskegee Airmen."

Figure 11: 1945 portrait of two Tuskegee Airmen, Benjamin O. Davis and Edward C. Gleed, in front of the plane "Creamer's Dream." Source: Library of Congress.

Outside of the case of the Tuskegee Airmen, we know remarkably little about race in modern aviation. Jill D. Snider's work has more recently tried to correct for this by drawing attention to the Black press and Black men like Lucean Arthur Headen in the shaping of aviation. The use of airplanes by white supremacists during the 1921 Tulsa Race Massacre marked a turning point, for the airplane became inescapably tied to race, as both a symbol of power and destruction and as a potential economic engine for revitalization. Aviation, it was clear by 1921, was power. Headen, for example, an African American man born in the post-Reconstruction South, navigated a variety of networks (from the Republican Party to the Presbyterian Church) to become a barnstormer and pursue a career as an inventor (with

several aircraft related patents) who stood on the margins of the emerging racialized landscape of corporate research and development.[88]

Finally, historians in the near future will have a plethora of unfortunate material to work with pertaining to race and commercial aviation in the post-9/11 era, given that the racial profiling and other forms of discrimination endured by people of color have given rise to the telling expression "flying while brown."[89]

FUTURE ROUTES AND CONNECTIONS

By tracing the history of flight without overly focusing on 1903 and the Wright brothers as a central fulcrum, the "New Aviation History" that followed Hansen's 1989 clarion call has revealed the intricate ways in which empire, nation, culture, race, and gender have shaped the human experience with aeronautical technologies. That being said, there are still plenty of topics to be further developed.

The "prehistory" of flight (that is to say, the history of flight before it became possible for humans to ascend into the sky) remains largely untouched by historians of technology. Additional rigorous analyses of sources that discuss human flight before the balloon's invention would contribute to our understanding of anticipatory technological discourse and shed light on the more oneiric dimension of human flight, given that before 1783 it remained consigned to the realm of the imagination. [90]

Other works from the past decade have also explored the relationship between balloonomania and emerging consumer culture, and have framed the balloon as a liminal machine to explore the transition from the Enlightenment to the Romantic Era.[91] Meanwhile, the post-Napoleonic period remains relatively barren of studies.[92] The exception are articles on scientific ballooning, which now include focused case studies on how aeronauts navigated the tenuous boundaries between science and spectacle in Britain (in the case of James

88 Snider, *Lucean Arthur Headen*; Snider, "'Great Shadow in the Sky.'"

89 The expression is an adaptation of "driving while black." For examples see Sayantani Dasgupta, "The Perils of Flying While Brown," Salon.com, July 5, 2004, https://www.salon.com/2014/07/05/the_perils_of_flying_while_brown_partner and Rachel Goodman, "Making Flying While Brown Safe Again," American Civil Liberties Union, July 18, 2014, https://www.aclu.org/blog/racial-justice/race-and-criminal-justice/making-flying-while-brown-safe-again.

90 Singer's *Like Sex with Gods* approaches the topic, for example, by looking at how mythical and symbolic representations have shaped mechanical designs. See also Duhem, *Histoire des idéas aéronautiques* and *Musée aéronautique avant Montgolfier*.

91 Lynn, *The Sublime Invention*; Brant, *Balloon Madness*.

92 For a survey of flight focusing on France that features some discussion of this period see Robène, *L'homme a la conquête de l'air*. For one focusing on ballooning in the United States see Crouch, *The Eagle Aloft*. For a more popular account of ballooning history see Holmes, *Falling Upwards*.

Glaisher) and in France (in the case of Camille Flammarion), and how ballooning was important in constructing the image of the self-sacrificing patriotic scientist in Third Republic France.[93] But there is still much that remains to be explored, such as the connections between aspirations for flight and currents of mid-nineteenth century "utopian socialism." One of the difficulties for such an avenue of research, though, is the question of sources, since most of the contraptions imagined never moved beyond the initial stages of design, and since most of the designers were themselves marginal figures in society. But tapping into these currents is essential to fully understand how aerial navigation, despite remaining a chimera for more than a century after the balloon's invention, persisted as a goal that people invested substantial energy into.

Meanwhile, given the popularity of aviation museums around the world and how claims of "first in flight" continue to produce controversy, the field would also benefit from research that tackles the relationship between flight and memory, since this is the realm where historians can most closely interact with the broader public.[94] Artifacts ranging from the 1903 Wright Flyer and the Spirit of St. Louis to Lucien Boucher's Air France planispheres and Pan Am's flight attendant uniforms have become veritable *lieux de mémoire*—they are material, symbolic, and functional sites that are invested with collective memories, and the struggles that ensue in defining what those memories mean.[95] Another aviation artifact (the Enola Gay) was also at the center of a "history war" in the 1990s.[96] The B-29 Superfortress that dropped the first atomic bomb on Hiroshima was to be the centerpiece of a Smithsonian National Air and Space Museum (NASM) exhibit commemorating World War II's 50th anniversary. The museum had been in the possession of the Enola Gay for several decades, but the artifact was never put into public display due to a lack of space and given its ties to the dawn of the nuclear age and the killing of tens of thousands of people. Curators tried to navigate the topic sensibly, engaging not only with the most recent historiography but also collaborating with museums in Japan to borrow artifacts. However, they faced strident opposition from groups like the Air Force Association and the American Legion, who had their own memory of that recent history and claimed that the exhibit script focused too much on Japanese suffering. The conflict over memory was quickly politicized and subsumed under the so-called "culture war." The Senate issued a proclamation condemning the exhibit, and under mounting pressure NASM removed most of the images and artifacts depicting the bomb's

93 Tucker, "Voyages of Discovery on Oceans of Air"; Locher, "De nouveaux territoires pour la Science"; De Oliveira, "Martyrs Made in the Sky."

94 In 2019, 3.2 million people visited the Smithsonian Air & Space Museum at the National Mall and 1.3 million visited NASM's Steven F. Udvar-Hazy Center in Fairfax, Virginia. "Visitor Stats," Smithsonian Institution, accessed September 21, 2020, https://www.si.edu/newsdesk/about/stats.

95 Nora, "Between Memory and History."

96 Engelhardt and Linethal, *History Wars*. See also the special section dedicated to the Enola Gay controversy in the July 1998 issue of *Technology and Culture*.

devastation from the exhibit plan and expanded the section on Japanese atrocities, changes that just heightened the controversy. As a result, NASM scrapped opening the major exhibit and replaced it with a simple display with very little context.

Figure 12: The Boeing B-29 Enola Gay on display in 2020. Source: Peter Miller via Flikr.

Future histories of flight might also engage more directly with the mobilities paradigm, which has been developed primarily by geographers working on contemporary topics. As Saulo Cwerner explains, "[t]he new mobilities paradigm allows us to look at aeromobilities in their relations with various social networks and systems, therefore *grounding* or *embedding* them in processes whereby these mobilities, and their own distinctive spaces, networks, systems, and environments, are effectively produced, reproduced, performed and regulated."[97] The higher speeds and altitudes achievable through flight fundamentally changed the way we move around and experience the world, meaning that they have also transformed our relationship to time and space. However, these changes cannot be fully understood only by looking at isolated technologies—balloons, airplanes, and helicopters need to be contextualized within a complex network of "mobility systems" and "infrastructural moorings" that produce new subjectivities.[98]

97 Cwerner, "Introducing aeromobilities," in *Aeromobilities*, 3-4.

98 Hannam, Sheller, and Urry, "Editorial: Mobilities, Immobilities and Moorings." Key texts for the mobilities paradigm include Cresswell, *On the Move,* and Urry, *Mobilities*. Adey's *Aerial Life* takes a mobilities-framed approach to

Meanwhile, responses to Hansen's call to situate aviation within the wider view have largely given priority to exploring how the advent of the airplane shaped specific socio-cultural contexts. Efforts at opening the airplane "black box" have been rarer, something that has helped sustain triumphant narratives of the technology. One major exception is *Wings of Wood, Wings of Metal,* Eric Schatzberg's study of how the triumph of metal over wood as the material of choice for airplane frames was more the product of ideology than it was of material efficiency, with industrialists like Henry Ford associating metal with modernity and spending loads of money to make it into a functional alternative.[99] In other words, there was nothing "natural" in the shift from one material to the other. Meanwhile, Jeremy R. Kinney's history of the variable-pitch propeller explains how an intense "culture of performance" informed the dense network of specialists operating across various government and private institutions—a culture that subsequently shaped this artifact that allowed pilots to "shift gears in the air."[100] Finally, Timothy Paul Schultz demonstrates in *The Problem with Pilots* how aircraft operators should also be understood as integral components of the flight technological system, and have typically been the less reliable partners in the man-machine relationship.[101] As airplanes achieved more extreme heights, speeds, and distances, physicians and engineers had to focus their attention on reinforcing this "weakest link," developing appendages like oxygen masks and sophisticated cockpit instruments that facilitated flying under low- and no-visibility conditions.

Recent trends have taken things even farther, such as the Remotely Operated Aircrafts (drones) that remove the pilot from the cockpit and place her behind a computer. The use of Unmanned Air Vehicles (UAVs) expanded dramatically during the American-led "War on Terror," both overtly through military operations and covertly through the CIA. Debates concerning the legality and morality of drone warfare flare up especially when it comes to the targeting of American citizens, but the way in which the technology has been used against foreign nationals brings into question foundational notions of sovereignty and the ethics of warfare that have been championed by liberal democratic societies.[102] One might be tempted to compare these developments to the debates concerning strategic bombing in World War II, but the way in which drone warfare has been shrouded in secrecy adds another layer of complexity to the phenomenon, as does the fact that a powerful discourse of drone

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explore the production of aerial bodies, but like much of the work produced by interdisciplinary mobilities scholars falters in not paying enough attention to historical context when searching for transhistorical connections.

99 Schatzberg, *Wings of Wood, Wings of Metal*.

100 Kinney, *Reinventing the Propeller*. Aeronautical engineering has also served as the locus for one of the more insightful studies about the relationship between science and engineering, and how the latter is not just applied science but a realm of knowledge production with its own culture and set of (messy) rules. See Vincenti, *What Engineers Know and How They Know It*.

101 Schultz, T*he Problem with Pilots*.

102 Kaag and Kreps, *Drone Warfare*; Parks and Kaplan, eds., *Life in the Age of Drone Warfare*.

humanitarianism (for instance, using drones in peacekeeping and search and rescue missions) has developed in tandem with its extreme militarization.[103]

Figure 13: An MQ-9 Reaper unmanned aerial vehicle flies a combat mission over southern Afghanistan in 2008. Source: USAF Photographic Archives via Wikimedia Commons.

While aviation is a fertile terrain to explore larger questions pertaining to economic and labor history, there has not been much sustained engagement with these topics. Little has followed Herrick Chapman's *State Capitalism and Working-Class Radicalism in the French Aircraft Industry*. Published in 1991, the study shows how as a technologically advanced strategic sector and prone to state intervention, the aviation industry in France became an intense site of conflict between a politicized labor movement, employers, and state officials.[104] Recent work also sheds light on how the privatization and deregulation that defined 1980s neoliberalism saw early formulations within the aeronautical sector as far back as the 1960s. Even before 1968, when Heathrow became the first major international airport to be privatized, the British government was already restructuring it in a way that made it into a quintessential space for the contradictions of neoliberal capitalism. Determined to make the airport profitable, the British Airports Authority weakened the power of labor unions and invested in duty free retail. Ironically, the outsourced labor that replaced the largely white male unionized workforce was made up largely of women of color

103 Sandvik and Jumbert, eds., *The Good Drone*.

104 Chapman, *State Capitalism and Working-Class Radicalism*.

from the Commonwealth—the same people that Britain's increasingly repressive immigration system sought to keep out.[105] Just as the history of flight is inextricable from the history of empire, it can also help us see the connections between decolonization, racial capitalism, and the welfare state crisis. Given how central airports and aircrafts are to our global economic infrastructure and networks, there is still much to be explored in this area.

Finally, the integration of environmental history into the histories of the railroad and of the automobile has infused new energy into these fields.[106] However, historians of flight have by and large ignored environmental history, which is all the more surprising given the airplane's status as a technology of the Anthropocene. (See "Anthropocene.") Not only has flight, with its access to the view from above, allowed us to see the environment in new ways, but it is also shaping our planetary future.[107] Recent research shows that if there is not a major emissions mitigation plan, by 2100 the aviation sector will be responsible for 5.2 percent of the total anthropogenic global warming.[108] If for many utopians the possibility of human flight represented the potential emancipation of humankind's nationalist divisions and a new cosmopolitan global order, today it can just as easily be imagined as an engine of dystopia, with jet-crowded skies auguring environmental catastrophe. To borrow from Melvin Kranzberg, flight is neither inherently good nor bad, but it has also never been neutral—and the histories we tell about it show that.[109]

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105 Vernon, "Heathrow and the Making of Neoliberal Britain."

106 Orsi, *Sunset Limited*; Wells, *Car Country*.

107 The view from above and its relationship to the environment has been explored mainly by art historians. See Dorrian and Poussin, eds., *Seeing from above*; Weems*, Barnstorming the Prairies*; Kaplan, *Aerial Aftermaths*.

108 And this is only considering the industry's carbon dioxide emissions. See Terrenoire, Hauglustaine, Gasser, and Penanhoat, "Carbon dioxide emissions."

109 Kranzberg, "Technology and History: 'Kranzberg's Laws.'"

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