

Book Reviews

The Wright Brothers¹

Reviewed by *Captain Nicholas C. Frommelt**

*It had taken four years. They had endured violent storms, accidents, one disappointment after another, public indifference or ridicule, and clouds of demon mosquitos . . . all to fly a little more than half a mile. No matter. They had done it.*²

I. Introduction

The Wright Brothers sit prominently in the American pantheon of historical figures.³ Two states' automobile license plates (perhaps somewhat ironically) lay claim to their invention, and three states quarrel over bragging rights for conceiving modern aviation.⁴ Indeed, it is difficult to overstate their importance. David McCullough's biopic has given life to these pioneers, coloring rich accounts of leadership, resiliency, grit, and collaboration. While these themes are well-tread for military leaders, McCullough's *The Wright Brothers* is a compelling case study in an important subject: innovation.⁵

Not only does a study of Orville and Wilbur Wright offer a valuable look at how innovation occurs organically, it also serves as an example of how innovation may fail without the conditions to foster its development. McCullough's biopic is a superb read for anyone, but it holds critical lessons in innovation for military leaders and judge advocates.

II. The "1000 Year Problem"⁶

McCullough begins his development of the Wrights as products of a liberal arts education, detailing a well-rounded, immersive approach to problem solving. The Wrights' parents steeped their childhood in everything from the classics of antiquity to contemporary scientific treatises.⁷ Reflecting on their accomplishments, Orville would remark that the Wrights "had no special advantages [T]he greatest thing in our favor was growing up in a family where there was always much encouragement to intellectual curiosity."⁸ Moreover, the Wrights had an incredible knack for mechanical problem solving. From printing presses to bicycles, the Wrights were "[e]ver enterprising, incapable of remaining idle"⁹

Captivated by the works of German glider enthusiast Otto Lilienthal, the Wrights studied aeronautics "as a physician would read his books."¹⁰ In his 1899 letter to the Smithsonian Institution, Wilbur began to orient himself to the problem of flight with a bold request: "I wish to avail myself of all that is already known"¹¹ Having no formal education in engineering and limited practical experience, such a request must have reeked of delusional grandeur. Sensing as much,

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¹ DAVID MCCULLOUGH, *THE WRIGHT BROTHERS* (2015).

² *Id.* at 106.

³ Ross Douhat, *The 100 Most Influential Figures in American History*, *THE ATLANTIC* (Dec. 2006), <http://www.theatlantic.com/magazine/archive/2006/12/the-100-most-influential-figures-in-american-history/305384/>. Based on a survey of ten "eminent historians," *The Atlantic* named Orville and Wilbur Wright as number twenty-three on its list of the 100 most influential figures in American history. *Id.*

⁴ Jim Siegel, *Ohio in First Flight Fight with Connecticut*, *THE COLUMBUS DISPATCH* (May 13, 2015, 6:18 AM), <http://www.dispatch.com/content/stories/local/2015/05/12/ohio-connecticut-first-flight.html> (discussing North Carolina's and Ohio's claims to the Wrights' innovation, memorializing their states connections on license plates, espousing the mottos "Birthplace of Aviation" and "First in Flight" respectively). Recently, Connecticut's legislature entered the fray, claiming that Gustave Whitehead made the first flight in 1901, two years before the Wright flight. *Id.* As noted by *The Dispatch* and McCullough, Whitehead's claims are dubious. MCCULLOUGH, *supra* note 1, at 260. McCullough concluded: "Strangely, the story still draws attention, despite the fact that there is still no proof." *Id.*

⁵ See, e.g., General Martin Dempsey, *18th Chairman's 2nd Term Strategic Direction to the Joint Force*, JOINT CHIEFS OF STAFF 6 (Jan. 2014), http://www.jcs.mil/portals/36/Documents/CJCS_2nd_Term

_Strategic_Direction.pdf (General Dempsey called "innovation and leader development" the cornerstone of the Nation's military advantage in his 2nd Term Strategic Objective.). Moreover, innovation figures prominently in the Air Force priorities. General Mark Welsh, Chief of Staff, U.S. Air Force, has said of innovation: "We were born from it." General Mark Welsh, *Remarks at Air Force Association Symposium*, U.S. AIR FORCE 10 (Feb 12, 2015), <http://www.af.mil/Portals/1/documents/af%20events/Speeches/af-150212-Welsh-AFA%20Remarks.pdf>. General Welsh continued, noting that "[e]very airman should be, can be, I believe must be innovative if we're to succeed in the future." *Id.* at 10-11.

⁶ After one failure with the Wrights' glider, Wilbur Wright remarked that "not in a thousand years would man ever fly." MCCULLOUGH, *supra* note 1, at 63. The Wrights had incredible resiliency in the face of repeated and overwhelming obstacles. See, e.g., *id.*

⁷ *Id.* at 17 (describing the Wrights' studies).

⁸ *Id.* at 18.

⁹ *Id.* at 23. The Wrights began selling and repairing bicycles in 1893, but the enterprise would not sustain their interest for long. *Id.* at 22. In 1896, Orville contracted typhoid, and Wilbur began reading works on aviation to Orville while bedridden. *Id.* at 28. The prospect of building a flying machine "infected" the brothers with "unquenchable enthusiasm and transformed idle curiosity into the active zeal of workers." *Id.* at 37.

¹⁰ *Id.* at 30.

¹¹ *Id.* at 27.

Wright defended: “I am an enthusiast, but not a crank in the sense that I have some pet theories as to the proper construction of a flying machine.”¹² So began the Wrights’ work—a journey from tinkerers to pioneers.

As the Wrights immersed themselves in the problem of flight from 1899–1903, they began to distill the critical issues associated with manned flight. They exhaustively studied the flights and wing shapes of different species of birds.¹³ Orville would write, “Learning the secret of flight from a bird . . . was a good deal like learning the secret of magic from a magician.”¹⁴ They made a major stride in focusing themselves on one major hurdle, stability in flight, as chronically neglected in the enterprises of their forbearers.¹⁵ The Wrights’ understanding of the mechanics of designing and riding bicycles naturally complemented their studies of aeronautics:¹⁶ “Equilibrium was the all-important factor, the brothers understood.”¹⁷

From thorough observation and continuous trial and error, the Wrights began work on their glider.¹⁸ Faced with repeated failures, the Wrights had to rethink the underpinnings of their design:

It was not just that their machine had performed so poorly, or that so much still remained to be solved, but that so many of the long-established, supposedly reliable calculations and tables prepared by the likes of Lilienthal, Langley, and Chanute—data the brothers had taken as gospel—had proven to be wrong and could no longer be trusted. Clearly those esteemed authorities had

been guessing, “groping in the dark.” The accepted tables were, in a word, “worthless.”¹⁹

The Wrights’ setbacks with the glider were only the beginning. They had several crashes,²⁰ injuries, and a brush with death.²¹ Indeed, their undertaking was so perilous that they would not fly together until well after refining their third Wright Flyer out of fear that the work could not continue if one of the brothers would die.²² They worked on a shoestring budget.²³ They conducted tests in an incredibly austere environment: The Outer Banks of Kitty Hawk, NC, were windswept and rugged.²⁴ They sustained life-threatening injuries, in one instance landing Orville in the hospital for weeks.²⁵ Following their work on stabilizing a glider in flight, the Wrights took on the task of building an engine, but they had no practical experience in combustion engines.²⁶ The Wrights leveraged the talents of Charlie Taylor, a “brilliant” local mechanic—a “godsend.”²⁷ Moreover, the Wrights faced a “still bigger challenge” in the design of the propellers.²⁸

Like any of the other problems they faced, the brothers immersed themselves in the problem, collaborated, and devised solutions—they innovated.²⁹ They learned from the successes and failures of others, like Langley and Chanute, as well as their own.³⁰ After several trials at Kitty Hawk, they devised a wind tunnel to test their rudders,³¹ enabling ongoing experimentation at their shop in Dayton.³² Moreover, they devised a way to stabilize their flyer with flexible wing surfaces.³³ They leveraged the talents of those around them,

¹² *Id.* at 32-33. McCullough notes that “strange or childish flying machines” served as a continuous source of comic relief in the press. *Id.* at 33.

¹³ *Id.* at 51-53.

¹⁴ *Id.* at 53.

¹⁵ The Wrights observed that “[e]quilibrium was the all-important factor . . . The difficulty was not to get into the air but to stay there. . . .” *Id.* at 38.

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ *Id.* at 56-63.

¹⁹ *Id.* at 63.

²⁰ *Id.*

²¹ *See, e.g., id.* at 106 (the “first ever airplane accident” caused from a gust of wind while not in flight); *id.* at 115 (Orville’s crash in the Flyer II); *id.* at 175-76 (Wilbur’s crash of the Flyer III in front of a large crowd at Le Mans, France); *id.* at 191-92 (Orville’s crash of the Flyer III that caused the death of Lt. Selfridge and Orville’s own life-threatening injuries at Fort Myer, VA). McCullough quotes Orville, stating that he said he “plunged straight down, ‘like a bird shot dead in full flight.’” *Id.*

²² *Id.* at 253. In all the years they had worked together, they never flew together, “so that if something were to go wrong and one of them should be killed, the other would live to carry on with the work.” *Id.*

²³ *Id.* at 108. The Wrights invested approximately \$1,000 into their first flyer design. *Id.*

²⁴ *Id.* at 40-41. The Wrights’ choice of Kitty Hawk was itself incredibly novel. They studied records of average wind velocities at over 100 locations. *Id.* at 40. Kitty Hawk provided not only high wind speeds but also remote isolation, affording the Wrights privacy. *Id.* at 41.

²⁵ *Id.* at 192.

²⁶ *Id.* at 87.

²⁷ *Id.* at 86.

²⁸ *Id.* at 88 (The Wrights drew on “several months of study and discussion” in understanding the mechanics of propellers.).

²⁹ *See, e.g., id.* at 88-90 (discussing their collaboration to solve the propeller problem).

³⁰ *See, e.g., id.* at 63 (The Wrights learned that they had to re-examine the data sets of Lilienthal, Langley, and Chanute.); *id.* at 101 (discussing lessons learned from Langley’s work).

³¹ *Id.* at 69-70.

³² *Id.* at 70. The Wrights tested “some thirty-eight wing surfaces, setting the ‘balances’ or ‘airfoils’—the different-shaped hacksaw blades—at angles from 0 to 45 degrees in winds up to 27 miles per hour.” *Id.*

³³ *Id.* at 63-64, 90.

like Charlie Taylor.³⁴ Where Samuel Langley failed with a \$70,000 budget,³⁵ the Wrights succeeded with \$1,000.³⁶ Even after their first flight, they continued to learn from mishaps and persevered after crashes.³⁷ They constantly refined and re-designed to increase distance and speed.³⁸

Upon successfully making their first flight at Kitty Hawk in 1903,³⁹ there was little traction for an event that would become a defining moment in the 20th century. They faced widespread incredulity, even from the Smithsonian Institution that provided the background materials for their undertaking.⁴⁰ It was not until May 1909 that President Taft recognized the accomplishment.⁴¹ Though several news outlets reported the first flight, “little happened as a consequence.”⁴² The French dismissed the accomplishment outright as a fraud,⁴³ though the French later showered effusive praise on the Wrights.⁴⁴ Years passed, with repeated signals of disinterest from the U.S. Government and the War Department, without any recognition of the significance of the event.⁴⁵ Following several successful demonstrations in France, the Wrights would receive broad recognition for their accomplishments in the United States.⁴⁶ In 1909, following a demonstration at Fort Myer, VA, the Wrights finally executed a contract with the War Department.⁴⁷

Readers will know the outcome before they begin reading: The Wrights would persevere and go down as pioneers of modern aviation. The rub, which McCullough masterfully depicts, is how their innovation took them from a bicycle shop to world-famous flyers.

III. Innovation in Action

Civilian and military audiences alike will find McCullough’s *The Wright Brothers* as a smoothly written, edifying historical account. However, there are some vital lessons that are pertinent for a military audience. McCullough provides a case study in the organics of innovation. Moreover, this book contains a subtle lesson in how leaders and institutions respond to the innovators around them.

The Air Force’s Vision Statement focuses on “Airmen, Mission, and Innovation.”⁴⁸ General Mark Welsh, the Air Force Chief of Staff, emphasized the critical nature of empowering Airmen to innovate:

This spirit of innovation, of seeing problems from an alternative perspective, is in our culture, in our heritage, and in every Airman Airmen characteristically view security challenges differently—globally, without boundaries The Air Force’s competitive advantage begins with its ability to recruit, develop, and retain innovative warriors with strong character Even though the Air Force has become significantly smaller since 1947, our Nation has maintained an asymmetric airpower advantage because Airmen continue to lead the way in integrating military capabilities across air, space, and cyberspace. In the face of an unknown and unpredictable future, the American military’s

³⁴ *Id.* at 86-88, 92.

³⁵ *Id.* at 93. Langley received \$50,000 from the publicly-funded Smithsonian Institute. *Id.* Private contributions to Langley totaled an additional \$20,000. *Id.* Langley would fail for a third time in late 1903 (a couple weeks prior to the Wrights’ first flight), and the Washington Post would call for defunding Langley’s enterprise. *Id.* at 100.

³⁶ *Id.* at 108.

³⁷ See, e.g., *supra* note 21 and accompanying text (describing Wilbur’s crash of the Flyer III at Le Mans, France and Orville’s crash of the Flyer III that caused the death of Lt. Selfridge and Orville’s own life-threatening injuries at Fort Myer, VA).

³⁸ The Wrights continued to set records for distance flown. Their first flight flew 852 feet in 59 seconds. MCCULLOUGH, *supra* note 1, at 106. While demonstrating the Flyer III at Fort Myer, VA, Orville would set “a new world record” by remaining in the air for an hour and six minutes. *Id.* at 185. Wilbur made another record-breaking flight in France, flying over one and a half hours at Camp d’Auvours. *Id.* at 197. Wilbur would later win the newly established “Michelin Cup” by flying 2 hours and 0 minutes, a distance of 77 miles. *Id.* at 210.

³⁹ *Id.* at 107.

⁴⁰ *Id.* at 32-33.

⁴¹ *Id.* at 229.

⁴² *Id.* at 110, 128.

⁴³ *Id.* at 132 (recounting the *Paris Herald* mocking the Wrights in an editorial “Flier or Liars”). The French Government was particularly dismissive prior to witnessing the flyer firsthand: McCullough writes, “At the war ministry it was being said the Wrights were ‘bluffers like all Americans’ . . . [and were] ‘worthless people’ trying to sell to France ‘an object of no value’ that even the Americans did not believe in.” *Id.* at 142.

⁴⁴ *Id.* at 203 (discussing how “[n]ot since Benjamin Franklin had any American been so overwhelmingly popular in France.”). The French would later hail the brothers as exhibiting “the grit and indomitable perseverance that characterize American efforts in every department of activity.” *Id.*

⁴⁵ *Id.* at 111, 123, 128. Shortly after flights in Dayton, the Wrights received a “standard reply sent irrespective of the fact that the Wrights had made no appeal for financial support.” *Id.* at 123. McCullough hypothesizes that such a response may be a function of “extreme wariness” after Langley’s failures, “plain bureaucratic ineptitude,” or even that the claims made by the Wrights “seemed too preposterous to be taken seriously.” *Id.*

⁴⁶ *Id.* at 230. The Wrights received praise from President Taft and visited the White House in 1909. *Id.*

⁴⁷ *Id.* at 238. The War Department paid \$30,000 for a flyer after it demonstrated a successful flight from Fort Myer, VA, to Alexandria, VA (approximately 10 miles). *Id.*

⁴⁸ General Mark Welsh, *The Power of Airmen*, U.S. AIR FORCE (Aug. 15, 2013), <http://www.af.mil/News/ArticleDisplay/tabid/223/Article/466873/the-power-of-airmen.aspx>.

ability to conduct successful joint operations is enhanced by the power of Airmen.⁴⁹

Innovation is at the core of U.S. military power, and few have embodied innovation quite like the Wrights. They demonstrated resiliency, grit, and collaboration in their efforts to innovate. They showed an acute knack for working analytically, where hard work alone would not be enough. Through exhaustive observation and testing, they pinpointed where others had erred in developing flying machines.⁵⁰ They shortened their learning curve by developing testing mechanisms like a rudimentary wind tunnel.⁵¹ Simply put, their success was a function of recognizing the need to innovate in order to succeed.

Perhaps more importantly, McCullough's work provides a case study for harnessing the innovation of others. *The Wright Brothers* offers a cautionary tale of bureaucracy obfuscating truly groundbreaking work. As noted, the U.S. Government took nearly six years to realize the significance of the 1903 Kitty Hawk flight.⁵² The failures to recognize the importance of the Wrights' innovation ought to serve as a note of caution to all leaders. It is critical to harness the vision and innovative spirit of the proverbial bicycle shop tinkerers in every organization.

In Colin Clark's recent editorial, *Can the Air Force Innovate? Snake Clark And Buzz Moseley*, Clark notes, "One of the standard comments you'll hear about smart colonels is that they were pushed out before they could win a star, precisely because they had a really good idea or two and were thus far too disruptive to the status quo."⁵³ Military members are charged with the imperative to innovate. Similarly, leaders must recognize and foster innovation occurring in their midst.

This imperative applies uniquely to judge advocates. Not only must judge advocates innovate to accomplish daily missions,⁵⁴ judge advocates must enable commanders and clients to innovate. In facilitating commanders' focus on the

mission, it is always easy to cite a rule as to why a course of action will not work. It is often more difficult to innovate, to help develop a new course of action that will work. Judge advocates will learn much from the innovative spirit embodied in McCullough's *The Wright Brothers*.

IV. Conclusion

David McCullough's *The Wright Brothers* is an outstanding read for even the casual student of history. His smooth account is as thought provoking as it is enjoyable. Moreover, McCullough delivers a compelling case study in innovation. Civilians and military members of all occupations and services will find tremendous value in following the Wrights' journey from their Dayton bicycle shop to worldwide recognition as the fathers of modern aviation.

⁴⁹ General Mark Welsh, *Global Vigilance, Global Reach, Global Power for America: The World's Greatest Air Force—Powered by Airmen, Fueled by Innovation*, AIR AND SPACE POWER JOURNAL 4-5 (Mar.-Apr. 2014), <http://www.airpower.maxwell.af.mil/article.asp?id=191>.

⁵⁰ See, e.g., MCCULLOUGH, *supra* note 1, at 69 (discussing how the Wrights determined that Lilienthal & Chanute erred, and how the Wrights set out to "crack the code of aeronautics themselves").

⁵¹ *Id.* 69-70 (discussing the Wrights' development of a wind tunnel for testing wings). Chanute remarked that they were "better equipped to test the endless variety of curved surfaces than anybody has ever been." *Id.* at 70.

⁵² *Id.* at 238. It took the War Department until 1909 to understand the value of the Wright Flyer. *Id.* They paid \$30,000 for a flyer after it demonstrated a successful flight from Fort Myer, VA to Alexandria, VA. *Id.*

⁵³ Colin Clark, *Can the Air Force Innovate? Snake Clark and Buzz Moseley*, BREAKING DEFENSE (Jul. 24, 2015), <http://breakingdefense.com/2015/07/can-the-air-force-innovate-snake-clark->

[and-buzz-moseley/](http://breakingdefense.com/2015/07/can-the-air-force-innovate-snake-clark-and-buzz-moseley/). Clark cites examples of military officers attempting to innovate at the expense of their careers. *Id.* Former Air Force Chief of Staff, General T. Michael "Buzz" Moseley, remarked that Moody Suter was such an individual who faced detractors trying to silence his innovation. *Id.* Suter was critical in the development of the Air Force's Red Flag exercise, which became a marquee training event. *Id.* Suter developed Red Flag to be "highly realistic training designed to ensure American and allied pilots survived their first ten missions, when a pilot historically faced the greatest chances of being shot down . . ." *Id.*

⁵⁴ Innovations in legal offices may be as small as refining the way attorneys provide legal assistance. A recent *Air Force Reporter* article highlighted using a "Legal Assistance Prescription Pad" for improving client services. See Captain Rodney Glassman and Senior Airman Diego Bermudez, *Exporting Best Practices to Your Next Base: The Legal Assistance Prescription Pad*, 24 THE REPORTER 34 (2015), <http://www.afjag.af.mil/shared/media/document/AFD-150427-034.pdf>.