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ENTREPRENEURIAL SUCCESS AND FAILURE
IN THE AVIATION INDUSTRY:
THE HISTORY OF THE WACO AIRCRAFT COMPANY, 1919-1963

by

Howard G. Jones, III

A dissertation submitted to the Johns Hopkins University in conformity with the
requirements for the degree of Doctor of Philosophy

Baltimore, Maryland

September 1999

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ABSTRACT

This dissertation shows how the history of the Waco Aircraft Company reflects the transformation of the American economy in the twentieth century. Beginning just after the First World War, its entrepreneur, Clayton J. Brukner, developed a network of relationships within the aviation industry. This allowed his company to develop significant competitive advantages in the private flying market. Those advantages and the popular appeal of aviation helped Waco to become the largest manufacturer of civilian aircraft by 1929.

The transformation of business-government relations during the New Deal demanded changes in Brukner's business strategy. The depression significantly cut sales of its popular biplanes, but Waco kept its Troy, Ohio, factory open and earned some profits during the downturn. Brukner's involvement with the trade associations in the 1930s revealed the critical role the government, the military in particular, played in the development of aviation. His flawed leadership in the changing context led to decisions that degraded the quality of its network signals and diminished Waco's effectiveness in crafting appropriate policies.

As the international situation grew increasingly tense throughout the 1930s, Waco, like other manufacturers, turned to exports to enhance sales. Contracts with foreign governments partially offset the setback the depression had caused domestically. They did not, however, drive Brukner to evaluate sufficiently Waco's potential participation in the U.S. military market. Only after the Munich Crisis in September

1938, when President Franklin D. Roosevelt decided to call for increased military spending, did the Waco Aircraft Company position itself to receive defense contracts.

It was almost three years, however, before the Army Air Forces directed the company to design and manufacture transport aircraft and cargo gliders. In the meantime Brukner had not developed the organizational capabilities needed to manage military contracts. Simultaneously directing the design, engineering changes, and production of numerous different models of military gliders proved extremely challenging for Waco. The effort exhausted the company leadership, and Waco emerged from the war with few resources to invest in its reconversion to civilian production. Waco produced no more aircraft, making it one of the notable casualties of the war.

Advisor: Professor Louis Galambos

Reader: Professor Ron Walters

Acknowledgments

In studying the networks that bound together various elements of the aviation industry in the first half of the twentieth century, I have found the energy of earlier aviation enthusiasts to be quite intact. In small towns like Troy, Ohio, and West Branch, Iowa, the librarians and archivists displayed an interest in interwar aviation that was truly contagious. Military researchers at Wright-Patterson Air Force Base, Fort Belvoir, Virginia, and the Air Force Academy, Colorado, similarly demonstrated an eagerness to identify documents that aided my efforts greatly. They provided invaluable support—both tangible and intangible—for my history of the Waco Aircraft Company.

The present and future aviation enthusiasts, the Air Force Academy cadets whom I have had the honor of helping to educate, further inspired me to better understand the complexities of the military profession in the twentieth century. In countless discussions in the classroom and in executing duties around the world, I have encountered individuals who strive to integrate experiential learning with academic knowledge to form a more rigorous professional expertise. They have challenged me to keep one step ahead of them and have forced me to be a better military and academic role model.

I had two role models and mentors for this extended endeavor. My advisor at Johns Hopkins, Louis Galambos, is perhaps the best practitioner of twentieth-century American economic history. If one can do a fraction of what he has done with his remarkable capacity for work and his creative thinking about historical synthesis, then one will enjoy professional success. For a student who must live by the power of the pen

(at least in part), he is the best teacher of concise writing. The fact that this study falls short of his high standards is a reflection of my failure and errors in judgment. It does not, however, result from a lack of professorial inspiration.

Earlier in my career I met Lieutenant Colonel John Obringer, whose personal and professional example helped me to chart a course for my own development. The dizzying pace he set as we marched through duties as diverse as earning academic degrees, coaching an intercollegiate athletic team, teaching full regimens of core and advanced-level courses, preparing papers for academic conferences, and recruiting instructors taught me whatever paltry skills I have in working efficiently. More importantly, the energy and integrity he demonstrated in continually trying to improve an Academy whose institutional setting included cultural biases against the educational mission inspired me to continue his campaign.

For a project that lasts as long as a doctoral dissertation, one reasonably expects changes in personal circumstances to occur—indeed that is part of the reason for seeking a doctoral degree. In my case, however, many changes were unexpected and unwelcome. My kids Cary, Katie, and Stephanie, have showed a continuing curiosity about life—no matter how difficult—and it has nurtured the same in me. If we can hold on to that, then anything is possible. But one person in particular has borne the brunt of the negative consequences of living with someone who is thoroughly engaged in creating history. She is my beautiful wife, Patty, and her graciousness and support far exceeded the burdens I placed on her. This work is dedicated to her. May all of our hard work—both tangible and intangible—serve as the basis for a bright future.

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Chapter 1

The Promise of Planes

The 1939 World's Fair in New York City was to be the greatest showcase of American aviation up to that time. Captain Eddie Rickenbacker, the famous American ace during World War I, led the aviation industry in organizing grand displays for the expected sixty million visitors to the fair. Warning his colleagues that the presentations were "to be measured and compared by the public with railroads, steamships and automobiles, he stated, "you cannot allow your industry to be dwarfed." He and his committee of workers vigorously promoted the opportunity to display the rapid technological advances that had caused the airplane to become the symbol of "the modern" American society.

Rickenbacker's scheme for the organization of the displays was straightforward. Three general categories of aviation gave companies the chance to characterize their products by their primary markets. Military aviation, commercial transportation, and private flying captured what the committee felt were the most important categories about which the public should be cognizant. Since the federal government could not sponsor its own displays at the World's Fair, the aircraft manufacturers most closely identified with military production covered the expense of having Army and Navy personnel and aircraft on the fairgrounds.¹ Most readily agreed, since the grim situation overseas in 1939 made the display of American aeronautical

¹ Eddie V. Rickenbacker to C.J. Brukner, March 7, 1939. *Brukner Papers*, Department of Archives and Special Collections, Wright State University, Dayton, Ohio (hereafter DoAaSC).

proless a patriotic duty as well as a great opportunity to garner more sales. Indeed the organizers were not hesitant about pointing out that "America awakened last September [during the Munich Crisis] to the new importance of air power in her scheme of national defense."² For commercial transporters the close proximity of the World's Fair to the airport at North Beach (the future LaGuardia) promised to give them new business as fairgoers traveled to or from New York. Airline companies' business had been improving steadily through the 1930s, as transport aircraft became more comfortable for passengers and more economical to operate. The last category, private flying, on the other hand, was suffering badly. The lingering depression had cut domestic sales so deeply that some companies devoted to production of private aircraft had turned to exporting their planes for foreign militaries. Some had closed their doors by 1939. Private flying's segment of the aviation market was very ill in comparison to the military and commercial transport segments. Why did Rickenbacker grant it equal status for the World's Fair?

Most histories of American aviation do not answer this question. Big businesses and government organizations shaped the aviation industry in the United States as in all nations, and the impressive technologies they have introduced since the 1930s have become symbols of the emergence of aviation as a key element of national power. That success has attracted numerous historians and economists intent on explaining the process of aeronautical innovation as it has evolved in the U.S. The disappointment prompted by the private flying field of aviation stands in stark contrast, yet few have studied the causes of that difference.

² "Your Aviation Exhibit at the New York World's Fair 1939," p. 5. *Bruckner Papers*, DoAaSC.

This study is intended to expand our understanding of aviation's past by including a story of the early success and ultimate failure of a company, Waco Aircraft, which was devoted to the private flying field. This field was the least wealthy in the industry, but it included a wide range of organizations and individuals devoted to the promotion of aviation in the United States. Firms like Waco hoped to make a profit from the rising popularity of the airplane. Community boosterism complemented the profit motive, just as it had done in the previous century with the railroads. Across the country numerous civic organizations initiated drives for aviation's acceptance into local and regional development plans. Their leaders said that economic and social progress depended on building airports and airways. In response to the pressure that these businessmen and civic organizations applied, government officials crafted various schemes to facilitate private aviation's growth. Thus Waco worked in an interdependent network of organizations, and innovations in one part of the network affected the multifaceted meaning of private flying in society.

This study will also examine the ways in which Waco's leaders reacted to the changes in the aviation industry as new technology and new government policies challenged established ways of doing business. At the level of the firm, Waco needed new capabilities to handle better the relationships it developed over time. Adaptations to the depression led to the development of niches in the export and military markets, but Waco expected these measures to tide the company over temporarily until demand picked up again after the depression lifted. Instead, they became desperate measures as the aviation market became almost exclusively a military one. Forced to interact frequently with other actors in the aviation industry like the military and trade associations, Waco

remained firmly committed to private flying. The consequences for the Waco Aircraft Company tell us much about the early development of American aviation and enable us to explore a facet of the history less familiar than the more successful shapers American aviation.

Nurturing Innovation

Historians of aviation have rightly placed considerable emphasis on the federal government's role in the industry. Aviation presented unique challenges to the government officials who first confronted the complexities of this advanced technology. They had experience in developing relationships with other industries and tried to adapt existing techniques and organizations to the task of nurturing American aviation. Government and industry leaders also had the lessons they learned from the mobilization for World War I, and they crafted new peacetime relationships in the 1920s. Then, certain aviation businessmen and some politicians perceived a common interest in establishing a more "rational" structure for the aviation industry. Specifically, they wanted to minimize the competition they thought was hindering the development of American aviation. In these markets, which were characterized by rapid technological development, the government through its military departments was the primary customer for the industry's products. And through the Post Office the government provided substantial subsidies to the airlines during their initial development in the 1920s and '30s.

Since the early days of the aviation industry, then, a mixed system of powerful government and corporate interests guided aeronautical development in the U.S.³

In the early 1920s the media had identified all the primary players and the roles they were to play in the drama that would become American aviation. Historians have presented the story as a dual one involving successful government and private innovation. The relevant national bureaucracies and their leaders have enjoyed the attention of such historians as Ellis W. Hawley and William F. Trimble. They have argued that the emerging aviation industry presented political leaders and mid-level managers opportunities for the government to exercise forceful influence on the development of aircraft technology to improve the efficiency of the economy and, later, to contribute to national security.⁴ Hawley and Joan Hoff Wilson have shown how aviation met the ideological needs of the post-Woodrow Wilson Progressives and how it played an important role in Herbert Hoover's associationalism.⁵ Hoover emphasized the airplane's economic potential, while his successor in the White House, Franklin D. Roosevelt, touted its politico-military significance. FDR supported a greatly expanded aviation

³ Louis Galambos with Jane Eliot Sewell, *Networks of Innovation: Vaccine Development at Merck, Sharp & Dohme, and Mulford, 1895-1995* (New York: Cambridge University Press, 1995), pp. 249-250; Edward W. Constant, II, *The Origins of the Turbojet Revolution* (Baltimore: Johns Hopkins University Press, 1980), pp. 8-15.

⁴ See Ellis W. Hawley, *The Great War and the Search for a Modern Order: A History of the American People and Their Institutions, 1917-1933* (New York: St. Martin's Press, 1992) and William F. Trimble, "The Naval Aircraft Factory, the American Aviation Industry, and Government Competition, 1919-1928" *Business History Review* 60 (Summer 1986), pp. 175-198.

⁵ See Joan Hoff Wilson, *Herbert Hoover: Forgotten Progressive* (Boston: Little, Brown, 1975) and especially Hawley, "Three Facets of Hooverian Associationalism: Lumber, Aviation, and Movies, 1921-1930," in *Regulation in Perspective*, ed. Thomas K. McCraw (Boston: Harvard University Press, 1981), pp. 95-123. For a good treatment of the Hoover administration's dealing with Post Office subsidies for the airlines, see F. Robert van der Linden, "Progressives and the Post Office: Walter Folger Brown and the Creation of United States Air Transportation," in *From Airships to Airbus: The History of Civil and Commercial Aviation, Volume 2, Pioneers and Operations*, ed. William F. Trimble (Washington, D.C.: Smithsonian Institution Press, 1995), pp. 245-260.

program, but both he and Hoover led administrations that helped launch American aviation on a trajectory that would carry it to world supremacy by the late 1940s.

Historians of the industry have depicted the private sector's complement to the government success story by paying most attention to those companies that won important military contracts. John Rae and Jacob Vander Meulen stress the initiative businessmen had in lobbying for key legislation and, more importantly, in sponsoring research and development that led to important technological innovations. These innovations allowed U.S. aircraft capabilities to leapfrog those of the Europeans during the interwar years. The unprofitable investments in R & D sustained progress, they argue, that neither the government nor the private sector alone could pay for.⁶ Other historians have examined corporate leaders, describing their success in forming, within the industry and with government officials, relationships that gave them access to information needed to compete effectively for new military contracts.⁷

These industry studies complement the work of other historians who have studied the process of innovation in large corporations and governmental organizations.

⁶ For a survey of the industry's development, see John B. Rae, *Climb to Greatness: The American Aircraft Industry, 1920-1960* (Cambridge, MA: MIT Press, 1968). Rae argues that despite the industry's utter dependence on the government, "a series of success stories" has established a "vigorously competitive" aircraft industry. Jacob A. Vander Meulen, on the other hand, describes Congress's mismanagement of the industry during the interwar years in *The Politics of Aircraft: Building an American Military Industry* (Lawrence, KS: University Press of Kansas, 1991). Procurement practices, he believes, were unfair to companies and their workers and created a business environment in which the technical advances made in U.S. aviation derived from the initiative of the private sector, not the coordinated efforts of the military and Congress.

⁷ An important early study is Elsbeth E. Freudenthal, *The Aviation Business: From Kitty Hawk to Wall Street* (New York: Vanguard Press, 1940). In it she details the consolidation of the aviation industry in the months following Charles Lindbergh's 1927 flight, and the government's strong reaction to the concentration of power in an aviation trust. For a more recent industry survey see Wayne Biddle, *Barons of the Sky: From Early Flight to Strategic Warfare, The Story of the American Aerospace Industry* (New York: Simon & Schuster, 1991), a study focusing on Martin, Lockheed, Douglas and Northrop—all important defense contractors.

Alfred D. Chandler, Jr., for example, studied large, vertically integrated corporations, highlighting the three-pronged investment companies have made in mass production, management, and mass marketing. These investments, he argues, gave them distinct advantages over competitors who faced ever-higher barriers to market entry.⁸ Louis Galambos has studied the formation of triocracies, or the three-sided alliances, that evolved as businessmen and officials in the government's regulatory agencies worked with key members of Congress to create policies that shaped industrial development.⁹ These more general studies of business-government relations and the evolution of the American economy in the twentieth century capture some aspects of aviation's history in the United States.

The picture, however, is incomplete. What is needed is a greater accounting for those aviation companies that did not participate heavily in the defense market and those that did not become the large businesses that produced aircraft in a mass production mode. Their stories are only imperfectly explained by the Chandlerian model of corporate development, and we need to understand their important role in the formation of the military-industry complex. These companies can tell us much about alternative market strategies and methods of development. Moreover, the many failures in this

⁸ Chandler, *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge, MA: Harvard University Press, 1990) and also *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard University Press, 1977).

⁹ Galambos, *America at Middle Age* (New York: McGraw Hill, 1983). Historians and political scientists have both used this approach extensively to analyze American politics. Early political scientists and their works include, Arthur Maass, *Muddy Waters: The Army Engineers and the Nation's Rivers* (New York: Da Capo Press, 1974); David Truman, *The Governmental Process*, 2d ed. (New York: Knopf, 1971); and Francis E. Rourke, *Bureaucracy, Politics, and Public Policy*, 2d. ed. (Boston: Little, Brown, 1976). For historians the organizational synthesis is a mainstay of historical analysis. The term originated with Louis Galambos, "The Emerging Organizational Synthesis in Modern American History," *Business History Review* 44 (Autumn 1970): 279-290. Good examples of its usage include William Lazonick, *Business*

sector of the industry can enable us to draw in finer detail the stresses the larger companies faced during the depression of the 1930s. These smaller manufacturers remained committed to specialty or batch production methods, even in the face of calls by industry leaders to prepare for mass markets for planes.¹⁰

This difference highlights the alternative ideologies that shaped aviation's development during the interwar years. The military contractors naturally favored the establishment of powerful air forces as the foundation for the defense of national interests, and they presented their ideas in technical aviation journals and in the popular media. Similarly the producers of private planes espoused an ideology that held that the new technology promised greater personal freedom. Companies like Waco retained a tangible link to those who hoped to put an aircraft in their garage, for their planes were the ones individuals bought for recreation and private flying. The media, through hundreds of printed stories and radio reports, nurtured the hope that planes could be as accessible as cars.¹¹ The defense manufacturers wanted to harness the political power that the airplane's popularity potentially created among the public. With that in mind,

Organization and the Myth of the Market Economy (New York: Cambridge University Press, 1991); and Stephan Skowronek, *Building a New American State* (New York: Cambridge University Press, 1982).

¹⁰ The hope for a mass market for airplanes endured for decades among aviation industry leaders and certain members of the public. It never came, but the aviation industry's constant drive for improvements in technical design in response to dynamic customer requirements provides a good example of specialty manufacturing. Philip Scranton's book *Endless Novelty: Specialty Production and American Industrialization, 1865-1925* (Princeton: Princeton University Press, 1997) provides a persuasive argument that specialty production deserves a more prominent place in American economic history. This method of manufacture produced goods worth more than those produced by Chandler's big businesses that used mass production for the period Scranton considers. This study hopes to further Scranton's study by showing how entrepreneurs in the aviation industry deployed specialty production methods until the mobilization for World War II began in 1939.

¹¹ The airplane's place in popular culture has numerous histories. The best is Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation, 1900-1950* (New York: Oxford University Press, 1983). For a study of Europe's response to the new technology, see Robert Wohl, *A Passion for Wings: Aviation and the Western Imagination, 1908-1918* (New Haven: Yale University Press, 1994).

they resisted marginalizing their smaller colleagues in the private flying field of the industry and granted them an important role in defining the meaning of the airplane in American society.¹² We need to know what the businessmen in this small, competitive sector of aviation manufacturing did with the power their position gave them. We need to understand the opportunities they created and exploited as the industry grappled with rapid changes in technology, in the economy, and in international affairs.

At the level of the firm other important issues arise. The hype surrounding aviation created an environment ripe for entrepreneurial activities, and the rapidly changing technology left the market in a constant state of disequilibrium.¹³ What kinds of innovations, actual or potential, most directly affected these entrepreneurs? What convinced them to enter the aircraft manufacturing market? What advantages accrued to the first-movers? What disadvantages? As the government became more prominent in shaping the market, how did these small companies learn to deal with regulatory agencies? Did they benefit from a technological push through the government's research and development efforts, or did they benefit more from the demand created by government procurement of their products? How did tax considerations and liability claims drive market behavior? As with all entrepreneurial endeavors, the ability to perceive the context accurately and retain the flexibility needed to meet changes

¹² Susan J. Douglas, *Inventing American Broadcasting, 1899-1922* (Baltimore: Johns Hopkins University Press, 1987), pp. xv-xx.

¹³ The hype extended into the post-World War II years, and the inflated rhetoric raised expectations in new aviation markets. For a good analysis of the creation of the postwar business jet market, for example, see Almarin Phillips, et al, *Biz Jets: Technology and Market Structure in the Corporate Jet Aircraft Industry* (Dordrecht: Kluwer Academic Publishers, 1994).

determines long-term success. How did manufacturing companies in the private flying field respond to new challenges and opportunities?

Aviation and American Society

Americans once loved aviation; many still do. Aviation, however, has become associated primarily with the large airline companies and the military. This perception has historical roots, in that companies in both the airline and the manufacturing areas of the aviation industry relied on the national government for their early survival and subsequent development. The government's support did not come easily, though, and in the years following the First World War Americans debated the extent to which taxpayers' money should be used to assist the new industry. This public discourse lasted until the end of World War II, when most Americans began to leave the details of the aviation industry and government relationship to businessmen, regulators, and politicians.

Americans today would find it hard to understand the tremendous appeal of the airplane in the early twentieth century. The enthusiasm surrounding the space launches in the 1960s approximates some of the emotionalism the public experienced for the airplane starting in the years prior to World War I. So strong was this sentiment that newspapers began hiring journalists whose task was to cover aviation developments. The *New York World*, for example, hired its first aviation reporter in 1910.¹⁴ The powered aircraft was, of course, an American invention (1903), but Europeans actually embraced the new technology more quickly than Americans did. After the U.S. Army declined the Wright brothers' offer to sell their design to the American government, the famous

¹⁴ Corn, *Winged Gospel*, p. 9.

Ohioans focused on earning foreign contracts. Their claims to have developed a flying machine excited the imagination of Europeans. Many British and French citizens had eagerly followed advancements in their own country, hoping they would be the first in the air. After witnessing Wilbur Wright fly at Hanaudieres, France, in 1908 one observer declared, "Nothing can give an idea of the emotion experienced and the impression felt, at this last flight, a flight of masterly assurance and incomparable elegance."¹⁵ A similar fervor in Great Britain had earlier persuaded the British journalist Lord Northcliffe, publisher of the *Daily Mail*, to hire an aviation correspondent in 1906.¹⁶ Very early in its history, then, aviation attracted great attention and aroused the nationalistic hopes in the technologically advanced nations, prompting the press to position itself to cover and thus to influence the development of airplanes.

The enthusiasm the public showed for flying on both sides of the Atlantic appeared very clearly in the various aerial competitions held prior to the Great War. Distance and endurance competitions, with large cash awards offered by the media, provided a constant source of newspaper stories that the public apparently loved. The September 1912 International Aviation Meet in Chicago, Illinois, attracted over 70 aviators and included ten days of events for land and hydro-planes. Chicago *Tribune* journalist William B. Stout, published the first issue of his trade periodical *Aerial Age* for the purpose of advertising the meet.¹⁷ Stout's airmindedness later drove him into the aircraft manufacturing business for a short period. In Europe Louis Bleriot's flight across

¹⁵ Wohl, *Passion for Wings*, p. 7.

¹⁶ *Ibid.*, p. 38.

¹⁷ Fred O. Kobernuss, *Waco—Symbol of Courage and Excellence*, vol. 1 (Terre Haute: SunShine House, Inc., 1991), pp. 61-62.

the English Channel in 1909 was typical in arousing the kind of hype that surrounded aeronautical accomplishments in this period. Many Frenchmen viewed the feat as confirmation of France's natural superiority in aviation technology and flying ability, and the British had direct evidence that the geographic isolation from the continent that Great Britain had enjoyed for centuries was now gone. Both Paris's *Le Matin* and Northcliffe's *Daily Mail* were on hand to convey the story and its significance to audiences on both sides of the Channel. The crossing was a dramatic achievement, and each subsequent record that fell in the years preceding World War I seemed to have military and political ramifications for all of the nations committed to developing aviation technology.¹⁸

Far from turning the public away from aeronautics, the war enhanced the public's fascination with the airplane. Even as instruments of war, planes still seemed to transcend the horrible killing machines that trench warfare created with other technologies, like the tank and the machine gun. The pilots symbolized a more chivalrous code of warfare that Hollywood depicted in successful 1920s movies like *Phantom Flyer* and *Hell's Angels*. The exploits of the American military pilots in the years immediately following the war reinforced popular culture's depiction of them as dashing pioneers. In 1919, for example, six Navy fliers launched a trio of planes in a flight from Long Island to Lisbon. Only one aircraft completed the trip, but the accomplishment made clear that the United States had not conceded aeronautical leadership to the Europeans. On the contrary, military leaders, aviation businessmen, and the public expressed mounting enthusiasm for the airplane as flying records continued to

¹⁸ Wohl, *Passion for Wings*, pp. 44-66.

fall. Two U.S. Army lieutenants completed the first non-stop cross-country flight in May 1923, earning a telegraph from President Harding himself. The *San Diego Union* declared that "imagination itself must pause." And key military leaders were learning to exploit the publicity the media afforded. Major Henry H. Arnold, later a five-star general, announced, "The impossible has happened."¹⁹ The military and the media made powerful partners in bringing the story of American aviation's progress to the public. An even more direct link between aviation and the public came in the form of the barnstormers. They flew to any location where an audience for their stunt flying could be found. They offered short airplane rides for a few dollars and then moved on to the next community.²⁰ Their enthusiasm for flying was contagious and it further fueled the interest that government and private leaders hoped to turn into tangible support for a comprehensive development program for American aviation.

Some military officers in particular recognized the impact that airplanes were likely to have on warfare. In Italy army officer Giulio Douhet, who had experienced the trenches of the Great War, published a book entitled *Command of the Air* in 1921. In it he argued that armies and navies were no longer the key to military strength, since aircraft could so easily overfly them both. On strategic bombing, the Italian held that the distinction between combatants and non-combatants had disappeared as nations developed the capability to bombard cities in order to destroy an enemy's will and ability to resist. Douhet believed a nation's security depended upon its ability to launch

¹⁹ Corn, *Winged Gospel*, p. 14.

²⁰ *Ibid.*, p. 12.

offensive air strikes from within its own borders.²¹ In Great Britain where German bombs had fallen on London during the war, Sir Hugh Trenchard, an officer in the Royal Air Force, said that civilian morale was one of the primary targets the military should attack. The panic and demoralization caused by aerial bombing had effects out of proportion to the material damage the attacks inflicted.²² Thus, in the 1920s European military leaders began to formulate doctrine for aerial warfare based on the recent experience of World War I and on their predictions about the pace and direction of aeronautical developments.

In the United States a similar process of creating the intellectual framework for the military use of aviation technology was underway. Headed by the dynamic Assistant Chief of the Air Service in the early 1920s, Brigadier General William L. "Billy" Mitchell, air leaders refined the "lessons" of the war. Although Douhet's translated book had arrived in the U.S. in 1923, its impact was minimal. Instead, Mitchell's ideas about strategic bombing were shaped by the unique geographical advantages and political climate in this country. Mitchell was influenced by the general American bias against aggressive militarism. He dealt with the inherently offensive nature of strategic bombing only in the last of four phases he outlined in this 1925 book *Winged Defense*. Before attacks on the enemy's homeland came the first three missions of the American air force; mobilization of American society; defense of the coasts; and control of the seaplanes.²³ Above all, Mitchell emphasized the necessity of ensuring the air force's independence

²¹ Wohl, *Passion for Wings*, p. 283.

²² R.J. Overy, *The Air War, 1939-1945* (New York: Stein and Day, 1980), pp. 15, 136.

²³ Jeffrey S. Underwood, *The Wings of Democracy: The Influence of Air Power on the Roosevelt Administration, 1933-1941* (College Station: Texas A & M Press, 1991), pp. 184-189.

from the Army and the Navy. Without autonomy from the other services, he believed, doctrine would be too slow to change and funding for aviation would never suffice. In that environment American aviation would not compete successfully with that of the country's international rivals.

Mitchell's commitment to organizational innovation led to open confrontations with his military superiors and generated strong political pressure in Congress for changes. The military's ineffective procurement policies for aircraft provided strong evidence that Mitchell's calls for radically restructuring the U.S. military into a Department of Defense were reasonable.²⁴ While unsuccessful during the interwar years in achieving his larger goal, his appeals to the public for centralized control of aviation drove the Navy to seek congressional authority, granted in 1921, for the formation of a Bureau of Aeronautics within the Navy Department. In 1925 Mitchell's antics again forced the issue of centralized control to the forefront and President Calvin Coolidge appointed a board chaired by Dwight W. Morrow in December of that year to consider the issue. The Morrow Board's conclusions led to the creation of a Bureau of Aeronautics within the Commerce Department and to the establishment of the position of assistant secretary of the navy for aeronautics.²⁵ While these measures moved aviation in the direction Mitchell wanted, Congress's pace was too slow for him and others who advocated more decisive action on behalf of American aeronautics.

For that reason his lobbying efforts were not confined to the Capitol. Mitchell worked hard, for instance, to establish support among private organizations interested in

²⁴ Vander Meulen, *Politics of Aircraft*, p. 73.

²⁵ Trimble, "Naval Aircraft Factory," pp. 182, 194-195.

aviation. In August 1920, for example, he endorsed the merger of the American Flying Club and the Aero Club of America as a better means to apply political pressure on reactionary military leaders and cautious congressmen. He told the *New York Times*, "The combined clubs bring together all the best elements in aviation that this country possesses. There is nothing which has happened in the development of our whole national defense system which will have a greater effect than this consolidation."²⁶ Within the aviation industry, however, Mitchell's antagonistic style eroded the sympathy that many businessmen had for his message. An industry representative wrote of the period 1921 to 1924 that "Both the Army and Navy in the confusion resulting from the . . . personalities exchanged between the officers and officials in Washington had no real policy for the development of aircraft. . . . The industry was about to become non-existent."²⁷ Mitchell shared the businessmen's frustration, but in his mind the proper organization and doctrine for the American air force were higher priorities than budgets for planes.

Mitchell was not alone in his campaign for an aviation program. Many leaders of the emerging aviation industry also lobbied intensely to garner support for flying. They were not dealing from a position of strength in the years following World War I. The speed with which the government cancelled contracts for aircraft totaling \$110 million left many aircraft companies reeling from the sudden loss of income.²⁸ While

²⁶ William A. Robie, *For the Greatest Achievement: A History of the Aero Club of America and the National Aeronautic Association* (Washington, D.C.: Smithsonian Institution Press, 1993), p. 100.

²⁷ Howard Mingos, "Birth of an Industry," in *The History of the American Aircraft Industry: An Anthology*, ed. G.R. Simonson (Cambridge, MA: MIT Press, 1968), pp. 53-54.

²⁸ Rae, *Climb to Greatness*, p. 2.

consistent with previous demobilizations in U.S. military history, that shock and the large surplus of planes flooding the market left very few manufacturers in business. The most prominent of these companies had existed prior to World War I and included Curtiss Aeroplane and Motor Company, Glenn L. Martin Company, and the Boeing Airplane Company. Despite the depressed times in the early 1920s, these firms were joined by new entrants to the manufacturing business. Douglas Aircraft was launched in Los Angeles in 1922, and Consolidated Aircraft in Buffalo, New York, in 1923.²⁹ Both secured a foothold by winning military contracts shortly after incorporation and became continuing members of a rather small group of government contractors. In 1925 the Assistant Chief of Staff of the Army testified to Congress that no more than twenty factories produced airplanes. Four years later the entire industry's value of capital totaled only \$111 million.³⁰ The industry was very small when compared to giants like the petroleum refining and automobile industries, which had \$574.5 million and \$257.5 million in capital respectively.³¹

The industry leaders nevertheless asserted that an inherent link existed between aviation and the nation's security. Key politicians agreed and helped to organize an American aviation mission to Europe in the summer of 1919. The contingent included representatives from the military, Howard Coffin the noted automobile engineer and head of the Council of National Defense during the war, the presidents of the Curtiss and

²⁹ Ibid., pp. 8-13.

³⁰ Ibid., p. 21.

³¹ U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970* (Washington, D.C.: GPO, 1975), p. 684. The figures presented are the 1929 book value of the capital for these industries.

Wright Aeronautical companies, and Samuel Bradley the general manager of the Manufacturers Aircraft Association (MAA), the organization chartered to administer the cross-licensing agreement which pooled aviation patents. The mission confirmed that many European leaders believed that the emerging industry was a key component of national power. The industry representatives in particular became ardent supporters of the idea that the national government owed the aviation industry special consideration.

Samuel Bradley of the MAA was the primary spokesman, and he executed his duties with great zeal. In May 1921 Bradley declared rather grandly that "the national interests and the individual interests of the aircraft manufacturers are identical."³² Bradley was in part trying to rally the industry around the MAA, since it was apparent to him that not all manufacturers were as zealous as he was in pushing for government action. The MAA also faced competition from other trade organizations that were trying to convey an "official" industry view on aviation developments. Drawing upon the experience of the mission to Europe, Bradley argued that European nations had decided that heavy government involvement was important to ensure that aviation developed in accordance with national objectives. In Germany, for example, the plans for postwar aviation placed strong emphasis on military control over civil aviation. The Treaty of Versailles forced much of German interwar development in aviation into secrecy,³³ but still, Germany was moving ahead and the German model was not unique. In Sweden a series of three postwar aviation commissions agreed that aircraft manufacturing was

³² Mingos, "Birth of an Industry," p. 55.

³³ John H. Morrow, Jr., "Connections between Military and Commercial Aviation in Germany: Junkers, Heinkel, and Dornier through the 1930s," in *From Airships to Airbus: The History of Civil and Commercial Aviation, Volume 2, Pioneers and Operations*, ed. William F. Trimble (Washington, D.C.: Smithsonian Institution Press, 1995), p. 153.

strategically important, and the Swedish parliament passed laws intended to create the foundation for rational aviation planning. Sweden decided to create an independent air force in 1925.³⁴ Swedish military leaders were influenced by Britain's independent flying service, as was American General Billy Mitchell. Equally compelling for American industry leaders were the annual appropriations for civil aviation in Europe. In Britain they totaled \$2.5 million in 1925; in France the amount was \$12.5 million.³⁵ As Bradley insisted, "Our Government is now faced with the task of nursing and actively encouraging a new transportation industry, whose healthy growth is vital to the future progress and defense of the nation."³⁶

Samuel Bradley and General Mitchell were two of many individuals who actively campaigned for aviation development in the United States. Airmindedness during the interwar years had three important components: first, a general enthusiasm for airplanes; second, a firm belief in the ability of aviation technology to contribute to a better life for Americans; and third, enthusiastic support for aviation's further development.³⁷ The advocates of airmindedness formed aviation clubs, lobbied government officials from the local to the national level, and a few even established companies to profit from aviation's popularity. Leadership fell primarily to the federal government due to the lobbying efforts of the industry and the American public's acceptance of the idea that aviation was to be a national technological system. Realizing

³⁴ Klaus-Richard Bohme, "Connections between Commercial and Military Aviation in a Neutralist Country: The Case of Sweden," in *From Airships to Airbus*, ed. Trimble, p. 209.

³⁵ Rae, *Climb to Greatness*, p. 21.

³⁶ Mingos, "Birth of an Industry," pp. 47-48.

³⁷ Corn, *Winged Gospel*, p. 12.

the potential of aircraft technology, however, proved to be an extremely challenging goal to achieve.

Entrepreneurship in an Emerging Market, 1919-1920

In 1933, Don Luscombe of the Monocoupe Corporation visited Clayton J. Brukner at the Waco Aircraft Company factory in Troy, Ohio, in an effort to coordinate small manufacturers' views on the state of private flying in the country as Franklin D. Roosevelt assumed the presidency. Brukner was an old hand in the industry then, having first started in aviation during World War I. Tracing his early steps reveals the bold decisions this entrepreneur took in charting a course very different from that chosen by most aircraft manufacturers. Waco's products far outsold the competitors', and even in the depression year of '33, the company turned a profit. The change of administrations in Washington was only the latest in a series of shifts in Waco's business context. His colleague's effort to assess the private flying field performance took him to see Brukner. Luscombe and Brukner both knew Waco was uniquely successful in the aircraft manufacturing field. And Brukner hoped to sustain his entrepreneurial endeavors well beyond the twelve years he already had under his belt.

The path to prominence had been a long one, and Brukner had enjoyed the assistance of others at key points in the early stages of his career as a manufacturer. Like him, they were determined to make their love of aviation the basis for a successful business. Also like Brukner, their love of flying predated the Great War. They learned the business of barnstorming and took the first steps towards aircraft production, hoping to cash in on America's enthusiasm for aviation.

Brokner was a self-made mechanic. Born in Ravenna, Nebraska in 1896, his family moved to Burkeville, Virginia, in 1904 or 1905. In 1908, however, his father decided to return to his native town of Battle Creek, Michigan. There Clayton received his secondary and primary education, graduating from high school in 1915. His first full-time employment came from the Postum Company in Battle Creek, where Brokner did electrical maintenance work.

Brokner's best friend from high school days played an important role in fostering his early interest in aviation. James Elwood "Sam" Junkin moved to Battle Creek in time for the last two years of Brokner's education. In their Manual Arts Class, Brokner and Junkin demonstrated their mechanical and creative talents, constructing an iceboat with a propeller they made themselves. After graduation both young men had a strong desire to learn how to fly, but a four-hour course cost \$400. Pooling their money, they flipped a coin to see who the lucky pilot would be. Junkin won. He then capitalized on his brief flying experience and mechanical talents by earning successive positions with the Curtiss Aeroplane and Motor Company in Buffalo, New York; the Standard Aero Corporation in Plainfield, New Jersey; and the Aeromarine Plane and Motor Company in Nutley, New Jersey. Junkin was apparently in high demand due to his rare and valuable flying experience, and higher wages enticed him to change jobs—none of which lasted more than three months during the prewar period. As the United States declared war on Germany in April 1917, however, Junkin moved back to the Curtiss plant in Buffalo,

where he stayed until the end of the war. His wanderings set a path that his good friend Brukner eagerly followed.³⁸

Their shared experiences gave them a common frame of reference as they contemplated their opportunities in the aviation business. Brukner arrived at the Aeromarine plant in New Jersey in March 1917, just before Junkin left for Curtiss in Buffalo for the war's duration. Brukner stayed with Aeromarine until October 1917, then moved to Buffalo as well. Within the Curtiss organization, however, their roles changed significantly. In January 1918 both of them became inspectors for the Aircraft Production Board, the federal government agency that monitored the aviation industry during the mobilization for World War I. In April 1918 Brukner was loaned to the British Ministry of Munitions, where he performed acceptance inspections on the flying boats that Curtiss built for Great Britain. He enlisted in the Army in October, just weeks before the Armistice, and was released in December 1918 just before he was to enter officers' training. Brukner and Junkin were reunited in January 1919, when they rejoined the workforce at Aeromarine Plane and Motor. But then their progress was suddenly interrupted. They were forced to formulate plans for their future quickly as the postwar cancellation of contracts cost them their jobs only one month later.³⁹ Their wartime experience placed them among the very few Americans who had an intimate knowledge of aircraft production, but they had neither jobs nor capital as they turned their attention towards the peacetime.

³⁸ Kobernuss, *Waco*, p. 52; Raymond H. Brandly, *Waco Airplanes—“Ask Any Pilot”* (Hamilton, OH: Raymond H. Brandly, 1988), pp. 6, 8-9.

³⁹ Kobernuss, *Waco*, pp. 53-54; Brandly, *Waco Aircraft*, p. 9.

The Aeromarine plant had also employed a Chicagoan named George E. "Buck" Weaver for a short time in 1917, but his piloting skills and love of flying soon won him an assignment as a civilian flying instructor for the U.S. Army at Rich Field in Waco, Texas. Upon his discharge from Army duty, he and his brother-in-law, Charles W. Meyers, who had gained his flying experience during the war as an instructor with the Canadian Flying Corps, used their wartime savings to buy two Canadian war surplus Curtiss JN-4 trainer aircraft in May 1919. They set out to make a living by barnstorming. Meyers' inside contact with the surplus disposal company earned them a twenty-percent discount, but the planes, known as Canucks, still cost Weaver and Meyers approximately \$1600 each. Barnstorming meant performing acrobatic maneuvers for crowds that gathered at whatever piece of ground was suitable for take-offs and landings. Once the crowd was sufficiently impressed, the pilots would offer rides for a certain fee per minute. They looked for fairgrounds, parks, golf courses, or farmers' fields for temporary bases before moving on to the next town and expected to earn up to \$20 per three-minute flight.⁴⁰ Not only would barnstorming keep their dream of flying for a living intact, but they also hoped the enterprise would be profitable.

Barnstormers often quipped that they stood a better chance of starving to death than dying in a crash, but Weaver and Meyer's early success in fact drew the Brukner and Junkin team to Ohio. After the Aeromarine stint ended in February 1919, the two mechanics moved back to Buffalo to work on a design project they had started in late 1917 while at Curtiss. Renting a small space from Curtiss, they tried to complete the construction of a small flying boat. The boat employed a motorcycle engine and featured

⁴⁰ Kobernuss, *Waco*, pp. 25-26, 28.

a pusher mount for the propeller. It was during this period of focused effort to bring the project to fruition that Weaver and Meyers stopped in Buffalo with their newly purchased Canucks to have Brukner and Junkin paint them in colors more appropriate to their new role as barnstormers. The flyers invited the mechanics to join them in their barnstorming enterprise. Although the pilots were accomplished mechanics themselves, they needed someone to help attend to the planes. Moreover, they did not believe the current design program would work. They were right. With room for only one pilot, the craft proved to be underpowered and could not generate enough lift to leave the water surface. Out of money and still determined to design a plane that could be sold, they contacted Weaver to see if his offer of employment still stood in August 1919. The pilots' barnstorming project had evolved somewhat by that time. Flying operations settled in Lorain, Ohio, due to the support of the mayor of nearby Avon Lake, Ohio, Gerald H. Brown. Brown had leased a farmer's field for the flyers, bought another two Canucks for them, and installed his brother Clarence as one of the pilots. They soon found that many people were willing to pay \$25 for a ten-minute flight around the resort areas such as Cedar Point, along Lake Erie. When Brukner and Junkin called in August 1919, there was plenty of work awaiting them in Ohio.⁴¹

Weaver's interests extended beyond the operations of the flying circus and training school that he, Meyers, and the Brown brothers had set up by the end of that year. Weaver had in mind the manufacture of airplanes, and he relied on Brukner and Junkin to produce a design that would carry the Weaver Aircraft Company into the ranks of aviation manufacturers. Weaver's childhood friend from Chicago, Matty Laird, had

⁴¹ Ibid., pp. 34-35, 39-40; Brandly, *Waco Aircraft*, p. 9.

established the Laird Company, which had already produced an aircraft intended to replace the war surplus planes whose performance would erode over time. Laird was ready to meet the demand for a better civilian plane once the public was ready to buy planes for recreation and travel. Weaver wanted to position his company to challenge Laird for that market.⁴²

Brukner and Junkin shared Weaver's desire to produce an airplane that average Americans could afford to purchase and fly safely. In the years when the emerging aircraft manufacturers were simply refurbishing military trainers (Laird's Swallow was very similar to the Curtiss JN-4), Brukner and Junkin tried to create a design which would become the "Ford of the Air." It had to be cheap, they knew. The motor was the largest cost driver of the aircraft, so to minimize its power requirement they had to minimize weight. Their early designs thus had only one seat for the pilot. The two mechanics voraciously consumed articles in *Aviation* magazine, gleaning as much knowledge of aerodynamics and airplane design as they could. They tinkered with the motorcycle engine and various configurations for the wings, while continuing to serve as the aircraft mechanics for the barnstorming and training activities in Lorain. In addition, Brukner and Junkin learned to fly and performed as wing-walkers in the airshows they conducted in numerous Ohio communities.⁴³ The income generated by barnstorming enabled them to keep the goal of manufacturing aircraft in the forefront of their minds.

In December 1919 the Brukner, Junkin and Weaver launched their new firm, the Weaver Aircraft Company, for the purpose of manufacturing planes. Brukner and

⁴² Kobernuss, *Waco*, pp. 34,51; Brandly, *Waco Aircraft*, p. 10.

⁴³ Kobernuss, *Waco*, pp. 55, 61.

Junkin worked in earnest on the company's first design, the Cootie, while Weaver initiated the incorporation paperwork, which resulted in the State of Ohio granting an article of incorporation on 1 September 1920. Their May 1920 advertisement in *Wings* magazine stated their goal: "The company had in mind the idea of presenting a machine which would be of universal use for popular flying as well as commercial work." The product was a high-wing monoplane with a two-cylinder engine and the appearance of a toy. The first test flight in June 1920 was a disaster. Weaver, who was at the controls, crashed the Cootie and received significant head injuries.⁴⁴ Weaver spent two months recovering from the accident, while Brukner and Junkin went back to the drawing board to design the next Cootie. They believed the basic design of the prototype was sound; pilot error, they thought, had caused the crash. By October 1920 they were advertising an updated, biplane version of the first Cootie with the noteworthy title, "The WACO COOTIE—The Ford of the Air." In addition to taking out ads in *Wings*, *Aerial Age Weekly*, and the *Columbus Dispatch*, the Weaver Aircraft Company bombarded parts of the city of Columbus with pamphlets in an attempt to generate interest in the Cootie and in company stock. Alas, no orders for planes arrived, and stock sales barely exceeded one hundred shares by March 1921.⁴⁵ The enthusiasm Ohioans and thousands of other Americans had shown for flying during the barnstorming performances did not translate into sales. The transition to manufacturing was apparently not going to be easy, if it was going to go forward at all.

⁴⁴ Ibid., pp. 67, 69, 76; Brandly, *Waco Aircraft*, p. 12.

⁴⁵ Kobernuss, *Waco*, pp. 79-88.

Three factors made it difficult for these aircraft entrepreneurs in the years following World War I. First, the American economy experienced a sharp contraction as the government cancelled war contracts and as labor organizations launched unionization campaigns to build on the progress forged in wartime. The deep recession significantly cut discretionary spending, making it difficult either to raise capital or sell aircraft.

Compounding the economic problem was the availability of cheap, war surplus planes and parts. In 1919 veteran aviators could buy from the distributors of Canadian and British goods, as Weaver and Meyers did, and the American government began selling surplus JN-4 trainers in 1920. Manufacturers of new equipment, like Weaver Aircraft, faced intense competition from these planes. The Cootie, for example, had a sales price of \$1200. While it was much cheaper than its commercial competitors, the surplus JN-4—which was bigger, able to carry passengers, and had a proven design—sold for as low as \$1500.⁴⁶

The third problem, safety, exacerbated the macroeconomic effects of the recession and the glut of planes in the aviation market. The enthusiasm Americans had for flying was based in part on the mystique of the pilot as daredevil. Indeed the images of the dashing military pilots and the barnstormers were sustained by the fact that flying *was* dangerous. The barnstormers worked hard to preserve this perception. Brukner and Junkin often performed on the wings or landing struts of aircraft flown by Weaver and Meyers. Ray Vaughn, the teenager they hired to help manage the logistics of the operations, also walked the wings. Parachuting demonstrations added more thrills to the

⁴⁶ The LWF Engineering Company had a Butterfly model that was listed at \$2,500, and Bellanca marketed a biplane for \$3,500. Kobernuss, *Waco*, pp. 64, 66.

shows and reminded participants and spectators of the risks aerial activity entailed. Such reminders were not always necessary. In October 1919, only eight weeks after Brukner and Junkin transferred to Lorain to preserve their designing aspirations, Weaver's friend and fellow pilot Clarence Brown and a passenger died in a crash witnessed by dozens of interested observers. Such crashes drew immediate and complete coverage in the local newspapers and reinforced the notion that flying was not yet for everyone. Weaver himself carried a deep scar under his right eye following his recovery from the June 1919 crash in the Cootie. He had devoted his life to flying and willingly faced the risks it brought, but his personal experience belied his company's claims that flying was safe. The Weaver Aircraft Company needed a new approach to the aircraft manufacturing business in order to improve sales.

The early postwar years introduce some themes that would remain consistent throughout the interwar period. First, the pervasive enthusiasm that Americans from many social classes had for flying animated aviation's development. The crowds that rushed to the fields in northern Ohio to see the barnstormers' performances and to pay for short rides expressed the simplest form of enthusiasm, but they had a zeal money alone did not express. In the later 1920s, one of Waco's dealers and a very famous barnstormer himself, Roscoe Turner, received a fan letter from a woman commending him for being "marvelously brave" for "flying about the Country as you do." And she had a confession. She had not visited Turner's airplane at the Buffalo airport during a recent stop, and this had apparently been a grave mistake. She wrote, "I should be ashamed of

myself, I know, for no one has a right to neglect their [sic] education in that matter.”⁴⁷ Another fan offered his view of the possible benefits of that “education.” “[T]he new and great industry of aviation,” he wrote, would make “this nation second to none in the world of aviation, not to conquer the world but rather to stay the peace of the world, the one thing that Americanism stands for. . . . [A]s are nation as a whole becomes air minded, we will find that are people have become more sober, we’ll have quicker minds and keener judgment, healthy qualities of any nation.” In closing the writer felt obligated to add, “My interest lie in aviation, and I hope to develope to the place in life that I will be worthy of the friendship of men like you.”⁴⁸ Aviation excited many Americans’ imagination, and in some it inspired big dreams.

Gerald Brown certainly was touched by that dream. His sponsorship of Weaver’s flying circus starting in May 1919 was part of a grand scheme he had to make Lorain an aviation center in the United States. He and his brother Clarence saw air shows and flight training as logical steps in their “plans . . . for a wide scope in aerial development” in Lorain. The town already had a prominent aviation booster in William H. Long, owner of the Hudson-Essex dealership and Long’s Aircraft Service. Long provided passenger service and, rumor had it, bootlegged liquor across Lake Erie from Canada. He, too, supported Weaver’s flying school, and took over for Gerald Brown when he withdrew his financial backing following the death of his brother in October 1919. Although Brown’s enthusiasm had waned, the entrepreneurs were able to keep

⁴⁷ Marie A. Ladd to Roscoe Turner, July 22, 1927. *Roscoe Turner Papers*, Number 5267, Box 28, Folder 4, American Heritage Center, University of Wyoming, Laramie.

⁴⁸ J.P. Klingensmith to Roscoe Turner, 1928, in *ibid.* I have omitted the conventional “[sic]” annotations due to the large number of errors in the letter’s prose.

going by tapping the boosterism and expectation of quick profits that complemented the enthusiasm the public showed for flying.⁴⁹

Barnstorming was an important element in the immediate post-war aviation market, but its success was based on factors that were fleeting in nature. The readily available war surplus aircraft and parts gave the gypsy flyers relatively low start-up and operating costs. But the frail machines could not last for more than two or three years before needing a more expensive overhaul or replacement. As the barnstormers visited increasingly remote areas of the country, introducing thousands of Americans to the airplane, they reached the point of diminishing returns in stimulating the public to pay for short flights. Soon those who were interested in flying wanted more specific information about how they themselves could take to the air. The manufacturers were then pressed to improve their aircraft's safety and performance characteristics to meet the emerging demand. Brukner and Junkin faced that challenge beginning in late 1920.

Up to that time, barnstorming had sustained Brukner and Junkin's efforts. The promise of planes generated enough income to cover expenses while they crafted a marketable design. Equally important, barnstorming kept Brukner, Junkin, and Weaver in touch with other entrepreneurs in the aviation business. Those contacts provided opportunities to compare designs and to learn of opportunities to buy aircraft parts and motors at favorable prices. Barnstorming continued to be a critical aspect of the Weaver Aircraft Company, even as it initiated changes to strengthen its manufacturing capability.

⁴⁹ For a good discussion about the enduring appeal of aviation with regards to the establishment of airports, see Deborah G. Douglas, "Airports as Systems and Systems of Airports: Airports and Urban Development in America before World War II," in *From Airships to Airbus, Volume 1, Infrastructure and Environment*, ed. William M. Leary (Washington, D.C.: Smithsonian Institution Press, 1995), pp. 55-84.

Chapter 2

Developing Comparative Advantages in Aircraft Manufacturing

Brokner's dynamic leadership created numerous opportunities that his company exploited in the 1920s. The flexibility he skillfully employed derived from his experimentation with products and business strategy and resulted in remarkable growth for the company. Maintaining some continuity in this rapidly changing context was important to Brokner, because he knew his customers and colleagues in the aviation industry valued name recognition. In addition, building brand name loyalty was a powerful marketing technique that firms in other industries used in the 1920s. For these reasons, planes produced by the Weaver Aircraft Company carried the acronym WACO as part of their designation. Subsequent changes removed Weaver Aircraft from the picture, but Brokner retained the WACO appellation for his products. Finally in 1928, his company assumed the same name as his planes, and the more recognizable Waco (pronounced WAH-co) Aircraft Company inherited the momentum its predecessors had built by then.

Experimentation Continues, 1920 – 1929

The failure to sell any Cootie airplanes forced the Weaver Aircraft Company to cut costs in order to sustain renewed efforts to design a successful plane for the public. A generous offer from A.I. Root, the wealthy founder of the Honeybee honey company, of a farm field from which to conduct operations and cheap rent for a factory in Medina, Ohio, prompted Weaver, Brokner, and Junkin to make the short move from Lorain in

March 1922.¹ Weaver was becoming increasingly anxious about the lack of progress in selling planes, and he renewed contacts with his Chicago friends Matty Laird and Charles Dickinson. This led to periodic trips west to serve as Dickinson's private pilot, and eventually resulted in Weaver leaving Ohio with his family in April 1921 to become the test pilot for Laird's company.² His impatience moved Brukner and Junkin to refocus their design efforts on a more conservative project.

They had extensive experience repairing and maintaining the Canucks Weaver and his fellow pilots flew in their barnstorming and training roles, and that familiarity and the availability of surplus parts gave them the opportunity to design a replacement for the World War I trainer. Brukner and Junkin knew by way of their visits to Cleveland about similar modifications to the larger DH-4 aircraft, which served as airmail carriers for the Post Office. Wing improvements increased lift and allowed greater payloads on the route to Detroit.³ New airfoils tested by the National Advisory Committee on Aeronautics (NACA) and described in the trade literature gave Junkin the idea of replacing the Canuck's wings with the new ones. Subsequent discussions with Clarence D. Hanscom, the chief engineer for the Glenn Martin Company in Cleveland, confirmed the efficacy of his ideas, and the duo laid plans to modify the Canuck to produce a marketable design more quickly.⁴ The ideas conformed to Weaver's desires, since he had seen his friend Laird selling airplanes designed as replacements for the war trainers. With cheap engines and parts for sale as war surplus, the cost of building the new planes was sharply reduced.

¹ Brandy, *Waco Airplanes*, p. 13; Kobernuss, *Waco*, p. 105.

² Kobernuss, *Waco*, p. 87.

³ *Ibid.*, pp. 100-101.

⁴ *Ibid.*, pp. 89-90.

Experience combined with expediency to convince Brukner and Junkin to try a different path towards successful manufacture.

Their designs, the Waco Four and Five, produced four sales but could not keep the company solvent. The redesigned Canucks sold to buyers in the Medina area, but with Weaver's attention drifting to other matters, the barnstorming income dropped. One of the planes was sold to Bill Long, the financial backer of the company in Medina, and his perpetually late payments on the plane never reached the full \$2,000 price.⁵ Unlike Weaver, however, Brukner and Junkin realized that their new strategy had substantial potential to give them a viable operation. They decided that severing ties with Weaver and Long was a prerequisite to establishing a firm basis for success in manufacturing. Thus in March 1923, the unprofitable Weaver Aircraft Company sold its paltry assets, mostly the Cootie aircraft, to the newly formed Advance Aircraft Company.⁶ Brukner had arranged for financial support from an aviation fanatic, Alden Sampson II, who stood to receive an inheritance of six million dollars in the near future. His family agreed to the purchase of \$20,000 worth of company stock as long as Sampson was employed in the company to learn a skill.⁷ With that agreement in place, Brukner installed himself as president and Junkin as vice-president when Advance was incorporated in February 1923. Relocated in Troy, Ohio, in March of that year, the new company gave Brukner and Junkin a fresh start in manufacturing.

⁵ Brandly, *Waco Aircraft*, p. 13; Kobernuss, *Waco*, pp. 102-103.

⁶ Kobernuss, *Waco*, p. 135.

⁷ Brandly, *Waco Aircraft*, p. 15; Kobernuss, *Waco*, pp. 133-134.

Many elements of the Weaver Aircraft Company's operations were, however, continued. The use of barnstorming to generate operating capital, for example, meant that on weekends Brukner offered flights to people who visited the farm field where they had established operations free of charge.⁸ Brukner assumed the role Weaver left as chief test pilot and pilot-for-hire. More importantly, Brukner continued in his role as parts purchaser for the company. His many contacts in the surplus parts markets allowed him to find good deals on the engines and common parts, such as engine mounts and fuselage braces, that were used in Advance's redesigned aircraft.⁹ Since they relied on hand-manufacturing techniques, they needed and hired skilled workers. Brukner and Junkin were still the primary shop floor laborers in an organization projected to produce no more than one dozen new aircraft in 1924. The move to Troy clearly brought no revolutionary changes in this tiny, entrepreneurial venture.

But it did shift the business focus of the organization. Before, barnstorming had been the primary effort; in Troy it was a secondary consideration. In Lorain and Medina, flying operations had subsidized the design efforts. In Troy Sampson's support diminished the importance of barnstorming and allowed Advance to concentrate on design and manufacturing. In northern Ohio the company had been a part of a larger scheme to create an aviation center, and the publicity that barnstorming helped generate was thus a primary mission of the firm. Manufacturing was less glamorous, as Weaver's impatience with the mechanics had implied. In Troy, few knew that Advance had moved to town, and it was only after Lindbergh's flight that the hype surrounding flying

⁸ Brandly, *Waco Aircraft*, p. 19.

⁹ *Ibid.*, p. 11; Kobernuss, *Waco*, pp. 106, 110.

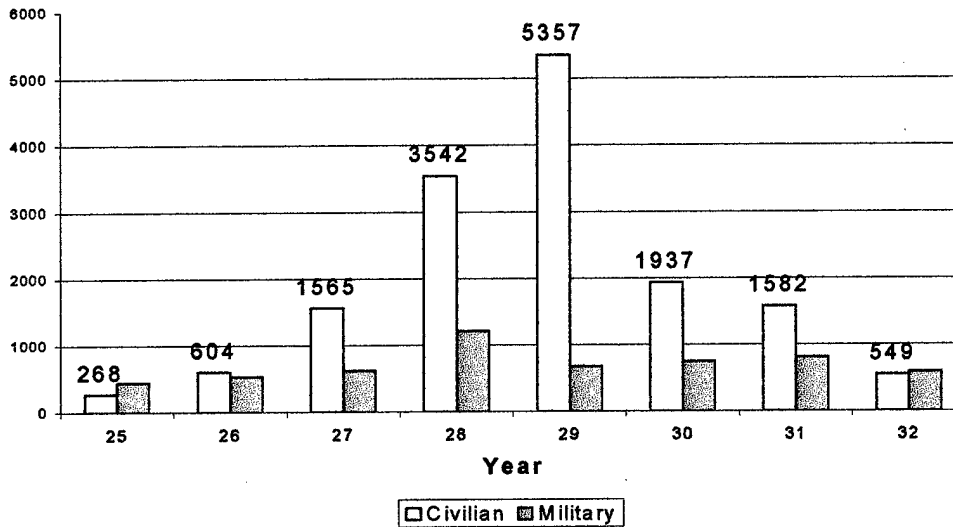
generated the kind of boosterism that Brukner and Junkin had experienced earlier. In short, relocating to Troy allowed them to focus on manufacturing, a significant change that allowed them to avoid some of the distractions they had experienced earlier.

The first year in Troy was an important transition, not because of a large increase in sales, but rather for the network of relationships Advance was able to establish. In 1923 the company sold only three planes, but at the end of the year Brukner and Junkin made a fruitful trip to the National Air Races in St. Louis, Missouri. There they saw other companies' aircraft that competed with their WACO Six, the latest of their replacement designs. It was apparent to them that they had a model whose safety characteristics gave it an advantage. In addition to gauging the competition, Brukner and Junkin favorably impressed trade magazine reporters and fellow barnstormers, who were themselves trying to find a more stable basis for remaining in the aviation business. The connections made in St. Louis and at numerous other air meets that enabled them to start building a nationwide network that would support the sales of Advance aircraft.

Within the private aviation field, competition flourished after 1926, as many "backyard businesses" tried to win customers from the pool of licensed private pilots. The increase in sales following Lindbergh's flight caused a temporary shift in favor of civilian manufacturing before the depression revealed the enduring importance of the government to this industry. From 1925 to 1929 the number of civilian planes built in this country per year increased almost twenty times, but in the next three years production shrank to only ten percent of the 1929 high. The next chart portrays these swings and shows the comparable figures for military aircraft. Manufacturers making civilian planes out-produced those making military planes for a number of years. But the

fiscal belt-tightening caused by the depression affected potential civilian customers more dramatically than the government. The demand for civilian planes dried up quickly, intensifying competition for the manufacturers that remained in the business, while government contractors experienced a relatively mild contraction.

Chart 2-1
Civilian & Military Aircraft Produced

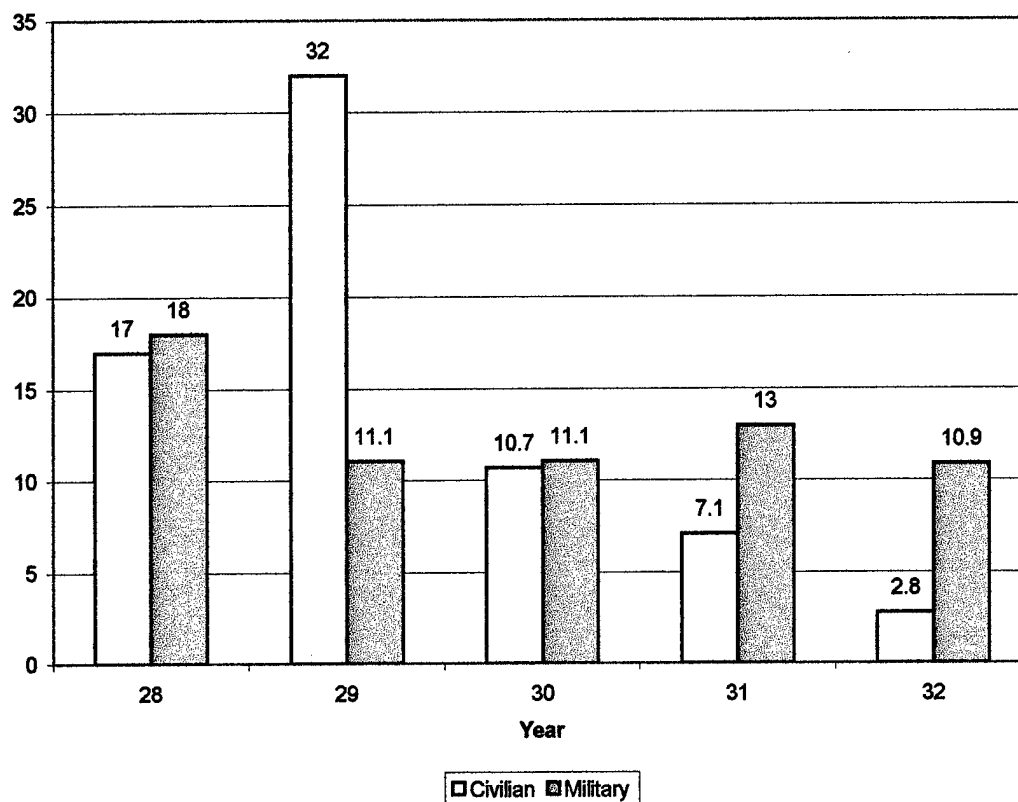


Source: Rudolf Modley, ed., *Aviation Facts and Figures, 1945* (New York: McGraw-Hill, 1945), p. 8.

The importance of the national government appears more clearly in figures indicating the value of the civilian and military aircraft produced. Only in 1929 did the total value of civilian aircraft exceed that of military planes. Private planes were smaller, less powerful and generally cheaper than those sold to the government. The relatively consistent military budget for aircraft purchases derived from the policy set forth in the five-year procurement plan Congress established in 1926. As hoped, it gave those manufacturers engaged in defense work a more stable base from which to plan future business activities. Glenn Martin, for example, decided in 1928 to relocate his company from Cleveland to Baltimore in order to concentrate on the Navy's seaplane orders, which had solidified since 1926. A more dependable flow of Navy funds, he reasoned,

allowed him to focus on technical improvements in his aircraft.¹⁰

Chart 2-2
Aircraft Value (\$ Millions)



Source: "Articles and Speeches, 1936," *John H. Geisse Papers*, Hoover Library.

Brukner competed in a niche within the civilian aircraft manufacturing industry that was very small and subject to significant and sudden shifts in demand. Some companies built only multi-engine transports; some made only mono-planes; and some, including Brukner's, produced only bi-planes. Transport aircraft alone accounted for approximately 33 percent of the value of civilian aircraft, while totaling only five

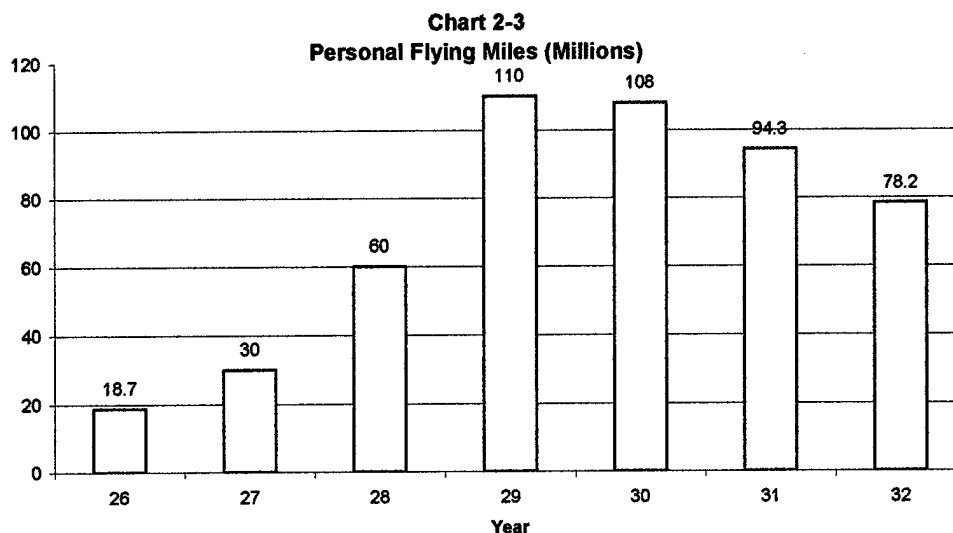
¹⁰ Biddle, *Barons of the Sky*, pp. 161-164; Vander Meulen, *Politics of Aircraft*, pp. 83-90.

percent of the number of civilian planes sold from 1928 to 1931. And in this transport field relatively few firms competed for customers—Douglas, Boeing, and Ford dominated the market.¹¹ For personal flying, Brukner's niche, Americans had myriad choices. Dozens of small manufacturers competed in local and regional markets, selling thousands of small, relatively inexpensive aircraft. When the overall number of civilian planes sold plummeted during the depression, many of these small firms went out of business. But before they did, they cut prices sharply. Added to this, aircraft owners who could no longer afford to operate and maintain their planes put them up for sale in the used aircraft market, thus placing more downward pressure on prices. Brukner found himself fighting hard to avoid the same grim fate.

The stock market crashed just as the industry appeared to be making headway in establishing private flying as an important activity for Americans. More and more of them were piloting planes just for fun and flying to another city for a business meeting or vacation.¹² Brukner and his colleagues had every reason to believe in the late twenties that they were the ones who could provide average Americans the means to manage their own air transportation using inexpensive and safe aircraft.

¹¹ Rudolf Modley, ed., *Aviation Facts and Figures, 1945* (New York: McGraw-Hill, 1945), p. 67; Irving B. Holley, Jr., *Buying Aircraft: Materiel Procurement for the Army Air Forces* (Washington, DC: GPO, 1964), pp. 11-17; Roger E. Bilstein, *Flight in America: From the Wrights to the Astronauts* (Baltimore: Johns Hopkins University Press, 1984), pp. 85-96.

¹² Corn, *The Winged Gospel*, pp. 91-92.



Source: Modley, *Aviation Facts and Figures*, p. 78.

Brukner's Performance, 1921-1932

The Weaver Aircraft Company's prototype, the Cootie, failed to launch Brukner, Junkin, and Weaver on the road to success, but the switch to JN-4 replacements generated sales that finally produced profits. The first replacement design, the WACO Model Four, appeared in late 1921. Each year thereafter, Junkin and Brukner introduced at least one new model, seeking to improve performance and reduce costs. In 1923 Brukner decided to stick with a selling price of \$2500 for his three-seater bi-plane, even though increasing demand probably would have supported a higher price. In addition to emphasizing the safety characteristics in his planes, he purposely set the price lower than his competition to attract those new entrants to private flying who could not afford the more expensive models. In 1924, the company introduced the Waco Model Eight, an eight-seater, in hopes of breaking into the transport market, but he found only one

customer and quickly decided to leave transports to others.¹³ Nonetheless, this period of experimentation increased sales and initiated a campaign to spread the Waco name nationwide.

Design and manufacturing capability were only part of a profitable aircraft company, however. Brukner also created an effective distribution network, and much of his company's success derived from his vigorous marketing efforts. From 1921 to 1924 while Brukner and Junkin were concerned with mastering the technical aspects of building new airplanes from surplus parts, they relied on Weaver's flamboyance and a few ads in aviation magazines to attract customers. Weaver's departure and the move to Troy in 1923 did not immediately affect this mode of operation; Brukner became chief salesperson, while serving as company president, chief pilot, mechanic, and laborer. He was a manager who worked in close collaboration with a small number of skilled employees in producing sophisticated planes.¹⁴ In 1924, however, the situation changed. Until then, he had placed ads in periodicals and offered rides to the people who came to the grass landing strip in Troy for a small fee—the use of barnstorming to generate working capital survived the move from northern Ohio. In late 1924 his acquaintance with John Kerr “Tex” LaGrone, whom he had met at an airshow that year, led to LaGrone becoming Advance's first distributor. He was ready for business when the marketing push began in earnest in spring 1925, and he quickly sold one of the two WACOs remaining in the inventory from 1924. LaGrone, who rapidly established his salesmanship credentials with Brukner, became Advance's top dealer and Brukner's good

¹³ Kobernuss, *Waco*, pp. 164-170.

¹⁴ In this sense Advance Aircraft clearly exemplified the characteristics of firms engaged in specialty production. Scranton, *Endless Novelty*, pp. 18-19; Vander Meulen, *Politics of Aircraft*, p. 51.

friend.¹⁵ He paved the way for the formation of a sales network spanning the globe only six years later.

Waco's remarkable success after 1924 resulted from astute shifts in the firm's business strategy. When the market for private aircraft was immature and uncertain, Brukner focused on selling safe, easy to fly planes to newcomers, as, indeed, most Americans were in the mid-twenties. As aviation competitions developed piloting skills and introduced sport flying to a widening audience, Brukner's business strategy evolved. By the end of the 1920s, he had diversified his product line to include higher performance aircraft. These planes interested not only sportsman pilots but also corporate pilots, who bought Waco planes for reliable transport of mail, products, and executives. The Great Depression forced a further refinement of Brukner's strategy, and he decided to concentrate on corporate sales and wealthy pilots, who both wanted luxury aircraft and could afford to pay for the more expensive models. Soon even this strategy needed the increased sales that exports provided for Waco. Many foreign countries built air forces in the 1930s, and most could not afford to buy the state of the art technology that American military manufacturers produced. While Brukner's planes were not the most advanced, they were well-built, affordable alternatives. Sales to foreign nations, in Latin America especially, derived from adroit strategic changes Brukner made as the aviation market evolved from 1924 to 1932.

Table 2-1
Waco Aircraft Sold by Year

<i>Year</i>	21	22	23	24	25	26	27	28	29	30	31	32
Waco Sales	0	4	3	14	47	175	454	653	NA	225	150	225

¹⁵ Kobernuss, *Waco*, pp. 154, 170.

By 1932 Waco had achieved prominence in the aviation industry.¹⁶ Commercial sales, a category including monoplanes, bi-planes, transports, and other types, show the dramatic expansion in the market.¹⁷ Brukner's sustained leadership was more noteworthy given the increasing importance of monoplanes and metal construction in the private flying market.¹⁸ Even as more manufacturers turned to this type of aircraft, Brukner continued to specialize in wooden bi-planes. Later, when it became apparent that the masses were unable to even consider flying in the depression years, Brukner changed his approach quickly and effectively. Waco's recognized name and reputation for quality allowed Brukner to appeal to the wealthier class, while his planes' good performance characteristics made Wacos strong candidates for export. This two-pronged approach enabled the Waco Aircraft Company to enjoy success as others shut down production lines after 1930. In a market with numerous competing firms and in the midst of both enormous expansion and contraction, Waco controlled a significant market share.

Table 2-2
Waco Market Share

Year	25	26	27	28	29	30	31	32
Commercial Planes	268	604	1565	3542	5357	1937	1582	748
Waco Market Share	18%	29%	29%	18%	NA	12%	9%	30%

¹⁶ These figures come from a number of sources: Kobernuss, *Waco*, pp. 70-95; Brandly, *Waco Aircraft*, pp. 80-103; and the *Aircraft Year Book, 1928*, p. 457. I calculated the numbers for 1931 and 1932 from sales data included in the audit reports in the Brukner Papers, assuming that the mix of aircraft sold was the same as what Brukner sold in 1930.

¹⁷ Modley, *Aviation Facts and Figures*, p. 8.

¹⁸ *Aircraft Year Book, 1929*, p. 62; "Commerce Department, 1931-1932," *Geisse Papers*, Hoover Library.

A more detailed look at 1927 reveals the competitive nature of this niche and Brukner's success in it. Advance outsold its nearest two competitors combined, as this table shows.¹⁹

Table 2-3
Production of Commercial Planes for 1927

<i>Manufacturer</i>	<i>Quantity</i>
1. Advance Aircraft Company	454
2. Alexander Aircraft Company	206
3. Travel Air Manufacturing Company	158
4. Swallow Airplane Company	104
5. American Eagle Aircraft Company	92
6. Nicholas-Beazley Airplane Company	60
7. National Airways System, Inc.	55
8. Stinson Aircraft Corporation	55
9. Fairchild Airplane Manufacturing Company	50
10. Pitcairn Aviation Company	49
Other Manufacturers (20)	440

As the market share data suggests, Brukner had done an excellent job of defining a market niche and producing aircraft that enabled Waco to exploit it.

His strategy for dealing with the depression was straightforward. Caught with an inventory of nearly \$300,000 in 1930, he could not unload a large part of it until 1932, when the inventory value had diminished to \$189,000. He reduced operating expenses twenty-five percent, from \$250,000 in 1930 to \$196,000 in 1932. Nineteen thirty-one was a difficult transition year. Sales in the first full year of the depression remained above the one million-dollar mark, but in 1931 they fell to only \$750,000.²⁰ At this point he refined his business strategy by focusing on the luxury and export markets. With this updated approach and with operating costs reduced, Brukner restored Waco to

¹⁹ *Aircraft Year Book, 1928*, p. 457.

²⁰ "Audit Reports, 1930, 1931, 1932," *Brukner Papers*, DoAaSC.

profitability in 1932 with remarkable sales that exceeded the 1931 total by 50 percent. He had to explain this change to some suppliers, who insisted that cheaper prices were the key to survival. He told the Comet Engine Company,

The lowest priced airplane we can turn out, under the present production volume and existing regulations, is high enough in price so that the customer is quite properly concerned as to its parentage. This would still be true if the motors cost us nothing, and the type of customer we are selling to, of late, is more concerned with having the latest and most improved equipment, than with saving a little money.²¹

His strategy of appealing to wealthy aviation enthusiasts while cutting costs worked. Long before most businesses experienced any change in fortune, Brukner put Waco back in the black.

From 1921 until 1932, the Waco Aircraft Company's quality products and Brukner's effective business strategy placed the company at the top of the private flying field in the aviation market. A closer look at Waco's products, manufacturing methods, workforce, and facilities will further explain Brukner's formation of a well-integrated firm committed to specialty production. Although mass demand for airplanes never materialized, Waco's rapid growth and quick recovery at the beginning of the depression gave Brukner confidence as other companies closed their doors.

Manufacturing

Manufacturing methods changed little with model updates and increased sales—each plane was still handmade. In this respect Waco was much like the rest of the industry. Workers hand-cut wood and fabric, the primary materials, to the correct size for a given model. "Mass" production meant hiring more laborers or working more

²¹ Brukner to Jack Spillane, December 6, 1932, "S Miscellaneous, 1929-1941," *Brukner Papers*, DoAaSC.

hours. "Mass" production to Brukner, after over a decade of experience in the industry, meant three aircraft left the factory each day. The post-Lindbergh boom placed his manufacturing processes under great strain, and his small, Troy factory could not meet the surge in orders. That exciting situation, though, did not cause an overhaul of methods. More workers and a larger factory built on the outskirts of Troy in 1928 adequately prepared Waco for the future, Brukner believed. His competitors were doing no differently. The authors of an aviation industry survey in 1930 offered this analysis of aircraft construction: "in some instances the factory processes are more suggestive of fine cabinet making than of automobile construction."²² Aircraft were still semi-precious products made by skilled artisans. Waco's manufacturing methods showed the aptness of the comparison.

The various Waco models of the 1920s were the products of careful design and highly skilled labor. Junkin made decisions about airfoils and engines, always with an eye towards making Waco performance among the private airplane field's best. Brukner was primarily responsible for finding the needed parts at the best prices from dozens of parts suppliers around the country. When the parts arrived at Medina, Brukner and Junkin and their small workforce built an airplane. In 1923, the Advance Aircraft Company roster listed only eleven people, six of whom were usually the ones actually working on the planes. The next year Junkin and Brukner hired a high school boy for summer work. He helped manufacture wings, wielding a fourteen-inch curved needle to stitch fabric sections together. Doping, or treating the fabric to withstand the elements,

²² Division of Commercial Research, *The Aviation Industry: A Study of Underlying Trends* (Philadelphia: Curtis Publishing Company, 1930), p. 111.

was a labor-intensive task involving strong-smelling banana oil.²³ This more general description of the manufacturing method for WACOs further details the simple construction techniques:

Hand tools continued to be the only means by which production and assembly were accomplished, although there was a small electric grinder on which drills were sharpened. All cotter pin holes were drilled with a hand operated eggbeater type drill; all bolts were cotted. Steel fittings were either hacksawed or chiseled out of stock and then filed down. . . .²⁴

These techniques were common in this emerging industry. Civilian aircraft manufacturers seldom used blueprints, instead crafting each plane from the ground up. The reliance on standard war surplus parts until the mid-'20s and the use of wooden templates from previous jobs sufficed to make each model "standard." This was how they made wing spars for the same airfoil, for instance. In the Advance factory, Junkin recorded other aircraft dimensions on long wooden sticks one inch square. One side of the stick contained notches marking the horizontal locations of things like firewalls and rudders. The other side of the same stick recorded vertical dimensions for similar features. These sticks, then, became the primary means to control an aircraft's configuration during construction. Blueprints were unnecessary.²⁵ Innovative designs and skillful construction allowed Brukner to produce aircraft that exceeded the capabilities of his rivals' planes.

The table of JN-4 "Jenny" and early replacements compares some important design characteristics:²⁶

²³ Kobernuss, *Waco*, pp. 149-150.

²⁴ *Ibid.*, p. 141.

²⁵ *Ibid.*, pp. 168-169.

²⁶ *Ibid.*, pp. 94, 153.

Table 2-4
Waco Versus Competitor Aircraft Design Parameters

<u>Aircraft</u>	<u>Design Year</u>	<u>Passengers</u>	<u>Full/Empty Wt</u>	<u>Max/Min Speed</u>
Curtiss "Jenny"	1917	1	1.345	1.665
Laird "Swallow"	1919	2	1.620	2.260
WACO Four	1921	3	1.780	2.545
Rogers-Day	1922	2	1.625	2.020
Stearman	1924	3	1.560	2.714
WACO Seven	1924	3	1.682	3.000

The ratio of maximum to minimum speeds, in particular, indicated that Brukner and Junkin were improving performance while increasing the payload capacity. This ratio meant that takeoff and landing speeds were low for greater safety and that the aircraft could cruise at a much higher speed for greater range. In spite of the low-technology manufacturing process, Brukner and Junkin were constructing high performance airplanes that steadily attracted more buyers.

The cost estimates and price data for aircraft manufacture reveal much about the nature of the product and the market. In September 1923 Brukner submitted to a detailed interview by a reporter from the *Troy Daily News*.²⁷ The subsequent article included a production cost estimate for the Advance Company's Waco Model Six. One aircraft took two weeks to build, (assuming a seventy-two hour workweek), and the total \$1180 figure reflected these costs:

²⁷ *Troy Daily News*, September 24, 1923, p. 4.

Labor (six men)	\$344
Propulsion (Engine, radiator, propeller)	\$268
Aircraft Material (Wood, fabric, etc.)	\$500
Overhead (i.e. factory rent = \$25/month)	\$ 60

The \$2500 price thus exceeded production costs by 112 percent. The profit rate is impossible to calculate, since advertising costs are unknown. Brukner had no distributors in 1923 and income from barnstorming could have funded sales costs. By 1926, three years later, Advance was producing almost six aircraft per week, but an informal estimate done by Brukner revealed the remarkable consistency in methods and price for the Waco Nine:²⁸

	<u>Low</u>	<u>Mid</u>	<u>High</u>
Labor	\$300	\$350	\$400
Propulsion	\$500	\$550	\$600
Material	\$260	\$300	\$350
Overhead	\$ 40	\$ 75	\$100
TOTAL	\$1100	\$1275	\$1450

The still-standard \$2500 price for WACOs produced manufacturing profits per airplane ranging from seventy to 127 percent. Again, the overall profit rate cannot be calculated, since the costs of the on-going development of a distributor network and of sales (magazine advertisements, trips to air races, etc.) are not available. In all cases labor costs were approximately thirty percent of total production costs, and the workers'

²⁸ Kobernuss, *Waco*, p. 146.

manufacturing skills determined to some extent material costs, because of their control over the amount of waste and rework needed. Until Junkin's death in 1926, Brukner and Junkin were two of the small number of workers employed by Advance; they were indicative of the highly skilled laborers aviation companies hired in the postwar years. The manufacturing methods they used and the high prices their airplanes commanded reflected the craft nature of the aviation industry in the 1920s.

Machine tools were important for making parts to the narrow tolerances good aircraft demanded, but the skilled workers who used the tools were the most important factor in this batch production mode.²⁹ With sales advancing quickly after 1925, Brukner needed more workers each season and relied on experienced laborers to train new employees. By October 1929 Waco had over 175 personnel on the payroll. He hired factory workers from the Troy area; managers, in contrast, were usually recruited from outside the local area. This difference and the high ratio of skilled labor did not, however, contribute to adversarial relations between management and labor. Neither labor unions nor the threat of unionization influenced Brukner's decisions until the mobilization for World War II. Waco's experience in the 1920s matched that of other aviation manufacturers. Effective unions would have commanded workers' loyalty that was stronger than their loyalty to their company. Instead, most aviation workers developed a sense of commitment to the aircraft they produced and felt responsible for improving their planes.³⁰ On the other hand, in a market as competitive as the private airplane segment, losing employees to rival firms could create substantial problems for

²⁹ Holley, *Buying Aircraft*, pp. 29-32; Vander Meulen, *Politics of Aircraft*, pp. 47-48; Modley, *Aviation Facts and Figures*, p. 29.

³⁰ Vander Meulen, *Politics of Aircraft*, p. 155.

any of the firms. In Waco's case, the large local supply of workers with useful manufacturing skills met the quickly increasing demand for labor throughout the 1920s. Brukner's decision to relocate Advance in the Troy area paid dividends: he was able to capitalize on a good labor market and favorable worker relations to execute his business strategies aggressively.

After 1924 Advance outgrew its factory on Union Avenue in Troy and had to rent additional space around the city to boost production. Aircraft production in 1924 was fourteen; in 1926 175 WACOs rolled out of the various manufacturing locations. The poor facilities and the absence of an adjacent airfield compelled Brukner to seek a new plant.³¹ The euphoria unleashed by the trans-Atlantic flight in May 1927 forced the issue. Citizens of Troy, after four years of scarcely noticing Advance, then launched an aggressive campaign to "Keep Waco in Troy." They raised nineteen thousand dollars to purchase 120 acres at the western edge of the city and donated it to Advance to be use for a new factory and public airport. One contributor expressed the emotional attachment Trojans had developed, seemingly overnight. In November 1927 he wrote to Brukner during a road trip to the East Coast, saying, "you would be surprised at the interest shown wherever we stop . . . on the highway, city streets, public garages Waco is being talked. I left my \$100.00 at the bank before leaving and don't want it back either."³² Brukner, who agreed to keep the company in Troy, contracted for a new factory worth an estimated \$150,000. When it opened for business in 1928, 130 employees reported for work. Only a year later Brukner contracted for the addition of 12,500 square feet to the

³¹ Ibid.; Brandly, *Waco Aircraft*, pp. 50-51.

³² Ed W. Cosley to Brukner, November 8, 1927, "M Miscellaneous," *Brukner Papers*, DoAaSC. Emphasis in the original.

factory floor.³³ Along with the new factory came the name change to the Waco Aircraft Company. By this time, Brukner had clearly made it to the top of the private aircraft market.

His expanded capacity provided the means to market multiple designs in the late '20s and early '30s. In 1930, for example, Waco was able to deliver seven different models, from the familiar three-seater to the sporty Waco Taperwing. In 1929 the company's success attracted the services of a very competent design engineer, A. Francis Arcier.³⁴ His addition to the Waco staff gave Brukner confidence in pursuing the marketing and future planning for many models simultaneously.

Marketing

Brukner's attendance at the 1924 National Air Races started a campaign that aggressively moved Advance Aircraft from a local to a national business. Until the 1924 races, Brukner and Junkin had been working to improve their designs. When they had achieved considerable success with the Models Six and Seven, Brukner began the next phase in his company's development. "We chose to demonstrate our product for the purpose of expanding our sales prospects for 1925, and to sign up distributors, rather than entering the racing competition," he said.³⁵ Racing would come later, but the connection with LaGrone was no coincidence.

³³ Brandly, *Waco Airplanes*, pp. 51, 81; "Audit Reports, 1930, 1931, 1933." *Brukner Papers*, DoAaSC.

³⁴ Brandly, *Waco Airplanes*, p. 91.

³⁵ Brandly, *Waco Airplanes*, p. 20.

Brukner built on his initial success by adding thirteen other distributors in 1925. This first full year of his campaign to form a nationwide network produced the best results in the Midwest, where he established five new distributors. Advance distributors in the South stretched from North Carolina to Louisiana, but the westernmost distributor was located in Tulsa. As of January 1926 these distributors sold Wacos.³⁶

1. Tex LaGrone's Waco Sales Company	Kansas City, Missouri
2. Muncie Aerial Company	Muncie, Indiana
3. Embry-Riddle Company	Cincinnati, Ohio
4. Roy Larson Aircraft Company	Larson, Wisconsin
5. New England Aircraft Company	Hartford, Connecticut
6. Aircraft Distributors	Flint, Michigan
7. Mid-West Airways Corporation	Monmouth, Illinois
8. Aircraft Sales Company of Oklahoma	Tulsa, Oklahoma
9. Louisiana Dusters Company	Tallulah, Louisiana
10. Otis A. Hardin	Sebring, Florida
11. Douglas H. Davis	Griffin, Georgia
12. Lloyd O. Yost	Pinehurst, North Carolina
13. Reisner Aero Service	Hagerstown, Maryland
14. Ludington Exhibition Company	Philadelphia, Pennsylvania

Brukner's determination to expand the network continued, especially since demand for his aircraft continued to increase. As a result of his concerted efforts, only two years later in 1928, the network included 31 distributors, with newly established locations in California, Oregon, Texas, and Montana. Additions in the Midwest, South, and East Coast regions gave him nationwide coverage. Significantly, his network also extended internationally to Canada and Cuba.³⁷ Brukner had effectively institutionalized the informal network of relationships he developed at air races and continued his efforts to identify reliable overseas agents.

³⁶ *Aviation*, January 25, 1926, p. 132.

³⁷ "Waco Advertising, 1928-1930," *Brukner Papers*, DoAaSC.

In January 1926 Brukner used his extensive distributor system to manage the burgeoning demand overwhelming the Troy factory and its seven ancillary production plants. Anticipating a hectic spring and summer, he published a warning to his dealers and prospective buyers in *Aviation*. The WACO Nine had an excellent reputation due its significantly improved performance (compared to the WACO Seven), and Brukner braced for the rush by concentrating production on only the Nine. Additionally, he told people that "present demand for Wacos is in excess of our production facilities. Future deliveries are being allotted to our distributors in strict numerical order. We suggest that you contact the Waco distributor in your territory if you wish to fly your Waco this spring." While obviously a marketing technique designed to stimulate even more demand, Brukner's announcement turned out to be a reasonable response to the demand.

Brukner and his distributors worked each year on a cyclical basis. The timing of Brukner's warning was no coincidence, as he knew the selling season was about to open. The average percent of sales in each month, computed industry-wide in 1929, showed this concentration of marketing activity.³⁸ This predictable cycle gave Brukner time to introduce the innovations defining new models each year. In 1932 he explained,

we utilize this period [November] to make plant changes and improvements, and to develop designs and processes for next years [sic] production. . . . I scarcely need to mention the fact that certain phases of it necessitate considerable temporary tightening of our usual policy of welcome to all. . . . Our Sales Department naturally wants to spring all new developments as a surprise and so, during this period, we do not maintain the usual open-house.³⁹

³⁸ *Aviation Industry*, p. 28.

³⁹ Brukner to Mr. P. Altman, November 18, 1932, "A Miscellaneous," *Brukner Papers*, DoAaSC.

Earlier, in 1926, Brukner had already found it necessary to make his customers stand in line, and many of them willingly endured the wait for the Waco Nine. His open communications with distributors and the public served him well, as Advance increased sales that year 372 percent over the 1925 figures.

By 1930 Waco Aircraft had greatly expanded its marketing network in concert with its production capacity. It had thirty-five distributors, who actually took title to the aircraft from the factory; there were also 300 dealers (who did not take title,) as well as agents in China, Mexico, San Salvador, Brazil, Argentina, and Australia. The sales figures continued to confirm Waco's leadership in the private flying market niche. In fact, in some years, Brukner sold more airplanes than those companies heavily engaged in business with the government, and he occasionally measured himself against them. In January 1931, Hugh R. Perry, Waco's sales manager, circulated a report of the average revenue per aircraft the distributors generated in 1930, a measure of the marketing network's effectiveness. Armed with this information, Perry then compared it to "the figures . . . I have swiped from [a] Curtiss-Wright Flying Service statistical report. . . ." Waco's sales force of approximately 400 brought in \$1,035,000, while Curtiss-Wright's 459 sales representatives managed sales of only \$963,000.⁴⁰ Although the measurements were crude, they showed that Brukner's sales organization compared favorably with one from another field in the aviation industry. Curtiss-Wright's concentration on defense contracting was very different than Brukner's exclusively civilian focus, but the sales per representative were similar.

⁴⁰ Memorandum, H.R. Perry to Brukner, January 30, 1931, "Perry, H.R., 1930-1949," *Brukner Papers*, DoAaSC.

Brukner's advertising strategy was consistent with industry norms. Beginning with the first Cootie in 1921, his company placed ads in numerous aviation magazines, published brochures and catalogs, and otherwise took advantage of the standard advertising schemes other American industries exploited. To reach a wide audience many companies advertised in periodicals with larger circulations than the trade magazines typically had. For example, the aviation industry paid \$410,000 for ads in the *Saturday Evening Post* in 1929, almost one percent of the value of the goods the industry produced that year.⁴¹ That amount paled in comparison, however, to the 6.5 million dollars the automobile industry paid the *Post* that year. Nonetheless, Brukner recognized magazine advertising was a valuable means of popularizing his airplanes.

In these advertisements Waco and other airplane companies downplayed the glamour of their product, instead emphasizing safety and reliability. Typical was a 1928 Cessna bulletin describing the company's founder and president, Clyde V. Cessna. It said, "His accomplishments have not been of the spectacular 'stunt' variety, nor of a 'happy-go-lucky' daredevil sort. Rather, they have been the means by which others have attained fame—the close application of aero-dynamics and the designing of planes that combine speed, safety and performance."⁴² Brukner made a similar pitch for his planes in 1922:

It takes off quickly and climbs rapidly. Fields heretofore considered impossible can be used with safety. It lands slowly. Forced landings are no longer to be dreaded. The speed is high enough to be economical for cross-country flying. It possesses marked stability, yet the controls are alert and effective. Its construction is simple, resulting in lower cost of

⁴¹ *Aviation Industry*, p. 134.

⁴² *Roscoe Turner Papers*, Number 5267, Box 14, Folder 32, American Heritage Center, University of Wyoming, Laramie.

manufacture and repair. . . . It is the result of the correct co-ordination of accepted good practices and the latest research with the experience of years in aeroplane construction and operation. It contains no erratic, untried new ideas.⁴³

Five years later, in ads for the Waco Ten, the theme was the same. Advance Aircraft said this “New Deluxe Model Ten WACO with its quicker take-off, faster climb, higher top speed than even the WACO Nine is a plane—full of safety, comfort and utility features—a worth waiting for surprise that very ably asserts WACO’S proverbial leadership in value and performance.” Another made a broad claim for the WACO’s reliability which later experience helped justify. It asserted that WACOs were “the most universally usable airplane ever produced.”⁴⁴

In order to formulate strategy and plan for the next selling season, Brukner instituted an annual meeting of sales representatives at the Troy factory in 1928. The shop workers and the sales force worked together to forge a coordinated campaign to maximize sales.⁴⁵ A steady stream of success stories boosted enthusiasm, as Brukner further enhanced Waco’s reputation by placing entries in the many air races and tours in the United States during the ‘20s and ‘30s. His planes’ success gave the ad men and salesmen all they needed to put Waco at the top of the industry.

Competitions were important because they captured the glamour and romance of flying while displaying the characteristics of safety and performance that the industry and its customers valued. Brukner attended air meets as early as 1921 in St. Louis, seeing first-hand rivals, such as the Curtiss “Oriole” and the Laird “Swallow,” and

⁴³ Waco Brochure reproduced in Kobernuss, *Waco*, p. 114.

⁴⁴ Advertisements reproduced in Brandly, *Waco Airplanes*, pp. 35, 40.

⁴⁵ *Ibid.*, pp. 56-57.

meeting other aviation entrepreneurs. By 1925 he had enough confidence to put his WACOs on the line. The National Air Race and the National Airplane Reliability Tour, sponsored by Edsel B. Ford, were the most prominent meets, and here the WACOs fared well from 1925 to 1932. With company pilots at the controls, WACO airplanes earned high marks for performance and safety in these competitions.

The company was then able to appeal to prospective buyers interested in sport flying, business travel, or commercial activity. Preparing aircraft for competitions was expensive, but Brukner accepted the cost and the risk of exposing his products to the wide publicity surrounding air meets. The risk of crashing was very real, and accidents threatened to put brand names in a bad light. In 1931 Waco's chief test pilot and one of the most famous stunt pilots in the country, Freddie Lund, died in an air race when a competitor's propeller cut his Waco's tail off, causing Lund to crash just in front of the spectator stands where his wife was watching.⁴⁶ Terrifying and risky though crashes were, they sustained the mystique of flying that for many Americans made aviation so appealing. As a shrewd participant in the aviation industry, Brukner was prepared to manage this risk. His planes' performance and their steady increase in sales after 1925 suggest that his advertising techniques, as well as his design and production, were successful.

Success in national competitions put credibility into the words of more conventional ads and earned prestige, not from an uninformed public, but rather from aviation people around the nation. The first National Air Race for Advance in 1925 was no grand entrance to the competitive flying world, but pilot Lloyd O. Yost, Advance's

⁴⁶ Ibid., p. 114.

North Carolina distributor, flew his Waco to a perfect score over the seven day, twelve-leg circuit. His success placed Advance on equal footing with Curtiss, Laird, and Martin—companies that already had recognizable names in the 1925 aviation industry. The National Reliability Tour did much more to further Advance's reputation. In Brukner's first year in that tournament, 1926, three of the top six finishers were WACOs; in 1927 three Waco Tens again placed in the top nine. The only bi-planes to make the top twelve in 1928 were Wacos, placing first and fourth. Waco won first and second, ahead of the Ford Tri-Motor the following year.

The Waco Company threatened in 1930 to win the trophy for three consecutive years, but that year changes in the rules favoring larger, multi-engine aircraft broke the streak. Ford's changes had the desired effect: his Tri-Motors placed first and fourth, while the Wacos won second, third, and tenth.⁴⁷ In the depression years of 1931 and '32, the expense of the Reliability Tour proved too much to bear, especially since multi-engine planes now had the upper-hand. Individual pilots by then were familiar with Waco's performance and they continued to fly them in the National Air Races, winning many prizes.

Excitement permeated the entire company in the weeks leading up to these annual competitions. Brukner later reflected on those days: "We had to work around the clock to finish those planes in time for the tour. We often would get a couple hours sleep

⁴⁷ The Aeronautical Chamber of Commerce reported results for the National Air Races and the Reliability Tours in each edition of its *Aircraft Year Book*. I used the 1926 through 1931 volumes to find the results for Waco aircraft.

on the concrete floor, under the wings of those planes.”⁴⁸ These efforts paid off with a special kind of advertising that most other products could not emulate.

Experiences with the Waco Aircraft Company showed customers that its quality product was matched by good service. The company’s support complemented other means of advertising to build a good name for Waco. Brukner went out of his way to please his customers and other people with whom his company came in contact. His efforts stood in contrast to those of some of his colleagues, who had a poor standing with their customers. Some suppliers “decided that until the aircraft fellows got down to business in their transactions . . . they did not want business from this industry.” The same observer, however, praised Waco as “the outstanding builder of commercial airplanes and every transaction we have with your Company further confirms this impression that you had to do everything better than the other fellow to gain, and hold your leadership in the industry.”⁴⁹ This response was not unusual. In 1931 the advertising manager for the Continental Motors Corporation, Dwight Davis, told Brukner,

I’m old enough to be beyond the influence of the mere glamor [sic] of aviation as aviation. In other words, I believe that the industry can only have its healthy development through the application of the same underlying principles of common-sense management that apply to the development of any business. . . . I feel that Waco represents one of the rather few well-managed institutions in the aircraft industry.⁵⁰

Customers appreciated Brukner’s commitment to high quality service. He guaranteed parts deliveries within twenty-four hours of order receipt and often performed repair

⁴⁸ Brandly, *Waco Aircraft*, p. 102.

⁴⁹ J.E. Menaugh to Brukner, March 21, 1931, “M Miscellaneous,” *Brukner Papers*, DoAaSC.

⁵⁰ Davis to Brukner, October 22, 1931, “Continental Aircraft Engine Company, 1929-1945,” *Brukner Papers*, DoAaSC.

services at the factory on demand. Problems with new aircraft received prompt remediation. Good service combined with manufacturing capability and rigorous marketing to establish and sustain an excellent reputation worldwide for the Waco Aircraft Company.

Figure 2-1
Waco Advertisement from *Aviation Magazine*

Let's call it the -

W A C O T E N

This Wonderful New DeLuxe Model

WACO stands for performance

TEN stands for the years the WACO organization, intact, has been *improving* airplane performance and utility for peace-time use.

This Year the Improvement is Colossal

Not just a new landing gear, or a few changes in our popular WACO NINE—it's just right and still far ahead of many—but this *New DeLuxe Model Ten* is a new ingenious combination of desirable appointments with proven construction.

Fancy this -

WACO VALUE

EFFICIENCY and PERFORMANCE

—combined with large roomy cockpits—practically no step required to enter—windshields that really protect—new seating comfort—accurate balance trimming in flight—elevators controlled without wires or exposed horns—four high aspect ratio ailerons independently and differentially controlled without wires or pulleys—beautiful enclosing cowling; not hand made but stamped in huge hydraulic presses, and easily removable in units—but

LET US SEND YOU COMPLETE DETAILS TOMORROW.
WRITE OR WIRE TODAY.

WACO Nine Price Reduction Effective January 31st., 1927

TERRITORIAL APPLICATIONS SHOULD BE MADE AT
ONCE AS ALLOTMENTS WILL BE MADE SHORTLY

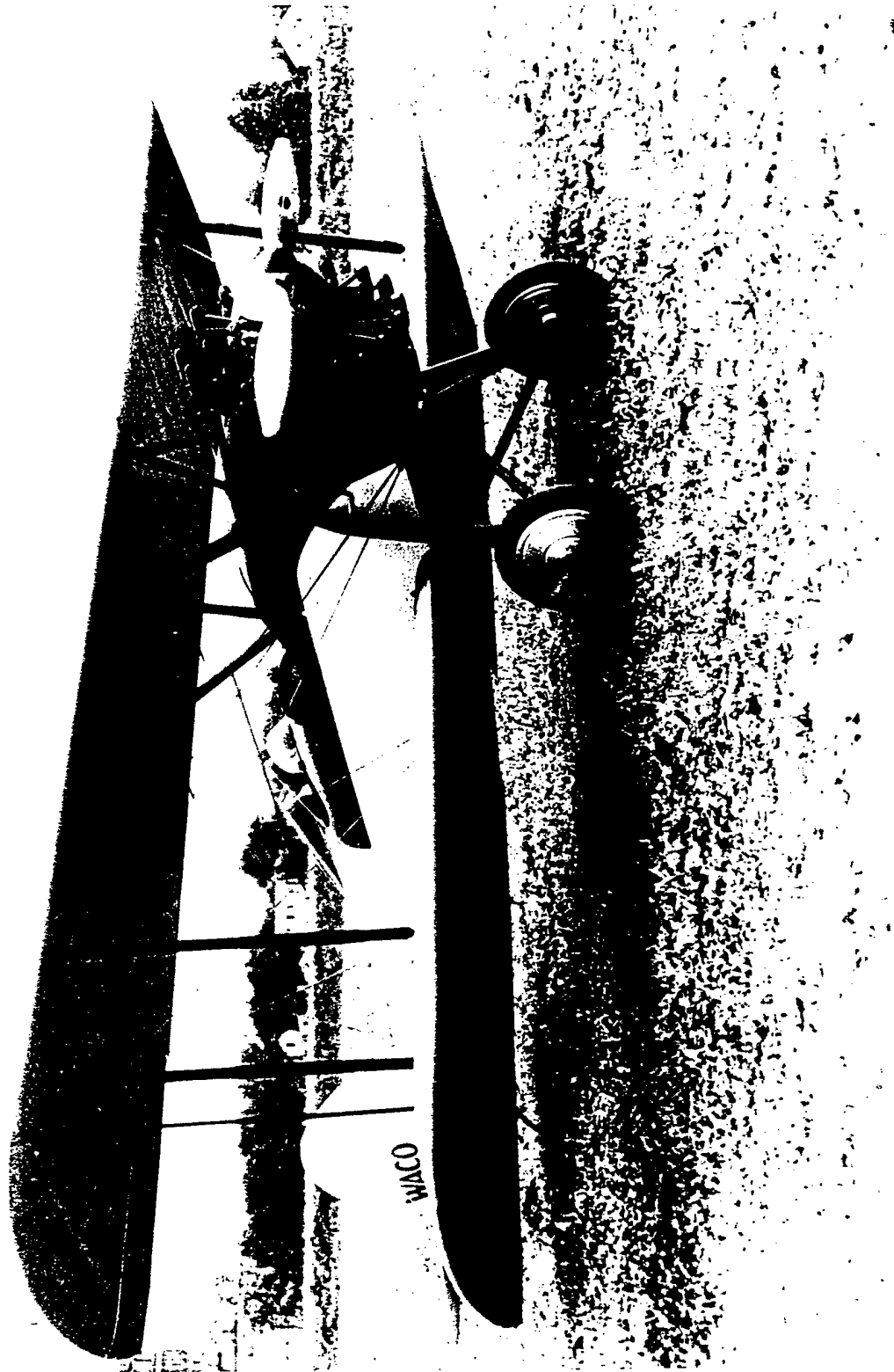
The ADVANCE AIRCRAFT Co.
TROY, OHIO U. S. A.

Ad placed in AVIATION magazine; February 7, 1927; pg. 287.

Figure 2-2

Waco Model Ten, 1927

From the collection of James Kessler



Waco's Corporate Culture

Brokner's leadership shaped the company's structure and its operating style. From the earliest days of the Weaver Aircraft Company, he was primarily responsible for the financial management of the flying operations and the design/manufacturing activities. At first, Buck Weaver was nominally the president of the company, but Brokner was the manager of the business. He later said of Weaver that he "kept insisting that he was president . . . but other than arranging for some financing, he did nothing other than the test flying. . . ." ⁵¹ While this remark certainly reflected some of the bitterness Brokner felt over Weaver's departure for a rival firm, it was an accurate description of the role Brokner played in the company. The Advance Aircraft Company was clearly his creation, since he was responsible for organizing the initial capital, locating the new factory in Troy, and determining the company's strategy.

His friend Sam Junkin played a key role, too, making technical design decisions and providing business advice to Brokner. His decisions to use the new USA 27 airfoil and to employ a simplified method of wing construction on the WACO Four set examples that other manufacturers followed in subsequent years. ⁵² He was more willing to absorb technical information from trade periodicals than Brokner, who preferred to "learn by doing" in their shops. ⁵³ Junkin's vigilance in monitoring trends within the aviation industry kept Advance's early models near the top in performance characteristics. His death on 1 November 1926 due to a heart condition was a serious

⁵¹ Quoted in Brandly, *Waco Aircraft*, p. 10.

⁵² Kobernuss, *Waco*, p. 90.

⁵³ *Ibid.*, p. 62.

blow to Brukner personally and professionally. Brukner, who was struggling to cope with increasing sales, took over Junkin's work. His experience and expertise guided the company from that point forward.

The Advance Aircraft Company remained small enough to allow Brukner to exercise a personal management style. As production increased through the 1920s, he still maintained a direct link to the shop floor activities, where he had earned his experience. His engineering expertise influenced the design of the aircraft that competed in the Ford Reliability Tours, and he served as a company pilot until 1926 when he finally left that role to others for good. He had ultimate authority over all advertisements placed in trade journals, and he authored articles for newspapers, as he had done in Lorain and Medina. No facet of the business was outside the realm of his personal involvement.

As the company expanded into new facilities and hired more workers, Brukner added new management staff, too. In 1927 Lee N. Brutus joined the company as vice president and general manager, positions he held for fifteen years. A military pilot during the First World War, he was a successful businessman in real estate and a member of the Indiana National Guard when Advance's Indiana distributor, Clyde Shockley, introduced him to Brukner. Not one to agonize over a personnel decision, Brukner hired Brutus by simply saying, "When you coming back?" He showed up in two weeks and quickly integrated himself into all departments in the company.⁵⁴ His arrival and forceful leadership triggered the resignation of Charlie Meyers, the chief pilot and Brukner's friend and cohort from Lorain, but Brutus's skills in the areas of sales and public relations

⁵⁴ Brandly, *Waco Aircraft*, pp. 32-33.

offset the loss. His mode of operation reinforced Brukner's preference for an extremely centralized management style.

Brukner's ideas about the appropriate strategy to market aircraft grew out of his experience in northern Ohio. There he had seen that customers came from the group of individuals who saw the products first hand. Most of them were pilots who had flown with Weaver, Meyers, or the other pilots associated with the Weaver Company. Some were pilots who needed a new barnstorming aircraft. But the common denominators were, first, that they were pilots and, second, that they had direct knowledge of WACO planes. With that in mind, Brukner placed tremendous importance on getting his planes to the best shows and competitions that he could afford to attend. He gradually built up a durable network of relationships through which he could make his products known to the greatest number of potential customers through the 1920s.

Meanwhile Brukner established manufacturing techniques that created the greatest flexibility in product characteristics, consistent with the company's ability to control the planes' configuration and cost. Configuration control was important because of Brukner's commitment to safety. After 1926 the U.S. Department of Commerce reinforced these requirements through a certification process that stipulated that an aircraft design was truly airworthy. In other words, Brukner may or may not have been able to satisfy a customer's request for a more powerful motor, depending on the analyses conducted by the company (and the government) on the structural strength of the airframe. Also prominent in Brukner's mind was his goal of selling his planes cheaper than the competition. Hence Advance's long commitment to the war surplus Curtiss OX-5 engine, even after other engines provided more power. The readily available engines

and parts meant that Brukner was willing to compromise on performance in order to achieve a lower sales price. As the economy improved in the later '20s and the company's profits grew, Advance developed the means to offer an expanding array of aircraft models, engines, propellers, and other options—all of which allowed customers to pick a plane that most closely matched their requirements. This new approach gave Waco a strong position in the upper part of the market.

Brukner again knew he needed help, and he hired a chief engineer in 1929. A. Francis Arcier had learned to fly in England in 1914 and had become an instructor pilot. He brought his international aviation experience to Troy and stayed until after World War II. After leaving the Waco Aircraft Company, he went to work for the U.S. Air Force at nearby Wright-Patterson Air Force Base. His responsibilities with Waco included the management of the design and testing processes that led to government type certification of the company's numerous models. He also ensured that Brukner had the flexibility to meet his diverse customers' needs.

Brukner was proud of Advance's hard-won success, and his experiences and personality combined to give him a strong commitment to independence for his firm. Early on he had shunned the kind of financial support Weaver wanted to enlist. Weaver said he could get whatever money was needed for their manufacturing projects from his wealthy friend Charlie Dickinson. Brukner preferred to remain unfettered. He was uncomfortable with Gerald Brown's support in Lorain and even shunned government contracts. He wanted to produce planes for private pilots, and although military work would bring in money, he saw it as a detour—not a credible means to his ends. Thus

when Weaver contacted the Army for possible sales of his company's Cootie for training purposes, Brukner was relieved when the Army rejected him.⁵⁵

Brukner had arranged for financial support from the Sampson family for the formation of the Advance Company, but he bought out their interests as soon as he could in 1925.⁵⁶ That left him and Junkin as the sole stockholders in the company. The tremendous hype surrounding aviation following Lindbergh's 1927 flight caused a flurry of mergers on Wall Street, as aviation groups established controlling interests in many companies. These vertically integrated groups owned airports, training school, airlines, and manufacturers. But not Advance. Brukner entertained no offers for his company's stock. In fact, he told *Aviation* magazine in 1929 that "the directors of the company . . . own in excess of 99 per cent of the outstanding stock. Stories representing other persons as directors or large stockholders are incorrect and while this announcement implies no malicious intent on the part of anyone, it is intended to offset the results of incorrect reports."⁵⁷ His route to prominence in the commercial aviation market was based on the creation of an organization and a distribution network that required no complicated ownership relations to make it work extremely profitably. From the vantage of 1929, that route promised more profits in the future.

Entrepreneurship in a Quickly Maturing Market

Waco was one of dozens of successful entrepreneurial ventures launched in the aviation industry of the 1920s. What was unique about Brukner's experience was his

⁵⁵ Kobernuss, *Waco*, p. 87.

⁵⁶ *Ibid.*, p. 152; Brandly, *Waco Aircraft*, p. 15.

⁵⁷ Quoted in Brandly, *Waco Aircraft*, p. 79.

relatively consistent improvement over time, once he had founded the Advance Aircraft Company. Others involved in aircraft manufacturing showed more halting growth, both in the military and commercial markets. The maturation of the aviation industry in the United States created opportunities that Brukner and the others were able to exploit before the depression caused a reassessment of the business strategies Waco had perfected.

Donald B. Douglas was for the military aircraft market what Brukner was for the commercial aircraft market—a remarkably successful entrepreneur at a time when he and others were just learning the business. Douglas capitalized on his M.I.T. degree in aeronautical engineering and his experience during World War I at McCook Field in Dayton, Ohio and in Washington, D.C., by forming the Douglas Aircraft Company in 1920 in southern California.⁵⁸ In his first year he won a Navy contract for six airplanes. This was followed by a string of successful contracts that by 1928 resulted in 314 deliveries to the U.S. military.⁵⁹ His dependence on the military stood in stark contrast to Brukner's aversion to military business, but it made Douglas Aircraft very profitable on sales that far exceeded the value of Advance's.

Glenn L. Martin's experience, on the other hand, revealed that business with the government was no sure means to profits. While he, too, relied on military contracts, the gaps between successful bids often meant layoffs in his Cleveland factory. Martin was extremely outspoken in his insistence that the government should nurture the aviation industry. At the same time that Brukner, Weaver, and Junkin were laying plans

⁵⁸ Bilstein, *Flight in America*, pp. 37-38.

⁵⁹ Biddle, *Barons of the Sky*, p. 136.

for the Weaver Aircraft Company in 1920, Martin told the *Cleveland Plain Dealer* that the government “must stimulate and aid in the application of aircraft industrially, and also aid in foreign trade, furnishing sufficient outlet for industrial aviation and guaranteeing a continuity of production at the required rate.”⁶⁰ His demands were not met, however, and in 1921 he was forced to layoff 300 employees; at that time, he expressed a desire “to get into commercial work.” Instead, he turned from Army to Navy work, when the Army Air Service awarded production contracts for his MB-2 bomber to two rival firms. Even this change failed to bring long-term stability. Three years later (1924), his company lost almost \$100,000 in one year.⁶¹ In 1929, when the company sold only two planes, Martin moved his company from Cleveland to Baltimore, Maryland, and he nearly lost his new factory when the stock market crashed only weeks after its opening. Martin’s troubled business dealings with the military were typical of the 1920s and probably justified Brukner’s avoidance of defense work.

Among those entrepreneurs who produced airplanes for the civilian market, Allan Loughhead (pronounced Lockheed) set a course that paralleled Brukner’s. Loughhead’s first attempt in 1920 to sell planes that were “small, reliable and economical and within reach of every automobile owner” failed completely, and he turned to real estate to support himself until his return to aviation in 1927.⁶² He was teamed at that time with Jack Northrop, who had designed a sleek monoplane called the Vega. Their first customer was arctic explorer George Wilkins, and his Vega’s first mission in January

⁶⁰ Quoted in Biddle, *Barons of the Sky*, p. 119.

⁶¹ *Ibid.*, pp. 141, 160.

⁶² *Ibid.*, pp. 128-129.

1928 was a successful flight from Alaska to Norway. The media frenzy following Lindbergh's flight the year before brought knighthood for the Australian and fame for the Vega. That year Lockheed Aircraft sold 29 Vegas, and 1929 brought 60 sales.⁶³ The company's success attracted the interest of the Detroit Aircraft Corporation, a holding company whose assets already included the Ryan Aircraft Company, makers of Lindbergh's *Spirit of St. Louis*, and Detroit's Grosse Isle airport. In July 1929 Detroit Aircraft purchased 87 percent of Lockheed.⁶⁴ The acquisition seemed to provide evidence that the company had arrived in the top rungs of the aviation industry, but it also set it apart from the independent course Brukner had chosen for Waco Aircraft.

Brukner's main competitor was the Travel Air Manufacturing Company based in Wichita, Kansas. It united the talents of Clyde Cessna, Walter Beech, and Lloyd Stearman in 1924 and produced planes with characteristics similar to those that Waco made. In 1927, however, Cessna left to form his own company committed to the manufacture of planes with single, cantilevered wings. He designed numerous different models until the depression forced the suspension of operations from 1931 until 1934. Beech continued to run Travel Air after Cessna's departure, and he produced 547 planes in 1929—private flying's best year until after World War II.⁶⁵ The depression convinced him to sell the company to the Curtiss-Wright group in 1930, thus leaving Waco as one of the few independents in the commercial aircraft market.

⁶³ Ibid., p. 155.

⁶⁴ Ibid., pp. 159-160.

⁶⁵ Bilstein, *Flight in America*, pp. 111-112.

So where do these brief comparisons leave us with regards to the performance of the Waco Aircraft Company in the emerging and rapidly maturing market for civilian aircraft in the 1920s and early '30s? Private flying was an extremely diverse field of American aviation, and historian Roger Bilstein says simply that "Specific definition of [this] aviation sector was not always easy. . . ." It included training, recreation, sport, business, agricultural dusting, photography, air shows, cargo, and other uses.⁶⁶ Sometimes the same plane could be used for multiple purposes. Brukner and Junkin designed the WACO Eight in 1924, for example, as an eight passenger plane to generate greater revenue on their weekend flights around Troy. When it sold the next year, the new owner removed all the seats and instead used it for aerial photography in the Kansas City area. WACOs filled all roles in the private flying field, and the planes' versatility, competitive purchase price, and economical operating costs gave Brukner's products a good name among a diverse clientele.

Meeting these multiple demands taxed Brukner's ability to design aircraft that met diverse requirements without sacrificing safety or economy. Unlike aircraft companies that won military design contracts, which compensated firms' research and design expenses, Brukner had to meet each customer's unique needs without incurring large design costs. Although these requirements did not place a premium on high performance (as did the military's), the diverse tasks that the planes accomplished meant that designs had to be done correctly to satisfy, first, the government for certification and, second, the customer as he or she used the plane. Indeed, this ability to match the final product with customer requirements was the crux of the business. Clement Keys, the

⁶⁶ Ibid., pp. 60-65.

president of Curtiss Aircraft, testified before Congress in January 1925 against the Navy's plan to maintain a design and engineering capability at its Philadelphia Aircraft Factory, because those functions "are the airplane industry."⁶⁷

Manufacturers of both military and civilian planes had characteristics that historian Philip Scranton describes for "networked" specialty producers in the late nineteenth and early twentieth centuries. He writes, "Specialists' competitive strategy involved differentiating products and marketing capacities for novelty or quality. The ability to make many different goods well and/or meet complex specifications often helped make price a secondary consideration in sales." Clearly this was the case in military procurement, wherein Army and Navy officers placed tremendous value on performance and less on procurement price. Civilian concerns similarly emphasized quality first, as did Brukner in designing aircraft whose safety qualities (low landing speed, for example), were crucial; while price was second, it was never unimportant in Brukner's view. The relatively small numbers produced for any single model meant that companies employed batch production operations. In this mode, many including Waco Aircraft conformed to Scranton's description of specialists as reliant on extensive contracting networks and skilled labor. These firms "focused on means to systematize, rather than standardize, production, information processing, labor recruitment, and marketing." Scranton identifies the aircraft industry as one of the successors to the specialist industries he studies in the period 1876 to 1920. Aviation, he argues, continued to provide the example of a dynamic industry in which managerial capitalism did not

⁶⁷ Trimble, "Naval Aircraft Factory," p. 189.

necessarily turn to mass-production to maximize profits.⁶⁸ My only caveat with Scranton's model is that price was a major constraint in the market Brukner served.

Brukner forged a successful company through the early years of the Great Depression, but three of his decisions had consequences that would become liabilities towards the end of the 1930s. Each of these decisions was made in the 1920s and reflected a careful consideration of the information he had available at the time. Other companies made the same choices, and as late as 1933, they were not seriously contemplating altering course. The three areas of concern here are product diversification, integration, and government relations—in each Brukner chose to limit Waco's exposure and developed no rigorous capability to deal with fundamental changes in the industry.

Waco built bi-planes almost exclusively, as we have seen. The early exception was the Cootie, a monoplane, that Buck Weaver crashed in 1920 and that the company never sold. Later, in 1930, Waco manufactured 300 very simple gliders in an attempt to provide an aircraft that average fliers could afford while the country was in the throes of the depression. Selling for \$385 each, the price was still too high and the fad soon faded anyway.⁶⁹ With these exceptions, Brukner committed Advance and Waco Aircraft to the production of bi-planes of various models. The commitment made sense in light of Brukner's desire to produce a plane that took off and landed in extremely short distances. His customers were thus not bound to fly their planes from developed airports, which were rare in the 1920s and not common even in the 1930s. Farmers' fields still

⁶⁸ Scranton, *Endless Novelty*, pp. 17-18, 347-348.

⁶⁹ Brandly, *Waco Aircraft*, p. 100.

frequently provided the runways and taxiways the planes needed, and the Wacos' demands for minimal space maximized a potential customer's usage of his or her purchase. The associated lower take off and landing speeds enhanced the planes' appeal to novice pilots, too, thus further increasing the number of pilots who found Waco aircraft interesting. The extra wing, in other words, was a distinct part of the capabilities that Brukner wanted his planes to have.

It came at a price he was willing to pay. The second wing added drag, which reduced the maximum speed an aircraft could achieve, but Brukner did not claim to have the fastest planes. His focus was on small field operability and safety. Monoplanes were not significantly faster than the latest bi-planes, and their superiority became apparent only in the 1930s. In the United States NACA and the military sponsored the technical research required to improve external aerodynamic efficiency. Not only was the research expensive, but enhancements also often required costly changes in production methods. Implementation was gradual. Indeed numerous militaries, including those of the U.S., flew bi-planes until the Second World War. From Brukner's point of view, the effort and expense of including monoplane designs could not be economically justified. He was not interested in competing in the aviation field that demanded diversifying into the manufacture of monoplanes.

Similarly, the shift from wood to all-metal construction necessitated a costly shift in production techniques that offset any changes in performance. Waco built planes with a welded metal frame covered with wood for the fuselage. Wings had wood frames and continued to be covered with fabric. Again, even in the military field the adoption of all-metal designs was not universal in the 1930s. The British company De Havilland, for

example, designed the highly effective Mosquito in 1939 as a wood fighter-bomber.⁷⁰ The U.S. military, as we will see, retained an interest in wooden aircraft during World War II. Waco's experience proved important in exploring those possibilities.

Brukner's commitment to a single aircraft type matched his reluctance to pursue integration or alliances with others in the aviation industry. He valued independence primarily because the financiers of the largest holding companies were interested in controlling the most lucrative parts of the industry, meaning manufacturers of military planes and airlines earning Post Office subsidies. Those individuals, Brukner believed, lacked the knowledge needed to win sales in the civilian aircraft market. He had gained that knowledge through hard experience through the 1920s. He was unwilling to submit to managers who expected his company's performance to mirror those who sold planes in the military market. So to avoid possible take-over bids, Brukner and his corporate officers held their stock themselves. They in turn did not consider mergers or acquisitions because, as successful as Waco was, it could not match the wealth of those who pieced together vertically integrated aviation holding companies, like Detroit Aircraft.

The most logical choice for acquisition would have been an aircraft engine manufacturer, since the motor rivaled labor as the largest element in the final cost of an airplane. Engine manufacturers, though, were among the first firms incorporated in the holding companies. Wright Aeronautical, for example, supplied numerous engines for Waco planes, but was the anchor for the Curtiss-Wright group. Continental Motors,

⁷⁰ Sebastian Ritchie, *Industry and Air Power: The Expansion of British Aircraft Production, 1935-41* (London: Frank Cass, 1997), pp. 31-34.

another Waco supplier, was part of the General Motors group. Brukner was in no position to compete with them for ownership of a motor company. Moreover, his need for productive flexibility meant that internalizing one company's products might have compromised his ability to offer a range of engine types (water cooled or air cooled) and size. Also, keeping propulsion outside the boundaries of his firm allowed maximum flexibility without incurring the costs for sustained research on engine improvements. The transaction costs for obtaining the products other firms developed were smaller and less risky than those that integration may have entailed. Brukner's success in selling airplanes enabled him to bargain for quantity discounts, further reducing the costs of the contractually acquired motors. Other aircraft raw materials, as we have seen, were less important in the final cost and were common resources, like steel, wood, and fabric. A reliable supply of these items gave little reason to consider purchasing a supplier. Thus no vertical integration occurred, reflecting both Brukner's corporate vision for Waco Aircraft and the impracticality of internalizing functions handled more economically across the boundaries of the company.

His staunch independence squelched as well any move towards horizontal integration. Moves into other aviation fields, like military or transport aircraft, did not comport with his vision of being the best builder of civilian planes for private flying. Intense competition in those fields and the much larger size of firms engaged in those markets further discouraged attempted merger or acquisition. Within private flying, Waco planes appealed to a broad range of civilian pilots, from beginner to sports pilot to company pilot. Brukner stood to gain little in the period 1927 to 1933 from buying a company that specialized in a certain type of civilian aircraft—his were already the most

popular. Taking over a rival then shutting the factory down might have enhanced sales in the long term, but Brukner faced enough short-term demands for capital to allow him to dismiss such a course as too risky. He built a new factory in 1928, for instance, and expanded it the following year. The onset of the depression made survival the top priority. As with vertical integration, horizontal integration did not earn Brukner's serious consideration for a combination of practical and ideological reasons.

The final decision under consideration here is Brukner's choice to create no organizational capability to manage government relations. He hired a general manager, a parts manager, and chief engineer and expanded the labor force to accommodate the rapid increase in demand for Waco airplanes from 1925 until 1929. The plethora of tasks associated with managing a burgeoning business demanded no less. But when Waco's business context changed significantly, he developed no special ability to deal with the challenges those changes presented. The Department of Commerce, for example, assumed regulatory responsibilities for civilian aviation in 1926. The State of Ohio had an aggressive Bureau of Aviation reporting directly to the governor, and its director constantly solicited Brukner's advice about proper state policy for aviation. Last, and most important, Brukner established no permanent links to the U.S. military. The company sold planes to the military, two to the Army in 1926 for test purposes and two to the Navy for use with the dirigible Macon in 1928, for example. But these sporadic and small sales placed the military on par with any other Waco customer—it had a unique set of requirements for bi-planes that Brukner made. Incorporation of those differences into the final product required no special design or sales capability. Brukner treated other government relations as necessary evils. By default, then, he as president became the

focal point for managing company-government affairs. The rapid increase in dynamic government involvement placed great demands on Brukner's time, and this burden, combined with his ambivalent attitude, made managing the business context a difficult burden for Waco Aircraft.

Chapter 3

The Government and American Aviation, 1921-1938

Aviation's early development fell under the purview of a federal government very much interested in playing an active role in the industry. The programs established during World War I were just beginning to produce results in aviation by the end of the conflict, and they provided a model that many Americans wanted to emulate in numerous facets of society in peacetime.¹ In the immediate postwar years, those aviation companies with wartime experience declared their strong support for government involvement. Due largely to the reservations many people had about the constitutionality of aviation regulation, quick action proved impossible. But persistent efforts from officials in the military, the Post Office, and the Department of Commerce finally forced Congress to pass legislation. These government leaders placed great emphasis on the formation of a self-sustaining aviation industry and looked to the Commerce Department to take the lead in setting policies furthering that cause. Herbert Hoover—the most powerful leader in the federal government—advocated a cooperative relationship between the government and the industry throughout the decade of the twenties.

The national government, however, continued to struggle with aviation. Hoover's vision of an associational state supported action, but many questioned the

¹ The Progressives in particular believed they had seen during the war the kind of administrative state that could bring about sweeping reforms. For good treatments of the high expectations for government see Hawley, *The Great War and the Search for a Modern Order* and Guy Alchon, *The Invisible Hand of Planning: Capitalism, Social Science, and the State in the 1920s* (Princeton: Princeton University Press, 1985).

constitutional basis for doing so. The debate over authority and policy continued until FDR's inauguration. Similarly, the military's debate over roles and missions for the airplane continued to rage through the entire decade. The struggle revealed the disruptive forces new technology unleashed on the battle lines the Army and Navy had previously established. Paralleling these conflicts was the Congress's antagonistic posture towards defense contractors. Frequently Congress frustrated the military's efforts to cooperate closely with manufacturers. To add to the confusion, the executive agencies were uncertain about the appropriate means to deal with private flying. The rapidly evolving aeronautical technology and constant pressure from international rivals added further complications to the national government's plans to assist American aviation.

Though disconcerting to aviation leaders, the situation was not unprecedented in early twentieth-century America. The radio, itself a new technology of tremendous social consequence, and aviation had appeared in the United States only four years apart. Guglielmo Marconi first demonstrated wireless telegraphy at the 1899 America's Cup yacht races, reporting the progress of competitors and exciting Americans' imagination. The press played a key role in portraying Marconi as an inventor-hero and in popularizing the new technology. In contrast, the Wrights' first flight at Kitty Hawk, North Carolina, in 1903 was followed by a period of relative quiet, as the brothers tried to secure their patents and their fortunes before extensive public demonstrations. Nonetheless, they too quickly emerged as popular heroes and demonstrated how powerful was the nexus between technology, business strategy, and the press in shaping American culture.

The interplay of individuals and organizations in each arena defines the purposes which new technologies acquire. Historian Susan J. Douglas argues that the centralization of power caused by the rise of corporate America created diminishing opportunities for the wireless inventors and the poorly organized public to play a forceful role in determining how the radio would be deployed in American society.² The story of Brukner's involvement in the private flying field reveals a similar pattern of power relations in the aviation industry. In the case of radio, the government's claim to have responsibility for public safety and for national security empowered Navy officials to assume leadership in developing a nationwide network of stations and operators. The Navy's decisions about equipment procurement and operating procedures favored corporate interests at the expense of the inventors, whose firms proved unable to compete effectively with the likes of General Electric and AT&T. The process of centralization and the military's facilitation of the process make the early history of radio similar to that of aviation.

Radio and aviation both enjoyed the attention of the media that tried to legitimize the new technologies as autonomous forces capable of revolutionizing American culture. As Douglas points out, the press initially allied itself with amateur radio operators, not commercial interests, and portrayed them as cultural heroes. Their stories appeared widely in mass media such as magazines, dime novels, comics, and

² *Inventing American Broadcasting, 1899-1922*, (Baltimore: Johns Hopkins University Press, 1987). Douglas's history of the early years of radio in the United States provides an excellent analysis of the interaction of business, government, and the public in the development of a new, very popular technology. Her treatment of the Navy is particularly effective. She explains the powerful role that naval doctrine played in blocking the integration of wireless technology into fleet operations. Not only is the carving of a niche within the tradition-bound service instructive for aviation technology, but it also exemplifies the role interest groups play in socially constructing a new technology.

movies. As heroes, the amateurs and their media sponsors fought for control of the ether. Douglas argues that the press "sustained their [amateur operators'] visions of being on the cutting edge of technological progress and of being the kind of men truly prepared for modern society."³ The romantic descriptions of wireless telegraphy and of the equipment operators rivaled the exaggerated copy the press published about aviation starting in the decade of the 1900s.

The amateur operators fell into disfavor, however, in the push for legislation following the 1912 *Titanic* disaster. With no rules about who had priority on the airwaves, transmissions were often impossible because of interference; too many people were frequently trying to communicate at once. The conflicting and confusing reports surrounding the *Titanic's* demise delayed the notification of survivors' families and hampered the press's ability to report the tragedy. The press became a firm ally of the Navy's in lobbying for legislation that assigned priority to operators. Public safety and national security demanded that the amateurs be pushed out of the primary frequencies, into the short wave range of 200 meters or less. Douglas summarizes: "What caused the amateurs to lose their freedom to roam the ether at will was not so much that the government would no longer tolerate that freedom, but that a very influential business, the press, found their activities a disruptive encroachment on its turf."⁴ The same had always been true of the Navy. The press's shift to the Navy's perspective ensured quick passage of the first Radio Act in 1912.

³ Ibid., p. 207.

⁴ Ibid., pp. 34, 238.

Subsequent development of radio regulation in the United States coincided with the national government's entry into the aviation field in the 1920s. The 1912 law had given the Department of Commerce responsibility for licensing radio stations and operators. The commercial success of the KDKA station in Pittsburgh, Pennsylvania, and radio's further technical development caused a boom in American radio. Between the beginning of 1922 and 1923, the number of stations increased from 28 to 550. Secretary of Commerce Herbert Hoover tried to use his Department to allocate the spectrum, but a court decision in 1926 found that he had no legal basis to act in that capacity. Station operators were left to choose frequencies and transmitting power. The resulting confusion demanded attention and led Hoover to declare that "the problems involved in Government regulation of radio are the most complex and technical that have yet confronted Congress."⁵

The 1927 creation of the Federal Radio Commission (FRC) and its early regulatory policies demonstrated Hoover's associationalism at work. The FRC gave radio engineers tremendous influence in setting regulatory policy. Historian Hugh Slotten argues that the FRC's reliance on the Institute of Radio Engineers and the American Engineering Council led to decisions emphasizing the technical efficiency of the nation's broadcasting system. Such technocratic decision-making favored the most modern, technically advanced equipment, which minimized interference but required

⁵ Hugh Richard Slotten, "Radio Engineers, the Federal Radio Commission, and the Social Shaping of Broadcast Technology: Creating 'Radio Paradise,'" *Technology and Culture* (October 1995): 950-986. Quote from page 953. Slotten convincingly argues that the values of the engineering profession and those of government regulators, who were led by the Great Engineer, Secretary of Commerce Herbert Hoover, helped forge an alliance between the commercial interests of businessmen and the commission charged to regulate them. The elite experts Hoover relied on made decisions clearly favoring corporate, not necessarily the public's, interests.

large financial investments. Non-profit or educational organizations could not compete with the newly formed national broadcast corporations. The opportunity to regulate based on qualitative factors, such as educational content or the proper use of advertising, did not interest the engineers. Not only was the efficiency of the communication network paramount, but the interests of the largest stakeholders in the decision-making process favored the centralization of control in broadcasting. Slotten's conclusion about Hooverian regulation supports Douglas' view of radio's earlier period of development in American society. He writes, "Engineers shared business executives' commitments to pragmatic values such as efficiency and planning as well as to the centralized control necessary for the construction of technological systems. Both groups were committed to large-scale development, both technological and organizational."⁶

Crafting New Laws

Historian David D. Lee has characterized the development of the first legislation for American civil aviation as another excellent example of Herbert Hoover's associationalism. Closely paralleling the work of Ellis Hawley, Lee maintains that Secretary Hoover largely succeeded in creating a self-regulating aviation industry, moving the regulatory process from the parliamentary to the techno-corporative realms.⁷ Hoover's concept involved the organization of economic units, which worked together in a spirit of social responsibility, to make technologically based decisions addressing

⁶ Ibid., pp. 984-985.

⁷ David D. Lee, "Herbert Hoover and the Development of Commercial Aviation, 1921-1926," *Business History Review* 58 (Spring 1984): 78-102.

America's problems. Government's role was to facilitate the growth of an elite group of experts in these organizations, which would then find ways to improve American business practices. Lee admits that aviation had unique challenges that forced Hoover to adapt his model of the associative state, but the result was a satisfying compromise and a success for commercial aviation.

Lee's analysis of Hoover's role in the passage of the Air Commerce Act of 1926 is not entirely persuasive, however. Although Lee carefully distinguishes the adaptations the industry's poor condition forced Hoover to make, the fact remains that the government played a much larger and more detailed role in the industry than Hoover's principles dictated. Key among his principles was forging a constructive partnership between an enlightened industry group and government officials. In the case of aviation, however, the industry proved unable to form a trade association with the kind of expert elites that Hoover's brand of associationalism demanded. When the secretary called for industry input, he turned to businessmen not directly linked to aviation, the American Engineering Council, to organize a response.⁸ The weakness of Lee's argument appears when we look at the years following the passage of the Air Commerce Act in 1926. The government became deeply involved in the organization of the airline industry through the award of airmail contracts, for example, and the manipulation of these subsidy payments by the Postmaster General violated the principles Hoover's associationalism prescribed. The government's overreaching regulation highlighted the impotence by 1930 of the aviation industry's trade associations. Lee understates the

⁸ Lee, "Herbert Hoover and Commercial Aviation," pp. 80, 97; Hawley, "Three Facets of Hooverian Associationalism: Lumber, Aviation, and Movies, 1921-1930," pp. 95-123.

fragmented nature of the aviation industry and the importance of the government in the early development of American aviation.

Hoover knew what he wanted government to do in conjunction with the aviation industry, and he pursued his goal very deliberately. "I am in hopes that we shall succeed in a further constructive relationship between the Department and the industry,"⁹ Hoover wrote in 1922. He patiently cultivated support for legislation while simultaneously reining in those who went too far in their drive for intervention. A section chief in the Commerce Department captured the kind of program Hoover wanted to pursue in 1925:

several of the newspaper publishers . . . are very enthusiastic on the subject of commercial aviation in general, and anxious to do anything that will aid its development. . . . A general publicity campaign stressing the need for federal legislation designed to regulate air navigation and to provide aids similar to those furnished for marine navigation, would be very helpful at this time. . . .¹⁰

Such efforts aided Hoover's push for reasonable regulation.

On the other hand, Billy Mitchell's outburst following the crash of the Navy's dirigible *Shenandoah* in 1925 did not meet his approval. Mitchell accused the military's top brass of incompetence in managing American air power. In an effort to ameliorate the situation, Hoover asked President Coolidge to charter a commission to investigate military aviation—the President's Aircraft Board, or Morrow (Dwight M. Morrow was the chairman) Board. Such deliberate, rational action would counter Mitchell's antics,

⁹ Herbert Hoover to Sidney D. Walden, October 28, 1922. "Aviation, 1920-1921," *Commerce Papers, Hoover Papers*, Hoover Library.

¹⁰ P. E. D. Nagle to Hoover, May 29, 1925. "Aviation, Commercial 1925," *Commerce Papers, Hoover Papers*, Hoover Library.

Hoover believed.¹¹ Mitchell's confrontational politics kept the famous general from assuming leadership in Hoover's style of associational state.

Hoover was not the only government official concerned about aviation. The United States' perceived inferiority to Europeans in aviation caused many Americans alarm, especially those in uniform. Beginning in 1922 the Army Air Service assigned officers to investigate "the relation of commercial aviation to the National Defense and the methods whereby a self-supporting aeronautical industry might be encouraged and promoted."¹² One officer, First Lieutenant J. Parker Van Zandt, pursued the task zealously and reported to Major General Mason M. Patrick, the Chief of the Air Service, with a comprehensive plan to lift the industry to European standards. Wanting to avoid the appearance of a conflict of interest, Van Zandt asked for and received a leave of absence from the Army. Patrick launched the lieutenant's new career with high hopes:

The initiative and energy which you have displayed in seeking to promote the development of a civil aeronautical industry is very gratifying to this office, and . . . you have my entire approval to use the prospectus, which you have prepared on your own initiative and in addition to your regular assignments, in whatever manner you consider is best calculated to advance the interests of the Government.¹³

Van Zandt's plan revealed the government's and many businessmen's desire to pool resources to create the kind of large company which could stabilize the young industry.

¹¹ Transcript, William P. MacCracken, Jr. Oral History Interview, September 1968, pp. 10-12. *MacCracken Papers*, Hoover Library.

¹² Mason M. Patrick to J. Parker Van Zandt, February 11, 1925. "Van Zandt, J. Parker, 1925," *MacCracken Papers*, Hoover Library.

¹³ *Ibid.*

“We have in mind the creation of a national organization whose ultimate control of, and influence in, the aeronautical field will correspond in general to the position of the American Telephone and Telegraph Company and its affiliated organizations in the telephone field.”¹⁴ Van Zandt told the director of the War Finance Corporation before he received his leave of absence. Specifically, Van Zandt was working on the formation of an airline that would provide overnight service between the New York, Philadelphia, Baltimore, and Washington region and the Chicago, Detroit, and Cleveland area. His proposed institution, National Air Transport, Incorporated (NAT) would combine the “support of the leading banking, shipping, industrial and commercial interests of the United States.” His goal was to constitute a “civic body whose patriotic motives are beyond question and whose financial standing is assured, with whom the Government may actively cooperate to bring about the early establishment of an extensive aeronautical industry.”¹⁵ Justification came in part from overseas—Germany, England, and Holland had similar organizations. In fact Van Zandt copied the German organizational chart to use as the model for his proposed company. But he wanted to make money, too, and he estimated that initial capital requirements of \$1.6 million would generate a thirty-seven percent return on investment over the first four years. He supplemented his appeal by informing prospective supporters “that the present offers an unexcelled opportunity to obtain control of the elements of monopoly value incident to priority in a rapidly developing field.”¹⁶

¹⁴ Van Zandt to Eugene Meyer, Jr., February 7, 1925, in *ibid.*

¹⁵ *Ibid.*

¹⁶ *Ibid.*

Military leaders understood commercial and military aviation to be highly interdependent, and communicated their vision to the public. Major General Mason M. Patrick, for example, told the *Chicago Commerce* in 1925 the nation needed “a reservoir of trained pilots and aircraft and a flourishing aircraft industry to supply our needs. These can be brought into being only by greater and greater commercial use of aircraft. . . . Our national existence and our economic independence really depend upon the use we make of aircraft.”¹⁷ He took his cues from his civilian superiors who had advocated government support for commercial aviation for years. In 1922 Secretary of War John W. Weeks wrote to Secretary of Commerce Herbert Hoover to assure him that the Army had “been greatly impressed with the necessity for adequate control of civilian flying. . . .” That same year the Assistant Secretary of the Navy, Theodore Roosevelt, Jr., wrote to Hoover lamenting “the fact that there are no laws whatever providing for the regulation of commercial Aviation.” Roosevelt told him “that I would be very glad to assist in any way I can” to gain passage of legislation during that congressional session.¹⁸ For these military leaders commercial aviation offered the means to broaden the manufacturers’ narrow base. Their assessment of the precarious state of the industry was widely shared. Indeed historian John Rae’s assertion in 1968 that the aviation “industry has depended for its existence on . . . the United States government” echoes what aircraft manufacturer Grover Loening said in 1921: “No private company could bear the cost of development

¹⁷ *Chicago Commerce*, June 6, 1925. “C General,” *MacCracken Papers*, Hoover Library.

¹⁸ John H. Weeks to Herbert Hoover, April 11, 1922; Theodore Roosevelt to Hoover, April 8, 1922. “Legislation, 1922,” *Commerce Papers, Hoover Papers*, Hoover Library.

work on commercial planes unless it had support from government contracts."¹⁹ The military, though, did not want to be the manufacturers' sole provider and worked hard to expand aviation's customer base in order to create a more stable foundation for future development.

Hoover's scheme for intervention in the aviation industry drew on the government's experience with involvement in other industries. His Assistant Secretary, J. Walter Drake, argued for legislation in 1926 using the most prominent examples: "An era of air transportation in this country paralleling the growth of the automobile industry and radio art awaits primarily Federal support in the matter of airway facilities—their administration, and the elimination of needless restrictions."²⁰ The connection between commercial and military aviation was important, too. He recognized, just like the American Legion, "that commercial and private aviation must be fostered and regulated in order to provide a reservoir for emergency service."²¹ Both efficiency and national defense demanded the government's attention. His department would do its part to provide economically sound support for the emerging industry.

Economic principles, which Hoover thought would provide the basis for rational decision-making, had not been clarified for civil aviation in the few years since the war. There was as yet no clear pattern of development. Clarence M. Young, who drafted regulations and later served as the Assistant Secretary for Aeronautics, was

¹⁹ Rae, *Climb to Greatness*, pp. vii, 17.

²⁰ Drake, announcement of final report of the Joint Committee of the Department of Commerce and the American Engineering Council, January 1926. "Legislation, 1925-1926," *Commerce Papers, Hoover Papers*, Hoover Library.

²¹ Harris C. Allen (Chairman, Aero Committee, American Legion) to Hoover, December 24, 1921, in *ibid.*

acutely aware of the problems. In anticipation of the next legislative session Young told Hoover plainly that the "problem is an exceedingly complex one, and it is doubtful if it can be suitably solved by a theoretical discussion of specific proposals in anticipation of a present trend which may or may not take place." He concluded by saying it was "exceedingly difficult to draft a proper air navigation law until such time as there is a real, going commercial aviation industry upon an established basis."²²

Five years later the situation was little improved. In 1930 William MacCracken, the former Assistant Secretary for Aeronautics, stated, "Inherently air transportation, unlike rail transportation, does not naturally lend itself to a monopoly; therefore, the basic reason for such regulatory legislation [rate and schedule regulations] by the national government, or the States, is lacking." He conceded, however, that although "air transportation has proven itself as a safe and reliable method of transportation, its economic principles are still in a highly experimental stage."²³

Uncertainty accompanied all government actions as it defined a role for itself in American aviation. Some definitions were negatives. Hoover said in 1926 "[i]t is not necessary that the Government should subsidize commercial aviation in this country, but it is highly necessary that it should provide certain services which are essential as a basis for its development."²⁴ The Post Office, meanwhile, pumped millions into the airline

²² Young to Hoover, December 7, 1925, in *ibid*.

²³ "Special Problems in Aeronautical Legislation," speech delivered by William P. MacCracken, Jr. to National Conference on Uniform Aero Regulation Laws, December 16, 1930. "Commerce Department, National Conference on Uniform Aero Regulation Laws, 1930," *MacCracken Papers*, Hoover Library.

²⁴ Hoover, forward to the final report of the Joint Committee of the Department of Commerce and the American Engineering Council, January 1926. "Legislation, 1925-1926," *Commerce Papers*, Hoover Library. Emphasis in original.

segment of the industry, fueling a consolidation of aviation companies seeking to maximize subsidies. The mergers similarly concentrated military aircraft manufacturing. The Assistant Secretary of Commerce said in 1932 that he saw "a noticeable concentration of manufacturing facilities within a less number of manufacturers which, when considered in connection with the situation previously existing, suggests a favorable trend with respect to the quality, type and manufacturing costs involved."²⁵ The industry's concentration received support from the national government in the form of favorable policies and appropriations. The industry's dependence on federal money and its struggle to survive the early years of the Great Depression forced many to reconsider government policies. The goal of self-sustaining development seemed as distant as ever.

The convoluted legislative efforts to authorize the government's entry into commercial aviation reflected some uncertainty about the economics of the situation, but it also showed the reservations many Americans had about the constitutionality of aeronautical regulations. The Tenth Amendment was a useful weapon for those opposing regulation. William J. H. Strong cautioned Hoover in 1922 that the

National Government enjoys only such powers as are delegated to it by the States. The National Government has control of the Army and Navy, Inter-State and Foreign Commerce and the territories but other powers related or concerned with the air have never been delegated to it by the States and until a Constitutional amendment, they reside with the States or with the people.²⁶

²⁵ Address delivered by Clarence M. Young to Aeronautical Chamber of Commerce and Society of Automotive Engineers, April 7, 1932. "Commerce Department, 1931-1932," *MacCracken Papers*, Hoover Library.

²⁶ Strong to Hoover, February 13, 1922. "Legislation, 1922," *Commerce Papers, Hoover Papers*, Hoover Library.

Advocates of legislation grudgingly acknowledged this difficulty and seized the offensive, arguing for the national government to move rapidly into the field. Hoover's 1925 Joint Committee led the attack. Seeking to build consensus between public and private experts, Hoover brought the American Engineering Council and the Department of Commerce together to conduct a survey of the needs of commercial aviation.²⁷ The Joint Committee on Civil Aviation released a report that blurred the jurisdictional issues. It said "the federal and state governments have concurrent jurisdiction," and left no doubt where the higher authority and initiative rested: the states had power only "to the extent that the federal government fails to exercise its authority."²⁸ Hoover may have thought consensus had been achieved, but Congress passed no aviation bill in 1925. The struggle for legislation continued.

The politics were strongly contested on both sides, and the debate continued even after Congress seemingly decided the matter in 1926 with the passage of the Air Commerce Act. Supporters used the railroad and automobile industries as persuasive analogies and obtusely concluded from them that "there is no need to point out the desirability of the federal government exercising the maximum regulatory jurisdiction in the initial stages of any new transportation activity." After all, they said, "[r]egulation by the several states is bound to be costly, lead to confusion and once established will be difficult to dislodge."²⁹ But many people believed that was the way the U.S. constitution

²⁷ Lee, "Herbert Hoover and Commercial Aviation," p. 97.

²⁸ Draft report of the Joint Committee, 1925. "Legislation, 1925-1926," *Commerce Papers, Hoover Papers*.

²⁹ *Ibid.*

dictated involvement. As Congress debated the Wadsworth Bill in 1925, members of the National Aeronautic Association debated aviation regulation. The Bill ultimately failed but it laid the groundwork for the Air Commerce Act of 1926.

In the 1925 discussions, the NAA President Godfrey L. Cabot strongly supported federal government regulation, but the organization's legal counsel, J. F. Victory, countered with a strong dissent. He challenged the blurring of jurisdictional boundaries that undergirded much of the argument for legislation, stating that "existing facts do not warrant the Congress in assuming that interstate air commerce and intrastate air commerce are so 'mingled together' . . . as to justify an attempt at this time to regulate intrastate air commerce."³⁰ From that point his argument was the standard Tenth Amendment thesis that the national government could not empower itself where the states had clear jurisdiction and had not delegated authority. Even the protests of industry insiders like Victory could not derail passage of legislation in 1926, but they had delayed the advocates for five years and sustained a debate about the limits of involvement. The need for a Commerce Department meeting convened in 1930 entitled *The National Conference on Uniform Aero Regulation Laws* demonstrated the enduring nature of the controversy.

The conference recounted the progress advocates had made in furthering federal regulatory powers at the expense of the states. William P. MacCracken, Jr., one of the architects of early legislative proposals, reminded those in attendance that "[t]here were those of us who felt that in order to adequately protect interstate and foreign

³⁰ Victory to Cabot, undated. "NAA, Correspondence, 1922-26," *Commerce Papers, Hoover Papers*, Hoover Library.

commerce by air it was necessary to require that all aircraft and personnel should meet the licensing requirements of the Federal government." The Air Commerce Act did not go so far. But MacCracken pointed out that most "States realized that a single standard was not only desirable, but was in fact so necessary that the great majority have adopted" federal requirements. Licensing, he summarized, had made "satisfactory progress" towards national control, but he warned that it was "important to be ever on the alert to guard against licensing requirements that are at variance with those of the Federal government." Air traffic rules also deserved highlighting, MacCracken believed. Safety demanded uniformity, and the Air Commerce Act provided it. He tried to close debate by maintaining, "Not only are State air traffic rules in general unnecessary, but also there is considerable doubt as to their constitutional validity, in view of the fact that Congress has already provided for covering the field by rules of nation-wide scope."³¹

Exercising Regulatory Powers

The passage of legislation in 1926 may not have answered all questions about government-industry relations in aviation, but it granted important powers to public officials who could now play active roles in the industry. Nowhere was this clearer than in the establishment and rise of Pan American Airways. In this case foreign competition, government support, and private interests combined to spawn what became the only American company offering foreign airline service. Pan Am began as a small airline carrying mail from Key West to Havana, but as the Europeans extended their airlines to

³¹ "Special Problems in Aeronautical Legislation," speech delivered by William P. MacCracken, Jr. to National Conference on Uniform Aero Regulation Laws, December 16, 1930. "Commerce Department, National Conference on Uniform Aero Regulation Laws, 1930," *MacCracken Papers*, Hoover Library.

include other parts of the world, Pan Am's symbolic importance as the United States' only international carrier increased. By 1928 German and French lines connected South America with Europe, and Great Britain was beginning to pull the empire together with air service. Some Americans had set up companies in foreign countries, but they attracted little attention from investors because they competed against the subsidized European airlines.³² Only when the Post Office acquired the same authority to award contracts for foreign routes that it had obtained for domestic ones did capitalists consider an international airline viable.

Aviation entrepreneurs were not the only ones interested in international airlines after 1926. The military became particularly interested in the airline when the German airline *Scadta* announced plans in 1927 to extend service from Colombia to Panama, Cuba, and the United States. The absence of an American counterpart and the proximity to the Panama Canal bothered air leaders, and one, Lieutenant Colonel Henry H. "Hap" Arnold, seized the initiative in publicizing the perceived threat. He relates in his memoirs that

I then called in Major Spaatz and Major Jack Jouett. We talked it over for hours, and finally we called in an ex-Navy man by the name of John Montgomery. Together, we drew up a prospectus of such an airline and how it might make money. . . . We found out that the Standard Oil Company had to send supplies to Havana, Key West, and to the Central American ports, and the freight charges and the funds received for carrying the mail between Key West and Havana would pay for the operating expense of that part of the line. . . . Very few people in the War Department . . . knew that at the moment, jobs had been offered to Spaatz, to be operating director of the new company; to Jouett, to handle all personnel; to Montgomery, to be field manager on the line when it was in

³² Freudenthal, *The Aviation Business*, pp. 165-6; *Aircraft Year Book, 1930*, pp. 259-298; Henry H. Arnold, *Global Mission* (New York: Harper & Brothers, 1949), pp. 114-5.

operation; and to me, to be president and general manager of Pan American.³³

Arnold and Spaatz decided to stay in the air force, but Jouett and Montgomery joined the aviation industry—Jouett, in fact, became president of the Aeronautical Chamber of Commerce. Legislation may have been slow in coming, but once the government was fully empowered, officials acted decisively.

The Post Office acted aggressively, because the Europeans' South American connections provided urgent reminders that American aviation was underdeveloped in this area. Less than twelve months after Lindbergh's 1927 flight, Congress passed a law empowering the Postmaster General to award, at his discretion, ten-year contracts for foreign air mail. President Herbert Hoover's Postmaster General, Walter F. Brown, pursued the task with the specific goal of making foreign airmail service "the peculiar field of the Pan American Company."³⁴ He permitted no other American airline to compete for the international routes (and the subsidy for carrying the mail), and he ignored the other American companies that had entered Latin America before Pan Am. These overseas independents folded or sold out to Pan American. The company grew quickly after 1928 with the whole-hearted support of Brown and other leaders in the Hoover administration.

In the context of the economic crisis following the stock market crash, the Post Office moved quickly to intervene on commercial aviation's behalf. As with Pan Am, it launched efforts to organize domestic airlines. The "Spoils Conference," sponsored by

³³ Arnold, *Global Mission*, pp. 115-6.

³⁴ Freudenthal, *Aviation Business*, pp. 173-4; U.S. Senate Special Committee on Investigation of Air Mail and Ocean Mail Contracts, Hearings, Seventy-Third Congress, 1933-1934, p. 2459.

the Postmaster General, sought to reallocate airmail contracts in 1930 so a few strong companies could dominate and bring stability to the airline business. Walter F. Brown had laid the foundation for this important conference in the year since his taking office with Hoover's March 1929 inauguration. He sought the help of those individuals in favor of a government initiative and asked them to draft new legislation giving the Postmaster General the power to wield his annual budget with more freedom. MacCracken, by then the legal counsel for Western Air Express, Warren I. Glover, Brown's airmail director, and Paul Henderson, former Second Assistant Postmaster in charge of airmail and currently representing National Air Transport, authored the McNary-Watres Bill.³⁵ Its provisions would have given Brown "dictatorial powers over the air-transportation system" by

1. substituting a space-mile rate for the existing pound-mile rate. The government, in other words, agreed to pay airline companies for space, regardless of whether there was any mail in that space.
2. allowing contracts to be awarded to the "lowest responsible bidder," but one who had operated an airline with a daily schedule of at least 250 miles for the last six months.
3. permitting companies holding contracts for the previous two years to extend the term for the next ten years.
4. empowering the Postmaster General to extend or consolidate routes when he believed "the public interest will be promoted thereby."³⁶

Wanting even clearer discretionary powers, Brown asked for the authority to award contracts with no competitive bidding. Representative Clyde Kelly, sponsor of the 1925

³⁵ Freudenthal, *Aviation Business*, pp. 110-17; Henry Ladd Smith, *Airways: The History of Commercial Aviation in the United States* (New York: Alfred A. Knopf, 1942), pp. 156-8.

³⁶ Smith, *Airways*, pp. 158-9.

act allowing the Post Office to contract with private companies for airmail service, felt slighted by Brown's alliance with McNary and Watres, and he opposed the postmaster general's drive for so much control. Although Kelly defeated the non-competitive award clause of the bill, the other provisions became law on 29 April 1930 and emboldened Brown to take strong action. He said, "somebody has got to solve this problem, or we are going to have a collapse of the passenger carrying industry in this country."³⁷

The Spoils Conference revealed how the tremendous public interest in aviation and the existing economic crisis had combined to overwhelm Hoover's style of associationalism. In the early days of his tenure as Secretary of Commerce, Hoover had insisted that initiative in planning aeronautical development had to lie with the private sector. He wanted an effective trade association to assume the lead, but instead saw industry leadership fracture. Consolidation into powerful, vertically integrated groups helped, but the economic crisis was so severe in 1930 that the public, investors, industry executives, and government officials supported immediate government intervention. Brown seized the initiative when no one else stepped forward. In the first meeting called by Brown only two weeks after the passage of the McNary-Watres Act, the airline executives could only agree to disagree. Problems had actually begun before the meeting, as industry leaders anticipated Brown's intentions. C. W. Cuthel of Transcontinental Air Transport wrote to C. M. Keys of the Curtiss-Wright Corporation explaining the situation as he saw it:

I am sure that the P.M.G. will go the full limit to avoid competitive bidding but the dangers to his own situation of overstepping his authority

³⁷ Ibid., p. 161.

are obvious. Unless everyone is taken care of, there may be an attack on the whole program in the courts and unless the routes and the moneys are so clearly equitably [sic] distributed, Congress simply will decline to appropriate more moneys at the next session, or indeed may amend the bill so as to change his provisions radically.³⁸

Small airline operators received no invitation or welcome. MacCracken, serving as chairman of the conference, dismissed one who came anyway, saying, "I do not believe that you would be interested in these proceedings. . . . It just happens that I and my associates have been delegated by the Postmaster General to draw up an entirely new airmail picture for the nation."³⁹ Hoover's vision of an associational state had come, in this instance, to a government sponsored meeting of industry elites, not defined by expertise but rather by size. Brown's intentional reshuffling of the airline industry pleased some, angered many, and threw into stark relief the debate over the proper role government should fill in the industry.

The affair antagonized Congress to the extent that aviation promised to become a major issue. The politics grew even more contentious as the depression deepened. At the May meeting, the airline executives agreed on the assignments for seven routes, but they could not agree on five and submitted to Brown's decision on the matter. He applied pressure to smaller companies to merge by simply ignoring the bids of uncooperative ones or by placing so many technical requirements on contractors that only the larger lines could legally submit bids. Thus Transcontinental Air Transport merged with Western Air Express to form Transcontinental and Western Air (T & WA). American Airways received part of the route previously serviced by Wedell-Williams Air

³⁸ Freudenthal, *Aviation Business*, p. 111.

³⁹ *Ibid.*, p. 112.

Service Corporation. The other part of Wedell-Williams' route received no service, and the company soon collapsed.⁴⁰ Cooperative companies received extensions longer than their original routes. By 1934 the major airline companies had pulled in so many independent airline operators that together they collected over ninety percent of all domestic air mail payments:

Table 3-1
Percentage of Airmail Payments

<u>Year</u>	<u>Percent</u>
1930	90.0
1931	92.1
1932	91.8
1933	91.1

Source: Freudenthal, *Aviation Business*, p. 306.

In the months and years following the conference, hostility towards Brown's heavy-handed leadership grew. In July 1931 he received a letter from the New York, Philadelphia and Washington Airway Corporation capturing the sentiment felt by many. It said, "the United States Government is in effect through your Department subsidizing an air transport line in that territory [New York-Washington-Atlantic City] at the expense of a private enterprise thoroughly capable of furnishing the required service."⁴¹ Predictably, some companies turned to their congressmen for help. In March 1932 the Ludington Line wrote to Representative James Mead, telling him "it is hoped that the [Post Office] committee will discuss the plan with the Postmaster General."⁴² Brown had

⁴⁰ Smith, *Airways*, pp. 161-3; Freudenthal, *Aviation Business*, p. 112.

⁴¹ Airway Corporation to Walter F. Brown, July 6, 1931. Eugene L. Vidal Collection, Number 6013, Box 19, "1931-34, Correspondence," American Heritage Center, University of Wyoming, Laramie (hereafter AMC, UW).

⁴² Eugene L. Vidal to Mead, March 14, 1932, AMC, UW.

acted aggressively to consolidate subsidy payments in a relatively small number of airline companies. He was unable, however, to squelch the politics of aviation, and counterforces mobilized and were ready for battle when Roosevelt took office.

Government involvement was most extensive in the airline segment, but many manufacturers depended on military contracts. As a result, the War and Navy Departments wielded much power in that field. Concentration of sales in the large aviation corporations resulted here, too. While not as dramatic as the figures for the airlines, the manufacturers in the United Aircraft & Transport and Curtiss-Wright groups won the vast majority of military business for the period 1927 to 1933 as seen here:

Table 3-2
Percentage of Military Contracts

	<u>Navy</u>	<u>Army</u>
United and Curtiss Sales	71.3%	79.5%

Source: Freudenthal, *Aviation Business*, p. 120.

The annual budget cycle for government departments granted Congress an important role in distributing wealth in the aviation industry. Its decisions during the 1920s and '30s drew much criticism from the public, the industry, and officials from the executive agencies. Historian Jacob Vander Meulen's *The Politics of Aircraft* details the suspicion Congress harbored toward aircraft manufacturers. He argues that congressmen had little appreciation for the technological complexities in military aviation and consistently advocated a free-market model for military procurement. Vander Meulen explains the failure of the armed services and Congress to deal with the challenges of aviation and

how their bitter politics created debilitating inefficiencies in military aviation between the world wars.⁴³

New Era Policies and Private Flying

Before the Air Commerce Act of 1926, the debate centered on the constitutionality of aeronautical regulation, but some people talked in terms of practical effects on the various fields of aviation. In 1925, as Hoover struggled to gain passage of enabling legislation, Earl D. Osborn wrote to Secretary Hoover to share his concerns: "When people speak of civilian aviation, they have in mind large aerial transportation companies. It is true that we have none of these but one might as well say that we have no automobile industry because there are few automobile transportation lines." This emphasis on airlines and the analogy to the car industry was familiar to Hoover, but Osborn had a different point to make. "The development of civilian aviation in this country," he believed,

has come through the work of the Barn Storming and Gypsy pilots. . . . To my mind there is a very serious danger that those who draw up the regulations which will govern civilian aviation will not realize the importance of the work done by the Gypsy fliers and small constructors. They will tend to adopt the Army and Navy specifications which are very rigid and which would tend to check the natural growth of aviation in this country. . . . I do not believe in too formal and rigid regulations which would tend to check the local development and initiative and put the development of aircraft entirely in the hands of large manufacturers who are accustomed to meet government specifications.⁴⁴

⁴³ Vander Meulen, *The Politics of Aircraft*, pp. 41-82, 182-220.

⁴⁴ Osborn to Herbert Hoover, January 9, 1925. "Legislation, 1925-1926," *Commerce Papers, Hoover Papers*, Hoover Library.

Osborn's prediction that the national government would quickly assume increasing control in private flying was an unusual expression of concern for this field of American aviation during the years of debate over legislative proposals.

Even in 1930, after four years of Bureau of Aeronautics involvement in private flying, Clayton Brukner feared that his market niche would suffer from the politics he believed drove the regulatory process. At the end of that year, he explained his view to an acquaintance, using the specific example of physical requirements for private pilots. These requirements directly affected the size of the pool of potential pilots and aircraft owners, and Brukner and the other manufacturers advocated less restrictive criteria to the Assistant Secretary for Aeronautics, Clarence M. Young. In the spirit of associationalism, Young requested expert medical advice, and, as Brukner related, the "report was just as most of us had anticipated, an array of statistics indicating that it was just about time to stiffen up the physical requirements." Brukner played the logic out such that "none but above par physical specimens would be permitted to learn to fly, and then the crash statistics would have to be interpreted as indicating that flying should be curtailed by further regulations as to airplanes, engines, airports, weather, and what not, until it would eventually be illegal to fly, and thus all air crashes would be eliminated." Brukner was cynical and knew his views were biased. He pointed out to his acquaintance, who was about to attend the Commerce Department's National Conference on Uniform Aero Regulation Laws, that "I find it difficult to convey my thoughts without appearing to be selfishly generous with the public's safety."⁴⁵

⁴⁵ Brukner to A. C. Arnett, December 11, 1930. "A Miscellaneous," *Brukner Papers*, DoAaSC.

Brukner may have been skeptical about the government's ability to manage aviation effectively, but he knew the Commerce Department was in his business to stay. In advising Dr. Arnett before the conference, Brukner in fact echoed the views of William MacCracken; Brukner said, "[i]f I can suggest anything to you that will be of any great help to the future of flying, it would certainly be to emphasize the importance of this uniformity of air laws." Unlike MacCracken, however, who had great faith in the national government to guide aviation to a better future equitably, Brukner saw uniformity as the only means to minimize "the annoyance we are to receive from air regulations in the future." He returned to the issue of requirements to obtain a private pilot's license to clarify the point and suggested that "the points covered by the physical examinations at present are as much of an indication of the person's ability to fly safely, as could be secured by some psychological . . . tests. . . ." He was afraid, however, "to suggest any such thing . . . to the Department of Commerce, even if I had complete faith in any definite tests, for fear that they would merely add the suggested tests to those already required, without conceding anything." Brukner wooed Arnett in hopes of influencing the regulators' decision-making process through indirect expert testimony. He told Arnett directly that "a man in your position will be very helpful, and will outweigh, in influence, the wailing of the entire aircraft manufacturing industry." He summarized his skeptical outlook: "I hope that many of the delegates will be men who understand aviation, and are in sympathy with it, but I am inclined to be pessimistic on this point, as all too frequently such things are ruled by politics."⁴⁶

⁴⁶ Ibid. All quotes come from this revealing letter.

Despite his pessimism Brukner did not shirk his leadership role in the industry and the Aeronautical Chamber of Commerce (ACC). In 1932 he assumed the chairmanship of the Airplane Manufacturers Section of the Chamber and vigorously defended his field's interests. Two issues demonstrate his commitment to politics as a very real part of the aviation business: the regulation of wooden propellers; and the licensing provisions for pilots. In September 1932 Brukner mobilized resources to confront the Commerce Department with evidence "that this year's attack on wood propellers constitutes an excellent example of the trend toward higher production costs. . . ." He called a Washington conference of manufacturers to set the record straight and to formulate a plan of action. Wooden propellers were safe, he and his chief engineer believed, as accident records showed it had an "innocent history." For Brukner this latest attack "threatens to drive this safest material out of use," and the higher costs "illustrate[d] the result of many regulations, although seldom is it so obviously demonstrated." Brukner believed criticism alone would gain nothing, and he planned to offer substitute testing procedures, "which would be acceptable to . . . a propeller manufacturer, and to them [Commerce Department officials] as guardians of the public's safety." He fought requirements that potentially increased production costs as a direct threat to his company's interests, since one of his products' strongest assets was affordability. Moreover, he questioned the very foundation of the government's rationale for regulation of the private flying field. In a communication with the Hartzell Propeller Company, he labeled the Commerce Department's "obligation to the public's safety" as "imaginary."⁴⁷ Such criticism of government regulation reflected Brukner's opposition to

⁴⁷ Brukner to Frederick Charavay, September 30, 1932. "C Miscellaneous," *Brukner Papers*, DoAaSC.

the government's undue shaping of the business environment in which he and other manufacturers worked.

If the propeller regulations had excited his interest, then the licensing rules aroused his passions. He wrote as president of Waco Aircraft directly to the Assistant Secretary for Aeronautics in October 1932, and spoke in terms, not of increased costs, but of survival. "Since the continued existence of this company depends upon the uninterrupted flow of aviation converts," he began, "we are somewhat alarmed at the proposed amendment relating to the private pilot license."⁴⁸ Specifically, the Commerce Department wanted to increase the amount of hours student pilots needed before getting their licenses by 150 percent. The government was concerned about the safety of passengers carried by junior pilots and tried to impose the extra hours to boost its confidence that even newly licensed pilots were safe fliers.⁴⁹ Brukner had a different view and called the new restrictions "out of all proportion to the needs that may appear to exist." His cost-benefit analysis failed to justify such action: "In view of the enormous increase in the cost of flight training to the passenger carrying stage, that would result from this proposed amendment or any similar measure, we believe that the progress of our branch of this industry would be arrested to an extent impossible to survive." In any case, "the instruction and early solo stages will unalterably be the most dangerous periods," and Brukner believed no additional restrictions should "be placed upon the

⁴⁸ Brukner to the Honorable Clarence M. Young, October 14, 1932. "Department of Commerce, Correspondence, 1928-1938," *Brukner Papers*, DoAaSC.

⁴⁹ Department of Commerce Memorandum to the Aircraft Industry, September 17, 1932. "Department of Commerce, Bulletins & Regulations, 1931-1938," *Brukner Papers*, DoAaSC.

industry during these times, until there is conclusive proof of its merits and necessity."⁵⁰ Clearly, where the national government seized the authority to set regulations, some people, Brukner especially, questioned the uses to which regulators put that power.

As the depression continued, Brukner's political activities no longer focused exclusively on the national government. Public officials at all levels had committed resources and reputations to American aviation, and many felt their investment slipping away. The national government had taken the lead in trying to shore up confidence in the public. The Spoils Conference and the Schall Bill were examples of these efforts, but the list of state legislative initiatives was also overwhelming. The ACC reported in 1930 that state legislatures had considered sixty-one bills dealing with aviation. The next year the deepening depression kept flying at the forefront of the legislative agendas, and the ACC counted almost 500 state bills. Nineteen thirty-two was less busy, but it still saw the states review 135 pieces of aeronautical legislation.⁵¹ This high level of effort by the national and state governments complemented efforts at the local level.

Fred L. Smith, the Director of Aeronautics for the state of Ohio, warned Brukner in early 1933 that "officials who have been elected since these high priced airports have been started are apt to feel that they have a white elephant on their hands and, accordingly, may do things which will discourage the private flyers a great deal in their effort to eliminate the expense of carrying the airport." Smith described the threat he perceived from state regulators: "I feel that the various states are quite anxious to do

⁵⁰ Brukner to Young, October 14, 1932. "Department of Commerce, Correspondence, 1928-1938," *Brukner Papers*, DoAaSC.

⁵¹ *Aircraft Year Book, 1931*, p. 235; *Aircraft Year Book, 1932*, p. 199; *Aircraft Year Book, 1933*, p. 157.

something without being quite sure just what is best for the aeronautical interests of their communities. Personally I am a little bit afraid that they are apt to do a great many things which may have to be undone later. . . ."52 Brukner was primarily concerned about airport landing fees. He added this topic to propeller regulation and licensing rules as his top issues to debate, again casting the matter in terms of survival. He told Smith, for example, that "this additional direct and very painful expense would certainly be the death of a type of sport and pleasure flying in which my company is very much interested."⁵³

His heightened sensitivity at the end of Hoover's term to government involvement was not unusual. The Assistant Secretary of War for Air, F. Trubee Davison, wrote to a friend in April 1932, saying, "owing to the fact that one never knows what may develop in Congress with respect to aviation matters, I have broken all out-of-town engagements until Congress adjourns."⁵⁴ From the local to the national level and in the private and public sector, many Americans were concerned about the nexus between the politics and economics of airplanes.

In this context of uncertainty and economic depression, Brukner and his colleagues anticipated with some fear the inauguration of FDR in March 1933. As frustrated as they were with the relative ineffectiveness of the ACC, the future looked more threatening. Don A. Luscombe, president of a Waco rival, Monocoupe

⁵² Smith to Brukner, February 9, 1933. "S Miscellaneous," *Brukner Papers*, DoAaSC.

⁵³ Brukner to Smith, February 13, 1933. "S Miscellaneous," *Brukner Papers*, DoAaSC.

⁵⁴ Davison to Charles W. Kerwood, April 21, 1932. Kerwood Collection, Number 6776, Box 1, "Correspondence, 1930-40," AHC, UW.

Corporation, wrote to Brukner within a month of the November '32 election suggesting "some combined effort on the part of manufacturers might be instrumental in causing the present personnel to be retained." After all, Luscombe said, "regardless of the present evils, we might be worse off under a new head"⁵⁵—a noteworthy example of the perception industry insiders had of the balance of power in government-business relations. Brukner was predictably ambivalent about his friend's "Washington campaign." He thought, "it is wrong to begin to heckle Clarence [the Assistant Secretary of Commerce for Aeronautics] in these uncertain days," but he admitted "that the time has come for frank and rough-shod treatment of the situation." Brukner was less dissatisfied with Young than with the regulatory bureaucracy, which he accused of pulling the "opaque wool . . . over the Colonel's eyes."⁵⁶ With the impending changes in administration, Brukner reluctantly cast his lot with the ACC. He felt like he was "out on a limb and won't know which way to swing until someone makes a bid for our organized support. . . ." He acknowledged, however, the possibility that the ACC may not have enough political power to warrant attention. His last thought to Luscombe before his Christmas break was "In the absence of such a bid, I would not know what to do but hang on and wait for morning to dawn."⁵⁷

Although Brukner questioned the underlying principles of associationalism, he worked hard to play a positive role in aviation's development. He joined and actively participated in the largest trade association, the ACC; he offered his expertise and tapped

⁵⁵ Luscombe to Brukner, December 1, 1932. "Luscombe, D. A., 1932-1933," *Brukner Papers*, DoAaSC.

⁵⁶ Brukner to Luscombe, December 3, 1932, in *ibid.*

⁵⁷ Brukner to Luscombe, December 19, 1932, in *ibid.*

into other sources to aid in decision-making; he provided cogent feedback to government officials; and he continued to operate his company successfully in this dynamic context and the worst business conditions in American history. The airlines and the manufacturers, however, had different interests and different government bureaucracies with which they formed symbiotic and dependent relationships. Associationalism encountered further difficulties when Congress considered aviation issues in this period. Legislative battles, interservice rivalry, patent infringement cases, and market competition all prevented associationalism from working as Hoover intended. By 1933 aviation industry leaders were frustrated and anxious as they awaited the new Democratic administration.

Most Americans greeted Roosevelt and his administration with high hopes for economic recovery, and they supported his bold initiatives for change. This enthusiasm found its expression in a flurry of legislative and executive actions during the Hundred Days.⁵⁸ In the weeks immediately following his inauguration, FDR's decisiveness on many fronts buoyed American confidence. Vigorous government action with the Democrats stood in stark contrast to the stasis citizens had perceived under Hoover. With aviation still very popular in America, the new administration dealt carefully with the industry. Its high visibility belied its still small size, and its future still looked as bright as ever as new airliners appeared, military technology evolved, and air-minded community boosterism continued unabated.

⁵⁸ The Hundred Days, the initiation of the New Deal, has received much scholarly attention. For a good overview of this dynamic legislative period see William E. Leuchtenburg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York: Harper & Row, 1963), pp. 41-62.

The New Deal employed different means to achieve its desired ends, and aviation was no exception. Associationalism had not measured up to the task at hand, Roosevelt believed, and he tried to distance himself from Hoover and his ineffective policies. Aviation, the airmail contracts in particular, provided a useful means to publicize the difference between the New Era and the New Deal. Through the public means of congressional hearings, New Dealers called into question the concentration of wealth and power in the aviation industry, and that publicity helped ensure that aviation remained an important part of American popular culture.

The lack of financial resources and the persistent depression prevented the sustained implementation of a bold new program for American aviation, however, and with the economic downturn in 1938 the initiative in the aeronautical industry was up for grabs. The Bureau of Aeronautics wielded too little respect or money to forge consensus in the industry. Similarly, the military departments had only enough money to sustain their regular suppliers, advancing aviation technology enough for the new Air Corps to challenge the Army and Navy on the proper distribution of roles and missions within the American military establishment. The airline segment of the industry weathered the turbulent politics of the New Deal, sustaining an upward trend throughout the thirties. But Brukner's commercial aircraft niche continued its intense competition for an eroding domestic market, forcing a turn to an equally competitive export market. Thus the fundamental structure of the industry remained intact as international affairs began to supplant domestic economic concerns.

"A New Deal for Aviation"

As Brukner and his colleagues feared, leadership in the Commerce Department changed hands shortly after the inauguration, signaling the arrival of a period of unpredictable policy revisions. Roosevelt first appointed J. Carroll Cone, formerly the Director of Aeronautics in Arkansas, to head the Bureau of Aeronautics but his tenure was short, as industry leaders challenged his credibility and Cone found other aviation duties in the administration. The president then appointed Eugene L. Vidal to the top aviation post in the Commerce Department.⁵⁹ Vidal was a West Point football star, an Olympic pentathlete, and an executive with Ludington Airline.⁶⁰ He assumed his new duties as the furor over the Spoils Conference grew and reacted to the political firestorm it unleashed. In the midst of the fallout, he lamented, "the airmail emergency . . . has caused all aviation projects to be held in abeyance."⁶¹ His own vigorous activities proved his pronouncement incorrect. Vidal sought to redefine the role of the Commerce Department in aviation. With help from John H. Geisse, who held a number of directorships in the Aeronautics Branch in the 1930s, he articulated a policy placing much greater emphasis on private flying. While this move seemingly favored Brukner and his industry segment, the change met bitter opposition and discredited the administration's efforts to bolster that sector of the industry.

⁵⁹ "Vidal, Eugene L., 1933-69," *John H. Geisse Papers*, Hoover Library.

⁶⁰ Eugene L. Vidal Collection, Number 6013, Box 1, Folder 1, AHC, UW.

⁶¹ Address by Director of Aeronautics, Detroit, Michigan, April 16, 1934. AHC, UW.

Vidal's refinement of the Bureau of Air Commerce⁶² mission initially took a back seat to the high drama of the Senate's airmail hearings. Senator Hugo Black's committee comprised three Democrats and two Republicans and met in September 1933 to consider (reconsider actually) evidence that the chief Republican politico, Postmaster General Walter F. Brown, had abused the power of his office. Congress had, in fact, explored the matter in March 1932 and again in February 1933, but the committees' legislative proposals generated little support before the Democrats' ascent. Black's committee initially intended to clear up disputes over ocean mail contracts, but forces quickly converged on aviation and made air mail the top agenda item. Representative William D. MacFarlane, a member of the House Subcommittee on Aeronautics, reported that the manufacturers dominating military business were part of the same holding companies controlling the vast majority of airmail contracts. Because the parent filed consolidated tax returns, he pointed out, the government lost millions of dollars in revenue. MacFarlane's revelations supplemented the negative finding of Senator Nye's investigation of the World War I munitions industry—a term appropriately including aircraft manufacturers. Added to this, the Senate Committee on Stock Exchange Practices exposed the fact that insiders had squeezed huge profits from stocks.⁶³ As word of the Spoils Conference spread, Democrats perceived an opportunity to air dirty Republican laundry. A New Deal for flying would come only after the politics of aviation took its latest and most dramatic turn.

⁶² In June 1934 the Bureau of Aeronautics became the Bureau of Air Commerce.

⁶³ Freudenthal, *Aviation Business*, pp. 193-8; Smith, *Airways*, pp. 214-27; *Aircraft Year Book, 1935* (New York: Aeronautical Chamber of Commerce of America, Inc., 1935), pp. 120-1.

Senator Black methodically guided his committee through the voluminous evidence and recommended to President Roosevelt that, because the contracts were awarded non-competitively, he suspend the current airlines' routes. The committee seized the records and correspondence of companies and individuals known to be involved in the Spoils Conference, an act that immediately caught the attention of an already-interested press. William P. MacCracken, Jr. again found himself center-stage, but this time in a defensive position. Some records requested by the government had disappeared from his office after he was informed of their seizure, and, as MacCracken employed all the legal tricks he could to slip out from under the jurisdiction of the committee, the press reveled in the thickening plot. At one point he presented himself to be arrested by the Senate Sergeant-at-Arms, only to be spurned. When he pushed his defiance too far, he earned a ten-day prison sentence for contempt of the Senate.⁶⁴ Such antics combined with the airline executives' feeble answers to the committee's probing questions to create the impression that Americans were once again confronting a scandal in the highest positions of governmental power. In that context contract cancellation did not seem overly drastic, and it served the political purpose of symbolically discrediting Republican efforts on behalf of aviation. Airmail service could continue if the Army Air Corps agreed to fill the gap until honest contracts could be awarded. When General

⁶⁴ Freudenthal, *Aviation Business*, pp. 193-5; Smith, *Airways*, pp. 243-4; Nick A. Komons, "William P. MacCracken, Jr., and the Regulation of Civil Aviation," in *Aviation's Golden Age: Portraits from the 1920s and 1930s*, ed. William M. Leary (Iowa City: University of Iowa Press, 1989), pp. 53-8.

Benjamin D. Foulois consented on February 9, 1934, Roosevelt had the means to "clear the air"⁶⁵ and put American aviation back on a firm footing.

Army operation of the air mail system in the days following cancellation revealed serious weaknesses in military aviation. General Foulois volunteered the Air Corps for airmail duty to show that airmen were team players and to showcase the men and equipment the taxpayers had invested in over the years. His boosterism backfired, however, as bad weather contributed to dismal statistics for the first week's flying: five pilots were dead, six were injured, and property damage totaled \$300,000. Despite Army efforts to minimize the risks and Postmaster General James A. Farley's hurried efforts to award new contracts, the carnage continued. By April twelve pilots had died, and sixty-six planes had made forced landings. Public opinion boomeranged on Roosevelt, sparked in part by the loud criticisms coming from Charles Lindbergh. The president suspended airmail service until the Post Office found acceptable airlines,⁶⁶ and the Air Corps drew up plans to address its training and equipment deficiencies.

While the airmail crisis played itself out in the glare of the media's bright spotlight, Vidal had been pressing forward in his efforts to redefine the Commerce Department's role in civilian aviation. "[I]f an aircraft manufacturer knew he would have a large market for a certain type craft, he would eagerly undertake production in volume which would enable him to sell his product for a price around \$700 or even lower," the Aeronautics Branch announced in a press release on 8 November 1933. Hinting at the

⁶⁵ Freudenthal's chapter 8 is entitled "Clearing the Air." Freudenthal, *Aviation Business*, p. 196; Smith, *Airways*, pp. 228-38; Arnold, *Global Mission*, pp. 142-3; *Aircraft Year Book, 1935*, pp. 121-2.

⁶⁶ Arnold, *Global Mission*, pp. 144-5; Smith, *Airways*, pp. 253, 256.

government's role, the release added, "All that is really needed is some step which will bring the producer and consumer together, with definite assurance to the industry that the market actually exists."⁶⁷ Driving down flying's cost was Vidal's mission, as he explained frequently. Planes were expensive to buy, expensive to learn to fly, expensive to operate and maintain—"too expensive for the average man," Vidal declared. He perceived an opportunity to accomplish through government action what Brukner had set out to do in 1921 with the Cootie. His vision was that "the New Deal may do for the airplane what the pioneers of automotive mass-production did for the automobile: convert it from a rich man's hobby to a daily utility or inexpensive pleasure for the average American citizen."⁶⁸ Vidal received some support from the industry. The president of Roosevelt Field, Inc. applauded Vidal's emphasis on private owners and told him, "[s]cheduled transport and the manufacturer occupy such an important position today that it is some time difficult to realize that it is the wide adoption of flying by the individual which will make a great industry out of aviation. It will only be when thousands own and fly their own planes that factories will hum and airports all over the land will be alive with activity."⁶⁹ Mr. H. C. Godfrey Fry wrote, "I know you are on the right path. You have

⁶⁷ Department of Commerce, Aeronautics Branch Release. "Vidal, Eugene L., 1933-69," *John H. Geisse Papers*, Hoover Library.

⁶⁸ Vidal address in Detroit, April 16, 1934. Eugene L. Vidal Collection, Number 6013, Box 19, "Addresses, Speeches, Statements," AHC, UW.

⁶⁹ George W. Orr to Vidal, September 25, 1933. Eugene L. Vidal Collection, Number 6013, Box 19, "Correspondence, 1933," AHC, UW.

the same idea that Ford had when he came out with his low priced car. There is no reason why we could not have low priced airplanes to meet our pocketbooks."⁷⁰

Vidal further explained the importance of private flying to American society. He pointed out "the more private fliers we have, the more quickly could this country prepare to defend itself by use of the airplane. . . ." ⁷¹ His right-hand-man in the Bureau, John Geisse, said later, "[p]rivate flying is a matter of vital interest to the Federal Government . . . from the standpoint of providing employment and it is for this reason that Congress has authorized the Bureau of Air Commerce to enter the role of capitalist in the development of planes and equipment."⁷² These arguments were attempts to link private flying with national defense and to give the Commerce Department a role analogous to the military in developing aviation technology.

Vidal chose aircraft safety as his primary weapon to fight high flying costs. He and Geisse fought for authority and funds to develop aircraft meeting rigorous safety specifications. The Bureau continuously asserted from 1933 to 1937 that improved aircraft safety was the key to inducing people to buy an airplane. Geisse wrote in a 1934 article that he wanted "to make private owner airplanes safer, simpler to operate and less expensive to produce. If the program meets with success, it will result in an increase in private flying, which in turn will further reduce costs to the individual."⁷³

⁷⁰ Fry to Vidal, February 12, 1934. Eugene L. Vidal Collection, Number 6013, Box 19, "Correspondence, 1934," AHC, UW.

⁷¹ Vidal quoted in *The Private Flyer*, no date. Eugene L. Vidal Collection, Number 6013, Box 19, "Addresses, Speeches, Statements," AHC, UW.

⁷² Geisse paper presented to American Society of Mechanical Engineers, 1934. "Articles & Speeches, 1933-34," *Geisse Papers*, Hoover Library.

⁷³ Geisse paper, untitled, 1934, in *ibid*.

The problem, as Clayton Brukner and other aviation businessmen saw it, was that in order to garner support for its program, the Bureau had to place too much emphasis on the existing danger of flying. Their fears were not misplaced. Geisse told the National Safety Conference in 1936, for example, "I regret to say that airplanes now being constructed are not as simple to fly and as safe as they could be. . . ." He further asserted that some manufacturers believed "that if a pilot crashes it is generally his own fault and nothing should be done about it [and saw] no reason for seeking added safety or ease of control."⁷⁴ These comments on the qualities of the existing industry were obviously not what Brukner and the others thought their taxes should be supporting.

The president of Porterfield Aircraft Corporation responded calmly, telling Vidal in 1935, "It is time that the government, through its Bureau of Air Commerce, should start inspiring confidence in the present-day airplanes rather than to lead everyone to believe that they are 'not safe enough' and that a new 'safe \$700 airplane' is just around the corner."⁷⁵ Luscombe told Brukner lightheartedly in 1933, "although I do not attach a great deal of importance to the Vidal matter, I feel it is our duty to heckle the boy on general principles if nothing else." Alluding to the on-going Black hearings he added, "I have no real desire to start a revolution, and I seriously doubt whether we can create a national scandal out of the Vidal dream airplane."⁷⁶ Writing for himself and Brukner, Luscombe attacked Vidal by declaring, "after ten years of constant study and contact with

⁷⁴ Geisse speech at Safety Conference, New York City, March 3, 1936. "Articles & Speeches, 1936," in *ibid.*

⁷⁵ E. E. Porterfield to Geisse, undated. "Development of Low-Cost Planes, 1935-64," in *ibid.*

⁷⁶ Luscombe to Brukner, November 27, 1933. "Luscombe, D.A., 1932-1933," *Brukner Papers*, DoAaSC.

the market possibilities of private aircraft, and the unsound periodic injection of the 'Henry Ford Parallel' in airplane manufacture, I am forced to openly criticize your action as ill-advised, and if not exceeding the authority of your office, it may be considered extremely rash."⁷⁷

Vidal, however, initiated government action to make a reality of the Bureau's bold words. Vidal sponsored a competition among manufacturers for an aircraft meeting his strict specifications. His plan to build a "poor man's" plane got off to a rough start, when only one manufacturer with a decent reputation submitted a bid. Vidal nevertheless wanted to buy a fleet of twenty-five planes for the Bureau to demonstrate to the public through daily use the efficacy of the new design. The disappointing proposals forced him to settle for one prototype plane from each of five companies.⁷⁸

Although demonstrating improved safety and ease-of-flying characteristics, each plane compromised performance and comfort qualities to the extent that none proved commercially viable. The autogiro, for example, cruised at twenty-five miles per hour, while cars cruised much faster. The Bureau tried to make the best of the situation. Geisse told the National Petroleum Association in 1936 that "the autogiro has been successfully landed on roof tops and I do not believe that one need to be highly visionary to foresee the day when it will be possible to use an autogiro for transportation from your

⁷⁷ Luscombe to Vidal, November 27, 1933, in *ibid.*

⁷⁸ Corn, *The Winged Gospel*, pp. 98-104.

suburban home to the office."⁷⁹ His words were hollow. Brukner and other businessmen in the private flying field no longer respected Vidal's vision after 1935.

Private flying's neglect at the hands of the Hoover administration made it an attractive alternative for the Democrats, especially because Black's committee was so thoroughly discrediting the Republican's priority, the airlines. Even before the hearings began, aviation leaders recognized the opportunity for a fruitful shift of focus. In July 1933 Edward P. Warner, the former Assistant Secretary of the Navy for Air, published an article in *Aviation* magazine entitled "Lo the Poor Private Pilot!" His argument for a change was straightforward:

Seven years ago last month the Department of Commerce was charged by law with the supervision of civil aviation. The personnel of the newborn Aeronautics Branch undertook to make flying safe. They have had remarkable success, particularly in the transport field, where the cooperation of operators and government has brought the hazard very nearly to zero. But now the time has come for reconsideration, in the light of seven years' experience, and for deciding how far the Federal Government's responsibility for the safety of every aircraft that flies should extend. . . . It is a particularly good time for a change, because the threat of declining military purchases, taken together with the improvement in general business and the revival of optimism among business men and investors, holds out the prospect of a rather rapid increase in the relative importance of the private market if that market is properly handled.⁸⁰

Private flying received more priority from New Dealers than ever before, but Vidal's chosen means to develop private flying, the \$700 safety plane, proved to be an embarrassing failure and blazed no new path in American aviation.

⁷⁹ Address made in Cleveland, Ohio, April 17, 1936. "Articles & Speeches, 1936," *Geisse Papers*, Hoover Library.

⁸⁰ Warner, *Aviation*, July 1933, pp. 217-8.

When the program ran its course in 1936 because no new models were forthcoming and because the press had exhausted coverage of the five unique models, Vidal could find support neither in the industry nor in Congress to launch another program to bring flying to common Americans. Vidal left the Commerce Department in 1937, and Geisse carried the flag from that point. In 1938 he published an article reminiscent of the one Warner had written five years previously. He called it "Private Flying—Aviation Orphan," and found it necessary again to formulate a program to make the plane more like the car. His introduction clearly expresses his mood:

Born in the United States, made an orphan here following the World War, placed under the watchful eye of a probationary officer in 1926, and left out in the cold since then by Uncle Sam—that has been the history of private flying in the United States. . . . While his brother, scheduled flying, has grown by leaps and bounds he has added not an inch to his stature in the past eight years.⁸¹

As the economic downturn in 1938 reminded Americans they were not out of economic difficulties yet, the best Geisse could do was tell them that private flying was in grave danger: "Unfortunately our orphan is almost inarticulate—entirely too weak to speak for himself. . . . Perhaps—he is your orphan—you might speak for him."⁸²

⁸¹ Geisse, copy of article published in March 1938. "Aviation Publishing Corporation, 1928-39," *Geisse Papers*, Hoover Library.

⁸² *Ibid.*

Chapter 4

Competition and Cooperation in Aviation, 1921-1938

Cooperation and competition coexisted in aviation, as it does in all industries. The formation of a trade association which could credibly represent aviation to the national government seemed paramount to some, superfluous to others. Organizations proliferated, most commanding support from some segment of the industry and none providing a satisfactory vehicle for adequate representation of everyone. Brukner reflected the ambivalence most aviation companies demonstrated towards joint efforts. He supported the Aeronautical Chamber of Commerce but still launched his own attempts to influence regulatory decisions at the state and national levels. Coordinated joint projects involving all of the major players appeared only at the end of the 1930s in the airline and military aviation fields.

Both government and aviation industry leaders were troubled to see such a rapid succession of setbacks in the two fields which had been the stalwarts in American aviation, the airlines and the military. Brukner became concerned, too, even though neither field pertained to him directly. Aviation's image was under assault, and he advocated "restoration to former contractors until deliberate study can indicate a sound foundation policy consistent with . . . the uninterrupted progress of American aviation. . . . [This] seems the only possible way to . . . avoid serious aviation retrogression."¹ The change in administrations had indeed brought the turmoil Brukner and others expected.

¹ Telegram, Brukner to Vincent Bendix, March 12, 1934. "B Miscellaneous," *Brukner Papers*, DoAaSC.

The furor over the Spoils Conference and the Air Corps airmail fiasco added fuel to the struggles within the industry and within the government that had existed during the New Era.² Specifically, the National Industrial Recovery Act (NIRA), a product of the Hundred Days intended to eliminate destructive competition and to establish a stable market, tasked industries to create codes all businesses would abide by and to submit them to the National Recovery Administration (NRA) for approval.³ Once accepted, the codes had the power of law in the industry, and violators faced penalties. The NRA put teeth into the arrangements trade associations had struggled to create since World War I.⁴ With the threat of legal sanction behind what the Aeronautical Chamber of Commerce advocated for the industry, many aviation executives became even more passionate in protecting their interests. They thought the ACC was too broadly based to represent any one field, or company, adequately. In other words, the NIRA exacerbated the tensions already present in the industry.

Legal Tensions

Those tensions had surfaced much earlier in the form of conflicting patent claims that threatened to prevent any aircraft manufacturing free from the risk of costly lawsuits. The arrangement hammered out between the government and the industry, the

² Correspondence between Bendix Aviation Corporation and Waco Aircraft, February 1934, in *ibid.*

³ *Aircraft Year Book, 1934*, p. 21.

⁴ Wharton Clay, Special Assistant, Trade Association Section, NRA to Brukner, June 9, 1934. "N Miscellaneous," *Brukner Papers*, DoAaSC. Clay spelled out in this letter the assumption on which the NRA's activities were based: "[t]he whole trend of industrial advancement is based upon industrial groups and associations in each field which may aid in solving the problems of each industry and act in behalf of industry for the prosperity of each individual engaged in it."

Manufacturers Aircraft Association, solved the problem during the mobilization for the Great War. Its reauthorization following the war laid the foundation for peacetime expansion, but tensions remained.

In 1924, Advance Aircraft faced the threat of a patent infringement suit from the Curtiss Aeroplane & Motor Company. Curtiss representatives appeared at the Troy factory and accused Brukner and Junkin of using their parts on the Waco Six, Seven, and Eight, which they had seen at the National Air Races in Dayton, Ohio, earlier that year. The engine mount, for example, and numerous other parts had come from the surplus Curtiss Jennies, so Advance had to take the threats seriously. Junkin quickly redesigned many parts on the next aircraft model, the Waco 9.⁵ These measures proved adequate to prevent trouble until 1930.

By then Curtiss had whittled the pool of infringers through two primary means, threatening lawsuits and buying competitors. The company formed the Curtiss Assets Corporation, which vigorously pursued any firm using World War I spare parts. Curtiss threatened court action if a suspected company did not join the Manufacturers Aircraft Association (MAA). This organization, formed in April 1917 to facilitate rapid production for the war, pooled patents for all manufacturers to use as long as they were members and paid a \$200 per aircraft fee, which provided funds to reimburse Curtiss for the original patents it had placed in the pool. By the mid-1920s the cost of joining the MAA was far less than the settlement Curtiss sought in court, so many companies joined simply to avoid further harassment. A number of other businesses succumbed as they

⁵ Kobernuss, *Waco*, pp. 174-5.

merged with the Curtiss-Wright Corporation at the turn of the decade. Keystone Aircraft Corporation, for instance, received pressure from Curtiss until it sold to the Curtiss-Wright group in 1929.⁶ Few holdouts remained in 1930—Waco being the most prominent. Curtiss set its sights on this lucrative target.

In October 1929 Brukner wrote to the Nicholas-Beazley Airplane Company to investigate the possibility of joint action in response to the Curtiss pressure. "It is . . . easy to be seen," he wrote, "that the situation could become very annoying and that some common clearing house for such matters should be the logical answer." As of then, he related, "a rather large percentage of the worthwhile companies have joined the Association [MAA], under varying amounts of pressure, and that the rest are under notification of suit."⁷ Waco Aircraft faced possible legal action, and Brukner sought another manufacturer's advice about how to proceed.

Brukner looked for alternatives to joining, because over the years he had received legal advice from no less prestigious a source than Toulmin & Toulmin, the Dayton law firm that had taken out the Wrights' original patents. Since that time they had won every infringement case. They played a key role in the litigation between the Wright brothers and Glenn Curtiss before World War I, an extended conflict that highlighted the need for a mechanism like the MAA to minimize confusion as the nation went to war. The association aroused the ire of Toulmin & Toulmin, and the lawyers told Brukner, "We opposed this Aircraft Association not only because most of the patents

⁶ "Curtiss Assets Corporation Lawsuit, 1930," *Brukner Papers*, DoAaSC; Kobernuss, *Waco*, p. 175.

⁷ Brukner to H. C. Blake, October 28, 1929. "Nicholas-Beazley Airplane Company, 1929-1931," *Brukner Papers*, DoAaSC.

were unworthy of tribute and constituted merely a means of giving the Curtiss Company a very material advantage in a business way, but also because we regard membership in the association as illegal. . . ." Thus when Brukner received his notification from the Curtiss Assets Corporation, the lawyers told Brukner, "We do not think that the Manufacturers Aircraft Association will sue, if it knows that there will be vigorous opposition."⁸

Brukner agreed to attend a conference organized by the Nicholas-Beazley Airplane Company. Those companies still outside the MAA would meet with the Toulmin & Toulmin firm to decide on a course of action. Brukner had in mind the formation of a "rump association" powerful enough to defeat Curtiss and to establish the civilian aircraft manufacturers as an independent force within the industry. Those companies most interested in the organizational meeting included, in addition to Waco and Nicholas-Beazley, Detroit Aircraft, Stinson, Mono Aircraft, Cessna, Lincoln Airplane, and Driggs Aircraft.⁹ Their commitment was, however, shallow and tentative. As pressure from the impending lawsuits mounted and mergers sucked peers into the large groups, few of these small company presidents could bring themselves to assume the tremendous risk of court action when their bottom lines were suffering so badly. In January 1930 Nicholas-Beazley told Brukner, "we regret to advise that we have definite advice from but six manufacturers that they will meet with us. . . . It would seem that an

⁸ Kobernuss, *Waco*, p. 175.

⁹ Nicholas-Beazley Airplane Company to Waco Aircraft Company, undated. "Nicholas-Beazley Airplane Company, 1929-1931," *Brukner Papers*, DoAaSC.

organization undertaken by so small a percentage of the total number not members of the association would indicate an element of weakness rather than otherwise."

H. C. Blake, the primary force behind the meeting, showed his exasperation in a letter to Brukner: "What do you suppose is the trouble with these other chaps—Haven't they any better use for their money than to hand it to Curtiss?"¹⁰ Nonetheless, joining the MAA became the path of least resistance, and Brukner reluctantly sent his company's dues in June 1930.¹¹ His acquiescence was a refusal to invest in the legal capabilities, either through a contractual relationship with an external firm like Toulmin & Toulmin or through the development of a legal department with Waco Aircraft. Just like his colleague at Nicholas-Beazley, Brukner acknowledged that the risk of legal action from one of the largest aircraft manufacturers in the country outweighed the expense of MAA membership.

Competing interests prevented the creation of a code for aircraft producers, but cooperative efforts between manufacturers did, in fact, exist during the 1930s. The courts continued to present significant business risks, and Brukner reacted decisively to the threats from this direction. Patent infringement suits hounded manufacturers, and in 1936 Mr. James V. Martin sued a number of companies for infringement of twenty-nine of his patents. In fact, Martin filed a ninety million-dollar suit against the Manufacturers Aircraft Association, claiming it orchestrated an elaborate conspiracy to discredit his patents. Brukner stood by the MAA as a credible industry representative, telling Walter

¹⁰ Blake to Brukner, January 6, 1930. "Nicholas-Beazley Airplane Company, 1929-1931," *Brukner Papers*, DoAaSC.

¹¹ Lee N. Brutus, Vice-President, Waco Aircraft, to V. R. Root, MAA, June 19, 1930. "Curtiss Assets Corporation Lawsuit, 1930," *Brukner Papers*, DoAaSC.

Beech, "The Association has a very complete library on the aeronautical art, and some capable men whose opinions and suggestions will be my guide. . . ." ¹² Beech advocated collective action as well, suggesting "all the manufacturers get together and lick him forever so that it will not pop up again." ¹³ Infringement cases were a common worry in the thirties, and Brukner wanted to counter this attack aggressively: "There may be several [patents] in the group that will have to be contested for the benefit of the entire industry, and since this is an ever growing hazard it would seem advisable for all manufacturers to lay back a reserve in a percentage of their business volume to meet future judgments which are inevitable in new industries such as this." ¹⁴

Patent infringement suits were not the only legal challenge manufacturers faced in the thirties. In 1937 the Stinson Aircraft Corporation fought a negligence of design case and pleaded for help from the aviation industry. Its lawyers framed the issue clearly:

In view of the fact that it is a case of first impression, it is very essential that the decision be in favor of the Stinson Company. We would like the court to decide that when a manufacturer has been granted an Approved Type Certificate by the Department of Commerce that the manufacturer cannot possibly be guilty of negligence of design. Such a decision would protect Stinson and all other companies in the future on this type of case. ¹⁵

Brukner was sympathetic and perceived a chance to reduce the business risks inherent in legal actions. He told the lawyers, "we will cooperate with you and the Stinson Aircraft

¹² Brukner to Beech, October 8, 1936. "B Miscellaneous, 1930-1941," *Brukner Papers*, DoAaSC.

¹³ Beech to Brukner, September 21, 1936, *Brukner Papers*, DoAaSC.

¹⁴ Brukner to Beech, September 18, 1936, *Brukner Papers*, DoAaSC.

¹⁵ George D. Miller to Brukner, August 25, 1937. "Stinson Lawsuit, 1937," *Brukner Papers*, DoAaSC.

Company in every reasonable way that will assist in obtaining a favorable court decision. . . . We feel that this is a very important point, and a favorable verdict would be effective in minimizing the number of unreasonable claims following accidents." He believed cooperative action was the best means to ensure that legal risks did not overwhelm the small firms constituting the civilian aircraft industry.

Trade Association Rivalry

In the months following World War I Samuel S. Bradley, the head of the MAA, tried to sustain the MAA's leadership position as organizer and spokesman for the aviation industry. In 1920 Bradley launched an attack on the Naval Aircraft Factory, claiming that government competition threatened too many of the remaining aircraft manufacturers. The MAA promised the government (the National Advisory Committee for Aeronautics and the War and Navy Departments) that if it gave all business to private companies, they would invest all profits in research and development. The proposal naturally died, as no manufacturer would make that promise for himself, let alone feel bound by the words of the MAA.¹⁶ The confused state of aviation was apparent to industry observers in the public as well as the private sectors. Herbert Hoover wrote in June 1921 that "[t]here is no reason why those interested in civil aviation should not form an association for the promotion of their views . . . , and I should welcome a committee from such an association."¹⁷ Thus the glaring need for a voice in May 1921, prompted

¹⁶ Trimble, "The Naval Aircraft," p. 181.

¹⁷ Hoover to Maurice G. Cleary, June 25, 1921. "Aviation, 1920-1921," *Commerce Papers, Hoover Papers*, Hoover Library.

Bradley to submit to a special committee of the MAA his draft plan for an independent trade association. To allow the MAA to focus on the administration of the cross-licensing agreement and on the analysis of new aviation patents, they needed, Bradley said, a separate organization.

The Aeronautical Chamber of Commerce, with an initial membership of 26 manufacturing and engineering companies and slightly more operators and distributors, began in January 1922 to carry the burden of public education and political lobbying for an ambitious agenda. Bradley was trying to broaden the constituency the organization served by courting those businessmen interested in commercial air transportation. He appealed for the manufacturers' continued support, telling them "We will never have an industry if we remain solely munitions makers." The industry, he believed, had to "procure capital and other forms of public support such as air law and regulations, landing fields and chartered aerial highways."¹⁸ Herbert Hoover had expressed interest in these same issues, and the Aeronautical Chamber of Commerce promised a new surge of industry input into the process of crafting legislation.

The ACC's continued reliance on aircraft manufacturers as its primary constituency left it open to strong competition from a rival association. Accordingly in October 1922, the Aero Club of America and the National Air Association merged into the National Aeronautic Association (NAA). Its charter clearly stated its objective: "To aid and encourage the establishment and maintenance of a uniform and stable system of laws relating to the science of aeronautics and the art of aerial navigation. . . ." The NAA

¹⁸ Mingos, "Birth of an Industry," p. 55.

set up headquarters in Washington, D.C., and its legal advisor, William P. MacCracken, Jr., the future Director of the Bureau of Air Commerce, immediately began drafting proposals for Congress's consideration.¹⁹ As with the leaders of the ACC, NAA officers assumed the existence of a strong connection between national security and an active commercial aviation industry. NAA historian Bill Robie, in fact, asserts that the "birth of the NAA may thus be viewed as a carefully orchestrated event intended to serve a specific role in strengthening the growing American military/industrial complex."²⁰ While this conclusion is perhaps too enthusiastic, important manufacturers, including Glenn L. Martin, joined the NAA instead of the ACC. A strong rivalry quickly undermined the authority each had to speak on behalf of the aviation industry.

Intra- and inter-organizational rivalries intensified as the battles over legislation persisted in the early 1920s. Within the ACC, Charles L. Lawrence, vice-president of Wright Aeronautical, succeeded Inglis Upperco, whose interests were primarily tied to commercial air transportation, as president of the chamber. He made decisions decidedly shifting policy in favor of military manufacturers in the period 1924 to 1926. The ACC, for example, opened an office in Washington and lobbied for increased military spending.²¹ The NAA also experienced internal tensions that inhibited its effectiveness. Many members lacked MacCracken's enthusiasm for federal involvement in the industry, fearing the hardships that regulation would impose on the barnstormers and other small operators. Others resented the favoritism the proposed

¹⁹ Robie, *For the Greatest Achievement*, pp. 104-105.

²⁰ *Ibid.*, p. 107.

²¹ Vander Meulen, *Politics of Aircraft*, p. 69.

legislation showed toward the larger companies. These divisions convinced NAA president Howard Coffin to withdraw his support for immediate congressional action.²² Thus Hoover had no authoritative trade association with which to work in his drive for regulatory powers for the national government.

Other organizations tried to fill this vacuum. The American Society for Promotion of Aviation (ASPA) in 1930, for example, presented Hoover with a plan to use aviation as a weapon against the depression. The July letter advocated the passage of a bill sponsored by Senator Thomas D. Schall calling for a forty million-dollar appropriation to give airplanes to civilian flying clubs.²³ The president of the ASPA explained that "the plan would provide a great national defense for our country at a very small cost and at the same time it would immediately promote this new industry of aviation and provide work for thousands of people." The Director of Air Regulation told the White House, "If the request had come from the National Aeronautic Association or the Aeronautical Chamber of Commerce, the proposed plan would no doubt serve a constructive purpose. However, in light of the standing of the American Society for Promotion of Aviation, it would probably be well not to take favorable action on their request."²⁴

The Aeronautical Chamber of Commerce thus emerged as a marginal representative of the aviation industry, but Brukner agreed to Advance Aircraft joining in

²² Robie, *For the Greatest Achievement*, p. 113.

²³ Thomas L. Hill to Herbert Hoover, July 2, 1930. "President, Aeronautics—Correspondence 1930, April-July," *Hoover Papers*, Hoover Library.

²⁴ Gilbert G. Budwig to George Akerson, July 10, 1930. "President, Aeronautics—Correspondence 1930, April-July," *Hoover Papers*, Hoover Library.

1928. In that first year, in fact, Brukner became a member of four of the fourteen committees.²⁵ In these and subsequent capacities he received many suggestions about how to further aviation's development and how to deal with the depression. Rowland M. Hill of Ann Arbor, Michigan, wrote to Brukner sharing his vision of aviation as a means to combat economic downturns. Hill, who assumed that the plane was the next step in faster personal transportation, bewailed the tremendous expense of building and maintaining highways. He believed that if "10 per cent of the road building expenses were appropriated to making available small landing areas, the public could use their personal planes as the automobile is now used." He explained further that "the business of the country would be speeded up and the cost of these super highways . . . would be saved to the taxpayers." For Hill, good economics was good politics: "When it is considered that a large percentage of national wealth goes to maintaining road systems, any development that would make a large decrease in taxation would meet with sensational public support."²⁶ Others emphasized jobs. Wallace S. Thomas of the successful Thomas Manufacturing Company in Springfield, Ohio, told Brukner that the jobs created to build additional airfields in his county would add \$120,000 to the local economy, thereby, "reduc[ing] her expenditure for poor relief. . . ." He added, "[t]he Federal Government could well afford to pay a portion of the cost without ultimate repayment because of the tremendous value from a national defense standpoint, of the expansion of flying."²⁷ As favorable as these proposals may have been to private flying,

²⁵ *Aircraft Year Book, 1928*, pp. 416-7.

²⁶ Rowland M. Hill to C. J. Brukner, March 22, 1932. "H Miscellaneous," *Brukner Papers*, DoAaSC.

²⁷ Wallace S. Thomas to C. J. Brukner, November 10, 1932. "T Miscellaneous," *Brukner Papers*, DoAaSC.

Brokner concluded that they had no chance for serious consideration in the Hoover administration. He was right. This approach to government involvement in the aviation industry found no favor, and the Schall Bill failed in the Senate. Aiding private aviation was a priority for neither the ACC nor the administration.

Businessmen in the private flying field found no satisfactory means to influence public policies due to the weaknesses in the trade associations. Both the ACC and the NAA sought broad constituencies as reliable sources of operating income and to enhance their claim to represent the entire industry. Their drives to offset parochialism ran counter to those of the airline executives and military manufacturers, who were quite content to remain dependent on government funds.²⁸ The diverse nature of the aviation industry made it almost impossible to create an effective coalition of special interest groups. The industry's fragmentation contributed to the confusion and delay surrounding the creation of regulatory legislation in the 1920s. It similarly influenced policymaking in the New Deal years and kept private flying a low priority in the eyes of industry and government leaders.

The Merger Movement within the Aviation Industry

The second half of the 1920s was a period of consolidation in many industries in the United States. Mergers, funded by speculative investments that many stock traders

²⁸ Vander Meulen, *Politics of Aircraft*, p. 64. Vander Meulen fails to mention the rivalry between the ACC and the NAA, instead implying that associationalism foundered on aviation executives' individualism and the military's inability to manage procurement procedures effectively. More compelling is the organizations' impotence in brokering deals between the various interest groups they hoped to represent. Businessmen's ability to join one or the other or neither prevented the formation of enduring alliances that had sufficient authority to influence industry members in a systematic way.

financed on margins of only 10 to 20 percent, allowed corporations to pursue integration strategies. In many instances corporate leaders sought vertical integration of production and distribution, creating large companies modeled after the examples of Standard Oil and U.S. Steel. Others pursued strategies emphasizing diversification along the lines of the Du Pont Company, which had successfully moved from gunpowder manufacturing to the production of numerous consumer goods as well. This trend toward a modern, complex form of corporation with professional management separate from the ownership picked up momentum in the 1920s. Mergers further concentrated wealth in the largest corporations by the end of the decade. The top 100 controlled half the industrial income by 1929, prompting fears that the entire economy would some day be dominated by only a few monopolies. But at that time, it was oligopolistic competition that characterized activities in the meatpacking, automobile manufacturing, and tobacco industries.

Although aviation was a very small fraction of the size of them, it was a highly visible and promising technology-based industry that experienced somewhat similar changes. The excitement generated by Lindbergh's flight combined with the speculative frenzy of the late 1920s funneled money into consolidation in the aviation industry. In 1927 the value of aviation securities totaled \$500,000, and two years later the total stood at \$175 million. Just before the October 1929 crash the sum reached \$300 million. This enormous increase in capital allowed some companies to expand their productive capacities, as did the Curtiss Corporation. More importantly, it allowed the formation of large holding companies, which encompassed subsidiaries in many different functions in the aviation industry. The interlocking ownership schemes among the biggest of the holding companies included executives, like Howard Coffin and Charles Kettering, from

outside industries. Aviation—like the internet companies today—was caught in the spotlight as an exciting opportunity. Investors mostly ignored government and even Charles Lindbergh's warnings that the future of American aviation was still uncertain.

The frenzied behavior of many industry executives undermined the sympathy that Hoover, congressmen, or military officers may have had for a more favorable aviation policies. Charles W. Deeds, an executive of United Aircraft & Transport (UA&T), received over \$150,000 in bonuses during the period 1927 to 1931. Stock manipulations had turned his \$40 investment in Pratt & Whitney, one of UA&T's subsidiaries, into stock worth over \$5 million. Another UA&T executive, F. B. Rentschler, received over \$1.2 million in salaries and bonuses from 1927-1933.²⁹ In the midst of this stretch of apparent good fortune, his statements as president of the ACC created the impression that the industry was greedy and selfish with public funds. Countering the argument that military air power depended on a sound civilian aviation system (an assertion that public and private officials had been making for years), Rentschler said, "Commercial aviation offers no substitution nor even a dependable reserve for our air defense."³⁰ During this period of vigorous, if frequently convoluted, dealings on Wall Street, the ACC reminded the Hoover administration that the recent increase in the value of investment capital did not relieve the government of its responsibility to provide generous appropriations for military aircraft.

In addition to the negative impression this created, the consolidations further weakened the trade associations. The ACC's goal to have a broad base within the

²⁹ Freudenthal, "Aviation Business," quoted in Simonson, *History of the American Aircraft Industry*, p. 90.

³⁰ Quoted in Vander Meulen, *Politics of Aircraft*, p. 105.

industry became more remote. Important military contractors remained outside the ACC. Glenn Martin and Donald Douglas, for examples, belonged to the NAA. They were similarly aloof from the merger movement within the industry, retaining control of most of their companies' stock. As key defense contractors, they had the ability to deal with the military bureaucracies independent of the interests of the holding companies and of the chamber. The onset of the depression whittled the ACC's membership roster: the number of businesses dropped from 419 to 120 from 1929 to 1933. Those that remained were competitors for military contracts or producers of civilian planes, like Waco, who had different interests. The relatively few members left had sufficient financial reserves from profits and/or investment capital to advocate staunchly their narrow interests, instead of being driven to craft compromises enabling cooperative efforts.

The National Aeronautic Association was having its own difficulties in this period. Initially it benefited from the hype following Lindbergh's flight, and membership doubled in the three years between 1926 and 1929. It, too, sought a broader constituency and appealed to average citizens to join the NAA as a means to show their airmindedness. The organization offered advice about how to form effective flying clubs and monitored the Commerce Department's regulatory policies to ensure the government did not unnecessarily restrict private flying. In 1927, for example, it successfully lobbied Congress against a proposal submitted by the American Bar Association that would have empowered the Bureau of Aeronautics to approve all overseas flights.³¹ By 1930,

³¹ Robie, *For the Greatest Achievement*, p. 124.

though, the image of the NAA had taken a turn for the worst, and the diminishing operating funds created severe tensions within the organization.

Senator Hiram Bingham served as the imperious president of the NAA from 1928 until 1934, and presided over the decline of the association. As early as 1930 the NAA drew strong criticism from the aviation industry periodical *Aero Digest*. Accusing Bingham of using the NAA for his own political purposes, the editorial called for Orville Wright to be appointed as honorary lifetime president. From within the NAA Bingham in 1933 faced the highly publicized and controversial resignation of the organization's vice president, Amelia Earhart. The famous Earhart had been one of the association's primary assets during the depression, and now her resignation was announced in *New York Times* headlines: "Amelia Earhart Quits National Air Group; Opposes Policies of Bingham Association." Her loss hastened the NAA's downward spiral. While her displeasure with Bingham had numerous causes, the immediate incident was his decision to turn the association's magazine, the *NAA Review*, over to a private publisher, who had editorial control of its contents. Glenn Martin was also upset by the move, offering further evidence of the tension within the NAA. In April 1933 he wrote, "I believe . . . the execution of this contract is another important step down the ladder of strength. . . ."³² The trade associations' inability to manage industry-government relations during the boom time of the merger movement and during the early depression reflected their inherent weaknesses. The expectation of rapid expansion in the civilian aviation businesses drew many companies and individuals into the associations in hopes of

³² Ibid., pp. 129-133, 347.

establishing positions that allowed them to exert effective influence on government policies.

Their place might have been taken by the new consolidations that sought to maximize profits that would have come from the continued boom. The largest aviation corporations even after mergers were complete, however, encompassed only 48 percent of the industry's assets in 1929.³³ Too many strong companies remained independent for the biggest three, UA&T, Curtiss-Wright, and the Aviation Corporation, to assert effective control of the markets or the political process.

Aviation companies vacillated between independent action and cooperative efforts through a trade association. They further divided over which organization, the ACC or the NAA, to support. Thus both trade associations were vulnerable to criticism from government officials and from the media that argued they were not representative of the aviation industry. The tremendous stress that the depressed economy placed on the industry highlighted the divisions and further confounded cooperative efforts to restore the health of aircraft manufacturers.

Manufacturers' Failure to Create a Code

The Roosevelt administration sought to revive the economy by minimizing the destructive competition that many businessmen and economists thought had exacerbated the depression. In June 1933 the president signed the National Industrial Recovery Act (NIRA), which created the National Recovery Administration (NRA) and empowered it

³³ Vander Meulen, *Politics of Aircraft*, p. 93.

to work with industry trade associations to create codes of fair competitive practices. The stability the codes fostered would allow better planning, and the labor provisions of the NIRA tried to generate greater employment through job sharing and collective bargaining. Many industries' trade associations responded favorably and effectively to the challenge of forging acceptable codes. The airline field of the aviation industry, for example, quickly codified the relationships that developed in the aftermath of the Black Committee's investigations. Aircraft manufacturers, especially those engaged in defense contracting, hoped to formulate rules that would allow them to hold proprietary rights for their designs. The ACC embraced the opportunity to create a code on their behalf and launched a campaign to recruit manufacturers who had remained outside the organization.

The tensions between large and small producers, reinforced by the divide between military and civilian manufacturers, affected the aviation industry's efforts to create codes meeting the requirements of the NRA. Early in the decision-making process, the representatives agreed to separate the industry into three distinct fields, each with its own code. In 1933 as pressures mounted in anticipation of the Black hearings, many aviation leaders expected a strong, negative reaction from the administration—one airlines should bear alone. The Air Mail Act of 1934, the legislation passed to fix the perceived problems in the air transport field, stipulated that the holding companies divest themselves of either their airline or their manufacturing subsidiaries.³⁴ Moreover, casting

³⁴ *Aircraft Year Book, 1935*, p. 17; Smith, *Airways*, pp. 291-300.

the airline companies away from the rest of the industry made good sense under the NRA regime.

The older independent airlines, however, felt cheated and expected more from the government because of their snubbing by the Post Office in 1930. Transport aircraft had improved in the early 1930s, and the airlines that deployed the new planes experienced significantly lower operation costs per mile as a result. The Douglas DC-1 and DC-2, introduced in 1932, were the most notable transports of the period, but other manufacturers also produced models that offered better performance. The new technology cost the airlines more, and the companies that had been a part of the large consolidated corporations could afford the investment. The re-opening of the airmail markets in 1934 pitted unequal competitors against one another. The newly independent companies re-entered the airmail and passenger markets in mid-1934 in a better position to compete on the longer routes than the older independents, who held no airmail contracts and thus weathered the depression without investments in new aircraft. The New Dealers urgently wanted to get codes in place and to restore airmail service, even if quick action relegated the smaller airlines to the control of the bigger ones.³⁵

The remainder of the aviation industry further divided into two groups, other commercial operators and manufacturers, the latter, of course, serving as the focus of Brukner's attention. Commercial operators included a variety of aviation companies having something to do with flying—the airport managers, flying schools, distributors, etc. This varied group represented a small fraction of the industry's output, and it, too,

³⁵ Freudenthal, *Aviation Business*, pp. 199-213; Smith, *Airways*, pp. 259-64, 278-81; Vander Meulen, *Politics of Aircraft*, p. 122.

was able to formulate a code agreeable to representatives and NRA officials. The manufacturers, on the other hand, found numerous reasons to head off a code for their segment. Brukner had a front row seat in this process, because he was on the ACC committee assigned the task of drafting a code to meet NRA requirements. Brukner had initially hoped for concerted industry action and was quickly disappointed. As the industry fragmented attempting to implement the NIRA, he grew increasingly leery of the entire undertaking.

The businessmen's internal fights were matched by those within the government, seen most clearly in the emerging rivalry between the airmen and the Army. This rivalry was not new, of course. General Billy Mitchell had advocated a separate organization for air power in the 1920s, and his ceaseless activities and confrontational approach earned an early retirement.³⁶ In the early 1930s, however, technological advances began to close the gap between the airmen's extravagant claims about aviation's superiority in combat and their planes' performance characteristics. For example, while Mitchell talked about heavy bombers leveling cities, the bomber whose development he sponsored, the Barling, could not clear the Appalachian Mountains between Dayton, Ohio, and Washington, D.C. In 1934, on the other hand, Lieutenant Colonel Henry Arnold led a formation of Martin B-10 bombers from California to Alaska and back—and the B-10 flew faster than any contemporary U.S. fighter airplane.³⁷ As bomber technology improved, emboldened air power advocates proclaimed the air force's ability

³⁶ For a good synopsis of Mitchell's efforts and the changes air leaders made in the 1930s, see Underwood, *The Wings of Democracy*, pp. 6-45.

³⁷ Arnold, *Global Mission*, pp. 110, 146-7.

to win wars independent of ground and naval forces. Organizational independence was a short, logical step from that proposition, but senior Army officers were understandably skeptical. The Navy, too, did not want its familiar struggle with the Army to expand to a third dimension, and the airmen presented a distinct threat. Interservice rivalry, then, emerged as the most visible example of the contentious politics of aviation within the federal government.³⁸

This rivalry was important to the industry, as aviation's priority within the military establishment affected appropriations, aircraft types, and thereby, specific companies. Aviation executives watched closely in an attempt to assess better their relative strength, and they simultaneously worked to forge an NRA code favoring their interests. Balancing ties to the War and Navy Departments with the need to create alliances within the industry proved too much for the businessmen to handle. Their efforts foundered under attacks from government officials who claimed the ACC was in fact trying to institutionalize oligopolistic conditions in a manufacturing field enjoying healthy competition. Since the early 1920s, the ACC had advocated the creation of a military-approved list of contractors who were authorized to compete for defense business. Drafts of NIRA codes included provisions limiting new entrants in terms that excluded even established civilian producers like the Waco Aircraft Company.

That proposed restriction prompted some government officials to lobby the NRA against acceptance of the ACC's draft. Vidal's vigorous attack as the new Director

³⁸ For a good treatment of doctrinal development in the American air force, see Thomas H. Greer, *Development of Air Doctrine in the Army Air Arm, 1917-1941* (Washington: GPO, 1955). I have written about the nexus between doctrine and interservice rivalry in "A New Rival: The Rise of the American Air Force," *Air Power History* Winter 1991, pp. 18-29.

of the Bureau of Air Commerce, for instance, concentrated on the ACC's claim to represent aircraft manufacturers credibly. Asserting that the current membership comprised only 28 percent of the builders, he argued that the ACC could not speak authoritatively for even military contractors. More importantly to Vidal, the depression had forced numerous smaller companies to suspend production and their interests were not considered in the ACC's draft code. These charges forced the ACC to renew its membership drive. It extended once again, for example, a special invitation to Glenn Martin. Martin's refusal and the cessation of production by such notable manufacturers as Clyde Cessna undermined the ACC's argument that those companies not represented by the trade association were inconsequential. Vidal's criticism hurt the ACC's efforts to win NRA approval of its draft code, and other executive agencies seconded his arguments against acceptance.

Army and Navy officials saw the ACC's proposal as too damaging to the competitive market they enjoyed for the procurement of military aircraft. The services asserted that government money paid for the development of new aircraft and that the military should have the authority to award production contracts for the new designs competitively. Limited budgets, the manufacturers argued, encouraged low-ball bidding and unprofitable business—exactly the conditions the NIRA was intended to ameliorate.³⁹ From the military's point of view, however, the greater number of aircraft such competitive practices generated was in the taxpayers' and armed forces' interests. Curtailing competition through the provisions in the various versions of the codes the

³⁹ Vander Meulen, *Politics of Aircraft*, pp. 129-130.

ACC forwarded thus met with little favor among military officials, whom the manufacturers said would benefit the most from rationalization of the industry.

Like the government leaders who interacted with the Aeronautical Chamber of Commerce, Brukner saw many deficiencies in the trade association and grew increasingly frustrated with its response to the NIRA. Even before the Roosevelt administration made any decisions about aviation (when Brukner hoped "for the retention of the present crowd on the grounds that they are 'less bad' than any new bunch"⁴⁰) his anti-Chamber sentiment was well developed. Small, civilian manufacturers, Brukner believed, held no influence in the organization, and he considered himself a member of "that great fraternity—'The Redheaded Stepchildren of the Chamber.'"⁴¹ His opinion was not unique. Later in 1933, when Vidal was pushing hard for his new vision of the federal government's role, E. T. Asplundh, vice-president of the Pitcairn Autogiro Company, told Brukner,

the Chamber of Commerce passed the buck because they had on their hands a rather nasty proposition to make a stir about, in view of the fact that after all the main interests of the Chamber do not include commercial aviation. You, of course, know how anxious the Chamber has been to represent us, but when they get a real proposition they just nicely pass out of the picture.⁴²

Brukner agreed and told Asplundh that "the Executive Committee had not referred the matter to one of the subdivisions but had branded it as a matter for individual action and thus killed an opportunity for the Chamber to serve its small and non-transport

⁴⁰ Brukner to Luscombe, April 7, 1933. "Luscombe, D.A., 1932-1933," *Brukner Papers*, DoAaSC.

⁴¹ *Ibid.*

⁴² Asplundh to Brukner, November 17, 1933. "A Miscellaneous, 1929-1941," *Brukner Papers*, DoAaSC.

members." In the midst of the depression and tumultuous bureaucratic politics, Brukner's faith in the ACC was threadbare and his anger was apparent. He closed his letter to Asplundh by expressing regret "that the New Deal is turning out to be such a raw deal. . .

"⁴³

Thus, 1933 saw no serious effort to hammer out a code because "[s]ome problems in the code involved basic changes in [government] aircraft procurement; and as there were indications that Congress might change the law, work on the code was temporarily halted by agreement between NRA officials and the industry, pending the outcome of Congressional action."⁴⁴ Congress provided no relief, so tough negotiations began in 1934. The divisiveness was apparent in the *Year Book's* summation of code activities for that year: "the manufactures have drafted more codes than there are companies in the industry."

In January 1935 the ACC mustered "one more last effort to obtain a code" and sent a long letter with the draft to the NRA. The letter explained the complexity manufacturers faced in dealing with the government, and, although certainly making a code difficult to negotiate, ignored the issues of civilian manufacturers. One paragraph, however, suggested the crux of the issues so deeply dividing manufacturers:

The industry is very widely bracketed as regards size of company and geographical location. It comprises large companies with a majority of their business done with the Army or the Navy, and small companies which do no Government business. There are centers of manufacturing on the West Coast, in the central States and in the east, with their varying

⁴³ Brukner to Asplundh, November 22, 1933, in *ibid.*

⁴⁴ *Aircraft Year Book, 1934*, p. 21.

cost-of-living scales. The interests of all types of companies must be observed in the writing of the code.⁴⁵

ACC leaders recognized the cause of their problems, but they found no means to solve them. When the Supreme Court declared the NIRA unconstitutional in 1935, manufacturers still had no acceptable code.⁴⁶

Such cooperative efforts on behalf of the aircraft manufacturing industry, or the private flying field at least, gave Brukner a model of a process he thought could work when addressing other issues important to plane builders. When cooperation failed, he became frustrated. In 1933 he wrote that the ACC was failing him and the private flying field, telling a colleague, "we need greater consideration and representation."⁴⁷ As efforts to craft the code bogged down, Brukner focused more of his attention on the new ideas emanating from the Department of Commerce. Vidal assumed leadership in the Bureau of Air Commerce in October 1933, precisely when the Black Committee began its airmail hearings. Vidal's aggressiveness added to the shock of contract cancellations and Army crashes and generated a decidedly negative reaction to his program among industry leaders. His ideas were on Brukner's mind, and, as efforts to craft a code languished, Brukner came to believe that the real government threat to his business came from the Bureau, not the NRA. Brukner held positions that provided opportunities to shape the industry's discussion with government officials. In 1935 he was on the ACC's

⁴⁵ All quotes come from 1935 *Year Book*, pp. 17, 22, and 25.

⁴⁶ Holley, *Buying Aircraft*, p. 8; Vander Meulen, *Politics of Aircraft*, pp. 115-146.

⁴⁷ Brukner to E. T. Asplundh, November 22, 1933. "A Miscellaneous," *Brukner Papers*, DoAaSC.

Executive Committee, and he was treasurer of the Manufacturers Aircraft Association.⁴⁸ His lobbying efforts, though, produced few tangible results, and his personal management style meant that he still invested most of his time in running the Waco Aircraft Company.

Brukner, like most manufacturers, found a safety valve in the export market. While still responsive to the domestic market, he cultivated overseas sales as the best means to keep production lines busy. His smaller competitors did not have the marketing and distribution networks needed to reach foreign customers. His larger rivals, of course, did, so Brukner carefully defined an export market niche that provided a steady number of sales while he waited for the depression to end at home.

The Waco Aircraft Company, 1933-1938: Enduring the Depression

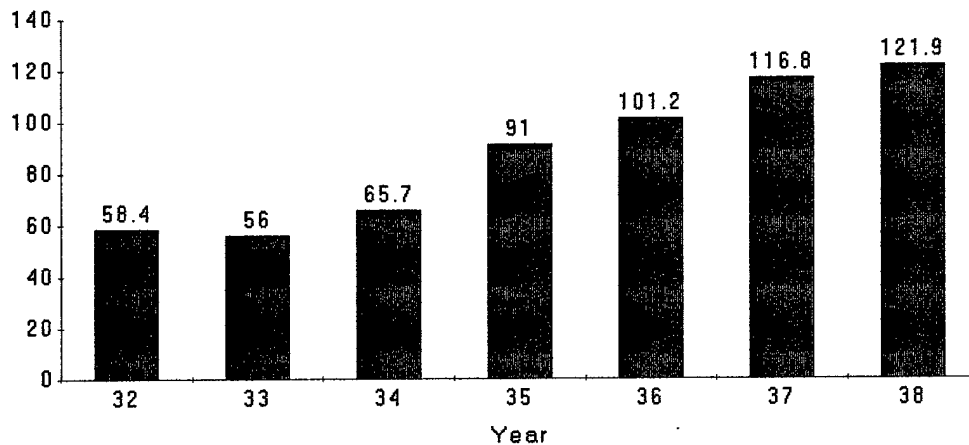
Exports did not change the overall structure of the industry, but they claimed an increasing share of the aviation market. Sales to the U.S. military continued to be the largest source of revenue for manufacturers. The ACC reported in 1935 that "for the past few years, about 60 per cent of the production of the industry has gone to the United States Government; about 25 per cent to export; and the remaining 15 per cent to domestic sales."⁴⁹ The manufacturers' expectation that the Democrats would cut military spending for aviation proved correct for 1933. As a result, there was vigorous competition in overseas markets. Congressional hearings, contract cancellations, and the Army airmail fiasco made exports seem to be an attractive alternative to the chaos and

⁴⁸ *Aircraft Year Book, 1935*, pp. 482, 487.

⁴⁹ *Aircraft Year Book, 1935*, p. 25.

depressed conditions at home. Those companies able to build export market mechanisms were able to realize that goal.

Chart 4-1
Military Appropriations
\$ Millions



Source: *Aircraft Year Book, 1940*, pp. 466-7.

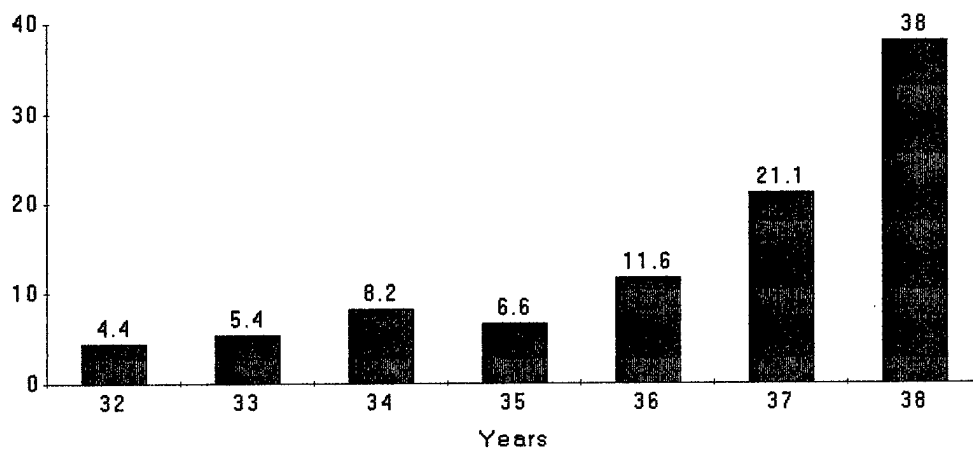
International tensions compelled many nations to purchase aircraft, universally perceived as the most advanced military technology. Japanese aggression on the Asian continent, the Chaco War between Bolivia and Paraguay, German and Italian belligerence, and many other conflicts fueled an international arms race for airplanes. American manufacturers of course competed against foreign companies, and this gave U.S. builders another reason to resent the New Dealers. Labor here cost more than European workers because of the burdensome labor requirements in the NIRA. The ACC told the NRA in early 1935 that

the important export sales are gone for many years, due to factors completely beyond its control. One of these is European competition based on lower wage rates. In airplane construction the average wages are: England 32.4 cents; France 40.4 cents; United States 66.4 cents. In

engine construction the average wages are: England 34.4 cents; France 43.4 cents; United States 70.4 cents.⁵⁰

Added to this, the Neutrality Act of 1935 restricted arms exports, and contributed to a setback in the export market that year. As the figures show, however, the ACC's pessimism was unfounded, and foreign sales resumed their upward trend the next year.

Chart 4-2
Aircraft Exports
Value, \$ Millions



Source: Modley, *Aviation Facts and Figures*, p. 88.

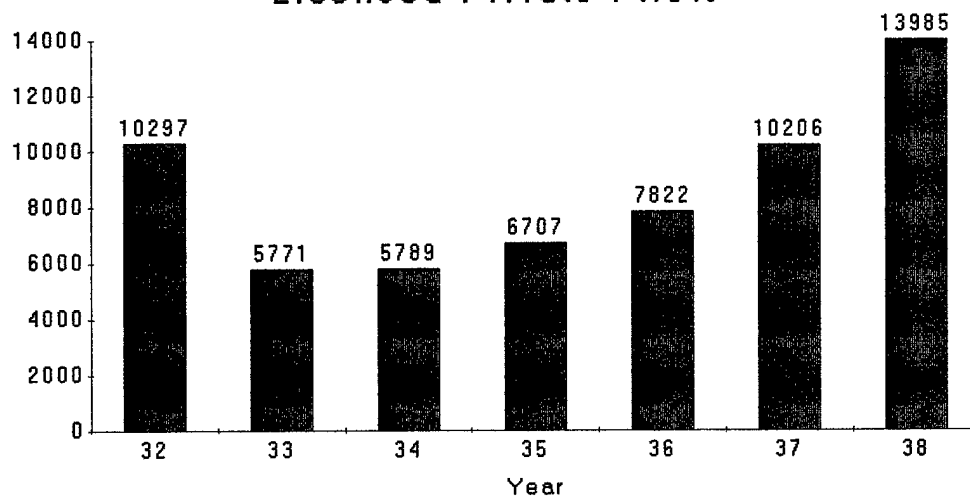
The Waco Aircraft Company saw great opportunity in exports. Brukner looked to foreign governments to buy militarized versions of his bi-planes. He was willing to place his airplanes' reputation for low cost, high reliability, and short take-offs and landings in the overseas markets, and he won a number of important contracts. He did not ignore civilian sales. In fact, he placed increasing emphasis on closed-cabin aircraft over the more sporty, open-cockpit planes because buyers in the depression were mostly wealthy people who valued luxury over high performance. Waco's success at home (it still outsold its nearest two competitors combined) and success abroad kept production

⁵⁰ Ibid.

lines open. Like many aviation executives he realized the short-term importance of export sales and had put off charting a longer-term course until the economy improved or current events forced the issue. When sales dropped in 1938, however, Brukner knew that neither the domestic civilian nor the export market would restore Waco to profitability, and he began shifting company priorities towards military business.

The Commerce Department reported the number of licensed private pilots, personal flying miles, and privately-owned aircraft in operation for the period 1932-1938. The number of private pilots determined to a large extent the number of potential buyers of civilian aircraft. While an imperfect measure, because corporations sometimes bought civilian planes, shuttling executives from meeting to meeting, it did gauge interest and ability to partake in private flying. The trend was notably positive after 1933.

Chart 4-3
Licensed Private Pilots



Source: Modley, *Aviation Facts and Figures*, p. 73.

The other two measures of on-going private flying also showed positive movement. The number of miles flown in the category of "personal flying" showed a slow, upward trend, culminating in a figure greater than the 1929 total. Likewise the number of aircraft in

operation in 1938 exceeded its previous high. On one hand, these Commerce Department figures were good news for the private flying field: Americans' interest in private flying was durable enough to survive the depression.

On the other hand, these data mask the fact that people eager to buy planes found good deals in the used airplane market. This bedeviled all manufacturers, and Brukner advocated efforts to curb the debilitating competition from used plane sales. Instead of saving money for new Wacos, which were targeted for wealthier customers, they could buy a good used one. The growing number of used planes spawned a related issue, trade-in allowances when buyers sought a new plane. Here Brukner advocated close cooperation between manufacturers. In 1936 he wrote to Walter H. Beech, the president of the Beech Aircraft Company, saying,

While I am not a believer in suppressing open competition, I do believe it would be helpful if a practice could be established of revealing to each other, when requested, our maximum allowance on any trade. . . . If such a procedure cannot be established within the industry then I say we are too unethical to be worthy of any better treatment than our prospect gives us.⁵¹

Beech agreed, telling Brukner, "In order to stimulate further sales, I also think it would be a good plan if all the manufacturers would have some form of trade-in values established. The public is conscious of the fact that airplane people are at one another's throats and are taking full advantage of that fact."⁵² Clearly competition continued abated, and these favorable data did not add to Brukner's bottom line.

⁵¹ Brukner to Beech, October 8, 1936. "B Miscellaneous, 1930-1941," *Brukner Papers*, DoAaSC.

⁵² Beech to Brukner, September 21 and October 13, 1936, in *ibid*.

Chart 4-4
Personal Flying, Miles Flown
 Millions

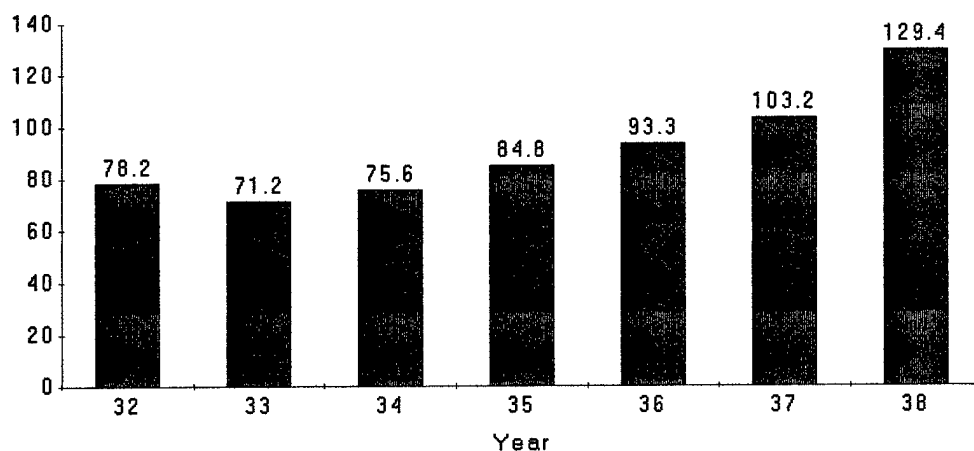
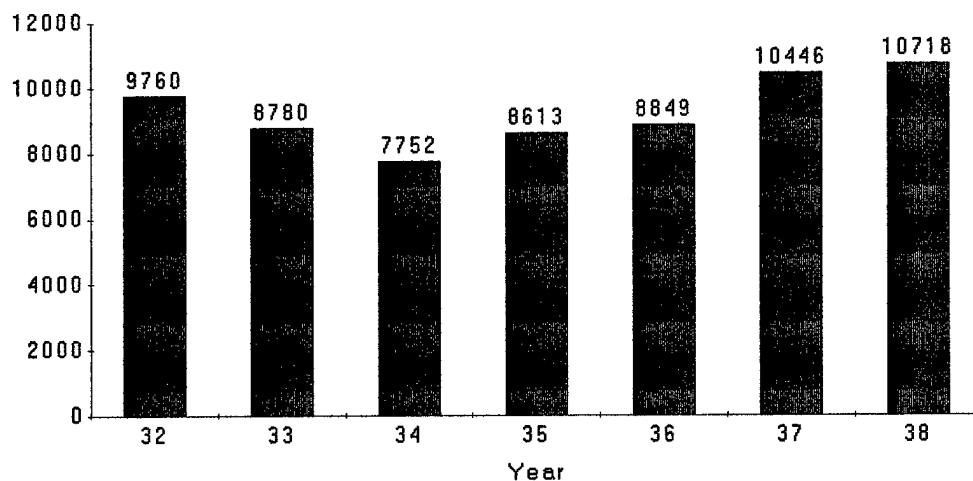


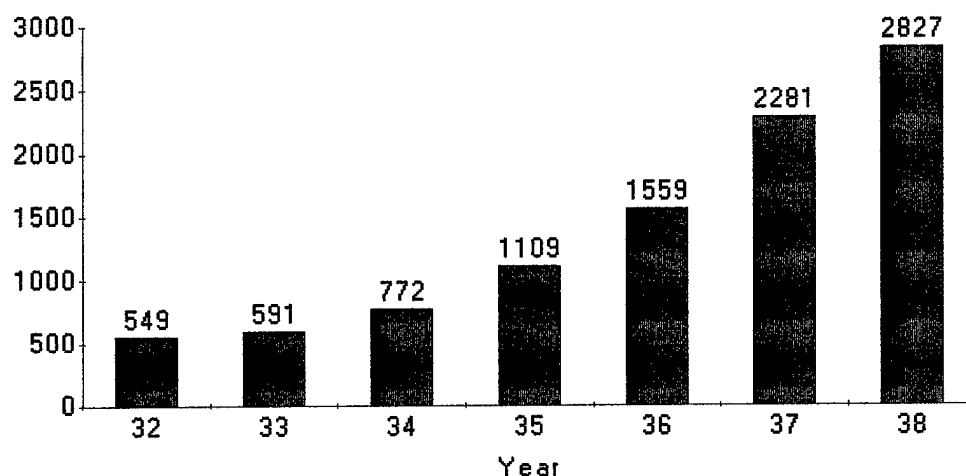
Chart 4-5
Aircraft in Operation



Source: Modley, *Aviation Facts and Figures*, p. 78.

In fact, interpreted correctly, they make understandable his frustration in 1938 when sales dropped amidst favorable domestic developments. The weakness of the private flying field can be seen most clearly in the number of aircraft produced each year. Here the depression was most evident, with annual figures in 1938 barely exceeding half the 1929 total of 5,357 civilian aircraft.

Chart 4-6
Civilian Aircraft Produced

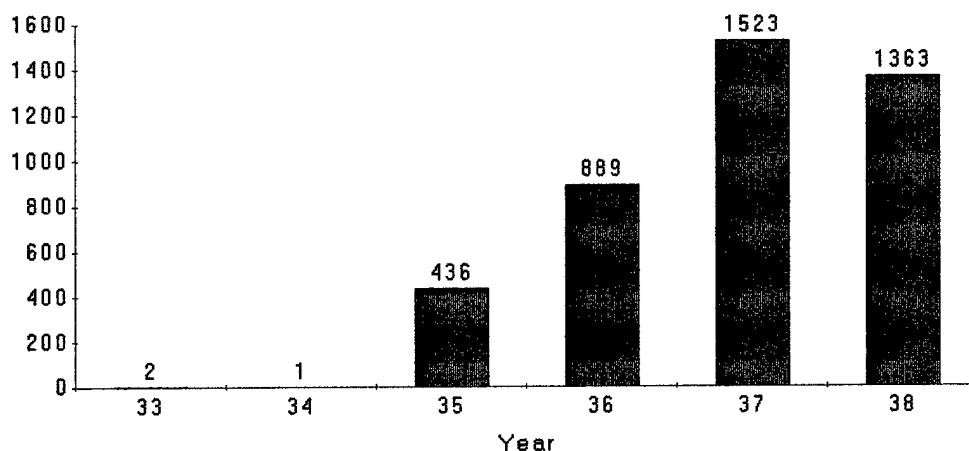


Source: Modley, *Aviation Facts and Figures*, pp. 8 and 88.⁵³

The overall trend was deceptively positive. A further breakdown into types of civilian aircraft reveals the very real crisis Brukner and others faced in 1938. First, the most valuable civilian plane was the transport, and as the airlines regained their footing in the late thirties more multi-engined transports were sold. More importantly for Waco, since it did not build transports, was the increase in sales of smaller personal aircraft (or lightplanes), those selling for under \$2,000 or weighing less than 1,300 pounds gross. As we have seen, neither was this Waco's niche, because Brukner chose to concentrate on larger, more expensive planes. This lightplane niche represented the entry-level for Americans learning to fly. If this group of beginners did not buy a used plane, then the less expensive models were a logical alternative. These smaller, cheaper aircraft account for the positive trend seen in the above chart as these data show:

⁵³ The figure for 1938 is an estimate based on the ratio of military to total aircraft production for the years 1932 to 1937. That ratio allowed me to calculate export figures for 1938 and add them to figures for domestic sales which was available. The chart shows total civilian aircraft produced in the U.S. for each year—domestic and export sales.

Chart 4-7
Light Personal Aircraft
Annual Production



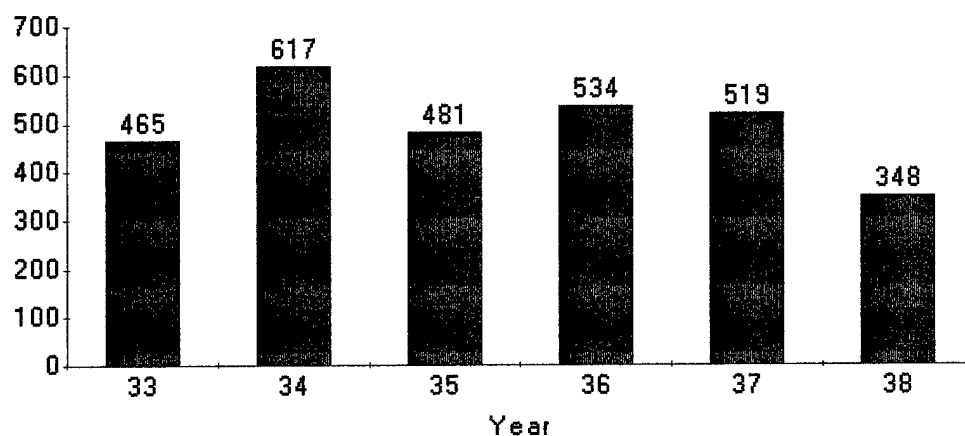
Source: Modley, *Aviation Facts and Figures*, p. 77.

Brukner's niche languished throughout the New Deal years. The larger personal aircraft, defined as those selling for \$2,000 to \$10,000 or weighing between 1,300 and 4,000 pounds with a single engine, sold in no discernible pattern. Even the most successful American manufacturer of commercial planes was unable to see much black ink. Each year in the 1930s saw Waco lead in new aircraft registrations with the Department of Commerce; its domination of the domestic civilian aircraft market continued. As in the 1920s and early '30s Wacos comprised a large portion of annual sales in large personal aircraft, but with totals so low, his operation could not be profitable without significant export sales.

Brukner enthusiastically solicited overseas customers. In 1933 Waco sold aircraft in Brazil, Norway, South Africa, Mexico, and Great Britain. The Waco reputation brought him numerous sales, and famous customers like the British aviatrix Lady Grace Hay-Drummond-Hay further enhanced the Waco reputation. In September

that year she said, "I don't feel that I am unpatriotic in buying a foreign aircraft, because I require a machine that has not been developed in England. . . . The construction and finish leave nothing to be desired."⁵⁴ As important as such prominent individuals were, foreign governments were more likely to become repeat customers. Brazil was the most important customer, ordering twenty Wacos to be used for training. The following year Brazil bought forty-nine more planes and set an example for other Latin American countries. Waco also built armed models of its cabin aircraft and sold these fighters or light attack planes to Cuba, Nicaragua, and Uruguay.⁵⁵

Chart 4-8
Large Personal Aircraft
Annual Production



Source: Modley, *Aviation Facts and Figures*, p. 77.

When the Canadian government contemplated changes in aircraft standards in 1935 to the new British Empire standards, Brukner turned for assistance to the Bureau of

⁵⁴ Hay quoted in "America's Aeronautical Industry," *Aviation*, September 1933, p. 260.

⁵⁵ Brandly, *Waco Airplanes*, pp. 119, 125, and 158.

Air Commerce. Waco's northern distributor had sparked Brukner's "interest in the Canadian market a little more than a year ago and ha[s] delivered fourteen seaplane cabins already, and ha[s] substantial orders and excellent prospects for this year." Brukner informed J. Carroll Cone, serving as Vidal's Assistant Director of Air Commerce in 1935, that "the literal enforcement of the new Empire regulations would destroy his business and deprive this company of a growing export market which it sorely needs." Brukner then cut to the heart of the matter:

We feel that much would be accomplished by a letter from your proper official to the Minister at Ottawa, stating that you are in favor of continuing the Export Certificates of this Waco Model YKO for another year or eighteen months. . . . [W]e assure you that the loss of this market is of major importance to the business welfare of this company and a number of other American manufacturers whose airplanes would become practically unsaleable over night if subjected suddenly to the meeting of these more severe requirements.⁵⁶

Brukner's effort to use the government's leverage failed. Cone reported back that the Canadians objected to granting waivers and that "[t]heir reason for this objection seems to be more politic than technical in that their own manufacturers and British representatives state that American aircraft [have] an unfair advantage in the matter of pay load capacity."⁵⁷ Waco had to strip down its planes to stay in the Canadian market, and the expected large increase in sales never materialized.

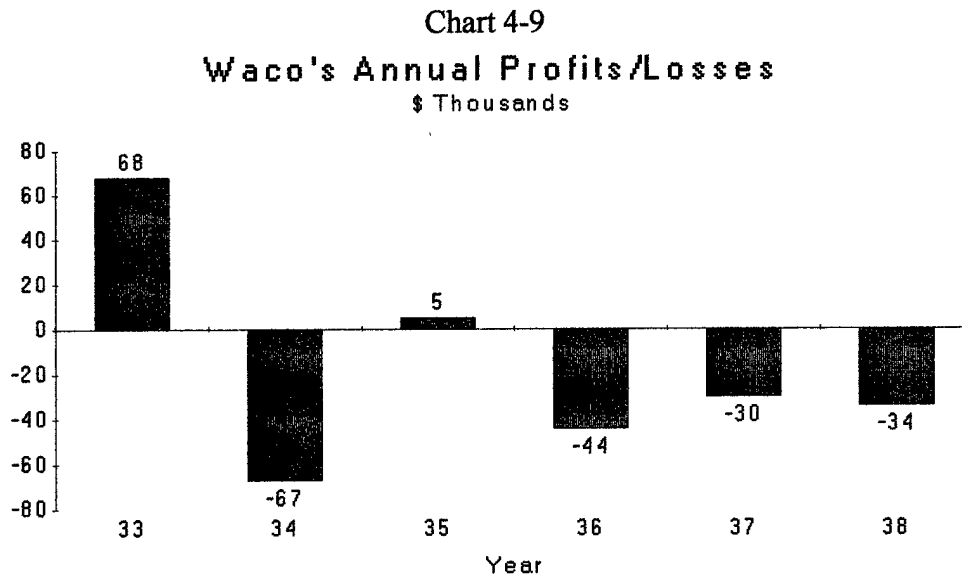
Exports helped, but it was soon apparent that they would not tide Waco over until the U.S. market improved. Profits per plane were higher, but maintaining an effective marketing network was costly. Brukner's niche—light attack, trainer, and

⁵⁶ Brukner to Cone, March 21, 1935. "C Miscellaneous," *Brukner Papers*, DoAaSC.

⁵⁷ Cone to Brukner, March 28, 1935, in *ibid.*

civilian aircraft—was a small factor in an export market predominantly demanding transports and more powerful fighter aircraft. As world tensions mounted in 1938, his biplanes competed less successfully as militaries demanded increased performance. His luxury civilian planes likewise experienced falling demand.

The Waco Aircraft Company's performance in these difficult years was in large part a consequence of the volatility in the upper-end of the civilian aircraft market niche.⁵⁸ Profitability and stock value paralleled the rise and fall in sales. They partially explained the anxiety Brukner felt in dealing with the new administration and his forceful rejection of Vidal's ideas in 1935. The slide after 1935 led him to the grim realization in 1938 that he needed to change business strategy.



⁵⁸ The data for these graphs come from audit reports for this period. "Audit Reports, 1933-38," *Brukner Papers*, DoAaSC.

Chart 4-10
Waco Stock Value
Price per Share

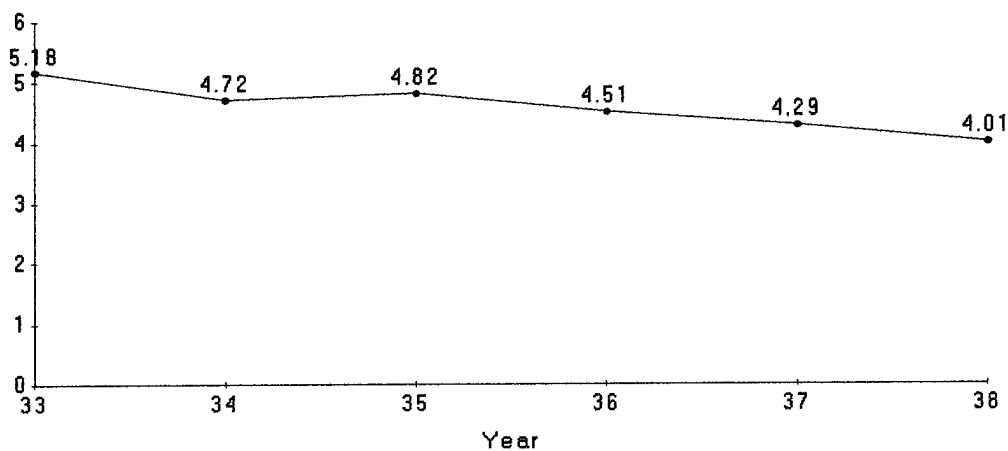
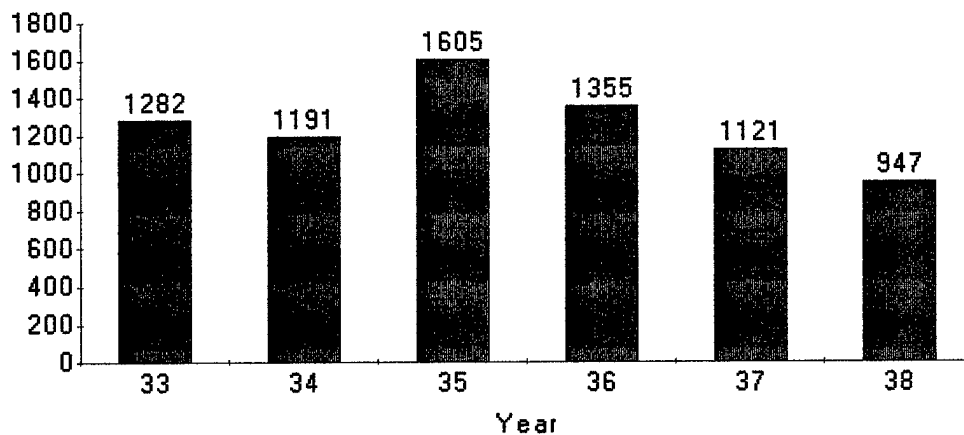


Chart 4-11
Waco Gross Sales
\$ Thousands



Brukner was receptive to the new signals the Air Corps leaders sent from Washington, D.C. Although exports continued to increase, Waco bi-planes began to appear anachronistic as more powerful, all-metal, mono-planes became the weapons of choice, even for poorer nations. The increasing proportion of export aircraft and the

relatively few domestic sales failed to keep manufacturers busy, and military leaders grew more worried about the country's ability to mobilize for war. Throughout most of the 1930s, many politicians dismissed their worries as war-mongering. The prevailing sentiment for neutrality found expression in a series of Neutrality Acts in 1935, 1937, and 1939. Concern about mobilization, especially if aviation manufacturers voiced it, attracted little interest—until 1938. Then a number of prominent politicians, most importantly President Roosevelt, asked American airmen to tell them what air power could do to protect national interests. Menacing developments overseas nurtured the perception that aviation was a strong foundation for national security.

Running out of Room

Brukner saw a number of significant developments in 1938 that should guide his company's new business strategy. First, after four years of atoning for their airmail sins, airline executives successfully campaigned for legislation providing a stimulus along the lines of the Air Commerce Act of 1926. Second, in September 1938 Britain and France implemented a policy of appeasement towards Adolf Hitler's expansionism, causing many American politicians to listen more sympathetically to the U.S. military's requests for additional funding. With the ACC firmly under the control of the larger manufacturers, lobbying efforts were likely to be successful in the near future. As the two largest aviation fields began to enjoy favorable results in advancing their interests, Brukner realized he had to make a difficult decision.

The airlines won everything they hoped for. With the passage of the Civil Aeronautics Act of 1938, the federal government agreed to the centralization of power in

an independent Civil Aeronautics Administration (CAA), stripping the Commerce Department of its role in civil aviation and seizing rate-setting power from the Post Office. The aviation industry sought "an agency through which its relations with the Government might flow in a single stream." It got this and more.

The CAA had significant legislative, executive, and judicial functions, and its five members were appointed to six-year terms. It became for the airlines what the NIRA was intended to be. *Aviation* magazine believed that the "industry actually wrote its own ticket. . . . Definitely, the ball has been passed back to the aviation industry—and on its own terms—and it is up to us to carry it on a steady march down the field."⁵⁹ Historian Henry Ladd Smith, writing in the early 1940s, pointed out the industry's displeasure with the men President Roosevelt appointed to the authority but concluded that a "new spirit of co-operation dispelled the old distrust between operators and the government officials."⁶⁰ The ACC proudly declared in 1939 that "[t]he Authority is empowered to supervise the business practices of air carriers, and to prevent unfair business practices and unfair competition. . . . Its passage was hailed as giving a new organic charter to civil aeronautics in the United States, framed in the light of existing conditions as well as with an eye to the future."⁶¹

John Geisse had predicted the June passage of the act back in March 1938, writing, "This year . . . Congress will probably set up an entirely new commercial aviation program primarily in the interests of our orphan's big brother, scheduled air

⁵⁹ "A Law at Last," *Aviation*, July 1938, p. 19.

⁶⁰ *Airways*, p. 310.

⁶¹ *Aircraft Year Book, 1939*, pp. 94-6.

transport, who is quite articulate and makes known his ailments."⁶² In fact the CAA also gathered in the Department of Commerce duties executed on behalf of private aviation, Brukner's field. But nothing changed. The list of objectives for the new organization read like the responsibilities assigned to the Bureau of Aeronautics in 1926:

- segregation of records
- interpretation of existing regulations
- development of further regulations
- development of utility and pleasure flying
- increased safety through standardization of training
- study the value of private flying to national defense
- study certification process
- bring about uniformity between State and Federal regulations⁶³

More of the same was hardly what Waco Aircraft needed in 1938, but that was the best the ACC and the government could accomplish for private flying. The Chamber was effusive about the Civil Aeronautics Act and devoted twelve pages in the 1939 *Year Book* to its coverage. Private aviation received two paragraphs in the write-up. Clearly the airline industry and the government believed they had done enough to further civilian aviation in America. Brukner was on his own.

The airlines had scored a big victory, and the other large field, military aviation, was making great strides as well. Increasing appropriations and spending on research and development advanced military aviation technology; as this happened, the fliers in the Air Corps made greater demands on the Army and began to acquire a significant following in Congress. Visionary air leaders, those espousing air arm independence, filled the top ranks of the Air Corps. They had gained their positions by

⁶² Geisse, copy of article published in March 1938. "Aviation Publishing Corporation, 1928-39," *Geisse Papers*, Hoover Library.

⁶³ *Ibid.*, p. 102.

employing tact where Mitchell was brash and by wisely choosing the right technology to develop with the funds they won from Congress. The emphasis on heavy bombers like the Boeing B-17 provided the combat capability to carry out the strategic bombing mission that some airmen had envisioned since World War I.

Chief among these leaders was Brigadier General Henry H. Arnold. He assumed Air Corps leadership when Major General Oscar Westover died in a plane crash in October 1938. His promotion coincided with the Munich Crisis and Roosevelt's realization that Nazi air power had made a difference in the outcome of the conference. He wanted an air force, too, and turned to Arnold to tell him what to do. As Arnold wrote in his memoirs, at that moment "there was no difference of opinion among us about the best way to reach more rapid aircraft production."⁶⁴ In accepting Roosevelt's challenge, Arnold became the leader for American military aviation and filled a void in the manufacturing segment of the industry.

Arnold galvanized manufacturers, military and civilian, into a cohesive unit, marching to the beat of his mobilization drum. As divided as they had been before, and as resentful as Brukner and others had become over the years, Arnold's vision, force of will, and political skills brought them together under the banner of national defense. No one seriously challenged his leadership after 1938. For Brukner, who had been running out of room because of his eroding business base, Arnold's vision of military aviation offered a path to success. As Arnold saw it, "the aircraft industry felt as if they had been given a shot-in-the-arm as they started to get to work on the new air deal. . . ."⁶⁵

⁶⁴ Arnold, *Global Mission*, p. 178.

⁶⁵ *Ibid.*, p. 180.

Chapter 5

Transition to Defense, 1938-1941

Through boom and bust, the Waco Aircraft Company successfully established itself as an industry leader. Brukner had adapted to his business setting in the 1920s, modifying his ideas about the "Ford of the Air" and begun to emphasize safety and low costs. Growing enthusiasm for flying and rising affluence brought Brukner sales far exceeding those of other civilian aircraft manufacturers. Then the stock market crash suddenly made flying an expensive luxury. Again Brukner adapted, narrowing his focus to target particular customers—the remaining affluent people in America and other countries. Asking, "Why make a second-rater just to sell it for less money?",¹ Brukner focused his company on the customer who could still afford to fly in the 1930s.

This new strategic vision enabled the firm to survive, but Brukner's niche was not stable enough to ensure his long-term success. The new strategy also had certain unanticipated consequences. Waco's exports began to blur the distinction between civilian and military aviation, as foreign governments purchased aircraft for their developing air forces. This led Brukner to seek to transform his company's relationship with the American military, but the U.S. Army proved to be a very different customer than either private citizens, companies, or foreign governments.

¹ Brandly, *Waco Airplanes*, p. 125.

Table 5-1

Largest American Manufacturers of Aeronautical Equipment, 1936

<u>Company</u>	<u>Sales (\$ Millions)</u>	<u>Principal Customer</u>	<u>Profit Margin, %</u>
United Aircraft	22.3	Military	8.6
Curtiss-Wright	18.9	Military	5.4
Wright Aeronautical	11.4	Military	9.3
Douglas	10.1	Military	9.7
Martin	6.2	Military	11.8
Consolidated	4.2	Military	4.6
Aviation Corp.	3.5	Military	3.0
Boeing	2.3	Military	7.3
Lockheed	2.0	Airlines	5.0
North American	1.3	Military	Loss
Waco	1.1	Private	Loss
Grumman	.7	Military	12.5
Fairchild	.7	Private	Loss
Beech	.6	Private	1.3
Seversky	.6	Military	Loss
Bell	.3	Military	3.6
Bellanca	.2	Private	Loss

Source: William B. Harding, *The Aviation Industry* (New York: Charles D. Barney & Co., 1937), pp. 64-5.

These data reveal the reason Brukner was willing to take the risk—Uncle Sam rewarded his suppliers. During the depression Waco Aircraft earned some profits and kept its production lines open while its competitors were shutting down. After several years of trying to expand business by supplementing domestic sales with exports, he had the experience he needed to make an informed decision when the 1937/1938 downturn occurred. With military appropriations increasing and forecasts for the private flying field grim, he could reflect on the sales data from 1936 and previous years and see that a significant change was needed.

Gaining the education and experience needed to succeed in this new endeavor was a painful process. The jump would have demand dramatic changes even in a stable environment. In the confusion of rapid mobilization after 1938, however, the government in general and the Air Corps in particular were experimenting, uncertain what to do but determined to find methods to turn America's industrial strength into military power. Further complicating the situation was the long transition period for Waco. Brukner changed his business strategy in late 1938 because the sustained depression had ruined the commercial market and because he embraced the prevailing industry ideology that military air power would necessarily derive from civilian aviation. It was 1941, though, before he landed his first significant military contract.

Brukner's Precarious Position

During the 1930s the private flying field experienced important changes that pressured Brukner to alter his business strategy. Waco had limited the number of models it offered in the early thirties, giving up the small glider and the sportier bi-planes in order to focus on the more expensive luxury planes. This logical response to the depression opened the niche for cheap, entry-level aircraft. Brukner's decision to export militarized versions of his planes offset the loss of that portion of the market, but the tactic failed to produce the capital needed to design and test further innovations in his products. Meanwhile, other entrepreneurs were designing planes that extended the performance characteristics of aircraft for private flying.

New entrants in the lower and upper ends of the market produced new aircraft for individuals and companies interested in private flying. The cheapest class of planes, light aircraft, attracted pilots who wanted to accumulate flying hours without paying the increased maintenance costs associated with higher performance planes. William T. Piper, a Pennsylvania oil man, owned the Taylorcraft Company, which had produced the E-2 "Cub" since 1931. Management problems and the depression forced Taylorcraft into bankruptcy. In 1938, however, the newly formed Piper Aircraft Company continued the light aircraft line after making adjustments to the design and initiating an aggressive marketing campaign. The updated Cub cost just less than \$1,000 in 1939, and the company offered eight hours of flight instruction with each new plane.² Piper's success in the light aircraft niche made Brukner's return to it unlikely, given the extensive design work needed to make his bi-planes competitive with the cheaper mono-planes.

Cessna and Beech, on the other hand, marketed aircraft that competed directly with Waco in the luxury niche. In 1934 Cessna introduced a high-wing monoplane, the C-34 Airmaster, that carried four people. This more aerodynamically efficient plane allowed the Airmaster to rival Waco's performance with smaller, less expensive engines. Similarly, the Beech Aircraft Company introduced the Model 17 "Staggerwing," a unique bi-plane with a "negative stagger." With the lower wing located farther forward than the upper wing, low speed handling characteristics and maximum speed improved markedly. Beech introduced the Staggerwing in 1932 and followed Brukner's model of success in

² Bilstein, *Flight in America*, p. 110.

competitions to earn sales in both the domestic and foreign markets throughout the decade.³ Thus at the higher performance end of the private flying niche, Brukner faced intense competition from rival firms that were introducing innovative products and increasing their market share.

Cessna and Beech also began building twin-engine planes, capturing corporate sales and preparing them to bid for military contracts. Beech's Model 18, the Twin Beech, which first flew in 1937, had accommodations for a pilot and co-pilot and six passengers. With a range of 1,000 miles and cruising speed of 190 miles per hour, Beech's plane could move the firm into the transport business, especially for feeder airlines supporting the larger trunk airlines. Beech's plane was premature, but many foreign companies found uses for the small transports. By the end of the decade, the two-engine Beeches were flying in twenty-three different nations. Significantly, the U.S. Air Corps bought a number of Twin Beeches for utility service. The Model 18 allowed Beech to pursue a strategy of product diversification successfully.

Cessna moved aggressively to meet the challenge, producing in 1939 its first twin engine plane, the T-50. Designed to offer slightly lower performance than the Model 18, it carried only five passengers and cruised at a slower speed. The price was correspondingly lower, approximately ten percent less than the Beechcraft. By 1942 Cessna had sold 43 T-50s, but at that point the Army Air Forces recognized the plane's

³ *Ibid.*, pp. 112-113.

potential as a trainer.⁴ This ensured the company a prominent place in the mobilization for World War II.

Although his business remained viable, Brukner was not a leader in this transformation of the private flying field and found it difficult to move Waco Aircraft into the military field. His rigid adherence to a narrow niche sacrificed the firm's ability to identify and evaluate new business opportunities. His industry network had focused on luxury and export sales in the 1930s, and his manufacturing methods continued to respond well to customers' needs. He did not, however, modify his network relationships to gather relevant information about the new facets of private flying and the defense business. Waco's cultural emphasis on independence contributed to its slow recognition of the fact that the transition to the military market required significant changes. That rigidity caused Waco to squander time that could have been used to learn the new business.

The decision to make this transition was not easy for a man who had committed to high quality airplanes and had dominated the private flying aircraft market. Waco had consistently outsold all its competitors since 1926. "We actually sold more airplanes in 1936 than any two of our most prominent competitors,"⁵ Brukner later boasted. But through the 1930s, there were danger signals for Waco and Brukner. The company had sold 194 planes that year, yet still earned a negative 4.14 net profit for the year. The next year was little better, with the bottom line showing a negative 3.46

⁴ Ibid., pp. 115-116.

⁵ Ibid., p. 150.

percent profit.⁶ Consumer demand in the niche Waco Aircraft occupied fell to a new low in 1938. Light personal airplanes outsold the larger aircraft, because Americans were willing to sacrifice performance and luxury for a cheaper price. That year, in fact, Waco sales totaled only \$950 thousand. Cessna and Beech enjoyed the fruits of their diversification strategy, as each grossed sales exceeding one million dollars.⁷ In May 1938 Brukner felt compelled to tell prospective employees that "[o]ur particular branch of the industry . . . has not yet found its stride this year, and so the military and transport divisions appear to be your best bet for the time being."⁸ Later that year he took his own advice.

Eroding Business Base

The road to that decision was not direct, nor was Brukner sure of the final destination. He had worked the export market for all he could by 1938, contributing a significant share to an industry export record: fifty percent of the industry's 1938 airplane and engine output, valued at forty-six million dollars, went overseas.⁹ The pattern continued the following year. From October 1938 until September 1939 the

⁶ Battelle & Battelle Certified Public Accountants to Board of Directors, The Waco Aircraft Company, November 21, 1938. "Audit Reports, 1934-1938," *Brukner Papers*, DoAaSC.

⁷ Vander Meulen, *The Politics of Aircraft*, p. 185.

⁸ Brukner to C. S. Jones, May 17, 1938. "J Miscellaneous, 1932-1942," *Brukner Papers*, DoAaSC.

⁹ John H. Jouett, "The Industry of the Air," presentation to National Aviation Forum, Washington, D.C., February 21, 1939. *Brukner Papers*, DoAaSC.

company manufactured eighty-five aircraft, thirty-five of which went to foreign nations.¹⁰

Yet even those efforts proved unprofitable.

Since exports provided insufficient relief, many Americans renewed their efforts to revive the domestic, commercial market. The depression forced businesses to cut budgets for ads, but earlier efforts had created a strong following for aviation in local, state, and regional organizations, which also invested thousands of dollars in pushing aviation. The Connecticut Aeronautical Development Commission, for example, sponsored radio programs, motion pictures, and airfield development. All commission activities targeted "the man in the street and his family. They emphasize, amongst other things, the low cost and usefulness of flying for recreational or business purposes."¹¹ Aviation was still popular, but in early 1939 Waco averaged fewer than four orders each month. Despite the best efforts of the manufacturers and their allies in civic organizations, private flying still had not regained the stature it had in 1929.

In 1939 some of aviation's boosters still hoped to resuscitate the private flying field. Brukner received numerous solicitations each year asking for some kind of support for various shows, fairs, and marketing campaigns. Kansans, for example, announced that "[t]he Wichita Air Congress is to be an all-commercial aircraft show, the purpose of which is to promote commercial aviation and prove to the public at large that flying is a

¹⁰ "Daily Sales Reports, October 1, 1938 - September 27, 1939," *Brukner Papers*, DoAaSC.

¹¹ Harvey L. Williams to Brukner, January 18, 1940. "W Miscellaneous, 1930-1941," *Brukner Papers*, DoAaSC.

safe, practical and economical means of travel."¹² Wichita, of course, was the home of numerous plane manufacturers in the private flying niche. Since the end of World War I companies like Travel Air, Beech, and Cessna had opened factories there. Brukner appreciated the Kansans' efforts and was sympathetic with their intent. But he declined to participate. The invitation coincided with Waco's negotiations with Eddie Rickenbacker and the organizers of the 1939 World's Fair, where Brukner hoped to get his aircraft displayed to a much larger audience. Talks broke down, however, as the fair managers insisted on more money than Brukner thought he should pay.¹³ Thus the New York World's Fair, despite the rhetoric declaring the important role private flying played in American aviation, did not include the nation's most successful producer of civilian planes. By this time, Brukner was convinced that boosterism was no longer the road to success.

Two aviation fields vigorously developed in the late thirties, however, and appeared much more lucrative than private flying. The airlines and military manufacturers showed a vitality uncharacteristic of the industry for the majority of that decade. Brukner had no desire to enter the transport business, however. The large, complex, all-metal giants rolling out of the Boeing, Douglas, and Lockheed factories embodied the latest aeronautical and manufacturing technologies, and improved efficiency in scheduled air travel dramatically. More Americans than ever were experiencing flying as passengers in these new planes. As comfort, convenience, and

¹² Wichita Junior Chamber of Commerce to Brukner, February 23, 1939. *Brukner Papers*, DoAaSC.

¹³ Eddie V. Rickenbacker to C.J. Brukner, March 7, 1939. *Brukner Papers*, DoAaSC.

reduced costs enabled more people to experience flying, the sense of adventure diminished. As the market continued to grow, however, Brukner was unable to master the technology needed to enter the transport business in 1938.

He did decide, however, to move Waco into an even wealthier territory. In addition to working the narrowing commercial niche, he now courted the military for business. Since World War I the Army's air service had nurtured aeronautical technology, expecting that further developments would justify the independence of the air arm. With the appearance of the Boeing B-17 in 1935, air leaders confidently proclaimed the arrival of American air power. But when the international situation worsened in late 1938 with the Munich Crisis, they realized that a handful of B-17s hardly prepared the United States for even minimal national defense. They reviewed America's plans for industrial mobilization and found them woefully inadequate. General Henry H. Arnold seized the initiative in reformulating plans to ensure that America's aviation industry could not only create the technology the air force needed, but could also produce the vast quantities of planes he felt national security demanded. Just at the moment the Waco Aircraft Company needed new business opportunities, the air force contacted Brukner about his company's ability and desire to support the defense effort.

The Air Corps' Early Planning Effort

Arnold and other air leaders thought an inadequate industrial base threatened the Air Corps' drive for independence. Part of the problem was internal to the air force.

Arnold was "shocked" and displeased when he directed his Air Staff to help him plan the effective air force Roosevelt had called for in the wake of the Munich Crisis. Under specific instructions to think imaginatively and boldly—"nobody hold back!"—the Air Staff recommended fifteen hundred aircraft to meet American defense requirements around the globe.¹⁴ Arnold was dismayed. His dismay is understandable given the fact that the Air Corps Act of 1926 authorized an Air Corps strength of eighteen hundred planes.

This type of constrained thinking was not unique to the military, however. Trying to formulate a plan to meet the expansion FDR demanded, Arnold called a July 1939 meeting of aviation industry representatives. He first told them, "You are going to write your own ticket." In response, Glenn L. Martin said simply that the industry had enough capacity to do the job at hand. *Aviation* magazine warned manufacturers "[d]on't let's get stampeded" into expanding needlessly, and the United Aircraft official reminded Arnold, "Having faced the cold shadows of a vacant factory, we ha[ve] no appetite for more of the same."¹⁵ The ACC backed them all, stating confidently, "Our survey shows that the industry can increase its military output more than twofold by hiring more labor

¹⁴ Arnold, *Global Mission*, p. 173.

¹⁵ Holley, *Buying Aircraft*, pp. 182-184. Brukner did not attend this meeting, but he took part in a survey commissioned by the Assistant Secretary of War Louis Johnson, inquiring about present capacity and plans for expansion, if any. Thus Arnold and the Army had more information than only that they received from the manufacturers who attended.

and installing machinery to prevent possible bottlenecks in production lines."¹⁶ A frustrated Arnold had anticipated this problem and challenged his Air Staff to fix it:

One of the main things that will have to be watched [during FDR's proposed expansion] is procurement. If we use the maximum facilities of all industry for procuring airplanes in 2 years, and if we put half of those in reserve, the chances are unless we look the matter squarely in the face that industry will get zero orders from the U.S. Army beginning at the end of the 2 year period. Somehow we must find a way to lick that problem. The purpose of this memorandum is to insure that your group does some deep thinking with a view of making this increase a direct benefit to the Air Corps, the Army, the country, and the industry. . . .¹⁷

Arnold, who clearly had service independence in view, identified several important hurdles the air leaders had to surmount before they could prepare the nation or the air force to achieve that goal.

He moved boldly as soon as the opportunity presented itself. In September 1938 with the Munich Crisis in the headlines, Arnold's boss, Major General Oscar Westover, convened a meeting between the War Department and a number of aviation company executives. One of the conference's most important tasks was to investigate "the time elements involved in wartime production of modern aircraft by latest and most improved mass production methods." More specifically, the air force needed training aircraft as soon as possible. The general said, "[t]hese particular types of aircraft are standardized for a longer relative period than are combat aircraft types, hence they afford

¹⁶ *Aircraft Year Book, 1939*, pp. 26-7.

¹⁷ Memo to Colonel Carl Spaatz, November 18, 1938. "Aircraft Production: Monthly production of large airplane companies, 1938 October," Subject File, 1918-49, Box 222, Henry H. Arnold Collection, Library of Congress.

a good basis for educational orders."¹⁸ The Washington meeting re-energized planning efforts and opened a dialogue between the Air Corps and the manufacturing field, including those producers not in attendance. In a summary letter to Brukner, who did not attend, General Arnold wrote, "The interest of your company in this important subject in its relation to National Defense is recognized. Any comments or recommendations that you may care to contribute . . . will be highly appreciated."¹⁹ The conference opened a window of opportunity for Brukner, and he responded quickly.

"We have been following with considerable interest the present modernizing program of your office . . .," he replied in October 1938. He took special interest in the possibility of learning how to deal with the military because he knew he had no expertise in this field. He wrote, "Should your program desire, for educational purposes, to place a trial production order with a commercial aircraft manufacturer not presently engaged in Air Corps work, we would be especially pleased at this time to go into the merits of our organization. . . ."²⁰ Educational orders offered opportunities to familiarize a contractor with the item he would produce during the mobilization. He could build the jigs, fixtures, and other tools required for a rapid increase in manufacturing capacity when the air force placed large orders. The Defense Act of 1920 had authorized educational orders, but Congress had been slow to appropriate funds. Historian Irving Holley

¹⁸ Westover statement to Conference of War Department Representatives and Representatives of the Aeronautical Industry, Washington, D.C., September 6, 1938, "War Department, 1930-1941," *Brukner Papers*, DoAaSC.

¹⁹ Arnold to the Waco Aircraft Company, September 7, 1938. *Brukner Papers*, DoAaSC.

²⁰ Brukner to Arnold, October 15, 1938. *Brukner Papers*, DoAaSC.

concludes that the Air Corps' efforts in 1939 were too little, too late: "The careful preparations that might have been secured at slight expense in the years of peace were at that late date to be had, if at all, only at tremendous cost."²¹ The cost from Brukner's perspective proved equally high, when both Waco and the air force entered World War II still largely unprepared.

Brukner wanted to exploit the Air Corps' openness to get his company's foot in the door. Strongly reinforcing this opportunism, however, was his long-term vision of Waco Aircraft. For almost two decades he had striven to keep Waco at the forefront of the privately owned aviation market. A colleague who shared his high expectations for the period of expansion preceding U.S. entry into the war told Brukner in July 1940, "This war will do for the airplane what the last one did for the automobile."²² That dream died hard. If in the meantime Waco profited from defense work, the lessons learned might facilitate a quick ascent to the top of a reinvigorated commercial market. In late 1938 Brukner was not a fully committed defense contractor, but he had started to make that transition.

Air Power and Civilian Aviation

Brukner's movement in that direction reflected business realities as he saw them, but an evolving aviation ideology powerfully supported his decision. One key

²¹ Holley, *Buying Aircraft*, p. 159.

²² C. K. Gregg, Secretary, Aviation Committee, Junior Chamber of Commerce to Brukner, July 25, 1940. "C Miscellaneous, 1928-1941," *Brukner Papers*, DoAaSC.

tenet, clearly expressed by Herbert Hoover in the early twenties, held that aviation's development would dictate the pace of economic progress in the United States. With unemployment still high, aviation advocates updated this notion by combining it with the axiom that planes were instruments of peace and security. Concerns about the domestic economy and the threatening international context thus made aviation seem to its friends to be a key factor in the nation's progress. John H. Jouett, the president of the ACC, succinctly outlined the evolving ideology in February 1939: "'An Aircraft Industry in Being' is the only means of meeting the demand for good airplanes after trouble starts. Germany's 'Aircraft Industry in Being' was a threat at Munich more potent than her actual air fleet." Extending the logic, Jouett, asserted, "We must maintain commercial superiority. It is as necessary as military preparedness. Indeed, it is part of any logical preparedness program."²³

One would expect the ACC to espouse such views, but actually the ideology attracted many important adherents. Airmen assured the aircraft industry "that entire harmony exists between the Aeronautical Chamber of Commerce and the Army Air Corps."²⁴ Politicians, too, became active proponents of the ideology. Congressman Jennings Randolph seconded the National Advisory Committee for Aeronautics, which stated that "[t]he crisis in Europe in the fall of 1938 brought forcibly to world-wide attention the overshadowing influence of air power in international affairs." Randolph

²³ Jouett, "The Industry of the Air," *Brukner Papers*, DoAaSC.

²⁴ Brigadier General A. W. Robins to All Manufacturers of Aeronautical Equipment, January 23, 1939. "War Department, 1930-1941," *Brukner Papers*, DoAaSC.

believed "wartime supremacy in the air is based upon peacetime supremacy in the air," and he explained that "[w]e must during peacetime promote and maintain civil aeronautics, providing for its constant growth and improvement, so that our factories can keep busy and make the necessary expansion, so that inventions may be availed of and improved, so that the skills of workmen and of mechanics may be developed and multiplied." He then reminded Americans that "we must not lose sight of the fact that military air strength is dependent in the final analysis upon the strength of civil aeronautics."²⁵ Senator Robert R. Reynolds took up the cause in the other house, stating, "Air power knows no boundaries and its wings have annihilated time and distance. . . . I believe that the only way we can guarantee peace for America is to make America first in the air."²⁶ President Roosevelt was in tune with the new ideology. He wrote, "Civil Aviation is clearly recognized as the backlog of national defense. . . . One fact which stands out is that hardly another civil activity of our people bears such a direct and intimate relation to the national security as does civil aviation."²⁷ While the military primarily benefited from this mindset (General Arnold was indeed very pleased), the new ideology favored all who were involved in any way with the industry.

²⁵ Randolph, "Aviation and American Welfare," presentation to National Aviation Forum, Washington, D.C. *Brukner Papers*, DoAaSC.

²⁶ Reynolds quoted in *Aircraft Year Book, 1939*, p. 26-7.

²⁷ Presidential Memorandum included in Colonel Edgar S. Gorrell, "Shall America's Aviation Set the Pace?" presentation to National Petroleum Association, Cleveland, Ohio, April 14, 1939. *Brukner Papers*, DoAaSC.

From Brukner's point of view, this ideology outweighed the business risk inherent in change. But risk was certainly not eliminated and Waco Aircraft had not passed through a magic gate to profitability. The transition to defense contracting was halting. Even with Roosevelt's call for a significant program for national defense in his January 1939 congressional address, military work came slowly. Early that year, Brukner initiated engineering changes to the Waco F-7 model, a plane intended for the sportsman pilot, to bring it in to compliance with Army standards for trainer aircraft. For example, Waco widened the landing gear from 74 1/2 to 100 11/16 inches and installed a Continental 220 horsepower engine and a metal propeller. By June 1939 his innovation was paying off; the Air Corps placed a small order for thirteen trainers, designated the YPT-14.²⁸

As the following table shows, Waco's manufacturing capability placed it among the industry's largest producers. These are the figures Arnold had on hand as he planned Air Corps expansion. He noticed the maximum numbers in particular, questioning the manufacturers' ability to meet the demand he had in mind. It was not at all clear either to Arnold or manufacturers like Brukner that the private sector could bridge this gap. Waco's thirteen trainers were a start, but a feeble start at best.

Brukner placed top priority on the military business, even though it was a small order. He was continuing activities to generate commercial sales, but the outlook was not good, so he focused on the government. Declining an invitation to attend a flying

²⁸ Brandly, *Waco Airplanes*, p. 182.

contest he wrote, "I know that you will realize the pressure of activities at this season of the year, and the exceptional condition this year due to the Government Trainer activity, and so I am obliged to state that any attendance from this organization . . . may not materialize at all."²⁹ Waco's military work needed his attention.

Table 5-2
Monthly Production Capability, 1938

<u>Company</u>	<u>Capacity</u>	<u>Other Information</u>
Beech	presently: 8 biplanes; 1 twin-motor max: 100 biplanes	300 employees
Bell	max: 56 fighters 23 twin-engine fighters 39 both	200K ft ² factory
Bellanca	max: 100 wood 60 metal	
Boeing	max (simultaneously): 34 P-26s 25 P-12s 3 B-17s	1426 employees 1007 employees 1461 employees
Cessna	max: 15 single-engine 5 twin-engine	
Curtiss-Wright	max: 140	
Douglas	present: 18 max: 45	980 employees
Fairchild	present: 20 max: 40	
Kellett	max: 12 autogiros, 16 trainers	
Martin	max: 100	750K ft ² ; 3,300 empl.
North American	present: 60 max (simul): 45-50 basic combats 17-20 observation	
Ryan	max: 20	
Seversky	max: 22	
Stearman	max: 15 first year, 35 second year	
Swallow	max: 4	
Vultee	max: 15	
Waco	max: 84	100K ft ² factory

Source: Correspondence, "Aircraft Production: Monthly production of large airplane companies, 1938 October," Subject File, Box 222, Henry H. Arnold Collection, Library of Congress.

²⁹ Brukner to Maurice L. Waters, June 22, 1939. "W Miscellaneous," *Brukner Papers*, DoAaSC.

Thirteen planes, though, hardly taxed his facilities. He had reported earlier in 1939 that his 100,000 square foot factory could produce 1,000 standard cabin airplanes per year. At the end of the year Waco still was still experiencing significant overcapacity; in December 1939 Brukner reported to the military that his factory logged 19,065 man-hours out of a maximum capacity of 129,975 man-hours per month.³⁰ While this defense contract taught Waco a little about dealing with the military, it did not carry the firm into mass, as opposed to batch, production. As an educational order, it failed, because the product was already familiar to Waco and because it resulted in no tools that might facilitate expansion when the Air Corps called for more planes. It did, however, have an important, immediate impact on the company. With gross sales of 1.2 million dollars in fiscal year 1939, Waco earned a five thousand-dollar profit—the first since 1935.³¹ The military effort was a start.

Brukner, ever the optimistic entrepreneur, entered 1940 with high expectations that Waco would find a more productive role in the defense program. At first no orders came. He nevertheless actively continued to seek new contracts, and in May he contacted the Anglo-French War Purchases Mission, hoping to make some progress in the European market.³² The huge congressional appropriations for defense following the

³⁰ Brukner to *Aero Digest*, January 9, 1939. "A Miscellaneous," *Brukner Papers*, DoAaSC. Man-hour figures from Vander Meulen, *Politics of Aircraft*, p. 229.

³¹ "Audit Reports, 1934-1938 and 1939-1942," *Brukner Papers*, DoAaSC.

³² Brukner to Mr. Ballentine, Anglo-French War Purchases Mission, May 31, 1940. "B Miscellaneous," *Brukner Papers*, DoAaSC.

fall of France in May 1940 sustained Brukner's expectations, despite the fact that his factory had still received minimal orders.

General Arnold perceived this event as a turning point in American aviation. He remarked that "Congressional Appropriations Committees [began] asking 'How much do you need?' instead of 'Who are we going to fight?'"³³ On 3 June the Waco Board of Directors outlined activities which might translate their expectations into reality. Noting that "Federal bidding has, for the present, submerged, apparently, commercial aircraft demands, leaving this field open for any deflection, and wholly unpredictable," the Board discussed the "possibility, or advantage, of developing a new trainer. . . ." It also considered "[t]he perspective for our company in the field of subcontracting on parts incident to the acceleration of the aircraft industry; and . . . the advisability of the management of our corporation keeping in close and continuous contact with the Federal lines and requirements at Washington."³⁴ The Board decided in favor of all the initiatives, and Brukner was optimistic. That same week he wrote to a banking acquaintance, "We are just now in a greatly reduced private owner market in our price class, and have not yet clicked in the defense program. . . ." But he added, "Of course we are expecting to engage our full facilities in the defense program. . . ."³⁵

³³ Arnold, *Global Mission*, p. 202.

³⁴ Minutes of Board of Directors Meeting, June 3, 1940. "Waco Board of Directors Minutes, April 30, 1940 - December 2, 1946," *Brukner Papers*, DoAaSC.

³⁵ Brukner to Joseph L. Overlock, June 8, 1940. *Brukner Papers*, DoAaSC.

A Costly Detour

July 1940 brought encouraging news for Brukner, whose factory was again busy. Waco had orders for 125 training aircraft from private schools contracting with the Civil Aeronautics Administration (CAA) for advanced flying instruction. Under the auspices of the Civilian Pilot Training Program (CPTP), fixed base operators and universities were providing aviation training to young Americans. Legislation passed by Congress and signed by President Roosevelt in June 1939 had for the first time authorized vocational training in the aviation field outside the military. The product of careful planning by Robert H. Hinckley, an original member of the CAA and the CPTP's first director, the program had two primary goals. First, it was the latest in a long list of New Deal initiatives designed to spur economic recovery, this time for the private flying field in American aviation. Government subsidies for flying training provided direct support to the universities and fixed base operators offering the training, and the contracts indirectly aided the commercial aircraft manufacturers who had suffered from inadequate demand throughout the decade of the '30s. The second goal was the formation of a large pool of well-trained candidates for further pilot training with the Navy or the Army. This civilian contribution to the cause of national defense provided the most credible argument for seeking money from Congress. Under Hinckley's adroit

leadership, the program expanded quickly in 1939 and 1940 to include advanced training in aircraft larger than those used in primary training.³⁶

This program especially stimulated business with the airport operators and flying schools, which had struggled financially during the depression. Among the beneficiaries was Roscoe Turner Flying Services, Inc. Turner, in fact, led a whirlwind of activities in 1940, resulting in the formation of the CPT Association, a trade organization representing those businesses with interests in the CPTP. Thus, a government innovation brought about the formation of an interest group to support the innovation. This pattern was characteristic of America's mature administrative state, and although it did not fit the myth of democracy, it worked rather well for all of the participants, including those in the Roosevelt administration. Turner had identified a constituency within the aviation industry and was articulating common interests, linking them to national political objectives, and lobbying for higher priority in the Congress and executive agencies. He sought the support of the National Aviation Training Association in January 1940, succinctly explaining the economic, social, and political significance of the CPTP:

After a quarter of a century of struggle CPT has sold aviation to all of our people, created standards of training that have incredibly high safety records and has given the industry a new dignity and stability by the acceptance and adoption of the CPT programs in the colleges and universities of the Nation. . . . With a government contract in his hand the CPT flight contractor has brought the commercial banking system of the country very definitely into the aviation picture.

³⁶ Dominick A. Pisano, *To Fill the Skies with Pilots: The Civilian Pilot Training Program, 1939-1946* (Urbana: University of Illinois Press, 1993), pp. 30-56.

As Turner's enthusiastic claims showed, the hype surrounding aviation still had considerable momentum, and others contributed to the new energy the CPTP infused into the private flying field. A fellow fixed-based operator declared that "there is probably more interest on the part of officials and business men than at any time since 1927."³⁷ Another offered that "I am glad to say that it has put aviation on a highly respected basis. . . . I have sold eight new planes this year. So you see the CPTP has made a new life for me as well as hundreds of others that I know of."³⁸ The excitement that those inside and outside the private flying field displayed in early 1939 gave additional impetus to the conviction that aviation was one of—if not the—most important components of U.S. military power. As business and government leaders expounded the aviation ideology, the public's enthusiasm influenced the officials of the New York World's Fair to give private flying equal footing on the program with military and commercial transportation. The fair, like the CPTP, showed the world the tangible steps the American people were taking to protect their national interests.

Turner's and other's rhetoric made the political point that the CPTP was doing what the rest of the New Deal had not—rebuilding "at local and not federal expense, scores of new airports and . . . rehabilitat[ing] hundreds of airports abandoned up to the beginning of operation of the CPTP. . . ." Manufacturers' "facilities capable of building component parts of military aircraft have been tremendously expanded," and, perhaps

³⁷ Ibid., p. 68.

³⁸ Ibid.

most importantly, the "CPT has in one year created a pool of approximately 50,000 men who have received primary training as pilots and who in a further brief period of training could be used for military missions. . . ."39 The CPTP brought the smaller manufacturers and other aviation businesses in line with the prevailing industry ideology.

The best history of the CPTP, Dominick Pisano's *To Fill the Skies with Pilots*, argues that the program was consistent with other New Deal initiatives in fundamental ways. Its dual goals gave it an ambiguity that reinforced the perception that it was experimental. As other historians have pointed out, the New Deal often experimented with government policies, providing Roosevelt an opportunity to reinforce those programs he thought politically effective and to cancel those that did not further his agenda.⁴⁰ The president initially supported the CPTP as a prudent step in preparing the nation for war. When the small number of pilots joining the military caused friction with the War Department, however, Roosevelt criticized the program. His attack had the immediate effect of causing Congress to cut the budget.⁴¹ Despite vigorous lobbying, however, Turner and others were unable to change the program into something more durable. Under the pressures of war mobilization, the CPTP was relegated to the status of a piecemeal program of mobilization, consistent with historian Paul Koistinen's

³⁹ Turner to Jesse Jones, January 8, 1940. Roscoe Turner Papers, Number 5267, Box 17, Folder 6, AHC, UW.

⁴⁰ See, for example, Gerald D. Nash, *The Crucial Era: The Great Depression and World War II, 1929-1945*, 2nd ed., (New York: St. Martin's Press, 1992).

⁴¹ Pisano, *To Fill the Skies*, pp. 78-79.

characterization of Roosevelt's handling of industrial mobilization.⁴² The changing power relationships within the government ultimately granted the military tremendous authority in managing the war effort. The civilian sponsored training program quickly floundered in this shift. Pisano's convincing portrayal of the CPTP and its advocates' struggles for status within the Roosevelt administration adds a new dimension to our understanding of the rapid shift from domestic to international priorities after September 1938.

Nevertheless, the CPTP provided a much-needed boost to companies not yet involved in defense. Besides Waco, Cessna "scrambled" to play a role in the CPTP because it, too, had not yet "clicked" with the military.⁴³ Piper benefited most from the spike in demand the program caused, but the company's president was skeptical about the politicians' claims of support for the private flying field. The House of Representatives Committee on Interstate and Foreign Commerce reported the bill to the full House with an endorsement saying that the CPTP would cause "a much needed stabilization of the American aircraft industry." Piper's response reflected the experience he had gained in the light aircraft segment of the private flying market: "Any government aid which would increase private flying today would have to be perpetual or

⁴² For a good overview of his argument, see Paul A. C. Koistinen, "Warfare and Power Relations in America: Mobilizing the World War II Economy" in *The Home Front and War in the Twentieth Century: The American Experience in Comparative Perspective*, ed. James Titus (Washington, D.C.: GPO, 1984), pp. 91-110. Koistinen's provocative, corporate-liberal argument holds that Roosevelt lost the opportunity to alter power relationships in the American political economy fundamentally. His delegation of authority to an alliance between military and business leaders resulted from the president's poor management of the chaos of immediate mobilization, Koistinen posits.

⁴³ Roscoe Turner Papers, Number 5267, Box 14, Folder 29, AHC, UW.

the result would be an over-production of planes and pilots when the subsidy was discontinued."⁴⁴ The Piper Cub was the standard CPTP trainer in 1939 and 1940, but after the move into advanced training, other companies took over the market.

The Waco Aircraft Company's orders for 125 advanced trainers taxed Brukner's personnel and facilities. He stated that "[t]he limited supply of skilled and semi-skilled labor indicates the need for a training program."⁴⁵ Later in July the high demand for aircraft parts forced his managers to either buy more equipment or farm work out to businesses around Troy. The long lead-time for delivery on machine equipment precluded the former, leaving Brukner struggling with the burden of additional subcontracting.⁴⁶ The further expansion of the Civilian Pilot Training Program in August increased the demands on Waco's facilities. The orders for 200 trainers, to be delivered by 1 October 1940, kept the plant busy. In fact, Brukner hired over 400 new workers and worked around the clock to handle the large orders. By 15 August Brukner reported that "trainer production has passed the two-per-day mark, and is being accelerated as fast as the delivery of materials will permit."⁴⁷ These busy times resulted in a seventy-four thousand-dollar profit for fiscal year 1940⁴⁸—and the company still did not have ties to

⁴⁴ Pisano, *To Fill the Skies*, p. 33.

⁴⁵ Survey of Waco Aircraft Company, July 15, 1940. *Brukner Papers*, DoAaSC.

⁴⁶ Waco internal memo, Pearson to manager, July 20, 1940. "Pearson, Russell E., 1935-1942," *Brukner Papers*, DoAaSC.

⁴⁷ Brukner to Earle L. Johnson, August 15, 1940. "J Miscellaneous, 1932-1942," *Brukner Papers*, DoAaSC.

⁴⁸ "Audit Reports, 1939-1942," *Brukner Papers*, DoAaSC.

the military. As important as these civilian orders were to Waco, they left unfulfilled Brukner's hope to "click" in defense. They also challenged Waco to be better prepared when the "official allotment of business" from the military arrived.

Trying to leave the commercial market and failing to emerge as a defense contractor, the Waco Company was caught in an awkward position. The situation's precariousness struck Brukner at the end of 1940. In early November the CAA canceled some orders for advanced trainers. Each of the four months after the fall of France saw an average of sixty-eight orders for trainer aircraft, but in November and December Waco received only eight each month.⁴⁹ Brukner was not the only one to suffer a setback; A. C. McInnis, speaking on behalf of airport owners and managers, said in November 1940, "I believe that it is about high time we did something to protect ourselves—our investment and our future as fixed based operators."⁵⁰ William Piper's forecast was proving accurate. A lull beset Waco after the flurry of activity following France's defeat in May, and Brukner stood to lose many of the hundreds of workers he had just trained. On 14 November, he wired the Curtiss-Wright Corporation to inform it of "our unique ability to handle substantial subcontract production for you as our present trainer production tapers off to conclusion. [We are currently] working six hundred

⁴⁹ "Daily Sales Reports, October 1, 1939 - September 30, 1940 and October 1, 1940 - September 28, 1941," *Brukner Papers*, DoAaSC.

⁵⁰ McInnis to CPT Program Operators, November 19, 1940. Roscoe Turner Papers, Number 5267, Box 17, Folder 6, AHC, UW.

factory employees [and] can shift over to your work beginning right now."⁵¹ As it turned out, Curtiss-Wright had no business for Waco, but Brukner found business with the Continental Motors Corporation and Republic Aviation. With no military contract of its own, the Waco Aircraft Company was forced to remain in limbo. Brukner steadily grew more uncomfortable in the status he characterized as that of a "quasi-commercial" manufacturer.⁵²

Nevertheless he continued to embrace the new aviation ideology and used it to justify a commitment to defense, even though he had no orders from the military. At the Waco Board of Directors meeting on 6 January, the managers began the process of financing "an expansion of our physical plant and equipment" and endorsed these ends as "patriotic and right."⁵³ By April, Brukner had dropped the "quasi-commercial" label and clearly stated that "our prime effort is in defense activity."⁵⁴ His expectations remained high despite the continued prominence of subcontract work in his factory. In August, however, his faith at last was rewarded.

⁵¹ Telegram, Brukner to Frank Maley, November 14, 1940. "Curtiss Aeroplane Division (Curtiss-Wright Corp.), 1940-1941," *Brukner Papers*, DoAaSC.

⁵² Brukner to Roy A. Hunt, January 23, 1941. *Brukner Papers*, DoAaSC.

⁵³ Minutes of Board of Directors Meeting, January 6, 1941. "Waco Board of Directors Minutes, April 30, 1940 - December 2, 1946," *Brukner Papers*, DoAaSC.

⁵⁴ Brukner to James C. Baggott, April 17, 1941. "B Miscellaneous, 1930-1941," *Brukner Papers*, DoAaSC.

Defense Work

The defense program had been furiously developing, just not at Waco's level. Congress had appropriated over 2.4 billion dollars for the Air Corps since the fall of France in June 1940. General Arnold knew trainers were important, but initially his attention was focused on combat aircraft. Bombers and fighters were needed. Besides they promised to convince the Army, Navy, and politicians that airmen deserved organizational independence. He was extremely concerned that President Roosevelt might give these airplanes away to arm Germany's enemies, thereby delaying direct American involvement. Arnold saw that as a detour on the road leading to real U.S. air power. Arnold and Henry Morgenthau, Jr., the Treasury Secretary, crossed swords in January 1940 over the issue of foreign sales. Arnold describes the conflict in his memoirs this way:

The responsibility for building up an Army Air Force was not that of the Secretary of the Treasury. He might give away, sell, or what-have-you, every plane produced, the latest planes which our engineers could develop, the most modern gadgets and devices out of our factories, and would lose nothing by it. It was someone else's responsibility. It was mine. To build up our Air Force was an obligation that I had to Congress, to the President, to the people of the United States. It was a job that was still ahead of me, for at that time we had no Air Force.⁵⁵

His concern and the urgency of the build-up dictated that orders for combat aircraft go to those companies well versed in defense contracting. Educating suppliers was too costly in terms of time and money. Businesses like Boeing, Martin, Curtiss-Wright, and Republic had enjoyed the lion's share of the mobilization orders to date. By the summer

⁵⁵ Arnold, *Global Mission*, p. 186.

of 1941, however, these companies were approaching capacity, and it was obvious that continued expansion demanded more creative approaches to mobilization. Waco's chance had finally arrived.

In August 1941 the Air Corps, acting on pressure from the State Department, outlined the aeronautical characteristics of a cargo aircraft for export to Latin American countries. It was to be a two-engine, low performance plane, capable of operating from poorly developed airfields. Carrying twenty troops or equivalent weight in equipment, the "tactical mission to be performed by this type of aircraft is mobile transportation of material or personnel." This aircraft had to be simple and rugged, as Air Corps planners envisioned "the possibility of crash landings" in harsh conditions.⁵⁶ The plane's political mission was to counter the German Ju-54, a Nazi cargo aircraft that played a potentially significant role in the German effort to stir up unrest in Central and South America. With German aircraft serving as political symbols in an unstable region, Roosevelt's State Department felt threatened. Indeed, Roosevelt had sent a flight of six B-17s to Latin America in February 1938 to show the flag and to demonstrate that America had a far-reaching air arm as well as a navy.⁵⁷ After achieving consensus at the very top of the Air Corps hierarchy on the nature of the new cargo aircraft (designated the XC-62), the administration gave procurement planning to the Materiel Division in Washington, D.C. Brigadier General O. P. Echols relayed the order to officers at Wright Field in Dayton,

⁵⁶ Brigadier General Muir S. Fairchild to Chief of Army Air Forces, August 21, 1941. Air Force Materiel Command Archives, Wright-Patterson Air Force Base, Ohio.

⁵⁷ For a good treatment of this unique event see Underwood, *The Wings of Democracy*, pp. 103-122.

Ohio, saying, "As I get the picture—it is one of these things that came right out of the sky. . . ."58

General Echols and Lieutenant Colonel F. O. Carroll hammered out a production plan, which was based on several key Air Corps' assumptions. One of the explicit ground rules was that the cargo plane project not interfere with on-going efforts. Specifically, "the present shortage of aluminum will soon be followed by an acute shortage of steel, and consequently it is desirable, from the start, to consider this project as one in which a maximum amount of wood and minimum amount of metal will be used."⁵⁹ Echols added, "We are not going to give them a lot of facilities. . . . It is getting so now that every time you get a contract out you have to not only pay for that but you have to build houses for the workmen. . . ." An extremely short development and production schedule complemented these restrictions. Echols pointed out that "they want them [the planes] as fast as they can; the South American situation is what is yelling for them." Clearly the key variables in choosing a company for this program involved unused engineering capability and production capacity.

With the usual military contractors already heavily engaged in the defense program, Echols and Carroll considered the next tier of candidates to develop and produce the XC-62. Echols had recently encountered a representative of the Ryan Company who was "running around wanting to build these Cargoes [C-47s or DC-4s]

⁵⁸ Transcript of telephone conversation, Echols to Carroll, August 28, 1941. Air Force Materiel Command Archives, Wright-Patterson Air Force Base, Ohio (hereafter AFMCA).

⁵⁹ James H. Doolittle, memorandum, August 20, 1941. AFMCA.

because he hasn't any business." Echols' solution was simple: "I want [Douglas] to throw this sub-contracting at him—a lot of it—so he can't say he doesn't have any business." Ryan would thus be too busy for this new project. Colonel Carroll suggested Bellanca, but he then undercut his own recommendation, saying, "they always seem so slow to do anything. It is hard to trust them." The two officers considered Beechcraft too "loaded up" and turned their attention to Waco. Carroll volunteered that "I . . . have a lot of confidence in Arcier [A. Francis Arcier, Waco's chief engineer]; I think he is a pretty solid citizen with a good technical background and apparently they are in a place now where they could go right ahead" with the program.⁶⁰ Specifically, Arcier reported to the Air Corps that "the Engineering Department, consisting of approximately 28 men, was practically totally available to undertake the design of the Cargo Airplane under consideration."⁶¹ He added, "[t]hey have built pretty good airplanes . . . in the past; that is commercial airplanes." General Echols agreed; "I think the idea to get Waco to father the design is the best one I have heard."⁶² With that, the Air Corps completed Waco's transition from civilian to military production.

The ability of these officers to make important decisions about military-industrial relations in a short phone conversation revealed much about the mobilization program. It was functioning under tremendous pressure of time and was relatively disorganized. President Roosevelt threw initiative up for grabs in September 1939 when

⁶⁰ Transcript of telephone conversation, Echols to Carroll, August 28, 1941. AFMCA.

⁶¹ Memorandum Report, Experimental Engineering, Materiel Division, September 13, 1941. AFMCA.

⁶² Transcript of telephone conversation, Echols to Carroll, August 28, 1941. AFMCA.

he formed the War Resources Board to review the Industrial Mobilization Plan the War Department had updated earlier that year. While that was his way of saying he was dissatisfied with the plan, War Department officials interpreted his move as the first step of implementation, especially since FDR had called for the largest peacetime build-up in U.S. history earlier in the year. The resulting confusion and the president's continued ambivalence towards mobilization planning (1940 was an election year) ensured that the people closest to the problems would have to work out all of the details.

Historian Paul A. C. Koistinen believes this awkward period of mobilization "proved at least one thing: the twenty years of industrial mobilization planning were largely wasted." He reprimands the armed services for not recognizing "the implications of their operations on the civilian economy. Both the Army and the Navy manifested incredible myopia concerning the concept of economic balance."⁶³ In the narrower context of aviation, however, Koistinen's critique seems exaggerated. Munich had prompted Roosevelt to express high expectations for the Air Corps, and Arnold and his subordinates used this mandate to galvanize an industry in need of new business. In the course of those changes, politicians, airmen, and the industry came to share a vision of American air power, while leaving to the Air Corps the responsibility for charting a course to its realization. Echols and Carroll were building bridges where none had existed before, and they were building them fast.

⁶³ Koistinen, *The Hammer and the Sword: Labor, the Military, and Industrial Mobilization, 1920-1945* (New York: Arno Press, 1979), p. 558.

My findings on the military's crash course in industrial policy formation complement those expressed in historian Jonathan J. Bean's study of small business policy during World War II. That segment of the economy, which included numerous aviation firms, was affected dramatically by those congressional leaders who were employing nationalistic ideology and a sense of crisis to pass laws supporting the efforts of small companies to deal with government procurement practices that favored big business. Bean shows how these politicians drew on the public's sympathy for small firms to garner support for the creation of the Smaller War Plants Corporation. Successfully portraying small business as a disaffected constituency and as a critical component of the American "way of life," Congress capitalized on the perceived crisis of the early mobilization period to show its support for this group of businessmen. The nexus between ideology and crisis brought government action, and, as Bean argues, this development reflects a common pattern in twentieth-century American political economy.⁶⁴

Waco's entrance into the defense market was consistent with the aviation ideology that held that civilian aviation would provide a foundation for military air power. Clayton Brukner embraced that ideology, but as the Waco Aircraft Company's

⁶⁴ Bean, *Beyond the Broker State: Federal Policies toward Small Business, 1936-1961*, (Chapel Hill: North Carolina Press, 1996), pp. 169-177. Although many aviation companies, including Waco Aircraft, fit the rather flexible definition of small business, few used that status as a means to argue for higher priority among government policy makers. Brukner did not, and the Aeronautical Chamber of Commerce usually emphasized the potential importance of the aviation industry to national defense, not American culture. Moreover, the small businesses, like the aviation industry, had no effective trade association to lobby on their behalf in Washington, DC. Brukner and other aviation leaders thus had little incentive to leave their own fractured associations to try to gain status in a similarly divided small business milieu.

experience indicated, this transition was neither easy nor natural. The Air Corps had relied as long as possible on those companies most familiar with Army requirements to mobilize American resources. They had put off the day when exclusively civilian manufacturers would need to be educated in the ways of defense contracting. There was a learning curve in this business and the nation would have been in better shape to defend its interests if Waco and other small enterprises were further up the curve by this time. The Air Corps had intended to undertake a rigorous program of educational orders, but this failed to materialize because of small congressional appropriations and the pressure the airmen felt to produce combat planes. Thus the Waco Aircraft Company's education became a crash course. Brukner's instruction began just as America faced an increasing threat from Japan and as the general mobilization efforts were intensifying. He learned the hard way about engineering new aircraft in a military context, fighting the government bureaucracy for new facilities, and finding skilled labor; he applied some of those lessons to Waco's most successful defense program, one involving military gliders.

During the war years Brukner found a new niche in the aviation industry. His earlier change in business strategy had maintained Waco's viability in the Great Depression, leaving the firm positioned to capitalize on the expanding defense program. Three years passed from the decision to first communicate with the Air Corps to Waco's emergence as a defense contractor. Brukner showed in these years his ability as a business leader in a small but important sector of the industry. In waters churned by the larger aviation companies, American big business, and big government bureaucracies, Brukner's skillful navigation allowed Waco to reach its immediate destination. His

vision and enthusiasm gave Waco employees a focus for their efforts. His patience was rewarded with substantial defense business, yet he would need all his leadership skills to guide Waco through the following years in a market and under government regulations with which he and his fellow workers were unfamiliar.

Chapter 6

The Waco Aircraft Company and World War II

Historians have devoted much energy for many years to the task of understanding technological change and its impact on society. They have studied the primary actors and the values they held as they made key decisions in the process of technological development. In twentieth-century society the importance of organizations in technology has given rise to histories of institutions and interest groups as key players in the process of economic development. Universities, corporations, government agencies, big labor, and other entities have been shown to have determined the paths certain technologies take in moving from a concept to a product or service in the marketplace.¹ Technology is a collection of “knowledge about things, products, or processes,”² and the generation and further development of that knowledge can lie among any or all individuals and organizations with a stake in the technology.

The work these historians have done will help us understand a crucial turning point in the development of the Waco firm. Historians have, for instance, developed the concept of communities or networks that bind interested parties together in their

¹ Histories of technology have increasingly embraced the complex interplay of societal actors in shaping the products and knowledge of a new technology. Its deployment in society is contingent upon decisions that a number of different stakeholders make in the often-long process of development. Good examples of these histories include Constant, *The Origins of the Turbojet Revolution*; Edwin T. Layton, Jr., *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Baltimore: Johns Hopkins University Press, 1986); Vander Meulen, *The Politics of Aircraft*; Douglas, *Inventing American Broadcasting*; Stuart W. Leslie, *Boss Kettering* (New York: Columbia University Press, 1983); Galambos with Sewell, *Networks of Innovation*.

² Constant, *Origins of the Turbojet Revolution*, p. 8.

endeavor to introduce innovative ideas to a technological system. Edwin Constant argues that these communities are hierarchical, containing subcommunities with various levels of commitment to a technology's development. In our story, for example, the airframe manufacturers like Waco were invested much more fully in aircraft technology than was Goodyear Tire, which produced plane tires yet had other, stronger interests in developing automobile tire technology. Similarly, Waco relied less on knowledge derived from the science of aeronautics than did those corporations committed to defense contracting where high performance aircraft depended on assimilating the latest information in order to enhance combat capability. Any technological change, Constant argues, must be negotiated through elements of the hierarchical community to gain acceptance in society at large.³ The wealth and power that various members of the community wield in thwarting or facilitating a new technology or a modification of an existing one determine the success or failure of the innovation.

Defining the boundaries of the community is problematic. They may change over time, and members may come or go. In the case of the Waco Aircraft Company during the Second World War, the challenge is particularly troublesome. On one hand the major components of the community were simple to identify—the Army Air Corps and Waco Aircraft. But neither was monolithic. On the other hand, the subcommunities within the military, the airmen and the ground force commanders, for example, had very different values and opinions about the innovations Waco helped manage. The airmen were fighting furiously to redraw the boundaries within the military establishment, and the process of technological innovation often interfered with that effort. Moreover,

³ *Ibid.*, p. 9.

Brukner had opportunities to forge new relationships within the aeronautical industry, thus supplementing his membership in the civilian aviation community with new civilian ties or with alliances with defense contractors. In short, the community was very dynamic at the same time it was managing the process of technological innovation.

Technological innovation lies at the heart of the process of defense acquisition, and ideas and beliefs about the nature of warfare have an important influence on acquisition decisions. During World War II the Air Corps' strategic bombing doctrine served as the most potent ideology shaping airmen's views.⁴ Its emphasis on independent air operations in combat led to a sustained campaign for organizational independence from the Army. While air leaders had won some congressional support for the idea during the interwar years, most politicians had stopped well short of advocating a separate air arm. With the nation's move toward mobilization beginning in 1939, General Arnold had perceived an opportunity to renew the drive for independence. His ambition infused the AAF and affected decisions on the homefront no less profoundly than those made on the battlefronts.

The Waco Aircraft Company's role in the AAF's scheme of technological innovation demanded a transformation of its corporate culture.⁵ Sweeping changes

⁴ An organization's prevailing ideology powerfully influences the hundreds of decisions the process of innovation demands. Any group needs a purpose, and an ideology provides a mission and a supporting set of objectives, which guide the group toward accomplishing its goal. An equally important aspect of an ideology is its ability to orient the organization with respect to its past and a vision of the future. This shared definition of the organization and what it will be guides decision-making and is reflected in planning and the execution of the plans. Howard G. Jones, III, "A New Rival: The Rise of the American Air Force," *Air Power History* Winter 1991, p. 28. Note: the Army Air Corps changed to the Army Air Forces (AAF) on 20 June 1941.

⁵ My conception of innovation is very straightforward; it is anything new to an organization. It does not have to be something original outside the organization--brand new creations are not necessary for innovation to occur. This is an important point. Military gliders existed in the German and British air forces by 1939.

replaced incremental improvements. They included a new customer, mass-production, a new product, accelerated schedules, and increased involvement with government bureaucracy. The magnitude of these innovations cannot be overestimated; indeed historian Alfred Chandler claims that the last item alone introduces major business risks. He writes, "Just as changes in the processes of production and distribution within units have a powerful impact on the nature of transactions between units [organizations], so do changes in contractual relations affect the operations carried on within units."⁶ Innovation of this fundamental type would challenge any business leader, and Brukner wisely had an informal transition plan that assumed a period of time during which he and his managers could adapt to the many changes Waco faced. In reality, though, Brukner had little time to adjust to the new situation.

He took on two challenging roles in the defense program almost simultaneously. The cargo aircraft was Waco's first experience as a prime contractor for the military, and he further taxed his organization by bidding on the glider development program. The complexity of either of these projects would have taxed this organization. In the case of the XC-62, the AAF's fluid requirements and Waco's need for more factory space stretched the engineering and subcontracting divisions to the limit. The gliders demanded more of the same, and the AAF added a requirement for Waco to cooperate closely with numerous other manufacturers (something Waco had not done before).

The Army Air Forces (AAF) had not even thought of them until 1940. This conception of innovation captures the simultaneous efforts of many organizations within the U.S. Army to employ the military glider technology. I have borrowed this broad interpretation of innovation from Louis Galambos, "The Innovative Organization: Viewed from the Shoulders of Schumpeter, Chandler, Lazonick, et al.," *Business and Economic History* Vol. 22, No. 1, Fall 1993, p. 84.

⁶ Chandler, *Scale and Scope*, p. 18.

Brukner had to deal with these challenges all at once, while the AAF pressured him to do better faster.

The airmen's focus on doctrinal development had caused the air force to enter the industrial mobilization game late. Enthusiasm had grown after World War I into the expectation that planes could serve as the ultimate weapon of deterrence. Failing that, many leading airmen claimed that high altitude, daylight, precision bombing of an enemy's economic infrastructure would single-handedly win future wars.⁷ Continued technological advancement fueled the public's and airmen's enthusiasm for this vision of future wars—one which would avoid the holocaust of the Great War.⁸ In an effort to turn these visions into reality, the airmen pursued aeronautical innovations that supported their evolving conception of war. The best example of this ideologically focused research was the Boeing B-17.

The B-17 emboldened the Air Corps in its struggle for more money and priority within the defense establishment. No longer was the concept of aerial warfare only visionary. The Boeing B-17 had the range and payload that would, with sufficient numbers of planes, bring the enemy quickly to his knees. The airmen turned to specific political leaders and the American public in an effort to forge a solid political foundation. General Arnold recruited as friends and political allies General George C. Marshall, later

⁷ For good treatments of the emergence of strategic bombing see Frank Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force, 1907-1964* (Maxwell Air Force Base, AL: Air University Press, 1971); Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917-1941* (Washington, D.C.: GPO, 1955); and Lee Kennett, *A History of Strategic Bombing* (New York: Scribner's, 1982).

⁸ Aviation permeated many aspects of American culture. Studies exploring its influence include Michael S. Sherry, *The Rise of American Air Power* (New Haven: Yale University Press, 1987); Corn, *The Winged Gospel*; and William M. Leary, ed., *Aviation's Golden Age: Portraits from the 1920s and 1930s* (Iowa City: University of Iowa Press, 1989).

to be Army Chief of Staff, and Harry Hopkins, one of President Roosevelt's most trusted advisors. With their aid Arnold built support for strategic bombing, even though funding for heavy bombers was still inadequate.

With tangible political support in hand, General Arnold wrote to the chief of Materiel Division at Wright Field in Ohio on 9 January 1939 to provide guidance for solving the difficult mobilization problem. When German leader Adolf Hitler pushed for British and French acquiescence on the issue of the Sudetenland in September 1938, the Army Air Corps had only thirteen B-17s in its inventory.⁹ The Air Corps needed far more combat aircraft, and he pointed out

that some of the airplane companies such as Waco, Ryan, Stinson, Beech Aircraft Corporation, Spartan and possibly others who are now building commercial airplanes have had sufficient airplane manufacturing experience to qualify them for the manufacture, in time of emergency, of the primary training and basic training types. . . . If the burden on the peace time military airplane industry can be lightened in this manner, increased experienced capacity will be available for the emergency requirements in military combat types.¹⁰

Not surprisingly Colonel A. W. Robins' more detailed planning premises included elements of this policy. For example, first on his list of priorities was speed. Fast deliveries of aircraft meant "[a]ssigning Army types and models to respective current manufacturers."¹¹ This provision explained why the Waco Company waited so long for defense business. The aviation industry had so much unused capacity in 1939 that the Air Corps was able in many cases to give an experienced military contractor both trainer

⁹ On the significance of the Munich Crisis and American unpreparedness see Arnold, *Global Mission*, pp. 180-90, and Thomas M. Coffey, *HAP* (New York: Viking Press, 1982) pp. 173-85.

¹⁰ Major General H. H. Arnold to Chief, Materiel Division, January 9, 1939. AFMCA.

¹¹ Colonel A. W. Robins to Major General H. H. Arnold, January 31, 1939. AFMCA.

and combat aircraft contracts. By the summer of 1941, however, those defense contractors were approaching capacity, and Waco's turn was near. In this respect, Waco's three-year wait for defense business supports historian Harold Vatter's conclusion that the early mobilization program neglected small businesses.¹²

The XC-62 Program

When business came in the form of the XC-62 cargo aircraft program, it presented Brukner with a unique opportunity. The airline field of the aviation industry had not attracted Waco's interest, because the development of trunk routes across the country placed a premium on the larger transport aircraft. Planes like the Douglas DC-3 provided greater efficiency over the longer distances than smaller planes, and the airlines' steady growth after 1934 had generated good business for Douglas.¹³ Brukner had no means to pursue the design and development required for a transport. To be competitive he would have had to augment his bi-plane experience with expertise in designing much larger, multi-engine monoplanes. Waco had neither the money nor the talent to do so. When Cessna and Beech created the small transport market niche in the late 1930s, however, Brukner had a strong incentive to expand his company's capabilities.

The rivals, Cessna and Beech, were able to broaden the private flying market and at the same time compete directly in Waco's narrow niche for sales to private flyers.

¹² Harold G. Vatter, *The U.S. Economy in World War II* (New York: Columbia University Press, 1985), p. 6.

¹³ Bilstein, *Flight in America*, pp. 90-92.

Their twin-engine planes met corporate demand for executive transports, and their sportier single-engine aircraft appealed to wealthier pilots who flew for fun or travel. Waco's market share was under direct assault. Attentive to the looming international crisis, Brukner decided that military business offered the best hope for his firm. The task of countering the threat from Cessna and Beech would thus wait until Waco was better able financially to deal with it. At first, it appeared that Brukner's strategy would succeed: the first aircraft the air force asked Waco to build was a twin-engine transport. A government-financed move in the direction of larger planes was a chance to diversify Waco's products and later to compete directly with his rivals in the postwar private flying market niche.

From the perspective of the military airmen, however, this brand of commercial self-interest was just an interference with the mobilization of America's industrial might. Other companies also perceived the threat and worked to thwart their rivals' ambitions. General Echols asked in August 1942, "Everybody wants to build transports of course, but where are our Military planes coming from?"¹⁴ Those companies already engaged in the transport business did not want to see any newcomers enter the market, especially when the government was sponsoring them. They complained.

Douglas, for example, was under contract with the AAF to provide parts for, and information about, the C-47 to Waco for use on the C-62 project. In September 1942, after almost one year of effort, "Douglas claimed that Waco had never told

¹⁴ General Echols to General Meyers and Colonel Chidlaw, Note, July 1942. AFMCA. Emphasis in original.

Douglas exactly what parts they wanted them to furnish." Hugh C. Robbins, the Waco Director of Subcontracting, refuted this assertion and provided copies of correspondence "asking for prints, parts lists, detail drawing lists and various other information to which Douglas had never replied." The Army representative, R. F. Trimbach, took part in the "heated discussion." He reminded Douglas representatives that he "was the direct representative of General Wolfe [Materiel Command in Washington, D.C.], and had been sent out here to find out why so much time had been wasted in getting started on this program, and he had spent nearly a week already and to date and accomplished nothing definite."¹⁵ Douglas was clearly less than forthcoming in assisting a successful aircraft manufacturer to join the transport business. Mobilization or not, competition was still on every businessman's mind.

The AAF requirements for the cargo program evolved as Waco tried to set up shop for the new airplane. The original contract for the prototype and thirteen production C-62s quickly expanded by February 1942 to 253 aircraft, spares, and technical data. Waco was to achieve the maximum monthly production of twenty planes by October 1943, thirteen months after the first delivery. The company won approval for a new factory building to support this production, but the preference rating for materials to finish it was so low that the 30 May 1942 estimate for completion was in jeopardy from the beginning. The air force promised to help expedite procurement of critical items, and Wright Field even sent design engineers to work in the Waco plant to facilitate

¹⁵ K. J. Sadders to Hugh C. Robbins, Waco Memorandum, September 19, 1942. "C-62 Production, 1942-1944," *Brukner Papers*, DoAaSC.

development.¹⁶ By July, however, the AAF raised the ante again and demanded 150 C-62s per month, of which 100 were to come from the Troy factory. The torrid pace of the program's development made it difficult for the Waco Company to set a schedule and develop the capabilities it needed to carry out the contracts.

Then, the military's request for additional factory space for Waco was vetoed in Washington, leading the airmen to question their current mobilization plan. Now they decided that "the production of the increased quantity calls for a very extensive sub-contract program. While these facilities are, no doubt, obtainable, [we] wonder in the light of the present agitation for transports if the Waco project is now as desirable as it appeared to be during its origin."¹⁷ In fact Henry Kaiser, with the support of key leaders in Washington, was contending that he could initiate the mass-production of transports using rolled steel. Acquisition leaders, already embarked on the wooden transport project, reluctantly addressed the issue; General Echols best summarized their attitude: we have "no objection to an experimental steel plane if it can be set up without interference with our military program." In fact, the general cared much more about combat aircraft. He lamented that "Everybody else is stampeded by Kaiser—who is going to get fighting planes—bombers and big bombers will win the war."¹⁸ The strategic bombing ideology thus continued to dominate the acquisition leaders' thinking and, in this case, relegated transport aircraft to a secondary status. In the summer of 1942

¹⁶ Brigadier General George C. Kenney, "Special Report on Status of C-62 Project," February 13, 1942. AFMCA.

¹⁷ Brigadier General K. B. Wolfe to General Echols, July 28, 1942. AFMCA.

¹⁸ General Echols to General Meyers and Colonel Chidlaw, Note, July 1942. AFMCA. Emphasis in original.

they still were not sure they had the proper balance between combat and support aircraft and between large and small manufacturers.

Even more damaging to the Waco cause were the military's impatience and the activities of an aircraft manufacturer with years of military experience, the Curtiss Company. The air force believed that Curtiss, with superior production capability, "will deliver their transport months ahead of Waco and the volume obtainable from the present facilities would be from four to five times that which is at present set up for Waco."¹⁹ The Curtiss C-76 program was clearly outstripping Waco's effort in the summer months. The jump from thirteen to 253 aircraft in Waco's contract in February had prompted Wright Field officials to conclude, "This accelerated delivery obligates the contractor to an all out effort for which he was not set up."²⁰

Within the Waco Aircraft Company its new role as a prime contractor for the military presented vexing administrative problems. As damaging as Douglas's foot-dragging and the AAF's changing requirements were the internal problems that frustrated the C-62 program. The engineering department struggled unsuccessfully to meet the new demands placed on it. The scope of the burden was unlike any they had encountered previously, and the crush of new work overwhelmed Arcier's shop. Specifically, the AAF reported, the "blueprint department at Waco has been seriously overburdened . . . to the extent that it has been necessary to employ blueprinting firms in Dayton, Ohio to take

¹⁹ Brigadier General K. B. Wolfe to General Echols, July 28, 1942. AFMCA.

²⁰ Brigadier General George C. Kenney, "Special Report on Status of C-62 Project," February 13, 1942. AFMCA.

care of the excess."²¹ The problems Waco encountered caused delays, increasing the doubts the military had about the company's ability to perform successfully on this type of contract. Waco did not do well in the informal competition the military set up between companies as they executed contracts.

Finally, the military had had enough by 1943. In October Wright Field prepared a long memo "in order to regain full control of the project."²² Matters came to a head in July when General Echols learned that "every effort is being made to complete the first airplane by 15 September 1943. . . . It is evident that this is highly questionable and it is estimated that the first airplane could be completed not sooner than December 1943."²³ Costs also skyrocketed; the initial two million-dollar contract for thirteen planes transmuted into \$3.5 million for the one prototype by September. The Technical Staff at Wright Field blamed the air force, in part. Requirements had changed so frequently that the latest contract specifications, dated 23 January 1942, "described an airplane far different from the present design." Verbal directions from the AAF guided the program, "without the required legal paper work to follow up."

Then, suddenly the military changed the program, cutting the order from 253 to 13 aircraft. This left Waco with no way to amortize the substantial costs of development, and the AAF reported in November that "[t]he morale of . . . all personnel connected with this project is low." The estimated completion date slipped again to

²¹ H. S. Lippman, Memorandum Report, "Engineering Progress, C-62 Airplane, Waco Aircraft Company," July 20, 1942. AFMCA.

²² Colonel D. L. Putt to Chief, Technical Staff, October 13, 1943. AFMCA.

²³ Colonel Orval R. Cook to General Echols, July 9, 1943. AFMCA.

February 1944. In that same report, the air force officials said they were "of the opinion that the C-62 if completed will not satisfactorily fulfill its intended mission . . . [and we] recommend that this contract be terminated immediately."²⁴ On 14 December Materiel Command approved the recommendation, and Waco's transport initiative died before the plane rolled out of the factory.²⁵

Waco's wartime experience with the failed C-62 program exemplifies the importance of ideas in military and economic affairs. Despite the fact that important constituencies (the State Department and Air Staff) wanted the plane, it did not fill a primary role in the strategic bombing doctrine. The AAF's low priority ratings and policy reversals reinforced Waco's difficulty in the program. Ideology thwarted innovation. Waco was also responsible for the failure to produce. Brukner had not acquired the personnel he needed in this new business. Nor did he acquire the funding and other resources that could have made this effort successful. The failure is typical of small enterprises in which the entrepreneurial and technical abilities are concentrated in a few leaders. If they are unwilling or unable to anticipate a new situation and acquire the skills they do not have, the firm is likely to experience the sort of problems Waco encountered.²⁶ The company did not make it successfully through the transition from

²⁴ "Status Report with Recommendations RE C-62 Program at Waco Aircraft Company," November 19, 1943. AFMCA.

²⁵ Major General Charles E. Branshaw to Brigadier General B. W. Chidlaw, December 14, 1943. AFMCA.

²⁶ Daniel M.G. Raff and Peter Temin, "Business History and Recent Economic Theory: Imperfect Information, Incentives, and the Internal Organization of Firms," in Peter Temin, ed., *Inside the Business Enterprise: Historical Perspectives on the Use of Information* (Chicago: University of Chicago Press, 1991), pp. 7-35, especially 28-32; Galambos with Sewell, *Networks of Innovation*, pp. 123-126; Scranton, *Endless Novelty*, pp. 185-187.

batch to assembly-line production, and the military was in part responsible for that failure.

The Military Glider Program

The development and use of military gliders between 1941 and 1945 illustrate this point even more convincingly. From their first use in combat during the invasion of Sicily in July 1943 to the end of the war, gliders promised much but delivered little. An analysis of their implementation underscores the interaction between the homefront and the battlefield, the military and industry.²⁷ It focuses on the process of technological innovation and the key role ideology plays in it.

When General Arnold initiated the glider program he said it was important, but he did not explain why. The impetus for this technology came from overseas. The Soviet Union and Germany had experimented with gliders before the outbreak of war in 1939. American airmen knew this but showed no interest in this unique aeronautical capability.²⁸ The Air Corps' efforts to articulate the strategic bombing ideology explains air leaders' disinterest in gliders. After all, gliders necessitated ties to the Army and a

²⁷ Many good histories take this kind of broad approach to the study of World War II. See for instance R. J. Overy, *The Air War, 1938-1945* (New York: Stein and Day, 1981) and Sherry, *The Rise of American Air Power*, both of which are noteworthy for their consideration of the political and economic dimensions of American air power. Studies focusing more on economic issues include Holley, *Buying Aircraft*; Vatter, *The U. S. Economy in World War*; and R. Elberton Smith, *The Army and Economic Mobilization* (Washington, D.C.: GPO, 1991, reprint). My study contributes to this literature by examining the effects of the powerful political and economic forces on a particular technology that failed. Most histories have emphasized the successes in the mobilization story.

²⁸ Paul M. Davis and Amy C. Fenwick, *Development of Gliders in the AAF* (Air Technical Service Command History Office, Study #216), May 1945, pp. 3-5; Janet R. Daly Bednarek, "'Damned Fool Idea.' The American Combat Glider Program, 1941-1947," *Air Power History* (Winter 1996, Vol 43, No. 4), pp. 40-41.

return to the ground—in fact, to the battlefield. The logic underpinning military gliders contradicted the ideology airmen were trying to impose on the U.S. defense establishment. It found a more receptive audience, however, in the German military. The *Luftwaffe* embraced the idea of marrying air power with ground forces and put the glider to effective use in the Low Countries in 1940 and Crete in 1941. These stellar examples stood as a challenge to General Arnold, who knew the American air force lacked a similar capability. Fearing that senior ground officers would exploit this disparity in their desire to derail or delay the heavy bomber program, Arnold insisted that the AAF should take the initiative. Taking no account of the glider's incongruity in the AAF, he ordered Wright Field to introduce the innovation as soon as possible. With such high priority and little guidance, the Air Corps initially struggled just to define what a military glider actually was. The planning process was, to say the least, confused.

Although Arnold had announced the gliders' urgency, this innovation did not shake the priorities airmen had established over the years. Nor did it overturn the existing plans. Nevertheless, the sudden emergence of a glider program in mid-1941 required drastic actions to organize resources for the innovation process. The need for a new kind of pilot meant the Secretary of War had to countermand a 1932 order prohibiting Army personnel from flying in a glider.²⁹ Since peacetime military contractors were fully engaged in mobilization, procurement officials had to establish relationships with companies they knew little about. Airmen aggressively initiated the process, but these new ties with business had to be tailored to fit the AAF's general

²⁹ Memorandum, Secretary of War, June 5, 1941. "Correspondence, 1941-1947," William C. Lazarus Papers, U.S. Air Force Academy Library Special Collections (USAFA Spec. Col.), Colorado Springs, Colorado.

scheme for mobilization. Constraints on the glider program included: 1) no interference with ongoing military contracts; 2) designs which minimized or avoided the use of any materials also employed in the strategic bomber program; and 3) a low priority rating.³⁰ Less than twelve months after development started, these constraints were jeopardizing General Arnold's desire to field gliders quickly.

Every aspect of the program involved serious problems. Intelligence from Europe indicated that the German glider could carry fifteen fully equipped soldiers and a small truck, and officials at Wright Field used this to guide the companies that offered specific proposals to the military for the glider. With no American experience from which to draw, the German information, though sketchy, was used to develop specifications. Attempts to have Soviet documents translated into English offered early evidence that the glider problem would be tough to solve: intelligence analysts told Wright Field that the Russian translators were too busy with higher priority projects.³¹ The technical requirements for the American military glider would have to be developed ad hoc and incrementally as the senior leadership began to determine its combat role.

With the larger, more experienced contractors busy, Wright Field faced the formidable task of building its own glider expertise while educating smaller aviation firms lacking any military experience. The Wright Field officials polled eleven prospective companies, most of which claimed to be too busy or too small for the anticipated program; only four, including Waco, responded favorably. Waco's

³⁰ Interoffice Memorandum, February 7, 1942. "Correspondence, 1941-1947," Lazarus Papers, USAFA Spec. Col.

³¹ Memorandum, August 25, 1941. "Correspondence, 1941-1947," Lazarus Papers, USAFA Spec. Col.

competitors in the experimental phase included the Frankfort Sailplane Company, Bowlus Sailplanes, Inc., and the St. Louis Aircraft Corporation. The program was explicitly competitive. Although the War Department wanted an intense competition with numerous contractors, it had to settle for four contracts for eight different experimental tactical gliders. The competition hinged on creativity and designing skill, and this favored Waco and its chief engineer Francis Arcier. In June 1941 the Department awarded Waco Aircraft a contract for detailed engineering drawings, static test models, and flight test aircraft. Waco and the three other contractors worked in parallel on their designs for both an eight-place and a fifteen-place glider. Based on the best military criteria available and on a trying experimental phase, the AAF announced in April 1942 that the Waco Aircraft Company had submitted the best design for the glider.

The few months of work the AAF invested in the experimental program revealed the pitfalls of dealing with companies lacking military experience. Frankfort, for example, delivered a static test model of its XCG-1 seven months after contract award, and it failed structural tests at only sixty-three percent of the design load. Given Frankfort's success in the training glider program, the company wisely focused its efforts there. It never delivered the XCG-2, however, and the air force returned its destroyed XCG-1 and canceled the contract in early 1942. The St. Louis contract was equally disappointing. Within weeks of the initial award, Wright Field canceled the fifteen-place XCG-6, because the simpler eight-place XCG-5 obviously exceeded the company's ability. The company did not deliver the static-test article to Wright Field until early 1942, when the military found "structural tests of the XCG-5 produced a serious failure at the 90 per cent load." The flight test aircraft revealed the extent of St. Louis's failure.

Delivered in October 1942, over a year after development began, it "was no more successful, displaying an unsatisfactory balance condition which would have necessitated a complete redesign of the glider for further consideration. As a result, there was no additional development of the XCG-5." The Bowlus contract for the XCG-7 and XCG-8 produced similar design failures, to which the company added a "dismal financial condition" and a propensity for displaying "more talent for salesmanship than for the manufacture of gliders." Bowlus failed to win a tactical glider production contract and, in fact, lost its trainer contract in 1943. With competitors self-destructing in the experimental tactical glider program, Waco was well positioned to win the air force's good graces—and contracts.

Waco's engineering staff was ready to go in the summer of 1941. Orders for CPTP trainers were winding down and required little engineering support anyway; meanwhile the XC-62 was in only the conceptual phase. Thus Arcier turned out a structural test model within a few weeks of contract award, and the flight test aircraft reached Wright Field in January 1942. It passed all its tests. The company produced the plans for, and the flight test version of, the larger, more complex XCG-4 by May 1942. It, too, passed. Wright Field was pleased with the firm's promptness and the quality of the designs and formally thanked Waco for the extra hours of work the business had invested in the project. As the Aircraft Laboratory at Wright Field commented: Waco "delivered several months prior to dates that would have been possible under normal operating conditions of this Company."³²

³² Davis and Fenwick, p. 25.

The AAF was eager to complete the transition from the experimental to the production phase and get around to introducing combat gliders. It created short cuts in an effort to facilitate their rapid delivery, but the government's new schedule proved the adage that haste does indeed frequently make waste. Immediately following the flight tests, officials pegged the initial CG-3A nine-place glider production run for Waco at 200. Only three months into the contract, however, the War Department decided it needed the fifteen-place glider and lots more of them. The urgency was so great, in fact, that Wright Field canceled the CG-3 order before flight tests on the XCG-4 were complete. Both the Waco Aircraft Company and Wright Field were struggling in an unfamiliar, rapidly changing business environment. Lacking any measures to guide decision-making at various points in the process of innovation, officials simply responded to short-term political pressures as readily as to technical inputs. As a new partner in the government-business relationship, Brukner worked hard to accommodate the ad hoc procedures and new responsibilities the military assigned him. But his firm frequently found it impossible to perform successfully under these adverse conditions.

Acquisition officials, for their part, realized that Waco was in no position to manufacture the total quantities the military needed. To prepare Brukner for the increased demands, the production contract called for 500 CG-4s for Waco and authorized funds for plant expansion from the Defense Plant Corporation (the wartime version of the Reconstruction Finance Corporation). The AAF also awarded production contracts to numerous other companies that were specifically instructed to work with Waco to maintain strict configuration control of the aircraft and to resolve technical manufacturing problems. Conversely, the air force required Waco to share its

engineering drawings with the other companies. In short, the air force gave Brukner assistance, money, and authority to forge an effective team of contractors, a task that was as unfamiliar to Waco as it was several of the other firms in the team.

The heavy load was bad enough, but the air force continued to present new challenges as the war continued. For example, in the summer of 1942 when Waco was rapidly changing its production plans and factory tooling from 200 CG-3s to 500 CG-4s, the military decided the company "was in a position to undertake a new development project."³³ Intrigued by the large British Hamilcar glider and desiring a more capable tactical transport plane, Washington officials approached Waco to investigate the feasibility of an even larger glider similar to our ally's. While continuing his preparations for production, Brukner signed a contract for the development of a thirty-place troop-carrying glider having a towing speed of 174 miles per hour at 12,000 feet, a gross weight of 15,000 pounds, and a useful load of four tons. Five months later Waco delivered the flight test model, and within days the air force decided to buy it in quantity.

At this point, it should have been clear to both the government and the company that Waco's ability was primarily in design and engineering. It was possible that the organization would become equally adept at large-scale production. But it was not likely. When Brukner's CG-4 production effort experienced severe problems, Wright Field finally bypassed Waco and awarded CG-13 production contracts to Northwestern and Ford for fifty gliders each.³⁴ Waco found the experimental effort at this time

³³ Ibid., p. 38.

³⁴ Ibid., pp. 39, 138-9.

extremely unprofitable, even on a cost-plus basis, but Brukner did not fight the AAF's decision. In fact he told the Waco Board of Directors

that the company would be obliged to decline any production contract on this new glider because of the already complete engagement of our production facilities, as well as all of our tool making capacity. Management is hopeful that the company will be permitted to recover engineering losses on this project thru [sic] furnishing reproduction rights and engineering services under contracts with the Government and other manufacturers.³⁵

Costs exceeded half a million dollars, and after extensive negotiations with the air force, Waco received \$373 thousand.³⁶ The AAF's poorly defined requirements for the glider programs disrupted Brukner's management of Waco's contracts, and the military's inability to set clear priorities complicated his task of leading a diverse team of firms in meeting the government's fluid demands.³⁷ Waco was straining to perform those tasks that it could do well let alone develop the new managerial capabilities it now needed.

The Challenges of Business Expansion

The internal challenges Brukner faced were daunting. By the end of 1941, Waco was engaged in the simultaneous development of three different aircraft (the XC-62, CG-3, and CG-4) for the AAF. And Waco had other work, too. Prior to the arrival of the military contracts, Brukner accepted orders for 800 trainer aircraft. In September

³⁵ Minutes of Board of Directors Meeting, May 3, 1943. *Brukner Papers*, DoAaSC.

³⁶ H. R. Perry to A. F. Arcier, Waco Memorandum, April 10, 1943. *Brukner Papers*, DoAaSC.

³⁷ Janet Bednarek argues in her article "Damned Fool Idea" (see full citation in note 26) that the reason "the glider program worked at all was largely the result of the efforts of the Waco Company. . . . (p. 40)" Such an assessment is overly generous, I believe. While Waco's engineering talent was undoubtedly the basis for whatever success the program enjoyed, the limitations of the engineering division and other corporate deficiencies prevented Waco from displaying effective leadership in the process of technological innovation.

1941 his factory produced one trainer per day with a force of approximately 450 shop workers and mechanics.³⁸ This work quickly ended, however, freeing the resources needed to focus on military projects. Of more importance was the subcontract work Waco took on. In addition to the trainers, Brukner had signed contracts with other defense contractors for components of aircraft they were developing. Waco built fuel tanks for Curtiss-Wright and manufactured motor mounts for Republic on the high priority P-47 fighter program. These subcontracts provided excellent economic and technical opportunities for Waco Aircraft, but they complicated Brukner's task of rapidly expanding his business to meet the military's demands.

Effective and efficient work with the larger defense companies gave Waco the chance to claim a larger niche in the lucrative military aircraft field. Not only was it possible to form an alliance with an established manufacturer, but the relationship also gave Brukner the means to learn more about military procurement practices. This was important knowledge, for he had neither a reliable contact in that aviation field nor any experience in the field. Brukner canvassed larger producers beginning in 1940, and the Curtiss-Wright Corporation was the first to respond to Waco's request for subcontract work.

Trying to capitalize on the opportunity, Brukner told his managers and foremen in January 1941 that "[w]e are being advised almost daily as to the strenuous need for these tanks, and urged to step up our delivery promises and results." His goal was to forge a strong team with Curtiss-Wright. Simply meeting the contractual requirement did not go far enough to demonstrate Waco's reliability, he felt. But his

³⁸ Experimental Engineering Section Memorandum Report, September 13, 1941. AFMCA.

concerns with the project foreshadowed the problems that were to plague all of Waco's enterprises during the war: the inability to handle multiple priorities. The factory was in the middle of producing trainers, and management had balked on the fuel tanks. Brukner complained that "much of our time has slid by and earlier delivery has become more urgent." Moreover, Waco was ill prepared to change production methods rapidly to accommodate new requirements. Brukner said, "In this project we must gamble on sure methods and equipment, even tho [sic] not the most economical." This type of improvisation also characterized its later war efforts and hindered its ability to succeed as a reliable supplier in the military aviation field. Lacking a solid sense of his best strategy, Brukner was merely jumping at each opportunity he perceived. He was, as well, keeping too much of the decision-making and planning in his own hands. This is a common constraint on entrepreneurial firms, as it is from time-to-time on larger organizations in both the private and public sectors.

Indicative of the challenges Brukner faced in expanding into the defense business was his subcontract with Republic. Started in early 1942, the P-47 program experienced difficulties right away, and they were serious enough to prompt the AAF to intervene. Wright Field officials mediated the disagreements that had arisen between Waco and Republic, and in April 1942 concluded that "The prime contractor, Republic Aviation Corporation, and the subcontractor, Waco Aircraft Company, have been in constant contact and have cooperated in all activities in connection with difficulties encountered in the fabrication of these engine mounts" and "the major difficulties

causing rejection and lack of production on this article have been overcome."³⁹ The motor mounts had strict requirements, and Waco struggled, not always successfully, to meet the technical and management challenges in delivering acceptable products to Republic. The military's involvement calmed the waters temporarily, but the problems continued.

Less than two months later Waco factory manager Russell Pearson admitted that "we do not have the crack situation in their motor mount straightened out, we are doing everything we know possible to control the situation but until such was the case we could not make definite promises."⁴⁰ In response Republic agreed to send three inspectors to Troy to work with Waco in each phase of production to catch errors early and to prevent "any further inspections here [the Farmington, New York, plant] and can thus eliminate the difficulties of having mounts sent all the way here and back again."⁴¹ Nothing helped. Pearson was clearly exasperated by August, and he told Brukner,

I feel that we are still miles from a solution and all the money we have spent blindly trying this and that has been for nothing. . . . [W]e have had no better results with Republic's talent sent in here as welding experts. . . . There is no one in this organization . . . that I believe capable of finding an answer to this problem . . . in time to get production and avoid going bankrupt.⁴²

Again the military attempted to come to Waco's rescue. In August 1942 the AAF conducted an investigation into Republic's rejections of the Waco motor mounts.

³⁹ Colonel Thomas H. Chapman to the Waco Aircraft Company, April 30, 1942. *Brukner Papers*, DoAaSC.

⁴⁰ Russell Pearson to C. J. Brukner, June 18, 1942. *Brukner Papers*, DoAaSC.

⁴¹ K. B. Walton, Republic Subcontracts Division Manager, to Waco Aircraft Company, August 7, 1942. *Brukner Papers*, DoAaSC.

⁴² Russell Pearson to H. R. Perry and C. J. Brukner, August 10, 1942. *Brukner Papers*, DoAaSC.

The P-47 program had such a high priority that Wright Field could not allow the friction between Republic and Waco to jeopardize output. After thoroughly checking the manufacturing process in the Waco plant, the AAF chief of the production division strongly criticized Republic. He wrote, "It appears that the Republic Aviation Corporation personnel have been lacking in common sense and have therefore been responsible for waste of strategic material, time and money."⁴³ While the air force had delivered a clear and decisive victory for Waco in its on-going battle with Republic, the price was high.

The damage the subcontract did to Waco was considerable. The bottom line reflected the troubles Brukner had in getting production up to speed. Waco lost nearly ninety thousand dollars on the Republic motor mounts in fiscal year 1942, which ended 30 September 1942. Brukner spent \$360 on each mount while Republic paid only \$192—a return of minus 86 percent. In addition Waco paid just over \$40,000 for tools needed to boost production to ten mounts per day.⁴⁴ More importantly, relations between Waco and Republic became antagonistic and there was little hope for improvement. While the figures for Waco's performance on the Curtiss-Wright subcontract do not exist for fiscal year 1942, the program clearly required less of management's attention. But instead of building on the success of the fuel tank contract, Brukner and his managers had to devote their resources to the difficulties with motor mounts. Although the AAF supported Waco in the early part of the program, the company could not depend on that

⁴³ Production Control Section Memorandum Report on Visit to Waco Plant, August 11, 1942. *Brukner Papers*, DoAaSC.

⁴⁴ Analysis of Republic Motor Mount Contract, September 30, 1942. *Brukner Papers*, DoAaSC.

temporary alliance; changes in personnel made the military an unreliable ally. Durable partnerships within the defense industry were preferable, but that remained an unfulfilled goal for Brukner as the country approached the first anniversary of Pearl Harbor.

One of the technical problems in the manufacturing process for the motor mounts, obtaining the right machines, was common to all Waco programs. The air force did not contract with Waco for extensive production until after the CG-3's successful test flight in January 1942. Because of this, Brukner's orders for the equipment necessary for mass production came well after most aviation manufacturers had covered the suppliers with demands. Even the experimental work on the gliders and the XC-62 exceeded Waco's capacity in January 1942. The opportunity to place orders came as the Defense Plant Corporation, created specifically to finance the rapid expansion of the country's industrial base, approved Brukner's request for a new factory building on Waco property. With the P-47 motor mount work, experimental efforts, and ramp-up for production under way concurrently, Brukner identified only four machines that were "badly needed at the present time."⁴⁵

His estimate proved too conservative, repeating the pattern of mistakes he had made in regard to expanding his production team. This mistake forced Waco to improvise constantly ways to compensate for a lack of factory capacity in Troy. At the beginning of 1943, the consequences of his cautiousness were apparent as the company tried to adapt to the AAF's changing requirements. The need for Waco to produce the CG-3 in great numbers was gone—the air force wanted only CG-4s. "As this is a larger

⁴⁵ Waco Report on Plancor 398 (this is the Defense Plant Corporation factory built adjacent to Waco's pre-war factory), March 20, 1942. *Brukner Papers*, DoAaSC.

glider involving more parts of heavier construction, it increased our machine load more than we had anticipated for the CG-3A," Brukner heard from Pearson. Moreover, "the shortage of and spasmodic delivery of metal stocks caused a production delay which . . . forces us to tie up machinery that we had scheduled for the C-62 production." This news was particularly disturbing since Waco's initial contract for thirteen planes had by now grown to a contract for 253 of the planes. Continuing developmental glider work, this time on the CG-13, "adds considerable burden to our machining facilities."⁴⁶ In short, Brukner gained no ground in the twelve months following his initial urgent request for more equipment.

Glider program contractors experienced a similar shortage. The AAF tried to compensate for the manufacturers' lack of experience and to promote standardization by ensuring uniformity across this diverse group. First, the airmen decided that the CG-4 was to be the standard glider—hence the cancellation of Waco's CG-3 production contract. Second, recognizing the glider program's extremely late start, the military contracted with the Bromley Engineering Company to produce standard tooling for the CG-4. Unfortunately, the need to produce gliders quickly for use in the European Theater compelled the AAF to instruct glider manufacturers to use their own tools or to subcontract that work to other firms. Wright Field cancelled Bromley's contract in late 1942, thus formally acknowledging that standardization was less important than rapid deliveries. What it received instead historian Janet Bednarek characterizes as a "logistical nightmare for those responsible for the repair and maintenance of gliders in

⁴⁶ All quotes from H. B. McDonald to R. Pearson, February 2, 1943. *Brukner Papers*, DoAaSC.

the field."⁴⁷ The lack of machining capability plagued the entire glider program, as many companies found, like Waco, that "all reliable machining and tool making facilities are filled to capacity."⁴⁸

Economist Tom Lilley and his colleagues conclude in their study of World War II aircraft production that the aviation industry in general did not suffer severe shortages of machine tools and equipment. During the initial expansion in 1940 and '41, aircraft and engine manufacturers had a high enough priority from government officials that machine tools rarely became the cause of bottlenecks, they point out. They acknowledge that later expansion in 1942 and '43 competed with non-aircraft production programs, which were earning higher priority ratings by that time. But they say this primarily affected the aircraft engine manufacturers. Waco's experience shows that their conclusion needs some modification. Clearly the lack of machines forced this aviation company to modify its production plans. The timing and the magnitude of the adaptations that Waco and other glider manufacturers had to make suggest that in this part of the industry the availability of machine tools had a significant effect on expansion.⁴⁹

So too with factory space. Expanding productive floor space was the industry leaders' top priority following Roosevelt's April 1940 call for a 50,000 aircraft program. The government stepped in to help manage the expansion, providing money for financing

⁴⁷ Bednarek, "Damned Fool Idea," p. 46.

⁴⁸ H. B. McDonald to R. Pearson, February 2, 1943. *Brukner Papers*, DoAaSC.

⁴⁹ Tom Lilley, et al, *Problems of Accelerating Aircraft Production during World War II* (Boston: Harvard University, 1946), p. 72.

the new construction and setting guidelines for plant location. Under the terms of a December 1941 agreement between the Defense Plant Corporation (DPC) and Waco, the government was to fund the construction of a new 100,000 square foot factory on Waco property. In addition the DPC purchased the new equipment and furnishings for it. For the duration of the emergency, Waco leased the property for one dollar a year. The government expected the Waco Company to identify facility requirements, find a contractor, and manage the construction project. The DPC office in Dayton, Ohio, provided oversight and released funding based on the inputs of its site manager. He selectively audited purchase orders and reported on the overall management of the program in the interest of the government. While all of this support favored Waco, it meant that Brukner had once again to manage a new program for which he had little experience or patience.

Again his conservative leadership caused problems that compromised Waco's credibility with the government. Brukner submitted his proposal to the DPC in late 1941, based on projected production of only the XC-62. Although the AAF had not yet issued orders for 253 aircraft, he later claimed that the factory, designated Plancor 398, could handle the larger order. But this request rested on two critical assumptions. First, Brukner's plan assumed the military would not choose Waco to produce either of the two experimental glider designs it was then completing (the CG-3 and -4). The AAF instead placed orders for both. And second, Waco's initial proposal to the DPC did not account for extensive changes in the XC-62 requirements. These added to Waco's needs for both outside manufacturing of aircraft components and internal production of fixtures for final

assembly.⁵⁰ As military orders piled up, Wright Field officials tried to help Brukner manage the load, but he had placed severe constraints on Waco's capacity with his low estimates in late 1941.

In February 1943 the War Department officially "stated that no expansion of their plant would be considered until after the flight test of the C-62 airplane." Air force managers had already worked closely with Brukner to accommodate the limitations of the Waco factory. They had cancelled the order for 200 CG-3s, and had extended the delivery date for the static test model of the C-62 numerous times. But these measures did not suffice to promote Waco's production or protect its reputation. The lack of progress following such measures inspired a lack of confidence in Waco. The military was realizing, as was Waco, the magnitude of Brukner's early misjudgment of the required factory capacity. One official reported, "By comparison with other companies fabricating cargo planes, the Waco Company will need not less than two-hundred-thousand square feet additional floor space in order to meet production schedule of twenty planes per month." In other words, Plancor 398 was only half the size the military estimated it should be. The report concluded that "it is evident that very little production on a plane of this size can be accomplished in this available space."⁵¹ By early 1943 the government was demanding better performance on existing contracts and was willing to offer no additional assistance.

⁵⁰ Waco Memorandum of Pertinent Information to DPC, March 13, 1943. *Brukner Papers*, DoAaSC.

⁵¹ Manufacturing Methods Section Memorandum Reports on C-62 Cargo Airplane, February 25 and March 26, 1943. AFMCA.

The DPC also grew impatient with Waco's management of the plant expansion program. Changing contractual requirements on the aircraft programs created problems and the opening of the new factory space lagged. Material deliveries were late and reliable construction workers hard to find. In December 1942, one year after the project started, the DPC said it was only 65 percent complete and estimated "it will overrun the contract approximately 53%." The DPC supervising engineer instructed Brukner to "instigate the proper papers for additional funds with the sponsor." The DPC had talked to the AAF and seconded the military's desire for Waco to perform: the engineer emphasized that "every effort must be made to have this project operating in time" for production next month.⁵² After one year of frustrating work, Brukner was still at square one with the DPC.

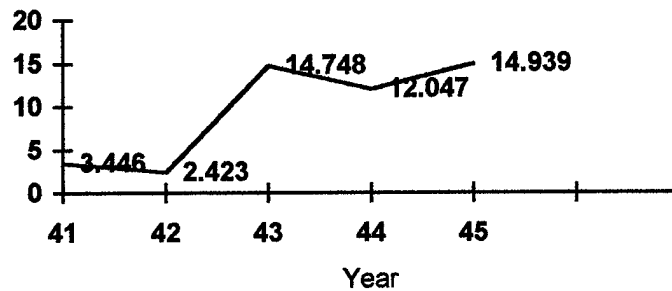
Waco's Performance

Sales figures for Waco Aircraft during the war years reveal the tenuous hold Brukner had on his new business niche in military aviation. His experimental, production, and subcontracting efforts earned revenue far exceeding the sales he had seen prior to the war. But the military's vacillation and Waco's inconsistent performance ensured that there would be an uneven flow of income. While 1944 proved to be the industry's peak year of output, for Brukner it produced decreased sales. After the AAF finally set a firm requirement for the CG-15 glider, a modified version of the CG-4A, in late 1944, sales rebounded in 1945. Other contractors were dealing with termination or

⁵² Curtis L. Hollister to C. J. Brukner, December 23, 1942. *Brukner Papers*, DoAaSC.

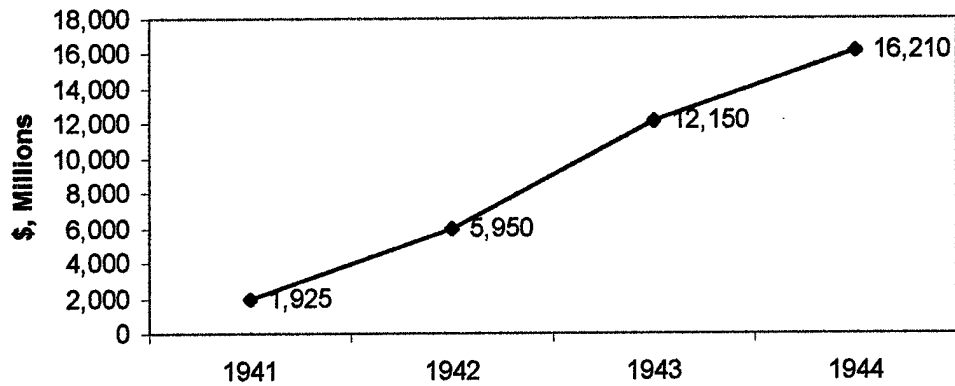
curtailment that year. Although seemingly setting Waco apart from the rest of the aviation industry, the data really shows the ambivalence the air force had for gliders. Neither the experimental contracts nor subcontracts affected overall sales figures as much as glider production, and Wright Field's confusion about Army requirements resulted, temporarily, in fewer Waco orders in 1944. Once the C-62 program terminated in 1944, the gliders provided Brukner's biggest niche in the defense business.

Chart 6-1
Waco Sales (\$, Millions)



Source: Audit Reports, 1939-1942 and 1943-1946, *Brukner Papers*, DoAaSC.

Chart 6-2
Aircraft Production

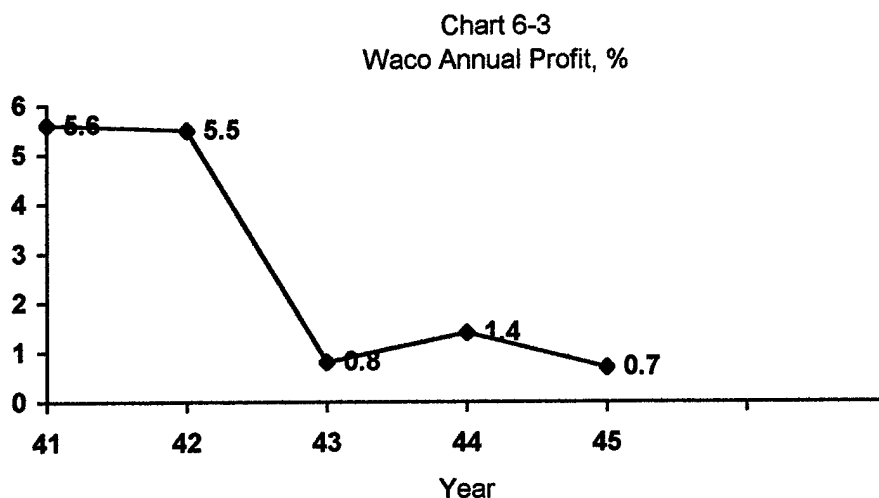


Source: Lilley, et al, *Problems of Accelerating Aircraft Production*, p. 6.

Increased sales did not, however, ensure high profits. Higher income taxes also affected net profitability, but this was true for all contractors. Labor shortages, the government's often conflicting demands, and Brukner's inability to prioritize multiple tasks effectively compromised his profitability throughout the war. In fact Waco's inefficiency attracted the attention of military officers, who had expressed hope that this old-line aircraft company would perform better. In April 1944 the AAF conducted a manpower utilization survey at Waco Aircraft. Brukner rather defensively tried to have the survey postponed, as the company was again in the midst of adapting to glider program changes and the recent cancellation (due to Waco's poor performance) of the C-62 program. Company vice president Hugh Perry admitted, however, "that management generally in these hectic days is inclined to live so close to the woods that they cannot see the trees. . . ."⁵³ Indeed the entire war period contained numerous episodes that revealed

⁵³ H. R. Perry to Lieutenant Colonel C. J. Carney, April 18, 1944. *Brukner Papers*, DoAaSC.

the extent to which the crush of mobilization details overwhelmed Brukner and his managers, and put a dent in Waco's profitability.



Source: Audit Reports, 1939-1942 and 1943-1946, *Brukner Papers*.

Within the Waco Aircraft Company the crisis of rapid expansion had destroyed the strategic focus of the corporate leaders. The challenges Waco faced were daunting, but they were not unique in the aviation industry. Brukner's work with the DPC was typical, as the federal government funded over ninety percent of the industry's facilities expansion.⁵⁴ This situation brought with it, however, tremendous opportunities for Waco to modify its business strategy and performance as the aviation industry was transformed into an instrument of national power, something along the lines that many business and military leaders had sought for decades. Brukner's sympathy for their ideology had helped convince him to make the transition to defense. But it did not help him form an

⁵⁴ William G. Cunningham, *The Aviation Industry: A Study in Industrial Location* (Los Angeles: L. L. Morrison, 1951), p. 116.

appropriate vision for this new business context. As the challenges mounted for Waco, crisis management replaced longer term planning as the basis for leading the firm.

Brukner and his managers could have adopted one of at least four possible courses of action during the war years. The military awarded the company contracts demanding efforts running the full gamut of aircraft manufacturing, from experimental design to production, to fly-away deliveries. The capabilities Waco developed depended on the specific goals Brukner set. He could have

- 1) pursued an alliance with a major defense contractor,
- 2) become a major prime contractor himself, or
- 3) built experience in other niches in the civilian and/or military markets.

The fourth was to choose none of these three, but rather to endure the war years in hopes of returning to strictly civilian production. In the case of Waco Aircraft it became the decision by default and had a profound effect on the war effort.

Waco's subcontract with the Curtiss-Wright Corporation offered the best chance to pursue the first course of action. In fact, early in the C-62 program the AAF tried to facilitate cooperation between Curtiss and Waco to speed the design work. Waco had experience in working with wood, and Curtiss understood large-scale production. Very quickly, however, the military dropped the idea. "We have ceased all effort to marry Curtiss and Waco at this time in order to avoid delay in getting wooden transport production underway," Wright Field reported in March 1942. The air force decided that the aircraft's design was less important than the ability to produce it quickly. The military had recently approved Curtiss' request for additional production facilities at

Louisville, Kentucky, and expected eighty C-76 planes per month.⁵⁵ Wright Field's skepticism that Waco's new factory would be ready for even twenty planes per month further convinced it to separate Curtiss from Waco. But possibilities for an alliance remained.

Brukner, however, was unable to capitalize on Waco's good performance on the fuel tank subcontract with Curtiss-Wright. Persistent delays on the C-62 project undermined the chances Brukner had to work more closely with Curtiss. The AAF helped Waco by requiring parts of the C-62 to be interchangeable with the Curtiss C-76 and the Douglas C-47. As with the Douglas negotiations, the air force intervened in March 1943 on Waco's behalf to forge satisfactory agreements for all drawings, engineering changes, and check fixtures for the Curtiss plane.⁵⁶ Still nothing developed. As the C-62 died a slow death in the Waco factory, so too did the opportunity Brukner had to engage in design or production work with the second largest American manufacturer of transports during the war.

The C-62 debacle also diminished the chances that Brukner had to become a major prime contractor for the military and to become more competitive in the postwar private flying niche. Waco's poor performance in the experimental phase of the transport program combined with its marginal production record to convince the AAF to limit its reliance on the firm. Curtiss's C-76 became the military's primary wooden transport. Although Waco continued as the primary glider designer for Wright Field, it produced in quantity only two of the four models the Army fielded during the war. Waco's persistent

⁵⁵ Lieutenant Colonel Carl R. Cook to Chief, Materiel Division, March 5, 1942. AFMCA.

⁵⁶ Manufacturing Methods Section Memorandum Report on C-62 Airplane, March 26, 1943. AFMCA.

problems with the high priority P-47 motor mount subcontract further aroused air force officials' suspicion about the company's production capabilities. Brukner's failure to finish even the test model of the C-62 ruined his chance to join Beech and Cessna in the manufacture of small transports. His foundation for the return to civilian production remained the market for planes for personal sport or travel, leaving him extremely vulnerable to his more diversified rivals in private flying. The failed C-62 program thus closed two paths open to Brukner during the war. The program's slow demise left him with little chance to set a new business strategy for his company. In Waco's case, crisis management thus supplanted strategic thinking and made each month as a war contractor a struggle for survival.

The most poignant moment came as Waco's glider faced combat for the first time. The cost overruns from Plancor 398 infuriated Brukner, and his temper and his personal management style drove him to participate directly in the business of C. C. Carpenter, the engineer Waco hired to lead the DPC expansion. "I cannot permit you to jeopardize Waco funds by operating contrary to DPC regulations,"⁵⁷ Brukner told Carpenter in April 1943. As DPC and air force officials applied greater pressure for completion, Brukner grew increasingly impatient. The next month he fumed that "I will not repeat the kindergarten explanations I have always given you . . . each time you indicated an acceptance of the government's right to make the rules for the expenditure of its money, and recognized the responsibility of this company, thru [sic] my office and yours, to observe those rules."⁵⁸ On 9 July 1943, as the CG-4 entered battle in Sicily,

⁵⁷ C. J. Brukner to C. C. Carpenter, April 23, 1943. *Brukner Papers*, DoAaSC.

⁵⁸ C. J. Brukner to C. C. Carpenter, May 17, 1943. *Brukner Papers*, DoAaSC.

Brukner had had enough. The fire door for one of the factory's rooms had not yet been installed and its absence threatened glider production. Brukner personally directed its mounting and, later that day, scolded Carpenter: "I believe that I have not been too aggressive in expediting this matter, and that everyone else concerned has left something to be desired."⁵⁹

The president was installing factory doors while his planes were entering battle for the first time—an appropriate symbol of how poorly Brukner prioritized tasks since joining the defense effort in 1941. Two years' experience had taught him little about how to lead effectively in the new business context or how to manage military-industrial relations. His retreat to the familiar ground of managing factory affairs yielded the initiative in directing the process of technological innovation to the military and to other firms engaged in the wartime aviation business.

The hierarchical community that Waco had joined gave the government authority over most economic affairs. Nevertheless, astute executives could exercise a measure of control over their firm's affairs. Brukner's distrust of public interference with business management was perhaps an appropriate ideology when he was a small manufacturer; but the war had changed Waco into a large company operating in a completely different context. That shift is a microcosm of the larger changes taking place in the American political economy. The government began to play an increasingly large role in stabilizing the economy, first through regulation of single industries, then across numerous industries, and then through the direction of activities that impacted the national business climate. For Brukner World War II compressed this transition into a

⁵⁹ C. J. Brukner to C. C. Carpenter, July 9, 1943. *Brukner Papers*, DoAaSC.

matter of months following his entrance into the military field of the aviation industry in 1941.⁶⁰ As the government, the military in particular, struggled to form adequate administrative mechanisms for leading the economic mobilization, Brukner found that he had to confront new problems in new ways. He was unable to complete this transition successfully, and he, his firm, and the war effort all suffered as a result.

⁶⁰ Louis Galambos and Joseph Pratt, *The Rise of the Corporate Commonwealth: U.S. Business and Public Policy in the Twentieth Century* (New York: Basic Books, 1988).

Chapter 7

Innovation and Acquisition

Many of the acute problems the air force encountered in the experimental phase of the glider program appeared also in the production phase, and the planes' high priority ensured high visibility for those government and business leaders who were trying to bring order to the chaos. Frustrations were common. After all, in addition to Waco, the air force chose seventeen contractors to manufacture CG-4 gliders. Waco had been in the second tier of companies the AAF turned to during mobilization; now many of the contractors Waco had to work with were even lower on the pecking order. Four had no experience in manufacturing aircraft. None had mass-produced wooden airplanes. The AAF official history politely concludes, "it was an unimposing industrial group which undertook the production of the tactical gliders demanded by the AAF."¹

Leading the Glider Team

Included in this group were both incompetent and effective newcomers to manufacturing like the Robertson Aircraft and Northwestern Aeronautical Companies. Robertson was an old aviation company engaged in aircraft service and training activities since just after World War I. In March 1942, while the CG-4 was still in flight tests, Materiel Command awarded Robertson a contract for twenty CG-4s. Nine months later in December 1942 the AAF plant representative reported to Wright Field that the

¹ Paul M. Davis and Amy C. Fenwick, *Development of Gliders in the AAF* (Air Technical Service Command History Office, Study #216, May 1945), p. 90.

company was "large enough to handle efficiently a contract ten times as large as the one they are working on," but that "the company is so torn with jealousies and hampered by restrictions and lack of authority that it is disgraceful."² In August Wright Field had recommended cancellation. In December General William S. Knudsen, Director of Production in the Under Secretary of War Office, recommended the same. Under Secretary Robert P. Patterson disagreed, however, and Robertson kept its contract—with devastating results. On 1 August 1943, within one month of the invasion of Sicily, a Robertson-built CG-4 crashed on a demonstration flight when a wing fell off. All of the passengers, including company officials, the mayor of St. Louis, and AAF officers, died. The glider program was center-stage, and the ensuing AAF investigation failed to clear the air. The report stated that "the conditions which were in existence at St. Louis prior to this accident are prevalent throughout the country." The conclusion was grim: "[t]here is little that the Materiel Command can do to correct conditions." General Knudsen stated his view more clearly (April 1943): "the glider program stinks."³

Northwestern Aeronautical, on the other hand, proved that "war babies," those companies formed during the mobilization to garner military contracts, could become valuable, productive assets. In February 1942 some New York investment bankers purchased the assets of the Columbia Aircraft Corporation, a small manufacturer that had closed its doors when the civilian pilot training program (CPTP) suffered cutbacks earlier that year. The bankers incorporated the Northwestern Aeronautical Corporation in Minneapolis, Minnesota, and quickly signed a contract with Northwest Airlines for

² Ibid., p. 99.

³ Daniel B. Blackman to Colonel D. C. Swatland, Report on Glider Program Conference, April 20, 1943. AFMCA.

engineering, production, and financial counsel. On 27 April 1942 Northwestern received its first AAF contract for thirty CG-4 gliders. Thirteen months later, Wright Field had 899 CG-4s on order from the company. In addition to hiring Northwest, Northwestern employed an experienced, independent accounting firm to establish a rigorous administrative system. These efforts and competent management made this company successful.

Very successful, in fact. In 1943 the AAF Inspector General reported that Northwestern's subcontractors were producing too many sub-assemblies too fast and recommended "immediate steps be taken to control the output of these subcontractors." Wright Field overruled, stating, "if subcontractors are doing their part so well that they are crowding a prime contractor, the remedy lies in speeding up the prime contractor's assembly process rather than in holding back the subcontractor."⁴ Northwestern complied and won the respect of air force officials. When the War Department extended the glider program in the summer of 1944, Northwestern was the contractor Wright Field relied on to produce the new Waco CG-13, while simultaneously building more CG-4s. Its solid production record countered the bad experience acquisition officials had with most other new entrants to the glider program.

The military's expectations were far higher for another new arrival, Ford, as it converted its vast production facilities to the aviation program. Negotiations between Ford and the Aircraft Laboratory resulted in a June 1942 contract for 1,000 CG-4 gliders—not the usual few dozen. Eight months later, however, Ford had delivered only six gliders. Tooling and buying the needed materials proved to be problems that even an

⁴ Davis and Fenwick, pp. 121-4.

organization accustomed to mass production could not always easily solve. Once the transition was complete, though, the Iron Mountain, Michigan, plant produced approximately one quarter of all the gliders used in the Army's program. Sound financing through the preparation period helped Ford avoid some of the pitfalls encountered by the less experienced, less wealthy companies the AAF had turned to in the early days. Also, the large quantities ordered on each contract allowed Ford to realize the lowest unit cost of any glider contractor.⁵ Efficiency in manufacturing large quantities was what the military expected, and Ford delivered.

Also included in the glider program were more recognizable aviation names, most notably the Cessna Company. This company's experience showed the power the military wielded in shaping the destiny of individual companies and the industry. Cessna received special treatment. Already engaged in other aspects of mobilization, Cessna was initially perceived by the AAF as one of the best additions to the program. Realizing that 1942 glider requirements far exceeded production capacity, Wright Field violated its own policy of avoiding established aircraft manufacturers in the glider program and asked Cessna (March 1942) to prepare facilities for constructing 200 CG-4s per month (assuming an initial order for 1,000 planes). The government authorized the construction of a new plant in Hutchinson, Kansas, and, when requirements further increased to 1,500 gliders (October), the AAF helped arrange subcontracts with Boeing and Beech, two other major aircraft producers. In July the Industrial Planning Section at Wright Field

⁵ Ibid., pp. 124-5.

removed more hurdles, telling Washington that "Cessna is to receive priority in delivery of material over all other Army aircraft orders."⁶

Even then, the company managed to deliver only 255 by the end of October, when the AAF had a change of heart. At that point the Army "decided to release the facilities of this contractor for full-time work on powered aircraft." On 31 October 1942 the government cut the quantity of gliders on the Cessna contract to 750, and the AAF permitted the company to amortize the cost of preparation activities over the smaller total. Cessna managed to produce gliders faster than any other company, but its unit cost far exceeded the Ford and Waco figures. More importantly, the air force bought a maintenance nightmare. Wright Field said "the quality of workmanship is poor and many details are not in accordance with Army Air Forces standards." Moreover, slashing the contract to half the original total included the cancellation of all spares. The air force learned in early 1943 that parts manufactured by other glider contractors were not interchangeable, further compounding a serious problem. There were precious few parts for the high-maintenance Cessna glider. The logistics problems reported at stateside Army bases confirmed that the Cessna CG-4 was "a poorer grade and less durable." As a result of Cessna's departure from the glider program, sub-standard materials were shipped to other glider contractors and double-payments made on cost-plus-fixed-fee contracts.⁷ The military's decision to place speed over quality had enduring consequences for the

⁶ Ibid., pp. 127-9; Colonel P. Schneeberger to Chief, Production Division, July 6, 1942. AFMCA; Janet R. Daly Bednarek, "'Damned Fool Idea.' The American Combat Glider Program, 1941-1947" *Air Power History* (Winter 1996, Vol. 43, No. 4), pp. 45-46.

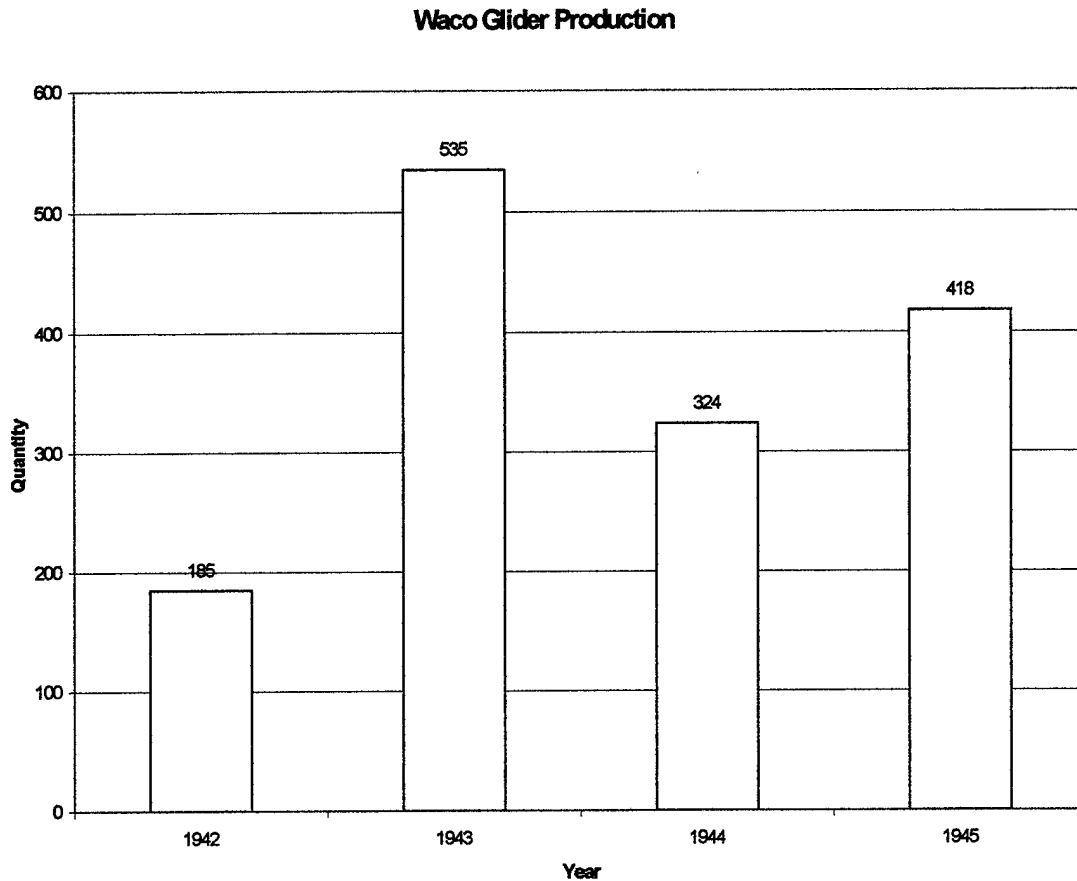
⁷ Davis and Fenwick, pp. 129-36.

entire program, while the favoritism shown to Cessna ensured that it would have a soft landing in other phases of the defense program.

The military also showed some patience with the Waco Aircraft Company, but the government's emphasis on rapid deliveries made it impossible for the business to sustain the high esteem it had earned in the experimental phase. Waco's on-going internal struggle over the proper balance to strike between the C-62 and the CG-4 contributed to the delay in tooling for mass-production. Like the other glider contractors except Cessna, Waco experienced delays in procuring the required raw materials, especially plywood; nevertheless, the AAF concluded that "Waco's production record was poor during the first year of the contract."⁸ After that, the C-62 clearly took a back seat, freeing factory space for gliders and increasing production to fifty-four per month in 1944. The unit cost for the CG-4 was just under \$20,000—a figure bettered by only Ford, which was unfettered by the engineering demands Waco had for the CG-4 and the more advanced gliders. Waco's effective experimental work contributed to the air force's decision in late 1944 to give it all of the contracts for the CG-4 replacement, the CG-15.

⁸ Ibid., p. 91.

Chart 7-1



Sources: Bednarek, "Damned Fool Idea," p. 47. Project Record CG-4A and CG-15A, Special Aircraft Branch, Procurement Division, September 1, 1945 (AFMCA). List of Waco Subcontracts, September 30, 1943; Revised CG-15 Work Schedule, June 15, 1945 and August 4, 1945; *Brukner Papers*, DoAaSC.

Note: The years 1942 and 1943 were exclusively CG-4 production; 1943 included 315 CG-4s and 9 CG-15s; 1945 was exclusively CG-15s.

But, as we have seen, Waco was unprepared to play its designated role as the glider program leader and had as well to deal with other firms and organizations new to mass production and defense contracting. For example, acquisition officials observed that "requests for information have been received from various paint and glue manufacturers, from various Chambers of Commerce who are interested in obtaining business for their home towns, and from various W. P. B. [War Production Board] organizations desiring to place wood workers in the field of glider construction."⁹ Brukner received some sympathy from officials at Wright Field, but that did not help the business increase output.¹⁰

A significant breakdown took place as a result of Waco's engineering drawings. While the company had, of course, produced many before, it had never done so with the intention that others would use them. The other glider manufacturers complained bitterly that Waco was delivering unsuitable drawings. The air force reported in 1944 that the Ridgefield Manufacturing Corporation "claimed that Waco had promised to complete delivery of drawings, bills of material, and working instructions by about 1 May 1942 but did not actually complete these deliveries until September. The experience of other contractors indicates that there was a great deal of validity in Ridgefield's view of its problems."¹¹ According to Babcock Aircraft Corporation,

⁹ H. S. Lippman, Memorandum Report, "Engineering Progress, C-62 Airplane, Waco Aircraft Company," July 20, 1942. AFMCA.

¹⁰ One wrote, "Poor old Waco doesn't do anything else but interview firemen who want to build gliders." Colonel F. O. Carroll quoted in Davis and Fenwick, p. 107.

¹¹ Davis and Fenwick, p. 108.

"Waco's engineering service was neither prompt nor accurate."¹² The engineering department fell behind in keeping the drawings updated as the AAF introduced changes. Waco claimed that by the middle of August 1942, Wright Field had sent 946 change orders, making its job "more difficult." Many producers asked for, and were usually granted, Army permission to deviate from the master design when compliance meant a longer delivery schedule.¹³ Control for the glider's design remained with the AAF, but the emphasis on speed over standardization complicated Waco's task of managing the aircraft's official specifications.

Brukner's duties as a prime contractor in the war effort were not atypical in the aviation industry. President Roosevelt's 1941 call for a vastly larger industrial capacity had energized military leaders and businessmen to organize the rapid growth that ultimately made the aviation industry the largest in the country. All established aircraft manufacturers expanded production capacity during the war. Intensifying existing plant utilization, expanding factory floor space, subcontracting, licensing non-aircraft companies, and less commonly obtaining satellite factories in other cities were the primary means aviation firms employed to increase capacity.¹⁴ Waco, as we have seen, expanded its Troy plant and resorted to extensive subcontracting to meet its contractual obligations. On the CG-4 production program, for example, Waco subcontracted

¹² History of Babcock Aircraft in Appendix I of "Glider Report," Vol. II. AFMCA. Part of the problem derived from the poor quality of the numerous copies Waco had to make.

¹³ Davis and Fenwick, p. 197; Bednarek, "Damned Fool Idea," p. 47.

¹⁴ Cunningham, *The Aircraft Industry*, pp. 76-94; Holley, *Buying Aircraft*, pp. 318-320.

approximately 39 percent of the work. In comparison the industry average for aircraft manufacturers in December 1944 was 38 percent.¹⁵

But as the requirements for subcontracting mounted, Brukner did little to enhance the capabilities of the company's subcontract division to deal with the changed situation. Recognizing the need for greater urgency in injecting Waco Aircraft into the defense program, Brukner had promoted Hugh C. Robbins to Vice President in Charge of Sales, a new position for the company in June 1941. His job was to promote "the sale of its products and prospective products, including contacting and negotiating with all Government and private agencies appearing to promise advantage to our production line."¹⁶ A little over a year later his primary duty was finding good sources to handle the work that an over-extended Waco production line could not perform. Robbins knew that Waco was not organized or equipped to accomplish the task and expressed his concerns to Brukner. "We [should] proceed immediately to obtain larger facilities for the Sub Contract Division and set up proper business engineering to properly handle all these projects," he told Brukner in September 1942. He faced sixteen other prime contractors in the glider program and possibly five more on the C-62 project. He further counted over 100 subcontractors for Waco's production gliders and C-62 aircraft.¹⁷ Waco could not carry that burden. Brukner, however, did not support his request, illustrating once again that Waco's entrepreneur was becoming a major impediment to further progress in the new enterprise. Rooted deeply in a batch-production, private market past, he was not

¹⁵ "Current Estimated Cost of Glider," no date (1943, est.). *Brukner Papers*, DoAaSC; Cunningham, *The Aircraft Industry*, p. 80; Holley puts the 1944 figure at 37 percent (*Buying Aircraft*, p. 494).

¹⁶ Minutes of Board of Directors' Meeting, June 9, 1941. *Brukner Papers*, DoAaSC.

¹⁷ Robbins to Brukner, September 21, 1942. *Brukner Papers*, DoAaSC.

making it possible for Waco to develop the new managerial capabilities it sorely needed.¹⁸

Waco continued to be overly reactive in dealing with the dramatic changes it faced in its business context. The primary concern of Brukner and Waco Vice President Hugh R. Perry was the cost of the proposed expansion. The company should expand only to the extent that the expense was chargeable to one of its government contracts, they believed. Perry told Robbins, "Again, let me point out that expansion at this time . . . would be entirely at the expense of The Waco Aircraft Company. . . . Certainly, the Subcontract Division should keep its organization equal to the [current] problems involved."¹⁹ But with the AAF changing requirements frequently, this stance severely limited Robbins. The military often gave verbal direction to increase the quantities of aircraft on order; formal contract modifications followed later. Often those orders were based on the confidence AAF officers had in a company's ability to respond to the change effectively. In Waco's case the jump from thirteen to 253 C-62s demanded action, but the contract was not in place yet to allow immediate funding for Robbins' request. Development of the C-62 languished. The CG-13 caused deep losses for Waco. The weakness of the subcontract division deprived Brukner of the flexibility he needed to deal with capricious military policies. When Wright Field officials lost confidence in Waco's ability to meet their needs, the C-62 program died, and Brukner lost any hope he had of amortizing the losses he faced in the experimental phase of the program.

¹⁸ William Lazonick, *Business Organization and the Myth of the Market Economy* (New York: Cambridge University Press, 1991), pp. 45-49, 77-84.

¹⁹ Perry to Robbins, September 22, 1942. *Brukner Papers*, DoAaSC.

In fact less than one year later, the AAF formally notified Brukner that Waco was under investigation for "the excessive purchasing of raw materials and the failure to endeavor to effect cancellations of purchases as promptly as is possible." Asserting that "contracts are burdened by additional costs occasioned by the inefficiency and neglect of certain of your employees to execute their duties in a diligent and competent manner," it would "not condone or make reimbursement of losses which are due to the neglect or other dereliction of duty."²⁰ Robbins' concerns about his division's shortcomings had developed into readily noticeable problems the military could not overlook. Brukner was simply too cautious to make a success of military production in this turbulent setting.

As the lead prime contractor for a major defense program, he showed a similar reluctance to shape his business environment. Recognizing all glider contractors were in the same boat, some firms advocated the formation of a manufacturers' association to present businessmen's interests to the military. Ridgefield initiated the drive in December 1942, sending Brukner a telegram: "We are starting on a new year of high production. Suggest we all work and pull together to form a Glider Manufacturer's Association to aid each other and thereby aid our air force." The common interest seemed obvious. In fact, Pratt, Read, and Company, Inc. seconded Ridgefield's idea, promptly responding, "Naturally our problems are all in common and it seems to me that the sooner we get working as one unit in the matters which interest all of us the better."²¹

But Brukner was not as certain what, if anything, should be done. He first suggested that "[p]erhaps there is a more forceful community of interest in the plastic,

²⁰ Major Edward H. Murphy to C. J. Brukner, July 29, 1943. *Brukner Papers*, DoAaSC.

²¹ James A. Gould to Carl Dolan, December 26, 1942. *Brukner Papers*, DoAaSC.

wood, and composite aircraft group including powered types."²² John E. Parker, president of Northwestern, agreed, writing in a telegram, "I do not believe glider program long enough established for Glider Manufacturers' Association."²³ Having challenged the premise of common interests, Brukner then turned to a point he had been pressing since the 1920s: "we [should] first endeavor to rehabilitate the aero chamber [the Aeronautical Chamber of Commerce] on a basis of aircraft industrial unity as evidence that we are capable of formal cooperation."²⁴

The enthusiasm of the new arrivals to aircraft manufacturing and defense contracting spawned cautiousness in Brukner that became more evident as events unfolded. Brukner told other Waco executives,

I think we should take a back seat and avoid any position of promotion. In view of the thin ice of some of the enthusiastic acceptors it might be best for us to send a *laisson* [sic] engineer on the assumption that the cooperation is to be in production matters only and thus avoid any connection with promotional activities. They won't want AAF attendance but we might take the production attitude and suggest approval of AAF.²⁵

His telegrams expressing his reservations that such an association was "premature" did not upset plans for a January meeting. Hugh C. Robbins, Vice President and Director of Subcontracting, was Waco's senior representative, and he effectively squelched any further development of a National Glider Association. When asked directly what Waco's position was on the matter, Robbins replied "that Waco would not entertain becoming a member of a new organization such as discussed at this time, on the

²² Brukner to Carl Dolan, December 24, 1942. *Brukner Papers*, DoAaSC.

²³ Parker to Dolan, no date. *Brukner Papers*, DoAaSC.

²⁴ Brukner to Dolan, December 24, 1942. *Brukner Papers*, DoAaSC.

²⁵ Brukner handwritten note, no date. *Brukner Papers*, DoAaSC.

basis that it seemed a little premature, and that Waco had long been a member of the Aeronautical Chamber of Commerce, and therefore saw no reason for an additional organization." Immediately following his response, the group voted on the formation of an association; the "vote was unanimously 'No.'"²⁶ Collective action failed to materialize again, this time the direct result of Brukner's continued skepticism about such efforts and his persistent hope that the ACC could organize effective action. As before, however, his decision left Waco to deal with the government bureaucracy alone.

Complicating Brukner's task was the air force's continuing ambivalence towards the glider. The only constant in the program was its urgency. Commanders debated the types and quantities of aircraft and tinkered with the pilot training program to the extent that even when the gliders were ready for the front, the AAF had no pilots to fly them.²⁷ Headquarters Materiel Command expressed its frustration to General Arnold in August 1942 as it tried to jump-start Cessna production: "The Glider Program is not being accomplished as desired; the bottleneck has been steel tubing and plywood . . . it is urgent that a glider program for the future be established to avoid bottlenecks recurring."²⁸ But problems continued, and the airmen floundered for solutions. Typical of their efforts was a February 1943 meeting between officers from the various Army organizations with a stake in the glider program. Their conflicting opinions revealed the glider's awkward position in an air force placing little doctrinal value on this technological newcomer.

²⁶ Robbins to Brukner, Waco Memorandum, January 21, 1943. *Brukner Papers*, DoAaSC.

²⁷ Meeting Minutes, February 16, 1942. "Correspondence, 1941-1947," Lazarus Papers, USAFA Spec. Col.

²⁸ Materiel Command to Arnold, August 25, 1942. "G-1m," Box 172, Henry H. Arnold Collection, Library of Congress.

The airmen may have been confused, but they were confident in their ability to manage the economic affairs of the businesses involved in the glider program. Air Staff planners in Washington set the 1943 requirement at 6,000 (down from over 10,000 largely because of the logistical difficulties caused by the Cessna CG-4s). Troop Carrier Command, the unit actually employing the glider in combat, claimed to need only 4,056. Major D. H. Hamilton from Flying Training Command pointed out that the glider pilot training program was geared to serve the larger number, and now the "flow of pilots . . . is more than we can possibly absorb." Major A. F. du Pont further confused the issue, concluding that "[t]he Air Transport Command has been conducting tests with the CG-4A glider and indications are that the present design is not suitable as a cargo trailer." The CG-4 was designed as a tactical troop-carrying glider, not a cargo carrier, so the major's comment seemed to expand the requirements for the glider program at a time when the tactical and training programs were most chaotic.

Moreover, Materiel Command received orders to initiate a project "to break down the CG-4A glider into smaller components in order to save shipping space . . . [and] investigate the possibility of utilizing facilities such as Ford for building gliders overseas." At that point the Air Staff astoundingly declared "the production program on gliders is settled," with the understanding that by "continuing with the present production schedule of 6,000 gliders we can control the total number to be produced by changing the preferential rating assigned to the contractors thereby increasing or decreasing the flow of critical materials to them."²⁹ While this authority may have boosted the acquisition leaders' confidence in their ability to meet program objectives, it proved maddening for

²⁹ Minutes of Conference held in the Air Staff, February 5, 1943. AFMCA.

the companies trying to meet their contractual requirements. The ever-changing priorities contrasted with their perception that the program was clearly high priority work.

While the confusion of the February conference could be related to the fact that the program was new, that meeting was actually typical of the entire effort, as a Wright Field memo in 1943 explained: "[t]his program started in confusion and will undoubtedly end that way." The memo went on to re-address the fundamental question, "Are CG-4A gliders or any other type troop carrier gliders essential to the War Effort and if so, to what extent?"³⁰ This was not a rhetorical question, as within thirty days the glider effort nearly died before seeing combat. The top generals involved in the program had a heated "discussion as to whether or not there was any need for more gliders, and if so, how many and what type." Initially they set the requirement for gliders at 1,500 between then and June 1944—another drastic reduction. As discussion evolved, however, they reconsidered the more fundamental point: Should the Army have gliders? They could not agree on that issue but did conclude "that General [George C.] Marshall . . . would have to decide whether or not the Army needed gliders."

The airmen seem to have hesitated because the forceful personality of General Arnold hovered over the meeting, even though he was not present. Arnold did not like the CG-4, claiming (through his spokesman, General Giles),

it was too well engineered, too expensively constructed and that what he wanted was a type that would be flown but once, dropped into some spot, perhaps in the form of a crash landing, and let emerge from the wreckage what was left in men and equipment, hoping that "it" would be enough to hold the spot until other combative forces could reach the area.³¹

³⁰ Lieutenant Colonel Charles G. Schaefer to Chief, Procurement Division, Inter-Office Memorandum, March 29, 1943. AFMCA.

³¹ Daniel B. Blackman to Colonel D. C. Swatland, Report on Glider Program Conference, April 20, 1943. AFMCA.

The aircraft should be disposable. General Chidlaw, the Materiel Command representative, countered that safety requirements called for the current approach—anything less substantial would jeopardize aircrews, passengers, and cargo.³² As the generals' wide-ranging discussion revealed, the nature of the plane, the quantities, its purpose, and its survival were all open to debate over a year after the commencement of the experimental program. Such uncertain guidance made technological innovation extremely difficult.

Feedback from the Front

All the problems of the program, while discernible on the homefront, reached fruition on the battlefield. From early May until July 1943 the gliders were poised in North Africa for the impending invasion of Sicily. The parts were there anyway. One observer, Lieutenant Rolland Fetters, traveled through the various echelons in this theater just before the invasion. Serving as an aide to the Special Assistant to the Secretary of War for Air Richard Du Pont, he witnessed the introduction of this new technology to warfare firsthand. His incredibly rich report from this trip revealed the deplorable treatment the glider forces received in Africa.

Senior commanders expressed views as confusing as those in the United States, but at the lowest levels the picture crystallized. Lieutenant Fetters noted there were different perceptions of gliders at the various levels of command. The generals gloated about their units' ability to field and maintain the new plane. The majors and captains at the depot level commented on the lack of parts and tools needed to assemble the gliders.

³² Davis and Fenwick, pp. 134-5.

Finally, Fetters met the soldiers responsible for actually doing the work and was appalled by the conditions in which they worked and the products they turned out. At one base he found only eight serviceable gliders out of twenty-eight he inspected, and they needed significant work to be airworthy. Gliders arrived with parts kits missing and in unmarked crates. When the aircraft sections were located, crews found assembly impossible because the Ford fuselage did not match the Waco wings, which in turn did not match the Cessna empennage and so forth. The maintainers needed to show initiative, creativity, and resourcefulness; instead, they were apathetic (which did not surprise him, given the low priority assigned to their task). The units were all undermanned, poorly trained, and under-equipped. Fetters later wrote, "nothing will improve until we outfit these units and treat the men as we should."³³

The air commanders, still obsessed the drive for air force independence, were not prepared to solve these problems as they prepared plans for the Allied invasion of Sicily. Even though the effort was to be a joint operation, employing sea, ground, and air forces, the airmen were not enthusiastic about cooperation. The British, partners in this invasion, supplied the overall air commander, Sir Arthur Tedder, who was adamant that the air force remain unfettered by ground and naval planning and operations. The ground and naval commanders, however, reasonably asked to know how much air support to expect over the landing zones. Wing-Commander Leslie Scarman, Tedder's Personal Assistant, said no answer was forthcoming. He wrote, "His attitude then, as always, was 'Tell me what you want done and I will deliver in my own style.'" American flyers' overriding concern about independence and the bombing missions in support of the

³³ First Lieutenant Rolland F. Fetters, "Overseas Assignment for the Investigation of Army Air Forces Glider Program in European Theater of Operations," no date. AFMCA.

invasion produced a skepticism about operation LADBROKE (the glider assault) and caused foot-dragging and delays in planning air routes for the mission. The airmen's intransigence irked General George S. Patton, who finally asked the naval commander to provide air cover. He fumed, "[y]ou can get your Navy planes to do anything you want, but we can't get the Air Force to do a goddamn thing!"³⁴

The plans called for the British to supply the glider pilots while the Americans would pilot the cargo aircraft, the Douglas C-47, which served as the tug. The British had previously used gliders in the North African campaign, so many of their pilots had combat experience. What they lacked was flying time in the Waco CG-4A aircraft. The gliders came in so recently and there were so many logistical problems in the theater, that there were RAF pilots with only two hours behind the controls of the CG-4 flying into combat.³⁵ The AAF C-47 pilots faced the challenging task of towing the gliders from Africa to Sicily at night, getting the aircraft into the proper position to release the glider, then returning home—a ten hour mission. Poor weather and Axis anti-aircraft artillery further complicated the task.

Operation LADBROKE encountered adversity from the start. The evening of the planned invasion, 9 July 1943, General Dwight D. Eisenhower, the overall commander, agonized over the decision to launch the aircraft in the face of the gale that was blowing in the Mediterranean. Realizing that scrubbing the missions would mean a month's delay until the moon would again cast enough light, Eisenhower gambled that

³⁴ Carlo D'Este, *Bitter Victory: The Battle for Sicily, 1943* (New York: E. P. Dutton, 1988), pp. 167-9.

³⁵ D'Este, *Bitter Victory*, pp. 172-175; William R. Breuer, *Drop Zone Sicily: Allied Airborne Strike, July 1943* (Novato, CA: Presidio Press, 1983); and Wesley F. Craven and James L. Cate, *The Army Air Forces in World War II. Vol. 2. Europe: Torch to Pointblank, August 1942 to December 1943* (Washington, D.C.: GPO, 1983).

the planes would get through. The rough weather made it difficult for the pilots, and, with so many inexperienced people at the controls, chaos reigned. Tugs got lost and returned to Africa. One released its glider over Malta—Eisenhower's command post, half way to Sicily. Most arrived near Sicily, but when the Germans opened fire on the aircraft, many C-47s immediately released their gliders.³⁶ Those that continued had difficulty finding the drop zone and simply guessed where to release the gliders.

In the darkness, over unfamiliar territory, the glider aircrews had no control over their rate of descent and very little over their landing site. Many landed in the sea, and the Waco aircraft sank very quickly up to the wing panels. With no escape hatches built for the airmen and soldiers, hundreds of men lost their lives in the Mediterranean. Those landing on Sicily could do little more than hope for a mild crash. Gliders that smashed into trees and had wings ripped off but otherwise remained intact were common. Some ran over rock walls, ruining the aircraft but not the men and equipment inside. Others were not so lucky. Some gliders crashed before slowing significantly, killing many soldiers. Most of the glider invasion force landed more than five miles from the drop zone, and in the bad weather and confusion of combat, the Allies lost or killed most of their own troops.³⁷ The 9 July 1943 glider assault on Sicily failed.

The debacle prompted some strong response from the American airmen. One of the C-47 pilots said he "would rather not have anything to do with these parasites." Another said "that his main objection other than the glider being a pile of junk, was the decrease in flying speed of the tug ship, with the glider in tow." Another said, "The hell

³⁶ Breuer, *Drop Zone Sicily*, p. 42.

³⁷ *Ibid.*, p. 45; D'Este, *Bitter Victory*, pp. 231-2.

with the maintenance, we don't want to tow them around anyway."³⁸ After many days in Africa and Sicily and many animated conversations with the troops, Fetters concluded that "[i]n general, the personnel in the North African Theater have little care or concern for gliders."³⁹ Du Pont agreed. He recommended to General Arnold the following month, "if TCC [Troop Carrier Command] cannot be convinced of the tactical utility of gliders, either relief be given personnel or the glider program be halted."⁴⁰

The AAF tried to address the problems of glider technology in the months after the assault. Specific recommendations for CG-4 improvements ranged from better cockpit instrumentation to escape hatches. In fact, the changes became so substantial that, instead of designing a CG-4B (an updated version of the basic model), Wright Field asked Waco to design the CG-15, an improved aircraft.⁴¹ Again, just as Brukner was ironing out wrinkles in the Waco production program for CG-4s, his engineers launched another experimental project. Only three months after the October 1943 contract signing, Waco delivered the XCG-15 for flight testing. Important updates included new ailerons for improved control, higher towing speed, greater payload, an improved landing gear, and better visibility for the pilot.

Although the changes were not as extensive as those embodied in the CG-13, they proved more disruptive to the Waco factory. Whereas the CG-13 contracts went to other companies, Wright Field curtailed Waco's CG-4 contract and ordered 385 CG-15s

³⁸ Fetters, "Overseas Assignment," Daily Diary, 11 July 1943, p. 11, AFMCA.

³⁹ Ibid., Report to Commanding General, Headquarters Air Service Command, p. 3, AFMCA.

⁴⁰ Du Pont to Arnold, August 21, 1943. "G-1m," Box 172, Henry H. Arnold Collection, Library of Congress.

⁴¹ Davis and Fenwick, p. 176.

in September 1944, requiring yet another retooling effort. Because of the military's continuing reliance on CG-4s, however, the other CG-15 contract to Northwestern was canceled before this manufacturer could begin its retooling. The air force knew it needed something better than the CG-4, but the urgent need to continue deliveries and the limited capabilities of the glider team hindered efforts to fully capitalize on Waco's new design.

Brukner tried to stabilize the glider program. Although he had rejected the idea of creating a Glider Manufacturers' Association early in 1943, the conflicting guidance and confusion in the program drove Brukner to become a member of the Central Aircraft Council (CAC). Businessmen from companies engaged in AAF work organized the CAC to provide a better means of communicating with procurement boards and the military. They wanted to alleviate the confusion that had emerged as military production continued to expand rapidly. Their efforts comprised the private half of an AAF campaign to create a rigorous, decentralized structure for procurement. Wright Field's campaign intensified when Brigadier General C. E. Branshaw assumed the duties of commanding general of the Materiel Command in April 1943.⁴²

The Central Council was part of a major effort to restructure the process of procurement. The Council encompassed a region defined by the military as the Army Air Corps Central Procurement District, which paralleled the East Coast and West Coast organizations already in existence. Members included established aviation companies like Republic Aviation and Waco Aircraft, firms from other industries that had been converted to aircraft manufacturing (Ford, General Motors, Chrysler, Goodyear, and Packard, for example), and aircraft equipment manufactures like Bendix and Thompson

⁴² Holley, *Buying Aircraft*, p. 504.

Products. CAC officials formed committees on Aircraft Materials, Manpower, and the Simplification of Paper Work. Together they hoped to "act in an advisory manner" on any issues facing "the Air Corps or any other government agency having to do with the manufacture of aircraft war materiel."⁴³

Brukner needed relief from bureaucratic pressures in 1943. Eighteen months of battling the government for facilities, manpower, and materials had resulted in a glider program that still lacked specific requirements. Brukner remained skeptical of the Aeronautical Chamber of Commerce (he sent no representatives to any of the meetings during the war years) and avoided alliances with other glider contractors. Membership in the CAC was a reasonable compromise. Characteristically, though, Brukner took no initiative in its formation and filled no leadership role.

The CAC failed, however, to bring under control the AAF's procurement policies. Continued fluctuations in the glider program devastated the procurement plans. In the wake of the Sicily invasion, general officers continued to challenge the utility of gliders in combat. Many called for smaller production quantities or outright cancellation of the program.⁴⁴ Although gliders played an important part of the Allied invasion of Normandy and the advance towards Germany, increased battlefield effectiveness failed to squelch the critics. The troops began to display a more positive attitude toward gliders, experimenting with their employment as mobile vehicle repair stations and aerial ambulances. For a number of weeks in 1944, some commanders began reconstituting the glider fleet for use in future offensives. As such efforts show, the AAF had made

⁴³ E. R. Breech to C. J. Brukner, April 24, 1943. *Brukner Papers*, DoAaSC.

⁴⁴ *Ibid.*, p. 84.

progress in solving the logistical problems revealed in the Sicily campaign. Clearly the planes proved to be of some utility in combat, but their strategic importance was less clear.

Army officers continued to debate the importance of gliders throughout the war. In opposition to Arnold's belief that the glider was of secondary significance, the Army's advocates for airborne operations argued vehemently for a primary role for gliders. In 1943 the airborne force's senior leadership asserted that "there was a tremendous strategic value in connection with gliders and that the very fact they were being produced in large quantities and being delivered to combat zones, created the desired psychological effect upon the enemy morale. . . ."45 The debate ruined cooperative efforts within the Army intended to stabilize the glider procurement program. Two years later the headquarters of the Army's Air Technical Service Command was still lamenting that "an urgent need for better coordination among all glider agencies including staff, development, training, and operations, has become increasingly apparent during the past two years. This coordination has been particularly lacking in the establishment of military characteristics for combat gliders."⁴⁶ As postwar project record concluded, "considerable confusion has resulted in the exact design requirements for . . . gliders."⁴⁷

The various Army commands were able to coordinate technological innovation involving safety. Protecting the aircrew, passengers, and equipment during the flight,

⁴⁵ Daniel B. Blackman to Colonel D. C. Swatland, Report on Glider Program Conference, April 20, 1943. AFMCA.

⁴⁶ Aircraft Laboratory Memorandum Report "Glider Development Conference," April 26, 1945. AFMCA.

⁴⁷ Special Aircraft Branch, Procurement Division, "Project Record CG-4A and CG-15A," September 1, 1945. AFMCA.

descent, and especially the landing became the basis on which most modifications gained support. The majority of the gliders the military purchased were of two types, the CG-4 and the CG-15. The CG-3 was too small to be of much utility, and the CG-13 required a landing speed that put its larger payload in greater jeopardy. Equally important, the CG-13 interfered with the production of the CG-4 and CG-15. To minimize its impact the AAF placed orders for fewer CG-13s, only 100 for the entire war, than the other Waco designs. Thus the safest gliders, from both the flight safety and procurement standpoints, became the focus of the AAF's efforts.

Still the airmen remained ambivalent. Most indicative of their skepticism was the call at the end of the war for gliders with engines, which would eliminate the need for a tug. This proposal would transform the craft into airplanes. The oxymoron—multi-engine glider—was the AAF's most succinct commentary on glider technology. Many officers and companies, including Waco, worked diligently in 1945 to untangle this paradox, but the top air leaders had their eyes on a different goal, cargo assault aircraft, like the C-123 of the Korean War and the C-130 of today.⁴⁸ Once all parties recognized the absurdity of "powered gliders," tactical cargo gliders and the niche they were intended to fill disappeared from military planning until the Vietnam War.

Inside the Waco Aircraft Company—The Labor Situation

The conflicting demands the government placed on Waco continued to make it difficult for Brukner to set priorities at a time when he was struggling with a critical labor

⁴⁸ Raymond J. Snodgrass, *The AAF Glider Program, November 1944 to January 1947* (Air Materiel Command History Office, Intelligence Department, Study #217, 1947) pp. 54-5.

situation. Workers were not only hard to find but also left at alarming rates. Turnover complicated production planning. As early as 1941, Brukner had begun to express alarm that the labor situation was constraining Waco's ability to compete on subcontracting opportunities with those firms already heavily engaged in defense business. "Bidding on parts in sub-contracting fields, . . . is not simple on account of factor uncertainties both as to labor hire and as to availability on the line," the Waco board of directors reported in March 1941. For the time being Brukner cautiously directed that the company should "stand in line" for government or defense contractor hand-outs. His concluding understatement of the situation belied the magnitude of the problems to come: "The labor market in the aircraft industry just now is highly competitive."⁴⁹

Conditions in Troy matched those around the country. The shortage of skilled aviation workers affected the rapid development of productive capacity throughout the aviation industry. Economist Tom Lilley concludes that the labor shortage had its greatest impact only after 1943, when other problems with plants and tools had been substantially fixed and the military had drawn off millions of men for overseas deployments.⁵⁰ Waco's experience suggests that Lilley's findings require modification. Brukner constantly faced shortages that delayed work on the C-62, the glider experimental programs, glider production, and Plancor 398 construction. The uneven flow of work to Waco and the importance of labor in the manufacturing process forced Brukner and his managers to alter production methods. Placed on unfamiliar terrain, they made poor decisions that eroded the company's effectiveness. Other firms did better.

⁴⁹ Quotes from Minutes of Board of Directors' Meeting, March 3, 1941. *Brukner Papers*, DoAaSC.

⁵⁰ Lilley, et al, *Problems of Accelerating Aircraft Production*, p. 4.

They successfully expanded their workforces and focused on implementing the changes needed to shift from batch- to mass-production methods.

Overall employment in airframe and engine manufacturing increased from 63,200 in 1939 to the maximum of 1,345,600 in 1943. Many companies became truly big businesses during the war. Lockheed's workforce, for example, grew to 93,000 at its peak. High turnover plagued all of these firms. North American Aviation saw its turnover rate climb from 30 to 100 percent by 1942. Waco, in comparison, experienced a 100 percent rate from October 1940 to October 1941.⁵¹ For those companies with enough war contracts to justify the purchase or construction of new factories, the availability of labor became the primary factor in determining their location. Moreover, the shift from a mostly skilled workforce to one that was predominantly unskilled caused revolutionary changes in methods of production.⁵² Clearly the labor situation had a profound impact on the aviation industry during the war years.

The problems for Waco began early. Brukner lost his vice president and general manager, Lee Brutus, at the end of 1941. Brutus had served with Brukner for over a decade, complementing Brukner's technical knowledge with his skill at managing Waco's external affairs. His loss at the beginning of the defense efforts left a leadership void that Hugh R. Perry tried to fill. He, too, had over ten years' experience with Waco, but he proved less adroit at managing the company's outside relationships with suppliers,

⁵¹ L. O. Mellen, Office of Production Management, to C. J. Brukner, October 9, 1941. *Brukner Papers*, DoAaSC.

⁵² Rae, *Climb to Greatness*, pp.149-153; Lilley, et al, *Problems of Accelerating Aircraft Production*, p. 76; Cunningham, *The Aircraft Industry*, pp. 130-131.

subcontractors, and the military. What Waco needed was new, vigorous leadership at a time when it was exploring for the first time possibilities in the military field.

Brukner was slow to realize the constraints the shortage of labor were imposing on Waco's ability to produce large quantities of aircraft. In 1942 he was still finishing the production of 800 trainers for the CPTP, by far the largest output Waco had seen since the 1920s. Two critical factors ruined the trainers' usefulness as a model for production of other planes, however. First, they were small, simple, and well-known aircraft of the type that Waco had built since its founding. Batch-production methods dependent on skilled laborers were sufficient to meet the requirements, even though they were comparatively the largest orders in the firm's short history. Second and more important, the trainer design did not vary during production. No further aircraft engineering or refinement of the production process was needed to ensure the on-time delivery of these 800 planes. On the other hand, both the C-62 and the gliders were much larger and more complicated than the trainers, and Wright Field frequently demanded changes in the planes' characteristics. Batch-production methods could have responded to changing customer demands, but the military's larger orders, the accelerated delivery schedules, and the dissipation of skilled labor militated against their use in the mobilization context. Brukner realized this too late. Only in 1943, after the AAF added CG-4 production to the requirement for 253 C-62s, did Brukner re-evaluate the production methods he needed. Then his assessment of the labor situation forced him to concede that "recent experience has demonstrated the advisability of more extensive tooling and jigging of production operations than was formerly contemplated, so as to

make effective use of the lesser skilled labor which is available and to be made available thru [sic] specialized training.”⁵³

Other Ohio companies had learned that lesson much sooner. Goodyear Aircraft in Akron, Ohio, a subsidiary of Goodyear Tire, was a major subcontractor for Curtiss, Grumman, Martin, and others, and a licensee for the production of the Chance Vought Corsair fighter aircraft. Employment at Goodyear Aircraft expanded from 30 in December 1941 to a peak of 33,500. To accommodate the huge defense orders, the DPC funded four new factories adjacent to the old blimp hangar in Akron and a satellite plant in Arizona.⁵⁴ Since first receiving orders for aircraft subassemblies, Goodyear management had emphasized production capability. “We turned to machines, which untrained people could learn to operate. A company might spend six months to a year tooling up before it produced a single plane. But once this industrial machine began to roll it turned out airplanes. . . .”⁵⁵ Key leaders of Goodyear Aircraft moved over from the parent company Goodyear Tire, and their familiarity with mass-production methods made them less reluctant than Brukner was to apply these techniques to aircraft.⁵⁶ The aviation industry had not yet needed to turn to mass-production in its few decades of existence. Brukner’s gradual, hesitant acceptance of production changes reflected his long tenure in the industry, his lack of experience with military demands, and a stubborn streak that is probably generic with successful entrepreneurs in a new industry. Those

⁵³ C. J. Brukner Memorandum of Pertinent Information to DPC, March 13, 1943. *Brukner Papers*, DoAaSC.

⁵⁴ Hugh Allen, *Goodyear Aircraft* (Cleveland: Corday & Gross Co., 1947), pp. 8-36, 52.

⁵⁵ *Ibid.*, p. 38.

⁵⁶ *Ibid.*, pp. 57-59, 72.

who are able to make a transition as formidable as the one from batch- to mass-production easily and quickly are, no doubt, extremely rare. Brukner, who was probably close to the norm for small enterprisers, jeopardized the schedules his contracts specified by dint of his cautious approach to the transition.

Waco's labor shortage, although typical in the aviation industry, hit hardest in the critical engineering division. Wright Field officials frequently cited the inadequacy of engineering staff as the primary reason for the company's marginal performance. "Considerable trouble has been experienced by Waco on wing engineering. . . . It is believed that because of Waco's limited engineering personnel and lack of experience in production of a plane of this size, it will be late in 1943 before the C-62 is ready for production," Manufacturing Methods Section reported in March 1943.⁵⁷ Earlier, the Experimental Engineering Section of Wright Field identified Waco's engineering force as a high risk to the C-62 program. Waco hoped to expand its engineering division in 1942 from 132 to 186 personnel, but the air force was skeptical about the plan since "most of this additional group are new engineers that will have to be obtained from whatever is available in the market."⁵⁸ The military had already declared that it would take all new engineers who were physically qualified for service. The demand within the aviation industry far exceeded the supply, and the Aeronautical Chamber of Commerce warned manufacturers that the "industry must depend upon upgrading and in-service training, and employment of women and older engineers."⁵⁹

⁵⁷ Manufacturing Methods Section Memorandum Report on C-62 Cargo Airplane, February 25, 1943. *Brukner Papers*, DoAaSC.

⁵⁸ Experimental Engineering Section Memorandum Report on Engineering Progress C-62 Airplane, July 20, 1942. *Brukner Papers*, DoAaSC.

⁵⁹ Confidential Report on War Manpower Program, September 4, 1942. *Brukner Papers*, DoAaSC.

The shortage stretched Francis Arcier's division to the breaking point. Unable to manage the concurrent demands of the glider workload and the cargo plane's development, Waco struggled to build up an appropriate engineering force. Then, suddenly, the AAF cut the quantity of planes from 253 to 13 in 1943. The effects on the engineering department were immediate. "Waco lost 12 engineers last month. Originally employing 175 the Engineering Department now employs 65," Wright Field told its headquarters in Washington in October 1943. More ominously, "a steady decrease in skilled employees has been experienced since the partial termination. . . ." ⁶⁰ Engineering's deficiencies impacted the factory floor and complicated Waco's remaining production contract for CG-4 gliders.

Shorthanded, the engineering department continued to find it impossible to keep up with the air force's demand for glider improvements. The CG-15 followed the GG-13, and Wright Field asked Waco to participate in experimental efforts to place engines on the gliders to reduce the burden on the AAF's fleet of transport aircraft. This project actually represented a formidable opportunity for Waco. It could either gain a foothold in the transport field, if powered gliders developed as the military envisioned, or regain a claim to expertise in large, powered aircraft, a niche that had disappeared with the cancellation of the C-62 aircraft. The realities of the labor situation, though, overwhelmed the organization and Brukner was unable to capitalize on the opportunity.

In early 1945 Brukner instructed his Vice President in Charge of Engineering, Francis Arcier, to reject the military's offer. Having lost money on all of the other experimental efforts, Brukner was reluctant to accept more work for the department that

⁶⁰ Colonel D. L. Putt to Chief, Technical Staff, October 13, 1943. AFMCA.

had been the most troublesome part of his firm. In a perverse shifting of responsibilities, the engineering prime contractor told Wright Field that "we have recommended, in the best interests of all concerned, that the project of adding engines to the CG-13A Glider be undertaken, if possible, by one of the two actual participants in the production program."⁶¹ The two contractors, Ford and Northwestern, joined the glider program only because of their production capabilities. They had little or no aeronautical engineering talent and no design experience. Thus Waco's recommendation to empower other firms in the glider program is clear evidence of the profound influence the labor situation had on the engineering department and the entire company.

Of course many other factors, including prevailing wages, influenced Waco's labor situation. In 1942 the government imposed wage controls to minimize the turbulence in the labor markets and prevent employee pirating. The controls affected all aspects of Waco's expanding business. In September 1942, for example, Brukner reported to the DPC that Plancor 398 was far behind schedule because

we are a small-town project within the shadow of the enormous industrial and government expansion at Dayton, Ohio. The demand for technical and skilled help within the factories and Posts . . . has handicapped overloaded architects and contractors in expanding their forces with sufficient capable help to make the desired progress.⁶²

Businessmen in Troy found it hard to compete for all types of labor in the tight market in that region.

Because of this Brukner tried to avoid the episodic hiring that had been the norm during the interwar years. The military's changing requirements often dictated

⁶¹ A. Francis Arcier to Director, Air Technical Service Command, January 8, 1945. AFMCA.

⁶² C. J. Brukner to Curtis L. Hollister, September 5, 1942. *Brukner Papers*, DoAaSC.

vastly different numbers of workers, depending on the types and quantities of aircraft on order. Periodically during the war Brukner grew concerned that his expanded factory and workforce might not be fully employed due to the C-62 partial termination, then cancellation, and the unpredictable deliveries of raw materials to the plant. He directed Perry and Robbins to look for other subcontracting opportunities, "pointing out the fact that such contracting should be done now if material flow and tooling equipment are to enable us to avoid a break which would lose personnel so difficult to replace when again needed."⁶³ Such efforts produced a contract in 1943 with Vultee on a classified project of approximately the same size as the Republic contract (just over \$300,000 for the year). In this new role, Brukner again had the chance to build a relationship with a larger defense contractor. Instead he lost almost \$60,000 and did not have any further dealings with Vultee for the remainder of the war. While the subcontract failed to edge the company towards a fruitful strategic alliance, it did succeed in the more limited goal of holding labor that Waco may otherwise have lost to other defense businesses in the region.

Government wage controls and the military's volatile demands taught Brukner some hard lessons. The difficulties in finding competent laborers were not solely a consequence of short supply. Both with Plancor 398 and the glider programs, the government's policies hurt Waco. In 1942 the DPC instructed Brukner to write to Washington, D.C., to seek relief from the loss of "six plumbers who have walked off of the job for the reasons that they could get \$1.65 per hour on private work" while the

⁶³ Minutes of Board of Directors' Meeting, February 7, 1944. *Brukner Papers*, DoAaSC.

Plancor 398 pre-determined scale was \$1.55 per hour.⁶⁴ The resultant delays and the enormous demands on Brukner's time to resolve such glitches in the government programs made each change extremely costly. Brukner needed to delegate more of this work to his colleagues, but he found it hard to delegate authority and responsibility for government relations.

Near the end of the war, the air force and Waco negotiated the conversion of the CG-15 production contract from a cost-plus-fixed fee to a fixed price basis. Waco's uneven performance on earlier CG-4 production contracts and the continuing regulatory constraints on the labor market were clearly on Brukner's mind as he crafted his proposal. In May 1945 he wrote that

unsatisfactory wage rates are now in effect at this facility by reason of War Labor Board . . . because of the proximity of the Contractor's plant to the Dayton Area labor market which enjoys a substantially higher classification. Relief from this condition has been repeatedly applied for and at present an appeal has been pending for more than four months without decision. The Contractor has been unable to secure new personnel or retain present employed persons at the sub-standard wage rates of this labor market.

He flatly told the AAF "it will be impossible to reach a delivery peak of 105 gliders per month" and demanded compensation for the "increase in cost of manpower for any reason whatsoever."⁶⁵

The labor situation applied pressure on Waco's overtaxed leadership throughout the war and stole whatever margin of error it might have enjoyed in learning the complexities of defense contracting. Waco's experience was not unusual.

⁶⁴ C. E. Jefferson to C. J. Brukner, November 17, 1942. *Brukner Papers*, DoAaSC.

⁶⁵ Waco Proposal for Conversion of Contract, May 31, 1945. *Brukner Papers*, DoAaSC.

Employment figures for the other contractors and subcontractors involved in the glider program show that Waco's workforce was of average size. The largest subcontractor, the American Stove Company in Muskegon, Michigan, had 1,000 employees. The high employment figures for early 1944 reflect the military's most extensive glider program, which included three models at that time. The labor problem Waco faced was thus not unique. While the subcontractors could focus exclusively on production, however, Brukner and his managers had other subcontracts and substantial engineering projects to execute as well. The multi-faceted nature of Waco's wartime business distinguished it from other firms in the glider program.

Table 7-1

Glider Program Employment, Prime Contractors
(as of November 1944)

<u>Contractor</u>	<u>Factory Location</u>	<u>No. Employed</u>
Ford	Iron Mountain, Michigan	3,200
Commonwealth	Kansas City, Missouri	702
General Aircraft	Astoria, New York	477
G & A Aircraft	Willow Grove, Pennsylvania	262
Laister-Kauffman	St. Louis, Missouri	1,238
Northwestern	Minneapolis, Minnesota	1,400
Robertson Aircraft	St. Louis, Missouri	318
Waco Aircraft	Troy, Ohio	1,308
17 Subcontractors (only 3 outside the Mid-West)		3,815
TOTAL		12,720

Source: Colonel H. A. Shepard to Commanding General, Army Air Forces, November 21, 1944. AFMCA.

Table 7-2

Glider Program Employment, By State
(as of January 1944)

<u>State</u>	<u>No. Employees</u>	<u>Percent of Total</u>
Connecticut	2,122	13.2
New York	1,418	8.7
New Jersey	445	2.7
Pennsylvania	804	5.0
Ohio	1,578	9.7
Michigan	4,994	31.0
Minnesota	1,635	10.0
Missouri	1,230	7.6
Kansas	1,969	12.4
TOTAL	16,195	100.0

Source: Cunningham, *The Aviation Industry*. pp. 212-213.

Waco's projects were all labor-intensive, and this ensured that problems in this area would command the immediate attention of management. Work on the experimental phases of the four gliders was centered in the engineering department, and as we have already seen, Arcier and Brukner experienced tremendous difficulty finding enough competent workers. Labor costs exceeded eighty percent on the experimental contracts for the CG-3, CG-4, and CG-13, all of which lost money. The CG-13 experienced 48 percent overruns.⁶⁶ On the production contract for CG-4 gliders, a profitable undertaking, labor accounted for approximately 60 percent of the total cost of each glider.⁶⁷ Labor was also the critical cost component on Waco's subcontracts, totaling as much as 60 percent of the costs on some of the projects. Since labor was the critical

⁶⁶ Calculations on the Redesign of the CG-4A Glider, March 3, 1942; H. R. Perry to A. F. Arcier, April 10, 1943. *Brukner Papers*, DoAaSC.

⁶⁷ CG-4A Production Costs, no date. *Brukner Papers*, DoAaSC. Unfortunately no similar breakdown of production costs for the CG-15 glider exists in the company's records.

component of cost on all Waco programs, Brukner spent much of his time—far too much, in fact—dealing with recruiting and retention problems.

Inside the Waco Aircraft Company—The Blurred Boundaries of the Firm

In some cases, like the Republic subcontract, management's leadership made a positive difference. After a difficult start, Brukner reversed Waco's performance on the contract and earned large profits in fiscal years 1943 and 1944. The turnaround resulted from intense efforts to solve the mystery of the poor welds on the motor mounts, which caused frequent rejections by Waco, Republic, and AAF inspectors. Brukner took two decisive steps. First, he sent Waco personnel to Farmingdale and to Republic's other subcontractor, the Mack Truck Company, to observe their manufacturing techniques. Second, he assigned a new manager to the task of analyzing the motor mount problems in February 1943, telling him that Waco had "some troublesome processing stages and [had made] numerous costly concessions."⁶⁸ The trips and the special analysis worked, and the Republic contract stands as a good example of a tactical victory.

⁶⁸ C. J. Brukner to King, February 8, 1943. *Brukner Papers*, DoAaSC.

Table 7-3
Waco's Subcontract Performance

	1943	1944	1945
Curtiss-Wright			
Sales	270.5	139.7	44.8
Gross Profit	31.8%	38.0%	31.6%
Republic			
Sales	351.0	310.5	
Gross Profit	21.6%	17.2%	
Vultee			
Sales	342.5		
Gross Profit	-16.8%		

Sources: Statements of Profit and Loss, Fiscal Years 1943, 1944, and 1945. *Brukner Papers*, DoAaSC.

Unfortunately the turnaround had no strategic value. By the time Waco fixed the motor mount problems, the relationship with Republic had soured to the point of ruin. Republic inspectors in the Waco plant told their supervisor in Farmingdale that improvements in the Waco process were unlikely. "This is doubtful due to the fact that we have had promises from [them] before on this score which were never kept," they told him in June 1943. They identified personnel problems as a key factor in Waco's poor performance: "We had several good inspectors but they either transferred to other departments or quit." But what irked them most was the perceived attitude of Waco's management. Waco inspectors compounded the mistakes the welders made, and "no attempts have been made . . . to eliminate the carelessness."⁶⁹ The letter to Republic's home factory signaled a permanent change in Brukner's relationship with the larger defense contractor. The military's finding that Republic's inspectors had been too

⁶⁹ All quotes from John Addeo and Walter W. Winazak to John Howard, June 2, 1943. *Brukner Papers*, DoAaSC.

aggressive and its stern scolding of the prime contractor added to the larger company's bitterness towards the manner in which Brukner managed the problem. Waco's mission to New York later that month resulted in better motor mounts. It did not, however, salvage the cooperation Brukner had hoped to garner from Republic. Brukner once told Mundy I. Peale, Republic Vice President, "we like to think of Waco as one of your departments, and to work closely with you in that capacity."⁷⁰ That opportunity was now gone.

Similar hopes to work effectively with the military faded when the workload overwhelmed Waco's management. The sudden switch to defense contracting caught Waco unprepared, and senior air force leaders quickly realized what had happened. From Washington, D.C., General Echols insisted that Wright Field "keep hammering away on Waco and continue to push the C-62,"⁷¹ trusting that Brukner would sort out the initial difficulties in time and successfully produce transports in quantity. But seven months later government officials reached the disappointing conclusion that they could not overcome "the inability of Waco to cope so quickly with a production program concerning which it personally lacked historical experience."⁷²

At times Brukner—who had built his enterprise on a foundation of hard work and confidence—began to doubt the company's ability to meet these challenges. His administrative processes were under extreme pressure, and his managers were, like their boss, often too slow to react to the increased burden. On occasion this caused

⁷⁰ Brukner to Peale, June 9, 1943. *Brukner Papers*, DoAaSC.

⁷¹ Colonel B. W. Chidlaw to Chief, Experimental Section, Wright Field, August 9, 1942. AFMCA.

⁷² Lieutenant Colonel Charles G. Schaefer to Chief, Procurement Division, March 29, 1943. AFMCA.

embarrassing mistakes. Brukner's already-taxed patience with the new DPC factory changed to anger when he learned in January 1943 that the accounting department had failed to pay the one-dollar rent to the government. In a scathing memo to the company's treasurer, R. E. Hoefflin, he said,

I realize that there have been large problems and complicated details to be handled in connection with all of our government negotiations . . . and that some of our difficulties are not our fault, but a simple matter like paying the \$1.00 annual Plancor rent, when they have sent us a letter of reminder in advance, could be handled. . . .

Effective interactions between members of the aeronautical technology community, as in all communities, depended on credibility, and Brukner knew that such stories eroded Waco's reputation. As the most eminent historian of military procurement, Irving B. Holley, has concluded, "when the air arm officials entered a contract, they expected to buy not only the end products on order but also the managerial skills of the contractors concerned."⁷³ It began to appear that the military had been shortchanged where Waco was concerned. Brukner could not stand these setbacks and told Hoefflin, "This incident will go a long way to substantiate anything they wish to say about your handling of Plancor accounting matters, and makes me do some wondering too."⁷⁴

The government, in fact, had much to say about Waco's management. Acquisition procedures intruded on every aspect of a contractor's business, from financial audits to material inspections. As a civilian manufacturer Waco had developed its methods of management in a context relatively unfettered by the government. The Department of Commerce certification process focused mainly on the final product, not

⁷³ Holley, *Buying Aircraft*, p. 402.

⁷⁴ Brukner to Hoefflin, January 14, 1943. *Brukner Papers*, DoAaSC.

on the manufacturing process. Nor were other aspects of business affairs, like subcontracting and finances, of concern to the regulators Brukner faced during the interwar period. With defense contracts came an enormous bureaucratic mechanism that ensured contractors managed programs in the interests of the government.

Grafting the processes and personalities into an organization with no previous experience in defense acquisition was a difficult undertaking even in theory. This was obviously a capability Waco did not possess. The results became clear very soon. Brukner's commitment to independence had created an insular corporate culture that resisted the rapid assimilation of external ideas. Hence the long, tentative transition to military aviation from 1938 to 1941. Moreover, the switch from batch- to mass-production methods, although never complete, further complicated the process of organizational innovation. In other words, in addition to transforming the power relationships within the company, the work methods that the firm employed also had to change drastically.

The process of integrating the military's oversight personnel and procedures and the corporate modifications which the new business context required blurred the boundaries of the firm. The rapid expansion impacted fundamental issues of span of control and lines of authority. Redrawing the organizational chart altered relationships that Brukner had created and that had been effective for many years. It disrupted the efficient flow of information to key decision-makers; decisive leadership was needed to guide the company through a turbulent transformation. During this critical period, though, Brukner turned cautious. Government bureaucrats stepped into the leadership void he left.

The blurred boundaries and structure of authority of the firm most forcefully influenced the inspection function within Waco, but other areas suffered, too. As Brukner wrestled with the DPC construction project, for example, his direct involvement gave him a narrow perspective that disturbed the government managers. After a year of delays, overruns, and poor decisions, the DPC supervising engineer directed Brukner to give Carpenter, Waco's hired engineer, "more authority and [assignment] to the project site as resident engineer."⁷⁵ Such an order directly impinged on Brukner's authority as company president. It not only contradicted Brukner's assessment of Carpenter's performance but also confused the relationship that Carpenter had with the DPC site representative—did he report meticulously to Brukner or did he expedite progress as demanded by the DPC? The muddled authority exemplified in this instance found full expression on the factory floor, where government and company inspectors negotiated the compliance of hundreds of manufacturing products every day.

Contracts for defense articles vested the military with the authority to inspect all work. In order to avoid wasting time and money on products that failed inspection only when completed, the military deployed a cadre of inspectors to contractors' plants to check materials, parts, subassemblies, and intermediate steps in the process of final integration of complete airframes. At any point they could pull an item from the line for repair or salvage, depending on the extent of the deficiency. The personnel demands were heavy, and the expense of maintaining a huge corps of inspectors drove the military to allow contractors to seek certification for their own inspection organization upon reaching certain standards of rigor and administrative competence. Achieving Class "A"

⁷⁵ Curtis L. Hollister to C. J. Brukner, December 23, 1942. *Brukner Papers*, DoAaSC.

rating for quality control indicated that a firm had become a full-fledged member of the military aviation community. It also indicated that the firm would be able to save considerable time and money otherwise devoted to dealing with the government inspectors.

Wright Field officials quickly realized that Brukner needed help to attain an "A" rating. Within the aviation industry, inspection departments most commonly fell under engineering to facilitate the flow of technical information from the design stage to production techniques on the factory floor. This was Brukner's scheme before the war. But with Arcier's department buckling under the load of the CG-3 and CG-4 gliders and XC-62 experimental programs, the inspection function suffered. The poor performance in the early stages of the P-47 motor mount subcontract with Republic resulted, in part, from the inspectors' relative neglect. Brukner's floundering with Republic, the DPC, and the XC-62 drove the military to force Waco to redraw lines of authority within the company. "Higher authority [has] requested that Waco Inspection Section be placed directly under your management by removal from the supervision of Waco Engineering Section,"⁷⁶ the AAF Resident Representative, Captain James C. Borah, told Brukner in April 1942. Brukner, in turn, dutifully "relieved Engineering of this function to enable the more intense concentration on the task at hand."⁷⁷

The AAF's aggressive campaign to get Waco on track hit other organizational pressure points as well. In April 1942 government auditors told Borah that he thought Waco's orders for glider materials were too low. The captain ordered Brukner to "advise

⁷⁶ Borah to Brukner, April 24, 1942. *Brukner Papers*, DoAaSC.

⁷⁷ Brukner to A. F. Arcier and George D. Miller, May 5, 1942. *Brukner Papers*, DoAaSC.

this office whether or not Purchase Orders, as issued, are sufficiently productive to insure material capacity to accomplish contract performance.”⁷⁸ Caught without a ready answer, Brukner had to ask Perry “if we have a systematic routine to catch material as soon as specified and get proper quantities on order.”⁷⁹ The paucity of information flowing to Brukner revealed a systemic weakness in Waco’s management scheme. Again, the military felt compelled to fill a perceived void and jump-start Waco’s efforts to become an effective defense contractor.

This sort of decisive action appeared to work, but the labor situation exerted pressures that undermined the accommodations the military forced Waco to accept early in the mobilization. In January 1943 the air force finally awarded Waco a Class “A” rating for quality control. The AAF Resident Representative Major Edward H. Murphy told Brukner that “your Company has demonstrated that your Inspection Department is well organized and has established the necessary inspection procedures so that it now can be entrusted with the full responsibility of ascertaining that your product meets all requirements as established.” He cautioned, though, that “the continuance of the foregoing system depends upon the confidence maintained by the Army Air Forces Resident Representative in your company’s inspection system.”⁸⁰

As CG-4 production increased, however, the tenuous nature of the arrangement became apparent. More work for Waco’s subcontractors meant that they, too, faced the need for more employees. Waco’s inspectors assigned to their plants were lucrative

⁷⁸ Borah to Brukner, April 29, 1942. *Brukner Papers*, DoAaSC.

⁷⁹ Informal memo, Brukner to Perry, April 30, 1942. *Brukner Papers*, DoAaSC.

⁸⁰ Murphy to Brukner, January 19, 1943. *Brukner Papers*, DoAaSC.

targets for pirating, and the threat to Waco's already-strained resources was considerable. In April 1943 the suspicion that the contractor for CG-4 fuselages had hired an inspector without obtaining the proper release from the War Manpower Commission prompted Waco Vice President Hugh Robbins to travel to Michigan to handle a problem, "which irritates me deeply." He pointedly told the subcontractor that he refused "to have business relations with any concern that will stoop to pirating of labor."⁸¹ Since the allegations remained unfounded, Robbins calmed his emotions and wisely decided to continue with the experienced company. Shortly after that, as we have already seen, Republic lost patience with Waco inspectors in the summer of 1943. High inspector turnover and management's unfamiliarity with guiding a far-flung inspection department degraded its effectiveness.

Finally in November that year, Brukner's frustration with the arrangement dictated by the military exploded in open confrontation with the AAF. Waco accused an AAF inspector in the Waco factory of arbitrarily rejecting work that Waco's inspectors had previously cleared. The resulting delays and the expense of rework affected the CG-4 production line, and Brukner sought a return to "harmonious routine functioning." What he got instead was a full investigation directed by Major Murphy, the AAF Resident Representative. Murphy's handling of the matter drew a clear distinction in Brukner's mind between "keeping the peace within our own organization" and "with an organization over which we have no control."⁸² Brukner had reached the limit of his

⁸¹ Both quotes from Hugh C. Robbins Memorandum to C. J. Brukner, Hugh R. Perry, and U. L. Moler, April 29, 1943. *Brukner Papers*, DoAaSC.

⁸² Quotes from Transcript of Hearing on Charges against Army Air Forces Inspector, p. 62. *Brukner Papers*, DoAaSC.

tolerance for the blurred lines of authority that had developed as he joined the military aviation community.

Murphy's insistence that there be a formal investigation dashed Brukner's hopes to resolve the problem informally. Since the founding of Weaver Aircraft, Brukner had been personally involved in all matters related to the quality control of his factory. The integration of AAF personnel and procedures into Waco required the extension of his span of control beyond his ability to manage affairs directly. The switch to a more managerial, bureaucratic corporate culture caused him to build up personal resentment and to lash out at those who had imposed the new arrangement on him. The AAF inspector was an outsider who was "destructive to smooth production flow, and to the cooperative harmonies so desirable to this relationship." In this case, Brukner thought Murphy already had enough information to force the inspector to modify his behavior. The calling of witnesses was superfluous, Brukner insisted. The major's investigation forced Brukner to realize that his authority no longer rested on his technical knowledge of aircraft design and nuances of production. Adherence to bureaucratic procedure supplanted his personal management style, and he had no choice but to yield authority to Major Murphy. Brukner and his managers withdrew from the proceedings, telling Murphy in a parting shot, "we believe that [you] already have obtained sufficient facts and information to enable [you] to take such action as will produce the conditions under which [you] desire this activity to operate."⁸³

⁸³ C. J. Brukner to Major Edward H. Murphy, November 5, 1943. *Brukner Papers*, DoAaSC.

Brukner's frustration with the "tyrannical methods"⁸⁴ of the government was genuine and enduring. By early 1944 Brukner realized that he could not regain the control within his organization that he had yielded earlier in the expansion program. The company's morale flagged with the end of the C-62, and contract termination problems added work to the already overloaded purchasing and subcontract departments. On top of everything, Waco's worsening situation eroded Major Murphy's confidence in the weeks following the investigation. Brukner's anger drove him to withdraw temporarily from most direct management activities, and the military again tried to take over.

Murphy boldly suggested a sweeping reorganization of Waco to handle better the simultaneous burdens of termination, production, and design confronting the company in February 1944. Hugh Perry prepared the response to Murphy's suggestion, a message that signaled the start of a new phase in Waco's relations with the AAF. His long letter revealed the disillusionment the company had with the defense business and removed any middle ground that may have served as the basis for renewing the resident representative's confidence in Waco. Perry first questioned whether Waco could reorganize, given the current guidance issued by the Internal Revenue Department of the War Labor Board. He pointed out that the regional board in Cleveland would need to approve any changes in the company's structure and that Waco "expected that the strongest representations will be made by the Government to assist the contractor in effecting such changes. . . ."⁸⁵ The wage freeze placed tremendous pressure on companies trying to recruit sufficient labor, and creative reorganization schemes provided

⁸⁴ Draft of Withdrawal Statement, no date. *Brukner Papers*, DoAaSC.

⁸⁵ H. R. Perry to Major E. H. Murphy, February 22, 1944. *Brukner Papers*, DoAaSC.

illicit means to circumvent War Labor Board controls. Proposals thus faced careful scrutiny and required aggressive campaigning to win approval. But Brukner and his managers had exhausted whatever initiative they had. Perry dumped the burden of gaining permission to revamp the company on the AAF.

Perry was skeptical about Murphy's proposed departmental consolidation. His criticism read in part,

it would appear to the contractor that if it is the Resident Representative's belief that subcontracting is not efficiently handled under Mr. Robbins, general material purchasing not efficiently handled under Mr. Brower, outside parts production . . . not efficiently handled under the jurisdiction of Mr. Putterbaugh, then no one of these three individuals could be counted upon to head an amalgamation of the three departments, their efficiency and capabilities naturally being spread more thinly than they are at present.⁸⁶

His stark bottom line was:

The contractor realizes full well that it is possible for conflicting branches of the Government to render this plant completely inoperative. If the Internal Revenue Department takes an arbitrary stand regarding reorganization and the creation of new jobs with commensurate salaries sufficient to enable the contractor to employ skilled and adequate personnel and if the Government, through the Resident Representative, refuses to issue any further contracts until its requirements are met, the subject then becomes one over which the contractor has no control and in which circumstances the facility ceases to operate.⁸⁷

So overwhelmed and disillusioned was Waco management that they were willing to throw in the towel.

Brukner's membership in the Central Aircraft Council proved unrewarding at this time. In early 1944 many procurement officials were questioning the efficacy of decentralization, since coordinating policies with a large number of contracting offices

⁸⁶ Ibid.

⁸⁷ Ibid.

was impossible. The arrangement sacrificed timeliness, and the administrative burdens overwhelmed the insufficient staffs assigned to the field offices. In fact, General Branshaw's retirement later that year brought an end to decentralized procurement and restored all authority to Wright Field.⁸⁸ When Brukner could have used the influence of the CAC in early 1944, it was becoming an impotent adjunct to a system the AAF was abandoning. With no alliances or other significant relations in the aviation community, Waco had no means to gain either a different perspective on these challenges or access to other resources to meet the company's short-term needs. Perry's letter surrendered of the reigns of control of Waco Aircraft to the AAF, the dominant member of the aeronautical community.

The immediate consequence of the letter was Murphy's suspension the following week of Waco's Class "A" rating for quality control. Under the new "C" rating, the AAF restored its complete authority to approve all phases of work in the Waco factory and to replace dispirited leadership with direct controls to ensure the interests of the government.⁸⁹ Wright Field did not, however, excuse Waco from the war effort. Much glider work, both experimental and production, remained at Waco. Its fall from the ranks of a Class "A" business meant that the company's membership in the military aeronautical community was contingent on the good graces of the AAF. With its company leaders unwilling to enthusiastically commit themselves to defense work, the only course of action remaining for Waco was to survive the war years before returning to civilian aviation.

⁸⁸ Holley, *Buying Aircraft*, pp. 507-509.

⁸⁹ H. R. Perry to Major E. H. Murphy, February 24, 1944. *Brukner Papers*, DoAaSC.

The glider experience tells us much about the comprehensive nature of the technological innovation process. The introduction of gliders into combat required actions from military officials in Washington, D.C., at Wright Field, in North Africa, and in Sicily. It likewise touched many firms in the aviation industry and impacted many civilian agencies that administered the mobilization. The community was, in effect, a worldwide network of actors, each having certain knowledge critical to developing an acceptable product. Creating an effective flow of that knowledge demanded manufacturing, administrative, and organizational innovations in the military and in business. Coordination was the key, but competing priorities within critical organizations actually dominated the process. Within the military few leaders were willing to invest the effort needed to forge consensus, because they were so overburdened. Likewise within the business community, Waco was unwilling to forge alliances to build an effective pressure group to lobby for the resources needed for success. Preconceived notions about proper government-business relations shaped decision-making on both sides. Ideas mattered. The glider program suffered because the logic of this technology and its mission countered prevailing air force ideology, and because no business group organized the support that would have enabled its champions to solve its problems.

Senior air force officers knew Waco was emerging from the war in a difficult position. In assessing the status of small businesses which had been involved in the war program, General E. M. Powers told the Assistant Secretary of War in 1946 that the

only company that might be considered a casualty of the glider program would be the Waco Aircraft Company. This company supplied the basic CG-4A design and furnished engineering to the other builders. Their profit position was not impaired by the glider program but unfortunately they had no post war design showing sufficient commercial promise to

warrant their continuing in business. It is reported that this company is, at present, liquidating.⁹⁰

The general was not entirely correct. Waco continued in business until 1963, but the war exhausted the company's leaders, made them passive rather than aggressive, and left them financially and organizationally weakened.

⁹⁰ Powers to Assistant Secretary, October 6, 1946. AFMCA.

Chapter 8
"Between Pictures"

The Waco Aircraft Company's status as a leading manufacturer of airplanes for the private flying market before the war meant nothing during the hectic reconversion in the months following VJ Day. War production had expanded the aircraft industry to levels few businessmen envisioned before 1941. Waco received its share of contracts, but so did its competitors. Their various degrees of effectiveness in managing the government mobilization bureaucracy created efficiencies that were important even on cost-plus contracts. The government did not reimburse all expenses, especially those resulting from learning the defense business, and reconversion to civilian production depended to a large extent on the surplus funds companies earned on military contracts. Waco met some of these challenges but struggled throughout with the problems of defense contracting. Waco's attempt to regain leadership in the postwar industry was neither well funded nor well planned for a setting that would include dozens of manufacturers who were preparing to compete in the private flying market.

Brukner faced the question that all businessmen dealt with as World War II ended: How much control of the economy would the government retain? Historians of the New Deal and the war years have documented the processes through which the federal government gained increasing authority to influence the economic affairs of the nation. The emergence of the national government as a power broker among competing interest groups allowed a measure of control and flexibility that suited President

Roosevelt's leadership style. It also, over time, allowed gains for historically weak groups, like labor and agriculture, while preserving much of the influence that historically powerful groups, like business, had held before the Great Depression. The elements and the processes of the corporate commonwealth were in place and functioning as the United States mobilized the economy to face the crisis engulfing the free world in 1940. The war years placed the system under tremendous pressure to produce war goods quickly, and to coordinate that vast effort, the government seized power as it never could have done in peacetime. The success in meeting the crisis caused some to advocate leaving intact the government controls that had directed the effort. Others wanted to re-establish the less intrusive system that existed before the depression had brought more public sector help than they thought was reasonable. Brukner fell into this group. He expected Waco to reduce its ties to the government as the company's activities refocused on civilian aviation.

But the aviation community was not so clearly demarcated. In seeking the appropriate postwar niche, Waco's efforts were uncertain. The company moved quickly from being a team leader in the aviation industry to being a firm struggling to survive. The marked increase in the power and wealth of other aviation businesses highlighted Waco's dramatic fall. When its strategy of returning to the private flying market failed, Waco reversed course and tried to muscle its way back into the defense market. The company was, however, well behind the leaders in that field too and continuing to suffer from a lack of strategic focus and drive.

Expectations for Postwar Commercial Aviation

The Waco Aircraft Company's postwar struggles paralleled the troubles advocates of private flying (or general aviation as the postwar lexicon named it) had in keeping Americans captivated by flying. Aviation's appeal as an efficient and effective instrument of national power had helped win billions of dollars for military aircraft from Congress. As a consequence of America's acceptance of the plane's military virtues, however, civilian aviation became insignificant during the war years. While some proponents expected to pick up where they left off when peace returned, most recognized the business context would be very different when civilian production resumed.

For one thing, the government was now the dominant force in aviation. It had been the largest, most reliable customer for years, and it had expanded its regulatory powers to encompass every aspect of the industry. Technological development depended on the funding providing by the government and on the military priorities established by Army and Navy officials. All members of the aeronautical community, including military procurement offices, corporations, universities, and laboratories, had a stake in the process of technological innovation, and without exception they were tied to the war effort through military contracts. Breaking apart or even loosening the vast network of aeronautical expertise to allow room for the reintroduction of civilian aviation disturbed lucrative relationships that had been recently formed and strengthened under the pressure of total war. Trying to form a mass-market for general aviation in this context was not the same as in the 1920s when businessmen screamed for prudent government intervention to boost public confidence in flying.

Government officials realized the aviation industry would need some assistance in reestablishing the market for civilian aircraft, and they initiated discussions about the proper policies to implement at the end of the war long before the termination of hostilities. They saw a role for the government insofar as demand for aircraft following the war was uncertain, planes needed advanced safety features, and the number of airports servicing private flyers needed to be increased. Civilian officials saw their role as involving the transformation of a monopsonistic market to one with a vigorous civilian sector.

Many businessmen were willing to address these issues, and the excitement surrounding the return of the American economy to a peacetime footing sent expectations in the aviation industry soaring. Companies and trade associations forecasted rapid growth and once again could foresee the airplane's rivalry with the car. With returning servicemen authorized to use GI Bill funds for pilot training, airport operators prepared for a business volume exceeding that of the Civilian Pilot Training Program in 1940 and '41. Similarly, manufacturers of light aircraft anticipated a boost from the increased demand for trainers. There were reasons in all fields of the aviation industry to be optimistic.

The tempo of activity at Waco's Troy plant at the end of 1945 fostered this spirit. Having put most of the demobilization issues behind them, company officials turned in earnest to the task of returning to the private flying market. Waco had been hit hard by the contract cancellations near the end of the war, and negotiations with the military over allowable expenses dragged on for months. Added to this, the company had to divest itself of the government-owned facilities and tools it had accumulated with the

XC-62 and glider programs. Only in early 1946 was Waco ready to focus on reconversion. Plans included the resuscitation of a prewar model and a new plane, the Aristocraft, an innovative design with the propeller mounted behind the passenger cabin. The race was on.

Government's Expectations

The military clearly held center stage at the war's end, but the Civil Aviation Administration (CAA) was, like Waco, looking forward to a return to normal conditions. While the crisis of war forced the CAA to defer to the Army and Navy at critical junctures, the continuing inter-agency friction shaped the government's emerging policies for private flying in the postwar period. Historian Joseph Corn states, "Millions of Americans came to know aviation first hand, flying for the armed services, working in aircraft factories, and serving as civil defense aircraft spotters in their communities."¹ Assuming these experiences were largely positive, CAA leaders viewed these Americans as potential supporters and worked to build the administration's image as the agency best prepared to manage aviation when the military ceded its leadership position after the crisis abated.

A zeal for aeronautical education, in particular, shaped CAA proposals to Congress. From 1940 until 1942, when the CPTP became more explicitly a military training program, it was one of the largest government-sponsored educational programs. It had also realized the New Deal goal of striking alliances between the government and

¹ Corn, *The Winged Gospel*, p. 109.

academe. The act pertaining to the CPTP, however, granted authority for its continuation only until 30 June 1944. CAA officials were, however, unwilling to give up on the successful program and lobbied hard for its extension. The Assistant Secretary of Commerce for Air and former CPTP Director, Robert H. Hinckley, expressed the CAA philosophy in a series of statements during the war. Education was important, he argued, because "Something deeper is needed than a mere consciousness of the airplane. There must be a universal familiarity with it, and basic understanding of why and how it operates."² His campaign to "air-condition" American society had many facets, but the CPTP best symbolized his ideal. As he testified before Congress in February 1944, he told legislators that the program's infrastructure was "an efficient, going concern that can step in almost at a minute's notice to begin again its work in the air-conditioning process. . . . We should not allow that mechanism to disintegrate. We should not allow the skills of its personnel or its facilities to go unused."³

As with the prewar lobbying effort, though, the benefits of aeronautical education boiled down to its importance to national security. Wartime experience had further reinforced that nexus in the minds of CAA leaders and of congressmen. Forecasting the postwar situation from the vantage of December 1943, the director said, "We need such an influx of young pilots [approximately 100,000 per year] if we are to retain our command of the air. We need them for civil aviation. We need them as a reserve to which we can turn if we are called on again to exert our armed strength in the

² Quoted in *ibid.*, p. 124.

³ Quoted in Pisano, *To Fill the Skies with Pilots*, p. 115.

air.”⁴ Government aviation officials also stressed the economic impact of the CPTP and prepared studies documenting its contribution to the aviation industry. Armed with that information and his own experience, the president of Colgate University, Everett N. Case, took the economic argument to Capitol Hill. The airport operators, communities, and universities stood to lose much if Congress did not extend the CPTP beyond its 30 June 1944 expiration date, he said. “[W]e would enter the period after the war very much the poorer for the loss of facilities which have already proved they are useful to the country.”⁵

The CAA knew the retention of CPTP infrastructure was only part of the political battle it needed to fight on behalf of private flying. For years pilots, manufacturers, and trade associations had asked the government to sponsor a comprehensive airport construction program. The Work Projects Administration had funded some airports in the 1930s, but they fit more clearly under the New Deal’s job creation policy than as part of a well-crafted plan to build a national network of airports. Such plans emerged in the late 1930s, before the war curtailed all such development unless militarily necessary. In late 1944 the CAA updated its plans, establishing a requirement for 2,900 landing fields.⁶ In addition to satisfying a long-standing need for airports for private flyers, the extensive building project promised to bring aviation to

⁴ Quoted in Pisano, *To Fill the Skies*, p. 114.

⁵ Quoted in *ibid.*, pp. 116-117.

⁶ William F. Trimble, “The Collapse of a Dream: Lightplane Ownership and General Aviation in the United States after World War II,” in *From Airships to Airbus: The History of Civil and Commercial Aviation*, Vol. 2, *Pioneers and Operations*, ed. William F. Trimble (Washington, D.C.: Smithsonian Institution Press, 1995), p. 142.

smaller communities across the country. "Air-conditioning" could, it seemed, gain more momentum. Thus infrastructure development joined training subsidies as the policies the CAA asked Congress to authorize.

The postwar general aviation market was different in fundamental ways from prewar conditions. Economic historians and political scientists have written widely on the rapid evolution of the American political economy from the World War II years into the Cold War bi-polar world. The continuing importance of big business, the growth of bureaucratic government, the perpetual climate of crisis, and the fusion of these elements into military-industrial-university complex characterize the immediate postwar years. Historians of aviation have noted that "it was strategic and military air power that dominated the proceedings."⁷ More specifically, those studying the lightplane industry have pointed to the failure of government and industry leaders to form a similar complex in the general aviation field as the cause of private flying's marginal existence in modern America. William Trimble calls it "the essential symbiotic relationship" that never formed.⁸ Among contemporary actors, keen observers saw evidence that private flying needed something more. Robert Hinckley said in February 1944 that private flying in general and the CPTP in particular were "much too big a program for any one agency to handle alone. This program for a nation of fliers, and air-conditioned population, requires teamwork—teamwork among governmental, educational, and business agencies."⁹

⁷ Corn, *Winged Gospel*, p. 67.

⁸ Trimble, "The Collapse of a Dream," p. 143.

⁹ Quoted in Pisano, *To Fill the Skies*, p. 116.

Industry's Expectations

Many within the aviation industry wanted to continue their wartime roles as key members in the aeronautical community. Businessmen had helped lead the rapid transformation of aviation from a small, mistrusted technology-based industry during the interwar years to the one ranked first in value of products in the U.S. during the war.¹⁰ They felt that their performance in the recent crisis vindicated their pleas to Congress for more money and more favorable military procurement regulations. The incorporation of non-aviation industries, like the automobile industry, into their efforts brought them an element of prestige that had eluded earlier aviation entrepreneurs. The Aeronautical Chamber of Commerce—reflecting the industry's burgeoning wealth and confidence—changed its name to the Aircraft Industries Association (AIA) in early 1945. It assumed a leadership role in outlining what it thought was the appropriate structure for the nation.

Research had emerged as the mainspring of technological superiority in military aviation, and the AIA leapt to the forefront as the industry's primary advocate for retention of the country's research and development infrastructure. Aviation leaders in both the public and private sectors had argued in the 1930s that civilian aviation was the foundation on which national security was built, but the war relieved them of the obligation to acknowledge the role of the commercial field of the industry. Whereas the government had sought to bolster commercial aviation while keeping military expenditures to a minimum before the war, after the fall of France in 1940 the

¹⁰ Modley, *Aviation Facts and Figures*, p. 35.

government demanded the suspension of civilian aviation in order to meet the military crisis. Spending billions of dollars on research at universities and with aviation companies, the government created a hothouse environment that stimulated rapid technological innovation. In this context the politically expedient assertion that military air power depended on a strong civilian field gave way to the corporate demand that, as an official of the Bendix Corporation said, "a strong aviation industry backed up with research and development must be supported in the future."¹¹

Industry leaders were reasserting their commitment to an alliance with military air leaders who sensed the economic and political power the huge expansion had lent to their drive for independence. General Henry H. Arnold declared in February 1945 that "The first essential of the air power necessary in our national industry is pre-eminence in research."¹² Accordingly, the AIA accepted the aviation industry's "responsibility to technological leadership of this nation" and lobbied "for the preservation of the skilled research and development teams and facilities created during the war." The AIA listed the wide-ranging functions of the aviation community, including "research, design, experiment, application, test, production, and development" and proclaimed them "essential elements in technological progress."¹³ The industry's special status and the tense Cold War situation compelled President Harry S. Truman in 1947 to appoint a

¹¹ Ernest R. Dreech, Bendix Aviation Corporation, to C. J. Brukner, telegram, June 13, 1945. *Brukner Papers*, DoAaSC.

¹² Quoted in "Aircraft Manufacturing in the United States," Reginald M. Cleveland and Frank P. Graham, eds., *The Aviation Annual of 1946* (Garden City: Doubleday, Doran & Co., 1945), p. 173.

¹³ *Ibid.*, pp. 172-177.

commission headed by attorney Thomas K. Finletter to set American postwar military aviation policy.

The Finletter Commission strongly favored the establishment of air power as the basis for defense of the United States. Its stance, documented in a December 1947 report, buttressed the newly established U.S. Air Force and elevated the aviation industry's concerns to a new level of importance. The commission said, "If a reasonable degree of expansibility is to be maintained for periods of emergency, it is necessary to exercise some industry-wide control in the interests of national security. It may even be desirable to keep a few marginal manufacturers in business who might be forced out if the normal laws of supply and demand were allowed to operate."¹⁴ These findings in large part reflected the success that military officers and aviation businessmen had in lobbying for greater priority with the postwar Truman administration, and it ensured the continued predominance of the military in the aeronautical community.

But many within the industry and even some military officers also realized the importance of a smooth transition to a peacetime aviation market. War work created new prospects for the airplane in American society. Some saw the glider, for example, as a commercial possibility following the war. As early as May 1943, the California Aero Glider Company contacted those businessmen involved in the glider program to advocate development along these lines:

The transport cargo glider of the future should not be confused with the present military version of large gliders now be [sic] publicized. . . . This glider has a very slow landing speed, and is not at all efficient at higher speeds. Cargo gliders will be expected to carry heavy loads, at high speeds, efficiently, in order to be economical; and since they will operate

¹⁴ Quoted in Rae, *Climb to Greatness*, p. 194.

from commercial airports, they should compare favorably with the design trend of our present transport airplanes.¹⁵

Military studies of the civilian potential of gliders were less sanguine. The best Wright Field could offer was that the commercial value was "open to question." It concluded simply that the "extent to which gliders may be used in commercial aviation can only be determined by a careful analysis of the routes to be flown."¹⁶

On the other hand, some glider manufacturers agreed with the idea. The Laister-Kauffman Aircraft Corporation, maker of both training and tactical gliders, wrote to Roscoe Turner in February 1944, asking for his support for the postwar glider program. The argument was familiar to anyone experiencing the interwar boosterism of industry supporters: "It is our belief that gliders are a unit vitally important to post-war cargo transport. . . . Glider trains, we think, afford the most economical mode of express freight, especially for use in short haul work between communities which cannot afford large municipal airports capable of handling present day transport planes."¹⁷ While Brukner believed such speculation about the glider's commercial future was "very interesting,"¹⁸ he was not prepared to enter the transport field by way of gliders. They had proven to be risky in the defense business and promised to be even more so in the commercial field. Thus with no leadership from the only cargo glider designer in the country, it was impossible for the advocates to mount a serious program.

¹⁵ John Robinson, "The Glider Clubs Are Coming," *Glider Progress*, Vol. 1, No. 2 (May 1943), p. 2.

¹⁶ Brigadier General David Cook to Securities and Exchange Commission, May 9, 1945. AFMCA.

¹⁷ William F. Nesbit to Roscoe Turner, February 29, 1944. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

¹⁸ Brukner to Volmer Jensen, May 5, 1943. *Brukner Papers*, DoAaSC.

Instead, the possibility of a boom in private flying loomed much larger on the horizon, and both government and private aviation enthusiasts engaged in the kind of reckless hype that had characterized aviation's earlier years. Navy Admiral John H. Towers, a pioneer in naval aviation, said in 1944 that a common question in his postwar household would likely be, "Who's going to fly the family airplane today?"¹⁹ During the war the Department of Commerce published estimates of postwar demand of 200,000 private aircraft per year—exceeding all previous sales figures combined. In the immediate postwar period manufacturers began advertising in traditionally non-aviation magazines, like *Business Week* and *Better Homes and Gardens*.²⁰ Another measure of the enthusiasm that many Americans harbored for flying appeared on the fifth floor of Macy's department store, as the retailer added the all-metal, two-seat Ercoupe aircraft to its inventory in 1945.²¹ Clearly many Americans hoped the easing of government control of the industry would lead to the airplane's ascendance to a position as a cultural icon—just as the aviation prophets had been predicting since the 1920s.

Those who had been engaged in the private flying field before the war were more cautious, however. In 1944 the Aircraft Owners and Pilots Association (AOPA) laid out a plan to address the troubling fact that owners kept their planes for an average of only 2.4 years. Its officials asserted that "several 'musts' are facing private flying if it is going to expand rapidly: (1) We *must* have more small airports; (2) we *must* have a good plane with extremely low landing speed for smallish fields; (3) we *must* have a 200

¹⁹ Trimble, "The Collapse of a Dream," p. 129.

²⁰ Bilstein, *Flight in America*, p. 195.

²¹ Corn, *The Winged Gospel*, p. 110.

m.p.h. plane at a popular price; (4) we *must* have a good amphibian at a popular price.”²² Of the four points, only one enjoyed broad support from commercial manufactures. The need for more airports became the cause around which many companies rallied.

The Civil Aviation Administration had picked this issue also, as we have seen, and the industry supported efforts to win approval for a construction program. In March 1945 William T. Piper president of Piper Aircraft and spokesman for the Aeronautical Chamber of Commerce, testified before the Senate’s Committee on Commerce. He told the senators that private aviation needed “legislation that will permit the construction of the largest number of landing facilities possible quickly, cheaply, and in convenient or accessible locations.”²³ The National Aeronautic Association joined the fight at the state and local levels, believing that its future strength lied in reaching an airminded public. It optimistically told Waco Aircraft in May 1945, “With the leveling of legislative stumbling blocks, the most important job of all in building a national airport system still remains to be done—organizing ‘grass root’ support for the program at the community level.”²⁴ Even before the war ended the proponents of private flying were beginning to organize to facilitate the establishment of a vigorous civilian aviation community.

Preparations for the postwar period spread industry-wide and included the predictable element of association forming. In 1943 manufacturers of civilian aircraft observed that “[t]he governmental agencies now engaged in post-war planning . . . are

²² L. P. Sharples, “Wanted—Private Flyers’ Amphibian,” *AOPA Pilot*, July 1944, p. 66a.

²³ Quoted in Pisano, *To Fill the Skies*, p. 135.

²⁴ Don Flower, Finance Committee N.A.A., Aircraft Manufacturers, to Clayton J. Brukner, May 14, 1945. *Brukner Papers*, DoAaSC.

emphasizing the commercial operation of large aircraft, and hence find it impracticable to devote the necessary attention and study to the problems . . ." of their segment of the industry. The age of mass-demand for private aircraft had not developed, so they

therefore propose the formation of an association of manufacturers of aircraft which are designed for private use both for business and pleasure, to be known as the "Association of Personal Aircraft Manufacturers, Incorporated." This organization would have but one objective: To encourage public acceptance of small aircraft in the post-war period.²⁵

Many supporters still measured "acceptance" against the benchmark the car had set in reshaping American society. Waco executive Hugh Robbins wrote in 1944 that if "properly presented, every person who can drive an automobile may want to own or at least fly an Airplane." He, too, believed the method to achieve this end was joint action: "There must be sincere unity to attain the strength necessary to tackle the difficult problems of developing this [private aircraft] Market."²⁶

Waco's Expectations

Robbins' enthusiasm about the future of private flying shaped Waco's expectations about the postwar market. In the midst of the difficulties defense contracting imposed on Waco Aircraft, Robbins concluded that the war actually created a unique opportunity for the commercial plane industry. "The situation might be compared to a man who can relive his youth, fortified by the wisdom of maturity. . . . [I]f the

²⁵ Dwayne L. Wallace to Hugh C. Robbins, June 15, 1943. *Brukner Papers*, DoAaSC. Emphasis in original.

²⁶ Robbins, "What Is Our Private Airplane Market?" Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

Industry fails to recognize this situation, and take full advantage of it, it does not deserve to survive," he asserted in February 1944. His warning to learn the lessons of the past clashed, however, with his giddy conclusion, "It is time now to think and talk of 'the two and three Airplane family.'"²⁷

Exaggeration was common as Waco executives reflected on their civilian business from the vantage of their war effort. Ignoring evidence to the contrary, they believed the company was gaining momentum when the government halted civilian production in 1941. Vice president Hugh R. Perry told Roscoe Turner in October 1941 that "we could have gone to town with the Model E if the government had permitted us to continue to build them."²⁸ Perry failed to mention that fixed-base operators were canceling orders and that Waco was struggling to find a niche in the defense business. One year later the anticipation of a bright future for private flying appeared in another letter to Roscoe Turner. Brukner said, "I promise you that we intend to enlist your aid in bigger and better things for Waco during the post war period."²⁹ During the war, though, Brukner worked hard to transform Waco into a semblance of a regular defense contractor—until 1943. Then, his growing disillusionment drove him to set plans for his tenure as a military contractor to end as soon as the government again allowed civilian production.

²⁷ Ibid.

²⁸ Perry to Turner, October 3, 1941. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW. The Model E was Waco's last open-cockpit bi-plane, intended for the sportsman pilot.

²⁹ Brukner to Turner, October 3, 1942. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

He planned a two-pronged offensive to reclaim a niche in the general aviation market. First, Brukner hoped to pick up where Waco left off in 1941 by selling cabin bi-planes. As the war wound down in Europe in 1945, Waco wrote to former distributors to solicit feedback on its tentative post-war plans. Among them was Roscoe Turner. "[T]he airplane will receive the benefit of our engineering experience gained through our war production and will be considerably improved," the company assured Turner.³⁰ Second, Waco planned as well to build a new aircraft. But in April 1945, when Brukner sent the first letters outlining postwar efforts, he offered no specifics on the new design. In September 1945 he told a local business leader, "I could explain in detail how our unstinted cooperation with Army Air Forces engineering development work thruout [sic] the war, and even afterward, has prevented us from advancing our postwar plans to a normal, businesslike extent."³¹ The delay troubled Brukner, and he felt compelled to explain the situation to Waco stockholders. He told them that glider "development activity was not particularly profitable, and made postwar designing an impossibility until some time after V-J Day." Summoning his normal optimism he continued: "Happily, our engineering energies are now again devoted to the development of safe, reliable and easy-to-handle Personal Airplanes . . . though considerable time will be required in the development and tooling for production of such an advanced design airplane. . . ." ³²

³⁰ Charles M. Moffitt, Waco Service Manager, to Roscoe Turner, April 8, 1945. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

³¹ Brukner to A. C. McClung, September 13, 1945. *Brukner Papers*, DoAaSC.

³² Condensed Report of the Waco Aircraft Company, 1945. *Brukner Papers*, DoAaSC.

By October he was ready to approach Turner with his more specific plans. The new model was still too immature to establish distributor contracts or to advertise to the public. Brukner instead decided that in order to market any Waco airplane early in 1946, he needed to offer the standard cabin for \$11,200, with a fifteen-percent discount for the dealer, and a requirement for a \$1,000 deposit to secure an order.³³ The prewar price had been about \$8,000, and the dealer's discount had been twenty percent. Turner responded quickly and decisively:

You have asked for my reaction—and so here it is: This thousand dollar deposit per plane, looks, on the face of it, as though you were trying to get enough money in to finance the original production of these planes. We think that is too much of a deposit. Second—the airplane is more or less out of date. . . . [T]he dealer's discount of fifteen percent is not enough, and the airplane is overpriced.³⁴

Turner was an old aviation hand, too, and his observations proved accurate. Waco sold no more cabin models, thus forcing the abandonment of the first prong of its postwar campaign. Nor did Waco renew its relationship with Turner.

Reconversion to civilian production was as complex as the conversion to defense contracting had been earlier. This time, however, Brukner had no customer with deep financial resources to help with the transition. He was left in a vulnerable position, similar to the one in 1940 when the CPTP orders had dwindled and no military contract had appeared. In 1945 and early 1946 his military business was gone, and a civilian market had not suddenly opened up for Waco. His first plan, to get the factory busy

³³ Hugh R. Perry to Roscoe Turner, October 16, 1945. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

³⁴ Tuner to Perry, October 29, 1945. Roscoe Turner Collection, Number 5267, Box 49, Folder 8, AHC, UW.

producing Waco's pre-war model, failed to produce any positive response from his market and his second option—development of a new model—was a risky undertaking.

Assessing that risk required the kind of judgment that Hugh Robbins in 1944 had urged business leaders in the private flying field to glean from their experience. Fellow vice president Hugh Perry had learned to fear the future, writing in August 1945, "It appears we may be in for some tough sledding. . . ." ³⁵ Brukner, on the other hand, was skeptical about such learning. Years later he confessed that he was simply too "busy and the past seemed insignificant." ³⁶

Waco's Tortured Path

The postwar general aviation market initially conformed to Americans' high expectations. Consistent with the surge in demand for all types of consumer goods in the U.S., the orders for private aircraft quickly exceeded some manufacturers' production capacity. As the backlog for companies like Piper and Aeronca grew in early 1946, some military aircraft companies considered entering the civilian market. ³⁷ Many Americans' dream of the aerial age seemed at hand.

Others, however, perceived serious problems with the private aircraft industry, and their concerns proved accurate. The strong postwar surge soon lost momentum. Nineteen forty-six sales totaled 33,254 personal aircraft—more than four times the prewar annual figure. But the Aircraft Industries Association reported that orders for the

³⁵ Perry to Brukner, August 21, 1945. *Brukner Papers*, DoAaSC.

³⁶ Brukner to John G. Shea, May 1, 1951. *Brukner Papers*, DoAaSC.

³⁷ Trimble, "The Collapse of a Dream," p. 131; Bilstein, *Flight in America*, pp. 195-196.

last two months of the year dropped 34 and 31 percent respectively. Despite Macy's best efforts, sales of the Ercoupe were so poor that the plane's manufacturer closed the production line by the end of 1946. By that time, the aviation press was already reporting a "general softening" of the private flying market.³⁸

Other aspects of the government-industry campaign to broaden the appeal of private flying met with decisive failure. The Civil Aviation Administration could not convince Congress to fund an extended CPTP. Although legislators passed bills authorizing the extension of the program for two years until 30 June 1946, the Bureau of the Budget rejected the CAA's request for \$11.7 million for fiscal year 1946. The Truman administration's desire to return to a more austere budget undermined support for the appropriation. More important, however, the Army Air Forces and the Navy declared their intention to manage their own pilot training programs and stated their opposition to any outside agency's involvement with the process. Also impacting the administration's thinking were the millions of dollars currently underwriting the education and training of millions of ex-soldiers and sailors under the GI Bill. The government paid for flying training for many veterans, and many congressmen thought that that stimulus to private flying was sufficient. Fearing wasteful redundancy, the Congress dropped the CPTP.

Equally frustrating for the CAA was the failure to win complete support for the airport construction program. The CAA had originally planned to allocate 39 percent of its proposed fiscal year 1946 budget for small airports that would primarily serve private pilots. The CAA argued for support based both on the public works facet of the program

³⁸ Trimble, "The Collapse of a Dream," pp. 137-138; Bilstein, *Flight in America*, pp. 196-197.

and its benefit to national defense. When the expected economic downturn failed to materialize in 1946, Congress found it more expedient to authorize money for larger, commercial airports, which also were more useful for the larger military aircraft.³⁹ Again, the CAA was unable to marshal enough political clout to establish a comprehensive program for postwar general aviation.

Similar frustrations at the local level foreshadowed the problems that Waco Aircraft would have in reclaiming a prominent position in the private flying market. The public's excitement about the return of civilian aviation caused outpourings of support for community campaigns to attract federal dollars for local airports. To that date Troy, Ohio, still had no municipal airfield, and some local leaders organized an effort to convert Waco's airport into a facility for public use. In January 1946 John A. Shartle outlined his plan to Brukner. "You [will] have all the pleasures of the private adjoining field with none of the pain," he told Brukner. The pains Shartle identified included taxes, maintenance expenses, and "the implied responsibility to gas and cater to transients."⁴⁰ Characteristically, Brukner was not enthusiastic, despite the benefits. He responded to Shartle pessimistically:

The hangover agony of our war activity still consumes a lot of time, and when you add to that the development of a new, postwar airplane, you will realize that we at Waco and I, personally, would like to confine our work on hypothetical plans to those plans which seem to have a fair chance of realization. . . . I am unable to get beyond your stipulation that the city is to make some degree of investment. . . . [U]p to the present time city officials have more or less outspokenly doomed this as an impossibility.⁴¹

³⁹ Pisano, *To Fill the Skies*, p. 136; Trimble, "The Collapse of a Dream," p. 142.

⁴⁰ Shartle to Brukner, January 24, 1946. *Brukner Papers*, DoAaSC.

⁴¹ Brukner to Shartle, January 26, 1946. *Brukner Papers*, DoAaSC.

But Shartle was persistent. Eighteen months later he wrote again to Brukner, pressing upon him the advantages of relieving Waco of the financial burden of the airfield. Those months had brought a dramatic change in Waco's outlook, and now Brukner badly needed the help. In spite of that, he told his friend that "the critics could misinterpret the present dullness in personal airplane sales very detrimentally."⁴² Brukner refused to take part in Shartle's scheme, and Troy never did get an airfield.

Upon shaking off the "hangover" from the company's military contracting experience, Waco entered—very late—the race to field a newly designed personal airplane. Several factors influenced Waco's slow start. When VJ Day arrived, Waco was one of few glider contractors still heavily engaged in producing planes for the military. Renegotiation of AAF contracts consumed much time, and that job dragged on until early 1946. In addition to renegotiation, Waco had to obtain the military's disposal instructions for the large quantity of materials still in the factory at the close of the war. Only in early 1946 did Wright Field issue orders to burn the war surplus.

Since Brukner's first plan to reintroduce the prewar cabin biplanes met with little enthusiasm, he was forced to rely on a new design effort. He chose to send the company in general and his engineer, Francis Arcier, in particular, into unfamiliar territory. The design was to be an all-metal, four-seat monoplane with the propeller located at the extreme rear of the airplane—all features that Waco had never before included in its planes. Further complicating matters, this was not Arcier's design. Although the source is not recorded in company records, Waco aircraft historian Ray

⁴² Brukner to Shartle, July 15, 1947. *Brukner Papers*, DoAaSC.

Brandly says the Aristocraft, or Model W, originated someplace outside the company.⁴³ The magnitude of the task Brukner took on quickly overwhelmed the Waco staff, as the ever-changing product development schedule proved.

At this time, the Aircraft Owners and Pilots Association was following Waco Aircraft and the rest of the general aviation industry with great interest. In the November 1946 issue of its newsletter, the AOPA reported that “popular makes of aircraft are backing up on the fields.” While this was good news for prospective plane owners, it was not good for manufacturers. The same newsletter announced that Goodyear Aircraft’s “experimental amphibian will not go into private-plane production.” More ominously the AOPA said that “at least half dozen other manufacturers originally planning to plunge have backed off.” But as these storm clouds were gathering, Waco was just gearing up for its return to private flying. The newsletter said its prototype “is to fly this month; deliveries not before next February.”⁴⁴

But Waco could not meet that schedule, and competitors moved to fill the niche Brukner had targeted. In April 1947, two months after the first, self-imposed deadline, Waco was finally flying the prototype and undergoing tests for CAA certification. That same month, though, Cessna, Luscombe, and Fairchild were in various stages of planning the manufacture of a four-place plane. These companies, like Waco, were looking to the more lucrative niche in the private flying market. The late 1946 downturn in the market hit the lightplane niche hardest, and orders for the larger

⁴³ Brandly, *Waco Airplanes*, p. 208.

⁴⁴ AOPA Newsletter, November 1946. *Brukner Papers*, DoAaSC.

four-seat craft were still higher than prewar figures.⁴⁵ Timely certification of the Model W was crucial to Brukner's strategy.

Waco failed. Members of the AOPA learned in July 1947 that "Waco dropped all work on Aristocraft," thus ending Brukner's bid for a position in the general aviation market.⁴⁶ Some people, looking for an easy explanation to the problems general aviation was experiencing, saw this turn of events as evidence of the government's inability to manage civilian aviation effectively. The Personal Aircraft Council of the Aircraft Industries Association wrote to Brukner immediately after the May 1947 failure of the Model W to earn certification, asking for help in revealing "the death grip which the CAA has on aircraft design certification." Brukner, still suspicious of the AIA, told his executives, "I want [all inputs] cleared thru [sic] me."⁴⁷ The Aristocraft had failed tests due to problems with the extended drive shaft, which the plane needed to transmit power from the forward-mounted engine to the propeller in the rear. Brukner also singled out material and component costs that were "discouragingly advanced."⁴⁸ In fact, for fiscal year 1947 Waco recorded losses totaling \$479,936.11, an enormous sum for a company with a total capitalization of just over \$700,000.⁴⁹ Brukner, who understood the design's technical shortcomings, was unwilling to participate in an attack on the CAA. He

⁴⁵ AOPA Newsletter, April 1947. *Brukner Papers*, DoAaSC; Trimble, "The Collapse of a Dream," p. 138.

⁴⁶ AOPA Newsletter, July 1947. *Brukner Papers*, DoAaSC.

⁴⁷ Brukner to Perry and Arcier, June 19, 1947. *Brukner Papers*, DoAaSC.

⁴⁸ Clayton J. Brukner, Annual Stockholders Statement, 1947. *Brukner Papers*, DoAaSC.

⁴⁹ Janet R. Daly Bednarek, "Damned Fool Idea," p. 48; Clayton J. Brukner, Annual Stockholders Statement, 1947. *Brukner Papers*, DoAaSC. Exact total capital: \$702,503.

resolutely resisted allowing Waco Aircraft to become the fodder in a misdirected AIA campaign.

Brukner's final attempt to pry open the market for general aviation followed quickly on the heels of the Model W failure. In July 1947 he briefly discussed with Mundy I. Peale, the President of Republic Aircraft, the possibility of producing Republic's amphibious private aircraft, the Seabee. Poor sales were pressuring Peale to try to sell his existing stocks of materials and to focus on military contracts. Brukner, however, was understandably skeptical about inheriting another outside design. He told Peale, "[O]ur company does not have the kind of money that it would take to properly handle the Seabee project; nor does old man Brukner have the ambition to attempt to secure it under today's low ceilings, particularly in the personal airplane industry."⁵⁰ Waco gave up after this discussion produced nothing.

General aviation, like Waco, was in trouble by 1947, and industry analysts commented on the decline. The AOPA told its audience in July 1947, "We must honestly admit that personal flying has hit a bump; how big a bump we don't yet know."⁵¹ One month later in the August issue of *Flying*, William T. Piper told readers,

Let's face it, there isn't a mass market. There can't be now or in the foreseeable future. If the past 20 years have taught us anything, they should have taught us that only a relatively few people can take advantage of the utility or pleasure of the airplane. They add up to a lot of people but not to the millions sometimes envisioned.⁵²

⁵⁰ Brukner to Peale, July 12, 1947, and Peale to Brukner, July 22, 1947. *Brukner Papers*, DoAaSC.

⁵¹ AOPA Newsletter, July 1947. *Brukner Papers*, DoAaSC.

⁵² "Mr. Piper Counts the Score," *Flying* 41 (August 1947): pp. 17-18.

Piper's pessimism proved to be well founded. Historian William Trimble writes of the postwar private flying market, "If 1947 and 1948 were bad for the lightplane industry, the next few years were disastrous."⁵³ Piper Aircraft nearly went out of business. Market leaders Cessna and Beech survived, but only after diversifying their product line. Cessna earned a profit in 1947 largely because of a contract with the military to manufacture office furniture and subcontracts with Boeing. Walter Beech's success derived from his company's continued excellence in updated twin-engine Model 18 transports and in a new postwar, single-engine design, the Bonanza, with a distinctive V-tail, which serves as Beech's signature characteristic to the present.⁵⁴ Neither Cessna nor Beech was in a completely safe position at this time, but they were in the black. The "dullness" Brukner ascribed to the postwar general aviation market affected Waco's attempt to return to the private flying field, but it did not predetermine the outcome. As Cessna and Beech showed, it was possible to survive even in the declining market. Technically sound designs helped. Diversification also provided a means to weather the downturn in demand.

In the rest of the industry, as at Waco, there was a tendency to cling to the hope that private flying would quickly recover. Too many were locked on course, unable to develop new approaches. The National Aeronautic Association, for example, published another plea for support of a small airport construction program in 1948. At that time it was still not too late for the association to claim that "there is latent power in the civilian airfield . . . its little planes . . . its amateur pilots, men and women . . .

⁵³ Trimble, "The Collapse of a Dream," p. 141.

⁵⁴ Bilstein, *Flight in America*, pp. 197-200; Trimble, "The Collapse of a Dream," p. 140.

National security requires vast reserve and auxiliary forces, largely self-supporting by volunteer action and private enterprise."⁵⁵ The AAF, however, had already decided that it needed no help from a civilian reserve. Lieutenant General James H. Doolittle, who was continuing the drive for air force independence in the immediate postwar period, told the Senate Military Affairs Committee that "the training, the doctrine, the thinking and the habits of men who we will train to fight the next war" should fall under the control of only one agency.⁵⁶ The service's consolidation of control left no middle ground for complementary efforts between military and civilian aviation.

Historian Joseph Corn identifies 1950 as the point in time beyond which Americans could no longer generate sustained enthusiasm for aircraft technology. As he explains, "The public, encouraged for decades to think that personal planes were just around the corner, had been disappointed once too often and now viewed the prospect of owning a plane or helicopter as improbable, if not utopian." The majority of Americans now left aviation to those who had managed the process of technological innovation since its earliest days. After the technical achievements of the World War II mobilization and the quick demise of general flying, "aviation became much less interesting."⁵⁷

Brukner's experience following his July 1947 failure to gain reentry into the general aviation market supports Corn's assessment. Brukner now tried to adopt the Cessna/Beech strategies. After that time he and his managers began to consider a wide

⁵⁵ National Air Council, "Consider . . . the Little Airfield," 1948, p. 3. Ellipses and emphasis in the original. *Brukner Papers*, DoAaSC.

⁵⁶ Pisano, *To Fill the Skies*, p. 120.

⁵⁷ Corn, *The Winged Gospel*, p. 111.

array of possible production jobs to use factory capacity. In March 1949 Brukner contacted Boeing Aircraft to solicit subcontract work on the B-47 bomber that the company was making for the Air Force. He told Boeing,

[S]ince the personal airplane industry divorced us we have been kind of kicking around manufacturing everything from truck bodies to stoves and what-not. I just wondered if your present policies on subcontracting were such that we might fit in. We are as they say in Hollywood "between pictures" right now, and could do quite a little.⁵⁸

Fortunately Boeing was interested and responded to Brukner's overture with specific questions about what Waco could accomplish on the bomber program. After queries about tools, floor space, and employees came the question for which Waco had no good answer. The bottom line for Boeing was "the processes you have currently certified for the Air Forces."⁵⁹ This issue forced Brukner to confront again the quality control procedures with which Waco had struggled during the war. Since he had at that time had no intention to return to defense contracting, Brukner had done nothing to regain a Class "A" rating for his factory inspectors after the CG-15 contract cancellation. He sheepishly told Boeing, "With reference to our Air Force certification for the various processes, we are checking to compare the latest requirements with those which we met during the war period."⁶⁰ This amounted to an admission that Waco's membership in the most influential clique of the aviation community had lapsed. Boeing awarded no subcontracts to Brukner.

⁵⁸ Transcript of Telephone Conversation between Clayton J. Brukner and J. E. Schaefer, Boeing Aircraft Company, Wichita Division, March 17, 1949. *Brukner Papers*, DoAaSC.

⁵⁹ Bernard Taylor, Outside Production Manager, to C. J. Brukner, March 30, 1949. *Brukner Papers*, DoAaSC.

⁶⁰ Brukner to B. Taylor, April 8, 1949. *Brukner Papers*, DoAaSC.

The rejection became complete one year later. Still searching for steady work in the Waco factory, Brukner tried to win Air Force approval to compete for a contract to refurbish AT-6 trainer aircraft. The approval required military certification of the Troy facilities and processes, and a full survey team visited Waco in March 1950 and filed its report the following month. It read in part,

The advisory board of the Dayton Procurement Field Office has not been able to qualify your facility at this time, due principally to the fact that your facilities have not been used for aircraft production or overhaul for a considerable length of time. Also sufficient personnel familiar with aircraft overhaul are not at present in your employ, which would necessitate considerable time to activate your facilities and hire and train the necessary personnel, and this time could not be possible under the present program.⁶¹

On the eve of the June 1950 outbreak of the Korean War, Waco Aircraft found itself formally expelled from the aviation community that would be called upon to meet that new crisis.

Hugh Perry launched a futile "vigorous protest," and openly discussed corporate liquidation with Brukner. "I am sure you will agree with me that we are now rapidly approaching the point of desperation," he wrote in February 1950. Without enough orders, Waco's cash reserves were threatened. Perry said that "loans would serve no purpose except to prolong the day when a complete shut-down would be inevitable. . . ."⁶² Perry's concern stemmed from Waco's growing dependence on small, fixed-price Air Force contracts, awarded by officials at Wright-Patterson Air Force Base through a process of closed bidding to the lowest-priced contractor. Waco started to bid in May

⁶¹ Walter R. Dunlap, Chairman, Advisory Board, to Waco Aircraft Company, April 3, 1950. *Brukner Papers*, DoAaSC.

⁶² H. R. Perry to Brukner, February 14, 1950. *Brukner Papers*, DoAaSC.

1948 and, despite the early realization that the competition “appears to be rather wild,”
 Brukner continued to submit bids in an attempt to keep Waco’s nose above water.⁶³

Table 8-1
 Waco Military Contracting

<u>Year</u>	<u>Sales \$K</u>	<u>Employees</u>	<u>% of Total Sales</u>
1951	848.8	96	88
1952	563.8	104	59
1953	986.9	154	80

Source: Waco Aircraft Response to the Federal Commission on Organization, August 27, 1954. *Brukner Papers*, DoAaSC.

Waco won some business under this setup and managed, periodically, to keep the factory busy. But the work was inconsistent. Waco released dozens of employees, including those who helped prepare cost estimates for contract bids. Perry reported that the firings “will impair our estimating ability somewhat . . . but, in view of the small or non-existent profit on Wright Field public bidding contracts, this may not be a liability.”⁶⁴ Nonetheless, the company managed to drag through the next three years by relying on small-dollar, fixed-price contracts. The contract values ranged from \$167 to \$515,340, and the products included a wide variety of aeronautical support equipment, such as bomb dollies and chock assemblies.⁶⁵

The period reflected in the table comprised only a subset of the total time Waco was engaged in this kind of military contracting. In the period before, from the start in May 1948 to 1950, the company suffered losses totaling over \$130,000; Brukner

⁶³ Perry to Pearson, Moffit, et al, May 19, 1948. *Brukner Papers*, DoAaSC.

⁶⁴ Perry to Brukner, June 13, 1950. *Brukner Papers*, DoAaSC.

⁶⁵ Compiled Statistics, August 9, 1954. *Brukner Papers*, DoAaSC.

described these losses to stockholders as "severe" and "alarming."⁶⁶ From 1951 to 1954, Waco actually earned small operating profits, but in 1955 cost renegotiations with the Air Force on contracts from the previous two years resulted in a \$111,000 loss for the year. The amount of defense business dwindled. Recognizing that "the competition continues to be severe," Brukner tried to win work in the new missile field, but he was unable to save the company. With losses averaging eighty thousand dollars per year in the period 1956 to 1963, Waco was inevitably headed toward bankruptcy.⁶⁷ Finally in 1963, Brukner sold the remaining Waco assets to Allied Aero Industries, which closed the Troy plant shortly thereafter.⁶⁸

A firm that had for a time been the leader in U.S. private aviation production failed in the postwar reconversion. Following the war Brukner had happily, if slowly, broken relations with the military and had staked Waco's future on the Aristocraft. Failure to win CAA certification meant that Brukner had to quickly reverse course and seek a new postwar role in that part of the aviation community he had recently left. As a small outsider trying to regain membership in the technological community, Waco had to compete with dozens of other similar firms hoping to gain a toehold in the defense business. With slim financial resources and a management team with little experience in the public bidding process, Waco won barely enough contracts to keep the factory open. The company's efforts in the 1950s, confirmed Hugh Perry's analysis that public bidding

⁶⁶ Bednarek, "Damned Fool Idea," p. 48; Clayton J. Brukner, Annual Stockholders Statements, 1949 and 1950. *Brukner Papers*, DoAaSC.

⁶⁷ Clayton J. Brukner, Annual Stockholders Statements, 1951-1959. *Brukner Papers*, DoAaSC.

⁶⁸ Bednarek, "Damned Fool Idea," p. 48.

would ruin Waco. The dozens of small contracts postponed the day of reckoning, but Waco's fate had actually been decided some years before when Brukner's latest innovation was a failure.

Chapter 9

Conclusion

Companies in the 1990s compete in an increasingly global marketplace, and national leaders in business and government have placed a premium on the economy's ability to adapt rapidly to market changes. As they work to formulate the appropriate policies to enhance economic competitiveness, we see an increasing number of academic studies that address the factors facilitating innovation and how to sustain it over time. Economists and historians have much to offer in shaping the debates over these policies, for the insights they have derived combine the theoretical underpinnings for understanding innovation with specific case studies that add flesh to the bones of theoretical explanations.

The Waco Aircraft Company, I believe, is one case that highlights the importance of public and private collaboration in encouraging innovative behavior. In small firms like Waco Aircraft, the innovative drive often lies with one leader. Economic and business historians have studied this leader, the entrepreneur, as the key to economic growth. His activities cause market disequilibria that create opportunities for consumers and firms to reallocate their resources more efficiently. A series of innovations stimulates economic growth, adding a dynamic component to the static equilibrium free market competition theoretically imposes on economies.¹ The history of

¹ Joseph A. Schumpeter explained the role of the economic hero, the entrepreneur, in classic works that now deserve more attention in light of the need for economies and firms to sustain entrepreneurial behavior or face a relative decline in international stature. The demise of most centrally directed economies has given greater latitude for market forces to influence decisions about investing in innovative enterprises.

Waco Aircraft is particularly useful because it includes both entrepreneurial success and a remarkable failure to continue innovative efforts as market conditions changed.

Brukner's successful first phase in the aircraft manufacturing field highlights the elements of entrepreneurship that economists and business historians try to understand in explaining the causes of innovation. Waco Aircraft was dynamic and innovative in defining a market niche and maximizing its market share in an early phase of aviation's development. As the federal government grew more active in shaping aircraft technology, Brukner worried that heavy-handed regulators would destroy the newly formed private flying field. His interactions with regulatory agencies and, later, the military shed light on how the government can craft policies and invest public funds in ways facilitating technological innovation.² The Waco Aircraft Company's history reveals the importance of three critical, interrelated components that made for success: astute, top-down leadership; an organizational culture conducive to learning; and effective civilian-government relations.

Leadership and Aeronautical Innovation

Clayton Brukner was not flamboyant, but beginning in 1919 his leadership helped shape the early expansion of an industry in which the U.S. has played a

Schumpeter's identification of innovation as the cause of growth in modern capitalist economies provides the compelling theoretical reason for seeking a better understanding of those factors that best allow innovation to take place. See, for example, Schumpeter, *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process* (New York: McGraw-Hill, 1939).

² Of course the military has been a primary leader in the advancement of aeronautical technology around the world. For an excellent collection of essays that investigate the military innovations that world powers of the interwar period implemented, see Williamson Murray and Allan R. Millett, eds., *Military Innovation in the Interwar Period* (New York: Cambridge University Press, 1996).

predominant role since before World War II. The tremendous success of Waco Aircraft in the 1920s gave Brukner the opportunity to serve as a key spokesman for an industry that enjoyed widespread public support. Some aviation entrepreneurs, like Roscoe Turner, reveled in the attention the media provided the exciting new technology. Unlike them, Brukner downplayed publicity, instead favoring the technical work of improving his company's planes. Only reluctantly did he engage in efforts to bend rapidly evolving government policy towards regulations that would have a minimal impact on private flying. As a consequence of his ambivalence about the government, Brukner's influence waned over time.

Waco reached its organizational zenith in 1929, when Brukner controlled a highly developed and effective corporate structure that had led the company to the top of the private flying market. He personally had forged the manufacturing, marketing, and management components into a coherent system that gathered market information and translated it into products that won sales regularly exceeding the combined efforts of his two closest competitors. A key to his success was his participation in competitive aviation events, like air races and reliability tours. At these gatherings he met fellow aviation entrepreneurs and learned about the competition first-hand. The informal exchange of ideas and information at the meets complemented the barnstorming Brukner did with the antecedents to Waco Aircraft, the Weaver and Advance Aircraft Companies. These local aerial stunt shows attracted thousands of Americans who wanted to learn about flying. Many paid for the opportunity to take a short ride around their neighborhoods, thus generating an income for the aviators. Competitions and barnstorming allowed Brukner to help shape the public's acceptance of flying. In

facilitating the definition of the new aircraft technology, Brukner influenced the size and character of the market for which he manufactured planes. The intimate connections between his company, other firms engaged in the aviation business, and the public gave him competitive advantages that he exploited throughout the 1920s.³

This early period in Waco's history challenges economists' neoclassical view of the firm as a basic indivisible element in the analysis of national economies. In that framework businessmen are economic actors, responding to cost signals the market provides for any given transaction. They are in a system that equates marginal costs and marginal revenues, thus distilling their experiences to a series of comparative statistical choices. Brukner's decision to engage in barnstorming arguably exemplifies this kind of simplified economic decision-making. While defying personal safety concerns, it did provide the most economical means to fund aircraft development projects. Such is not the case, however, for his commitment to air races and competitions. The marginal return for victory was impossible to quantify, and often appeared only indirectly through the imperfect medium of the aviation press. The enhanced reputation of Waco planes surely derived in part from success in the National Reliability Tour, but Brukner could not measure how many additional sales resulted from his first, second, or third triumph in a row. Thus his decision to commit his firm to attendance at aviation competitions was a strategic one that established lines of communication between his company, prospective

³ Business historians and historians of technology are increasingly emphasizing the importance of technological communities or networks in fostering innovation. See, for example, Constant, *The Origins of the Turbojet Revolution*. The new technology could not revolutionize the aviation industry, he argues, until a "community of practitioners" accepted it as the basis for a new way of doing business. Louis Galambos and Jane Eliot Sewell found that in the pharmaceutical industry the technological capabilities of organizations in business, government, and non-profit (academia, for example) sectors generated signals that stimulated innovative responses over the long-run, even as the context in which these organizations operated changed in fundamental ways. Galambos with Sewell, *Networks of Innovation*.

customers, the aviation press, the public, and the marketing network. Moreover, much of the information Brukner obtained as a result of these various ventures was not readily available to others. Without tapping the network as Brukner did, they could not share the information and make the same strategic choices.

The flexibility that derived from these lines of communication was lost, however, as a result of a series of decisions Brukner made in response to the pressures of the Great Depression. Integrating the diverse knowledge he had obtained about the private flying market, Brukner had in the 1920s offered to novice pilots and advanced acrobatic fliers a number of aircraft models that spanned a wide range of performance characteristics. Responding to the depression, Brukner chose to reduce costs by focusing on higher performance planes, a logical decision, since beginners were less likely to have the money to buy a new plane. This and a series of other decisions, though, limited his exposure to key elements of his private flying network of relationships. For example, he had given up barnstorming in the mid-1920s, when profits from aircraft sales relieved him of the need to subsidize manufacturing activities in his factory. Then, the economic downturn drove him to end regular attendance at aviation competitions after 1930. Thus by the beginning of the New Deal in 1933, Brukner had relinquished access to key nodes in the network of relationships that had provided information critical to winning a large market share, without finding alternate means to gather and integrate information about the private flying market.

In the short-term his decisions had the intended results, but the long-term consequences were devastating for Waco Aircraft. The immediate result of the cost-cutting measures was clear: the company earned a profit in 1934, while most American

companies continued to lose money. Also, the company's concentration on higher performance models created the opportunity to win export sales for militarized versions of its planes. During the 1930s exports played an important role in keeping the Waco factory open while rivals closed their doors. But his decisions had negative consequences as well, and competitors perceived Brukner's vulnerabilities. Brukner's rigid adherence to civilian biplanes yielded the initiative in designing and marketing monoplanes. To capture the business of student and novice pilots, for example, the Piper Aircraft Company designed and built low-cost airplanes. By 1938 Piper had effectively wrested control of the entry-level niche in the private flying field (for trainers and low performance aircraft) from Waco and all others. In Waco's higher-performance niche Cessna marketed monoplanes with characteristics similar to Waco's, but Cessna's planes required smaller, less expensive motors to achieve the same result because of less aerodynamic drag. Brukner was, as a result, losing market share. The most important consequence of Brukner's adaptation to the depression was his refusal to explore any potential business with the U.S. military. His steadfast commitment to civilian aviation foreclosed consideration of diversification into the wealthiest field in American aviation, military aircraft manufacturing. This left Waco in an increasingly narrow and tenuous niche. It also severed Waco Aircraft from sources of aeronautical knowledge that could have provided vital market information similar to that which allowed Brukner to build a diversified and dynamic company in the 1920s.

Organizational Adaptability

Brukner's personal management style ensured that he played a pivotal role in building administrative routines that channeled information from customers to the factory floor. Such routines helped systematize the inputs Waco received from numerous sources, including distributors, prospective customers, and Waco aircraft owners. Even as Brukner curtailed activities like barnstorming and air racing, enough industry intelligence entered Waco's manufacturing system to enable the firm to retain a dominant market share. The existing structure proved sufficient for other adaptations as well. The turn to exports in the 1930s, for example, added Waco dealers in foreign countries to the distribution network. There was no need, however, for systemic change.⁴

As the private flying market continued to wither under the sustained economic depression, however, the rigidity of Brukner's administrative routines became more apparent. We see this weakness most clearly in Waco's ineffective relationships with the Aeronautical Chamber of Commerce (ACC), an aviation industry trade association, and with the Army during World War II.

Economists and business historians' evolving study of corporate structure and internal processes has addressed the most serious deficiencies of the neoclassical model, but the new, more sophisticated approaches have raised further questions about how businesses innovate. Neoclassical economics views the firm as a black box and offers no analytical tools for explaining why different firms within the same industry, facing a

⁴ Waco's system was particularly adept at organizing the chaos (i.e., the diverse information it gathered from numerous sources), and it also had a high degree of flexible manufacturing capability. Specialty production required flexibility, and the small quantities of aircraft Waco sold hardly justified standardizing models. For an excellent analysis of the downside of systemization, see Scranton, *Endless Novelty*, p. 99.

similar set of options, make different decisions. Trying to understand the differences has driven economists to study ways to define the boundaries of the firm. As economists gained better insight into the complexity of the economic relationships within companies, they found that transaction costs helped define corporate limits: activities that could be conducted more cheaply inside the firm were brought in. But the costs were not always apparent in advance. For example, Brukner decided early in Waco's development to hire outside toolmakers instead of developing that capability within the firm. The readily available pool of industrial expertise in the Troy area and the predictable schedule on which he could plan tooling efforts made this a cost-effective decision. When the war came, however, his routine broke down for two reasons. First, by the time Brukner needed tool-making services in 1941, toolmakers already had large backlogs of orders that pushed delivery dates far beyond Waco's requirements. Second, the military's fluctuating contractual requirements deprived Brukner of any ability to plan tooling purchases. This uncertainty increased risk and in turn drove up costs. Brukner's system failed because his administrative routine could no longer effectively manage that cost. But could he have anticipated this change?

This question points to the importance of an organization's ability to learn new capabilities to adapt to changing contexts better. In seeking to understand factors that encourage openness towards innovation, historians have carefully reconstructed various contexts in which entrepreneurial activity took place. Such an approach naturally emphasizes the organizational culture in which innovation occurs, and it appears to have

improved our understanding of public as well as private bureaucracies.⁵ As the result of Alfred Chandler's work in documenting the tremendous advantages that accrued to private corporations in capital-intensive industries, we also now have a better understanding of how huge corporations captured the economies of scale by investing heavily in mass-production, mass-marketing, and management.⁶ Only those rivals able to make similarly large three-pronged investments successfully challenged the market positions of the first-movers. As corporate power grew, governments at all levels responded with various regulatory schemes. In the early twentieth century government officials gradually gained authority and experience in exercising their power. Soon public bureaucracies multiplied in size and number and competed with private organizations for well-educated administrators.⁷ Leaders of these organizations faced challenges that paralleled those of the businessmen: how to remain relevant and effective as the context changed. Building public and private organizational capabilities thus emerges as a key aspect of the process of sustaining innovation.

In this context trade associations became clearinghouses for aeronautical information that business and government officials used in their efforts to formulate consistent and effective policies. Beginning in the 1920s, the ACC and the National Aeronautic Association (NAA) vied to become the primary educational and lobbying

⁵ For a good treatment of entrepreneurial behavior in government agencies, see Jameson W. Doig and Erwin C. Hargrove, eds., *Leadership and Innovation: Entrepreneurs in Government* (Baltimore: Johns Hopkins University Press, 1987). The best leaders, the editors point out, develop both internal and external constituencies tied to the organization's mission. Thus building the technical capabilities to accomplish and communicate that mission becomes a key objective for effective leaders.

⁶ See Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard University Press, 1977) and *Scale and Scope*.

⁷ Skowronek, *Building a New American State*, pp. 16-18, 233-234.

organization for the rapidly maturing aviation industry.⁸ To maximize the influence they had with politicians in Washington, both sought to create a membership that spanned the wide range of companies and individuals with a stake in aviation technology. The onset of the depression caught the industry in an awkward period of change. The larger aircraft manufacturers, who were dependent on the military for business, had already learned how to deal directly and effectively with the armed services. Poor relations with Congress, however, created an opportunity for a broad-based trade association to offer better communications. Commercial air transportation (the airlines) developed rapidly after 1926, as Congress passed a number of bills to improve the country's aviation infrastructure and to subsidize flight operations with airmail contracts. Congress was unwilling, however, to reform in any significant degree the military's procurement procedures, which denied manufacturers a proprietary right to the aircraft they designed under contract and emphasized the use of low-bid contracting for sophisticated combat aircraft.⁹ Procurement reform thus became a priority for military contractors, the ACC, and the NAA.

As these communication networks integrated business and government organizations that had a stake in the development of aeronautical knowledge, Waco Aircraft was moving in the opposite direction towards a more insular stance within the

⁸ Bilstein, *Flight in America*, pp. 28-35. The emerging aviation community in the 1920s also included organizations like the National Advisory Committee on Aeronautics and the Guggenheim Foundation, which began sponsoring aeronautical research at universities. The trade associations attempted to establish a network connecting these organizations with firms and other government agencies to facilitate the flow of information.

⁹ Vander Meulen, *The Politics of Aircraft*. The politically imposed requirements for competition eroded any mutual trust that businessmen in the aviation industry might have developed, Vander Meulen argues, and erected barriers to cooperative efforts that would have enhanced the industry's innovative capacity (52).

industry. In the early 1930s Brukner placed his hope for collaboration, if any, with the Aeronautical Chamber of Commerce. But Brukner was highly skeptical about cooperative efforts for two reasons. First, he valued independent action and found little immediate reward for his efforts within the ACC. Cooperation countered his intense personal desire to control Waco independently. At the height of his success in the late 1920s, he proudly declared to the aviation community that Waco Aircraft was controlled by its corporate officers, who owned the vast majority of the stock. He was, he proclaimed, independent from the wave of mergers that swept over all fields in the aviation industry in the late 1920s. Whereas some of his rivals, like Walter Beech and Stinson Aircraft, happily merged with the large corporations like Curtiss-Wright and United Aircraft, Brukner wanted to remain unfettered by ties to companies that worked in the commercial transport and military fields.

Brukner had worked hard to create a profitable company, and the idea of compromising his views for the sake of obtaining an industry stance on issues irked him. As the largest manufacturer of private planes he believed government regulators should listen to him as they formulated policy. The Aeronautical Chamber diluted whatever message he had to offer public officials, Brukner believed. His strong personal bias had important organizational effects, as Brukner chose to handle interactions with government officials himself. He invested no money or effort in developing an organizational capability to manage regulatory and lobbying affairs, despite the fact that representatives from the local, state, and national levels of government regularly sought

his input on aviation issues. The drain on his time grew considerably and helped convince him to join the ACC.¹⁰

The second reason he was skeptical about the trade association was the predominance of military contractors in the organization. He reluctantly agreed that manufacturers should organize to confront the government's increasingly vigorous involvement in aviation, but mutual interests were hard to find. The armed services had little to do with civilian aviation other than to encourage its rational development, and the Department of Commerce, the agency charged in 1926 with the regulation of private flying, had no authority to deal with military aviation. Thus the ACC's success in establishing a broad constituency compromised its ability to organize effective lobbying efforts. Although Brukner continued his membership and active involvement in various ACC committees (even after its telling 1934 failure to forge an industry code under the provisions of the National Industrial Recovery Act), he grew increasingly disillusioned with the trade association. He still often resorted to unilateral attempts to win support for his view among government bureaucrats.

¹⁰ The ACC advertised itself as a service organization for business, academic, and government customers. Brukner was, in a sense, buying the political capabilities of this trade association. Louis Galambos has described the three distinct stages (dinner-club, service, and policy-shaping associations) the trade organizations in the textile industry passed through as they tried to impose stability on a chaotic market. If these stages were common to other industries, then aviation's experience is particularly confusing. In contrast to the decades of developments seen in the textile associations before launching a campaign for the most ambitious scheme to shape public policy, the ACC and the NAA tried to take those responsibilities at the moment of formation. Thus social relationships, administrative procedures, and network relationships developed simultaneously in the 1920s. The rapid changes in context during the Great Depression placed these immature organizations under extreme pressure and reduced them to impotence. A closer examination of aviation trade associations using the framework offered by Galambos is needed to better understand how they built capabilities over such a short period of time. Galambos, *Competition and Cooperation: The Emergence of a National Trade Association* (Baltimore: Johns Hopkins University Press, 1966).

The government's involvement in economic regulation accelerated dramatically during the Waco Aircraft Company's lifetime. In fact the zenith of Waco's accomplishments coincided with the 1929 collapse of what had been President Hoover's rather conservative scheme for public-private collaboration in stabilizing American markets. Hoover's voluntary associationalism gave way to President Roosevelt's more assertive management of the nation's myriad economic activities. In this new context Waco Aircraft's ability to identify and react appropriately to signals from the private flying market proved to be increasingly poor and this failure compromised Brukner's ability to shape the market through political lobbying. Why was he unable to lead his previously innovative company through this transition?

During the New Deal years the rapidly developing network of public and private actors in the aviation industry threw into stark relief Waco's drift toward isolation. The sharp decline in the private flying market reinforced this developing insulation. The depression almost ruined the market for civilian aircraft, and Brukner survived because wealthy customers continued to buy expensive Waco planes. But Brukner was nearly alone in the private flying field. The open, freewheeling exchange of information that had once taken place at air shows and competitions became a quiet conversation as most of the former participants stayed home. Attention turned to Washington and the Roosevelt Administration's antagonistic rhetoric about the aviation industry. The cancellation of airmail contracts in 1934 dealt a blow to the commercial transport field, and the ill-conceived Commerce Department program sponsoring development of a \$700 plane for everyman brought strong protests from industry leaders.

These policies further convinced Brukner to stick with his decision to remain aloof from lobbying campaigns.

Brukner's self-imposed limitations thus forced him to make decisions from within the rather opaque boundaries of his firm as the depression wore on in the 1930s. His push into the export market helped restore Waco's profitability, but the flagging domestic market eroded the foundation on which he had built the company in the twenties. He attempted to manage Waco's government relations through the ACC, but its ability to influence Congress, the regulatory agencies, and the military had not advanced sufficiently to make this an effective medium. Instead, Brukner himself, as president of the largest, most successful manufacturer of private aircraft, tried to shape Waco's business environment.

His limited success and his decision to concentrate on a very narrow market niche created opportunities for others. Towards the end of the thirties, rival firms moved to exploit changes in technology and market conditions, generating new competitive pressures in the private flying field. Single-wing designs and small, twin-engine transports from companies like Piper, Cessna, and Beech captured increasing market shares in the niches both below and above the niche for large personal airplanes that Brukner dominated. Still, he refused to diversify his product line and ignored the possibility of establishing ties to the American military. His rigid commitment to one course of action sapped Waco's ability to adapt as new market conditions emerged in the late thirties. Only after the Munich Crisis in September 1938, when some Americans began to question the nation's commitment to isolationism, did Brukner open a dialogue with the Army in hopes of gaining defense business.

Military-Industrial-University Relations

By 1938 Waco's competitors and the aviation industry had developed networks of interaction that made Brukner's management seem antiquated and unreliable. His transition to the defense business started much too late in early 1941, only months before Pearl Harbor. Transforming Waco into an organization with the capabilities to confront the new business context in which Brukner found himself was a challenge of the highest order. Skilled labor and managers with aircraft manufacturing savvy had been in short supply since 1938, due to the European demand for military aircraft. After the fall of France in May 1940, the largest expansion of the aviation industry since World War I lured away Waco talent. Brukner entered the war years in the unenviable position of simultaneously expanding a workforce with lower-skilled laborers and developing the higher-level corporate skills needed to manage military contracts.

While all this was new to Waco, the mobilization only accelerated existing trends of development within the aeronautical community. Military and business leaders extended their networks of communication and contracts to include new companies, like automobile manufacturers, and universities; they created in this manner a vast complex of technical capabilities that successfully directed the technological innovative process for the U.S. during the war.¹¹ Not all aspects of the complex were successful, as Waco would discover. But on balance it served the nation well. The military was able to

¹¹ The air force's energetic leader, General Henry "Hap" Arnold clearly perceived the importance of developing his service's innovative capabilities. This appears in the field of science and technology in his strong support for Theodore Von Karmen and in the field of combat tactics in his endorsement of General Curtis E. Lemay's fire-bombing raids in Japan. See Arnold's memoirs, *Global Mission*.

integrate Waco into the network with little difficulty. Officials at Wright Field expected Brukner and his managers to respond in concert with the other actors in the aeronautical community; the military ignored the difficulties Waco faced in adapting to this new context with inadequate resources. Brukner reacted in a halting and uncertain manner and failed to provide the kind of civilian leadership the combat glider program needed. Of course the military leadership in this case was also deeply flawed. Neither the private nor the public sector distinguished itself in this phase of the mobilization.

Because of Brukner's limited vision he failed to perceive key opportunities to move Waco into a sounder strategic position for postwar business. Time and again Brukner ignored or only half-heartedly pursued relationships with the large military contractors, most notably Curtiss-Wright and Republic.¹² He allowed the transport program that Waco had won from the Army Air Forces to languish under the twin burden of murky requirements and insufficient resources. The fluctuating aircraft specifications and production schedules demanded that Brukner devote more effort to helping the military define those requirements instead of trying to react once they arrived at his Troy factory. He held monopolistic power over the combat glider designs, yet he never used that power to influence the Army. Lobbying efforts instead occurred on the factory floor,

¹² This is certainly consistent with Brukner's bias towards independence, but historian Bernard W. Carlson offers another framework in which to analyze this decision. Carlson argues that within large organizations, innovation is largely a social process wherein effective change takes place only when key leaders achieve consensus on a course of action. When the military forced Waco to serve as the leader for a team of glider contractors, Brukner made no organizational adaptations for the new role. The reliance on the existing engineering office caused internal friction that compromised glider production in all companies and Waco's XC-62 transport program. Carlson explains this. He writes, "Significantly, the linking of technology, organization, and marketing strategy did not take place automatically, driven by inexorable technical or economic forces. Rather, individuals and groups forged those links gradually as they interacted on several levels, making mistakes, changing their approaches, and ultimately developing an appropriate match between hardware and the business system (350)." Carlson, *Innovation as a Social Process: Elihu Thomson and the Rise of General Electric, 1870-1900* (New York: Cambridge University Press, 1991).

as Brukner and his managers fought countless battles with air force inspectors and auditors over the minutia of manufacturing and accounting procedures. Caught in a sticky web of responsibility for detailed, tactical leadership, Brukner lost his strategic vision, and Waco Aircraft emerged from the war poorly positioned to compete in either the military or the civilian field of the aviation industry.

Which brings us again to the limitations of the neoclassical model of the firm in explaining how innovation takes place. The formulation of business strategy lies beyond the ken of comparative statistics. Astute leadership, keenly aware of the environment in which the company operates, must chart a course for future development that takes account of as much relevant information as possible. In those industries that are dependent on scientific and technological innovation for sustained growth, leaders must cultivate relationships with those organizations with a stake in developing technological knowledge. The American aeronautical industry relied on the military for advancement during and after World War II. In directing technological innovation, however, the armed services responded to much more than advances in technology. The politics of interservice rivalry dictated much of the AAF's ambivalence towards glider technology, for example. Military politics extended beyond Pentagon offices to the White House and the halls of Congress. Officers worked hard to cultivate constituencies in the executive and legislative branches of government, and new technologies often disturbed the alliances and rivalries that the services had cultivated over time. Thus

politics tempered technological development no less forcefully than financial constraints.¹³

Of course the armed forces bear the primary responsibility for ensuring that the nation's military capabilities remain sufficient to deter or, as a last resort, to win conflicts. Although the traditional American suspicion of large, standing military forces limited the extent to which the services could draw on the civilian economy, the experience of World War I taught senior leaders in and out of uniform that wars were national phenomena. The innovations that the military implemented during the interwar years and during the Second World War drew on the knowledge embedded in various elements of a national system of innovation that spanned the public, commercial, educational, and public sectors of American society.¹⁴ The United States and other nations laid plans to harness the resources of their societies in mobilization schemes that produced various levels of effective military capability. The success or failure of the innovations depended on innumerable factors and presented military planners with the challenge of implementing innovations during peacetime in ways that produced superior capability at some indefinite point in the future.

Wartime and postwar aeronautical development solidified a network of relationships that has become known as the military-industrial-university complex. It consists of four primary groups of people: business firms, academic researchers, the

¹³ For a superb example of the politics of technological innovation in a military setting, see Eugene Lewis, "Admiral Hyman Rickover: Technological Entrepreneurship in the U.S. Navy" in Doig and Hargrove, eds., *Leadership and Innovation*, pp. 61-88.

¹⁴ Richard R. Nelson, ed., *National Innovation Systems: A Comparative Analysis* (New York: Oxford University Press, 1993); Williamson Murray, "Innovation: Past and Future" in Murray and Millett, eds., *Military Innovation in the Interwar Period*, pp. 300-328.

armed services, and elected politicians. This four-sided alliance has displayed remarkable resistance to change and its stability and power concerned President Eisenhower by the end of his second term in office. This rigidity, or some say intransigence, has fed the impression that large bureaucracies, public or private, are lethargic beasts incapable of responding to changing needs.

While the military has, on occasion, earned its reputation for bureaucratic lethargy, too little credit has been given for its success in sustaining technological innovation in the long term. At critical moments the armed services acted in creative ways to adapt organizations to new technologies. The Navy, for example, institutionalized many of the advantages of the aircraft carrier in the years before World War II and laid the foundation for rapid adaptations based on combat experiences. The Army Air Corps under the prewar leadership of General Arnold did a good job of quickly mobilizing money and manpower to meet the challenge of multiplying the output of the aviation industry in record time. The technological and organizational innovations the air force incorporated were not the automatic result of political fiat or economic reason. Experimentation and contingency abounded.

The combat glider technology, of which Waco was an intimate part, was a creative response to a threat Arnold perceived. Germany's glider capability and his own service's inability to deliver airborne troops to the battlefield reliably potentially gave to American ground commanders the ammunition to interfere with the air force's drive for independence. As this threat faded so did the importance of the glider program. Nonetheless, the robust networks that Arnold had forged allowed him to invest the air force's resources in more promising technologies, like heavy bombers and radar. The

stability of the military-industrial-university complex thus fostered competition between the services and experimentation. In this context the military refined technologies and organizational capabilities to the extent that the U.S. created and has sustained a qualitatively superior air force for over five decades.

The military-industrial-university complex provides a key resource to member organizations: stability. It is the positive aspect of what frustrated Americans call "rigidity." The complex's monolithic appearance masks the large number and dynamism of the relationships that exist between organizations in the public, private, and academic arenas in this and all similar networks. In bureaucracies as large as the military, defense contractors, and research universities the technical and communicative skills of individuals make critical differences as they decide how to respond to changed circumstances. These changes may favor one part of the network over another. For example, the collapse of the Soviet Union has diminished the impact of the military's threat assessments and placed greater emphasis on joint military-commercial use of technologies, especially electronics. The changing context, then, places firms with access to commercial electronics expertise in a relatively advantageous position in the network of institutions. Will military and business leaders respond to the new opportunities, or will they resist the change in their status in the complex as Brukner did in the late 1930s and early 1940s?

Adaptability derives from astute leadership. Leaders with effective lines of communication to their internal and external constituencies make better decisions. Organizations with the capability to interpret accurately the information they receive from their networks recognize opportunities that others do not. Brukner did not perceive

the changes in the nature of the aviation market that resulted from the Great Depression and the mobilization for war. And in small firms like the Waco Aircraft Company, the importance of leadership and organizational flexibility stand out clearly. Formulating an effective business strategy demands an accurate perception by only one or two leaders of the context in which the firm operates. In larger organizations, it is more difficult to locate both the good and bad decisions and perceptions. The behavior of Waco's rivals demonstrates that other aviation entrepreneurs saw the opportunities that Brukner either failed to recognize or chose to ignore. His overriding concern to manage Waco efficiently in the style to which he was accustomed led to a failure to manage effectively.

Conclusion

Brukner's story reconfirms for business historians the need to keep individuals center stage in studying how innovation takes place. Quite simply, leadership matters. Of course, leaders face resource constraints, and organizational culture shapes the options available at any point in time. But the notion that individuals are less important than their organizational setting leaves us with an inadequate explanation of the history of the Waco Aircraft Company or the aviation industry. Waco's development prior to World War II defined the first stage of corporate growth in which Brukner built an integrated system of management, manufacturing, and marketing. In that timeframe, he provided the entrepreneurial drive and technical expertise that led the company to the top of the private flying market. He proved unable, however, to stabilize Waco's position in the market and to lead Waco into a second stage in which control of the company passed to a second generation of professional managers with a broad range of capabilities.

Instead Brukner's biases blocked paths towards more effective integration in the aeronautical community, as the New Deal and international politics changed Waco's business context. Here is clear evidence that business leadership can cause both remarkable success and enormous failure.

In studying Waco Aircraft I have purposely employed many of the concepts Philip Scranton's model of specialty production introduces. Scranton's corrective to Chandlerian business history, with its emphasis on managerial development of large corporate structures, offers greater explanatory power in the early phases of Waco's case. Most aviation companies before World War II were small businesses that were dominated by their entrepreneurial founders. Certainly Waco fits this description, but that model also fits the experiences of Martin, Douglas, Lockheed, and many others. Even when these firms grew into corporate giants during the war, they remained committed to the kind of specialty production Scranton analyzed in the machine tool, furniture, jewelry, and locomotive industries. These firms developed production flexibility through the personal management of highly skilled workforces. Waco and its industrial colleagues employed the same techniques, and their history adds veracity to Scranton's conclusions and extends their usefulness beyond 1925, the endpoint of his study.

In the wartime, mass-production phase of aircraft manufacturing, the Chandlerian model has more applicability. Then, scale (as attested by the Ford Motor Company's contributions) mattered. So too with Chandler's emphasis on firm investment in managerial capabilities, a theme Waco supports with a positive and then a

negative example. Even then, batch elements of production still mattered, as they do today in aircraft production both for the civilian and military markets.

As a result of this study, I have joined those historians of technology who use a contextual approach to understand technological development. As the history of Waco Aircraft shows, technological artifacts by themselves do not dictate any one path of development. My study diverges from those of historians, like Thomas P. Hughes, who argue that technology generates its own expanding body of knowledge. Contextual factors form the background and play a secondary role in the technology's evolution, in their view. But I find that context matters and contingency abounds in the process, as Bernard W. Carlson has convincingly argued in the case of Elihu Thomson in the rise of General Electric. Individual leaders' ambitions, biases, and limitations affect the terms of the debate about how artifacts are deployed in society. Entrepreneurs—individuals—create social artifacts like firms, magazines, and public bureaucracies that define the social meaning of the technology.

That meaning can change over time, as it did for the airplane. For Americans who had visions of a social revolution carried on the wings of personal airplanes, the private flying field in aviation was the most important. Others portrayed the plane as the cornerstone to affordable national security and advocated the creation of a vigorous aircraft manufacturing industry based on a realignment of organizations and resources within the military establishment. The arrangements that emerged as the various actors in the industry, government, and the public negotiated were only tentative until the international crisis of the 1930s clearly favored the military's supremacy in the network. In this contentious interwar context the social and technological artifacts that the

entrepreneurs in the aviation industry created competed for priority. As late as 1939, the New York World's Fair aviation exhibit included private flying as a co-equal partner with military aircraft and the airlines. My study of Waco's participation in the dynamic process of assigning meaning to the airplane falls in league with those historians of technology who show how technology can be socially determined.¹⁵ In aviation the interactions of social institutions played a decisive role in the advancement of aeronautical technology.

The quantity and quality of formal and informal institutional interactions point to the importance of informal networks in facilitating innovation. The tremendous success of the American aviation industry during World War II revealed the efficacy of forging effective links between public and private organizations for sustaining the innovative process. The industry became the largest, most productive one in the world during the war years. Waco's history, on the other hand, highlights the consequences of neglecting these links. The tens of millions of dollars Brukner received on military contracts was a necessary but not sufficient resource for Waco to succeed. More important were the capabilities to interpret accurately and to respond effectively to the

¹⁵ For an excellent introduction to this analytical approach, see Wiebe E. Bijker, Thomas P. Hughes, and Trevor J. Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge: MIT Press, 1987). For historian David F. Noble cultural forces are much stronger than technical factors in determining what technological products are deployed in society. See *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Oxford University Press, 1979) and *Forces of Production: A Social History of Industrial Automation* (New York: Oxford University Press, 1986). See also Susan J. Douglas, *Inventing American Broadcasting, 1899-1922* (Baltimore: Johns Hopkins University Press, 1987); Benjamin F. Cooling, *Gray Steel and Blue Water Navy: The Formative Years of America's Military-Industrial Complex, 1881-1917* (Hamden: Archon Books, 1979); Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1983); and Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993).

military's requirements. Waco's rivals had learned how to do that prior to the mobilization crisis; building network links during the war proved difficult. The network's importance reaffirms the contextual approach to studying business history. It connects business historians' traditional concern for innovation at the level of the firm with the social innovations that historians of technology have shown play influential roles in defining the meaning of technological change.

Which brings us back to the challenge business leaders face today in nurturing the ability to exploit new opportunities in the competitive context of a rapidly globalizing economy. This is an organizational problem and one that extends beyond the boundaries of the firm. The integrated nature of the problem and its solution cuts across the grain of many Americans who still retain an individualistic outlook. Popular culture perpetuates the heroic image of individual accomplishment. Bill Gates as hero-inventor-entrepreneur is the late twentieth-century incarnation of a much-used model. But individuals, Gates included, most often act in institutional settings. In crafting policies to meet the challenge of competition, leaders must face this reality. The histories of organizational successes and failures will help identify and refine a wide range of credible options for public and private innovation. We may sacrifice a bit of the luster of the heroic entrepreneur, but there is still plenty of latitude for his or her very human strengths and weaknesses. More important, we may better understand what makes her or him successful and thereby address Schumpeter's challenge to explain the dynamic equilibria that cause sustained economic growth.

HOWARD (Hadd) G. JONES, III
 Date of Birth: 26 November 1963
 Place of Birth: Tucson, Arizona

ACADEMIC BACKGROUND

- Education
 - PhD Business History, Johns Hopkins University, 1999
 - MA American Economic History, Johns Hopkins University, 1990
 - BSs Economics and History, USAF Academy, 1985
- Broad range of faculty duties as Assistant Professor in the USAF Academy Dept of History, 1990-94
 - Earned grants to conduct research at Library of Congress, University of Wyoming, at Dayton, Ohio
 - Organized funding for cadet research at Defense Systems Management College
 - Worked directly for Dean and Superintendent to write quality curriculum and implementation plan
 - Mentored cadets on academic/military professional matters—three won graduate scholarships
- Courses Taught
 - Modern Military History; 1990, 1992
 - Modern World History; 1991, 1993
 - American Southern History (Course Director); 1991, 1993
 - The Civil War and Reconstruction (Course Director), 1992
 - America between the World Wars (Course Director), 1993
 - Foundations of American History (Course Director); 1992, 1993
 - American Economic History (Independent Study Course), 1994
 - Modern American History (Distance-Learning Course at U.S. Embassy in La Paz, Bolivia), 1995
- Published three articles on business-government relations
 - "A New Rival: The Rise of the American Air Force," *Air Power History* Vol. 38, No. 4 (Winter 1991): 18-29.
 - "Two Propellers Short of a Plane," *Program Manager* Vol. 23, No. 1 (Jan.-Feb. 1994): 24-30.
 - "Testing the Waters: The Waco Aircraft Company," *Essays in Economic and Business History* Vol. 12 (1994): 133-154.
- Authored five book reviews on American history
 - *Air Power History* (three times)
 - *Ohio History*
 - *Journal of Southwest Georgia History*
- Presented five papers at professional conferences
 - Northern Great Plains History Conference, Apr 1992
 - Economic and Business History Conference, Mar 1993
 - Siena College World War II History Conference, Jun 1993
 - Social Science History Association Annual Conference, Nov 1993
 - U.S. Naval Academy History Conference, Sep 1999

ACHIEVEMENTS

Outstanding Logistics Plans Manager of the Year, 1997
 Outstanding Military Educator, Department of History, USAF Academy, 1993
 Hoover Scholar (Grant awarded by Hoover Presidential Library), 1993
 Nat'l Endowment for the Humanities Summer Seminar on Amer. Southern History, 1991
 Distinguished Graduate, USAF Academy, 1985

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- Geisse, John H. Papers. Herbert Hoover Presidential Library, West Branch, Iowa.
- Hoover, Herbert C. Papers. Herbert Hoover Presidential Library, West Branch, Iowa.
- Kerwood, Charles W. Papers. American Heritage Center, University of Wyoming, Laramie.
- Lazarus, William C. Papers. U.S. Air Force Academy Library, Colorado.
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- Turner, Roscoe. Papers. American Heritage Center, University of Wyoming, Laramie.
- Vidal, Eugene L. Papers. American Heritage Center, University of Wyoming, Laramie.
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AOPA Pilot

Aviation

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