"Born of a Wartime Necessity": From Combat Gliders to Computers in Minnesota, 1941–1946

Revised edition

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Introduction

In December 1941, the United States had few plans, no blueprints, and no inventory of combat gliders. By then, however, the German Air Force had already demonstrated (May 1940 in Belgium and May 1941 in Crete) that the combat glider was a weapons system that could be effective in air-land assaults. Spurred by Germany's successes, in May 1941 the U.S. Army Air Forces (AAF) rushed to establish its own glider program and to purchase five training gliders for testing and familiarization. In December then Major Fred R. Dent Jr., the assistant chief of the army's Aircraft Laboratory at Wright Field in Dayton, Ohio, was formally assigned as the Director, Glider Unit, as part of the AAF's Experimental Engineering Section.

The combat glider was a piloted aircraft that had no power, no defensive weapons, and no armor. Consisting of a frame of welded steel tubing, with wooden wings, a honey-combed wooden floor, and a wooden tail, only thin, doped fabric covered the gliders' fuselage, tail, and wings. On the ground, gliders appeared to be fragile aircraft, particularly when seen alongside powered airplanes made of metal. Yet when used in combat, they proved to be surprisingly sturdy and capable of doing the job in the face of enemy fire.

The combat glider was designed to carry additional personnel, such as infantrymen or cargo. A powered aircraft, such as a C-47, was used to pull the glider into the air and ferry it to a target. Once a glider reached its objective, the aircraft's pilot

released the tow rope and guided it using gravity and its diminishing airspeed, careful control of the craft's ailerons, spoilers, elevators, and rudder, and an understanding of air currents to a landing on the ground. Challenging to fly, especially when making what was essentially a dead-stick landing, gliders and their pilots were initially assigned second-place status relative to the pilots of powered aircraft in discussions of air-land assaults. By the end of the war, that misperception had largely disappeared as U.S. and British senior officers recognized that the glider was indeed an important weapon in their arsenal.

What is of paramount importance about combat gliders is that their birth as a weapons system coincided with the origin of airborne forces in the armed services of combatants on both sides of the war in Europe. Thus their development involved much trial-and-error testing under great pressure to produce effective weaponry. After the U.S. and British air forces used gliders in actual combat beginning in July 1943, both services continued to improve and develop this weapon. By the last year of the war, the combat glider was a mature weapon that was a standard tool in airborne assault. Ironically, just as the glider was proving its value, U.S. planners were exploring what they could use instead of the combat glider to achieve comparable results in future air-land attacks.

The CG-4A glider, which was the U.S. Army Air Forces' most widely used glider during World War II, is central to the story of the Northwestern Aeronautical

Corporation. In the designation "CG," the "C" stood for "cargo" and the "G" for glider. The "4A" simply represented the model number, the first version ("A") of the fourth basic design. This book is about how one glider manufacturing firm, Northwestern Aeronautical Corporation (NAC) in Minneapolis and St. Paul, Minnesota, contributed a little over 1,500 CG-4A gliders to meet the AAF's combat needs. Although NAC also built some 50 CG-13 model gliders and eleven powered gliders, this account concentrates on the CG-4As. Telling the story of NAC includes examining how the company got their glider contracts from the air force; reporting what is known of the men and women who built these aircraft, and evaluating the company's leadership, especially that of John E. Parker, who was the impetus behind the formation of NAC in early 1942.

The U.S. Army Air Forces ordered and paid for all of the American combat gliders that were manufactured between 1942 and 1945. The air force required that the gliders be constructed from readily available, lightweight materials, materials that would not take away from the raw resources needed by powered aircraft manufacturers. The gliders were considered expendable and expected to be "one-landing aircraft." At the same time, the AAF made no reduction in its quality standards for how the CG-4As were to be built. Consequently these gliders were well made and performed at a high level in combat.

Early in 1942, the U.S. Air Force selected the CG-4A glider, which had been designed by the Ohio-based Waco Aircraft Company, as the particular model that would best meet their combat needs. Before the war, Waco was a small, commercial aircraft manufacturer, but in June 1941 it received a contract to build two experimental gliders, the 8-place XCG-3 and the 15-place XCG-4 (the "X" stand for "experimental). Although both models were accepted, the CG-4A proved the most suitable. Similar to the CG-3A, the CG4-A was a little larger and was deliberately designed to carry a light jeep.

Tactically speaking, the combat glider was employed in large offensive operations to quietly deliver squads of infantry or cargo in airborne assaults behind enemy lines. Along with Great Britain, the U.S. military landed combat gliders, loaded with troops and armaments, to support the paratroopers who dropped from transport planes. The paratroopers went in first, but they often landed over a wide area, requiring time to gather and form up to be effective fighting units. Although ammunition and additional weaponry could be dropped along with the paratroopers, the quantity was very limited, and there was no way to control where this material would land.

Gliders, on the other hand, made mass landings from a low altitude. Unlike powered transport aircraft, gliders could land in short, unprepared fields. Even when gliders were damaged in their landings, they could still deliver, most of the time, their infantry squads or cargo. As a result, massed glider landings provided more troops and

more gear to the assault than paratroop drops could alone. Once they were on the ground, glider infantrymen could quickly move toward an objective. Unlike paratroopers, the soldiers that gliders delivered behind enemy lines needed little specialized training to do their jobs.

By the end of World War II, sixteen manufacturing firms scattered across the United States had produced nearly 14,000 CG-4A gliders along with a variety of other models. Some of the others included approximately 1,200 training gliders and some more specialized, experimental aircraft.

The focus of this book is on the human side of those involved with building the gliders at the Northwestern Aeronautical Corporation. Who did this work, where did the men and women come from, and what was involved in the work they did? As much as can be done using the fragmentary records that have survived from the 1940s, this book tries to answer these questions. Whenever possible, the men and who were NAC tell their story in first-hand accounts. Background on how the glider manufacturing "landed" in the Twin Cities and how NAC's leadership overcame a variety of obstacles to meet the military's war demands provides a Minnesota story of unwavering determination and undying patriotism that so typified the country's Greatest Generation. Concentrating on the home front in Minnesota during World War II, interviews with the men and women of who built the gliders, along with those who flew the gliders into combat, are included.

This history is not intended to detail the glider operations during the war or how gliders contributed to combat against Axis forces. Those operations have been examined in depth by other very able authors, and there is no need to repeat in detail what they have so skillfully accomplished. Neither is this book an in-depth examination of the CG-4A as a type of aircraft and how it differed from other glider models. Readers who want a comprehensive look at the CG-4A and how it compared with other glider models will need to consult reference works such as Bill Norton's *American Military Gliders of World War II: Development, Training, Experimentation, and Tactics of All Aircraft Types* (2012).

One final question that this history addresses is what happened to NAC after the war. By the time the Japanese government formally surrendered in early September 1945, the future looked bleak for NAC. The only aircraft it manufactured during the war was the glider and once the Axis forces were defeated, the Army Air Forces had already begun to look at other types of aircraft, such as the helicopter, to meet any future combat needs in airborne assault. John Parker had the difficult task of determining how NAC could carry on, and as he had done in 1942, he would again make history by putting the Twin Cities on the map of the country's nascent computer industry.

In 1946 NAC morphed into a new corporation, Engineering Research Associates (ERA), with John Parker as its president. A few of the same people who had worked at NAC were holdovers at ERA, but most of the new company's pioneering work resulted

from the talents provided by newcomers who were engineers and other technically trained professionals. Today historians of computer technology acknowledge that between 1946 and 1952 ERA established itself as Minnesota's first computer company just as this new technology was also being developed elsewhere in the United States.

Lastly, this book includes a look at how a committed team of volunteers, over sixty years later, would bring the CG-4A back to life in the Twin Cities. From 2007 to 2012, the team devoted countless hours to restoring a CG-4A, the beginnings of which were located in a field in Missouri. This valuable teaching model is now very accessibly displayed at the Fagen Fighters World War II Museum in Granite Falls, Minnesota, so that anyone who is interested in gliders can examine its design, construction, and materials.

In the years preceding the attack on Pearl Harbor, Minnesota was hardly a hotbed of aviation. Although William Markoe, a St. Paul resident and businessman, made the first balloon ascent in the state in September 1857, aeronautical exploits in Minnesota prior to the U.S. involvement in World War I were largely confined to balloon ascensions and flying shows. The first public, sustained flight by a powered, heavier-than-air machine in Minnesota took place in June 1910 at an airshow attended by an estimated crowd of 18,000 at the State Fairgrounds.

After the United States entered the World War in 1917, Minnesota joined the effort to train aviators and mechanics, but little came of these activities before the

armistice of November 1918 ended the fighting. Earle Brown, the director of the Aero Club of Minneapolis, offered his large farm northwest of the city as an aviation training field. That site is generally considered to be the first airport in the Twin Cities.

During the war, many men from the state volunteered for military service and learned to fly. Following their return from wartime duty, some of them continued flying and began to promote Minnesota's aviation development by barnstorming, selling aircraft, providing flight instruction, offering sight-seeing rides, or marketing other aviation-related services. During the 1920s William Kidder, for example, had an active aviation business at Curtiss-Northwest Field on Snelling and Larpenteur Avenues in St. Paul. And along with the growing interest in aviation came Minnesota's first airfields. St. Paul established an airport, called appropriately the St. Paul Airport which is now known as Holman Field. Speedway Field, located in southern part of Minneapolis near Fort Snelling and the confluence of the Mississippi and Minnesota Rivers, had a large, oval, two-mile concrete track with grandstands capable of holding thousands of spectators. Bounded by South 60th and 66th Streets, and South 34th and 44th Avenues, the racetrack was designed in the style of the Indianapolis Motor Speedway, but when auto racing at Speedway fell on hard times, aviation replaced it.

The track had opened with its first race on September 4, 1915. Due to poor construction, that was the only major race held at Speedway. The concrete oval, which was extremely hard on the race cars, was not steel-reinforced in places and

complemented by Minnesota's harsh winters, the track started heaving and breaking up. The Speedway Corporation went into bankruptcy in 1916, and the facility was sold in a sheriff's sale in late 1918.

The following year, some local businessmen who were also aviation enthusiasts, built a hangar on a section of the concrete straightaway and offered flight instruction, sight-seeing flights, weekend air shows, and aircraft sales. The race track encircled 160 acres of relatively flat field, which was ideal for aircraft operations. By 1920, members of the Minneapolis Aero Club and other investors had incorporated Twin City Aero Corporation and arranged to lease the speedway property for aviation pursuits. Then in August 1920, the U.S. Militia Bureau established a Minnesota Air National Guard unit at the field and in 1921, the State of Minnesota built three hangars at the field for the Guard's aviation unit. The field quickly became known as Speedway Field or Twin Cities Airport. In 1923, it was renamed Wold-Chamberlain Twin City Airport in honor of two local pilots who had been killed in France during the war, Ernest Groves Wold and Cyrus Foss Chamberlain. Today this airport is known as the Minneapolis-St. Paul International Airport.

St. Paul Airport and Wold-Chamberlain Airport soon became centers of the fledgling aviation industry of Minnesota. The first airmail flight in Minnesota took place on August 10, 1920, when an airplane from Chicago delivered 30,000 letters to Speedway Field. This airmail route between the Twin Cities and Chicago initially

proved to be a deadly one. In less than a year, four pilots were killed and eight aircraft were destroyed, and the airmail service ended in June 1921.

Five years later, regularly scheduled commercial air transportation in Minnesota also got a rough new start on June 7, 1926. Two Minneapolis flyers left with sacks of letters for Chicago. One made the trip successfully; the other crashed due to high winds and was killed. The entrepreneur behind these flights was Charles "Pop" Dickinson, and his airline was called Dickinson or C.D. Airlines. Soon thereafter Dickinson encountered serious difficulties when his pilots, unwilling to risk their lives, refused to fly in his airplanes.

In September of that year, Dickinson gave up on his business, but a new company, Northwest Airways Inc., had just organized in August 1926 to take over his airmail contract with the U.S. Postal Service. Northwest began operating the Twin Cities-Chicago route on October 1. Colonel Lewis H. Brittin of St. Paul was the driving force behind the formation of Northwest. He had business connections not only in Minnesota, but also with executives of the Ford Motor Company, and he was able to persuade investors in St. Paul and Detroit to put up $300,000 needed to incorporate this new airline in Michigan. Northwest had been the sole bidder to take over the Twin Cities-Chicago airmail route. With increasing revenues, the airline began buying additional aircraft and by July 1927, the airline was also able to offer commercial

passenger service as well. Northwest grew slowly in those early years, and its airmail contracts provided the steady income needed to sustain this growth.

To support the new airports and regional airline during the 1920s, several aviation manufacturing companies also sprang into business in Minnesota. One was the Mohawk Aircraft Corporation, which was organized in 1927 in southeast Minneapolis near Prospect Park. Estimates indicate that Mohawk built between thirty and forty aircraft before the lack of sales forced the company out of business by 1931.

In St. Cloud several local businessmen incorporated the North Star Aircraft Company in 1928 to build a biplane for business and personal use. One model was produced and initially tested, but the company ran out of money and soon closed. Another short-lived airplane manufacturer, Trainer Aircraft Company, emerged in Cloquet, Minnesota, in 1931, but again, the lack of adequate capital resulted in the company's demise. An aircraft manufacturing company registered as a South Dakota corporation, the Waldron Aircraft and Manufacturing Company, was started in Minneapolis in 1928. Later known as the Starling Aircraft Manufacturing Company, the company actually built only two planes, and similar to the others, financial difficulties forced the company into bankruptcy.

Minnesota, like many states at the time, had its share of inventors who tried building airplanes in the 1920s and '30s, but none of these efforts were strong enough or sufficiently capitalized for a commercial market caught in the midst of the Great

Depression. As Minnesota aviation historian Noel Allard pointed out: with the exception of the combat gliders that the Northwestern Aeronautical Corporation built for the Army Air Forces during World War II, "Minnesota had no history of mass-producing airplanes prior to 1945." Given the absence of any significant aviation manufacturing in Minnesota before 1941, the emergence of NAC and its record of building 1,510 CG-4A gliders is both surprising and truly remarkable.

The history of NAC, John Parker, and the CG-4A glider that is presented in this book is not a traditional military history of combat operations. Instead it examines a very unusual situation where time, place, people, and circumstances all came together under the stress of war to demonstrate how determined and resourceful Minnesotans, even on the home front, could step up to meet the demands of war. Although neither NAC employees nor any others associated with the glider production in the Twin Cities were ever awarded medals for their work, their contributions were heroic and worthy of recording in this history, a piece of Minnesota history that should not be forgotten.

Chapter One

The War Brings Glider Building to Minnesota

Late one night in the early fall of 1942, the planing mill at the Villaume Box and Lumber Company on the river flats along the west side of the Mississippi River was alive with activity. This was not the norm at Villaume, but these days nothing at the plant seemed to follow the work rhythms that were typical before the Japanese attacked Pearl Harbor. Not only was the plant in operation, the company's skilled woodworkers were busily finishing up the construction of a wooden glider wing. Building wings for a CG-4A glider was totally new for these workers. Formerly a manufacturer of millwork, window sashes, cabinets, and wooden boxes, Villaume was now completely caught up in building wooden parts for combat gliders.

Two Frenchmen, Eugene and Victor Villaume, organized this company in 1882. In 1873 they had emigrated first to New York City and then to St. Paul, where their company got its start on the city's west side manufacturing wooden boxes for local breweries. Three years later, Victor retired and sold his interest to Eugene. Over time, Villaume had expanded and grown so much that by the early 1940s, the company had established a solid reputation of working with wood and producing fine millwork for buildings such as the Ramsey County Courthouse and the St. Paul City Hall. Now Villaume was a subcontractor working for Northwestern Aeronautical Corporation (NAC) in support of the U.S. Army Air Forces.

The company's current project, building the all-wood wings, control-surface structures, and the honeycombed wood floor for a CG-4A combat glider, was straining its resources. No one at Villaume had ever built anything like these wooden parts for an aircraft that had not even been counted among the airplanes on hand in the air force less than a year earlier. The identifying "C" stood for cargo and the "G" for glider. Because this aircraft was designed to be towed behind a powered airplane such as the C-47 (the military version of the Douglas DC-3 passenger airliner), the CG-4A had no engine. Nor was it equipped with any defensive armaments.

Northwestern Aeronautical Corporation, the primary contractor, had only just sprung into existence in February 1942 out of the crisis brought on at the beginning of World War II. Villaume's managers were very aware that NAC had no history of building any kind of aircraft because NAC had no history. Established by a handful of business leaders who wanted to do their part in the early days of U.S. involvement in the war, NAC also had no employees nor any buildings when it was organized. The air force, which desperately needed to have gliders for the war, gave NAC a contract to build them, even though the air force procurement officers knew that NAC had never built anything that could fly, much less a combat glider. NAC was not the only contractor the air force had hired to build these gliders. There were fifteen other firms that had contracts to build gliders. Like NAC, other companies such as the Ford Motor Company and the Gibson Refrigerator Company had no prior experience

manufacturing any type of aircraft; others such as the Waco Aircraft Company, the firm that had designed the CG-4A, and the Cessna Aircraft Company, had previously built only small airplanes. The government contract taken on by NAC meant that the company had to find the necessary subcontractors and workers in the Twin Cities who were willing to shoulder a portion of the challenging workload to meet the air force's expectations in building its nascent glider program.

The blueprints for a CG-4A indicated that it was to have a wingspan of 83 feet and 8 inches. The aircraft itself was designed to carry a payload of 3,750 pounds. That payload might consist of a pilot, copilot, and thirteen glider infantrymen; or instead of the infantrymen, the glider could deliver a 75 mm howitzer or a quarter-ton jeep. Regardless of what it was, the cargo was positioned on top of the honeycombed wood floor inside the glider's fuselage, which measured 72 inches wide by 65 inches high. Cotton fabric covered with dope and paint covered the wings, tail, and fuselage. A hinged nose section at the forward end of the fuselage allowed for loading and unloading the troops or cargo. No internal braces impeded the movement of men or cargo in or out. When loaded with infantry, the troopers sat on wooden benches positioned longitudinally along both sides of the cargo compartment. Seat belts helped secure the men in flight. If, on the other hand, the glider was loaded with a jeep or howitzer, the benches were removed, the cargo loaded in and secured to the welded steel framework that gave shape and substance to the fuselage. In the case of NAC's

gliders, the local company hired to build the steel framework was De Ponti Aviation Company in Minneapolis. Like Villaume, this work was a totally new venture for De Ponti's workers.

On that fall evening when everyone on the night shift at Villaume was working so diligently to meet their first deadline, Robert W. Whittingham was one of the supervisors. He had learned to fly in 1919 and later worked for the Detroit Aircraft Company as well as Midwest Airways in Milwaukee. As the depressed economy worsened and commercial aviation suffered declining revenues, he went into the automobile business for Ford Motor Company, and by 1939, he had moved on to selling snow-plow equipment. After war came to the United States in December 1941, these types of manufacturing took a back seat to war production, and Whittingham became an instructor in the U.S. Office of Education in the Civilian Aviation Program. When asked to join NAC in early 1942, he grabbed the chance to return to aviation production—even though he knew nothing at the time about gliders.

On the scene at Villaume that night, Whittingham was making sure that the crew was going to get the first pair of wings to the assembly facilities that NAC had rented at Wold-Chamberlain Airport (now known as Minneapolis-St. Paul International Airport). The wings were due at Wold-Chamberlain the next morning, and there they would be covered in fabric, doped, and painted before being attached to the steel-framed fuselage that De Ponti welders had been building concurrently in their Minneapolis plant.

Workers at Villaume, however, were struggling with the large and bulky wooden wing frames in their attempt to load them on trucks for transport to Wold-Chamberlain. Although Villaume and De Ponti had spent about three months tooling up for actual production that had begun in August, it had taken much more time than forecast to build the first wings. Now those present, including Bob Whittingham, realized that not enough planning had gone into how they would get the wings from the second story of the Villaume plant into trucks that were waiting in the street below. Stymied by this unplanned logistical problem, they eventually found a makeshift solution that allowed them to maneuver the wings out an opening in the plant wall and then carefully lower the wings with the aid of a series of pulleys down to the trucks. Completing this final step took five hours, which included a last-minute holdup due to a hailstorm.

One witness to the awkward scene at Villaume was the man behind NAC: John E. Parker. In mid-1945, Parker recalled the earlier struggle with these first glider wings. He recounted how at the time one of the workers at Villaume had come up to him and said, "You'd better send Bob home. He's been at work for 60 hours now and I'm afraid he'll crack up." Parker then went over to Whittingham and told him he should leave.

"I said I'd stay till this wing got to Northwestern, and I mean to," Whittingham replied with determination. That ended the conversation, but when Whittingham

climbed aboard one of the trucks, he was asked where he was going. His answer: "Oh, I want to see that they make the trip across town OK."

This time, however, Parker intervened. He had two security guards take Whittingham home and put him to bed. Some weeks later, Parker also made sure that Whittingham was promoted to the post of production manager for NAC. He knew that Bob and his team of woodworkers at Villaume deserved credit for getting this first set of wings to the airport as planned. Few people at Wold-Chamberlain, however, had any knowledge of what exactly NAC was doing at the airport much less how this newcomer had gotten into the business of building gliders.[1]

When interviewed some forty years later, John Parker explained how Northwestern Aeronautical Corporation came into existence in February 1942.

> One of my partners, Hugh Auchincloss, this is back in the earlier days when I was a partner at Auchincloss, Parker & Redpath, in which we did financing of various aviation companies, had gone off on his own and somebody persuaded him to make an investment in this Porterfield Aircraft Company in Kansas City. And after the company got in trouble, he came to me and asked me if I'd go down and see what I could do about it, which I did. And this was just the beginning of the war. I foreclosed, that is the lawyers foreclosed on the loan, took the company over. And at that time, Porterfield was making a proposal to, it was then the Army Air Corps, not the present Air Force, to make a trainer aircraft.
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> … [P]ursuing this invitation to bid on this trainer airplane, I found out at Wright Field [in Dayton, Ohio] it was going to go somewhere else, but they were going to put out a request for bids for a glider. So I took that back to St. Paul. I sat down with the Northwest engineers and asked could we do this, and they said sure they could and so forth. And so we made a bid for it. And I think really trying to get rid of me because of my trying to persuade them to use the Porterfield aircraft as a trainer for the Army. They actually gave me a contract to build 13 airplanes on an experimental contract.[2]

Although John Parker's account contains considerable information, it's also somewhat cryptic and omits a lot of details. The best place to begin a fuller explanation is with Parker himself.

John Elbridge Parker was born in Danvers, Massachusetts on October 26, 1900. His father, Elbridge J. Parker, owned a farm in Maine, but he moved to Danvers prior to the birth of his only son, John. John Parker's mother, Emma, was a native of Newfoundland and her first child had been a daughter, Florence E. Parker, who was about four years older than John. Emma Parker died when John was about two years old.

The Parker family roots were in Maine and his great-grandfather had been killed while serving in the Union Army in the Civil War, but military service was not a family tradition. In John's words, "my family was farming people." After his father remarried, John Parker went to school in Danvers and he later attended English High School in Boston for three years. Because he had a private tutor, Parker was able to pass the entrance exam for the U.S. Naval Academy after completing only three years of high school. He graduated from Annapolis in 1922 and was commissioned an ensign in the U.S. Navy.[3]

Notable among his peers at Annapolis was classmate John Higgins. He would rise to the rank of rear admiral in World War II and be awarded the Navy Cross, the Silver Star, and two Legions of Merit. Another celebrated classmate

was Hyman Rickover, who became best known as the father of the "nuclear navy" in the decades after the war. Arleigh Burke, who would later gain fame as a destroyer commander in World War II and who served as the chief of naval operations in the 1950s, was a year behind Parker at Annapolis.

As John Parker explained to Arthur L. Norberg, his interviewer in 1985, he resigned from the navy three years after he graduated and went into business. "The reason for that was not that I'd been wanting to do it, but I was married [1925] and within a year after my marriage, my father-in-law discovered he had a terminal disease and asked me would I get out of the Navy, that there was nobody else left in the family to carry on his business. He owned a New York Stock Exchange brokerage firm here in Washington. I did get out. And that's the beginning of my business career."[4]

By the time John Parker left the navy in 1926, his father-in-law had already died. Instead of working for John L. Edwards & Company, his father-in-law's brokerage firm in Washington, he started out as a runner with Hornblower and Weeks in New York City, which was associated with the Edwards firm. As a lowly runner, Parker educated himself in the stock market and the world of investments as he moved through a series of assignments in various departments of the company. Parker explained, "Although slavery was illegal at the time, part of the deal was they had to take me for a year." Parker worked hard and was

eventually named a partner in John L. Edwards before the firm's operations were merged with G.M.-P. Murphy, founded by Grayson Mallet-Prevost Murphy.

At West Point, Grayson Murphy had been a classmate of the future general, Douglas MacArthur, and succeeded MacArthur as the chief of staff of New York City's Rainbow Regiment in World War I. (When the Rainbow Regiment was mustered into federal service in the early days of mobilization in 1917, it became the 42nd Infantry Division.) Parker had a lot of admiration for Murphy who, during the 1920s also served as a director of multiple blue-chip corporations, such as Goodyear Tire and Rubber, Anaconda Copper, Bethlehem Steel, and Guarantee Trust Company. When Murphy died in 1937, his firm was liquidated. Most of the firm's partners in New York City joined other investment firms, but Parker took charge of the Washington, Baltimore, and the Philadelphia offices. He then merged these offices into a new firm, Auchincloss, Parker, and Redpath. Although Parker was a partner in this firm as well, the named partner refers to Chauncey G. Parker.[5]

John Parker only made a brief reference to Auchincloss, Parker, and Redpath when he was interviewed in the mid-1980s, but this investment firm is important for understanding his involvement with Northwestern Aeronautical Corporation. In May 1931 the nation's financial press reported that Hugh D. Auchincloss, Chauncey G. Parker, and Albert G. Redpath had organized a new

brokerage firm in Washington, D.C. with Auchincloss putting up much of the money needed to buy a seat in the New York Stock Exchange.

Hugh D. Auchincloss (1897–1976) came from a very prominent family in New York City. His father, Hugh D. Sr., a graduate of Yale and a well-known merchant in the city, served on the boards of a number of prominent corporations. He had married Emma Brewster Jennings, one of the daughters of Oliver B. Jennings, who had amassed a considerable fortune outfitting prospectors in the California Gold Rush. Oliver Jennings would later become one of the original stockholders in Standard Oil of Ohio. When Emma Auchincloss died in September 1942, her personal fortune, estimated at the time to be about $5 million, was divided among her three children. Thus her son, Hugh D., had access to the necessary funding to start his own investment firm.

Hugh D. Jr. was born in Newport, Rhode Island, where the family had a home. He enrolled at Yale, but his studies were interrupted when he enlisted in the navy shortly before the U.S. declared war in 1917. He served about eighteen months, mostly in a communications office in Newport. After the war, he went back to Yale and graduated in 1920. He earned his law degree from Columbia in 1924 and practiced law in New York City until 1926 when he was appointed a special agent in aeronautics in the Commerce Department in Washington. A year later, he joined the State Department as an aviation specialist.[6]

During the 1920s the commercial aviation industry, as we know it today, was born. Although many business and government leaders at the time welcomed this newcomer to the transportation field, many of these same people also recognized that the federal government needed to develop structure and regulations within the industry.

The Air Commerce Act of 1926 is generally acknowledged as the federal government's cornerstone for the regulation of civilian aviation. Leaders of the aviation industry urged Congress to pass this law in an effort to establish and improve safety standards for commercial aviation. With the overall goal of promoting air commerce in general, air traffic rules were implemented, along with pilot certification and licensing, aircraft certification, and standards for radio communications.

Prior to joining the Department of Commerce, Hugh Auchincloss married Maya de Chrapovitsky in 1925 whom he had met in Russia in 1922. Maya had been born in St. Petersburg and was a member of her country's old nobility. While working for the Commerce Department, Hugh and Maya went for a flight from the Washington Naval Station in an amphibian airplane operated by a friend. Following the landing of the airplane, Mrs. Auchincloss was struck in the head by one of the plane's propellers. Remarkably, she survived the accident, but their marriage did not and they divorced in 1932. Auchincloss's work for the

State Department also ended when he resigned in February 1931 to be a founding partner in the investment firm of Auchincloss, Parker, and Redpath, which was headquartered in Washington. Although Hugh Auchincloss was no longer specializing in the aeronautical field for the federal government, he recognized the opportunities offered by the aviation industry. To realize those opportunities, members of the firm took on the arduous task of surveying every airplane plant in existence in the United States at the time.[7]

The second founding partner of Auchincloss, Parker and Redpath was Chauncey G. Parker (1898–1953), no relation to John Parker, was the son of a lawyer of the same name who had been for many years the general counsel to the United States Shipping Board. Chauncey Parker had enrolled at Harvard for his undergraduate education, but then he left school to join the army prior to the start of World War I. He served in Mexico with General John J. Pershing and later in France. A resident of Washington, D.C., he joined the Marine Corps reserves about the time he became a founding partner in Auchincloss, Parker, and Redpath. He rose to the rank of colonel in the Marines and during World War II, he became the first chief of the division of finance and supply of the Selective Service System. After the war, Chauncey Parker was with the World Bank from 1946 to 1950, served as United States Assistant High Commissioner

for Germany (1951–1952), and subsequently held other senior positions in international affairs.[8]

The third founding partner of Auchincloss, Parker and Redpath was Albert Redpath (1896–1984) who graduated from Columbia College in 1918, and earned his law degree from Columbia Law School four years later. A life-long resident of New York City, he spent most of his life as an investment broker, first with Auchincloss, Parker, and Redpath and later with Drexel, Burnham, Lambert, and finally as a governor of the New York Stock Exchange.[9]

Prior to joining the Auchincloss firm in July 1938, John Parker had also been educating himself in the world of commercial aviation finance. During the 1985 interview with Arthur Norberg, Parker pointed out the pioneering role that G.M.-P. Murphy Company had played in aviation finance. Along with other investment firms, Parker claimed that G.M.-P. Murphy had participated in underwriting approximately 70% of the major industry players, including Pan American Airways and United Airlines.[10]

Parker went on to add that when he took over the Washington, Baltimore, and Philadelphia offices of G.M.-P. Murphy: "I brought with me Northwest Airlines, and I became a director of Northwest Airlines. This … is why I had Porterfield …." He also mentioned that he had done financing for Cessna, Beech Aircraft, and a lesser known company, Canadian Colonial Airways. Although

Parker lacked the blue-blood credentials or the personal wealth of the founders of his latest investment firm, his track record of working with aviation companies, his proven ability to bring aviation clients to Auchincloss, Parker, & Redpath, and his connections in Washington and the navy provided his new company with a talented and experienced broker.[11]

Northwest Airlines, which Parker brought to Auchincloss, Parker & Redpath, got its start in 1926 in St. Paul. The year before, Congress had passed the Contract Air Mail Act of 1925 with the intention that the Post Office would no longer be responsible for providing airmail service to the nation. Instead, private aviation companies would bid to deliver airmail. This law, in conjunction with the Air Commerce Act, gave incentive to private operators to join the business of delivering mail.

In 1926, a Chicago seed dealer and aviation buff named Charles "Pop" Dickinson submited a bid for airmail delivery between Chicago and the Twin Cities, a route that the U.S. Post Office had abandoned six years earlier. Awarded the contract, Dickinson's first pilot crashed, and later, his other pilots resigned after various mishaps. Soon Dickinson was down to a single airplane, operating under continuing financial losses, and most of his pilots had quit over safety concerns. In August he notified the Post Office that he was giving up his contract and would abandon the business.

Fortunately, there were others who were also interested in the Chicago-Twin Cities mail route. A St. Paul businessman, Colonel Lewis H. Brittin (1877–1952), a World War I veteran who had served in the army's Corps of Engineers, and his St. Paul and Detroit associates who had organized Northwest Airways, as it was called then, stepped forward to replace Dickinson's faltering service. After the Post Office awarded the contract to Northwest, Brittin served as the vice president and general manager of the airline until 1934. In that role, he was basically in charge of the new company's operations, but he drew no salary for the work because he remained a vice president of the St. Paul Association, a predecessor of today's Chamber of Commerce. He remained on their payroll until he resigned that post and joined Northwest full time on July 18, 1928. Initially Northwest planes carried only mail, but soon the airline added passenger service. Similar to other fledgling airlines of the day (1926-1941), there were many financial hurdles to overcome. And it was Northwest's mail revenue, which always exceeded its passenger revenue, that carried it through those challenging years.

By the 1930s, Northwest expanded its air routes west to cities such as Fargo and Bismarck, North Dakota, and then further west to Billings, Montana. Eventually, Spokane and Seattle, Washington, were added to the route. All of this expansion and development of Northwest would probably not have

occurred had St. Paul banker Richard C. Lilly not been successful in bringing together a number of Minneapolis and St. Paul business leaders in 1929 to buy out the airline's Detroit investors, thereby ensuring that Northwest was locally controlled by Minnesotans.

Following the election of Franklin D. Roosevelt in 1932, his newly appointed postmaster, James Farley, cancelled all airmail contracts in mid-February 1934 after receiving complaints that his predecessors had entered into airmail contracts that unduly favored certain airlines at public expense. Roosevelt then ordered the army's Air Corps to carry the mail. This decision quickly turned into disaster as the Air Corps was not equipped to do this safely and efficiently. Crashes occurred and airmail service suffered greatly. Public pressure on Farley to do something became intense.

Consequently, in April 1934 Farley ordered all airlines to reorganize, rid their ranks of any officials who had participated in the former "spoils system," and submit new bids. Brittin, who admitted he had destroyed Northwest documents but was innocent of any financial shenanigans relating to the airline's mail contract, had to resign and went to jail for ten days for contempt of Congress. In the aftermath of the airmail scandal, Northwest quickly reorganized on April 16, 1934, by changing its name from *Airways* to *Airlines* and submitting a

new bid for airmail service. Soon Northwest was again providing airmail service across the northern tier of states.[12]

Minneapolis and St. Paul had long been rival cities; so it was natural for each to have its own airport: Wold-Chamberlain in Minneapolis, and St. Paul Municipal Airport, later renamed Holman Field after the death of Charles "Speed" Holman. Holman had been a celebrated pilot employed by Northwest who died in an air crash in 1931.

St. Paul businessmen had successfully lobbied the city to buy land for an airport, and in 1926, bonds totaling $295,000 were sold to cover the costs involved. Colonel Brittin, as the vice president of the St. Paul Association, was a key advocate for the city having an airport downtown and helped work out the necessary property sales for the city to acquire the land. The city owned and managed the airport, which was built on the flats on the west side of the Mississippi, not far from the Villaume plant. Over the years, the city of St. Paul invested more money in Holman Field and gradually improved its facilities by constructing an Administration Building and various hangers. Negotiations for the city's investment in what became Holman Field included an agreement with Northwest that allowed the airline to operate maintenance facilities at the airport for twenty years. By the late 1930s, Northwest also maintained offices in the Administration Building at Holman Field.[13]

Although this deal between the city of St. Paul and Northwest may have initially made sense for both parties, especially in light of the roles that Colonel Brittin played simultaneously at the St. Paul Association and at Northwest, by 1940 it began to chaff for the airline and its board of directors. Northwest was committed to expanding its passenger routes and to buying bigger, multiengine airplanes, such as the Douglas DC-3, to accommodate more air travelers.[14] Although Northwest was a small, privately held competitor in the field of commercial passenger aviation throughout the 1930s, especially when comparing its revenues to those reported by United Airlines, Pan American, or others, its board of directors was looking for ways to increase its financial resources. As a result, the board decided to sell common stock to the public, beginning on February 14, 1941.[15] If John Parker's statement that he brought Northwest Airlines to the Auchincloss firm when he joined it in 1938 is accurate, then Northwest must have hired the G.M.-P. Murphy firm sometime before July 1938 to help with the airline's financing, which may have included taking the company public about three years later.

In 1938, North Dakota banker William Stern joined the Northwest Board, and would later become a key member of the management team at Northwestern Aeronautical Corporation. The following year, Richard Lilly, the president of St. Paul's First National Bank, rejoined the board of Northwest Airlines, which he

had left in 1933. That same year, a very able St. Paul attorney, Francis D. Butler, of the firm of Doherty, Rumble & Butler, also joined the board. Although Lilly and Butler served on Northwest's board for only one year, their expertise would also have contributed to improving and growing the airline's finances. Unlike these business leaders, John Parker did not join the board of Northwest Airlines until 1942, after he had organized Northwestern Aeronautical Corporation. Nevertheless his previous and current investment activities would have given him familiarity with Northwest's finances between July 1938 and early 1942. This would have also included knowledge of Northwest's lease arrangement with the City of Saint Paul for maintenance facilities at Holman Field.

Around this same time, officials at Northwest realized they would soon need to move their base of operations to Wold-Chamberlain Field because it had more land nearby for future expansion to accommodate the newer, larger multiengine aircraft that would come into service. Holman Field was limiting in this sense because it was essentially landlocked by the Mississippi. Lastly, John Parker's association with Northwest through Auchincloss, Parker & Redpath meant that he already knew Croil Hunter (1893–1970), who had become Northwest's president and general manager in 1937, as well as other key investors and managers at the airline.[16]

Northwest, of course, was not the only aviation company Parker was dealing with. The 1937 survey of airplane manufacturing companies that the Auchincloss firm had made indicated that Porterfield Aircraft Company in Kansas City, Missouri, was a good risk, but for whatever reason, Parker was opposed to the firm getting involved in financing Porterfield. About a year later, however, Hugh Auchincloss made the first of his personal loans to Porterfield Aviation to the tune of $25,000. Porterfield intended to use the Auchincloss money to build a small, powered airplane that that he could submit to the air force when the government requested bids for this type of aircraft.[17]

Edward E. Porterfield (1890–1948) was the founder and president of Porterfield Aircraft Company. He had gotten his start building small airplanes in 1925 at the American Eagle Aircraft Corporation in Kansas City. At the time, American Eagle had adequate financial backing, a board of directors that included some well-known personalities in aviation circles, and a track record of selling more than 400 planes before the onset of the Great Depression.

The Depression took its toll, however, and early in 1931, American Eagle faltered and was forced to declare bankruptcy. In 1932, Porterfield organized Porterfield Aircraft Company with the intention of building airplanes that could compete with those being manufactured by Piper Aircraft, Aeronca, and Taylorcraft. All of these companies made small airplanes that catered to buyers

who could afford to own their own, private planes. But as the military services increased their light aircraft purchasing for scouting and other purposes in the late 1930s, these manufacturers and their competitors, Porterfield among them, sought to win military contracts.

No information has survived that explains why John Parker advised the Auchincloss firm against investing in Porterfield in the late 1930s, but apparently his judgment prevailed, and although Auchincloss was putting up his own money the firm did nothing. Possibly Porterfield may have been undercapitalized for the market in which it sought to compete. Going his own way, however, Hugh Auchincloss wound up investing by 1941 a total of $140,000 (nearly $2.25 million in 2015 dollars) in Porterfield. With so much at stake, Auchincloss dispatched Parker to Kansas City to see if he could do anything to protect the founding partner's personal investment.[18]

Once John Parker analyzed the situation at the Kansas City plant, he had the lawyers call in the loans and shut Porterfield down. Initially Edward Porterfield was to be retained for six months as president and general manager, but sometime after Parker arrived in Kansas City, Porterfield received a contract from the Materiel Command of the Air Forces at Wright Field in Dayton to manufacture gliders. Here is how the historian for the Air Force explained what happened next:

> [Porterfield] telephoned Mr. Parker at night, and asked that his resignation as president be accepted. The following morning Mr. Parker was informed of the contract given Mr. Porterfield by [the colonel in the Air Force Materiel Command who was in charge of the glider program], who was under the impression that it had been awarded to Parker's company. Mr. Parker immediately went to Wright Field for a conference with [this colonel], and on 23 February 1942, secured a contract for 30 CG-4A 15-place gliders.[19]

By this time, Edward Porterfield had decamped for Fort Smith, Arkansas, with the intention of building gliders. (His new company did receive a contract for twenty CG-4A gliders on April 2, 1942, but it lacked woodworking experience and in May 1942, and the company was acquired by the Ward Furniture Manufacturing Company). But as the Air Force historian later reported, Porterfield "never produced a single glider."[20] He did, however, take with him all of the key personnel at Porterfield, leaving behind in Kansas City some $9,000 worth of aviation manufacturing equipment.

While John Parker was at Wright Field meeting with the Air Force managers about a glider contract, the colonel in charge, who by now knew that Porterfield Aviation had been foreclosed, asked Parker what was the name of the company he now represented. Once more, in the words of the Air Force historian,

> … Mr. Parker stated that he would tell him in the morning. That evening, Mr. Parker decided to call the company the Northwestern Aeronautical Corporation, and so informed [the colonel] of his decision the following day.
>
> NAC was organized with a capital of $1,000.00 cash and $9,000.00 worth of equipment formerly owned by the Porterfield Aviation Company, and was incorporated under the laws of Minnesota. Auchincloss, Parker, and Redpath later gave additional financial assistance.
>
> It should be emphasized that the contract was merely a supply contract, the government refusing to furnish a facility. NAC had neither buildings, labor, nor trained

> executive personnel. Mr. Parker contacted Northwest Airlines, Inc., of which company he was a director and made arrangements to house his plant in a hangar at Wold-Chamberlain Field, St. Paul [actually Minneapolis], Minnesota.
>
> Auchincloss, Parker and Redpath owned the controlling interest in Northwest Airlines. The company had lost a large percentage of its business, due to the war, and was anxious to help in the war effort. Their service was invaluable to the newly-formed corporation, for they aided in securing personnel, making up cost estimates, and giving engineering counsel and technical and financial advice.[21]

For the record, Northwestern Aeronautical Corporation was incorporated on February 27, 1942. The three incorporators were Francis D. Butler, John C. Foote, and Irving Clark, all of whom were partners of the St. Paul law firm of Doherty, Rumble & Butler. As previously mentioned, Francis Butler had served on the board of directors at Northwest Airlines in 1939-40 and would have again provided his expertise in getting NAC legally organized.

The network of tightly knit St. Paul business connections that supported the founding of NAC was more than a coincidence. NAC's first offices were located in the First National Bank Building in downtown St. Paul, the same building in which Richard Lilly, who had brought the Minnesota investors to Northwest Airlines in 1929, had his office.[22] John Parker met Richard Lilly and Francis Butler when Parker began working with the Northwest Airlines board in the late 1930s. Lilly or Butler may have introduced Parker to Frank Villaume, the president of Villaume Box & Lumber Company, who lived near Wilford Rumble, a senior partner in the Doherty, Rumble & Butler law firm.

When NAC needed a subcontractor to build wooden wings, tail sections, and honeycomb flooring for CG-4As, the Villaume Company got the work. Similarly, when NAC needed a general counsel to handle its legal matters, it hired Harold L. Rutchick, a St. Paul attorney. Rutchick was the secretary of the Villaume Box & Lumber Company, had his office in the First National Bank, was well connected to the local Democratic Party, and lived in the Highland Park neighborhood, not far from where the Rumbles lived.[23]

John Parker's account of the way events unfolded in early 1942 that led to the creation of Northwestern Aeronautical Corporation has a step-by-step logic and his narrative seems understandable, given the times. Nevertheless in recalling these watershed moments, Parker completely omits his attempt to rejoin the navy in the years leading up to the attack at Pearl Harbor. This is an element in his backstory that says much about Parker as a person.

Nowhere in his lengthy interview in the mid-1980s or elsewhere in his published biographies does John Parker report that in May 1938 he applied to the U.S. Navy for a commission in the Naval Reserve with the rank of lieutenant commander, requesting that he be assigned to Naval Intelligence. Based on the documents in Parker's naval personnel file, he sent in his application for a commission shortly after Grayson Murphy died. He may have been uncertain what his future would be following the liquidation of the Murphy firm. Yet only

a few months later in July, Parker joined the investment bank of Auchincloss, Parker, and Redpath in Washington, D.C.

When Parker applied for a commission, he was married, 37 years old, had two young children, and had been away from military service for almost thirteen years. Events taking place in Europe may also have influenced his actions. In early March 1938, Hitler annexed Austria and in September, he took control of Czechoslovakia following the signing of the Munich Pact with Great Britain and France. Like many who had lived through World War I, Parker may have feared that war with Germany was coming soon and he wanted to get back into uniform before the storm of war broke out. It is unlikely that he was concerned about a peacetime draft, which Congress did eventually authorize, but that legislation did not become law until September 1940 and initially, it applied only to men between the ages of 21 and 35.

Following his initial application to join the naval reserve, John Parker passed a physical in May 1939. His paperwork went up through channels in the navy's Bureau of Navigation which, at the time, handled personnel matters, with the recommendation that he be given an appointment in the reserves. On September 6, 1939, Parker was appointed to the Naval Reserve with the rank of lieutenant commander. The officer who signed off on Parker's appointment was Rear Admiral Chester W. Nimitz, who was then the bureau chief. Assignment to

intelligence duties was also approved at this time, but no orders to a specific duty station are in the file. At this point, the paper trail ends.

Then on June 27, 1941, John Parker wrote a letter to the navy commander at the Washington Navy Yard in which he requested deferment of active naval duty "for the time being" because of the "special business in which I am currently engaged connected with National Defense … necessitates this request." Parker's request went up the chain of command, but in July the Bureau of Navigation decided that Parker is "considered available for active duty at any time" and he was ordered to duty as a Naval Observer at Pará, Brazil.

Pará is a state in northeastern Brazil where the Amazon River flows into the Atlantic Ocean. In the late 1930s, the chief exports from this area were agricultural products and rubber. Following the German invasion of Poland in September 1939, Brazil declared its neutrality in the European war, but the United States subsequently negotiated the rights to use air bases in northeastern Brazil as stopover points in its air traffic between the Americas and North Africa and the Mediterranean. Beginning in 1942, Brazilian ports also became important bases for the U.S. Navy in its antisubmarine warfare against Nazi U-boats.

Before John Parker could report for active duty, however, he received orders to have another physical. The examination on July 29, 1941, did not go well and the doctors found that Parker had serious back problems and was

overweight. They reported that he was not physically qualified for active duty. So in September, the navy gave Parker an honorable discharge from the naval reserves and cancelled his orders to active duty in the Intelligence Branch.[24]

Although Parker's personnel file establishes what happened and when these events took place, his paperwork offers no insight into why this abrupt change in direction happened when it did. What was the "special business" in which he was engaged? Was it his work with the airlines? Being assigned to a naval outpost in Brazil may not have been as appealing as the desk job in Washington he had hoped for. But in any event, his work with aviation firms through Auchincloss, Parker, and Redpath was by that time financially more rewarding than the pay of a mid-level naval officer. And his association with a variety of civilian airlines was professionally more challenging than what he might have done for the navy. Whatever the reason, just six months later, Parker had an opportunity to lead a company that was committed to building gliders for the air force. At Northwestern Aeronautical Corporation he could serve his country during wartime and make a mark for himself. In short, John Parker was in the right place at the right time in February 1942.

The day after NAC was incorporated in Minnesota, the Army Air Forces Materiel Command at Wright Field in Ohio issued a letter of intent for NAC to build 30 CG-4A, 15-place gliders. NAC agreed to the terms of the contract on

March 4, 1942, and three days later the Materiel Command gave its approval. Final, formal approval of the contract followed on April 27.

Based on the terms of this first agreement, the estimated construction cost for 30 gliders was $512,100 plus 15% for spare parts which was estimated to be an additional $76,815. The contract included a fixed fee of 5% of construction costs, which was $29,445.75 for NAC, plus a licensing fee of $8,625 to be paid to Waco Aircraft Company for use of the Waco plans. Adding in all the costs that NAC had already incurred prior to signing the contract, the estimated grand total for their first contract came to $636,986.75.[25] A fixed fee contract allowed the airplane manufacturer to be reimbursed for the approved expenses it incurred, but the fee or "profit" was limited to an amount that was rigidly fixed at the time the contract was signed. If the civilian manufacturer's costs subsequently ran higher than it had estimated, or if some of those expenses were not approved, then this "profit" might be considerably reduced or even eliminated unless the air force agreed to cover some or all of the cost overruns.

In dealing with air force officials at Wright Field, John Parker showed he could be a skilled negotiator. On the other hand, the speed with which he was able to persuade the procurement officers at Wright Field to give NAC, a company that barely existed, a contract for 30 gliders also indicated just how desperate the Materiel Command was in early 1942 to find any aviation-related company that would risk taking on such a project—to build a new aircraft that

had never been used before, but one that the air force brass in Washington had decided was an absolute necessity in America's prosecution of the air war.

What had compelled the U.S. military to build a glider program in the first place lay in the history of how the air forces of Germany, Great Britain, and the Soviet Union employed them in combat. And the circumstances leading to the decision in early 1942 that the United States had to add gliders to its air arsenal was based a great deal on the early success of Americans' primary enemy in the next several years to come.

Chapter Two

What Is a Combat Glider?

When German troops used high-winged combat gliders (the DFS 230) on May 10, 1940, to capture the bridges across the Albert Canal and successfully attack the supposedly impregnable Belgian fortress of Eban Emael, Allied war planners took notice. A handful of proponents had discussed the glider's value as a weapon for aerial assault in the United States and Europe during the 1930s, but those ideas had never been tested in actual combat. Then at Eban Emael, the Germans demonstrated that their military not only had a glider force, but that they could also use this weapon successfully.

As far back as 1783, Benjamin Franklin proposed using combat gliders when he suggested that, given the right wind conditions, 5,000 balloons carrying 10,000 soldiers could launch a successful attack. Another seventy years would pass before George Cayley, an Englishman, was credited with inventing the first glider capable of carrying a human in 1853. But the Soviets were the first to actually design a transport glider, the Gribovski G-63 (later designated G-11), in 1932 that would carry a pilot and ten troopers.[26]

At the end of World War I, the Versailles Treaty imposed restrictions on Germany's heavier-than-air plane production. So Germany's military leaders encouraged the development of "sport" flying with gliders in the 1920s and '30s. During the early 1920s, Captain Eddie Rickenbacker (1890–1973), America's famous

World War I ace, had travelled to Europe and while in Berlin, he met with four German pilots, also renowned for their World War I air feats.

Rickenbacker had earned his fame when he commanded the 94th Aero Pursuit Squadron in France, taking credit for 26 kills, and was later awarded the Medal of Honor. In the years between the world wars, he went on to great business success in the auto industry and with Eastern Airlines. In his autobiography, Rickenbacker recounts his meeting with the German pilots, one of whom was Hermann Goering, the man who would later command Hitler's Luftwaffe in World War II. According to Rickenbacker, Goering told him:

> Our whole future is in the air. And it is by air power that we are going to recapture the German empire. To accomplish this we will do three things. First, we will teach gliding *as a sport* to all our young men. Then we will build up commercial aviation. Finally, we will create the skeleton of a military force. When the time comes, we will put all three together—and the German empire will be reborn.[27]

Just as Goering had boasted, the Germans did achieve considerable glider experience during the interwar years, and they developed a cadre of trained pilots whose expertise contributed to the success of the Germans' surprise landing of troops on the top of the Belgian border strongpoint.

Flying the silent gliders, the pilots were able to quietly land on the flat, grassy top of the fortress at Eban Emael. Approximately 85 soldiers then made deft use of explosive charges and flamethrowers to disable the fort's gun turrets and observation cupolas, taking the defenders by complete surprise. Within a matter of hours, Eban Emael was in German hands.

The Germans also employed gliders on the island of Crete in 1941 as they expanded their operations in the Mediterranean. This was just one step of their plan to wrest the Suez Canal from the Allies, and on May 20, the Germans attacked the British forces defending Crete. In this operation, they employed eighty gliders carrying ten soldiers each as part of their massive airborne assault on three airfields on the island. The glider units landed successfully, but the accompanying paratroopers took heavy losses. The Germans quickly brought in additional troops and soon outnumbered the British defenders who yielded ground grudgingly. Unable to supply Crete with adequate reinforcements, the British subsequently decided to evacuate the island. Hitler achieved a victory on Crete also, but the high cost of men and material led him to abandon the use of gliders in future airborne operations.[28]

Allied military leaders took note of what the Germans had accomplished in Belgium and Crete and decided to develop a glider program to increase their own airborne assault capabilities. The British began their glider construction program in June 1940. The goal of their program was to build aircraft large enough to transport troops and heavy equipment to complement Britain's airborne forces. The most frequently used glider that came out of this initiative was the Airspeed Horsa AS 51, which went into production in early 1942. Designed to be built in 30 subassemblies, the subcontracted manufacturers transported their finished goods via truck to RAF

maintenance facilities for final assembly. By the end of the war, the British had produced more than 3,800 Horsa gliders.

Comparing the two, the Horsa was larger than its U.S. counterpart, the Waco CG-4A. It had a wingspan of 88 feet and a length of 67 feet and weighed 15,250 pounds where the CG-4A only had a wingspan of 83.7 feet, length of 48.4 feet, and weighed 3,750 pounds when empty. The CG-4A could carry a cargo load equal to its own weight, so ideally, the towing C-47 could get 7,500 pounds into the air, but even under the right circumstances with an overloaded CG-4A, the C-47 could lift up to 9,000 pounds in tow.

The Horsa's design was based on a high-wing cantilever monoplane with wooden wings, a wooden fuselage, and fixed, tricycle landing gear. The fuselage, which was comprised of three sections, was later bolted together after being transported to the assembly point. Similar to the CG-4A, the Horsa was manned by a pilot and copilot, but the Horsa could carry up to 25 infantrymen whereas the CG-4A could only carry 13. Another big difference between the two was that the wings of the Horsa had large flaps, which allowed for a steep, high rate-of-descent landing, rather than the long, relatively slow landing glide of the CG-4A. This, however, also created a drawback for the Horsa, which was far less likely in the CG-4A: a poor landing in an all-wood Horsa could result in a shower of deadly splinters.[29]

In the United States, both the army and the navy had also experimented with gliders during the interwar years. The army, for example, briefly tested a single-seat

glider (the GL-2) in 1922, which was towed by an automobile. By the 1930s, Army pilots were becoming interested in gliding with sailplanes but when one pilot was killed in a sailplane, the Air Corps issued an order prohibiting its pilots from flying either sailplanes or gliders without permission from the War Department.

While those in the military could see the potential of the glider in wartime, others saw it differently. In his 1931 letter to a member of the House of Representatives, Secretary of War Patrick Hurley stated, "It is considered that the military value of glider flying is negligible, and that the expenditure of time and funds required to teach the art is not warranted." Given that this letter was written during the Great Depression when appropriations for both military services were being reduced, the secretary's evaluation of the cost effectiveness of a glider program was consistent with holding the status quo.

In the navy's experimentation with gliders, a rigid dirigible was produced in 1930 that made an air-to-ground flight. Then in April 1941, the navy developed the *Glomb*, a glider bomb, which was a glider filled with explosives designed to be towed by an airplane and released in the vicinity of a target. Pilotless, the *Glomb* was guided by radio control which employed a television camera to transmit a view of the target to the control plane. Due to technical issues, the navy never took the *Glomb* beyond experimentation, but in retrospect, it was a harbinger of today's "smart" bomb. And on January 30, 1942, Secretary of Navy Frank Knox authorized the Marine Corps to institute a small glider program that consisted of two battalions of about 900 men each,

but the program was cancelled on May 18, 1943. By that time, the Marines had decided to concentrate on training their personnel for amphibious assaults in the Pacific war. The army, however, continued to pursue a glider program.

On February 25, 1941, General Henry H. (Hap) Arnold, chief of the Army Air Forces, directed the AAF to study the "possible use of combat gliders." Less than two months later, he asked that the air arm develop specifications for "proposed military glider characteristics and tow planes." This analysis focused on two-, eight-, and fifteen-place gliders.[30] When the United States entered the war in December 1941, the military still had no established glider program, but attitudes began to change from those of the 1930s. Senior air force leaders were now authorizing the procurement of glider aircraft, even before any design studies had been completed or engineering requirements spelled out.

Initially, the officer charged with moving the glider program ahead was Major Lewin B. Barringer, who was well suited for the role. Barringer was an army reserve officer who had piloted both powered airplanes and gliders and at one time, he had held the world's altitude record of 14,000 feet in a sailplane. In 1933–34, he, too, visited Germany and inspected their gliding and soaring schools. Called to active duty just before the U.S. entered the war, he was assigned to coordinate the Army Air Forces (AAF) glider program in October 1941. One air force official is quoted in early 1942 as saying that Barringer "swings a pretty big stick merely by virtue of being General

Arnold's man."[31] As qualified as Lewin was, his impact on the glider program was brief because he died in a plane crash in the Caribbean in January 24, 1943.[32]

Throughout the 1930s, civilian enthusiasm for gliding and sailplaning grew steadily in the United States, but still, the number of people engaged in this sport was not significant. When the air force had to name someone to replace Major Barringer, another civilian glider proponent, Richard C. DuPont was assigned the role. Like Barringer, he was a pilot who had also developed an interest in gliders and sailplanes. And similar to Barringer's fate, DuPont was later killed in a crash on September 11, 1943, while testing the XCG-16 (here the "X" stands for "experimental") glider in California. His brother, Major A. Felix DuPont, who was a graduate of the Army Air Corps Flying School, was named to succeed him.[33]

Once air force leaders in Washington decided to actually initiate a glider program, the day-to-day responsibility for developing glider aircraft shifted to the Aircraft Laboratory of the AAF Materiel Division at Wright Field in Dayton, Ohio. Initially, the Aircraft Laboratory had dual responsibilities relating to gliders: development of glider engineering specifications and the procurement of these aircraft. The officer in charge was Major (later Colonel) Frederick R. Dent Jr. Under Dent's leadership, the glider program grew so rapidly that by mid-1943, the air force had to separate the responsibilities for glider research, development, and testing from glider procurement.[34]

Born in Mercer, Pennsylvania, in 1908, Frederick R. Dent attended schools in Pittsburgh, and following high school, he entered the U.S. Military Academy at West Point. Commissioned a second lieutenant, he graduated from West Point in 1929, and moved on to flight training school in Texas where he earned his wings. Dent joined the Air Corps in 1930, but his formal education did not end there. Following a series of assignments in Texas and Hawaii, he entered the Air Corps Engineer School at Wright Field in Ohio in 1935. And in 1936, he enrolled at Massachusetts Institute of Technology to study aeronautical engineering, graduating from there in 1938 with a master's degree. He then returned to Wright Field to become a test pilot. For the next five years, Dent would serve as the chief of the Dynamics and Glider operations within the Experimental Engineering Division at Wright. He took charge of glider development for the AAF in February 1941 and issued his first contracts for U.S. glider production in May 1941. A year later, he became the first AAF pilot to test the new American military glider.

By 1943, Dent had been promoted to colonel, and in June of that year, he was sent to England where he eventually assumed command of the 44th Bomb Group, which participated in the invasion of Sicily in July 1943. Although Dent had no direct role in the glider operation, this invasion was the Allies' combat test of their new aircraft. From April until August 1944, he commanded the 95th Bomb Wing as part of the Eighth Air Force and subsequently held a series of senior-level assignments after the

war. Dent retired with the rank of major general in 1957 and died on September 1, 1969.[35]

In Colonel Dent, the Army Air Forces had an experienced senior officer in charge of glider development at Wright Field, a leader who was technically well qualified for his duties, and someone who could work well with civilians such as John Parker. Parker, for his part, may not have been wearing a military uniform in February 1942 when he met with Dent about Porterfield Aviation, but Parker had gone to Annapolis, was a trained pilot, and was well connected within the civilian aviation community. Based on the few surviving records, Dent and Parker worked together effectively.

Although the U.S. Army began its aviation program less than a decade after the Wright Brothers achieved powered flight in 1903 at Kitty Hawk, North Carolina, its air arm was not named the Army Air Corps until 1926. To provide more autonomy that would allow for expansion, the name was changed in 1941 to Army Air Forces (USAAF or AAF), and assigned to head up the newly created division was General Henry "Hap" Arnold. Although the AAF had become an independent air force by the end of World War II, that reality would not be recognized by law until 1947 when the Congress established the U.S. Department of Defense and made the air force an equal with the army and the navy. Thus, the AAF operated as a subordinate agency of the War Department throughout World War II.

Manufacturing combat gliders in the United States during the war required a partnership between the AAF and civilian manufacturers, and building aircraft for the military became a thriving business. As far back as 1926, the Materiel Division of the Air Corps had been responsible for the logistics functions of supply, maintenance, support equipment, and industrial planning as it related to army aviation. Although Henry Ford had introduced assembly-line production to the automobile industry long before 1920, assembly lines were not being utilized in U.S. military aircraft production. And before World War II, military aircraft requirements were so low that handwork-type industries could still meet the army's contract requirements. Much of the army's aircraft procurement was concentrated in the vicinity of Dayton, Ohio, the home of the Wright Brothers, and handled by what in early 1942 was renamed the Materiel Command.

When it came to buying aircraft before the war, the Materiel Division would issue its specifications for a desired airplane via a circular and the aviation-manufacturing companies submitted their sealed bids. The intended goals of this process were to generate impartial competition among many small companies and to keep the costs down. The resulting acquisition process was slow and deliberate, a process that would not suffice as World War II was imminent.

When President Franklin Roosevelt boldly declared in May 1940 that the United States would soon be able to build 50,000 aircraft per year, he caught the Air Corps by surprise. Although no one in 1940 could have predicted how many planes would

actually be built over the next five years, the transition to wartime production proved significant. By the end of World War II, the nation had produced more than 300,000 aircraft. Industrial mobilization for total war, of which glider production was just a small part, made all the difference.

Industrial mobilization required experienced leadership to meet the high, military demands, and in January 1942, the War Production Board (WPB) was established. Assigned to lead this board was a civilian, Donald N. Nelson, who had formerly been a senior executive with Sears, Roebuck. The role of the WPB was to establish priorities among the many needs of a wartime economy. Roosevelt also named William S. Knudsen, formerly the president of General Motors, the director of production in the War Department and assigned him the rank of lieutenant general. Thus, Knudsen had an indirect role in the procurement of all types of aviation and in January 1944, he made a one-day inspection tour of aviation manufacturing plants in the Twin Cities that included a visit to NAC's glider assembly operations at Wold-Chamberlain Field.[36]

In March 1942, the AAF Materiel Center at Wright Field in Ohio was expected to handle, among many duties, the procurement of combat gliders. This was not a routine assignment. To begin with, the Materiel Center had few experienced contracting and engineering officers. The personnel on staff at the time were accustomed to buying aircraft using the policies and procedures of the interwar years. Significant changes

were also needed to increase efficiencies to meet the military's increased and timely demands. The first challenge, of course, was to find qualified contract officers. Those in charge at Wright Field had to compete with private industry in hiring and retaining experienced civil service personnel who could handle the hundreds of details involved in each contract. After all, Colonel Dent and his staff at Wright Field had no prior history in procuring gliders.

The first gliders the Materiel Center purchased were training gliders. On September 29, 1941, the Frankfort Sailplane Company of Joliet, Illinois, delivered the first of three experimental, two-place gliders, which were designated XTG-1, to Wright Field. Slowly, other companies such as Schweizer Aircraft of Elmira, New York; Laister-Kauffmann Aircraft of St. Louis, Missouri; Bowlus Sailplanes of San Fernando, California; Wichita Engineering Company of Wichita Falls, Texas; and Briegleb Sailplane of Beverly Hills, California, all delivered different training models for Colonel Dent and his staff to study. Colonel Dent and his team had a great deal of work ahead of them before they could actually begin the development and procurement of tactical models for combat use.[37]

In the spring of 1941, the Materiel Division recognized that in order to save time in the procurement process, it would have to develop tactical gliders before its engineering staff had completed any design studies. The Division needed to find companies that could provide originality, design skill, and efficiency in producing

aircraft. To that end, the contracting officers at Wright Field sent preliminary engineering requirements for gliders to eleven companies experienced in building either sailplanes or small aircraft. Only four aviation companies responded positively: Frankfort Sailplane, Waco Aircraft Company, Bowlus Sailplane, and the St. Louis Aircraft Corporation. Although Frankfort, Bowlus, and St. Louis Aircraft all attempted to build tactical gliders that could pass the various tests performed by Materiel Division personnel, these aircraft "showed little promise" in meeting the need for an acceptable fifteen-place glider. Only Waco's model, the XCG-4, was "declared satisfactory," and it was accepted in June 1942. The shortcomings of the other, potential glider manufacturers illustrates just how difficult it was for officials at Wright field to judge the soundness, capacity, and skill of these small aviation companies to produce gliders. Moreover, because these firms were eager to secure a government contracts, they could easily overestimate their abilities to deliver satisfactory aircraft within the time constraints of the contract terms.[38]

Waco Aircraft Company, initially called the Weaver Aircraft Company, was located in Troy, Ohio. Before the war, Waco manufactured small, commercial aircraft, building radial-engine sport biplanes and four-place cabin cruisers. But in June 1941, the company received a contract to build an eight-place (XCG-3) and a fifteen-place glider (XCG-4). Although both models, later known as the CG-3A and CG-4A, were accepted and built, the CG-4A proved more suitable to the AAF. Similar to the CG-3A,

the CG-4A was larger, and it was designed, at the suggestion of General Arnold, to carry a light jeep. Waco engineers are credited with having designed the nose of the aircraft, where the pilot and copilot were seated, to swing upward on a pulley, allowing a jeep to be loaded into and driven out of the glider's interior cargo area.

Although the AAF's historical report on gliders provides the basic details of Waco's role in designing and building the CG-4A glider, a more informative, insider account of how Waco designed the CG-4A appeared in the Sunday edition of the *Dayton Journal-Herald* in August 1942. This feature story was written by Alexander McSurely, the newspaper's aviation writer. According to McSurely, Dr. A. Francis Arcier, Waco's "brilliant" chief engineer designed the CG-4A and employed a "regiment" of engineers and draftsmen who worked long hours of overtime to prepare the production drawings and complete the stress analysis needed for what was described as an "emergency program."

Although a small company, the Materiel Division selected Waco for the glider project because of the firm's "years of experience with wood, plastic, and plywood construction." In addition, Waco had Dr. Arcier, who had joined the company in 1930. He is credited with designing more than fifty different types of aircraft over his career, and was considered "an expert in plywoods and wood construction whose experience with it dates back to years with Tony Fokker, and before that to airplane design with Handley Page in England during the First World War."[39]

AAF historian Mary Barnes reported in 1945 that because Colonel Dent had spent six months in Europe studying German glider parts captured in the landings in Crete, he was able to pass what he had learned to Dr. Arcier at Waco. She further states that Arcier and his engineers completed the plans for the Waco glider in ninety days. Thanks to Arcier's talents and leadership, Waco engineers then "designed and produced a glider that was ready to fly and delivered [it] to Wright Field, January 31, 1942." That was nine months after Waco received their contract for the glider. It was also less than a month before John Parker and NAC received their first contract for thirty CG-4A gliders.[40]

Because the Waco gliders "showed excellent performance," the company was "named as lead plant for the national glider program and ordered to furnish its designs to 14 other firms who would also work in the [glider] program." To produce all the production drawings and stress analyses for the various parts and subassemblies of the CG-4A, additional help was needed. So the AAF's representative to Waco Company recruited a team of twenty-three men and women from engineering schools from across the United States to come to Troy. They provided invaluable assistance, complementing Waco's small engineering team in the crash program to produce all the drawings and analyses for the CG-4A in less than thirty days.

Among the many production problems that U.S. War Department planners faced in early 1942 was the question of how to build sufficient numbers of gliders without

affecting the production capabilities of the country's established aircraft manufacturers. Proving to the Materiel Division in 1942 that the CG-4A was reliable and durable was just the first step. Waco also had to produce a design that relatively inexperienced aircraft manufacturers could mass produce at multiple locations around the country.

Compared to today's aircraft, the simplistic design and basic resources used in building the CG-4A was amazing. The entire glider was constructed on a steel, welded frame. Its rectangular wings, which were strut-braced from the fuselage, were made entirely of wood and plywood, including the main spar, rear spar, and ribs. The floor of the fuselage consisted of a honeycombed, plywood insert that, based on its design, provided a great deal of strength but added only minimal weight. Serving as the cargo compartment, the floor was bolted to side truss members to form the frame of the fuselage.

Once completed, the entire glider was then covered in fabric which was ironed and doped to keep it taut for final painting with camouflage colors and the standard aircraft insignia. There were entrance doors on both sides of the fuselage at the rear of the cargo compartment as well as two triangular emergency doors at the forward end of the compartment. All the doors could be jettisoned in an emergency. To maneuver the aircraft in flight and landing, it was equipped with an elevator and rudder, conventional landing gear, brakes, and a small tail wheel that swiveled.

Just over 48 feet long and standing more than 12 feet from the ground, the

CG-4A had dual wheel controls for a pilot and co-pilot, and a rounded, Plexiglas-enclosed nose that surrounded the cockpit. The pilots' instrument panel was very simple compared to that of a powered aircraft. Only light switches, an airspeed indicator, a rate-of-climb indicator, a bank-and-turn indicator, an altimeter, and a compass were included. The cockpit itself was equipped, again, with only the most basic controls for the brakes, rudder, trim tabs, spoiler, nose release, and the towline release. Other equipment included a twelve-volt battery that powered the glider's few electrical lights, and a phone line that was connected to the tow plane, either connected to or woven into the tow line. Later on in the war, radios would replace the telephone.

The power to get the CG-4A airborne came from a conventional aircraft, typically the C-47, which was the military version of the Douglas DC-3 passenger airplane. A 350-foot, 11/16-inch nylon towline connected the C-47 to the glider. In situations where C-47 towed two gliders, a 425-foot nylon rope was attached to the glider on the right so that the two would lift off at different distances astern of the tow plane.

In the air, the CG-4A reacted to aerodynamic forces in the same way that a powered aircraft did. The biggest difference, of course, was that once the glider was released from the tow plane, there was no engine power to adjust the aircraft's descent to the earth. While in tow, the CG-4A had a safe air speed of about 150 miles per hour. Once it was released from the tow and began its glide to the ground, the air speed dropped to between 60 and 72 miles per hour. The slower speed gave the pilot some

control of the aircraft in landing, which some pilots considered akin to a controlled crash, and was an asset when landing in a confined area. But it also meant the glider was completely vulnerable to antiaircraft fire. Without any aircraft armaments, the glider riders were separated from the enemy only by doped fabric and their personal weapons. Some soldiers who flew in them called their aircraft "flying coffins" or "tow targets." Unlike paratroopers, these soldiers had no parachutes. Flying into combat in a glider was not for the faint of heart.[41]

The AAF recognized that Waco would not be able to build all the gliders it needed. For its part in the contracting process, procurement officers at Wright Field had been "instructed to place glider orders with companies not already engaged in the manufacture of metal or combat planes."[42] So they had to find a way to overcome the inexperience and limited capacity of the smaller manufacturers. Consequently it sought out firms, such as Ford Motor Company, Iron Mountain, Michigan; the Gibson Electric Refrigerator Company in Greenville, Michigan; Pratt-Reed & Company, Deep River, Connecticut; and the Kilgen Organ Company, St. Louis, Missouri that were not already in the powered aircraft business, but they had the capacity for building gliders. They were ideal candidates to build the CG-4A. By July 1942, a total of sixteen companies received contracts to build gliders. The contracts stipulated, however, that the firms could not hire workers away from existing aircraft factories and that the least critical materials, such as wood and cloth, be used for production. One of the sixteen

companies that received a glider production contract as part of the procurement process at Wright Field was, of course, Northwestern Aeronautical Corporation in St. Paul.[43]

The restrictions imposed by the glider contracts issued by Materiel Division were necessary to avoid competition between glider manufacturers and powered aircraft manufacturers. Building capacity and resources were limited, and powered aircraft had to be the top priority to fight a global war. Although the procurement officers at Wright Field may have preferred to deal entirely with well-known, established companies, such as Waco or the Ford Motor Company, that was not an option. They had to look to the lesser known companies such as NAC or Gibson as well to get the glider program off the ground.

At the time, a small business was generally understood to be a company with 500 or fewer employees. In early 1942, NAC was definitely a small business. Prior to the war, small businesses in the United States generally avoided government contracts because of all the paperwork and administrative overhead associated with them. Faced with the possibility of going out of business because priority ratings from the WPB substantially reduced or eliminated the availability of certain raw materials, small businesses such as Gibson Refrigerator took a different view. Now they would gladly take a government contract along with its rules, regulations, and paperwork.[44] Looking back at the glider program in 1946, AAF historians acknowledged that of the sixteen companies that actually manufactured combat gliders during the war, only four (Waco,

Ford, Cessna, and Timm) had some degree of prior aeronautical experience. In short, they declared these companies were "an unimposing industrial group."[45]

These same AAF historians succinctly articulated the dilemma involved in setting up the glider procurement program:

> The development of tactical gliders was one of the most difficult tasks undertaken by the Materiel Command. Working with few precedents as a guide, and handicapped by provisions excluding the larger aircraft companies from participation in the program, engineers of the Aircraft Laboratory were nonetheless asked to develop acceptable gliders in the shortest possible time. The pressure under which the Glider Branch worked is evidenced by the fact that the urgent requirements for gliders prompted the award of 11 production contracts for the CG-4A before the first flight-test XCG-4A was delivered to Wright Field. In addition to these factors, the problems of the Materiel Command were aggravated by changing requirements, …, and by the activities of AAF organizations other than the materiel establishment.[46]

Developing the requirements for tactical gliders was a monumental task for not only the officers of the glider program at Wright Field, but also the contractors who took on the contracts to build the gliders. How would a start-up company such as Northwestern Aeronautical Corporation meet not only the logistical challenges of setting up production of an unknown entity, but also meet the high demands of the military for volume production? It was up to John Parker to pull it all together.

Chapter Three

Northwestern Aeronautical Builds Its First Glider

In February 1942, Colonel Fred Dent at Wright Field gave John Parker a letter contract to build thirty CG-4A gliders. At the time, John Parker might have taken some satisfaction in obtaining this contract, but he may have also felt some uneasiness over how the newly organized Northwestern Aeronautical Corporation would fulfill the agreement. A lot of start-up work had to be accomplished in a very short amount of time if NAC was going to succeed with the AAF assignment.

Although John Parker had a major role in organizing NAC, he was not, initially, the man in charge of day-to-day operations. That role was taken on by Harry A. Shaffer. And how all the contract details were negotiated is not known, but Parker confirmed in the mid-1980s interview that Northwest Airlines agreed to help NAC by allowing its staff at Wold-Chamberlain Field to assist the newly formed glider manufacturer. Parker also does not mention Harry A. Shaffer in the interview; yet the few surviving records identify Shaffer as NAC's first president and general manager.[47] And for the time being, Parker would serve as chairman of the board for NAC.

Born in New Hampton, Iowa, and educated at the University of Chicago (class of 1923), Shaffer (1901–1961) learned to fly and worked for the General Motors Acceptance Corporation for about eight years before he organized the Interstate Credit Corporation in 1934. The company specialized in providing loans to pilots and others involved in

civil aviation. The following year he established American Aircraft Underwriters, an aircraft insurance company that sold policies to light-plane owners. According to his obituary, in 1938 Shaffer settled in Bloomington, Minnesota, a suburb of Minneapolis located next door to Wold-Chamberlain Airport, and by 1940, he was conducting his business from one of the hangars owned by Shorty De Ponti. His wife, Vida, was also a pilot and one of the charter members (1937) of the Minnesota branch of the Ninety-Nines. A national organization, the Ninety-Nines took its name from the number of women who took part in the first meeting (1929) of licensed women pilots in the United States.

Prior to direct U.S. involvement in World War II, Shaffer became the coordinator for civilian aircraft production for the Office of Production Management, later renamed the War Production Board. That agency's primary responsibility was to centralize federal military procurement programs and quasi-war production. At OPM, he served as a liaison between the government and the light-aircraft manufacturers around the country. Based on the few newspaper reports in which his name is mentioned, Shaffer took a leave of absence from OPM in early 1942 to join Northwestern Aeronautical Corporation.

Harry Shaffer was an ideal candidate to run NAC. He was a pilot who was familiar with aircraft financing and had worked briefly for a federal agency, and he also had the local business connections that would contribute to building NAC. According

to aviation historians Noel Allard and Gerald Sandvick, Harry Shaffer and his business partner, Harvey Cook, were "regular faces in the airport gang" at Wold-Chamberlain.[48] Based on information found in *Tow Lines,* NAC's employee newsletter, John Parker was initially the chairman of the board of directors of NAC, but this source doesn't identify the other board members. Thus the full extent of Shaffer's authority within NAC is not clear. With his local business activities, Harry Shaffer could easily connect with other business leaders such as Angelo "Shorty" De Ponti of De Ponti Aviation and members of the Villaume family whose organizations would become key contributors in completing the AAF glider contracts.

In terms of initial financial resources, those for NAC were quite meager. According to AAF historian Mary Barnes' history, NAC was organized with capital of $1,000 cash and the $9,000 worth of equipment formerly owned by the Porterfield Aviation Company. The cash was provided by John Parker and an unknown partner whom he later bought out. Certainly the fledging glider manufacturer would need a lot more working capital with which to hire personnel, order materials, and establish contracts with the subcontractors.

While all the details have not been confirmed, there are a number of possibilities of how that capital was raised. Shaffer might have applied to any number of local banks, such as Richard Lilly's First National Bank of St. Paul, for loans that would be backed by the government contracts. And considering John Parker's role in Northwest

Airlines and his acquaintance with Lilly, Parker also had avenues, either through Dick Lilly or the Auchincloss firm, of which he was still a partner.

Regardless of how the funds were raised, it was Harry Shaffer's job to manage the manufacturing operations during those challenging days, and John Parker served as its executive leadership. Referring again to the 1985 interview, Parker stated: "I solely owned Northwestern Aeronautical. I used to have a partner, but I bought them out during the war. And I was the sole owner."[49]

Considering his numerous business interests, Parker travelled a great deal, and when asked if he spent the war in St. Paul he responded that, "Well, I kept my home here in Washington, but yes, my wife and I we lived at the Commodore Hotel [in St. Paul]. We were there on and off for about 8 years, as a matter of fact."[50] Being on the scene when necessary was crucial to NAC's success, but Parker also continued with his other business interests.

In the effort to expand Northwest Airlines' commercial routes, Parker, made a trip to Alaska in late March or early April of 1942. Prior to 1942, no U.S. continental airline had yet identified the best air route to Alaska via the Canadian "back door." There were no radio communication facilities, no landing fields, no hangars, and no quarters for air crews or support personnel along the likely route.

The AAF asked Northwest Airlines to develop an air supply route to Alaska because Northwest was already experienced in flying in the cold weather found along

its existing routes from the Twin Cities to Spokane, Seattle, and Winnipeg. And on February 27, a Northwest survey party departed the Twin Cities in a Douglas DC-3 for Fargo, North Dakota. From there they flew across Canada, made an intermediate stop in Edmonton, Alberta, and then proceeded to Anchorage and Fairbanks, Alaska. The airline's first northbound cargo flight followed soon afterward on March 15, and within two weeks, supplies were being flown to Alaska on a regular basis. AAF's reasons for establishing an air cargo route to Alaska via Canada were soon validated. On June 3, 1942, Japanese planes attacked Dutch Harbor, and Japanese troops landed on the remote islands of Kiska, Attu, and Agattu in the Aleutians.[51]

Why John Parker went to Alaska in early 1942 is not entirely clear. But as a member of the Northwest board, and as a representative of his own investment company, he was able to see firsthand how the newly established route could serve the airline. Based on a certificate found in his personal archives entitled "Totem Igloo Mystic and Auroral Order of Alaska Checeechakos" of Nome, Alaska, John Elbridge Parker visited Alaska, on April 9, 1942.[52]

While Parker was preoccupied with other business responsibilities as exemplified by this trip to Alaska, Harry Shaffer was handling day-to-day operations at NAC, including all the start-up arrangements with the AAF's Materiel Command. Here is Barnes' summary of the terms of the first NAC glider contract:

> A letter of intent for 30 CG-4A 15-place gliders was issued on 28 February 1942. Upon acceptance by NAC on 4 March 1942, and approval by Wright Field on 7 March

> 1942, it became a letter contract. The formal contract, superseding the letter contract, was signed on 31 March and approved by the AAF on 27 April. The instrument provided for the production of thirty gliders, constructed according to Waco specifications. Estimated cost was $512,100.00, plus 15% for spare parts at an estimated cost of $76,815.00. The contractor was allowed a fixed fee of 5% of construction costs, amounting to $29,455.75. NAC was also allowed an amount to be paid to Waco under agreement estimated to be $8,625.00, making a total contract value of $636,986.75. In addition all costs incurred by the contractor in anticipation of the contract award, and prior to the signing of the formal contract were to be allowed. The contractor was also to obtain certain engineering services and license rights from Waco.[53]

Developing a consistent manufacturing process involving numerous subcontractors would prove to be a challenge. Waco, of course, would provide the subcontractors with the glider design and specifications through their license agreements with the subcontractors. But the rest of the work of actually building the gliders was up to the subcontractors to manage. Originally, the AAF had planned to have a Detroit company, Bromley Engineering, provide the jigs and dies to all the subcontractors, based on the Waco plans, in an effort to generate consistency and easy exchange if necessary.

But that plan was not carried out. The AAF Materiel Center was so pressed to get gliders built as fast as possible, it abandoned the idea of having a single source for jigs and dies and directed the glider contractors to fabricate their own. As soon as CG-4A deliveries were reaching their AAF destinations, glider units in the field quickly found that the same parts from different contractors were not always interchangeable. In hindsight, the AAF report on the glider program called the "[f]ailure of the government tooling program one of the most severely criticized aspects of the glider program."[54]

NAC's first glider contract allowed for a fixed fee of 5% of the construction costs. Congress had authorized use of cost-plus-fixed-fee (CPFF) contracts by the U.S. military in 1940 in an effort to avoid the serious abuses resulting from the cost-plus-a-percentage-of-cost contracts issued during World War I. With CPFF contracts, the airplane manufacturer was reimbursed for the expenses incurred, but the fee or "profit" was limited to an amount that was rigidly fixed at the time the contract was signed.

With their first contract, NAC's predetermined, 5% profit amounted to $29,455.75. Although the profit percentages were considered negotiable and could vary from one contract to another, the contract officers at Wright Field tried to hold them to no more than a 6 or 7 percent of costs. In some of the later NAC glider contracts, the fixed fee was reduced to 4%.

Critics of the CPFF contract structure argued that it lacked incentives because the manufacturer made a "profit" regardless of how inefficient the business may have been. This criticism overlooks the fact that the fixed fee was not guaranteed. It represented the maximum that the parties agreed to. So contract officials in the Materiel Command could in theory penalize an inefficient vendor by disputing or disallowing specific costs, which would reduce the fee accordingly.

In addition, the fees that the AAF paid to contractors such as NAC were not paid in a lump sum. Instead, they were disbursed in increments based on the contractor's rate of production. The more efficient glider manufacturers quickly found that the faster

they delivered gliders, the sooner they collected their fees. This method of payment also created an incentive for the manufacturer because once the final fees were paid, the manufacturer became eligible to negotiate a new contract.

NAC, by all accounts, became one of the more efficient builders of CG-4As, and between February 1942 and the summer of 1945, the company received at least a dozen contracts, or supplements to existing contracts, for the production of at least 2,126 CG-4A and CG-13A gliders. The contracts included spare parts, assemblies, subassemblies, and packing crates for shipping finished gliders overseas. Not all of these gliders were built, however, because the Materiel Command began executing partial terminations of existing contracts in August 1944. And following V-J Day in August 1945, a stop order ended all work on gliders at NAC.

Before that time, however, NAC had received contracts totaling more than $43,000,000 (about $602 million in 2015) over a period of just three and a half years before the partial terminations were issued.[55] In spite of all the earlier challenges, NAC had stepped up to the plate. Based on AAF reports, NAC produced 1,509 CG-4A (15 seats); one YCG-13 (30 seats); two YCG-13A (30 seats); forty-seven CG-13A; and one XPG-1 (CG-4A powered glider) with 15 seats and ten PG-2A (CG-4A powered gliders) with 15 seats. The sixteen companies contracted to build gliders during World War II produced a total of 13,909 Waco-designed CG-4As. Of these companies, Ford Motor

Company produced the most CG-4As, a total of 4,190, at its plant in Iron Mountain, Michigan[56]

Considering its 70,000 parts, the CG-4A glider presented a complex challenge in estimating the actual costs to produce. Waco had estimated the production costs for a single CG-4A to be $14,000 (about $202,000 in 2015). Yet when the contracting officers in at the Materiel Command calculated the average cost, based on all contractors combined, for the first 1,000 CG-4As produced, the average cost per unit came to nearly $26,000 (about $372,000). The manufacturing firms, therefore, considered that CPFF contracts, such as the ones issued NAC, were entirely justified.

One of the primary obstacles that NAC and many of its counterparts had to address was the lack of working capital. Based on the contract terms, NAC could expect their production costs to exceed $600,000 for the first thirty CG-4As they built. And after the contract was fulfilled, NAC could expect to be reimbursed. Between contract signing and reimbursement, however, NAC had to finance all the expenses incurred unless Materiel Command authorized an advance payment. In January 1943, for example, NAC received an advance of $1,814,791 which provided the needed working capital to cover not only their day-to-day expenses, but also support their primary subcontractors, Villaume Box & Lumber Company and De Ponti Aviation Company.[57]

Although the AAF had indeed moved from the sealed-bid process used in the 1930s to a system of negotiated contracts, this latter arrangement put a premium on the

bargaining techniques between the contract officers at Wright Field and the aircraft manufacturers. And with a new design being produced by inexperienced manufacturers, there was more at stake with these aircraft. The AAF had to take more responsibility in supervising each aircraft manufacturer's operations than they had with the contracts of the 1930s. Thus, AAF representatives were placed in each glider contractor's plant, including Waco and NAC, to ensure that quality control met the AAF's specifications. When problems arose, particularly with specification and blueprint changes, cost effective solutions could be reached. We know from NAC's *Tow Lines* that by December 1943, the War Department had nearly forty civilian representatives assigned to NAC, whose primary duties involved auditing, inspection, and property management.[58] In addition, the AAF had a number of its uniformed officers on the scene as well who were mostly involved in inspection work.

Because aircraft manufacturers such as NAC had an incentive to negotiate on their CPFF contracts, they had to be able to determine precisely which expenses could be considered legitimate costs. In each contract, those legitimate expenses were determined by the contracting officer. With glider production in its infancy, there were no specific rules. So, individual contracting officers sometimes found it difficult to reach a consensus on whether or not to allow a specific expense. In general, glider manufacturers' reimbursement claims that gave rise to the most frequent disputes were concentrated in three areas: overhead, salaries (bonuses in particular), and taxes, and

NAC was no exception. The War Labor Board severely criticized NAC for the wage increases authorized between the fall of 1942 and the summer of 1943.[59]

In the case of NAC, however, overhead would not create an issue because NAC only manufactured gliders. On the other hand, for those glider manufacturers that were still producing other products as well, true overhead costs came into question. As one expert put it, sorting out which expenses were allowable and which were not would be "an accountant's nightmare."

Savvy in contract negotiations could go a long way which was proven in NAC's case. Publishing costs for the organization's monthly, in-house newsletter, *Tow Lines*, were even considered "allowable." While some viewed the newsletter as nothing more than an advertisement, its contribution to morale building proved essential. *Tow Lines* was definitely intended by NAC management to build community spirit, boost morale, and keep NAC and its subcontractors informed of what was going on. Hence, any overhead and direct costs associated with *Tow Lines* were allowable and therefore reimbursable.[60]

With a contract from the Materiel Command to build thirty CG-4As in hand, NAC's president, Harry Shaffer, had to first arrange for subcontractors to manufacture the major components, primarily the welded steel fuselages and the wooden wings, tail sections, and floors. Shaffer also needed to arrange for substantial technical assistance.

John Parker had talked to engineers at Northwest Airlines about this, but NAC needed more than just engineering support.

Historian Mary Barnes reported that on June 27, 1942, NAC signed an agreement with Northwest Airlines by which the airline company would provide NAC with technical, administrative, and financial services relating to the layout of NAC's facilities at Wold-Chamberlain Airport; the production methods to be developed; the raw materials needed; and the personnel needed to get the operation up and running. Northwest also agreed to assist NAC with its accounting; arrange for financing and insurance; represent NAC in government meetings; and assist in preparing reports on the glider program. Because all these services were required in the production of gliders, NAC could charge these start-up and tooling expenses against the contract with the Materiel Command. In short, the AAF paid NAC to hire Northwest to help NAC.

Manufacturing facilities were also needed, and NAC leased four buildings from De Ponti Aviation at Wold-Chamberlain Airport. One was the main hangar, used as an assembly plant; another was a storehouse for materials; another building served as a covering shop where the wooden wings, tail sections, and glider fuselages were covered with a fine-weave cotton; and a final building served as the dope and paint shop. The main hangar, which was 300 feet long and 100 feet wide, provided nearly half of the manufacturing space. In addition to glider assembly, the hangar also housed the executive offices of NAC, as well as a cafeteria for all the shift workers. In total, the four

buildings provided 64,020 square feet, which NAC quickly outgrew. Even before NAC achieved steady production flow, these quarters became crowded.

The structural work on the glider's components was completed at the two subcontractors' plants. Villaume Box & Lumber Company in St. Paul built all the wood components, principally the wings, wood components of the tail sections, and the honeycombed wood floors. Located on Indiana Avenue on the river flats on the west side of St. Paul, Villaume had the space needed for building the large, CG-4A wings. And Villaume also had all the necessary equipment, such as three Moore Dry Kilns with the capacity to dry a million board feet of lumber, as well as all the saws, shapers, sanders, planers, routers, and joiners needed for high-volume woodworking. Frank E. Villaume, one of the sons of Eugene, was the president of Villaume and his brothers, Julius L. and Louis. A., were vice presidents. When interviewed about Frank Villaume Sr., who was her uncle, Christine Linsmayer described him as "an elegant man" who was "the entrepreneur" in the family. He died in 1946.[61]

A huge Corliss steam engine powered many of Villaume's woodworking tools, such as saws and planers, via overhead shafts and great pulleys that transferred the energy from the engine to each tool. Although the plant also had electrical power, it was not sufficient to run all the equipment that Villaume had, and the Corliss engine ensured that all the woodworking operations had power when it was needed. Villaume's throw-back power system was sufficient when making cabinets, millwork,

and crates, but it sometimes presented a challenge for the precision needed in producing more intricate aircraft parts.

Fortunately, Villaume got help from two men who could address some of the shortcomings. The Minnesota Aeronautics Commission loaned Villaume Theodore G. Ballak, who had studied soaring as a teenager, setting an overwater soaring record in 1939. The Minnesota Aeronautics Commission hired Bellak in 1941 to direct its Gliding, Soaring, and Aeronautics Division. At Villaume, Bellak advised the woodworkers on setting up a production line for aeronautical parts, interpreting Waco's CG-4A drawings, and building all the jigs needed for assembly.

Villaume's management also hired Charles P. "Chuck" Doyle, who had learned to fly when he was in high school in the early 1930s. Something of a daredevil, Doyle was a parachute jumper, motorcycle stuntman, and a skilled mechanic who had also earned his commercial glider license. As an inspector at Villaume, he selected all the spruce planks that would be machined into wing spars and ribs, and he directed the casein gluing operation that Villaume workers used to fasten the rib parts together. Doyle's insistence on high quality in a mass production operation assured NAC that Villaume's wooden parts would meet the AAF's standards for integrity and airworthiness.[62]

The metal fuselages were built at the De Ponti Aviation Company, owned by Angelo "Shorty" De Ponti (1908-1991), a pilot turned entrepreneur. As one of the

forerunners in aviation in the Twin Cities, De Ponti offered aircraft storage, flight training, aviation fueling, sight-seeing and charter services, and aircraft sales. Another Minneapolis subcontractor, Cronstrom Furnace and Sheet Metal Works located at 3011 East 42nd Street, manufactured the landing gear.

Aviation historian Noel Allard, who grew up only five blocks away from Wold-Chamberlain Airport, knew Shorty De Ponti, and he recalled that only later in his life did he address him as "Shorty." Before that, he always called him "Mr. De Ponti." Allard describes De Ponti as "an irascible character" who was quick to criticize a person if they did something he didn't like. With most people, however, Shorty was "nice" as long as they "were serious about things."

Allard also recalls that De Ponti was involved with "virtually every aspect of aviation at the Minneapolis airport from the days when it was Speedway Field to the present." In Allard's opinion, De Ponti was one of the ten most important Minnesota aviation pioneers.

De Ponti, says Allard, opened his first business when he was only nineteen. By the early 1930s, he had a business at the airport called Aero Salvage, which bought and sold aircraft parts, wheels, and engines, and within ten years, he would own five hangars at the airport. His business interests expanded to a Piper Aircraft distributorship, selling their Cub airplanes, and he sold aviation fuel through his Texaco

Oil distributorship. On a tip from Colonel Jimmy Doolittle early in the war, he acquired the Shell Oil distributorship as well, which made him a lot of money.

Subcontracting the work of welding glider fuselages with the De Ponti firm made sense because of the company's experience in rebuilding airplanes. In contrast to the spread-out facilities (over sixteen acres) at Villaume, the undersized De Ponti plant of less than four thousand square feet was set in the heart of a residential neighborhood in south Minneapolis, located at 53rd Street and Lyndale Avenue. (Prior to Shorty De Ponti leasing the building, it had been an auto showroom and repair shop for the O.I. Borton Motor Company.) As both a pilot and entrepreneur, Shorty De Ponti was just the kind of leader NAC needed to oversee the structural work for its glider production.[63]

Both the Villaume and the De Ponti plants were geographically close to Wold-Chamberlain Airport. Villaume was about eleven miles to the east and De Ponti about five miles to the northwest. NAC also rented storage space in several warehouses scattered around the area. And despite the cramped spaces at Wold-Chamberlain Airport, NAC was able to assemble nearly 600 CG-4As there before it found additional workspace at 1902 Minnehaha Avenue in St. Paul in September 1943.[64]

NAC's contract with Villaume stipulated that the St. Paul firm would fabricate all the wood floors, tail, and wooden wing assemblies. By the fall of 1943, after NAC had acquired the plant at 1902 Minnehaha, the wings were manufactured in that building and Villaume was primarily responsible for making the floors and wood tail

assemblies. NAC supplied all the jigs, tools, and materials. The agreement with Villaume also stipulated that NAC would provide the supervisory management at Villaume, maintain production control of the subassemblies, and pay for plant security. With De Ponti producing the fuselage assemblies, NAC provided all the tools, jigs, and materials for this work as well.[65] Although NAC, Villaume, and De Ponti made a good team in building CG-4As, they could not have accomplished all that they did without the help of what John Parker estimated to be about fifty additional subcontractors. Their specific contributions to this glider program have, unfortunately, been lost in the passage of time.

In Mary Barnes' 1945 history of NAC, she addresses the initial start-up challenges. Based on her research, NAC was hampered in the beginning because of the contract stipulations themselves. NAC was prohibited from using skilled production workers, and the government provided no manufacturing facilities. Even by February 1942, NAC could only list ten employees. And given their lack of experience in aircraft manufacturing, John Parker can be applauded for pulling it all together.

Barnes also recounts the problems resulting from Bromley Engineering's (Detroit) failure to deliver the requisite jigs and dies to NAC. Consequently, NAC's initial production was delayed because of the design work needed to build its own jigs and dies, which took them into September 1942. And due to the commercial and military competition for raw materials, as well as overall doubts about this new aircraft,

NAC struggled to obtain the necessary materials for building the gliders. As she reported, "Gliders were manufactured of seamless, or welded seam steel tubing, mahogany and poplar plywood, and muslin of the best quality obtainable. All of these items were controlled materials, and required priorities for their procurement. The glider program was not in high favor with the AAF at the time of its inception, and, consequently, priorities were difficult to obtain. In fact, the inability to obtain a steady flow of materials caused production slowdowns throughout the entire glider manufacturing period."[66]

Taking on the glider contracts from Materiel Command grew even more complicated as the summer of 1942 progressed. By September, all sixteen of the contractors received notification from the Materiel Command in Dayton that "no further purchases of gliders beyond those called for in the subject contract are contemplated." Having just received in August 1942 the "green light on CG-4A production," this notice left the companies "confused and rendered less efficient." It encouraged the contractors to "attempt to secure other business in order that the facilities engaged in the manufacture of gliders may continue to be usefully employed after the completion of the subject contract." A week later, however, the AAF reversed its course and set a goal of producing 350 gliders a month through the end of 1943. By mid-1943, the goal had been pushed higher to a total of 12,826 CG-4As to be built by July 1944.[67]

Confusing or not, Harry Shaffer and the members of his staff at NAC still had a job to do. To complete the one contract they did have, they still needed to concentrate on hiring personnel, organizing the production facilities at NAC, Villaume, and De Ponti, and procuring the lumber, steel, cotton, and other controlled materials that they needed just to manufacture thirty CG-4As. And that they did.

On September 23, 1942, the *Minneapolis Star Journal,* reported under the headline, "First of Giant Army Gliders Is Completed Here," that their combined efforts had reached a milestone. The story announced that Northwestern Aeronautical Corporation, the "first Minneapolis firm commissioned to build huge troop-carrying gliders for the army, completed its first ship early today. The job was completed in 95 working days from June 4, the date the army contract was awarded, according to H.A. Shaffer, president and general manager." This article further explained that NAC was going to build gliders "on a quantity basis" and had spent considerable time obtaining "3,000 different kinds of materials" for glider production and designing and building tools, including "massive jigs weighing several tons" that could "meet tolerances down to the thousandths of an inch."

The reporter also confirmed that the work of building the glider had been divided between two subcontractors, Villaume in St. Paul and De Ponti in Minneapolis, with NAC's main assembly plant at Wold-Chamberlain field. Included in the article was a large photo showing the eight key managers who were responsible for overseeing

the completion of this first glider. Seated in the center behind a desk covered with papers was Harry Shaffer and surrounding him on both sides were Robert W. Whittingham, production manager at Villaume; James B. La Mont, production manager for NAC (also an employee of Northwest Airlines); C.W. Savidge, production manager from De Ponti; NAC's chief engineer, T.C. Thieme; NAC's chief inspector Werner Schwyzer; and the NAC material control supervisor, W.W. Boardman; and finally the AAF inspector, L.W. Whitcomb.[68]

There is some speculation that the September 23 article is not entirely accurate. If Harry Shaffer started counting work days on June 4, 1942, and considering a six-day work week, then the "95 days" reported in the article closely approximates the date when the AAF history states the first deliveries of CG-4As began.[69] In her 1945 account, however, Barnes reported that NAC had delivered an experimental glider in October 1942 and "the first production model CG-4A glider was delivered to the AAF in December of that year."[70] *Tow Lines*, the company's monthly newsletter, indicates that the first CG-4A was completed on September 30, a week after the newspaper published the photo of NAC's leaders.[71] Thus the September delivery appears to be the more accurate date, and in any event, NAC pulled off a major accomplishment in a very short amount of time.

With the successful construction and delivery of this first CG-4A, there was plenty of work yet to be done before NAC could fulfill its thirty-aircraft contract.

Delivery of those gliders would not be made until 1943. At the same time that workers at NAC were toiling to make good on the firm's contract with the AAF, the company also underwent a change in its top leadership. Only a few months after the *Minneapolis Star Journal* carried the photo of a smiling Harry Shaffer and identified him as the president and general manager of NAC, John Parker put his indelible mark on NAC and started providing overall direction of NAC's operations in January 1943. There was a lot at stake: NAC had to meet its contractual obligations to build hundreds of gliders ordered by the AAF, which would require expanding its operations. Starting in 1943, NAC received new or supplementary contracts to build not only CG-4As, but also other glider models. Together these aircraft would then do their part in helping the United Nations to defeat the Axis enemies in Europe and Asia. And equally important to meeting the production deadlines, NAC had to provide a quality product that would deliver in combat. Quantity and quality went hand in hand. There could be no compromise.

Chapter Four

"Nothing Less Than the Best Aircraft"

In October 1943, the opening sentence of *Tow Lines,* NAC's employee newsletter, told readers, "Nothing less than the best aircraft in the world," would satisfy the AAF. If anyone at NAC, Villaume, or De Ponti doubted the importance of this objective, he or she only had to read a little further. The article reprinted verbatim a directive from Major General Charles E. Bradshaw, the officer in charge of the AAF Materiel Command at Wright Field, to anyone associated with the Materiel Command, military or civilian: "Because superior equipment is a most powerful factor in winning the war, the AAF is DETERMINED that its aircraft and equipment shall be the best in the world. That is why we of the Materiel Command must resolve that our efforts be dedicated to making certain that such aircraft and equipment is as perfect as American manufacturers can produce."[72]

Having delivered its first CG-4A in late 1942, and with John Parker taking charge of day-to-day management shortly thereafter, NAC began 1943 with a daunting challenge: build more gliders. The surviving records reflect the challenge they were faced with: to manufacture gliders in large numbers and at the same time, maintain high quality standards.

The importance of effective quality control in glider production made national newspaper headlines on August 1, 1943. In St. Louis, a CG-4A built by the Robertson

Aircraft Corporation crashed during a demonstration flight over the local airport when its starboard (right) wing broke off at the attach mount on the fuselage. Investigation of the crash found that a wing-strut fitting had been machined much too thinly, which was not caught on final inspection. The crash killed the mayor of St. Louis, the president of Robertson, and eight others, including two AAF officers, who were aboard the aircraft that day. According to the newspapers, "thousands" of spectators witnessed the crash.

Prior to receiving a contract in March 1942 to build twenty CG-4As, Robertson had provided aircraft services and training, but the company, like NAC, had no experience in airplane manufacture. Once Robertson was awarded the glider contract, the company incurred problems that almost forced AAF's contract cancellation, but the company was allowed to continue working on CG-4As. According to AAF historians, the investigation of the crash revealed that "the crash was caused by the failure of an end inner wing fitting manufactured … in St. Louis [by a subcontractor that was a] former manufacturer of caskets." In addition, the inspection personnel at Robertson "had passed a defective part because of their incompetence."[73]

The CG-4A was a complex aircraft. Not only was it comprised of more than 70,000 parts, one glider took, on average, nearly 7,000 hours of labor to build. And its design was also in constant flux. In 1942 and 1943 alone, over 1,000 changes were made, "deviations" to the blueprints and specification that resulted from training, testing, and other field experience. As with any new aircraft model, there were bound to be change

orders that affected the design of parts and subassemblies. But according to James E. Smith, a draughtsman for NAC from 1942 to 1945, nearly 15,000 blueprints associated with the CG-4A had been published. By the end of the war, the total number of changes to the CG-4A's design specifications exceeded 7,000.[74]

Jim Smith was born in Litchfield, Minnesota, and attended high school in Minneapolis, where he studied machine drafting. Classified 4F for medical reasons, Jim was hired on the spot in September 1942 when he applied for a job at NAC. He was assigned to the engineering department, which at the time was located in an office in the Highland Park neighborhood of St. Paul at the corner of Ford Parkway and Cleveland Avenue. (The engineering department later relocated to St. Paul's Midway area after NAC acquired the plant at 1902 West Minnehaha.)

When interviewed in 2012 about his work for NAC, Smith remembered that he was employee number 711. Like all employees, he wore a badge with his picture and his number on it. His starting pay was $125 per month, and he estimated that he put in about ten hours a week of overtime. By the end of the war, Jim had been promoted at least once and with additional raises, he was earning about $300 per month.

Jim started out working the night shift, but after about a month, he was put on the day shift. Initially, it was his responsibility to make changes, or deviations, in the blueprints for the CG-4A. For example, there might be "a bracket that was welded onto the steel frame [of the fuselage] and maybe it was too short or too long and they would

want to have it in a different place. So we would have to make up a drawing as to where it should be located." Once Jim or other members of the drafting team made the new drawings, they would send them over to Minneapolis Blue Printing Company at 523 Second Avenue South to have multiple copies made. One copy always went into the master file of blueprints; other copies went to the departments handling the parts that were involved in the deviation; and one copy was always mailed to Waco Aircraft for their files. Each shift received about four changes per day. Some would require an hour or two of drafting; others took as much as four or five hours. NAC also received deviations from Waco that would have to be copied and distributed. According to Smith, all the deviations had to be approved by the Materiel Command.

In time, Smith was promoted to be in charge of all blueprint deviations, and by 1945, the Engineering Department alone had grown to about fifty personnel. Because Jim had the use of his mother's car, he also served as chauffeur from time to time when he drove his boss to the Villaume or De Ponti plants to confer with his counterparts in those shops or to one of the many small subcontractors. One such subcontractor was Cronstrom Furnace and Sheet Metal Works at 3011 East 42nd Street in Minneapolis. According to Jim, Cronstrom made all the sheet metal parts that De Ponti needed for the CG-4A; thus any time a deviation had been approved for a sheet metal part, his department would have to deliver a new blueprint to Cronstrom.

When asked about John Parker, Jim Smith recalled meeting Parker in 1942. His impression was that Parker spent much of his time during the war in Washington, D.C. Smith also recalled that when Parker was in St. Paul, he drove himself around to the various NAC plants in a maroon, 1941 Packard coupe. It was, said Smith, an "impressive car."[75]

The AAF's General Bradshaw was a perfectionist, and he expected the same of the companies producing aircraft for the war effort. Although perfection was the goal, it was an elusive target. Certainly the glider manufacturers pushed for perfection as well, but in reality, their successes and failures were primarily judged in terms of the quantities they built and not by the quality of the aircraft.

For example, when Parker and others analyzed how the company was performing in early 1943, the delivery schedule for the first order of thirty gliders seemed, in the words of AAF historian Mary Barnes, "reasonable." The contract called for the delivery of two CG-4As in August 1943; four gliders in September; six more in October; and nine CG-4As in November and the same number in December. This forecast gave the impression that NAC would be able to meet its target of 30 gliders by the end of 1943. But as Barnes pointed out, "[a]s difficulties were encountered throughout the year, it soon became apparent that it would be impossible to meet this schedule."[76] Consequently the schedule was revised several times in 1943. And although NAC would not meet its original production goal for 1943, the company was

awarded several supplementary contracts, raising the total number of CG-4As on order to 300.

According to aviation historian I.B. Holley, building any airplane involves four equal steps. About 25% of the work consists of making or purchasing all the parts, and another 25% is devoted to fabricating all the subassemblies. Manufacturing the fuselages accounts for another 25%, and the final 25% allows for parts and subassembly installation and final aircraft assembly.[77] For NAC, of course, Villaume and De Ponti were the primary fabricators of parts and subassemblies. At Wold-Chamberlain, NAC was in charge of installing parts and subassemblies and overseeing the final assembly of each glider.

Although some NAC records no longer exist, interviews with men and women who built the gliders in the Twin Cities provide credible evidence of NAC production. Other surviving documents, such as the *Tow Lines,* provide a window on how NAC and its primary subcontractors handled CG-4A production. Noel Allard, known as the senior historian of Minnesota aviation, interviewed Chuck Doyle in 1986 about his work at Villaume as an inspector, particularly about how Villaume could consistently manufacture precision wood parts in the quantities that were required by NAC's contracts. Doyle gave Allard an example of just one of the many "difficulties" the workers at Villaume had to address to meet the high quality standards demanded by the AAF's inspectors. According to Doyle, "a drill press was being used to drill holes in

the butt-ends of wing spars for the purpose of attaching the heavy-duty steel wing-to-frame brackets. It would not sink a perfect perpendicular shaft all the way through the massive spar. The drill was 'crawling' with the exit hole being somewhat offset from the entry hole, causing misalignment with the bracket, and creating many rejected parts." The solution that Doyle and the Villaume engineers hit upon was to put a stop in the drill head so that the hole was drilled only half way through the wing spar. Then, "all the holes [had] been drilled halfway, a dowel [that was the same diameter as the drill bit] was mounted in the drill base, and when the spar was turned upside down and set on the dowel, the other half could be drilled with perfect alignment."[78] It was a simple solution, but a lot of time had been lost, and many parts had been rejected before workers could achieve "perfect alignment" in their drilling. As long as the operators of the drill press carefully followed these steps, the required holes would align properly to meet the AAF standards.

At NAC, the Materiel Control Department determined the quantities of lumber, steel, and other raw materials needed by NAC, Villaume, and De Ponti, all of which were requisitioned through NAC's Purchasing Department. Orders were placed with hundreds of vendors from coast to coast. Because a shortage of one item or raw material could shut down or delay a production line, NAC operated on a program of "Perpetual Inventory." Essentially, this required a record of every item in the stockrooms and warehouses of NAC and its contractors. The goal was to provide a thirty-day lead time

for all parts and materials, which included raw materials, such as aluminum or steel; standard parts and aviation parts; finishing materials, such as fabric, paint, or varnish; and the thousands of other parts that came from outside manufacturers.

The importance of parts, inventory control came up in an interview in 2013 with Anthony F. (Tony) Rericha, who worked at Villaume in 1942. Rericha recounted how, "[t]he attach point for the struts to the wing spar required an aluminum bushing and there was such a shortage of material and somebody lost one of the bushings. So there is a CG-4A glider that has a wooden bushing in lieu of the aluminum bushing. [The wooden bushing was fabricated] on a lathe. But the significant thing is that they weren't able to replace that lost, misplaced aluminum bushing. That's how critical everything was."[79]

Because glider manufacturers were competing with other aircraft companies, ordering parts was no easy task, especially when some items had been deemed controlled materials. Often the delivery of parts had to be expedited or in NAC's terminology, shipped "at once if not sooner." In the words of the *Tow Lines* reporter, "to get things delivered on time has required great salesmanship, and good fellowship—not to mention cajolery and keeping the telephone wires hot."[80]

Among the vendors supplying lumber and other wood products to NAC, Ford, and the other glider contractors, were two companies in Wisconsin: the Connor Lumber and Land Company of Laona, and the Roddis Lumber & Veneer Company in

Marshfield. The lumber, usually No. 1 Pine or a hardwood, supplied by Connor Lumber, went into the same packing crates that would ultimately be used to ship CG-4As overseas.

Each glider required five crates totaling more than 10,000 board feet of lumber for shipment. The demand for these crates grew so large that Villaume set up a co-partnership to build the crates in St. Paul. Known as the Glider Crating Company, it leased space at the Osgood & Blodgett Manufacturing Company, a wholly owned Villaume subsidiary in St. Paul run by Louis Villaume.[81] After a completed CG-4A had been flight tested, NAC had two options, depending on the orders from the AAF. The glider was either disassembled, packed in the shipping crates, and loaded onto rail cars at a siding at 59th Street and Nicollet in south Minneapolis for shipment to a seaboard port. Or, it was towed by a C-47 to a troop carrier base in the U.S.

The other Wisconsin firm, Roddis Lumber & Veneer, supplied aircraft plywood made from mahogany, which was plentiful during the war, along with veneer. The plywood from Roddis Lumber was used to build the glider wing panels and the horizontal and vertical stabilizers.[82]

Another forest product that was often used in CG-4A construction was a paper laminate made from black spruce pulp, produced by Consolidated Water & Power Company in Wisconsin Rapids as well as other mills. The company's trade name for this product was Celluweld. This and other phenolic paper laminates were developed

in the early 1940s as a paper-based, laminated plastic that weighed half as much as a comparably sized sheet of aluminum. This newly developed product had a tensile strength of 35,000 to 50,000 pounds per square inch, approximately the same as certain aluminum alloys on a relative weight basis. Paper laminates also provided superior dimensional stability, low abrasiveness, and high-impact resistance. Therefore, they were in high demand from aircraft manufacturers, including glider builders, who found the material ideal for constructing the glider floors. Between 1943 and 1945, Consolweld, a subsidiary of Consolidated, supplied NAC with 156 glider floors. NAC also used a paper laminate for at least one "snow glider nose," a paper/plastic nose designed specifically for sliding across snow upon landing.[83]

Each CG-4A had about 10,000 glued parts. The failure of any one of these joints could bring disaster to a glider and its crew; so reliable glue and good gluing procedures were essential to high quality manufacturing. When NAC received its first contract, the AAF had no gluing standards for aircraft woodworking and as a result, the task of developing satisfactory, pressure-gluing machinery that could meet the AAF production requirements fell on NAC's engineers.

Initially, NAC woodworkers used a urea-formaldehyde glue or a casein-based glue derived from milk protein, with a fungus inhibitive added. These glues were most suitable for gliders destined for North African and European operations. Later, when some of the gliders were built specifically for operations in the Pacific Theater, only glue

with a phenolic resin base could be used for aircraft operating in the heat and humidity of Southeast Asia. One of these glues, known as Super Harbord, had been developed prior to the war by Dr. James Nevin, a forest-industry chemist associated with the Harbor Plywood Corporation of Hoquiam, Washington. The glue was intended for use in the production of exterior-grade plywood because it was insoluble in water, rot proof, and toxic to termites, mold, and fungi.[84]

Beginning in 1942, the typical method of gluing was to place the parts being pressure glued in a cold press for six to eight hours, after which they were released and dried for another twenty-four hours. This method required considerable hand work and didn't meet the needs of accelerated wartime production. One young man who gained experience in the gluing process for the gliders was Tony Rericha, who worked on glider wings at Villaume in 1942 before he enlisted in the Air Force.

Tony had grown up in South St. Paul, and right after high school, he got a job at Holman Field where he started learning aviation mechanics. He also worked at Fleming Field in South St. Paul before joining the glider production workforce. George Gagnen, who worked for NAC, recruited Tony to work at Villaume. In Tony's words, NAC was "desperate" for workers, and Tony was qualified simply because he'd "been around aircraft." Actually, Tony "was familiar with Manual 18 and that's the bible for airplane mechanics." His job was "to supervise the placement of the ribs on a spar." He was

paid, as Tony remembered, $110.00 (about $1,584 in 2015) a week for his work at Villaume.

In a fixed-wing airplane, such as a glider, the spar is the main structural member of the wing. It usually runs the length of the wing at a right angle to the fuselage, and it carries the flight loads and the weight of the wing when the aircraft is on the ground. The ribs are attached to the spar to form the remainder of the wing and share the integrity of the load when the aircraft is in flight. In the case of the CG-4A, Tony explained that, "the spar would be varnished except where the ribs were to be placed. You just slipped the ribs onto the spar. It was very, very close dimensions. Very tight. The glue would be applied to the vertical members that made contact with the spar."

While Tony was at Villuame, the glue being used was casein glue, which had, in Tony's words, a "shelf life" of about two hours. Casein, according to him, was "a standard adhesive in wood production" that was made from milk protein. When casein was used to build glider wings, "you would nail gussets [a triangular brace] with the brads and it was not to fasten the gussets to the rib members. Its purpose was to provide pressure so that the glue, the adhesive, would be the only source keeping the assembly together. … [W]hen you use fasteners such as that, you had to be careful not to impact on the brad that it would imbed itself into the skin of the gusset. It was purely to seat the member and apply pressure to squeeze out the glue … and keep the glue line to a minimum and let it set up" to dry and bond.[85]

This procedure that Tony used at Villaume owed much to the inventive talent of George Beiter, who was associated with Steinway & Sons Company in New York City, well known for their pianos. Because pianos were not essential to war production, their manufacturing was curtailed, and Steinway & Sons became a woodworking subcontractor to General Aircraft Company, a Delaware corporation, which rented a plant of Long Island owned by Steinway. Beiter submitted a patent application on July 3, 1943, for his invention, which he identified as the "Securing Means for Adhesively Held Parts." It was intended to be used in the construction of gliders or airplanes where plywood or wood veneer were used as a shell or skin over a framework.[86]

Another notable contribution to the gluing process was made by Otto Mueller. In July 1944, NAC hired Mueller, who had spent eight years designing and experimenting with marine equipment. He was given the task of finding a way to improve the gluing procedures. After several months of experimenting, Mueller found that the process went much faster when hot presses were used with phenolic-resin glue. This glue was mixed from two parts: a liquid, resin glue and a powdered catalyst. And in order to be effective, the parts measurements had to be precise, each carefully weighed and checked. If any dirt or impurities got mixed into the glue, the batch would be spoiled, and there was no way to distinguish an improper or contaminated mix. Thus, cleanliness in this work area was paramount.

This glue had to be mixed in a water-jacketed cauldron with a temperature around 50° F and had to be applied within two hours of mixing. Otherwise it would become too thick for application. Consequently, new batches of glue had to be mixed every two hours. Woodworkers used different colored cups to distribute the different batches of glue and after a two-hour interval, any unused glue was collected and disposed. Tony Rericha later identified this glue as resorcinol, a marine glue first manufactured in 1943.

In the gluing process, the thickness of the wood determined where the hot presses could be used. Wood that was too thick took too long to heat, and excessive heat would dry out the plywood. Temperatures in the hot presses averaged 200° F, but the entire setting and curing process took only eight minutes, an enormous savings in time. In addition, the temperature and relative humidity of the plant area where the gluing was done had to be carefully controlled. The temperature had to be above 72° F and the relative humidity above 45%. Mueller used electric fans, forced spray, and live steam to maintain an even distribution of moisture in the air of the gluing operations area.

Analysis of gluing data showed that hot presses shortened gluing time by about 40%; turned out a better product; and allowed for poorer grades of wood to be used. Once the results of hot-press gluing became evident, about 97% of the gluing utilized this method, and parts production increased in 1944-45 over threefold per day, without increasing employee headcount. [87]

Although hot press gluing greatly improved efficiencies, this innovation was not available when NAC was initially trying to meet the Materiel Command's revised delivery schedule. Glider deliveries improved over time in 1943 but only slowly. Between January and June 1943, for example, NAC was scheduled to deliver 50 CG-4As per month (for a total of 300). It actually delivered 25, 26, 32, 37, 47, and 54 for a total of 221 gliders or about 74% of the targeted number. With much celebration, NAC achieved the elusive 300 deliveries (the quantity ordered under the first CG-4A contract and its supplements) on July 23, 1943. A ceremony marking this achievement attracted a lot of publicity. Procurement officers, including Colonel Frederick Dent from Wright Field, and Minnesota Governor Edward J. Thye even attended the party at the Radisson Hotel in downtown Minneapolis to celebrate NAC's initial achievement.[88]

Historian Mary Barnes explains that along with developing new production processes, other issues also impacted NAC's ability to deliver aircraft. One of these problems was finding capable and sufficient workers to handle the production work. When NAC began operations, Minneapolis and St. Paul were classified as a Group 4 labor market, the lowest ranking out of four classifications. This meant that a substantial labor reserve was expected to remain six months after war had been declared. This classification correlates with NAC's experience because initially, the company had little difficulty attracting workers when the organization was formed. By mid-1943, however, the Twin Cities labor market was reclassified as Group 1, which meant its market now

experienced an acute labor shortage. *Tow Lines* highlighted the tightening labor market by regularly listing those NAC employees who were either drafted into or volunteered for military service. And as time went on, these lists grew longer, creating much higher employee turnover.

Despite the meager number of employees NAC had when it was established in early 1942, by October of that year the company recorded 346 people on its payroll. Nearly a year later, by August of 1943, the ranks had grown to more than 1,100. Employee headcount slowly increased throughout 1943 and 1944 until it peaked in April 1945 at 2,468. Most NAC employees worked eight-and-a-half-hour shifts six days per week, or fifty-one hours per week. Many, of course, also worked overtime.

Villaume's records indicate that the company employed about 150 workers before the war and in 1944 its payroll had grown to 1,050 workers. At its peak during the war, approximately 1,500 Villaume employees were working three shifts, six days a week. With so many young men joining the military, NAC and Villaume were no different than other defense contractors: they drew a good number of employees from rural communities because the pay was good, and the demand was high. For the few individuals who came to the Twin Cities to work in defense plants and for whom records are available, most found lodging with relatives who were already living in the area.

One such Villaume employee was Martha Billmeyer Schmidt (1913–2007), who grew up and was educated in Sauk Centre in central Minnesota. She had been accustomed to hard work on the farm, and to do her part, she moved to St. Paul to work at Villaume. In 1944, however, she met and married an airman stationed in Oregon, which ended her work on gliders. On the other hand, Bernice I. Anderson Ackert (1915–2005), who had grown up on St. Paul's East Side, took a job at Villaume building gliders to add to the family's income after she married in 1942. Admittedly Martha's and Bernice's contributions at Villaume are small examples, but they illustrate how jobs in defense plants drew women into employment outside the home from far and near.

De Ponti, in contrast, employed many fewer workers than Villaume. With so few records to draw from, only 450 people were estimated to be working at De Ponti by early 1945.[89] Overall, Mary Barnes reported that about 90% of the workers employed in building gliders were "lifetime residents of the Twin Cities" and almost 60% of them had at one time been employed during the 1930s on Works Progress Administration projects.[90]

Like any other start-up company, one of NAC's most pressing problems was that of personnel training. Once again, Barnes summed up the problem: "These unskilled workers had to be trained, not only in modern production methods, but also in the specialized field of aircraft fabrication. Two types of trained personnel were required,

wood workers and metal workers, as one of the chief construction problems was that of the amalgamation of a wooden wing to a steel fuselage."[91]

Many residents of the Twin Cities who were looking for war-related industrial work applied directly to NAC, but the company also advertised its openings for workers in the local newspapers, on the radio, and communicated its personnel needs to the U.S. Employment Service (USES), as well as to the local offices of the Urban League.

Created in 1933 to ounter the effects of the depression, the Roosevelt administration established USES as a federal agency in 1942, but it remained a state-run organization. The primary purpose of USES was to mediate between employers and job seekers through the hiring process. It had a stated policy of racial equality in the workplace, but support for this goal varied from state to state. In contrast, the Urban League, a private but national organization with offices in major cities across the country, had offices in both Minneapolis and St. Paul in 1940. As a nonprofit agency, it was led by an interracial board that was committed to advancing employment opportunities for African Americans in the Twin Cities and to cracking the color bar in local defense plants. Advertising NAC job openings through the Urban League ensured that African American job seekers were offered war-production opportunities and that they would receive appropriate assistance throughout the hiring process.

At NAC most new hires were trained on the job by older, more experienced workers. Some employees were sent to classes at the University of Minnesota or at Dunwoody Institute in downtown Minneapolis, which offered a wide variety of trade and industrial training. One course at the University of Minnesota, for example, required sixteen hours of study to learn blueprint reading and wood identification. The U.S. government paid the tuition costs for those who attended these classes, but NAC employees had to sign statements that their attendance in a class was voluntary to prevent later claims that they should have been paid time-and-a-half for their participation.

Because so few NAC employees had any prior airplane manufacturing experience, *Tow Lines* carried a regular feature which was entitled "What Was Your Former Occupation?" As examples, a Methodist pastor, who had served as marine chaplain in World War I, became a carpenter; an artist cut plywood into triangular braces; a dancer made wing ribs; a former hockey star took on the role of foreman of welding assemblies; and a steeplejack became an inspector. Other recruits to the Twin City aviation industry included a hotel waiter, an orchestra leader, a chiropractor, a violin maker, a bond salesman, school teachers, a palm reader, an undertaker, and a former bartender. Anyone who held the potential for retraining could land a position at NAC.

Arthur O. Edwards (1919–2012), however, found work at NAC more closely related to his talent. A native of Minneapolis, Arthur attended the University of Minnesota and then started his career as a residential building contractor. When the war restricted the availability of building materials, Arthur was hired by NAC, a job that would be short lived. When the selective service began drafting fathers, including Arthur, he enlisted in the Air Force in the Cadet Pilot Training Program instead. Military needs intervened once again, and Arthur soon found himself working with the Corps of Engineers in California, where he supervised the conversion of a large airplane hangar into an air force radar lab and training facility.[92]

Because so many men were being drafted or were enlisting, more and more women were being hired by companies that had war contracts. After the war started, Violet Judith Oquist (1912–2008), who was born in west central Minnesota in Parker's Prairie, moved to the Twin Cities and found work at NAC. Willetta V. (Billie) Jenkins Berry (1917–2010) came from Worthington, Minnesota, in the southwestern part of the state. Although she had married in 1937, the family moved to Minneapolis shortly after the war started because her husband, Dolan Berry (1917–1994), was also hired by NAC. In 1943 Mathilda Kathleen (Kae) Eisenreich Vandeputte (1922–2014) moved to Minneapolis from St. Cloud in central Minnesota because she was hired at NAC. She demonstrated a superior aptitude for careful work and attention to detail that over time led to her being selected as the first female, production inspector for the glider-building

operations. The end of the war, however, ended her employment at NAC. Harriet Gayle Olson Kronman (1925–2010) was also drawn to war work on gliders, joining NAC right after graduating from Central High School in St. Paul.[93]

With so many employees inexperienced in aviation production, NAC proved its organizational strength in hiring the right people, people they could adequately and effectively train to meet the military's timely demands. NAC's primary subcontractors, De Ponti and Villaume, had to deal with the same types of training issues. Noel Allard interviewed a De Ponti employee, Floyd M. Homstad (1924-2009) in 1987. Homstad had been hired to become a welder, and according to him, he too learned on the job how to weld the steel for the CG-4A fuselages: "Like all new welders-to-be, [Homstad] learned the art at an in-plant school taught by instructor Wenzel Broash. Upon completion of the classroom work, with a welder's certificate in hand, he stepped right onto the production line, working either a single or double shift, without a break, for a solid year…nearly the entire time on tail sections alone."[94]

Working in cramped quarters, Homstad and his fellow workers were surrounded by steel tubing and other raw materials, as well as tools and jibs. Thus, Deponti workers would:

> …weld up a frame [fuselage] or two a day and then they had one truck that was dedicated to hauling these fuselages from the plant … out to the airport. One driver and one truck. He would make the trip back and forth. He had a tight squeeze to back up to the door and the whole truck didn't even fit in the door but the fuselage would come up. They'd pull it up on the truck [by hand] and then [the driver would] take off and go over to the airport. … [Homstad] worked eight to fifteen hours a day there and he said the pay was only fair. … [I]n those days you were working kind of on a war schedule and they

> took five bucks out of your pay every pay period for a Victory Tax they called it plus the state and federal tax. So everybody at that point was working for the war effort. … You probably went home when you got to the point where you couldn't stand any longer… . But Floyd said it was very difficult work.[95]

Tony Rericha, the young man who built glider wings at Villaume in 1942, worked briefly at De Ponti as well. He confirmed the long hours worked when, periodically, there was a push to get more gliders built. He would work a twelve-hour shift at Villaume in St. Paul, get off around 8:00 in the evening, and then take a streetcar over to the De Ponti plant in Minneapolis, and work more hours. During one of these marathons, he was found in the cockpit of a CG-4A, asleep with a screwdriver in his hand. He said that falling asleep on the job was not that unusual and spoke about a welder at De Ponti who had fallen asleep while welding, and "he ran the torch across his hand."[96]

Another welder at De Ponti was Leonard G. (Lenny) Johnson (1923–2014). Lenny was born in East Chain Township in rural Martin County, but his family later moved to Minneapolis, where he graduated from South High School (1942). Lenny had been diagnosed with a medical condition that prevented him from serving his country, so he got a job at De Ponti where he put his childhood farm skills to work as a welder. He became so efficient in such a short time that he was promoted to hiring and training new welders. (After the war, Lenny attended Dunwoody Institute to formalize his training, and he later contributed to the development of the welding department at Hutchinson Vocational Institute.[97])

Lack of working space and dealing with makeshift conditions were not the only production obstacles that NAC had to deal with. Cold weather presented another set of challenges. *Tow Lines,* for example, reported that in the winter months of 1942-43, working conditions in the hangars at Wold-Chamberlain Airport became less than desirable: "Nov. 13: One man went home at 6:00 P. M., and another at 12:00 A. M.—sick. Too damn cold and we can't keep the big doors closed. Almost everyone has a cold." As with any manufacturing operation, there were problems getting the various parts and assemblies to fit together according to the blueprints. Again *Tow Lines* provides a window of this: "Nov. 15: Tried nose section. No. 11 [the eleventh CG-4A unit being built] on finished center No. 9 with the intention of completing the nose so that, because of the shortage of … clamps, the nose section wouldn't be held up. It didn't fit worth a damn. Nov. 18: Nose assembly No. 12 delivered tonight [from De Ponti] but unable to use it because of the bulk heads that were removed for the welders. Couldn't get them mated because the center section was in dope. Dec. 1: Received some parts (ate them up in a hurry.) Quite a bit of salvage. Dec. 15: Going too good. Now we are short of emergency doors and frames. Jan. 1 [1943]: New Year's Day and everyone on the beam. Completed center sections No. 41 and No. 39 and nose section No. 39."[98]

Mary Ellen Kruger, another Minneapolis native, got her start at NAC even before she graduated from high school, sewing fabric for the glider wings. She had grown up about two miles from the airport and according to her, "there wasn't anything else

around [Wold-Chamberlain field]." There were very few houses. It was mostly farms." She heard that NAC was building gliders at the airport; so she went over out of curiosity and applied "in the spring or summer of '42 or '43." There was no interview before being hired, and she wound up working on gliders for about two years until she got married and left NAC to follow her new husband to his military, stateside assignment in Florida. Due to the nature of their work, she and her female coworkers were able to work in their street clothes. Overalls or coveralls were not necessary.

Mary Ellen Schwab (later Kruger) was a trained typist, and she lived close enough to NAC that she could walk to and from work. Initially she worked at night in "a little office" where she got "the papers and things ready so that they could take the little radios to be put in" gliders. It was her job to type the instructions on how to operate the radios.

Later, after she had married Walter Kruger, she "worked in the fabric building," which was the first of the three hangars that NAC leased from Shorty De Ponti, where two daily shifts operated. She, along with the other women, "cut and sewed and everything." Sometimes she sewed the canvas sandbags used in the finished gliders for ballast, and at other times, she cut fabric for the wings, based on the patterns provided. A bank of sewing machines consisted of both heavy-duty machines used for sewing canvas and regular machines used for other fabric.

Each of the women was given two large pieces of fabric, about 30 or 40 inches wide and in Kruger's words, "miles long," which had to be sewn together. The fabric, which she remembered as cotton, "like sheets" and "so thin," came in rolls "about the size of a garbage can." These bolts of fabric were so heavy that she had to get one of the men to lift it into place so it could be fed through her sewing machine. Sewing the two pieces together, she was "in the middle" with one piece on each side of her. Once the two rolls of fabric were completely sewn together, the single sheet dropped into a bin, ready to be slipped over the frame of a wooden glider wing.

The sewing machines were "real fancy. I thought I'd died and gone to heaven. It was such a fancy sewing machine because it had a double foot so you could get a flat seam or a double-double seam by just dialing it in there and it took two pieces and wow!" Other women used needles to do some of the sewing in places where machines were not practical. The needles used for hand sewing were metal "potato sack needles," and "kind of like a knitting needle" that came in different diameters. These needles were also used in stitching the fabric to the metal frame of the glider's fuselage.

Kruger's supervisor was one of the few men who worked in the sewing shop. He was "an upholsterer by trade so he knew about fabric. He knew about the stitching and all this type of thing." From time to time, an inspector would come through the hangar and "check the covering and check the wing design and check the stitching and all those things." In the course of her work, Kruger met Shorty De Ponti who she

remembered as "a really jolly, vibrant guy. … He was shrewd … in my estimation; he was very generous and gave everybody a chance." She "never saw De Ponti in a business-type suit. He was just one of the guys."

Once the wing, which was positioned in a cradle, was all covered in fabric, the men would "whip it out the door and over into the dope room and spray it." The workers who sprayed the dope on the fabric wore masks, but these masks were not respirators and they "weren't very good. You were glad to get outside and get a breath of air." John Storm, who was also interviewed by Noel Allard, worked in the paint department at NAC. He described this step in the process of building a CG-4A:

> The first coat of clear nitrocellulose dope was brushed on, lightly sanded, and a second coat was sprayed on. Following this, they started spraying the olive-drab on the tops [of wings and fuselages]. Some were painted olive-drab underneath as well; some were painted grey underneath. There were no silver coats. Between each of the two olive-drab coats, the parts were sanded. One man laid out the insignia. The old insignia with a red meatball in the middle changed to a plain blue circle with a white star and bars.[99]

James B. ("Big Jim") La Mont, who was on loan to NAC from Northwest Airlines, was the chief inspector at Wold-Chamberlain. Like an orchestra conductor, his primary responsibility was to synchronize the assembly process so that each part of a glider was present on the assembly floor at the right time for it to be installed. Aviation historians Noel Allard and Gerald Sandvick summarized the assembly-line operation as follows:

> In the south-most hangar, slip-case envelope wing and fuselage covers of unbleached muslin were sewn. They were fitted to the wings, fuselage, and tail components. The large covered units then moved next door to the second hangar where they were painted. …

> Women workers did all the taping, laying tape strips along all the stress points on fuselages, wings, and surfaces. They also did the sanding between paint coats, while teams of men did the spray painting. When a wing came into the spray booth, it was pushed under a scaffold. Two men stood below the scaffold, one on each side to paint the lower half, while two men on the scaffolding painted the upper portion.
>
> As the glider fuselages were finished, they were moved into the third of the smaller hangars where they were mated with tails, and other interior components were installed. Then the major assemblies were moved into the larger bays of the former Universal [Aviation Corporation] hangars where they were either crated for rail shipment to southern or eastern training bases and storage depots; or they were fully assembled. In the latter case, they were pushed outside and lined up waiting for tow planes to pull them out of the field.[100]

Because she worked in one of the airport hangars, Mary Ellen Kruger would sometimes see a finished glider taken aloft for a final test and inspection before it was sent on to its next destination, a troop carrier base or overseas. "It made you tingly inside. Then the first time I ever saw them open the nose, and they were doing it for demonstration purposes, and then they drove a jeep INSIDE. I think we all just stood there with our mouths [open] … and you think you're going to get that off the ground with all that in there? It was just fascinating."[101]

This type of public demonstration of the gliders was characteristic of NAC. Unlike his predecessor, John Parker actively promoted NAC and the company's participation in war-related work on the home front. On March 20, 1943, for example, Northwestern Aeronautical Corporation received the Army "B" Award for "partial approval in quality control" in its CG-4A glider manufacturing. Although this award was not as prestigious as the coveted "E" award, it meant that NAC was improving its production to meet its production schedules. With a big headline, "NAC GOES TO A PARTY," *Tow Lines* reported on the party sponsored by NAC to celebrate this

achievement and to thank the employees. An estimated 2,000 people attended the party at the Radisson Hotel, which included live music, plenty of food, and an ice-sculptured glider. All attendees received a miniature glider pin and every table had a small plywood glider as a centerpiece.[102] Throwing a party to thank the employees who worked long hours and gave extra effort to their jobs likely provided NAC a big morale boost.

In May and June 1943, Materiel Command increased its contract with NAC to a total of 899 gliders. This increase reflected the AAF's confidence in NAC because "Northwestern proved that a small concern could, with intelligent management, reasonable facilities, and sound financial backing, become a highly satisfactory producing agency."[103] Cost accounting analysis showed that in 1943 and 1944, CG-4As delivered by NAC were built at an average cost of $24,500 each [about $350,000 in 2015], which was "an accomplishment exceeded only by Ford [in Iron Mountain, Michigan] and Waco and matched by Commonwealth [Aircraft Inc. in Kansas City, Missouri]."[104]

Also in the spring of 1943 Materiel Command, initiated a small test program of building powered gliders. The concept involved adding a low-power engine to each wing of a standard CG-4A. These aircraft were intended to operate like gliders, but they would not need a tow plane to take off. Thus they could be reused after a mission (assuming they landed without damage), eliminating the need of a powered plane to tow them back to their base. NAC received a contract on April 1, 1943, to install on one

of its CG-4As, two 125-horsepower Franklin engines, roughly the equivalent of two outboard boat motors. Relative to the other glider contracts issued NAC, this one was only for $29,277.45. Designated the XPG-1, NAC delivered this aircraft in May 1943, after successfully testing it in a flight piloted by Colonel Dent on May 12th over Wold-Chamberlain Airport. NAC subsequently built two more of these powered gliders (PG-1 and PG-2) during the war, but the AAF eventually decided not to pursue this option further.[105]

Although the XPG-1 did not produce a great deal of revenue for NAC, other AAF manufacturing needs by the middle of 1943 prompted John Parker to locate additional space where NAC could expand its production facilities. Within days after NAC completed the final delivery on its initial glider contract in July 1943, the *Pioneer Press* published an article with a photo of a glider under the eye-catching headline "NAC TAKES OVER RADIATOR PLANT; BECOMES 2D BIGGEST GLIDER MAKER." This was NAC's public announcement that it would take over the American Radiator Company plant at 1902 Minnehaha Avenue in St. Paul's Midway neighborhood. Readers learned that with the expansion to this new plant, NAC trailed only the Ford Motor Company plant in Michigan in facility square footage devoted to building gliders.[106]

The American Radiator plant filled nearly fifteen acres and had about 140,000 square feet of floor space. The site included the main factory building, an office

building, a laboratory, a guard house, a water reservoir for fire protection, a fenced perimeter for security, and a rail siding. In the early 1920s, many Americans were converting their home heating systems from massive, coal-burning furnaces to compact boilers using hot water that circulated through a series of radiators. With a boom in home building and the popularity of hot-water heating, American Radiator was compelled to look for new plant site. Thanks to the efforts of Colonel Lewis Brittin and the St. Paul Association, the company acquired the site at 1902 Minnehaha.[107] But in came the Great Depression of the 1930s, and down went new home construction. By the outbreak of war in 1941, metal previously available for commercial products was being diverted to war production, and American Radiator simply could not survive. Hence, their plant was available to NAC when it was needed.

On June 11, 1943, NAC and Ford had each received a contract from the AAF to build yet another type of glider: fifty YCG-13 gliders ("Y" meaning prototype). These new gliders would be built concurrently with the CG-4As. As with the CG-4A, Waco designed this new and larger glider, which could transport up to thirty infantrymen, or two jeeps, or a howitzer. The initial cost to build fifty CG-13s was estimated to be $2,976,175. Although this contract was later increased by Materiel Command to 200 aircraft, a contract value of more than $12 million, NAC only built the original number. According to the available records, NAC manufactured one YCG-13 in 1943; two YCG-13As in 1943; and forty-seven CG-13As in 1943-45. During the same time period, Ford

built the same number of CG-13As.[108] When NAC accepted the original contract for fifty CG-13As, however, John Parker knew immediately that a lot more manufacturing space would be needed.

Toward this effort, Parker opened negotiations with the Defense Plant Corporation (DPC), a subsidiary of the U.S. government's Reconstruction Finance Corporation. Congress had chartered the DPC on August 22, 1940, to provide for new defense-related facilities and equipment, as well as the expansion of existing defense facilities on behalf of the War and Navy Departments. With financing provided by the Reconstruction Finance Corporation, DPC ensured that the money was spent as intended on war-related plant facilities. Typically these plants were government-owned, but privately operated as was the case with the plant at 1902 Minnehaha.

Following the closure of American Radiator operations at 1902 Minnehaha, DPC spent $615,402 to purchase and rehabilitate the facility with the intention that Aluminum Company of America (Alcoa) would occupy it. At the time, Alcoa was producing aluminum cylinder head castings for a Pratt & Whitney aircraft engine, but in May 1943, Alcoa stopped work on this aircraft engine program and the Midway plant, once again, became vacant. Through Parker's negotiations with DPC, NAC acquired a lease to the site in July.

Much of the work that Alcoa had done to the plant had to be torn out and converted to glider manufacturing. NAC spent $177,000 on the conversion work, most

of which was later charged to DPC. By contract, DPC owned 1902 Minnehaha, but NAC could not be expelled from this facility as long as NAC held a government contract. This was an important provision for NAC once World War II ended in August 1945.[109]

According to *Tow Lines,* NAC began moving selected departments and operations from its other sites into 1902 Minnehaha on October 16, 1943. The new facility was designated Plant No. 1 and the facilities at Wold-Chamberlain became Plant No. 2. The Engineering, Purchasing, Personnel, Payroll, and Material Control departments moved to the Minnehaha facility, as well as the NAC administrative and executive offices, which had formerly been cramped into hangar space at the airport. In addition, NAC built a woodworking operation at Plant No. 1, greatly expanding its capacity for manufacturing and assembling wood parts beyond what Villaume was able to do in its plant.[110]

As told by NAC employees, security at Plants Nos. 1 and 2 and at Villaume consisted of a perimeter fence at which employees displayed their badges to security personnel to gain entrance. The degree of security varied at the different facilities.

Christine Linsmayer was a young woman during the war growing up in a house that sat on the river bluff immediately above the Villaume plant. When interviewed about her wartime experiences, she recalled that whenever her cousin, Julie Villaume, the daughter of Villaume's president, needed gas for her car during the war years, she simply drove "through security [at the main gate] to pick up our gasoline at the factory.

We always had free gasoline too. … I don't know how we got through security."[111] Security may have been less stringent at Villaume than at NAC, but all NAC employees were required to wear their badges when they came to work. One of the men who worked at the plant on West Minnehaha, Bill Igoe, recalled what it was like working there in 1944.

William T. (Bill) Igoe graduated from Central High School in Minneapolis in 1943. Being eighteen, he registered for the draft, but while undergoing the routine military physical, the doctors classified him 4F due to the polio he had contracted during his youth. Instead of donning a uniform, he went to work for Northwest Airlines as an apprentice mechanic making eighty cents an hour. In late 1944, when Northwest cut back its staffing, he left the airline and took a similar job with Honeywell, which involved working on an airplane, autopilot project in one of the hangars at the airport. In November 1944, he changed jobs again, and this time, joined Northwestern Aeronautical, which placed him at the plant at 1902 Minnehaha working on the CG-13As. In a 2013 interview, he shared his work experience at NAC.

Bill's job on the day shift was to install the pulleys and cables and other subassemblies, such as the flooring and benches in the fuselages. When the steel frames for the fuselages arrived at Plant No. 1 from the De Ponti shop, they had already been welded and painted. As best Bill could remember, he was paid eighty-five cents an hour for his installation work.

The main assembly building at 1902 Minnehaha was, as Bill recalled it, "like a huge airplane hangar. … [with] a cement floor and a lot of space." Interior lighting was provided by electric lights and a series of large skylights. One aspect of the plant that impressed Bill was that it "was very clean." The assembly work on the gliders was done by both men and women, with most of the men being "4F people or guys over forty-five years old [that is, too old for the draft] or ex-GIs that had been in the service and were out."

Bill remembered that one day a supervisor put out a call for someone who could do safety wiring on the landing gear of a CG-13A. As Bill explained,

> That's where you have several bolts. They wire the bolts together so they can't turn or be vibrated loose. So they didn't have anybody who knew how to do safety wiring. I said I know how to do that. It was a matter of lying underneath the fuselage and working overhead to wire these bolts from one to the other so that they couldn't be vibrated loose. … So then the inspector went down there and he looked at it and he was satisfied. I thought it was pretty unusual because nobody else knew what that was.

Bill and the other assemblers "were separated from other people in another part of the building that I think had a climate control [very likely the woodworkers using the phenolic-resin glue that required climate control] where they were doing assembly of wings and covering the glider with the fabric. That was walled off from where we were. … There was an actual door into that other area. We never went there because we had no business there. So there could have been a hundred people working there. Mostly women."

As Bill recalled his work at NAC, the "significant presence was the inspector looking at all the work we did." The inspector was "an employee of NAC and he was always a male … . The women did assembly work, but the male guy checked the work that was done." Much of the work that Bill and the other assemblers did was handwork and they usually worked in pairs. In Bill's estimation, their work "was deliberately simplified so that a lot of average people could put the glider together."

Unlike Mary Ellen Kruger, who was just out of high school when she worked for NAC sewing fabric, by the time Bill Igoe worked in Plant No. 1 in 1944, "there weren't many teenage girls there. … They were all older women. Older meaning thirties or something. To me that was old." As Bill remembered the circumstances, "[u]sually some woman and myself would be doing this assembly work. Some of them were pretty experienced at doing this stuff."

Bill was surprised, however, "that the guys took such liberties with the women. That was new to me because I was eighteen years old." Bill commented, however, that this kind of behavior was, in his opinion, "commonplace at the time." Others who were interviewed about NAC and the working conditions during the war did not recall any instances of men harassing women on the job. In fact, only one other interviewee reported anything notable about women working alongside men at NAC. This anecdote involved a security guard who discovered a couple using the privacy of a glider fuselage to enjoy each other's company rather than getting a hotel room.[112]

In his history of Minnesota aviation, Noel Allard discussed the challenges of a mixed workforce:

> In the beginning, there was a strict division of labor, with men doing the doping, women the taping and sanding. In a move to integrate the workforce, Northwestern Aeronautical tried to move the women into the painting operation, mixing the paint crews with members of both sexes. There were negative reactions among the males, some refusing to work.
>
> Urban McMiller, assistant production manager, and manager of planning and control for all three of Northwestern's facilities, had to deal with this problem. His schooling at Dunwoody Institute had been in Industrial Management ("foremen training," he called it) … [had made him] well equipped to handle employee relations plus the myriad other problems [that came up]. … He and his staff successfully integrated the workforce.[113]

At first, Northwestern Aeronautical Corporation was an open shop, meaning it had no union presence. Beginning in May 1943, union organizers for the United Automobile, Aircraft, and Agricultural Implement Workers of America, CIO, Local 772, filed a petition with the National Labor Relations Board for a union election. Unionization of defense plants during the war was not unusual. Even the Ford Motor Company, which had been openly hostile to unions since Henry Ford had founded the company, eventually accepted unionization and signed its first contract with the United Auto Workers-CIO on June 20, 1941.

The union vote at NAC was held on May 18, 1943, but 97 out of 507 votes were challenged, and a second election was held on June 10. Local 722 of the UAAA, CIO won this vote and was certified as the bargaining agent for production and maintenance employees of NAC.[114] The November 1943 issue of *Tow Lines* published a letter from Carl A. Hallquist, the union local's president, to John Parker in which Hallquist stated

that the negotiations on a union contract "were conducted in a cooperative manner with both parties striving to reach a mutually satisfactory Agreement." John Parker responded on behalf of the management of NAC that "the terms of the contract will be applied to all employees within the bargaining unit certified by the National Labor Relations Board, even though they may not be members of the union."[115]

Although labor relations between the union and management at NAC may have seemed harmonious, Barnes reported that in September 1943, NAC "was severely criticized for wage increases given to their employees." In other words, NAC was paying some workers in certain job classifications more than the going rate locally for similar types of work. Consequently, the War Labor Board (WLB) ordered a hearing at its Regional Office in Chicago. At this hearing, the WLB spelled out eight different charges and summed up its position that NAC "had been guilty of repeated violations" despite several warnings. These "flagrant" violations could have resulted in NAC receiving a fine of $700,000. At this point, officials with the AAF's Materiel Command conferred with representatives of the WLB and with John Parker and proposed a compromise in an attempt to get the case settled. According to Barnes,

> NAC was justified in raising the salaries of their employees, for that was the only way possible of keeping them. An example of the wage situation was that of upholsterers. Their beginning pay at NAC was less than the existing rate for that trade in the Twin Cities. These men would not stay with the company unless their wages were increased. There was a definite shortage of this type of workers, and production would have suffered had they been allowed to resign.[116]

The pay differential that Barnes describes between upholsterers working in the local economy versus upholsterers employed at a plant building gliders for the air force is accurate for the first year or so of the war. That was a reality of wartime hiring. As the war continued, however, fewer and fewer men were available to fill upholstery jobs at NAC. Increasingly these jobs were filled by women, such as a Mary Ellen Kreuger, where the wages were the same as her male counterpart in the local economy who wasn't building gliders. Certainly this provided attractive opportunities for the many women who worked in plants with war contracts, earning the same pay as some of the men.[117] In the end, nothing came of this dustup with the NLRB.

By late 1943, production of CG-4As was moving forward with greater consistency and predictability, and work had been started on the contract received earlier in the year for the CG-13As. With the first CG-13A completed, Lieutenant Colonel Bruce B. Price, who had succeeded Colonel Dent at Wright Field and was responsible for the entire glider program, came to the Twin Cities to pilot the first test flight of the larger model. Newspapers reported that the CG-13A had a greater load capacity than the Douglas C-47 that was used for the test flight. According to the newspaper accounts, the CG-13A easily passed its twelve-minute, flight test over Wold-Chamberlain Airport and was pronounced airworthy. As many as 1,000 people had gathered at the fence around the airport to witness the flight. Also on board for the test flight were NAC's chief inspector, James B. (Big Jim) La Mont, and production manager,

Robert W. Whittingham.[118] Colonel Price was quoted as telling NAC officials, "She's proved herself a mighty good craft. I like it and I'll buy it."[119] But by the end of the war, NAC had built only 50 of the CG-13s.

As 1943 drew to a close, war continued to rage around the world, and the prospects for peace seemed very remote. The battles that lay ahead at Normandy, Holland, and elsewhere would provide the true combat test for the CG-4A underscoring its important role in the mighty endeavor to defeat the Axis powers. Only the pilots and the soldiers who rode in the gliders could speak to the thrills and terrors associated with a glider assault on enemy territory. Their recollections of what those experiences were like provided the best evidence of how the gliders and their heroic riders helped the United States and its allies win the war.

Chapter Five

Redoubling the Fight to Win the War

While people such as Mary Ellen Kruger, Tony Rericha, John Parker, and so many others were working long, hard hours to build gliders in the Twin Cities, the AAF was learning how to use these aircraft in actual combat with Axis forces. Although retelling the story of combat operations involving gliders is not the focus of this book, there were Minnesotans who flew gliders or who fought after landing in gliders. Thus their stories provide additional insight into how building gliders back home at NAC contributed to success on the battlefield.

Operation Husky, the invasion of Sicily on the night of July 9–10, 1943, provided the first combat test for the CG-4A gliders, a test that would prove disastrous. Roughly nine months before that assault, on November 8, 1942, Allied amphibious forces landed at Casablanca in Morocco and at Algiers and Oran in Algeria. These port cities are situated in the portion of North Africa that borders the Atlantic and Mediterranean Oceans, respectively. Facing the Germans in North Africa, the Allies suffered several setbacks at the hands of General Erwin Rommel's *Afrika Korps.* But in time they gained the upper hand, first in Morocco and later in the spring of 1943 in Algeria and Tunisia. Eventually the Allies drove the German defenders northward toward the Mediterranean, where the remnants of German troops and material was evacuated to the nearby island of Sicily, situated south of the boot of Italy.

Once the Allies had secured North Africa, Sicily was next, and they began preparing for Operation Husky. Preparation for the invasion involved training with gliders, American CG-4As, as well as the British Horsas. The gliders had arrived in North Africa in their crates, but not all crates arrived together, which delayed the glider assembly. By mid-June, however, about 300 aircraft were ready for training. When the Allies launched their early July assault on Sicily, 136 CG-4As and 8 Horsas were employed in the invasion.

Each glider had to be towed 240 miles from North Africa to Sicily, which was about a three-hour flight over water. Flying at an altitude of just 200 feet, the aerial transport could avoid being detected by radar. Glider historian Bill Norton describes the flight to Sicily as "a very challenging navigational exercise at that time in the war." As a result of this and other factors, only 49 CG-4As and 5 Horsas actually landed in Sicily. Some 169 gliders crashed into the sea with the loss of 326 men, including 57 glider pilots of which five were Americans.[120] In Norton's words, "the airborne mission was little short of disastrous." What went wrong?

Although the initial Italian and German defense of Sicily was not very strong, the initial airborne assault proved to be a costly effort. Strong winds and blowing dust, inexperienced tow-plane pilots, navigational miscalculations, premature release of gliders too far from the island, and friendly fire from the ships in the assault force below all contributed to the disaster. Although the Germans adeptly used Sicily's

rugged terrain to slow down the advance of U.S. and British forces, the Allies kept the pressure on. Once more the Germans retreated, this time across the Strait of Messina to mainland Italy, where they consolidated to rebuild their fighting units. In spite of what seemed doomed at the beginning, the Allies controlled Sicily by the middle of August of 1943, and their ships could safely sail into the eastern Mediterranean without the threat of attacking enemy planes based on that island.[121]

At NAC, word that the American and British forces had used gliders in Operation Husky came to workers via the newspapers. One headline, for example, in a Chicago paper read, "Gliders Used in Drive on Sicily Called Marvels." Another read, "Chute, Glider Troops Aid Fight for Catania; Allied Sky Warriors Drop behind Foe Lines—Yanks Roll On." (Catania is the name of the coastal plain in Sicily where the landings occurred.) About six months later, *Tow Lines* reported Elwin G. "Al" Carson's account of his experience in North Africa prior to Operation Husky. Carson (1904-1998) was a glider mechanic who worked in the 140° temperatures of North Africa to assemble CG-4As in preparation for the assault.

Born in Mower County in southern Minnesota, Carson graduated from Spring Valley High School in 1923. After attending the University of Minnesota for a year, he returned to Spring Valley where he worked as a sales clerk. On August 23, 1942, Al Carson, age 37, got his draft call. The local newspaper identified him as one of 103 draftees from that area who reported to Fort Snelling. When Carson was inducted, men

who had scored well on the army's classification tests were often assigned to the Army Air Forces, which were in dire need of technical expertise, men who could adapt quickly to aviation mechanics. Carson passed the required tests, and following his training in Texas, he was sent to North Africa where the Allies were battling the Germans in Algeria and Tunisia. For a time, he served in Algeria where the British pilots were trained to fly American gliders.

Veterans Affairs records indicate Al Carson was released from military service on November 13, 1943, and the *Spring Valley Tribune* reported that two days later Carson, who had been honorably discharged for being "over age," arrived by bus in Spring Valley. Although his actual military service was short lived, Carson would go on to contribute to the war effort on the home front, taking a job at NAC in early 1943. His obituary states that he was an inspector at Holman Field, where he met his future wife, Myrtle Burman, also an employee. Myrtle was born in Malmo, Minnesota, and had been a school teacher in Elk River before moving to St. Paul, where one of her sisters was employed by Northwest Airlines.[122]

Following the assault on Sicily, combat operations in Europe involving gliders went on hold until the landings at Normandy in June 1944, Operation Overlord. In the meantime on March 5, 1944, another glider operation took place in north-central Burma. In this action, a small force of several dozen CG-4As landed American and British engineers and Indian assault troops under the command of Colonel Philip G. Cochran,

USAAF, the commander of the 1st Air Commando Group. This operation was equally dangerous in that it was conducted at night in jungle clearings more than 150 miles behind Japanese lines. Because powered airplanes were not able to land in the limited space available in the jungle, gliders were ideal for inserting the men who could build a landing strip. Less than a day later, the first powered airplane was able to land and unload more infantry and tons of equipment and supplies.[123]

In the USAAF, glider pilots were not recognized in the same manner that powered aircraft pilots were, some of which was due to their aviation backgrounds. Some glider pilots were individuals who had failed to earn their wings during conventional flight training but still wanted to fly. Others were civilians in uniform who had experience flying light planes only. Age, the inability to pass a physical, and the lack of college education that precluded men from powered aircraft training, were not, however, obstacles for glider pilots. A handful of glider pilots were not even U.S. citizens. Regardless of what led them to become glider pilots, all were volunteers.

Because of their different qualifications, or lack thereof, glider pilots would not be commissioned as second lieutenants, the initial rank for pilots of powered aircraft, when they finished their training. The AAF assigned glider pilots the rank of "Flight Officer," or FO. This rank was equivalent to the army rank of warrant officer. Although some glider pilots eventually earned commissions, most did not. The highest ranking glider pilot in the war, was Michael C. (Mike) Murphy, a lieutenant colonel, who had

been a powered-plane barnstormer and an accomplished sailplane pilot. Murphy was in charge of glider pilot training in the U.S. and later took part in the glider landings at Normandy, where he broke both his legs on landing his CG-4A, known as "The Flying Falcon."[124]

The infantry who were transported via the gliders were often called glider men, glider troopers, or glider riders, and were also treated differently from paratroopers, even though in many cases, they had less to rely on for a safe landing. Many received only minimal training as opposed to the rigorous, extended training that the paratroopers endured. Typically their training included about three weeks of classroom instruction and a few rides in a CG-4A, with landings at nearby English airfields. Most were assigned to glider troop commands from regular infantry units. In addition, glider men initially received no extra pay as the paratroopers did. After their heroic performance at Normandy, however, glider troops not only got the same pay as paratroopers (an additional $50 per month), they also received the same combat gear.[125]

Hal Roed of Richfield, Minnesota, was a paratrooper in the 515th Parachute Infantry Regiment of the 13th Airborne Division in World War II. Drafted in the spring of 1944, he wanted to learn to fly but had poor eyesight, so he volunteered to be a paratrooper. When he was interviewed in 2013 about his experiences in the airborne, he spoke of the "friendly rivalry" between paratroopers and glider riders, but the latter

"just got plain infantry training and they were assigned to be glider men in an airborne unit. They had no choice in the matter."

Because Roed wore a reproduction of his uniform to the interview, he was asked about his ribbons and the other insignia on that uniform, particularly the wings that were pinned just above the pocket on the left side of his shirt. He said,

> This, of course, is the parachutist wings. They are almost sacred. Between the wings and the boots, they identify a soldier as a paratrooper. Incidentally, we talked [earlier] about gliders. The glidermen have wings as well. Instead of the parachute in the center of these wings, they have a nose view, a front view if you will, with the wings and the fuselage from a front view that indicates a gliderman. So they have their wings as well.[126]

The lessons of the Sicily glider operations were not forgotten. As the Allied airborne forces extensively planned the cross-channel, Normandy landings in France, they analyzed the Sicily, as well as the Burma, glider operations. When the assault was finally launched on June 6, 1944, more than 850 CG-4A and Horsa gliders took to the air. In the early morning hours before dawn, the gliders left their bases in England just behind the paratroopers of the 82nd and 101st Airborne Divisions. Overall, the assault involved more than 13,000 parachute and glider troops.

Prior to the Normandy invasion, some Allied planners had forecast glider losses to be as high as 50-70%. When the CG-4As and Horsas landed, the results were mixed, partly because intelligence reports about the landing areas failed to inform glider pilots of the trees, some of which were as much as forty-feet tall, surrounding some of the landing zones. Adverse weather also caused the C-47 pilots plenty of problems in

actually locating the correct landing zones, while a lack of moonlight hampered the glider pilots' landing visibility.

One of the casualties of these initial glider landings was Brigadier General Don F. Pratt, assistant commander of the 101st Airborne Division and the highest ranking American officer killed on D-Day. But the actual losses incurred fell far below the forecast numbers. Out of 1,034 American glider pilots who flew to France on D-Day and D+1, 44 died in action, 122 were wounded, and 33 were captured or missing. During those two days, over 20% of the materiel (guns, vehicles, and supplies) delivered to the beachhead and almost 4,000 infantry (with 463 casualties) came in by glider.[127]

The primary role of these glider assaults was to provide aerial reinforcement of the paratroopers with early delivery of glider infantrymen, jeeps, and artillery. Soldiers and pilots of the Glider Infantry Regiments who flew into Normandy unloaded the gliders that were not totally damaged and fought alongside the paratroopers. Within a few days, many of the glider pilots had made their way to the Normandy beaches and were evacuated to England. Most of the gliders, however, were left to rot in France.[128]

A radio operator who was aboard one of the many planes that towed gliders from English airfields to the beaches of Normandy on D-Day later wrote that these silent aircraft "crashed, more or less successfully. Slow and easy targets, flying directly over enemy positions, gliders had to get down quickly."[129] One of the major obstacles that the glider crews had to deal with in some parts of France was "Rommel's

asparagus," (the name used by U.S. forces and *Rommel-spargel* by the Germans) six- to eight-inch wooden poles that were about ten- to twelve-feet high and planted upright in fields behind the beaches where gliders were likely to land. To make these defenses even more potent, the Germans sometimes strung cables between the poles that would set off mines on the ground below as a glider tore into these obstacles.

Raymond P. (Ray) Nagell (1922–2016) was born in Minneapolis, but he grew up in nearby Mound. After he finished tenth grade, Ray quit school to work for his father, but then he got drafted in 1942. From Fort Snelling he was sent to Fort Bragg in North Carolina for airborne training as a glider man. At Fort Bragg, Nagell and others were taught how to load a CG-4A with either a jeep or a 75mm howitzer. The tie downs were critical to holding the load in place during flight and for quick removal of the cargo after landing. When loading a jeep, for example, they would compress the jeep's springs so it wouldn't bounce in flight or on landing. Loading the howitzer required proper stowage of its ammunition supply.

When interviewed in 2013 about his wartime "gliding" experiences, Nagell said that on his first trip up in a glider, he "looked out the window and the wings were flapping and I thought they're going to fall off," the noise level was "terrible. You couldn't talk in the glider. It was so noisy." The view also wasn't the best, but the CG-4A had a series of small windows on both sides of the fuselage, and the glider riders could also see ahead through the Plexiglas nose of the aircraft. So they had some sense

of what was going on around them as they flew. Ray pointed out, however, that he and the other men in the fuselage usually could not see the tow plane ahead. The glider pilot had to position the glider above the tow plane to avoid the prop wash from the C-47's twin engines. Being tethered at the end of a 300-foot tow rope, "we could get up pretty high or go sideways. We could steer it anywhere behind the [tow] plane."

In the summer of 1943, Nagell, who was now a member of the 321st Glider Field Artillery Battalion of the 101st Airborne Division, sailed with the rest of his division to England. Ray's ship was in a convoy, zig-zagging across the Atlantic when it encountered fog. In the fog, another ship "didn't zig" and the two ships nearly collided. Once the division (about 12,000 men) reached England, his unit continued its training near Oxford in anticipation of the cross-channel assault on the beaches of France. Because Ray's battalion was part of the field artillery, he and four others assigned to the same glider were trained to fire a 75mm howitzer. One complication they knew they would face when landing in the midst of combat was locating another glider carrying a jeep. Each howitzer needed a jeep for tow, and under combat conditions, there wasn't a lot of time or opportunity for locating the jeeps, so their tasks were always fraught with a great deal of risk and uncertainty.

Shortly before D-Day, Private Nagell, who was then about twenty-one, and the other glider riders were told that they would not be flying into France. Instead they would go by ship. The division's glider units were assigned to two ships: one would

transport their equipment; and the other, the USS *Susan B. Anthony* (AP-72), would ferry about half their personnel, as well as about half of the men in the 90th Infantry Division, to Utah Beach at Normandy. At approximately 7:30 on the morning of D-Day+1, the *Susan B. Anthony* hit a mine about half mile from Utah Beach. Although there was no loss of life, Ray recalled the chaos:

> So we had our packs on and sleeping bags and all that stuff. So we were really loaded. All of a sudden [the ship] hit that mine. It was like hitting a brick wall. You wouldn't think a mine would stop a big ship like that, but we all fell over. We were overloaded too. Standing up. We were supposed to get off in ten minutes. Everybody fell down. All the lights went out. We were on E deck. That's the deck [just below the main] … deck. We were lucky there. The other guys were down below. It was 90th Division was down there. We had half of 90th and half of our division.[130]

Fortunately cool heads took charge, and three nearby British ships used skilled seamanship to evacuate all the soldiers from the *Susan B. Anthony*.

Ray and others were then transferred from the British rescue ships to LCIs, small landing vessels that took them close to the beach. The LCIs got as close to shore as they could and then lowered their front ramps, allowing the men from the 101st Airborne to walk through the surf onto Utah Beach. Once these glider troops were on the beach, they had to wait for the other ship with their equipment to arrive, which took two days. In the meantime, Ray and the others in his division endured sporadic rifle and artillery fire from the Germans during the day and periodic strafing and bombing from Nazi aircraft at night.

After their weapons, ammunition, and other gear were ferried ashore, the glider troops joined the effort to expand the U.S. lodgment in the hedgerows of Normandy.

According to Ray, none of these airborne troopers had had any training in small-unit tactics for fighting in this type of terrain. They learned on the job and subsequently spent twenty-nine days in combat, moving half way across the Carentan Peninsula before they were relieved and sent back to their base in Oxford. According to Ray, his unit lost 64% of their men, who were either killed, wounded, or missing in action, over the course of those twenty-nine days.

Unlike Ray Nagell, an airborne trooper who arrived in Normandy by ship, Kermit J. Swanson of Dassel, Minnesota, actually landed in Normandy in a CG-4A. Although Swanson's arrival was not perfect, he piloted one of the many gliders that were sent to reinforce the paratrooper assault. Kermit had always wanted to be a pilot, but with only a high school diploma, he knew his chances of joining the USAAF were pretty slim. So in the spring of 1940, he left his dad's farm in Dassel and went to Chanute Field near Chicago where he signed up to become an aviation mechanic. When the Japanese attacked Pearl Harbor in December 1941, Swanson was working at an air base in Texas. He had recently returned from advanced training where he had qualified as an instrument specialist.

Because Swanson had been taking private flying lessons in his spare time and had gotten his pilot's license, the air force allowed him to take an equivalency test so he could apply for flight training. He took the test and qualified, but his previous training would stand in the way of joining the USAAF. His commanding officer needed to send

an instrument specialist to North Africa in early 1942, which took a higher priority over the waiting list for flight school. At the same time, Kermit learned that the demand for glider pilots took an even higher priority over a trip to North Africa. So he promptly signed up to become a glider pilot.

Kermit initially trained in Spencer, Iowa, where he flew small planes and learned how to maneuver "dead stick" landings, landings without any engine power. He didn't see his first glider until he arrived in New Mexico for additional training. There the glider training, which included night flying and grass-runway landings, got progressively more challenging. During this training, Swanson learned the importance of a wad of chewing gum. He found, for example, that if he put a wad on his windshield to mark when his plane was level, then he could use any movement of the wad of gum to tell him if the aircraft was going up or down and not maintaining level flight. For these training flights, enough sandbags were stowed in the fuselage to replicate the weight of carrying a jeep, common cargo of the CG-4A gliders.

After about a year of training, Swanson qualified as a flight officer and was sent to England in the winter of 1943–1944. There he was assigned to a squadron at an airbase near Reading, a city located about forty miles west of London. When asked about the differences between flying a Piper Cub and a CG-4A, Swanson answered, "Not much at all. Not much as flying goes. Judgment is a different thing. A very

different thing.… Life or death depended on your judgment [in a glider] because you were going to get but one chance. It wasn't hard [flying a glider]."

The quarters assigned to the glider pilots at Reading were very rudimentary. Initially they lived in tents, but when the snow started blowing in, the glider pilots moved into glider shipping crates they converted to living quarters. "They just took a bunch of the boxes and put in a sewer system," Swanson explained.

Swanson was geared up and ready to head for France on the night of June 4, when he learned that the assault had been called off due to bad weather over the English Channel. The next night, he boarded his CG-4A and took off at approximately 11:30, right behind the C-47s carrying paratroopers. Swanson wore a flak suit over his overalls and had a 45-caliber pistol, a submachine gun, and some grenades in his glider. Amazingly, parachutes were not provided the glider pilots and riders. A piece of armor plate the size of his seat with a cushion on top for comfort was his only other protection from flak during the forty-mile flight across the Channel. Swanson's cargo that night was a jeep carrying four airborne glider troops and a trailer carrying ammunition and machine guns. Once they were airborne, the tow plane's pilot headed south over the ocean, intending to land from the landward side once they reached France. That way they would be more likely to avoid any German flak protecting the beaches. The weather was poor, Swanson, recalled.

> It rained and you went through some scud clouds. We were flying and all you saw was the [tow] rope. Sometimes you got in the fog and you couldn't see the tow plane

> anywhere. You looked to see how the rope was hanging. … It was about one o'clock at night.
>
> We approached that landing zone … . The light [on the tail of the tow plane] came on. Green was to get off and we looked down and that was no good because it was just as black as soot down there. You couldn't see nothing down below. There wasn't any lights on any houses or any cars moving or anything. Everything was dark.

At about 500 feet elevation, he cut the glider loose from the tow rope, and headed down into blackness, hoping for a landing area where they could arrive in one piece:

> My copilot was telling me my airspeed and my altitude. It was enough so that you could see … you couldn't see the skyline but you could kind of see where the earth and the sky was and that's how you kept your wings level. … .
>
> Then [my copilot] told me the airspeed and I had to keep the airspeed at about seventy … at least seventy miles an hour. You'll start stalling at about fifty-five or sixty. Sixty with a load. …

By maintaining his airspeed, Swanson was able to control the glider's descent, but he still couldn't see the ground below.

> Now it's down to four hundred feet or three-fifty. Something like that. Turned to the left and waited until I got down to about two hundred feet, made my last turn in to land and from there on all I did was just sit there and had it at about sixty-five or seventy miles an hour. Right above stalling speed. I didn't want to hit a tree any faster than I had to. [My copilot] was calling off the altitude a little bit. Still you couldn't see the ground. It was still so dark you couldn't see a tree or nothing; and pretty soon there was a crash and I hit this tree, but I hit it with the wing. … I never did know how far in on the wing I hit it, but I must have not been in where the trunk was because it turned the glider this way a little bit and the next thing … I didn't know how high I was right then. Now you was getting down to where the altimeter doesn't tell you very accurate. I think I hit that tree at about twenty feet up, something like that. Then we fell for the next twenty feet. Got caught. That took the wheels off and then I slid to a stop.

Swanson "landed" his CG-4A on its belly "not too far from Ste.-Mère-Église," which was one of the most important objectives for the paratroopers. In Swanson's words, "That was a good landing. … So we had the boys on the coast [that is, Americans on the beach] on one side of us when we landed and we had the Germans, that armor [in

reserve away from the beaches] and stuff over there on the other side." After the glider came to a stop, Swanson recalled:

> It got quiet and we just sat there for a little bit. Then decided that we'd been this far we probably should get out of this box. Got out of the box and it was dark and it was about one o'clock at night, I guess. I had four men in the jeep and now there were six of us. We sat down together and tried to decide what we should do. They were looking for the military part of this thing. The copilot and I, we were looking for the same thing.

Safe on the ground, they had no idea where they were or in what direction they should head to join up with other Americans:

> Then when we were sitting in the dark we thought we heard … it sounded like a vehicle over here probably a quarter of a mile away or something like that. And that was the only sound we heard for a while. Then after a while we hear another one.
>
> My copilot and I, we decided we'll go over. You stay here and take care of this end here. We're going to sneak over and see if this is a road. What are we going to do with this jeep we got now once we get it unloaded? Where are we going to go then? …
>
> [The others in the glider] were unloading and the copilot and I we went over [in the direction of the noise]. We snuck through the woods. It was in the woods and some big trees in there and we got closer and closer to that road and once in a while you'd hear the vehicles so we knew there was a road there and we got closer and we weren't far from the road. I think … within a hundred feet from the road and there were some rocks and some trees there. …

Because French farmers would frequently pile rocks from their fields as fence lines, Swanson and his copilot knew the road was probably twenty to thirty feet away.

> All of sudden BANG! it went. Right across the road from us. It was really dark and quiet. We stood still and quick got behind a tree. We heard where it came from. Didn't know who it was or what. Stood there for a while. Pretty soon BANG! it went again. Waited a while. Did you ever see that cricket that they used? We all had one of them. Everyone had [a cricket] … that's their life or death, that cricket. Took that thing out and snapped it once and stood real quiet. Hiding behind the tree. Nothing happened. I snapped it again and I waited. Pretty soon it snapped, and then it snapped again. Then I snapped. Then he snapped. Then we worked toward the road and he was a paratrooper.

Swanson quickly learned they had found a lone paratrooper who had landed on the other side of this road. This paratrooper didn't know where he was either, but he was grateful to meet some Americans. Swanson continued,

> So … we motioned for him to come across the road to us. He came over there and we were sitting in the dark and pretty soon here come a vehicle down the road, and it looked kind of like a staff car. It was pretty dark, but it wasn't going very fast because you couldn't see. Pretty soon he got about … a few hundred yards from us down the road and BANG! It went and got quiet. Pretty soon it went BANG! again and then got quiet. After a while didn't hear nothing more.

Swanson soon figured out what he thought had happened in those tense moments.

> I think he had heard us. … . The [paratrooper] shot a cow over on the other side of the road. That's what he shot at. Something was in the bushes there and he was a paratrooper and he was alone over there and something was moving in there. I don't know if he snapped at all, but I didn't hear no snapping when he shot, but he heard when I snapped. Then he said he checked and it was a cow he shot.

Then another paratrooper, who had landed just up the road a little bit, took a shot at what they thought was a staff car, but in the dark they weren't sure if it was a military vehicle or not. This second paratrooper had a grenade launcher on his rifle and he let one of the grenades go, but it just went into the ditch. After a while he sensed there was something moving, so he sent another grenade in the direction of what they thought was a car. When there was no more movement on the road, this second paratrooper found Swanson and the others who were with him. Swanson then recounted what the four Americans did next,

> We went back to where our glider was and they were unloading over there and had gotten the jeep out and stuff. Our load was all intact. Of course we'd never been hit [by flack or ground fire].
>
> Then at daylight … I don't remember what we did for the next day or two. We didn't do much at all. We didn't see much or do anything. There was quite a bit of fighting going on, but we weren't involved in it. It seemed like it was a distance from us.

> We were about five or seven miles or so we estimated to Ste.-Mère-Église and that was the seashore. This road was leading that direction so we figured if we could get out on this road … we had a jeep … we could take this jeep and go until we found somebody that wanted it. We was getting there and after it was daylight, well afterwards, I think we was there for another night … where we landed and didn't see too many people. … But then … later on we moved over close to the road and then we hailed down a truck that came and he was going back, coming up with a load and then he was going back to the coast again. So we rode with him back. Then they had just gotten the invasion cleared up a little bit. This was probably about the third day after they hit the beach.[131]

The language that Kermit Swanson used in his account of his experiences at Normandy mirrors his understanding of what happened: a tense flight and landing followed a lot of confusion; a shared uncertainty about what to do next; a cautious attempt to get his bearings, followed by an inability to see where he was and what was happening nearby; and of course, a willingness to improvise when necessary. Despite the many obstacles encountered in those first hours in France, good judgment soon brought Swanson and his unnamed companions of June 6 to relative safety on the beach, and for Swanson, a quick return to England.

Harold A. Shebeck (1915–2008) of Richfield, Minnesota, another glider rider of the 82nd Airborne Division, also landed near Ste.-Mère-Église on the same day that Swanson landed his CG-4A there. In 2008, shortly after Shebeck's death, reporter Ben Cohen wrote a tribute, recounting Shebeck's experience on that historical day. Shebeck had taken a nap during the flight across the English Channel to Normandy because "there was nothing else [he] could do about it up in the air" and he knew that once he was back on the ground in France, he was "not going to get any sleep." In the midst of

all the chaos after Shebeck's glider landed, a Frenchman appeared who told Shebeck and his group about a nearby town, recently abandoned by the Germans, where they could get food and shelter. Shebeck, who was an officer, told a sergeant to go with the Frenchman to check things out. The sergeant, who was not the most savvy trooper in Shebeck's unit, soon returned and reported that he had learned "the most amazing thing" about the town: "The people [there] all spoke French, even the little children."[132]

Although Kermit Swanson's memories of his glider landing on D-Day are full of the tension and drama of an airborne assault, the AAF also used gliders for medical operations in Normandy that supported front-line soldiers. Richard F. Noland (1922–2009) interrupted his studies in chemical engineering at the University of Minnesota to serve in a burn unit that was attached to the U.S. Army's 192nd General Hospital in Cirencester, in western England. This hospital, typical of those found in the European theater of operations, had more than 1,000 beds housed in semi-cylindrical, metal Nissen huts on concrete foundations. Because so much acreage was needed, these hospitals were generally located in parks or on country estates. Noland and his colleagues would fly by glider to France in the days following the Normandy landings, to treat wounded near the front lines and then arrange their transportation back to Cirencester. Drawing on the experience of British medical personnel, U.S. Army doctors recognized that treating burn wounds as quickly as possible greatly improved the soldiers' chances of survival. Thus, getting to France by glider, which was never routine

for Noland or other medical personnel, was fast and flexible because the gliders didn't require a prepared landing strip. As a result, these medical evacuations by air proved efficient and beneficial for the patients.[133]

The Allies followed the cross-channel attack on Normandy beaches with landings in southern France on August 15 in Operation Dragoon (previously code-named Anvil). For this American-British-Free French assault, which involved more than 400 gliders, most of the aircraft and troops were moved from England to airfields in Italy. When they received the signal to take off, more than 9,000 paratroopers and glider troops made a daylight attack in the area between Toulon and Cannes. Although glider losses were heavy due to ground fog, obstacles in the landing zones, and a few midair collisions, the landings on the beaches were largely unopposed and went ahead nearly flawlessly. In terms of numbers, parachute and glider troopers (11 glider pilots killed, 30 pilots wounded, and about 100 glidermen injured) were light.[134]

Lloyd J. Jackson (1918-2007) was a member of the 551st Parachute Field Artillery, 1st Airborne Task Force, U.S. Seventh Army that participated in Operation Dragoon. Born in Duluth, Jackson graduated from Denfeld High School and joined the Minnesota National Guard in 1936. By 1941, after the National Guard was called into federal service, Jackson wound up with the 125th Field Artillery Battalion of the celebrated 34th Division, also known as the Red Bull Division. He subsequently fought the Germans in

North Africa and Italy in 1942–43 before participating in the landings in southern France.

Prior to the landings in southern France, the Germans had planted anti-glider obstacles ("Rommel's asparagus") throughout much of the Le Muy area where the airborne units were planning to land. French workers who had been forced to do the "planting" had deliberately placed many of them in shallow holes with loosely packed dirt around them. Thus, when the gliders came in for landing, they still wound up in shambles, but personnel losses and cargo damage were minimal. Once the 1st Airborne Task Force was on the ground, it established a strong blocking position along the Argens Valley and isolated the beach area from German reinforcements.

In the following weeks, the U.S. Seventh Army and its British and Free French allies slowly moved northward from the beaches toward the German-held city of Strasbourg on the Rhine. The 1st Airborne Task Force was assigned to cover the southern third of the Allies' right flank along the Franco-Italian border, which stretched 190 miles from Switzerland to the Mediterranean. During this phase of the campaign, Lloyd Jackson earned his Purple Heart when he was wounded in action on September 29, 1944.

Unlike the airborne operation in southern France, the attack in September 1944 on German-held bridges in Holland was a costly one. Market was the code name for the airborne operation, which was combined with a British armored ground attack, code

named Garden. Operation Market Garden was designed to strike from Belgium into Holland and was intended to capture six key bridges, the last of these spanning the Rhine River at Arnhem. Allied planners expected that their combined air and ground forces could take all the bridges, which would provide them access to the Ruhr Valley, the heart of Germany's industrial power.

One of the critical elements of this plan was to have the airborne units seize several major waterways and railheads in advance of British tanks. Although Allied paratroopers and glider troops did capture several of the targeted bridges, even the bridge at Arnhem, the joint operation failed. British armored units were unable to reach Arnhem before the Germans mounted a counterattack and retook it. Of the 2,900 British and American gliders utilized in the entire Holland offensive, about 1,200 gliders and some 7,000 troops landed near the Dutch city of Son and attempted to reinforce the paratroopers who were already on the ground.

In preparing for the airborne assault, the USAAF in England had more than 2,100 CG-4As available but only 2,060 glider pilots. A command decision was made, eliminating the copilot and filling that seat with another trooper who was not trained to fly. Another complication to the airborne part of the mission was a shortage of C-47s. The USAAF and the RAF lacked the necessary C-47s to deliver all the paratroopers and all the gliders on the same day. So it was decided that the C-47s would deliver all the paratroopers and only some of the gliders on the first day. The following day, C-47s

would tow the remaining gliders, a much larger proportion, to their landing zones. By launching the glider assault over successive days, the Allies lost the element of surprise and reduced the offensive push once on the ground. It also forced some of the troopers who landed on the first day to remain at the landing zones to hold them for the second-day landings.

Despite all the effort and resources dedicated to Operation Market Garden, the Allies suffered severe losses and could not overcome the stout, German resistance in Holland. In addition, bad weather and the slow advance of British ground troops hurt the Allies' chances for taking and holding their objectives. There would be no crossing of the Rhine in 1944.[135]

Walter Chronkite, the famous CBS TV news anchor, was a reporter for the United Press in September 1944 when he flew in a glider participating in Operation Market Garden. Many years later, Chronkite described the experience, "like attending a rock concert while locked in the bass drum." The noise from the fabric covering the fuselage "beat against the frame with enough decibels to promise permanent deafness." When the glider pilot dropped the tow rope to begin his descent, the aircraft "dropped like a stone—plunged straight down, it seemed to me . . . ." Chronkite's glider did land safely just as two other gliders "collided almost above us, and a jeep and a howitzer, and soldiers, came crashing down."[136] And to emphasize his harrowing experience, "I'll tell you straight out: If you've got to go into combat, don't go by glider. Walk, crawl,

parachute, swim, float—anything. But don't go by glider."[137] Perhaps due to different circumstances, Hal Roed, one of the Minnesotans with the 13th Airborne Division, didn't find glider riding as deafening as Walter Cronkite did.

Roed's paratrooper unit was training outside of Paris in the spring of 1945. On Sundays, after their long runs, they had the rest of the day off. On an adjacent field, he noticed about a half dozen CG-4As and C-47s practicing snatch take offs, a technique whereby the C-47, flying low, would snatch the glider's tow rope from a frame and quickly jerk the glider into the air. Once airborne, the C-47 would tow the glider in a big circle, then release it, so the pilot could practice landing the glider to prepare for another snatch.

Roed jumped the fence alongside the landing area and asked one of the glider pilots if he could get a ride in his glider. Invited to come aboard, Hal sat on one of the benches in the fuselage, making five or six glider trips that day. Asked about the noise level, Roed said: "It was noisy. It was a thrum. Just a constant thrumming. I don't know where it was coming from, whether it was just the wind buffeting the cotton [fabric] sides or the tow rope or just what. It was not an unbearable sound at all.[138]

In a 2013 interview, Roed unwittingly responded to Walter Cronkite's opinion of gliders when addressing the differences between being a paratrooper, which he had been, and being a glider rider. Roed began by saying, "it was fun to be in that glider, but I think I'll take my chances with a parachute anytime." Roed had made a total of

fifteen successful jumps during his time in the airborne, but he also had a great deal of respect for the glider troops:

> There was some general or someone of higher rank that … after the war in a speech … he made the comment, "If you're going into combat, run, crawl, swim, walk, ride a jeep, ride anything but don't be a gliderman." So it was a tribute to the glidermen that … they were put in a position that they had nothing to say about. They had no control over it and yet it was, as far as I'm concerned, all at the whim of fate where they landed. In combat, there's no picking and choosing. … So, personally, I have a lot of regard for the glidermen.[139]

As with nearly every weapons system in wartime, gliders prompted strong opinions about their value and performance in combat from astute observers of differing backgrounds.

Ray Nagell, who was aboard the *Susan B. Anthony* on his way to Utah Beach, also participated in Operation Market Garden. Because of the shortage of C-47s needed for transporting paratroopers and gliders, the USAAF had experimented in early September with towing two CG-4As behind a single C-47. They found that the C-47 could manage the double-tow, but the additional weight involved, along with the estimated three hours of flying time from the airfields in England to the landing zones in Holland, was more than the C-47 twin engines could handle.

During these preliminary tests, the C-47's engines would overheat, which didn't solve the C-47 shortage for the Holland operation. Although Ray knew about the double-tow tests, he was not told about the upcoming mission until the night before the operation began.

Ray's unit was assigned to go into Holland on the second day, September 18, 1944, another foggy England morning with very limited visibility. Rather than take off right after breakfast, the gliders waited until around 10:00, but it was still foggy. According to Ray, there were sixty gliders headed east and "I don't know how the pilots could see. … We couldn't see the [tow] plane. We were just following the rope." All was going well for the first ninety minutes flying over the English Channel, but then, as Ray recalled:

> All of a sudden the damn plane [C-47] down below … he slows down. We don't know [why]. No radio contact. He slows down. He's running into [another] glider. … So we're flying along and we passed up the plane that was pulling us. … They were looking up at us and we were looking down at them. … They speeded up. About four tons in the glider total. I thought that rope is not very big and it's three hundred feet long and I thought when that [rope] tightens up, if it broke, we'd go down, four tons, right into the Channel. But anyhow it didn't break. So he got out of our way and tightened it up and we're going along again.[140]

The tow plane and Ray's glider were safe for the moment, but they were still flying through fog. Then Ray saw a different C-47, towing another glider, cross the tow rope pulling his glider. Ray's glider was above this other C-47 and there was another glider behind his. "Two gliders. Our ropes were twisted now. … But then they saw each other; so then the planes backed off and we backed off. Didn't twist the rope at all. … So we got out okay."

Once free of this latest danger, Ray realized that his C-47 pilot had decided not to go due east. Instead, he veered slightly off the course to Holland and soon was flying over France or Belgium where the sky was clear. Clear skies, however, brought them

the antiaircraft fire from below, and to avoid as much of the enemy's fire as possible, the C-47 pilot headed down to the rooftops. Ray could see the gunners below, close enough that he could have dropped a hand grenade on them. The glider remained under fire for about half an hour, but amazingly, neither the glider nor its crew were harmed.

Ray's CG-4A reached its target area about six miles past the Dutch city of Son, also known as "Zon," the site of one of the target bridges. As the C-47 released the glider, Ray could see the paratroopers landing in the potato fields below. "Then some C-47s were forced down. Some crashed in there. … We were coming in and there was a[nother] glider on our left and there's water ditches in Holland everywhere. Both sides of the road." Then the glider pilot of Ray's CG-4A did something totally unexpected:

> But this glider on our left, he was slowing down before we were and going to land and our pilot saw that ditch going this way and he was going to go right into it. So he put his [left] wing on top of [the right] wing of this [other] glider and we skidded, both skidded right up to the water. It was about four or five feet away.

Thanks to some quick thinking and strong nerves, both gliders landed safely and no one was injured. With a howitzer in their glider, the pilot, Ray, and the gun crew rolled it out and then headed for a nearby road to wait for their jeep, which was coming in another glider. As soon as that glider landed, they hitched the howitzer to the vehicle, and headed for Son and the bridge over the Wilhelmina Canal. When they got there, they found the Germans had blown up the bridge about two hours earlier.

Their secondary mission was to keep the road to Eindhoven, about five miles away, open. By mid-afternoon they had taken up their positions along the road while they waited for the British tanks and ground forces to arrive. Eventually, the British armor showed up, but direct fire from the German 88s in the area pummeled the tanks and infantry. Using their howitzer, Ray and his crew defended themselves as best they could, but their efforts and those of the other glider artillery failed to alter the outcome.

For sixty-nine days, regardless of the weather, Ray and his howitzer crew and the others of the 101st Airborne battled the Germans. Their only shelter from the rain was their pup tents and their rain coats. By the beginning of November 1944, however, the tables started to turn. The Germans tried to break through the American line but by that time, and with the aid of their forward observers, the Allies had zeroed in their artillery. As a result, the Germans took heavy losses because they lacked sufficient artillery to counter the barrage of incoming fire. According to Ray, the British and the Americans killed many Germans that day. The action between Son and Eindhoven had been horrendous, and as Ray recalled, "about two days later rain and sunshine and the stench. … Just hamburger out there. … There's nothing worse than dead bodies. … We couldn't stand it. Couldn't even eat." By November 25th, Ray and his unit were sent to an empty camp in France where they found hot water and beds.[141] The fighting in Holland had taken its toll on the 101st Airborne, however. The division suffered 375 soldiers killed and 1,307 wounded.[142]

After his experiences at Normandy, Kermit Swanson also participated in Operation Market Garden. Like Ray Nagell, he went into Holland on the second day. He recalled that the gliders that flew on the first day "got smeared" and he "lost several friends in that one." Swanson had left Reading, England about 11:00 that morning, flying into Holland across an area that the Germans had flooded. That meant there was no antiaircraft fire. As he explained,

> I knew exactly when I was supposed to be at that bridge [at Son], when I was going to land. I had another minute or so left and a couple, three or four bullets went through the windshield from behind. Right up past my leg. I didn't see them or hear nothing …. Just the bullet holes. Kept on going. Made a good landing. Didn't hurt the glider or nothing.[143]

As he had at Normandy, Swanson delivered a jeep and a crew of four to Holland, landing "within a mile or so beyond the bridge." Swanson could see that the Americans had taken control of this bridge at Son, but the British were still having problems with the next two targets, including the last bridge at Arnhem.

Successfully completing his delivery of the jeep and its crew, Swanson and his copilot decided to head for Paris. They had been told to go to a city in Belgium whose name he couldn't remember, but as he explained, "Nobody knew where you were or when you was going to get back or cared. Just so you GOT back. You had to take care of yourself." Paris had recently been liberated (August 25th), "So we decided Paris is just right now." The two glider pilots spent a few days in Paris, enjoyed a free room and board in a hotel, and then caught a plane ride back to Reading.[144]

Lyle Sande (1923–2014) of Willmar, Minnesota, and later Sioux Falls, South Dakota, was another airborne trooper who landed in Holland on September 17th. A member of the 82nd Airborne Division's 325th Glider Infantry Regiment, Sande had enlisted in November 1943. Also a Normandy "veteran," he had parachuted into that offensive, but in the Holland operation, he arrived by glider. Experiencing the same combat intensity that Ray Nagell did, Sande was wounded in the back near Mook, Holland, south of the bridge in Nijmegen on the Waal River, another Market Garden target. Evacuated to the 188th General Hospital in England, he recovered from his wound and returned to his company to fight in the Battle of the Bulge.[145]

Another member of the 82nd Airborne Division, Staff Sergeant Henry C. Langevin of Roseville, Minnesota, considered himself a "handcuffed volunteer" when a glider took him into the Holland offensive. His battle days started when he arrived at Casablanca on a troop ship during the assault on North Africa in 1942, and in July of 1943, he had parachuted into Sicily in Operation Husky. When Langevin's group of gliders arrived over Holland on a bright, sunny day in September, they were completely exposed to German antiaircraft fire. On its way in, his glider hit some trees as it neared the ground, but Langevin was able to get out of the aircraft and dig in. Some of the other approaching gliders were not as fortunate and were shot down.[146]

Despite all the hard fighting in Holland, the Allies slowly advanced eastward and in the fall of 1944, they entered Germany itself. Hard pressed but determined, the

Germans tried to defend their homeland at all costs. In mid-December, they launched the now-famous attack to recapture the Dutch port of Antwerp which resulted in U.S. ground forces getting caught up in the Battle of the Bulge.

Among their initial successes in this westward thrust, German soldiers captured the entire medical staff of the 82nd Airborne Division, which was in great peril at Bastogne, a key road center in the Ardennes region of Belgium. The division held out against the surrounding enemy until a single CG-4A was deftly able to land inside the U.S. perimeter at Bastogne to deliver a new team of surgeons and much-needed medicine. Soon thereafter, 64 gliders also resupplied Bastogne's defenders with gasoline and ammunition to help them out until the poor weather broke. After the weather broke, Allied air support returned, and General George Patton's tanks arrived to break through to the beleaguered town.[147]

Ray Nagell got caught up in the Battle of the Bulge, but this time, he didn't arrive in a glider. His unit had been held in reserve in France following Market Garden, and on December 17th, the division got the word that they would be leaving the following morning. "We went just as we were. And we got up there [to Bastogne] and we weren't ready for winter at all."[148] Most of the men had only their helmets, jackets, and fatigues for warmth, no overcoats, no long underwear, and no gloves or hats. "And," as Nagell emphasized, "it got real cold." Ray and his gun crew spent thirty-one days defending

Bastogne, supporting the infantry and other airborne units with their artillery, and even capturing a German Tiger tank.[149]

By late January 1945, the Allies had completely halted Hitler's surprise thrust toward Antwerp in the Ardennes Forest. Roughly one in ten U.S. combat casualties of the entire war occurred in the Bulge where more than 60,000 soldiers were wounded. Survivors such as Ray Nagell could see that their enemy was not yet ready to surrender. Consequently, the U.S., British, and Canadian ground forces continued their advance toward the German heartland, confident that they needed to cross the Rhine River and strike toward Berlin if they were to achieve victory against such a determined enemy.

Unlike the plan for the airborne attack on Holland in Operation Market, all the British and American gliders made their assault across the Rhine on the same day in the largest glider operation of World War II. This air and ground attack, known as Operation Varsity Plunder, took place across the Rhine River near the city of Wesel on March 24, 1945. In all, 1,346 British and American gliders participated in the push across the Rhine, code-named Operation Varsity. C-47s transported 17,000 paratroopers and glider troops from airfields in England and France in the airborne assault preceding the ground attack.

In order to maximize the number of gliders for Varsity, most C-47s did take on dual tows, resulting in the largest USAAF operation using this configuration. Varsity proved to be a success with 883 CG-4As delivering the U.S. 17th Airborne Division,

including more than 4,800 troops, 645 vehicles, 43 heavy guns, and more than 1,000 tons of cargo. But airborne losses were also very high on that day. Many gliders went up in flames because enemy tracers ignited the wooden wings and floors and the fabric skins. Others collided with trees, poles, and other gliders at their landing zones. And many others were destroyed by German gunfire alone.[150] To describe the horrific losses of Varsity, historian Rick Atkinson wrote, "Once again, airborne forces appeared to be coins burning a hole in the pockets of Allied commanders, coins that simply had to be spent. Soldiers soon mocked the operation as VARSITY BLUNDER, and burial squads with pruning saws and ladders took two days to cut down all the dead."[151] Despite the losses, Varsity was a success and it allowed the Allies to land a large, concentrated offensive force at the point of attack very quickly.

As he had done for the Normandy invasion, Kermit Swanson also piloted a glider in Operation Varsity. As he approached the Rhine River on March 24th, he knew that this time they would be facing heavy antiaircraft fire. Although his earlier experience in France had landed him in the trees, his landing this time was far more precarious:

> I approached the [Rhine] river middle of the day and just started over the river when I felt the first thud and I knew something hit us in the tail back there somewhere and my rudder pedals went slack. … But the elevators worked. Boy, that was a relief. They can have the rudder. I'll take the elevators. Then the next shot … hit between the tail and the cargo section and there's just tubing and stuff. It went through there. The next one hit underneath the jeep and exploded. The tires blew on the jeep and the oil and the gas you could smell it all and there were four men sitting in the jeep.
>
> The next, fourth one, hit under my copilot's seat. … He was sitting on that armor plate and it came up and it hit right in that armor plate and it blew his legs up. They were

> hanging down here and it blew his legs up real bad, especially one of them. … We had flack suits on and sitting on this armor plate. So back where he was sitting, the only exposure he had was his legs and me. …
>
> It exploded under his seat and then outwards this way and up and it got me in [the right] leg and [right] arm because that isn't covered by the flack suit and I must have been talking to the copilot because I had my head turned this way and a piece of shrapnel went in right … in my cheek and right back out again. Never went in to touch my teeth. It never bled inside my mouth but went in … and out again. If I had been looking [the other] way, it would have gone in here. … That's how close you can get. Other than that … my copilot was shot up bad. I had this shrapnel in my legs.

Although both Swanson and his copilot had been hit, they still had about four or five miles to go, or another ten minutes, to get to their designated landing circle. Miraculously, they made it to the site with the glider still intact. According to Swanson, they "Made the circle and landed and made a pretty good landing." Once Swanson had his CG-4A on the ground, he immediately gave medical attention to his copilot, Steve Crowser:

> I told the four guys sitting in the jeep back there, "See if you can open the back door."
>
> There's only two doors on those gliders, one on each side and if you take a look they're back quite a ways back into the cargo section. …
>
> "Can you open the door? If you can't get the door open, how are you going to get out of this box? Maybe you can try to crawl between the ribs somewhere, but otherwise you can't get out of it."
>
> So one of the guys got unhooked and he opened the door. I was glad of that. I said, "Now come and get a hold of my copilot. We've got to drag him out. He's bleeding bad. Drug him out on the ground there."
>
> I was all blood. You know how it bleeds if you cut yourself in the face. It wasn't so bad. It was quite a gash, but it wasn't so serious; but I was all bloody. We got him on the ground there and then I had a kit in a leg here, a medical kit, and got that out and we had this rope and this stick in there.
>
> I told them cut the … we all had knives on us too, trench knives … cut his pants off and rip them open so we can get at his [leg] … above the knee. They did and we got it open and we got a cord around [his leg] and we twisted it tight [to make a tourniquet] and we shut [the bleeding] off. That's good because he gushed out and [the tourniquet] shut it off. We put [a tourniquet] on his other knee too because it was bleeding some.

Recalling all the action, and even though he had been bleeding profusely, Swanson couldn't even remember any physical pain. After attending to Steve Crowser as well as they could, Swanson's crew turn their attention to him:

> I was bleeding pretty bad out of [my cheek], but I wasn't losing that much blood; but the shock was getting me. They gave him [Crowser] a shot [of morphine] and pretty soon he came to. He was laying on the ground and they were working on him and he began coming to again and about that time I was about to go under from shock.
>
> So they gave me a shot. Morphine. It releases the nerves in your neck, the muscles in your neck. Pretty soon you can start seeing again. I was bleeding pretty bad in the face here. They put patches on. We had a lot of tape. Put some gauze on. Pulled my cheek together this way and taped it up so that it couldn't bleed out. That seemed like that would help there. … That was about all that I was hit.[152]

Understandably, Swanson remembers few of the details of what followed. He thinks medics put him and his copilot on stretchers and laid the stretchers across the hood of a jeep to transport them to a hospital in Eindhoven. "We got aid pretty fast….. I can't think of the name of the town [Wesel] … but they had a hospital, civilian hospital, there and they took us to that hospital and took him in there because he had pretty near died."

In just two or three days, Swanson had recovered enough that he could have been released from the hospital, but Crowser, a former bartender from Wisconsin and Swanson's copilot for the missions at Normandy, Market Garden, and Varsity, needed about ten days in the hospital before he was allowed to even walk on crutches. Swanson stayed with Crowser until his release, after which they both were sent back to the States on a returning bomber. Operation Varsity would be the final glider operation in the European theater, but it wasn't the last one conducted during the war.

The last use of gliders in World War II combat took place in the Pacific theater on June 23, 1945, when seven gliders delivered artillery and jeeps to support paratroopers who had landed at a small, remote airstrip in northern Luzon in the Philippines.[153] While this final glider operation was being carried out, Kermit Swanson was on leave at home following his hospital stay, but he had already received orders to report to an air base in California. He was not surprised that he would soon be sent to fight again in the Pacific. Instead, the Japanese surrendered and Swanson was discharged. After some adventures in the West, he returned to Dassel and resumed farming.

At a 1994 gathering at Holman Field in St. Paul to commemorate the hard-won victory in World War II, Anthony John Sablak of South St. Paul and his twin brother, James S. Sablak (1923–2012) of Rosemount, briefly documented their experiences while working at the Villaume plant during the war. They worked on the crew that built the honeycomb plywood floors for the CG-4A.

Each floor measured 13 feet 6 inches by 6 feet 2 inches and had 216 individual cells that were glued together within a reinforced spruce framework. Once a floor was assembled, the cellular framework was covered with a thin sheet of mahogany plywood, which provided additional strength to carry the glider's cargo. The completed floor itself weighed only 300 pounds, but its unique design required 420 clamps to keep it together during the gluing process.[154] The extensive use of glue in the entire glider building process, of course, helped keep the weight down.

Working at Villaume was John's first paying job. His brother, James, considered their time in the Floor Department "a great experience," especially since he would be drafted in 1943. After his stateside training in the USAAF, James was shipped out to France. Once overseas, he saw gliders in action at the front.[155] Although the wartime experiences of the Sablak brothers were not as dramatic or as life-threatening as those who served in combat, the Sablak brothers played the more typical role of those on the home front. When they were in the Twin Cities, they did their part and contributed at war plants such as Villaume or NAC; but when called to service, they went and served their country, wherever the military sent them.

By early 1945, news from Europe created optimism in the U.S. because the Allies had crossed the Rhine, and the Soviet armies were closing in on Germany's eastern borders. In the Pacific, the successful landings at Leyte Gulf and elsewhere in the Philippines represented the progress the Allies were making toward Japan's home islands. But the Japanese were as determined as the Germans had been, and there was still no sign that they were ready to surrender. So, it would seem that NAC still had plenty of gliders to build. John Parker, a proven business leader, was already worried, however, about NAC's future and what his company would do once the fighting ended.

Chapter Six

From Combat Gliders to Computers

In the Chapter Four, Floyd M. Homstad recounted his experiences as a welder at the De Ponti shop on Lyndale Avenue in Minneapolis. He worked for this NAC subcontractor for only a short time before enlisting in the AAF. Eventually he became a pilot flying C-46s and C-47s in the China-Burma-India (CBI) Theater of the Pacific War, where Homstad flew a total of 224 combat missions and was awarded the Distinguished Flying Cross along with other medals for his wartime service.[156]

In the final year of his life, Floyd Homstad became involved with a group of volunteers in the Twin Cities that was restoring a full-size CG-4A glider. When he was asked about his time in the CBI during the war, Homstad liked to tell those who were restoring the CG-4A that one day he had casually mentioned to another pilot at their base in Burma that a particular glider he had been towing was one that he had helped to build before he had enlisted. Understandably, this other pilot expressed doubt regarding Homstad's statement and asked him to prove it. Undaunted by the other man's skepticism, Homstad immediately took him inside the glider and showed him a spot on the glider's welded frame where he had etched his initials, "F.H." No further proof was needed.[157]

Floyd Homstad and his involvement with CG-4As in World War II serves as an ideal bridge between the men and women who manufactured gliders at NAC,

Villaume, and De Ponti; the military personnel who flew or rode in gliders in combat; and a small team of men and women who restored a CG-4A in the twenty-first century. Like many wartime pilots, Homstad followed his passion for flying and became a commercial airline pilot, enjoying a thirty-five-year career with Northwest Orient Airlines (now part of Delta Airlines). He loved flying and he was able to continue to pursue that passion after the war. On the other hand, the Northwestern Aeronautical Corporation was not so fortunate. John Parker had to scramble to find work for his company in late 1945, but hard work and good luck did produce a new opportunity early in 1946. In the meantime, NAC had still had glider contracts to fulfill. Based on local and national press coverage regarding the gliders built at NAC in 1944 and 1945, there were two topics that got most of the coverage: building and testing the CG-13A glider, and the contributions the gliders made to Allied advances on the battlefields of Europe.

In February 1944, the Air Force Association's *Air Force* magazine carried an article written by Lieutenant Colonel Bruce B. Price, chief of the Glider Branch at the Aircraft Laboratory at Wright Field and successor to Colonel Dent. Price discussed the development of the YCG-13 ("Y" meaning "prototype"), which had been designed at Waco and built at NAC. He also discussed the test flight he had made in this aircraft at Wold-Chamberlain. *Western Flyer* magazine, a trade publication for pilots and aviation enthusiasts, also reported on Price's test flight made on November 30, 1943. Even the

New York Herald Tribune chimed in on March 12, 1944, providing front-page coverage of the YCG-13. These and other press releases emphasized how big the CG-13 was and how much more freight it could deliver to the battlefield.[158]

While the press was touting the potential benefits of the CG-13, John Parker and others in the local community were doing all they could to keep up workers' morale at NAC, and to encourage their continued support of the war effort through activities such as bond drives, blood drives, pep rallies, employee sports teams, and public tours and glider demonstrations. His efforts to boost morale were a reflection of his dedication to ensure that NAC did its part to win the war.

Although NAC was receiving a great deal of press coverage, especially after June 6 when the glider proved its value in airborne operations in Normandy, John Parker was also confronted with the harsh reality that once the war was over, the AAF may no longer need gliders. If there were no more contracts coming from Wright Field for CG-4As or CG-13As, what then would Northwestern Aeronautical Corporation do? John Parker owned NAC, the organization he had so diligently built it up between 1942 and 1944. In spite of the frenetic pace to meet war demands, and in the midst of such positive acknowledgement of the gliders' performance in combat, John Parker also needed to look forward to answer the question of NAC's future.

January 21, 1944, was an important day for John Parker and NAC because Lieutenant General William S. Knudsen, the former General Motors auto executive

whom President Roosevelt had put in charge of war production for the army, paid a visit to NAC. Along with a few of his staff members, they came to the Twin Cities to inspect three aviation-related war plants. In addition to NAC, they toured A.O. Smith Corporation at the Minnesota State Fair Grounds in St. Paul, where aircraft-propeller parts were manufactured, and the Minneapolis Honeywell Regulator plant where engineers had developed the C-1 Autopilot for U.S. bombers. Although one Minneapolis newspaper prominently featured a photo of the general and other officers looking at blueprints at the propeller parts plant, the John Parker Collection includes a photo of General Knudsen sitting on one of the benches in a CG-4A across from John Parker while the AAF's resident military representative at NAC looks on approvingly from the copilot's seat in the glider's cockpit.[159]

The same day that General Knudsen visited the Twin City plants, the *St. Paul Pioneer Press* carried an article about NAC employees' complete dedication to the war effort. With increasing numbers of employees purchasing war bonds, they had more than doubled their purchases through their payroll savings.[160] During World War II, the United States sold retail bonds, or debt securities, to its citizens to help finance military operations and other government expenditures. By selling bonds to its citizens, the government could also help control inflation during wartime by removing money from circulation.

When a government resorts to selling war bonds, it typically appeals to patriotism and conscience to promote sales. In World War II, Series E bonds, also known as "defense bonds," sold for as little as $18.75. When these bonds matured after ten years, bond owners were paid $25.00, a return of 33.3% on the face value of the bond. Other bond denominations were also available, but they were not as popular. Anyone who could not buy an entire bond in a single purchase could instead buy ten-cent savings stamps, which were collected in U.S. Treasury-approved stamp albums, allowing bond buyers to save up until they could purchase an entire bond.

There were eight, war-bond drives during World War II and when the war ended, some 85 million Americans had purchased bonds totaling about $185 billion. A bond drive was no small effort, and there was an abundance of advertising through contemporary posters, tours by Hollywood movie stars or other celebrities, and other marketing programs to encourage voluntary contributions to the bond program. Even artist Norman Rockwell helped to market bonds by painting the *Four Freedoms* series, which toured nationally in a very successful drive.

Corporations, such as NAC that received government contracts, played a key role in these bond drives. John Parker's personal papers include many newspaper clippings, telegrams, letters, and other documents related to the various drives. In an effort to promote bond purchases, *Tow Lines* regularly reported the results of the sales campaigns. For example, the October 1943 *Tow Lines,* reported that for the third drive,

Villaume was leading the way with the purchases totaling $22,765, followed by NAC and De Ponti.

The January 1944 *Tow Lines* printed a letter from John Parker to all employees in which he appealed to them to "do their part" by buying bonds in the latest drive. The message was direct and emphatic: "Let us resolve that every man and woman at Northwestern Aeronautical Corporation will do his or her part by investing in this new War Loan and in addition set as a goal 20% of our earnings regularly for War Bonds."

The following month, *Tow Lines* reported that the fourth war bond drive had gone "over the top" and "as is usual when it comes to Bond buying, Villaume topped the list." In June 1944, the headline in *Tow Lines* read "The Thermometer Stands at 85—Thousand" and the accompanying article told readers that in the fifth war bond drive, the campaign to date had reached $85,000 toward a goal of $100,000 in sales for the three companies. The writer attributed much of the success to the bond-rally party held for the three companies on the opening night of the drive.. The writer further stated that employees of NAC and its two principal subcontractors "regularly" subscribed 12% of their income to buying war bonds, a remarkable figure exhibiting employees' patriotism.

A final example of the constant promotion of war bonds was presented on the front cover of the November 1944 issue of *Tow Lines.* It featured a pencil sketch of a C-47 towing a glider. Underneath this reminder of what employees at NAC were building, a

GI with his rifle was sprinting into battle in front of two tanks, surrounded by exploding bombs and artillery. Given that press reports and photos from the front were hitting all the newspapers, this would have been a familiar tableau for NAC readers. But the impact of this dramatic battle illustration is diminished by a large image of a Series E bond in the amount of $100, centrally positioned to separate the glider from the soldier and the tanks. No subtlety here![161]

One intriguing question related to John Parker's vigorous promotion of war bond purchases is when did Ingrid Berman, the glamorous actress who played opposite Humphrey Bogart in the 1942 film *Casablanca,* visit NAC? In the Parker Collection at the Smithsonian there are two photos. One is of John Parker and Ingrid Bergman sitting at a table enjoying what appears to be cocktails. A second photo shows William Stern, a member of the Northwest Airlines board of directors and the president of a bank in Fargo, N.D., handing what looks like a war bond to Ingrid Bergman. Toward the end of World War I, William Stern (1886–1964) briefly served as a second lieutenant in the Quartermaster Corps in Washington, D.C. before embarking on a very successful career as a banker in his home state. In this undated photo, his NAC employee badge, pinned to the lapel of his suit jacket, is unmistakable.

In the copies of *Tow Lines* that are available, Stern is identified in the masthead as the Director of Public Relations, but surviving records provide no date that indicates when Stern took on this role. Photos in *Tow Lines,* the local newspapers, and the Parker

Collection confirm that whenever NAC held a public event, Stern served as the master of ceremonies. Hence he was the NAC official who presented the bond in the "grip and grin" photo with Bergman, who on that day was wearing what appears to be traditional Swedish dress. Both are standing in front of a mural photo of an airborne glider, which probably graced the wall behind John Parker's desk in his NAC office in the 1902 West Minnehaha plant.

In September 1943, the Hollywood Bond Cavalcade of more than forty movie stars and celebrities visited fifteen U.S. cities, including Minneapolis and St. Paul, by private train over the course of three weeks, but Bergman's name does not appear in the newspaper reports of this junket promoting bond sales. That tour was made before NAC was likely to have moved its executive offices to Plant No. 1; thus, the Bergman visit to NAC probably occurred sometime in 1944. If that timing is correct, then it's too bad that we don't have a *Tow Lines* that reports on her visit.[162]

Bond rallies and other social occasions such as NAC parties were exciting for the employees, but work on the gliders was not always as upbeat and successful. The January 20, 1944, issue of the *St. Paul Dispatch* carried a big headline that read "12 Escape in Forced Landing of Secret-Type Glider Here." In this instance, the newspaper reported a forced, CG-13A landing in a pasture between Victoria and Lexington Avenues in Mendota.

According to the article, the pilot had maneuvered his glider to land about five miles south of Wold-Chamberlain field to avoid both high tension electric lines and a barbed wire fence. Two AAF pilots and ten NAC engineers were aboard this flight, but no one was injured in the unexpected landing. Only the landing gear was damaged. According to the newspaper, the tow line had either snapped or become detached from its fitting on the tow plane.[163]

The following April, another forced landing occurred in a farmer's field in in Lakeville, Minnesota, south of the airport. This incident involved two CG-4As that were in a dual tow behind a C-47. The newspaper reports identified the tow-release mechanism on the tow plane as the likely cause for the unscheduled landing. As with the earlier incident, no one was hurt, and NAC employees dismantled the gliders and hauled them back to the airport by truck. One newspaper confirmed with John Parker that this latest landing was the sixteenth accident of the past eighteen months, but in none of them was anyone on board injured. In Parker's words, "This is the same type of glider in which Jackie Coogan [a child actor and Hollywood movie star who served in the AAF] and others landed behind Jap lines in Burma last week. We feel proud of its landing ability. It shows that the ships we make here do what they are supposed to do—get to the ground safely."[164] It was his way of turning "lemons," into "lemonade."

May 1944 brought NAC a different kind of problem with its gliders. On May 10, four gliders ready for shipment were partially damaged by high winds at Wold-Chamberlain Airport. The estimated cost of the damage was $50,000. Then on May 19, another wind storm with 65-mile-per-hour gusts destroyed eight more CG-4As and badly damaged four others. This time, repair costs totaled approximately $200,000. In both cases, the gliders were moored outside, but the tie downs were insufficient to protect the aircraft in the heavy wind. But because the gliders had already been accepted by the AAF for delivery, the air force had to pay for the cost of repairs.[165]

On the positive side of the news, the *New York Herald Tribune* carried an article headlined "Glider Troops Train for Role in the Invasion." The newspaper's reporter certainly could not announce when the Allies would invade Europe but wanted readers to know that the press had witnessed a staged dress rehearsal for what was expected to take place. The reporter had attended an air base, training demonstration in North Carolina conducted by the Troop Carrier Command. Twenty-two CG-4As participated in this drill along with glider troops, jeeps, and howitzers. A photo depicted a jeep towing a howitzer exiting through the open nose of a CG-13A. Accompanied by its gun crew, the picture reinforced the point that gliders would give the infantry on the ground ample reinforcement through airborne delivery of men and equipment once troops had landed in Europe.[166]

Meanwhile, NAC engineers were installing an automatic pilot for CG-13A gliders that had been developed in the Aircraft Laboratory at Wright Field. Auto pilot was intended to lessen pilot fatigue on long flights and to assist the pilots flying in bad weather. The initial test flight involving this new device was conducted at Wold-Chamberlain Airport in early May, and it was considered to have been successful.[167]

At the same time, expansion at Northwestern Aeronautical continued. June 2, 1944, was a day of celebration when the company held the Opening and Inspection Day at its new facility at 1902 West Minnehaha in St. Paul. Even though Plant No. 1, as it was called, had already been operating for several months, NAC's management used the occasion to formally invite the business, professional, and civic leaders of the Twin Cities to tour the plant and witness the actual glider production. In addition, Minnesota Governor Edward Thye, St. Paul Mayor John J. McDonough, and several AAF officers from Wright Field were among the attendees. The opening was a good venue to convey the vital role the gliders would play in the upcoming European theater. A week later, as Minnesotans were following reports of the assault on Normandy, NAC held another war bond rally. Gliders and bonds intertwined once again. With increasing momentum of combat operations in Europe, the pace at NAC was accelerated to meet the demand.[168]

Local and national newspapers carried banner headlines announcing the invasion at Normandy on June 6, 1944, and the scrapbooks in the Parker Collection are

full of these clippings, particularly those covering the glider's role in the invasion. The *Chicago Times,* for example, had an "exclusive" report entitled "How Gliders Took Cherbourg Area," and the account of June 6 in another Chicago paper carried a secondary headline, "Glider Forces in Fierce Fight." Later in June, the *Minneapolis Star Journal* reproduced a photo headlined "Supplies Glide into France" in which a CG-4A can be seen landing on its fuselage in a cloud of dust.[169] One *New Republic* magazine reporter, who had witnessed the Normandy assault from a navy ship offshore, said it best:

> The greatest thrill was the arrival of the vast sweep of glider-borne troops towed by transport planes, in the late afternoon and evening of the first day of the assault. It was a wholly unexpected and soul-stirring sight, … . It was so long from end to end that the first transports were returning without gliders on one side of the ship while on the other the gliders were still going by. … First there was a distant mutter which quickly rose to thunder. Then they were above us in perfect formation, the twinkling spider web filament visibly connecting transport with glider. … But there is no question that this is one of the great developments of the war.[170]

This was dramatic and colorful language, to be sure, but Ray Nagell and the other glider troops who were on board those CG-4As probably experienced very different emotions going into battle.

Major William H. Taylor was an AAF glider pilot who had participated in both the glider operations in Burma in March 1943 and in the glider landings at Normandy. In July 1944, he wrote a letter to John Parker, thanking Parker and all the employees at NAC for "the grand job you have done," especially for overcoming all the difficulties involved in getting the first gliders built. In closing, he added, "I'm proud of gliders and

the people associated with them" and "I'm sure [that the part that gliders and their pilots] played [in Burma and Normandy] fully justified the sustained faith the people at home have in the American glider."[171]

Tow Lines printed another testimonial about the importance of gliders in its August 1944 issue after Flight Officer Ralph E. Toms visited NAC, speaking with employees about his combat experiences as a glider pilot. Toms was from Hibbing, Minnesota, and was at the controls of a CG-4A at Normandy where he was wounded by enemy flak and artillery fire. While convalescing in the United States, the AAF asked him to make an inspection tour of the glider facilities in the Twin Cities. During his visit, he encouraged the NAC employees, "Don't let up now. The war is a long way from being over. Your responsibility in furnishing the fighting equipment must not lessen until the final defeat of the enemy."[172]

Further appeal to NAC workers to do all that they could came in another message from John Parker in *Tow Lines.* Parker began by addressing the fear of job loss at war's end:

> Victory jitters, a new disease that had its start with the invasion of Europe, has been appropriately diagnosed as a mental condition caused by the fear of the future. It is a fear that the end of the war and the termination of war contracts will find us without employment; that our job is only of a wartime existence with little or no possibility of permanency.
>
> …
>
> It is true that this company was born of a wartime necessity, in the hour of America's greatest need. During our brief existence, we have proven ourselves capable of producing vital instruments of war, thus serving our country in the best way we know how. This, however, is not enough.

> During the present period, we are under the crucial test, our job now is to complete the tremendous task ahead; that of turning out a greater man-hour production to meet the increasing needs of the Army Air Force.

Parker added to his encouragement with, "The company has definite postwar plans, that if consummated will require the entire present personnel. The important part of these negotiations lies squarely on our ability to perform our production contracts." Once hostilities have ended, Parker forecasted that, "we will convert to postwar needs at the first opportunity."[173]

What exactly those "postwar needs" would be, Parker could not say. Other than building more gliders for the AAF or potentially for postwar commercial air-freight transportation companies, there is nothing in the surviving records from the summer of 1944 that identifies an NAC, postwar product or service that would serve a peacetime market. For the time being, however, glider production would remain the focus. By early September, the local newspapers carried stories and photos about an AAF conference where Parker was encouraged to accelerate production of CG-4As and CG-13As at NAC. The AAF wanted more gliders and NAC was committed to building them.[174]

Less than two weeks after NAC employees and the public learned that the AAF needed more aircraft, banner headlines of local and national newspapers reported on Operation Market Garden and the role gliders played on the battlefield in Holland. Although much of the newspaper coverage concentrated on the fighting around the key

bridges the Allies attempted to seize, especially at Arnhem, one account told of three AAF glider pilots who avoided capture by the Germans near Nijmegan. The pilots had "crash-landed" their gliders and unloaded their cargo and were headed back to Allied lines on foot. Thinking they would have to seek shelter from nearby enemy soldiers, a Dutch peasant, who was part of the underground, appeared just when they needed help the most and safely led them to friendly lines.[175]

The brutal combat operations in Europe continued into the winter of 1944 as the German army attempted their breakout at the Bulge with the siege of Bastogne. To emphasize NAC's contribution to the war effort, John Parker addressed the employees again in a letter in *Tow Lines.* He wrote,

> You as a member of the Northwestern Aeronautical Corporation have been, and are now, one of the important cogs in the production machinery. It has been only through the efforts and cooperation of you and your fellow worker[s] that we, as an organization, have successfully fulfilled our obligation to the war effort. The splendid record resulting from your endeavors has brought us national recognition as one of the nation's largest manufacturers of gliders. This honor we jointly hold in the highest esteem.

Along with holiday wishes, and in an attempt to keep up the morale, employees were gifted with fresh turkeys for their Christmas tables: "It is, therefore, my wish that you accept, as a token of our appreciation, and with the compliments of this office the gift of a Christmas Turkey, which will be presented to you on the 22nd day of December."[176] The New Year would bring not only more glider contracts, but also new work for the company.

In mid-1944, the engineers at NAC had developed a new design for aluminum "jettison tanks" for fighter aircraft. When fitted on fighters, the additional 310 gallons of fuel provided the pilots greater flying distances while protecting long-range bombers over the ocean or enemy territory. NAC's initial prototype tanks failed the AAF's tests, but a new model designed under the direction of Chief Engineer Bertil H.T. Lindquist, who had only joined NAC in June 1944, turned out to be a success.[177]

Under the new AAF contract issued on July 18, 1944, NAC was assigned to manufacture 11,340 fuel tanks. NAC would be the prime engineering contractor for the drop tanks, responsible for providing designs, blueprints, and consultation services to any other firms receiving AAF, fuel-tank contracts. As part of this work, the Defense Plant Corporation contracted with NAC to supply $70,000 in special spot-welding equipment that would be used to fabricate the tanks at Holman Field.[178]

The contract to manufacture these jettison tanks was a promising way to begin 1945, but it represented only a small addition to NAC's bottom line. Because glider production generated nearly all of NAC's income, John Parker had to find other post-war products or services for NAC. Research had to be done, and in mid-1944, he commissioned Booz, Allen & Hamilton of Chicago to conduct a business survey. A July 1944 article titled "Doctors of Management" in *Fortune* magazine profiled Booz, Allen & Hamilton along with a number of other management consulting firms in the United States. The article highlighted the increasing demand of American business executives

for outside advice on how to improve their business operation, particularly when navigating government regulations and labor policies resulting from the war. Assuming the consultants would provide business improvement measures, their fees were tax deductible.

By the late nineteenth and early twentieth centuries, American business leaders were rethinking their manufacturing processes. Drawing from the work of Frederick W. Taylor and other management consultants of the day, more focus was being placed on actual efficiencies and productivity. Known as "scientific management," consultants such as Booz, Allen & Hamilton used data and facts in their analyses, encouraging management teams to rely more on their findings and less on intuition when making their management decisions. The biggest asset that these consultants brought to their clients was objectivity. As outsiders, the consulting firms were free of any entangling loyalties, and presumably they could provide well researched and unbiased opinions concerning the company's personnel, operations, and prospects. The consulting industry had been born.

As one *Fortune* writer succinctly stated, "the war has been a field day for consultants." For example, shortly after Republican Frank Knox became Franklin Roosevelt's secretary of the navy in July 1940, he used consultants from the Booz firm to determine how he could restructure his department to meet its growing responsibilities as it prepared for war. One of the outcomes of this analysis was to establish in January

1942 the Office of Procurement and Material within the Navy Department. It subsequently became the principal agency for directing the navy's wartime contracting and supply operations.

The army followed suit. In mid-1941, Robert P. Patterson, the undersecretary of the army, also hired the Booz consultants to analyze the army's mobilization preparations. The firm of Booz, Allen & Hamilton was gaining a solid reputation in the consulting business, so it was an informed decision when John Parker asked for the firm's help in 1944. Who better could help him with recommendations for the future of Northwestern Aeronautical Corporation?[179]

The consultants from Booz, Allen & Hamilton calculated that between February 1942 and November 1944, NAC's gross income from glider production totaled $27,807, 535. The consultants also estimated that NAC's gross income for 1945, based on existing contracts, would be an additional $20 million. With World War II drawing to a close, however, NAC's income in 1945 was considerably less than that amount.

No one could foresee in early 1945 when the fighting, particularly in the Pacific, would actually end. Many military experts predicted that the United Nations would defeat Japan only after their combined military forces invaded the Japanese home islands. Such an invasion, these experts calculated, would very likely result in great losses in killed and wounded. At the time, they forecasted that the war would likely continue into 1946 or even 1947. Given the prospect of fighting beyond 1945, the $20

million total income that Booz, Allen & Hamilton's consultants forecast for NAC was realistic as long as the military needed gliders. Changes that affected NAC's income were, however, already taking place even before the consulting firm submitted its report to John Parker.

Partial terminations of the AAF's contracts with NAC started in August 1944. The large contract for 250 CG-13A gliders was cancelled after NAC had built only fifty of them. John Parker may not have had a crystal ball to forecast what was ahead for NAC in 1945, but given the company's dependence on the glider contracts, his concern was growing. There was no better time to bring in the consulting firm to analyze NAC's organizational structure and to project how the company would prosper in a peacetime economy.

In the meantime, business continued as usual at NAC. On February 28, 1945, the Troop Carrier Command put on an impressive demonstration of troop and equipment delivery to a small landing area, as well as an evacuation of the "wounded." As with others, the demonstration was held at Wold-Chamberlain Airport, and afterward, John Parker and his managers provided tours of the NAC plant for AAF officers, Governor Thye, and local officials. One Minneapolis newspaper estimated that 10,000 people stood outside the airport fence to witness the demonstration.[180]

By March of 1945, Allied forces in Europe were clearly on the road to victory. Operation Varsity, the push to cross the Rhine, was the largest airborne assault to date

employing approximately 1,300 gliders. Again the newspapers trumpeted the assault with banner headlines. And gliders were hailed for their participation, but this time, the emphasis appears to have shifted from aerial assaults to aerial rescues, highlighting the gliders' ability to quickly remove wounded soldiers from the field and carry them to hospitals behind the lines. And in spite of their precarious and dangerous occupations, glider pilots and troops once again proved their utility in combat. [181]

The apparent success of Operation Varsity encouraged a rush to conclude the war with Germany. The Allied armies relentlessly pounded the remaining enemy forces and the fall of Berlin to the Soviet armies soon gave way to the heady feelings of relief and pride that came with the Nazis' final surrender in early May. Now all that remained was to defeat Japan.

As if it was a signal that the fighting would soon be over, the last story about NAC appeared in a local newspaper on April 3. Rather than touting glider production, this article praised employees for their personal sacrifices to the war effort. NAC employees had exceeded their goal for buying bonds in the Seventh War Loan campaign.[182] Not discussed in the article was the looming question: what would NAC do after the war? Would Booz, Allen & Hamilton be able to answer the question?

The first part of their report is dated February 19, 1945, and titled "General Survey: Organization." It provided analysis of NAC's organizational structure as of December 1944, and covered certain, structural deficiencies. Specific changes were

recommended that the consultants suggested would improve the effectiveness of NAC executives and managers in the future. Most interesting were the organizational charts that were included. In the December 1944 chart, NAC exhibited a very shallow or flat management structure. All the key executives reported to John Parker, the president, and he, too, was heavily engaged in day-to-day operations as well as working with clients.

To lighten Parker's load, the consultants recommended that an executive vice president be added to the hierarchy. Reporting to the president, this individual would oversee all the other senior executives and managers. All information about current operations would be delivered by the executive vice president to John Parker, and this change would then allow John Parker to focus more on strategic planning and negotiating future business.

Although this analysis was insightful, it didn't answer the question of what NAC's new industrial role. By adding a layer of management, the role of executive vice president, NAC would resemble the larger, well established corporations producing annual incomes in the neighborhood of $20 million. But this alone didn't solve the problem at hand. And it wouldn't be the consultants who did.

In the second section of their report titled "Postwar Products Survey" dated May 7, 1945, the day before V-E Day, they described their efforts in attempting to come up with the answer. Booz, Allen & Hamilton sent their consultants around the country to

meet with representatives of the AAF, aviation manufacturing companies, commercial airlines, and other aviation industry experts. Based on the feedback they accumulated, the firm reported that the AAF considered gliders "a costly method of getting this troop and cargo carrying method done." The AAF also "deplored" the "waste" of "good pilots who with very little more training might operate planes," and was very "conscious of diverting C-47 pilots, crews and ships from other important operations whenever a glider towing or pick-up job is necessary."

In addition, the AAF judged that any gliders built after the war would require new designs to include all-metal construction, rear-loading capabilities, and engines for easy reuse. According to those at Wright Field, the "need for [gliders] will simply evaporate after the war."[183] If that information wasn't damning enough, the consultants found that while the larger manufacturers had stepped up to the plate to meet war demands, they wanted to resume their prewar activities. As in the case of the Ford Motor Company, they were planning to resume building station wagons at their Michigan plant. And although there may have been a market for gliders to haul commercial freight, or even to entertain sport gliding enthusiasts, those markets would pale compared to the previous AAF demands.

The reality was that glider production in a post-war economy simply held no promise. And the conclusion that the consultants outlined in their report was that Parker and NAC would have to choose from the following alternatives:

- Liquidate NAC;
- Continue to operate as at present relying solely on army contracts;
- Manufacture products unrelated to the aviation field; or
- Remain an aviation manufacturing company but expand the scope of products and services NAC offers and, when possible, add non-aeronautical products[184]

The future of NAC fell to John Parker, and he spent most of the fall and winter of 1945 looking for a way to keep the company in operation. When the Japanese signed the terms of surrender in Tokyo Bay on September 2, 1945, he became more determined than ever. In the interview that Parker gave Arthur Norberg in the mid-1980s, he told his interviewer, "I had been investigating everywhere."[185] Then circumstances related to military defense, previously unknown to Parker, intervened unexpectedly and would determine the future for NAC and John Parker.

Before and during World War II, the U.S. Navy had enlisted several civilian companies and universities to help with the navy's cryptology program. Their goal was to develop new mechanical techniques for analyzing data derived from coded messages. All of the projects, of course, were held in secrecy until long after the war ended. One of the "products" of this effort led to the founding of a civilian company, Engineering Research Associates (ERA), in early 1946 in St. Paul, Minnesota. ERA had its roots in Northwestern Aeronautical Corporation and John Parker's search for NAC's new mission.

Arthur L. Norberg, a technology historian, summed up the circumstances that led to the birth of ERA:

> By the middle of 1945, navy personnel were convinced that the effort to enhance analysis techniques by new data processing concepts should continue [after the war] and these techniques should make as much use as possible of the newly developing computing ideas. In the navy, this work was done primarily under the direction of the Communications Supplementary Activity—Washington (CSAW). CSAW was composed of a hastily assembled group of cryptologists, mathematicians, physicists, engineers, and chess and bridge masters. Foiled at keeping this prime group together after the war as civilian employees to pursue such work under direct supervision, the navy assisted in the establishment of a private company, composed of many of those same men, to perform the same investigations with classified contracts. This company was Engineering Research Associates, Inc. (ERA), located in St. Paul, Minnesota.[186]

CSAW, the navy's operational branch for cryptanalysis, was located on Nebraska Avenue in northwest Washington, D.C. In navy parlance it was labelled OP-20-G, a name that had its origins in World War I. During World War II, the officer in charge of CSAW was Captain Joseph N. Wenger, a 1923 graduate of the U.S. Naval Academy who had served in OP-20-G and had been involved in radio intelligence work in the Pacific in the 1930s. Assigned to the Office of Naval Communications in Washington in 1941, Wenger returned to OP-20-G as its director.

Wegner's boss from April 1943 to August 1945 was Rear Admiral Joseph Redman, the Director of Naval Communications, who was directly subordinate to the chief of naval operations. Redman was also a Naval Academy, graduating with the class of 1914, and his younger brother, John "Jack" Redman, graduated with the class of 1918. Jack Redman would witness the Pearl Harbor attack, serving as a communications officer in Hawaii on Admiral Nimitz's staff from October 1942 to May 1945. Both Joseph and John Redman were instrumental in solving John Parker's dilemma with the founding of ERA.

OP-20-G was responsible for establishing the various navy codes and for breaking enemy codes. This Washington operation along with its counterpart in Hawaii had played a major, analytical role that led to breaking the Japanese naval code in the spring of 1942. This effort later resulted in the stunning victory for the United States at the Battle of Midway in early June. One of the senior admirals who was privy to this codebreaking triumph was Admiral Chester W. Nimitz, Commander in Chief, Pacific, headquartered in Hawaii. Of all people, Nimitz certainly understood the value, not only of war-time codebreaking, but also the role it would play in the future. As such, he would later play a part in the navy-civilian collaboration that led to the founding of ERA.[187]

OP-20-G was divided into several sections. Civilians in one section were primarily tasked with intercepting enemy messages, direction finding related to enemy naval forces, and with message traffic analysis. Another civilian section dealt with the electronic equipment that had applications for codebreaking and code solution techniques. Most of the early employees of ERA came from these two sections.[188]

In November 1942, following the success at Midway, the navy established the Naval Computing Machine Laboratory (NCML) in Dayton, Ohio, at the home of the National Cash Register Company (NCR). NCML's mission was to design and build machines that could intercept and decrypt coded messages.[189] Earlier in 1942, senior officials at OP-20-G concluded that they needed far more technical assistance with their

code breaking, particularly with the German navy code used to communicate submarine activities in the Atlantic Ocean. At the time, Nazi U-boats were highly successful in sinking merchant ships supplying Great Britain, and the tremendous Allied losses suffered in the Battle of the Atlantic led to the creation of NCML in late 1942. The navy's Bureau of Ships (BuShips) placed a contract with NCR to design and build the badly needed code-breaking equipment. Given the unconventional requirements of this contract, BuShips had to send someone to NCR's research laboratory in Dayton to oversee the project. The bureau chose a reserve naval officer in his forties, Lieutenant Commander Ralph I. Meader (1897–1963), who was a graduate of Dartmouth and had served in the navy during World War I. Educated as an engineer, Meader held several patents on his own inventions, and had worked for several large corporations, including Western Union, in their electrical divisions. Hard times in the 1930s and several failed business ventures led Meader to return to the navy as an engineer on the staff of BuShips. And by December 1942, he was off to Dayton to serve as the liaison between OP-20-G and NCR.[190]

Joseph R. Desch of NCR's electrical laboratory was the chief engineer at NCML. NCR received the unusual contract with BuShips in part because Desch's credentials. Although he had no knowledge of what the application would be, Desch had previously built electronic equipment used in the Manhattan Project (atomic bomb). In addition, the navy already had a contract with NCR and Desch's laboratory for other

equipment. Very shortly after this arrangement with NCR was worked out, the navy, led by Commander (later Captain) Meader assumed leadership of the project over Desch, his staff, and his lab. With the navy in charge, the specialized electronic equipment developed by Meader and his team provided OP-20-G with the advanced technology needed in their code-breaking operations.[191]

Dayton was important to NAC for a variety of reasons. The foremost reason was the AAF's Materiel Command, which provided the contracts for building gliders, was based there. Dayton was also the home of Wright Field, where much of the testing of gliders was done. Lastly, the city was about twenty miles south of Troy, Ohio, the home of the Waco Aircraft Company, the firm that designed the CG-4A. Coincidentally, it was also the headquarters for the National Cash Register (NCR) Company and the NCML, which was located in Building 26 on NCR's campus.

John Parker was NAC's only salesman. He travelled regularly to Dayton, Chicago, Washington, and St. Paul as NAC's representative to meet with government officials, businessmen, military officers, and politicians. When he was interviewed in the 1980s about the part that Dayton had in the future of NAC, Parker said:

> The contracting source for the glider program was in Dayton, but the actual administration of it was done through the Chicago office of the government. And that was headed by a Colonel named Nelson Talbot. … His brother, Harold Talbot, later became Secretary of the Air Force. Came from Dayton. And apparently in looking around, whoever was doing this, either the Navy itself or this group of Howard Engstrom, [William] Norris, and [Ralph] Meader. Anyway, through Talbot, who had met Meader, he suggested that they talk to me. Well, it's hazy on my part now the steps that actually happened, but... Engstrom and Norris and Meader ... . They told me that this

> was a group that had been doing some very classified work during the war and so forth and under certain circumstances that they would like to continue to carry on this work and be together.[192]

During the war, Commander Howard T. Engstrom (1913?–1962), who had previously been a professor of mathematics at Yale University, led the unit within OP-20-G that would benefit from NCML's efforts. A bright young man who worked hard, Engstrom brought impressive credentials to the OP-20-G organization. He had earned an undergraduate degree in chemical engineering, had worked at Western Electric, and went on to earn his doctorate at Yale. Engstrom was also versed in at least four languages, including German, which he had learned while a student at a German university. At the time that Yale hired him as a junior mathematics professor, he also joined the naval reserve, enrolling in a cryptologic course sponsored by OP-20-G. When war broke out, Enstrom resigned from Yale and went on active duty with OP-20-G.[193] One of his senior associates was Lieutenant Commander William C. Norris (1911–2006), an electrical engineering graduate of the University of Nebraska who had worked in sales at Westinghouse before the war. Similar to Engstrom, Norris was also a member of the naval reserve in 1941 who went active and was assigned to OP-20-G.

Nelson S. "Bud" Talbott (1892–1952), whose roots were in Dayton, was another Yale graduate who had served as an army captain in World War I. After the war, Talbott joined the army's Officers' Reserve Corps, attaining the rank of major, and went into business in Dayton. By the time Parker met him in the course of negotiating the

early, AAF glider contracts, Talbott was back in uniform, a colonel in the Chicago office of the Quartermaster Corps. Talbott was also a member of the small group of aviation leaders in Dayton that went back to the time of the Wright brothers. Counting the president of NCR among his friends, he was well-connected in both commercial aviation and the military.[194] As Parker explained, Talbott had met Meader at NCML in Dayton. Being well-positioned in the business of military planning and contracting, Talbott saw an opportunity to assist the navy by inviting Captain Meader and Commander Engstrom to meet with John Parker.

Parker was reluctant in the 1980s to provide all the specific details of his initial meetings with the OP-20-G representatives. Meader, Engstrom, and other OP-20-G personnel had the foresight to know, however, the important role OP-20-G would play even after the war. By early 1945 navy leaders, such as Captain Wenger, clearly recognized the accomplishments of civilians in uniform such as Engstrom and Norris at OP-20-G and Meader at NCML. Even though the war was winding down, the advancements these men had made with digital electronics had to continue. As Arthur Norberg explained, "By the end of the war, the personnel at the NCML and at CSAW had become very knowledgeable about the techniques involved in designing high-speed computing devices. In fact, they were among the most knowledgeable in the world."[195] But would they have the funding to continue their work?

Senior navy leaders, including Admiral Nimitz, who became the Chief of Naval Operations in November 1945, were also concerned about the likely budget cuts that would follow the end of hostilities. And with the widespread talk in the Congress about defense reorganization after the war, they had to find a way to retain the services of all these talented individuals. There was also the concern that many of the civilians in uniform at OP-20-G had expressed their desires to return to their universities or corporate jobs once the war was over. The navy's challenge, however, provided an opportunity for Parker. He needed to find revenue-generating work for NAC, and a contract with the navy might offer just what he was looking for.

Secretary of the Navy James Forrestal, who took over his role after Frank Knox passed away in 1944, supported the effort to maintain a small team of well-trained electronic engineers and continue the work on code breaking. To do that, the navy had to identify a commercial enterprise that could continue the cryptographic machine development. Using the contracting template that had been established earlier between BuShips and NCR to get NCML up and running, and with the help of Engstrom, Norris, Meader, and a few others in OP-20-G, NAC (through Engineering Research Associates) could remain in business.[196]

Before ERA was organized, the navy had initially approached NCR to see if they wanted to continue their work in codebreaking, but they were not interested. NCR wanted to return to their peacetime commercial operations of making cash registers and

accounting machines. The firm had a backlog of commercial orders they needed to fill now that the peacetime market was opening up, and the company had made no money on the contract involving the NCML.

Ironically, other companies, such as IBM and Kodak, also turned the navy down. The navy even reached out to the nonprofit Rockefeller Foundation to see if they might be interested in this work. They weren't. A former ERA engineer later speculated that possibly one reason these established companies had little interest in this work on code-breaking machines was that during the war, their military contracts had not been that profitable. So, by the time John Parker got involved, the navy was open to any potential investor who was willing to consider a contract for a top-secret research and development project. Fortunately, Parker was in the market to replace the glider production at NAC.[197] As Parker explained in the mid-1980s, he then arranged to meet with Chief of Naval Operations Admiral Nimitz:

> And all Admiral Nimitz said to me, as he tapped me on the chest, was: "I've looked into your background and there's a job I would like to have you do." And he said, "It may be more important in peacetime than it is in wartime."
>
> And I said, "Aye, aye, sir." I had no idea what I was going to do. Well as it turned out, … this group [Engstrom, Norris, and Meader] then said that if they could get someone who would give them half interest in the company, finance the company, and certify that they wouldn't direct any of their scientific research activities, that they would agree to bind themselves together under contract for three years. This was the beginning [of ERA].[198]

Initially, the navy negotiated a consulting contract with Parker and NAC to analyze the navy's data processing needs. This first contract between BuShips and NAC was completed in late February 1946. Having BuShips issue the contract meant it could be

buried in obscurity, and since NAC already had a contractual relationship with the AAF, it met the existing conditions for establishing new contracts, a circumstance that prevented an initial contract with ERA.[199]

In December 1945 when NAC received this first contract, Parker, Engstrom, Norris, and Meader had already organized Engineering Research Associates.[200] Once NAC got what it wanted from BuShips in early 1946, the actual work for the navy was subcontracted to ERA. The organization of ERA consisted of a financial group and a technical team. Capitalized at 300,000 shares of stock, the company initially distributed only 200,000 shares at a cost of ten cents per share. The relatively low cost per share meant that the stock was affordable to the electronic engineers who would be the core employees of the new organization. John Parker took on the role of president with Howard Engstrom, Ralph Meader, and William Norris serving as vice presidents and directors. Nelson Talbott of Dayton and Richard C. Lilly of St. Paul also served as outside directors. As president of First Bank St. Paul, Lilly had handled the banking needs for NAC; so it was an obvious choice that he do the same for ERA. One of the first actions the new company took was to open an office in Washington for the purposes of recruiting additional employees and procuring more work from the federal government.[201]

The establishment of ERA in 1946 meant that a number of NAC employees could move from their former employer to the new company if their skills were needed at

ERA. For example, workers who had been machinists at NAC could transition to ERA, but those with less technical skills, such as sewing fabric to cover wings, were laid off or they left NAC voluntarily. Two senior administrative employees of NAC, George H. Plufka and Harold L. Rutchick, moved to ERA in the same positions they had held in their former company, treasurer and secretary, respectively. Bertil H.T. Lindquist, who was the director of research or chief engineer (sources differ as to his title) at NAC, stayed on as an engineering manager at ERA.

By October 1946, the leadership team of ERA was represented by Howard Enstrom, executive vice president reporting directly to Parker; William Norris, in charge of engineering and research; and Ralph Meader, heading up the manufacturing department. Because NAC held the original contract with the navy, their building at 1902 West Minnehaha in St. Paul, which was owned by the Defense Plant Corporation and leased to NAC, served as the manufacturing headquarters and plant for ERA. The spacious plant was essential to the new company because in the spring of 1946, the navy also moved NCML from Dayton to St. Paul. One of the functions that these holdovers from NCML had at ERA was to provide inspection and quality control for ERA's customer: CSAW. Now, as an official naval facility, ERA could post guards at the gate without acknowledging it was doing secret work for the government.[202]

Although contracts with the navy and other governmental agencies provided the main revenue stream for ERA in its early years, John Parker's knowledge of and

connections to commercial aviation enabled the company to develop other revenue sources as well. These additional projects provided the cash flow needed by the start-up firm in its early days. This necessity for trying out different ways to generate income was important for ERA because at the time no one was sure exactly what technologies were going to be practical for the storage of digital information. By 1947, ERA completed the first navy contract, and the second contract brought a new challenge, to design and develop a "stored program" computer. Thanks to the persistence and savvy of John Parker, ERA established itself as one of the nation's earliest computer manufacturers.

John Parker remained in his role as president and chairman of Engineering Research Associates until 1953. In the company's first five or so years, generating sufficient cash flow was an ongoing challenge. In addition, navy officials in the postwar years were often much less willing to approve payments to ERA for cost overruns and other unexpected expenses. There just wasn't the same sense of urgency as there was when gliders were needed for impending battle. As a result, Parker and his senior associates thought ERA would benefit financially by merging with a larger firm, a firm such as Remington Rand. At the time, Remington Rand also manufactured business machines, competing with NCR, IBM, and other well-funded companies.

After ERA merged their operations with Remington Rand in 1952, Parker became the general sales manager of its Univac division. When Remington Rand later merged

with Sperry Rand Inc., he worked for the new owners until 1956. But his business career was not over. He went on to work for Hall-Scott Inc., a manufacturer of truck, aircraft, and landing-craft engines for the military during World War II, headquartered in San Francisco, and the Teleregister Corporation (later Bunker-Ramo Corporation) in Stamford, Connecticut, taking on positions of increasing responsibility. In 1956 he had also been elected to the board of directors of the Glenn L. Martin Company, an aircraft manufacturer headquartered in Baltimore. Within a few years, Parker became the president and chairman of the board of the Teleregister Corporation. Widely recognized today as a pioneer in the computer industry, John Parker also served as a trustee of the U.S. Naval Academy Foundation during his later years. He died in Washington, D.C. on December 23, 1989.[203]

Defeating the Nazis in Europe and dropping the atomic bombs on Hiroshima and Nagasaki signaled the end of World War II. By then, Booz, Allen & Hamilton had delivered a clear message to John Parker that NAC had no future in building gliders. But John Parker persisted, and through his persistence, he was able to transition to an industry that represented the forerunners of today's computer industry. And the story of those World War II gliders does not end there.

While John Parker was building up ERA in the early 1950s, the aviation industry was developing a new weapons system, the helicopter, which soon replaced the glider in combat operations. Because of helicopters' lift and thrust capabilities, they could

operate in tight places. And today, helicopters deliver troops and armaments to the battlefield, and they evacuate the wounded, just as the gliders had so valiantly done in World War II.

The first operational helicopter was actually flown in 1936, and by 1942, a helicopter designed by Igor Sikorsky went into full-scale production. Sikorsky's model R-4 was the only Allied helicopter to be used in World War II, primarily in rescue operations in rugged terrain. By 1951, piston engines were being replaced by turbine engines that provided more speed and the power to carry much greater payloads. And with continued advancements and technology, today's helicopters provide countless services, not only in the military, but also in medical emergencies, scientific research, law enforcement, building construction, tourism, and a wide range of other operations. Toward the end of World War II and into the late 1940s, the AAF and its successor, the U.S. Air Force, pursued experimental glider development on a limited basis. The new, larger prototypes were built with all-metal fuselages engines. This program included models identified as XCG-14, XCG-14A, XCG-15A, XCG-16, XCG-17, XCG-18, XCG-18A, XCG-19, and XCG-20 ("X" meaning "experimental"). Although the budget was available for these experimental models in 1946 and 1947, this program was not supported by the air force. In December 1945 the deputy commander of the AAF discussed glider development with his counterpart for the army ground forces and then announced, "The Air Force is opposed to the development of a powered glider. As a

matter of fact it is a misnomer. There is no such thing as a powered glider; it then becomes an airplane."[204]

By the summer of 1946, the Engineering Division at Wright Field, for all practical purposes, forecasted the end of combat gliders. In their report, it was stated:

> a. Pending the eventual development of helicopter assault aircraft, the most desirable interim development appears to be a powered transport aircraft … .
> b. It is suggested that redesign of gliders presently under development may meet this interim requirement.
> c. It is required that the assault aircraft possess the same or greater assault operational capabilities than gliders and at the same time possess day by day utility value in Troop Carrier type of operations.[205]

Helicopters were moving in, but the gliders of World War II, and NAC's contribution to the program would not be forgotten. Writing in late 1947, air force historian Raymond J. Snodgrass summed up NAC's performance between early 1942 and the end of the war in this way,

> Northwestern had been one of the best producers of CG-4A's and had rendered valuable assistance in the manufacture of CG-13A's and PG-2A's (powered version of the CG-4A). The personnel of this company increased from 1,400 in November 1944 to 2,416 in July of the following year. Approximately 30 per cent of its work on CG-4A gliders was done by subcontractors.
>
> Northwestern's contract unit price on the first 1,200 CG-4A's was approximately $27,000, which was below the average for the initial program. For the 1945 program, the unit cost was reduced to $19,176 on the first 315 articles and to $17,056 on the final 860. Only Ford was able to present a lower unit figure for this last procurement. … By December 1946, a total sum of $39,328,671.73 had been paid to the company on [AAF contracts].[206]

Historians today marvel at what gliders accomplished in World War II combat and how they contributed to the Allied victory. And some companies were better at building them than others. Ford and NAC and its subcontractors were able to produce

not only a high percentage of the aircraft needed, but they also produced a high-quality glider. Others were less successful. Production records of all the glider contractors show that those companies adequately financed and producing high-quality products before the war, were more easily converted to wartime production.[207] NAC proved to be an anomaly. Considering that they did not exist prior to 1942, they had become one of the top performers by the time the war ended, a significant accomplishment in a short amount of time.

John Parker knew NAC had performed well for the United States when they were most needed. But as an aviation realist, he could also see where the air force was headed and that the glider was not going to be a part of that future. Nevertheless, the CG-4A that had been the key to NAC's wartime success would make a surprising return to Minnesota in the early twenty-first century. And only those with a passion for aviation and the love of history could make that happen.

Chapter Seven

Combat Gliders in the Twenty-first Century

After World War II, the CG-4A and other combat glider models faded into the background. By the beginning of the Korean War (1950-1953), helicopters took on the roles of ground-support operations, reconnaissance, and MEDEVAC. World War II glider pilots and troopers still discussed gliders and even wrote books about their wartime experiences. But in Minnesota, the story of Northwestern Aeronautical Corporation and glider production in the Twin Cities became a hazy memory, that is, until the 1990s. The Minnesota Historical Society had launched its "Greatest Generation Project," which stirred up local interest in World War II. In 1993, Noel Allard and Gerald Sandvick published their seminal book, *Minnesota Aviation History, 1857–1945,* in which they discussed glider manufacturing at NAC and fully profiled Shorty De Ponti's contributions to the development of aviation in Minnesota. About the same time this important book was published, the local press and other media began focusing their attention on the fiftieth anniversary of the D-Day landings in Normandy.

Locally Dick Williams, an aviation enthusiast, organized an event at Holman Field for June 6, 1994, that would focus on Minnesota's home-front contributions during the war. Preparing for the 1994 celebration, he called J. Nicholas (Nick) Linsmayer, the president of Villaume Industries, the successor company to Villaume Box & Lumber Company of the 1940s. (Today, Villaume specializes in manufacturing roof trusses and

custom-designed wood packaging.) Williams invited Nick to set up a company booth at the Holman Field festivities to talk with those interested in Villaume's participation in the war effort. Nick was quite familiar with Villaume's wartime history because during his youth, he had worked in the plant alongside several women who had been Villaume employees during the war. And they had shared with him their stories about building gliders.

In addition, Nick's dad, Robert Linsmayer, who had managed Villaume during the 1950s and '60s, had actually taken Nick to see a glider at Wright-Patterson Airfield. (This particular glider is now a part of the National Museum of the U.S. Air Force, outside Dayton, Ohio.) According to Nick, however, the 1994 event at Holman Field, was what really stirred up his interest in researching Villaume's World War II story, the history of NAC, and generally all things about combat gliders.

By 2005, Nick had become quite an expert on glider history, and he was asked by former paratrooper Hal Roed to give a presentation about Villaume and the gliders at the 13th Airborne Division Association's national convention being held in Bloomington, Minnesota. During World War II, the 13th Airborne had included paratroopers, pilots, and glider riders. Meeting these veterans prompted Nick to learn even more about gliders, and in his words, "I really got a sense [at the convention] … about the specialness of being in World War II with the Airborne and how even though the glider pilots and the glider riders competed, they were doing the same thing."[208]

Independent of Nick Linsmayer, James N. (Jim) Johns and Ingemar Holm, a team of aircraft restorers by avocation, had been busy since the 1970s restoring World War II aircraft. With the help of others, they have led the restoration efforts of about twenty aircraft over the years, so they were likely candidates to bring the CG-4A glider "back to life." Jim would serve as spokesperson for the volunteer project, but the two would lead the team to restore what would become one of just nine full-size CG-4A gliders worldwide. With their passion for military history, and more particularly Minnesota military aviation, Jim and Ingemar had made quite a few connections, one of whom was Donald G. (Don) Patton. Along with Dr. Harold C. Deutsch, Patton had helped organize the World War II History Roundtable in the Twin Cities during the late 1980s.

Interest in the World War II gliders was growing, and by 2007, Don Patton, heading up the Roundtable, was asked: could a glider be built?

His answer: "I don't know. We'll see." And Don starting calling various organizations around the country. One of the businesses he contacted was Ezel Aviation Inc. of Breckenridge, Texas, a company well known for restoring aircraft. He asked the managers at Ezel if they had any glider parts. "No," they answered, but they gave Don a lead on where he could locate some, in Rockdale, Texas. The glider parts had been pushed into the mesquite at the edge of a little-used airport, and understandably any wood or fabric from the original gliders had long ago rotted away. But the metal parts were still intact, even sixty years later. A short time later, Don took a business trip to

Texas, taking a detour to Rockdale where he found the glider parts, what he thought to be a nose section and a fuselage.

When he returned to Minneapolis, he reported his discovery to Jim Johns, Ingemar Holm, and another airplane restorer, Dr. Tom Weir, who was also a retired general. With trailer in tow, the three were off to Rockdale, Texas to find "the find." After some missed turns and mistakes, they located the parts, a nose and two cargo sections. There were two problems, however. No one knew who owned the parts, and the mesquite trees had grown through the pile of framework, entangling all the parts.

With the help of the local police, they met the mayor of Rockdale and asked him who owned the parts. The mayor told them if they could remove the parts by 4:00 P.M., they could have them. Fortunately, the Minnesotans were able to borrow a chain saw to cut the mesquite away, and they were able to load up everything they wanted by the deadline. Once back in the Twin Cities, they unloaded the glider materials in Ingemar's pole barn and started doing their research. Looking at photos of CG-4As online, they realized the glider parts they had travelled so many miles to acquire, were not even for a CG-4A, the primary glider built at NAC. Instead they had transported back to Minnesota parts of a CG-15, the improved CG-4A that was only built by Waco in late 1944 and early 1945.

Again, Don Patton made more calls to locate parts for a CG-4A and found his way to Frank McKinley, a civilian who worked at Whiteman Air Force Base, known as

Sedalia Glider Base during the war, in Missouri. Frank was involved with a group that had at one timed planned to build a glider at this air force base near Knob Noster, Missouri, about seventy miles southeast of Kansas City. The project had never gotten off the ground, but there was quite a collection of parts, especially those for the glider frame located there. Commonwealth Aviation, formerly the Rearwin Aircraft and Engines Company, (incorporated January 7, 1943, as Commonwealth Aviation) had built 1,470 CG-4As in Kansas City, so it wasn't surprising that there were so many glider parts remaining in the area when Don Patton was making his calls. Another road trip was in the works.

Again, there was a hitch. Whiteman is still an operational air force base today, and it has high security. Jim, Don, and Tom, however, are all retired military officers. So that was enough to get them onto the base to load up the parts. In the middle of an ice storm in early 2007, the travelling trio finally reached Minneapolis with the needed parts to start their project.

Gradually, the project gained momentum and other volunteers joined the glider restoration project. D. Dale Johnson joined the team in fall of 2007. He began by building wooden ribs and a horizontal stabilizer in his shop at his home. Then he built two nose sections, fin and rudder stabilizers, elevators, and ailerons. Dale Johnson's involvement helped move the work along because, as Jim Johns is quick to point out, the CG-4A had about 65,000 wooden parts and only about 7,000 metal parts. Thus, there

was a lot of woodworking to be done. Dale was aided in his work by the availability of a few wood parts from original CG-4As that the team either discovered in the searches or that were donated to the project.

Frank T. Ourada recalls that he started working on the glider restoration project in early 2008. He makes no claim to having a special skill for this work, but he enjoyed being a member of the team and doing whatever someone asked him to do. Joe Messacar, a retired aerospace engineer, started volunteering with the group in April 2008, initially helping with putting the frame for the center fuselage together. Blueprints for the CG-4A were acquired from various sources, and as an engineer, Joe's aerospace training was invaluable in interpreting them.

Joe's explanation of the problems with the blueprints is helpful in understanding the complexity of the restoration work. The team had acquired two large rolls of microfilm containing blueprints for the CG-4A, and they took the microfilm to the Minnesota Historical Society to use a microfilm reader. Jim Johns then explained, "We pulled up the first print and it's a bolt. We said this is going to take FOREVER. There were thousands of prints. And it's not indexed. … This is going to be a problem." Eventually the team was able to borrow a better set of microfilm from Frank McKinley, who had gotten the rolls from the Silent Wings Museum in Lubbock, Texas. Dedicated to World War II gliders, the Silent Wings Museum has its own restored glider in its collection of glider artifacts, interviews, memorabilia, and other archival materials.

Joe now had the job of making the blueprints accessible for the team. He estimated there were about 12,000 images of varying sizes on the four rolls. First, he had the rolls converted to digital files and then stored the digital files on four CDs. This way he could scan the files on his computer when looking for the blueprint of a specific part number. Once he located the image with the correct part number, he could print the image on paper.

The images on the microfilm, as Joe explained, had originated at the Ford Motor plant in Iron Mountain, Michigan. He estimated that they were from 1945, when the last of the CG-4As were built there. Ford Motor had sent the original blueprints to The Smithsonian in Washington after the war where the microfilms were produced. Silent Wings had gotten its copy of the microfilm from the Smithsonian. In spending hundreds of hours looking at the blueprints, Joe realized that "some of the parts were obsolete and they had different versions [of the same part]. Sometimes it was deciding whether we were going to make the obsolete version or try to find the newer version."[209]

Eventually Joe received some unexpected help in figuring out all the part numbers, which made locating the print for a specific part much easier. The Minnesota Historical Society had requested some information on gliders from the Smithsonian as part of its Greatest Generation Project. Among the materials the Smithsonian sent were pages and pages of numbers. No one knew what these pages were. Joe looked at the

pages of numbers and recognized that they were part numbers, all organized so he could match them up with the blueprints. These lists of numbers were his key to speedily searching his CDs. So when a team member needed a blueprint of a specific part or a subassembly, Joe could find the print in a relatively short time.

The work that the volunteers were doing was important and exciting because of their progress, but there were other challenges they had to deal with: space and money. The team realized early on that with all the progress they were making, the glider sections were outgrowing their pole barn. They needed more space—a lot more space if they were going to build a full-size glider. They had no hangar available to them, nor did they have the funds available to rent a hangar that would be adequate to house a completed glider. By 2008, Jim Johns approached Nick Linsmayer to see if there was any space available at Villaume Industries. Nick agreed and, as Jim recalls Nick saying, he would give the team the space they needed for a year, "but on the 366th day, you'll be a memory."

When asked why he agreed to let the restoration team use valuable space in his plant, Nick responded, "I didn't want to make any long-term commitment, but I didn't know how long the project would take …. What I do remember specifically was that you two [Jim and Ingemar] came up with those parts that you got from Kansas and there was ice on it. It was frozen. And you drive into Villaume and everybody looking

at this thing. … What is this? This looks like the junkman showed up instead of going out."

Linsmayer also appreciated the track record compiled by the restoration team from its earlier projects. As he explained, "When I talked to you two, you said, 'We're not amateurs here.' … You really had this huge experience, and I think that was to me very exciting. … I wouldn't have let you in the door if I didn't think you had the capability."

By the time the restoration team had received Nick's support for using space in the Villaume plant, it had also solved another problem, which had nothing directly to do with parts, blueprints, or space. Initially the team had been paying its expenses out of the pockets of the individuals involved. Team members treated the glider restoration as a private project, but that wouldn't be enough to get them through to completion.

Jim Johns and Tom Wier had been board members of the American Aviation Heritage Foundation (AAHF) since 1995, when Terry Baker, the former director of the Planes of Fame Museum, had created the foundation. AAHF's mission was twofold: to promote American aviation primarily through aircraft restoration and to educate the public about the amazing history United States aviation.

Around the same time that the restoration team got Nick's permission to use space in his plant, Terry Baker and Jim Johns were discussing the glider project, and Jim mentioned the anticipated funds that would be needed to complete the glider. Terry

Baker suggested that the team bring the glider restoration project, as Baker explained, "into the foundation, which being a nonprofit … would be able to raise funds through tax-deductible contributions that we could then use to complete the glider restoration."[210] The glider restoration leaders agreed, and according to Baker, "It worked out really well because we did receive contributions and they came in quickly enough that the glider … restoration process could be moved along more rapidly than it could have ever been done privately."

Terry Baker, administrator of the AAHF, acknowledged that Nick Linsmayer's offer to have the team use space at Villaume "was just the perfect solution in many ways … not only because the glider requires a large area to work on it, but [also] because of his family heritage."

When asked about the cost of the restoring the glider, Baker confirmed that contributions came from individuals in the community who were known to support aviation history. He also pointed out that "we had a lot of materials that were donated to us that were necessary for the glider." Villaume Industries, for example not only donated work space at its facility in Eagan, the company also donated much of the wood needed for the project. Other wood contributions came from The Roddis Lumber and Veneer Company. The biggest single donation to the project, however, as Baker was quick to mention, was the estimated 30,000 hours of donated labor from the restoration team. Once they were settled in the Villaume plant, team members gathered

every Tuesday and Friday for the next four years, a little longer than the original 365 days promised by Nick Linsmayer! Financially speaking, individual gifts, grants, and in-kind contributions generated about three-quarters of the money raised, all of which went into supporting the project.

When asked about how much cash was actually available to cover costs, Jim Johns said, "I raised the whole $14,000 that it took to build the glider … and we built the glider for the $14,000 and NO ONE in that $14,000 gave us money because they wanted a tax write-off. They gave us money because they wanted to see a glider built."[211] As Nick Linsmayer summed up the expenses involved, "I think the amazing thing is that you built this [glider] on a shoestring, that the foundation was the instrument by which we were able to set aside funds."

The project gained even more momentum when Don Patton organized a Twin City symposium in May 2009 that focused on the use of gliders in World War II. This event was well attended, drawing former glider pilots, glider troopers, and historians from both local community and from around the country. When asked how the glider symposium had influenced the work on the project, Ingemar Holm gave this answer:

> I'd say [the glider symposium] motivated [me] and I really got a feel for "wow," this really is an important part of World War II and then to speak to some of the people who actually flew in these gliders. It really helped me refocus and see the importance of the project. …
>
> I learned a lot more about the history and we had a better appreciation, I think, for where that airplane was being used in the war. Because we had a lot of authors of books that had been written about [gliders] who were there, and [we] got a lot of good information.[212]

Prior to the symposium, the team was pushing to get as much done as possible, and the team publicly put out a call for additional volunteer help. That plea paid off, and in the coming months, new volunteers, including Pat Foss, Kevin Pamperin, Scott Ingram, and Marilyn Curski, came forward. Some worked with the team temporarily, and some saw the project through to completion.

Pat Foss had joined the team in February 2008, more than a year before the symposium. He recalled that he initially worked on the glider's tail section. In an interview, Pat explained his introduction to the glider this way:

> It was a lot of rust to clean up and a lot of nasty old things that we had to just try to assemble out of a pile of stuff that looked like it came out of a an old muffler shop with all the pipes and stuff laying around. Going to make an airplane out of that? It was kind of fun though. It was challenging and I liked the thought of doing it. Didn't think it would take four years, but it did.[213]

Kevin Pamperin joined the restoration team after the 2009 symposium, and he considered the project "a major learning project as far as all the different parts and how things fit together and what their purposes actually were and how this thing actually would fly." Scott Ingram described himself as "a latecomer" to the project. Scott had never done any aircraft restoration, but he had once done work restoring streetcars. With his own machine shop, he was also experienced in reading blueprints, and he was able to complete some metal fabrication that was a very helpful to the team when the work was being accelerated. [214] Marilyn Curski, a World War II enthusiast, had absolutely no experience for the work whatsoever, but she most enjoyed finer work such as stringing and taping. She was completely amazed that these aircraft loaded

with men and armaments had been held together with waxed string, electrical tape, and wood glue!

The restoration team also received excellent help from the Silent Wings Museum in Lubbock, Texas. Jim Johns and others drove to Lubbock to pick up parts that would have been hard to fabricate. Among these helpful spares from Lubbock was the landing gear for the CG-4A. Johns called that a "BIG" part. Although the team had to actually produce nearly all the wooden parts, they were able to save a lot of time, money, and labor by using the parts donated by Silent Wings, parts that had originally been made during World War II.

Other original parts that were donated to the project included a horizontal stabilizer and a tail wheel strut assembly. A man from Richfield, Minnesota contacted the restoration team about a pair of glider skids that his deceased neighbor had stored for years up in the rafters of his garage. When the team went to see these original skids, they found that one of them had been sawed in two. The other was undamaged, however, and it was used as a template for making a replacement.

After hearing about the glider project in the local news, a woman in the Twin Cities gladly donated a large bundle of fabric that her deceased sister had brought home from NAC after the war. Stenciled with "CG-4A," the fabric was clearly original from the days of NAC, but unfortunately after one of the volunteers opened the bundle, he found that "big circular tablecloths that had been cut out of the fabric."

Original fabric from NAC simply wasn't available, so, according to Jim Johns, when it came time to apply fabric to the wings, tail, and fuselage, the restoration team used "all new modern stuff." Easily applied with glue, the "modern stuff" made of polyester is expected to last at least fifteen years. Doping the fabric, however, was just as unpleasant to smell as it had been during World War II.[215]

Practical changes such as substituting polyester fabric for a very expensive cotton weave similar to what had been used in the 1940s were part of the decision making required to keep the project moving forward. Another change of this sort occurred with building the wood floor for the interior of the cargo area. In the original CG-4As, the floor consisted of a honeycomb assembly which, according to the blueprints, had cells of glued plywood every six inches and then was covered top and bottom by mahogany veneer. That design made the floor very strong and also very light, especially for such a large surface area (roughly thirteen feet long, six feet wide, by six and a half inches thick). By Jim's account, building the floor "according to the plans would have been a real nightmare." The team decided that since the restored glider was not going to be flown, they did not have to make it exactly as the plans indicated. Instead the floor in the restored glider is built from plywood with cells of about sixteen inches on a side (instead of every six inches). This floor was strong enough, but it was not as light as the original (or as fragile). The tradeoff they quickly found was that they had to use a forklift to move the floor into position once it was ready to install in the fuselage. By

appearance, the floor the team built looks just like the original. It was simply cheaper and easier to build.

When team members were asked, "What was the biggest problem the team faced in the restoration project?" Their answers were not about money, time, or finding skilled volunteers, or even finding the correct blueprints. One of the biggest hurdles in the project was finding all the parts that they could scrounge up so some parts would not have to be newly fabricated. The other hurdle involved mismatched dimensions.

Concerning the parts shortage, the Internet in one instance was a big help. Ingemar Holm needed to find a load levelizer, a part that is sometimes called a "loadmaster." The pilot or copilot used the device to calculate the glider's load, depending on whether the cargo was thirteen glider troops, a jeep, a howitzer, or even at times, a small bulldozer. The load levelizer, which looks something like an old slide rule, was installed in the cockpit of the glider and was used to determine the correct load positioning that would allow the glider to fly properly. Ingemar was able to find one on the Internet that had never been used—and at a very reasonable price.

Concerning mismatched dimensions, Joe Messacar and Pat Foss explained that when Dale Johnson was building the parts for the wings and ailerons, he had been working from a wartime glider maintenance manual. Later on, after Joe found the correct blueprints, they discovered that during the CG-4A manufacturing lifespan, between 1942 and 1945, the width of the ailerons had changed. As a result, the wings

had been built one way, the ailerons another way, and the struts that supported the wings had been built yet a different way. Nothing matched, and none of these parts could be put together unless they "made some modifications." It took them a "couple of months" in 2011 or 2012, according to Joe, until they "started putting things together to really make it look like an airplane."[216]

Finally by early 2011, the AAHF team could estimate completion of the glider by the following year. Nick Linsmayer also needed his space back for upcoming work at Villaume Industries. Now the team was confronted with another dilemma: where would the completed glider? Don Patton, Jim Johns, and others approached various museums and other public venues (Minnesota and elsewhere) to find an organization interested in displaying the restored glider. A number of interested parties visited the Villaume plant and marveled at the work the team had done, but no hard offers to take the glider were forthcoming, largely because few museums had the requisite space to house a full-size glider.

As Nick Linsmayer recalled, he got a phone call one day in the spring of 2011 from Boyd Huppert, a TV news reporter for station KARE, Channel 11, in the Twin Cities. Huppert had heard from a viewer that Villaume had a glider. Nick explained what the glider project was, emphasizing that this was as much a Minnesota story as it was a World War II story, and that Huppert should do a story on it. And on July 10, 2011, Channel 11 aired a three- or four-minute report on the restored CG-4A.

Boyd Huppert's Channel 11 report triggered a phone call that evening to Nick Linsmayer at Villaume from the office of Ron Fagen of Fagen, Inc. Nick had never heard of Fagen, nor where his company was located. He soon learned that Fagen's home office was in Granite Falls, Minnesota, and that Ron Fagen, the owner of the business, was interested in the glider because he was building a museum on the grounds of the municipal airport in Granite Falls. As Linsmayer tells it, "We went out there [to Granite Falls] and saw what a beautiful operation they had. It was just spectacular. [Even though Ron Fagen was not there], we met his crew and thought this is a home for us, this plane." Today, the museum is the Fagen Fighters World War II Museum, a Minnesota nonprofit that Ron Fagen built to honor his father, Ray Fagen. Ray was a private first class in World War II who was a member of the Fourth Infantry Division when it landed at Utah Beach on the Normandy coast on June 6, 1944.[217]

Because Ron Fagen was planning to hold an airshow at the airport on June 16, 2012, the pressure was really on for the team to finish their work so that the AAHF could turn over the CG-4A to the Fagen Museum. But the mismatched dimensions and other problems slowed the team's progress. Estimating the work that still had to be done, they proposed a solution that would give Ron Fagen and the airshow a CG-4A glider, just not a completed one. The solution was that the team would complete the entire fuselage and one whole wing for the airshow. And that's what they did. The other wing was finally completed in early 2013. Today visitors to the Fagen Fighters

Museum can see the restored CG-4A with one wing attached and the other carefully mounted on a wall that is adjacent to the glider.

With the glider having found a home in a Minnesota museum dedicated to those who had served in World War II, Nick Linsmayer threw a party for the CG-4A in its final days at Villaume before carefully loading it on a flat-bed trailer and hauling it west to Granite Falls. The celebration took place on June 6, 2012, the sixty-eighth anniversary of the D-Day landings at Normandy, with the fuselage and tail section of the glider on display for the festivities. All the fabric that would normally have covered part of a wing and one side of the tail, fuselage, and nose had been left off, allowing visitors to see inside the aircraft to examine the controls, the instrument panel, and the other details of the interior that had so carefully been restored. Perfect weather promoted high attendance of the event, which was also covered by the local press.

Today there are only a small number of museums across the United States that have full size, fully restored CG-4A gliders on display. In addition to Fagen Fighters World War II Museum in Granite Fall, the other museums that tell the glider story include the Kalamazoo Aviation History Museum, Kalamazoo, Michigan; the National World War II Museum, New Orleans, Louisiana; the New England Air Museum, Windsor Locks, Connecticut; the Pima Air and Space Museum, Tucson, Arizona; the Silent Wings Museum, Lubbock, Texas; the Travis Air Force Museum the Travis Air Force Base, California; the National Museum of the U.S. Air Force Wright-Patterson Air

Force Base, Dayton, Ohio; and the Yankee Air Museum Belleville, Michigan; and the Menominee Range Historical Foundation, Iron Mountain, Michigan.

In 1988, aviation historian Noel Allard interviewed John Storm, who had worked for Northwestern Aeronautical during World War II. Storm explained to Allard how much pride the NAC workers had taken in the aircraft they built. In Storm's words, "We were cognizant of the fact that these gliders had to be flown, and if they didn't have a nice finish, they wouldn't fly as well. People worked very hard."[218] That pride, commitment to excellence, and work ethic of more than forty years that John Storm recalled was also evident in the glider restoration project that was completed at the Villaume plant so many years later. Nick Linsmayer commented during an interview that "I think … the things … that make this project unique was your [team's] experience [in doing restoration work], your passion, the people you brought around you, the fact that nobody got paid a dime, … the willingness to work. The teamwork was unbelievable."[219]

Restoration of the CG-4A glider between 2007 and 2013 was a team project. It is also a Minnesota story about how Minnesotans did their part during World War II to win the war regardless of whether they were wearing a uniform and serving overseas or wearing overalls and working in a plant building gliders in the Twin Cities. They all did what they could and we can see the results today in the combat glider that is now on display at the Fagen Fighters World War II Museum.

Conclusion

This book chronicles the remarkable achievements of the Northwestern Aeronautical Corporation (NAC), its management, employees, subcontractors, and the people of Minnesota during World War II. NAC mostly made and sold a single product: the CG-4A glider. Yet these aircraft played an important role in combat in the war, particularly in the European Theater. Much of the NAC story involves John Parker, a talented and energetic businessman who cast his lot with local leaders in the Twin Cities to create NAC in 1942 and then in 1946 to help found Engineering Research Associates (ERA).

The building of gliders in World War II at Wold-Chamberlain Field provided an unexpected (and unlikely) foundation for the establishment of ERA and the beginning of today's tech industry in Minnesota. John Parker was not an engineer or a mathematician. He admitted he had only a very basic understanding of what ERA was attempting to do in 1946. On the other hand, Parker was also a shrewd entrepreneur. He knew enough about the wartime work in codebreaking done by the handful of engineers who joined with him in founding ERA that he was willing to risk investing a significant amount of his own money in this start-up company and to see where it might go. As historians of the computer have shown, ERA in St. Paul was one of the original (and Minnesota's first) computer companies in the United States.

Prior to the attack on Pearl Harbor in 1941, Parker had spent his days negotiating financing for Northwest Airlines and other firms that flew commercial airplanes. On the surface, the establishment of NAC in collaboration with people such as Richard C. Lilly and the executives at Northwest was an extension of the investment banking work that Parker had been doing with Northwest and other air carriers in the 1930s. NAC, however, took him into uncharted territory. Working through the details involved in those prewar air-carrier finance deals was often complex and stressful, but that was not the same as the wartime demands Parker would face at NAC.

Before he took over as president of NAC in early 1943, John Parker had never been in charge of a business and unlike most of the businessmen who ran prewar airplane manufacturing companies, Parker had no sustained experience running a company that built aircraft. In addition, manufacturing combat gliders was not entirely the same as building powered aircraft for the commercial market. At the same time, Parker's only client for these gliders, the Army Air Forces, had little prior experience in the design, building, and testing of gliders. Before February 1942, NAC didn't exist. Yet by the end of the war it had built 1,510 CG-4A and 50 CG-13A gliders. That accomplishment alone surprised many contemporary observers who were knowledgeable of the aircraft industry at the time.

Because NAC was built from scratch, its wartime accomplishments as a new manufacturing company stand today as one more instance of American industry

answering the country's call for help. NAC's wartime performance demonstrates that the popular slogan "Production for Victory" was not limited to the output of weapons from major defense contractors such as the Ford Motor Company, General Motors, General Electric, or aircraft manufacturers such as Boeing, Lockheed, Douglas, Consolidated, Republic, or United Aircraft. NAC may have been a small business in comparison to those giants, but what NAC did contributed in a mighty way to winning the war.

NAC depended on more than John Parker to achieve these results. Beyond the leadership of John Parker, NAC's record reflects the talented, dedicated, and loyal men and women who made up the company's management team and the hard-working and resourceful individuals who actually built the gliders that performed so well in combat. In taking stock of NAC between 1942 and 1945, we need to honor all those people, many of whom we can't identify today from the available records, who gave of themselves to build so many gliders under such difficult circumstances.

In 2010 Fred R. Kaen, a professor of finance, analyzed large aircraft manufacturing businesses in World War II to determine if they generated outsized returns for their investors and stockholders during the war. Although this analysis focused on the companies that were building powered aircraft, the conclusions that Dr. Kaen reached have applicability to NAC. In the course of the war, the U.S. government awarded $175.062 billion dollars of prime defense contracts to U.S. corporations. Of this

total, $58.424 billion was used to buy aircraft, of which $35.171 billion or 60.2% went to the eleven largest airframe manufacturers. NAC was definitely not one of those companies.[220]

By the end of the war, NAC had received a very small portion of the remaining $23.253 billion that was spent on aircraft built by all the other companies in the United States. According to the Booz, Allen & Hamilton report in 1945, NAC's gross income from glider production totaled $27,807,535 or slightly more than 0.11% of the money that went to all the other aircraft manufacturers during the war.

By August 1945, the manufacturers of powered aircraft had delivered 295,959 airplanes of all types to the U.S. armed forces. That total is, of course, substantially greater than the total for the glider companies. Bill Norton, one of the foremost historians of the glider in World War II, summed up the performance of the U.S. glider manufacturers as follows:

> The initial rush to procure tactical gliders saw contracts placed for 11,814 aircraft in 1941 through 1943, of which about 10,000 were delivered. In developing the cargo glider, the U.S. Air Forces worked with 16 companies and 22 basic contracts. It expended $6.2 million [in 1944 dollars] through 31 October 1944, and more the next year. Ten of these contracts were cancelled, all but two because of poor contractor performance. An interim program in 1944 and final effort in 1945 saw nearly 5,000 additional gliders delivered of 8,150 ordered. … The Americans ultimately expended approximately $327 million ($4.12 billion in today's dollars).
>
> While the glider program succeeded in equipping the service to deliver airborne forces directly into combat, these were almost exclusively with the Waco CG-4A. … The nearly 15,928 military gliders ordered included 14,644 combat types, almost exclusively CG-4As, of which 9,723 were deployed overseas. Of these, more than 6,000 were shipped to the ETO, 2,303 to the MTO, 515 to CBI and the Pacific Theater, and 746 supplied to the UK.[221]

This means that of the 14,644 combat gliders produced in the United States during World War II, NAC built roughly 10% of them and received about 8.5% of the total money spent on these aircraft. These figures bolster the argument made in this book that NAC was a major contributor to the AAF glider program.

What is even more surprising about the companies that built gliders, only the Schweizer Aircraft Corporation of Elmira, New York, a builder of sailplanes before the war (it built no CG-4As), survived as a glider manufacturing company after the war. With the coming of peace, Ford Motor Company went back to building station wagons at its plant in northern Michigan. The Gibson Refrigerator Company of Greenville, Michigan, which built 1,078 CG-4As, resumed manufacturing refrigerators. Cessna Aircraft Corporation in Wichita, Kansas, returned to making small, powered planes. Even Waco, the company that had built small aircraft before the war and designed and built 1,075 CG-4As in the war, fell on hard times. It suffered crippling labor strife in the late 1940s and eventually was liquidated. Thus NAC's struggle to survive was no surprise. On the other hand, John Parker's ability to turn NAC into Engineering Research Associates in 1946 was completely unexpected and a credit to his entrepreneurial skills.

Another factor in the financing of aircraft manufacturing in World War II that Dr. Kaen analyzes is the importance of the contracts that the U.S. government awarded to the aircraft manufacturers through the Defense Plant Corporation (DPC). The DPC

financed the construction of $11.185 billion of industrial facilities that were leased to defense contractors during the war for supplying war materials. Aircraft manufacturers leased $1.431 billion (12.8%) of these government-owned plants that the firms could purchase at the end of the war.[222] The public investment in private industry's manufacturing capacity represented by the Defense Plant Corporation Act of June 1940 helped NAC to expand at a critical time. When the extensive facilities at 1902 West Minnehaha Avenue in St. Paul that the federal government had previously allocated to Alcoa became available, Parker was able to lease this site just when NAC needed more space to meet the increased demand for gliders. Fortuitously for Parker and his fellow investors in 1946, the facilities at 1902 Minnehaha then became the home of ERA and the navy provided security for the secret work that was going on there. Because ERA had the use of a government-owned plant, this fledging company had no need to raise the additional capital necessary to build or buy its own plant.

From the outset of the war, civilian and military officials in Washington from Secretary of War Henry L. Stimson on down recognized that businesses had to make money on defense contracts or they wouldn't take the work. In addition, American business leaders, especially those who had experienced the defense contracting problems of World War I, wanted government protection from large losses resulting from unexpected changes to or cancellation of government contracts.

The solution to this dilemma, as explained in chapter 3, was the cost-plus-fixed-fee (CPFF) contract. Although the CPFF solution was not perfect, it did result in a widespread willingness of American businesses to convert from their peacetime activities to the manufacturing of all sorts of weapons, equipment, and materials needed by the armed forces. The CPFF approach benefitted a small business such as NAC because it was able to get glider contracts even though it had no previous record of building gliders or anything else. In addition, as historian Mark R. Wilson points out,

> For military contractors, the most intrusive regulation of prices and profits did not come from OPA [the Office of Price Administration], which in autumn 1942 abandoned its piecemeal efforts to regulate the price of finished munitions. Instead, contractors dealt most directly with the War and Navy Departments, which acted as powerful price and profit regulators in their own right.[223]

Over time, AAF contracting officials at the Materiel Command at Wright Field and at the administrative offices of the Quartermaster Corps in Chicago became seasoned negotiators with companies such as NAC both in establishing contracts and in reviewing all the paperwork when contractors applied for payment. As Parker related in his mid-1980s interview, these military officials, as exemplified by Colonel Nelson Talbott, could also provide timely tips to a contractor regarding new opportunities to get defense-related work.

Looking at the experience of NAC between 1942 and 1945, the company's record shows that investors in NAC, such as John Parker, could obtain a contract to build gliders without excessive fear that the company might incur great losses; that the company could make a profit on building gliders; that the government

would help NAC get the additional plant space it needed for building gliders; and lastly, that NAC, just like the automobile companies that manufactured aircraft, could build these gliders without the large research and development costs that a typical aircraft manufacturer incurred.

Impressive as the performance of NAC was during the war, even more surprising is the rapid demise of the combat glider in all its variations following the defeat of the Axis powers. The glider story from 1943 to 1945 is mostly one of success on the battlefield. These aircraft did what they were designed to do. Yet only a few years after the war was over, the Air Force turned in a different direction to find a weapons system, the helicopter, that was more suited to their idea of how land warfare would be conducted going forward. These developments in air force planning were foreshadowed as early as November 1946 when Brigadier General A.R. Maxwell, who was then the Chief of the Requirements Division, Office of the Assistant Chief of Air Staff for Operations stated, "We are interested in replacing gliders as military equipment since they are too bulky and difficult to ship. … It is hoped that someday a helicopter can be developed to take its place ….[224] Combat operations in the 1950s subsequently proved that the glider of World War II was an obsolete weapons system.

The combat glider may have been a technological dead end in 1945, but NAC lived on in Engineering Research Associates. Today we need to credit John Parker and the others who saw opportunity in organizing ERA out of the experiences and

personnel of NAC that would play a vital role in the nascent computer industry in the United States. Although the active life span of ERA was only from 1946 to 1952, when it was bought by Remington Rand, ERA became an incubator for a significant number of tech companies that were subsequently organized by people who had worked at ERA.

As Minnesota's original computer company, ERA was organized at the same time the computer industry itself was first being established in the United States. According to William C. Norris, the founder of Control Data in 1957, ERA was the "wellspring," for other companies in the tech field in Minnesota. "In fact," stated Norris, "there are many companies not necessarily identified as computer companies that have their origins in computer technology that was developed by ERA." Control Data was, of course, the best known firm that had its roots in ERA, but one history of ERA identifies nearly forty spinoffs that were started by former ERA personnel.[225]

The story of NAC and its successor, ERA, is a fascinating account of the partnership between the national government and private enterprise first during World War II and then in the postwar years. Without the direction that the Materiel Command of the U.S. Air Forces supplied from Wright Field in guiding private companies such as NAC and others to successfully deliver combat gliders, the combined air-land assaults that Minnesotans such as Kermit Swanson and others participated in beginning in 1944 might have had more casualties and taken much longer to defeat the enemy. Once the war ended, the navy found that they needed a partner in private industry that would be

their supplier of computer technology so that they could continue their work in code breaking in the postwar years.

Although the founding of ERA and its emergence as an early computer company preceded what President Dwight Eisenhower identified in 1961 as the military-industrial complex, the origin of ERA is a case study in how the American military economy continued to move toward privatization as the preferred solution for the design and development of new technology that had applications in warfare. Since the early days of the American Republic, the U.S. Navy had had its own shipyards and facilities, such as the Naval Aircraft Factory (1917–1945), which took the lead in the development of new ship types and aircraft. In 1945-1946 the navy might have chosen to keep the development of new data storage devices that built on the pioneering work that was done in the lab at National Cash Register in-house at its communications facility in Washington. To do that, the navy knew it had to have a team of highly qualified engineers, but it had to face the reality that many of these civilians in uniform were unwilling to become civil service personnel.

For these and other reasons that seemed at the time to make sense, the navy chose instead to give the work to John Parker and his investors and this wartime project gained new life at ERA in St. Paul. Although ERA is only one small example, it demonstrates how outsourcing the development of new weapons and technology to private industry became the solution that was repeatedly used by the U.S. armed forces

in the years that followed. Because of widespread anxiety about national security, particularly the developing Cold War with the Soviet Union, secrecy regarding the development of new weapons and technology was of paramount importance. ERA met this need too. Over time the development of the computer transcended, however, these security concerns so that today it is a widely available device used daily by millions of people around the world.

The final chapter of this book is a compelling account of how the CG-4A glider of World War II is still with us. The project in the Twin Cities between 2008 and 2012 to restore a CG-4A was not unique. A variety of groups and institutions in the United States and elsewhere have restored World War II-era aircraft. Many of these restored planes can be found in museums in this country or abroad.

What is so unusual about the project to restore a full-size CG-4A is that the work was done totally by volunteers and it mostly took place in a warehouse belonging to Villaume Industries, one of NAC's two primary subcontractors in the war. Today that newest CG-4A is accessible to anyone who wants to see it and to marvel at the work that went into making it (and all of its wartime predecessors) at the Fagen Fighters World War II Museum in Granite Falls, Minnesota. Born in Minnesota, this CG-4A will live on in Minnesota thanks to the dedicated men and women who built it and the museum professionals who chose to preserve it for posterity. That glider represents a fitting contemporary monument to the wartime efforts of so many Minnesotans who

worked at Northwestern Aeronautical Corporation and its many subcontractors to ensure that the United States would defeat the Axis powers.

Notes to Chapter One

1. Mary C. Barnes, *The History of the Glider Program at Northwestern Aeronautical Corporation* (Wright Field, Ohio: Air Technical Services Command, U.S. Army Air Forces, September 1945; copy prepared by the American Aviation Heritage Foundation in the files of Villaume Industries, Eagan, Minn., 2009), 25–27; *Tow Lines,* June 1942, p. 4; *Erection and Maintenance Instructions: CG-4A Glider* (Patterson Field, Fairfield, Ohio: Air Service Command, U.S. Army Air Forces, February 15, 1943; copy in the files of Villaume Industries), 2–8.
2. Interview with John E. Parker (OH 99) by Arthur L. Norberg, December 13, 1985 and May 6, 1986, in Washington, D.C., Charles Babbage Institute, The Center for the History of Information Processing, University of Minnesota, Minneapolis, Minn., 4 (hereinafter referred to as the Parker Interview).
3. Ibid., 5–6. For information on Parker's parents and sister, see John E. Parker, 1920 U.S. Census; the 1920 Census also identifies him at the U.S. Naval Academy in Annapolis. Ancestry.com is the source for these census records.
4. Parker Interview, 6.
5. Ibid., 7-8.
6. "Hugh D. Auchincloss" [Hugh D. Auchincloss senior], *New York Sun,* April 22, 1913, p. 7 and "Hugh D. Auchincloss Dies," *New York Times,* April 22, 1913, p. 11; New York, Abstracts of Military Service, 1917–1919 for Hugh D. Auchincloss, New York (State) Adjutant General's Office, Abstracts of World War I Military Service, 1917–1919, series B0808, New York State Archives, Albany, N.Y.; "Mrs. Auchincloss Is Felled by Plane," *New York Times,* July 16, 1928, p. 3; "H.D. Auchincloss Resigns Post," *New York Times,* January 21, 1931, p, 29; "Mrs. H.D. Auchinloss [*sic*] in Reno for Divorce," *New York Times,* April 15, 1932, p. 16; and Hugh Auchincloss Sr., Stockbroker, Dead," *New York Times,* November 22, 1978, p. 38.
7. Barnes, 4–5.
8. "Chauncey Parker, A Leader at Bar" [Chauncey Parker senior], *New York Times,* July 13, 1943, p. 21; "C.G. Parker Dead; U.S. Aide in Italy" [Chauncey Parker junior], *New York Times,* August 6, 1953, p. 21.
9. "Changes Among Brokers," *New York Times,* May 23, 1931, p. 28; "Two More Concerns Will Join Exchange," *New York Times,* May 29, 1931, p. 31; "Albert G. Redpath," *New York Times,* December 21, 1984, p. A30.
10. Parker Interview, 9.
11. Ibid., 10. The *New York Times* carried articles about the aviation industry in which the Auchincloss, Parker & Redpath firm participated in underwriting syndicate handling stock sales on behalf of airlines or airplane manufacturing companies included Pan American (March 7, 1940, p. 42); Canadian Colonial Airways (May 10, 1940, p. 39); Chicago & Southern Air Lines (June 27, 1940, p. 36); Pennsylvania Central Airlines (October 31, 1940, p. 37); Bell Aircraft Corporation (August 14, 1941, p. 27); Cessna Aircraft Company (December 17, 1941, p. 48); and Northwest Airlines (March 27, 1944, p. 25; April 17, 1944, p. 29; and March 22, 1945, p. 31).
12. Kenneth D. Ruble, *Flight to the Top: How a Home Town Airline Made History … and Keeps Making It* (New York: Viking Press, 1986), 7–72; Jack El-Hai, *Non-Stop: A Turbulent History of Northwest Airlines* (Minneapolis: University of Minnesota Press, 2013), 1–84. Richard Lilly owned $1,000 in stock in Northwest in the late 1920s. For more on the work of Colonel Brittin, see the *St. Paul Dispatch,* July 18, 1928, p. 1. Lilly's stock ownership is found in "Saint Paul Stockholders Northwest Airways, Inc." in Lewis H. Brittin Papers, P723, file 3, Minnesota History Center, Minnesota Historical Society, St. Paul, Minn. Brittin apparently was not a stockholder because his name is not on the list. Because Charles W. "Speed"

Holman is listed as the largest St. Paul stockholder at $2,000 and he died in 1931, the list must have been compiled sometime after the Detroit investors were bought out in 1929 and before Holdman's death.
13. Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History, 1857–1945* (Chaska, Minn., MAHB Publishing Inc., 1993), 134–37. Information on the Holman Field Administration Building is from David Vassar Taylor, *Cap Wigington: An Architectural Legacy in Ice and Stone* (St. Paul: Minnesota Historical Society Press, 2001), 38–41, 105, 110, 113. For some details relating to Northwest's lease at Holman Field, see Parker Interview, 11. During the war, NAC proposed that it would take over this lease; see Holman Municipal Airport Correspondence, 1927–1944, March 24, 1944, Northwest Airlines Archives, 6 and 9, and John E. Parker letter to the Minneapolis St. Paul Metropolitan Airports Commission, August 31, 1945, in the Papers F.G. Geng, both in the Minnesota History Center, Minnesota Historical Society, St. Paul, Minn. The general offices of Northwest Airlines were located at Holman Field in 1942; see *1942 St. Paul City Directory,* p. 1948.
14. Parker interview, 11.
15. Ruble, 72 and 256.
16. The *Minneapolis Star Journal* reported on September 29, 1942, p. 18 that Northwest Airlines had elected, among others, John E. Parker, Washington, D.C. and William Stern, Fargo, N.D. to its board of directors. William Stern would play a prominent role at NAC assisting John Parker in managing the glider manufacturing company. The following day (September 30) the *Star Journal* reported (p. 27) that Northwest Airlines had decided to move its offices from the St. Paul Airport to 1885 University Avenue in St. Paul by November 1. The article stated that the vacated space at the St. Paul Airport would be occupied by "persons working on military projects." In all likelihood, this was the first step toward the establishment of Northwest's Modification Center for AAF bombers at the airport.
17. Barnes, 5.
18. Ibid.; "Airplane Plant Expands," *New York Times,* October 15, 1928, p. 30; "To Produce 1,200 Planes in 1929," *New York Times,* May 14, 1929, p. 50; "Plane Deliveries Rise," *New York Times,* March 3, 1937, p. 17; George R. Bauer, *A Century of Kansas City Aviation History: The Dreamers and the Doers* (Kansas City, Mo.: Historic Preservation Press, 1999), 176.
19. Barnes, 5–6.
20. According to Bill Norton, that statement is not supported by other AAF records. Norton reports that Ward Furniture delivered 7 CG-4As before its contract was cancelled on April 1, 1943 and the U.S. government wrote off over $1.9 million. Bill Norton, *American Military Gliders of WW II: Development, Training, Experimentation, and Tactics of All Aircraft Types* (Atglen, Penna.: Schiffer Military History, 2012), 71.
21. Barnes, 6–7.
22. Northwestern Aeronautical Corporation, Incorporation Records, Minnesota Secretary of State, Minnesota History Center, Minnesota Historical Society, St. Paul, Minn. For a biographical profile of St. Paul banker Richard C. Lilly, see Virginia Brainard Kunz, "Richard C. Lilly, The Man Who Led Two Lives: Banker and Philanthropist," *Ramsey County History,* 33, no. 3 (Fall 1998): 4–17. In the middle of 1942 Lilly was appointed to the Army Price Adjustment Board. In that capacity, he was a re-negotiator whose duties involved examining army war contracts and negotiating with contractors to reduce the profit the contractors would make on their contracts (*St. Paul Pioneer Press,* September 21, 1942). In July 1943 Lilly was elected president of the Upper Midwest regional board of directors of the Smaller War Plants Corporation. This group tried to encourage the awarding of defense contracts to smaller manufacturers, such as NAC, in this area of the country (*St. Paul Pioneer Press,* July 22, 1943). Since Lilly's First National Bank of St. Paul provided financing to NAC, no doubt Richard Lilly kept John Parker informed regarding the latest developments in the handling of defense contracts.
23. Interview with Christine Linsmayer conducted in 2013 by John M. Lindley, Nick Linsmayer, and Robert P. Barros, copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society. For Harold Rutchick, see *1942 St. Paul City Directory,* 1135.

24. Parker, John Elbridge, Official Military Personnel Files, National Personnel Records Center, St. Louis, Mo.
25. Barnes, 7–8.

Notes to Chapter Two

26. J. Norman Grim, *To Fly the Gentle Giants: The Training of U.S. WW II Glider Pilots* (Bloomington, In.: AuthorHouse, 2009), xviii, xx, xxiv; Bill Gunston, *The Osprey Encyclopedia of Russian Aircraft, 1875–1995* (London: Osprey, 1995), 82; Stephan Wilkinson, "One Way to Hell: Were Assault Gliders the Worst Idea of World War II?" *Military History*, 27, no. 2 (July 2010): 26.
27. Eddie V. Rickenbacker, *Seven Came Through: Rickenbacker's Full Story* (Garden City, N.Y.: Doubleday, Doran, 1943), 104.
28. Grim, 1–3, 15; Wilkinson, 26.
29. Grim, 258, 260, 262; Wilkinson, 28.
30. Grim, xix–xx; *United States Naval Aviation, 1910–1970* (Washington, D.C.: U. S. Department of the Navy, 1970), 76, 104, 109, and 121.
31. Quoted in Paul M. Davis and Amy C. Fenwick, *Development and Procurement of Gliders in the Army Air Forces, 1941–1944* (Washington, D.C.: Army Air Forces Historical Studies No. 47, AAF Historical Office, Headquarters, Army Air Forces, 1946), 6.
32. The National Soaring Museum's *Quarterly Journal* has the most detailed biographical profile of Barringer that is available at www.soaringmuseum.org/landmark/nls14/Barringer; see also "Air Forces Party Lost in Caribbean," *New York Times*, January 29, 1943, p. 6; and "Armed Forces Urged to Make Use of Glider," *Charelroi Mail* (Charleroi, Penna.), June 28, 1941, p. 12, in which Barringer discusses how the Germans used gliders in their surprise attacks in Belgium and Crete.
33. "R.C. du Pont One of Four Killed during Glider Test for the Army," *New York Times*, September 13, 1943, p. 21; "Richard Du Pont Pioneered in Development of Gliders," *Minneapolis Tribune*, September 13, 1943, p. 8 and "DuPont, 3 Others Killed in Glider," *Minneapolis Tribune*, September 13, 1943, p. 1, both in a scrapbook, no page number, box 2 of the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
34. Davis and Fenwick, 2–9.
35. The details of General Dent's biography can be found at www.af.mil/AboutUs/Biographies/Display/tabid/225/Article/107251/major-general-frederick-r-dent.aspx; see also "Glider Authority at Wright Field Gets New Mission," no newspaper identified and the newspaper clipping from an unidentified Texas newspaper "Kerrville Man Awarded DFC," [the photo shows Colonel Dent receiving the Distinguished Flying Cross for leading a group of B-24 Liberators on a mission over Germany] dated May 4, 1944, both in a scrapbook, no page number, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. NAC's internal newsletter, *Tow Lines*, carried a brief biographical sketch of Colonel Dent at the time he received orders to go overseas. The profile was in the August 1943 issue. A copy was pasted in the scrapbook in box 5, no page number, of the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
36. Lawrence R. Benson, *Acquisition Management in the United States Air Force and Its Predecessors* (Maxwell Air Force Base, Ala.: Air Force History and Museum Programs, 1997), 7, 11–14, 16–19; "Knudsen Views Twin Cities Plants," *Minneapolis Star Journal*, January 21, 1944, clipping in a scrapbook, no page number, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
37. The development and procurement of training gliders is discussed in detail in Davis and Fenwick,10–21.
38. Ibid., 22-32.
39. Anthony Fokker was a Dutch aircraft designer whose fighter planes were well-known to Allied pilots in World War I. Fokker opened an aviation plant in the United States in 1923 and became a naturalized citizen. Arcier became chief engineer for the Fokker Aircraft Corporation and is credited with having designed the Fokker Trimotor Transport which was flown by Amelia Earhardt and by Richard Byrd in his flight over the North Pole in 1926. Arcier (1890–1969) was a flight instructor in England during World War I with Handley Page Ltd. With that firm, he designed the first twin engine and the first four engine bombers for the Allies. He came to the United States in 1919, became a naturalized citizen in 1929, and in 1930 became the chief engineer at Waco.

40. Alexander McSurely, "Waco Builds 15-Place Gliders to Carry Yanks to Battle," *Dayton Journal-Herald*, August 23, 1942, pp. 12–13, in a scrapbook, no page number, box 5 of the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.; Mary C. Barnes, *The History of the Glider Program at Northwestern Aeronautical Corporation* (Wright Field, Ohio: Air Technical Services Command, U.S. Army Air Forces, September 1945; copy prepared by the American Aviation Heritage Foundation in the files of Villaume Industries, Eagan, Minn., 2009), 3.
41. For a detailed account of the development of the CG-4A and its specifications, see Bill Norton, *American Military Gliders of WWII* (Atglen, Penn.: Schiffer Military History, 2012), 60–79.
42. Davis and Fenwick, 23.
43. For a brief overview of the role of gliders in the aircraft procurement programs of the AAF, see I. B. Holley, *Buying Aircraft: Matériel Procurement for the Army Air Forces* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, Government Printing Office, 1964): 324, 373, 552, 558. See also Wesley Frank Craven and James Lee Cate, *The Army Air Forces in World War II,* vol. 6 *Men and Planes* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, Government Printing Office, 1958): 224–25, 621–25. These pages cover the use of gliders as troop transports in the war and the training of glider pilots. For an overview of all sixteen manufacturers of the CG-4A, see Norton, 69–71.
44. Holley, 316–325.
45. Davis and Fenwick, 90.
46. Ibid., 62–63.

Notes to Chapter Three
47. For example, see "John E. Parker Elected President of NAC," *Tow Lines*, 1, no. 3, January 1, 1943, p. 1. This short article informed NAC employees that Harry Shaffer had resigned in December and John Parker had been elected to be the new president. Parker is identified in this article as having been the chairman of the NAC board and a director of Northwest Airlines.
48. Information about Harry Shaffer is drawn from his obituary in the *Minneapolis Star*, January 6, 1961, p. 13A and in the *St. Paul Dispatch*, January 6, 1961, p. 10; *1940 Minneapolis City Directory*, 1306 and 2229; the Minnesota Historical Society Biography File; and Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History*, *1857–1945* (Chaska, Minn.: MAHB Publishing, 1993), 256.
49. Interview with John E. Parker (OH 99) by Arthur L. Norberg, December 13, 1985 and May 6, 1986, in Washington, D.C., Charles Babbage Institute, The Center for the History of Information Processing, University of Minnesota, Minneapolis, Minn., 4 (hereinafter referred to as the Parker Interview), 15; Mary C. Barnes, *The History of the Glider Program at Northwestern Aeronautical Corporation* (Wright Field, Ohio: Air Technical Services Command, U.S. Army Air Forces, September 1945; copy prepared by the American Aviation Heritage Foundation in the files of Villaume Industries, Eagan, Minn., 2009), 25–27 (hereinafter referred to as Barnes).
50. Ibid., 13.
51. Kenneth D. Ruble, *Flight to the Top: How a Home Town Airline Made History … and Keeps Making It* (New York: Viking Press, 1986), 75–82; Jack El-Hai, *Non-Stop: A Turbulent History of Northwest Airlines* (Minneapolis: University of Minnesota Press, 2013), 91–97; Northwest Airlines undated press release regarding the February 1942 survey flight in in a scrapbook, no page number, box 5, of the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
52. Scrapbook, no page number, box 5, of the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
53. Barnes, 7–8.
54. Paul M. Davis and Amy C. Fenwick, *Development and Procurement of Gliders in the Army Air Forces*, *1941–1944* (Washington, D.C.: Army Air Forces Historical Studies No. 47, AAF Historical Office, Headquarters, Army Air Forces, 1946), 168.
55. Barnes, 7–18.
56. Glider production statistics vary slightly depending on the source and when they were compiled. Perhaps the most reliable secondary source is Bill Norton, *American Military Gliders of World War II: Development*, *Training*,

Experimentation, and Tactics of All Aircraft Types (Atglen, Penna.: Schiffer Military History, 2012), 244–45. According to Norton, the 16 glider contractors produced a total of 13,906 CG-4As and G-4As. Ford produced the largest number with 4,190; NAC followed with 1,510; Commonwealth Aircraft followed with 1,470; General Aircraft with 1,112; and Waco Aircraft with 1,075. None of the other 11 manufacturers produced more than 750 (Cessna Aircraft). For all versions of the CG-13A, only Waco, Ford, and NAC built these larger gliders. Their combined total was 139. In this book, Norton's totals are used unless the numbers built are taken from an original document that is identified in the text or a note.
57. Barnes, 10.
58. *Tow Lines*, 2, no. 6 (December 1943), p. 2.
59. Ibid., 42–45.
60. I. B. Holley, *Buying Aircraft: Matériel Procurement for the Army Air Forces* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, Government Printing Office, 1964), 372–420.
61. Interview of Christine Linsmayer conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
62. Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History, 1857–1945* (Chaska, Minn., MAHB Publishing Inc., 1993), 229–230.
63. Ibid., 230. Allard and Sandvick's biographical profile of Angel "Shorty" De Ponti is on pages 186–190. Allard also discussed De Ponti in an AAHF interview conducted by John M. Lindley, Nick Linsmayer, and Robert P. Barros in 2012 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
64. Barnes, 9, 19–20.
65. Ibid., 28–29.
66. Ibid., 122–23.
67. Davis and Fenwick, 83–87.
68. *Minneapolis Star Journal*, September 23, 1942, p. 1.
69. Davis and Fenwick, 83.
70. Barnes, 122.
71. *Tow Lines*, June 1944, 2, no. 12, p. 4.

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72. *Tow Lines,* 2, no. 4 (October 1943), p. 1.
73. Paul M. Davis and Amy C. Fenwick, *Development and Procurement of Gliders in the Army Air Forces, 1941–1944* (Washington, D.C.: Army Air Forces Historical Studies No. 47, AAF Historical Office, Headquarters, Army Air Forces, 1946), 98–102 and 155; see also the several clippings from unidentified newspapers in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. and Bill Norton, *American Military Gliders of World War II: Development, Training, Experimentation, and Tactics of All Aircraft Types* (Atglen, Penna.: Schiffer Military History, 2012), 71, 72–74. Norton provides a detailed account of what happened in the accident and how the company was able to retain its contract to build gliders. By the end of the war, Robertson delivered a total of 170 CG-4As (p. 245).
74. Davis and Fenwick, 166–68; the total of 7,000 deviations is from William H. Nicholas, "Gliders—Silent Weapons of the Sky," *National Geographic,* 86, no. 4 (August 1944): 160. See also Norton, 67.
75. Interview with James E. Smith conducted by John M. Lindley, Robert P. Barros, and Donald G. Patton in 2012 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
76. Mary C. Barnes, *The History of the Glider Program at Northwestern Aeronautical Corporation* (Wright Field, Ohio: Air Technical Services Command, U.S. Army Air Forces, September 1945; copy prepared by the American Aviation Heritage Foundation in the files of Villaume Industries, Eagan, Minn., 2009), 123. (hereinafter referred to as Barnes).
77. I. B. Holley, *Buying Aircraft: Matériel Procurement for the Army Air Forces* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, Government Printing Office, 1964), 306

78. Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History, 1857–1945* (Chaska, Minn.: MAHB Publishing, 1993), 230.
79. Interview with Anthony F. Rericha conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
80. *Tow Lines,* 2, no, 6 (December 1943), p. 4–5.
81. A.A. Figen to Villaume Box and Lumber Company, April 4, 1946, p. 4, audit reports, Villaume Box & Lumber Company, 1945, box 7, Villaume Glider Files, Villaume Corporate Records, 1936–1950, Villaume Industries, Eagan, Minn. Christine Linsmayer discusses her recollections of Louis Villaume and Osgood & Blodgett in her interview in 2013 with John M. Lindley, Nick Linsmayer, and Robert P. Barros, copies on file with the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
82. Sara Witter Connor, *Wisconsin's Flying Trees in World War II: A Victory for American Forest Products and Allied Aviation* (Charleston, D.C: The History Press, 2014), 72–83, 88–91; see also her *Hamilton Roddis Memorial Lecture Series, No. 11: "Wisconsin Flying Trees: Wisconsin Plywood Industry's Contribution to WW II* (Madison, Wis.: University of Wisconsin, 2007). The caption under a photo of a locomotive with rail cars in the May 1944 *Tow Lines* reports that in October 1943, the AAF decided that it would fly all finished CG-4As away from Wold-Chamblerlain Airport. Then in April 1944 the AAF decided instead that the aircraft were to be shipped by rail. The rail spur was about four miles west of NAC's facilities at the airport.
83. Ibid., 139–45. Norton discusses the "snow glider" on page 77 and 250.
84. Sara Witter Connor, *Wisconsin's Flying Trees: Wisconsin Plywood Industry's Contribution to WWII* (Madison: University of Wisconsin: Department of Forest & Wildlife Ecology, 2007), 3–5.
85. Interview with Anthony F. Rericha conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
86. Connor, *Wisconsin's Flying Trees: Wisconsin Plywood Industry's Contribution to WWII*, 7 and Norton, 70. Beiter's U.S. patent is number 2345025, of March 28, 1944. According to Norton, General Aircraft built 1,112 CG-4As.
87. Davis and Fenwick, 103–08; *Tow Lines,* 2, no. 10 (April 1944), p. 5. The high relative humidity needed for hot-press gluing in the Villuame plant caused problems for the company after the war ended and it converted to peacetime operations. Among other issues, "the extreme humidity required in glider fabrication subjected buildings to abnormal wear and deterioration. The effects of such humidity were not fully ascertainable until termination of war contracts in 1945." This quotation is from a letter from the Villaume Box & Lumber Company to T.H. Feig, U.S. Internal Revenue Service, August 11, 1948, p. 2, income tax records, 1945–1950, Villaume Box & Lumber Company, 1945, box 7, Villaume Glider Files, Villaume Corporate Records, 1936–1950, Villaume Industries, Eagan, Minn.
88. Telegram from Orval R. Cook, Wright Field, to John E. Parker, July 23, 1943 congratulating NAC on its achievement, box 2, John E. Parker Collection; "Glider Contract Completed Nine Days Early; Firm Celebrates Today," *St. Paul Pioneer Press,* July 24, 1943, box 5, John E. Parker Collection; "City Glider Shops Hit Goal in Output," unidentified newspaper, box 5, John E. Parker Collection; "2 Firms to Celebrate Reaching Glider Quota," unidentified newspaper, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
89. NAC employment numbers are from Barnes, table following p. 37; Villaume Box & Lumber Company to T.H. Feig, U.S. Internal Revenue Service, August 11, 1948, p. 2, income tax records, 1945–1950 and Villaume Box & Lumber Company Production Facilities [circa 1950], p. 4, Villaume Box & Lumber Company, 1945, box 7, Villaume Glider Files, Villaume Corporate Records, 1936–1950, Villaume Industries, Eagan, Minn.; and for De Ponti, see Allard and Sandvick, 188.
90. Barnes, 32.

91. Ibid.
92. Arthur Oliver Edwards, obituary, *Minneapolis Star Triibue,* May 6, 2012, p. 7B.
93. "Violet Judith Oquist," obituary, *Mesabi Daily News,* January 9, 2008; "Willetta Berry," obituary, *Fergus Falls Daily Journal,* June 23, 2010; Mathilda Kathleen "Kae" Vandeputte, obituary, *Minneapolis Star Tribune,* May 15, 2014, p. 6B; "Harriet Gayle Kronman," obituary, *Hibbing Daily Tribune,* February 25, 2010.
94. Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History, 1857–1945* (Chaska, Minn., MAHB Publishing Inc., 1993), 230.
95. Interview with Noel Allard conducted by John M. Lindley, J. Nicholas Linsmayer, and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
96. Interview with Anthony F. Rericha conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
97. "Leonard Johnson, 91," obituary in *Hutchinson Leader,* October 13, 2014.
98. *Tow Lines,* 2, no. 12 (June 1944), p. 4.
99. Allard and Sandvick, 131.
100. Ibid.
101. Interview with Mary Ellen Kruger conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
102. *Tow Lines,* 1, no. 9 (April 1, 1943), p. 1.
103. Davis and Fenwick, 121–22.
104. Ibid., 123.
105. Ibid., 57–59. The XPG-1 received lots of publicity; see the newspaper clippings from the *Washington (D.C.) Evening Star, St. Paul Pioneer Press, St. Louis Post-Dispatch, Minneapolis Star Journal, Dayton Daily News, Chicago Tribune,* all dated May 13 or 14, 1943 as well as *Tow Lines,* 1, no, 12 (May 15, 1943, p. 1 in box 5, and "Wing Talk," *Collier's,* June 26, 1943, in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
106. *St. Paul Pioneer Press,* July 25, 1943, no page identified, in box 5, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
107. Several newspaper clippings that discuss Colonel Brittin's career mention his efforts to get American Radiator to build their plant at 1902 Minnehaha. See the Lewis H. Brittin Papers, P723, folder 1, Minnesota History Center, Minnesota Historical Society, St. Paul, Minn.
108. Davis and Fenwick, 137–39; Barnes, 13–25 (contract details) and 150–51 (for the specifications and various loads for which the CG-13A was designed).
109. Barnes, 20–24.
110. *Tow Lines,* 2, no. 5 (November 1943), p. 1.
111. Interview with Christine Linsmayer conducted in 2013 by John M. Lindley, Nick Linsmayer, and Robert P. Barros, copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
112. Interview with William T. Igoe conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society. The anecdote about the man and the woman in the glider fuselage is from the 2012 interview with James E. Smith.
113. Allard and Sandvick, 231.
114. Barnes, 41–42.
115. *Tow Lines,* 2, no. 5 (November 1943), p. 1.

116. Barnes, 41–45. In early 1944 the War Labor Board authorized a wage increase in a union agreement made between the Cabinet Makers and Millmen's union, No. 1252, and the Villaume Box & Lumber Company. The agreement provided pay increases of 5 to 7½ cents per hour for the 1,200 employees of the company engaged in war production. The contract approved on March 2, 1943 was completed August 11. The WLB order authorized payment retroactive to May 1, 1943, on the basis of the wage increases set up. The pact also allows an additional increase of 3 cents per hour for night workers; see *The Minnesota Union Advocate,* March 9, 1944, p. 6. A copy of *The NAC Answer Book* (1943) is in box 1, of the Parker Collection. This is the equivalent of an employee manual for NAC. Based on information in this source, the minimum wage rate at NAC for unskilled workers was 45¢ per hour for the first three months. After three months, the minimum increased to 50¢ or 60¢, depending on the workers' experience. Workers assigned to the second shift were paid a shift differential of 5¢ more per hour; workers on the third shift received a 10¢ more per hour. Employees normally worked six 8-hour days with Sunday off. Official holidays at NAC were New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving, and Christmas. Overtime pay was calculated at 1.5 times base pay rate; this rate also applied to work on Saturday for anyone who had already worked 40 hours that week. NAC employees were not permitted to work more than 12 hours in any one shift or more than 72 hours in any one payroll week.
117. I NEED TO ADD REFERENCES TO THE ROSIE THE RIVETER BOOKS HERE.
118. Jim La Mont (1889–1964) was a storied aviation mechanic who was working for Northwest Airlines when the war broke out. The airline "loaned' him to NAC during the war, which was undoubtedly very helpful to the glider builders. In 1946 he retired from Northwest Airlines with the title Superintendent of Inspection in the maintenance department.
119. "Giant Transport Will Soar on First Test Flight Today," *Minneapolis Morning Tribune,* November 30, 1943, no page number, in box 2, and "Huge Glider Set for Flight Test," *St. Paul Pioneer Press,* November 30, 1943, no page number; "Army's Largest Glider Built in Twin Cities," *St. Paul Pioneer Press,* November 30, 1943, no page number; "Biggest Troop Carrier Airworthy," *St. Paul Pioneer Press,* December 2, 1943, no page number [includes the Price quotation, all in box 5, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

Notes for Chapter Five

120. The information on glider losses in Operation Husky are from Bill Norton, *American Military Gliders of World War II: Development, Training, Experimentation, and Tactics of All Aircraft Types* (Atglen, Penna.: Schiffer Military History, 2012), 157–58.
121. For a brief account of glider operations in the landings on Sicily, see J. Norman Grim, *To Fly the Gentle Giants: The Training of U.S. WWII Glider Pilots* (Bloomington, Ind.: AuthorHouse, 2009), 255–260 and John C. Warren, *Airborne Operations in World War II, European Theater,* USAF Historical Studies, No. 97 (Maxwell Air Force Base, Ala.: USAF Historical Division, Air University, 1956), 3–4 gives a succinct summary of all the problems related to gliders in Operation Husky, which states that the "principal glider mission in HUSKY had been a fiasco." Warren also states that prior to July 1943, "written documents for airborne operations scarcely existed … when the Allies invaded Sicily." In other words, the USAAF needed to do a lot better job of planning for the use of gliders in future landings. See also Stephan Wilkinson, "One Way to Hell: Were Assault Gliders the Worst Idea of World War II?" *Military History,* 27, no. 2 (July 2010): 29.
122. "Gliders Used in Drive on Sicily Called Marvels," *Chicago Tribune,* July 13, 1943; "Chute, Glider Troops Aid Fight for Catania," no newspaper or date identified; "Gliders Pass Test in Invasion," no newspaper or date identified, all in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.; *Tow Lines,* 2, no. 7 (January 1944), p. 2. *History of Fillmore County, Minnesota* (Preston, Minn.: Fillmore County Historical Society, 1982), "Elwin & Myrtle Carson;" *Spring Valley Tribune,* August 10, 1942, p. 1; "Elwin Carson," U.S. Department of

Veterans Affairs BIRLS Death File, 1850–2010 online database; *Spring Valley Tribune,* November 18, 1943, p. 7.

123. William H. Nicholas, "Gliders—Silent Weapons of the Sky," *National Geographic,* 86, no. 4 (August 1944): 149–150. More details on this operation are found in *Tow Lines,* 2, no. 10 (April 1944), p. 1. Cartoonist Milton Caniff made Cochran famous when he modeled Flip Corkin, a character in Caniff's strip, *Terry and the Pirates,* after Cochran. A second operation involving gliders took place at a Japanese-held airstrip near the town of Myitkyina in northeastern Burma (now Myanmar) on May 17, 1944. See Charles F. Romano and Riley Sutherland, *United States Army in World War II; China—Burma—India: Stillwell's Command Problems* (Washington, D.C.: Center of Military History, 1956; 1987), 197, 227.

124. A profile of Murphy is found in "Col. Murphy Heads AAF Glider Section," *Aviation News,* February 12, 1945, no page identified, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

125. Wilkinson, 29. See also "The Airborne Invasion of Burma," *The Waco World*, 2, no. 4 (July 1944): 1, 7; "Gliders Land Commandos Behind Japs," unidentified newspaper, no date or page; and "Coogan Makes Glider Invasion Sound Easy," *St. Paul Pioneer Press*, June 6, 1944, no page identified, all in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

126. Interview with Hal Roed conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.

127. Norton, 163.

128. Warren, 61–74.

129. Kevin L. Cook, "The Planes with No Engine," *American Heritage of Invention & Technology,* 21, no. 2 (Fall 2005): 37.

130. Interview with Raymond P. Nagell conducted by John M. Lindley, Robert P. Barros, and Donald G. Patton in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society. Ray Nagell was also interviewed in 2009 by Douglas Bekke as part of the Minnesota Military Museum's World War II Veterans Interview Project. Copies of this interview are available at the Minnesota Military Museum, Camp Ripley, Minn. and at the Minnesota Historical Society. For more details regarding the operations of the glider units in the 82nd Airborne and the sinking of the *Susan B. Anthony,* see Leonard Rappaport and Arthur Norwood Jr., *Rendezvous With Destiny: A History of the 101st Airborne Division* (Greenville, Tex.: 101st Airborne Association, 1948; reprint edition, Old Saybrook, Conn.: Konecky & Konecky, 2001), 132–137; 151–52.

131. Interview with Kermit J. Swanson conducted by John M. Lindley and Robert P. Barros in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.

132. "Harold Shebeck, Weathered Many of the Famous WWII Battles—A Visit to Normandy in 1996 Was a 'High Point' of His Father's Life, His Son Said," *Minneapolis Star Tribune,* June 21, 2008, p. 6B; Harold A. Shebeck obituary, *Minneapolis Star Tribune,* June 15, 2008, p. 8B.

133. Richard Fewell Noland obituary, *Minneapolis Star Tribune,* December 24, 2009, p. 6B; Graham A. Cosmas and Albert E. Cowdrey, *United States Army in World War II; The Medical Department: Medical Services in the European Theater of Operations* (Washington, D.C.: Center of Military History, 1992), 40, 83, 95, 132, and 256.

134. Wilkinson, 30; Rick Atkinson, *The Guns at Last Light: The War in Western Europe, 1944–1945* (New York: Henry Holt, 2013), 188–200; and Norton, 164-65.

135. Ibid., 256–289; Wilkinson, 30; Warren, 149–55 provides a detailed analysis of the role that glider played in Operation Market.

136. Quoted in Ibid., 37-8.

137. Quoted in Wilkinson, 30.

138. Interview with Hal Roed conducted by John M. Lindley and Robert P. Barros in 2013.
139. Ibid.
140. Interview with Raymond P. Nagell conducted by John M. Lindley, Robert P. Barros, and Donald G. Patton in 2013.
141. Ibid.; see also Warren, 101–155 and Cornelius Ryan, *A Bridge Too Far* (New York: Simon & Schuster, 1974), 216–17, 366. Correspondent Walter Cronkhite is quoted in a note on page 216 of Ryan's book as having reported: "I thought the wheels of the glider were for landing. Imagine my surprise when we skidded along the ground and the wheels came up through the floor. I got another shock. Our helmets, which we all swore were hooked, came flying off on impact and seemed more dangerous than the incoming shells." All three armies plus the Dutch civilian population suffered greatly as a consequence of Operation Market Garden. Ryan provides casualty numbers on page 599.
142. Casualty statistics are from Charles B. MacDonald, *The United States Army in World War II; The European Theater of Operations: The Siegfried Line Campaign* Washington, D.C.: Center of Military History, 1993), 206.
143. Interview with Kermit J. Swanson conducted by John M. Lindley and Robert P. Barros in 2013.
144. Ibid.
145. David Little, "For Willmar Man, His War Heroics Aren't Forgotten by Faraway Land," *West Central Tribune,* November 11, 2009; Lyle Sande obituary, *Sioux Falls Argus Leader,* November 14, 2014.
146. Curt Brown, "Heroic Drop into History," *Minneapolis Star Tribune,* October 16, 2009, p. 3B.
147. Hugh N. Cole, *United States Army in World War II; The European Theater of Operations; The Ardennes: Battle of the Bulge* (Washington, D.C.: U.S. Army Center of Military History, 1965), 468 and 609.
148. Interview with Raymond P. Nagell conducted by Douglas Bekke in 2009, Minnesota Military Museum's World War II Veterans Interview Project. Copies of this interview are available at the Minnesota Military Museum, Camp Ripley, Minn. and at the Minnesota Historical Society.
149. Interview with Raymond P. Nagell conducted by John M. Lindley, Robert P. Barros, and Donald G. Patton in 2013.
150. Warren, 177–188. Glider statistics are from Norton, 168.
151. Atkinson, 565.
152. Interview with Kermit J. Swanson conducted by John M. Lindley and Robert P. Barros in 2013.
153. This airborne operation was code-named Gypsy Task Force. It was sent into the northern Cagayan Valley in Luzon near Aparri on June 23, 1945. The airborne portion of the assault included Parachute Infantry units, a battery of Parachute Field Artillery, and seven gliders.
154. Kevin L. Cook, "The Planes with No Engine," *American Heritage of Invention & Technology,* vol. 21, no. 2 (Fall 2005): 35.
155. *Tow Lines,* vol. 2, no. 10 (April 1944): 5. The material on John A. and James S. Sablak is drawn from their 1994 written "Experiences" sheets in the files of Villaume Industries, Eagan, Minn.; and the obituary for James S. Sablak, *St. Paul Pioneer Press,* June 27, 2012, p. A8.

Notes for Chapter Six

156. Obituary for Floyd M. Homstad, *Minneapolis Star Tribune,* July 7, 2009, p. 6B.
157. This anecdote is repeated by Nick Linsmayer, president, Villaume Industries, during an interview with Noel Allard by John M. Lindley, J. Nicholas Linsmayer, and Robert P. Barros conducted in 2013 on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society. It is also retold in the interview with Ingemar Holm, Pat Foss, Kevin Pamperin, Dr. Tom Wier, D. Dale Johnson, Scott R. Ingram, Frank T. Ourada, Joe Messacar, James N. Johns conducted by John M. Lindley and Robert P. Barros in 2013. Linsmayer was involved in the glider restoration project and knew Homstad then.

158. Bruce B. Price, "Glider Giants,"*Air Force,* February 1944, no page identified; *Western Flyer,* February 1944, no page identified; "New U.S. Glider Can Carry Big Gun and Crew," *New York Herald Tribune,* March 12, 1944, p. 1; and "Wing Talk," *Colliers,* March 11, 1944, no page identified.
159. "Knudsen Views Twin Cities Plants," *Minneapolis Star Journal,* January 21, 1944, no page identified, box 2; the photo of Parker and Knudsen is in the scrapbook in box 4, page 30 top; both are in the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. This same photo also appears in *Tow Lines,* vol. 2, no. 8 (February 1944), p. 1.
160. "War Bond Purchases Doubled at One Firm," *St. Paul Pioneer Press,* January 21, 1944, no page indicated, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
161. All references to *Tow Lines* are to copies in the Villaume Glider Files, *Tow Lines,* box 3, Villaume Industries, Eagan, Minn. except for the November 1944 issue, which is in box 1, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. In box 1 of the Parker Collection there is a clipping of a photo from the November 18, 1944 edition of the *St. Paul Dispatch* in which John Parker is shown with the woman who was the chair of the NAC employees' committee for the sixth war loan (bond) drive. They are standing on a platform in front of an estimated 4,000 NAC employees who were being encouraged to put the drive over the top at a "pepfest" at the Prom Ballroom in St. Paul. In a number of newspaper photos or articles in which Stern is mentioned, he is sometimes identified as the "assistant to the president," John Parker.
162. The photos of Parker and Bergman and of Bergman and Stern are in the scrapbook in box 4, page 60 in the John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
163. *St. Paul Dispatch,* January 20, 1944, p. 1; *Minneapolis Morning Tribune,* January 21, 1944, p. 5; *Minneapolis Star Journal,* January 21, 1944 and the *St. Paul Pioneer Press,* January 21, 1944, page numbers not identified, all in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
164. *St. Paul Pioneer Press,* April 30, 1944, no page identified; *Minneapolis Tribune,* April 30, 1944, no page identified, both box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. Parker's reference is to the 1st Air Commando operation in Burma on March 5, 1944, which received widespread publicity.
165. *Minneapolis Star Journal,* May 19, 1944, p. 1 and *Minneapolis Daily Times,* May 19, 1944, no page identified, both in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
166. "Glider Troops Train for Role in the Invasion," *New York Herald Tribune,* April 17, 1944, no page identified and "Troop Carrier Command Two Years Old," identified newspaper, no date, no page, both in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
167. "Tests Here Prove Robot Glider Pilot," *Minneapolis Tribune,* May 13, 1944, no page identified, box 2, and "Automatic Pilot Controls Giant Glider in Successful Flight Test," *St. Paul Pioneer Press,* May 14, 1944, p. 6, box 5, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
168. "Glider Plant to Be Opened Here Friday," *St. Paul Pioneer Press,* May 31, 1944, p. 1; "New Army Glider Plant Open Friday," *Minneapolis Times,* June 1, 1944, no page identified; "New Glider Plant to Open Formally," *Minneapolis Star Journal,* June 1, 1944, no page identified, all in box 2; a program for the Opening and Inspection Day is in box 4, p. 39 bottom; "Glider Makers Back Them Up [with bond purchases]," *Minneapolis Tribune,* June 9, 1944, no page identified, box 3, all in John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

169. The many newspaper clippings on the Normandy landings are in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
170. "D-Day," *New Republic,* June 19, 1944, no page identified, box 3, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
171. William H. Taylor letter to John E. Parker, July 18, 1944, original in box 2; letter reprinted in *Tow Lines,* 1, no. 19 (September 1944), p. 4, box 1, both in John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
172. Clipping and photos from *Tow Lines* about Toms' visit in box 5, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
173. Clipping from *Tow Lines,* undated, box 5, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
174. "Boost Production," *St. Paul Dispatch,* September 7, 1944, no page identified; "Boost in Glider Output Planned," *Minneapolis Tribune,* September 7, 1944, no page identified, both in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
175. "Sky Army Invades Holland," *Minneapolis Tribune,* September 18, 1944, p. 1; "Gliders Land Thousands to Aid Lost Air Division," *Milwaukee Sentinel,* September 24, 1944, p. 1; "New Sky Army in Arnhem Fight," *Minneapolis Tribune,* September 24, 1944, p. 1; and "Glider Pilots Recall Thrill of Escape from Nijmegen," no newspaper, date, or page identified, all in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
176. Typescript of the letter is in box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
177. Born in Chisago, Minnesota, in 1912, Lindquist grew up in St. Louis Park, a suburb of Minneapolis. In 1938 he graduated from the Institute of Technology (now the College of Science and Engineering) at the University of Minnesota with a degree in aeronautical engineering. To help pay for his schooling, Lindquist worked as a draftsman. Following graduation, Lindquist was employed by the Parker Appliance Company (today it is known as the Parker Hannifin Company), which was headquartered in Cleveland. The company specialized in the manufacture of high-pressure connections used in the automobile, machine tool, and aviation industries. In 1939 Lindquist had become "an expert in fuel system and hydraulic design" and along with a number of other American engineers and aviation experts was sent to Sweden to advise that country's air force. He returned to the United States in March 1940 and is identified in the Census of 1940 as living in Fairmont, Minnesota. Then the University of Minnesota in Minneapolis hired Lindquist as an engineer in December 1942 at its Engineering Experiment Station, where he did aero-medical research in conjunction with the Mayo Clinic. When that project ended, he taught mechanical engineering in the Engineering Department before joining NAC. He died in 1965 in Little Falls, Minn. Sources for the career of B.H.T. Lindquist are the *St. Paul Pioneer Press,* March 3, 1940; Ancestry.com, *Find a Grave Index, 1600s–Current; New York Times,* October 17, 1940, p. 39; *1940 U.S. Census,* Census Place: Fairmont, Martin, Minnesota; Roll: T627_1937; page 14A; enumeration district: 46-9A; University of Minnesota, Board of Regents, Minutes, March 12, 1943, p. 534; September 10, 1943, p. 37; and February 11, 1944, p. 223.
178. Details of the contract for jettison fuel tanks are in the "Postwar Products Survey" prepared for NAC by the Booz, Allen & Hamilton consulting firm in May 1945, p. 4, copy in box 1, Villaume Glider Files, Northwestern Aeronautical Corporation, Booz, Allen & Hamilton Business Survey for Northwestern Aeronautical Corporation, 1945, Villaume Industries, Eagan, Minn. The original copy of the Booz, Allen Report is in box 1, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C. See also "N.W. Aeronautical Gets DPC Funds," *Minneapolis Star Journal,* January 10, 1945, no page identified, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.

179. "Doctors of Management," *Fortune,* 30, no. 1 (July 1944): 142–46, 201, 208, 210, and 213. A brief discussion of the work the Booz firm did for the navy at a cost of $200,000 is on page 144 and the quotation is on page 210. See also Paul A.C. Koistinen, *Arsenal of World War II: The Political Economy of American Warfare, 1940–1945* (Lawrence, Kan.: University Press of Kansas, 2004), 103, 104, 105, 108, and 110 and Keith E. Eiler, *Mobilizing America: Robert P. Patterson and the War Effort, 1940–1945* (Ithaca, N.Y.: Cornell University Press, 1997), 236–38.
180. "C-47s, Gliders to Put on Show for City Workers," *Minneapolis Star Journal,* February 21, 1945, p. 1; "Air-Land Offense to Be Displayed," *St. Paul Pioneer Press,* February 25, 1945, page not identified; "To Display Glider," *St. Paul Dispatch,* February 26, 1945, page not identified; "Glider Show Attracts Thousands," *St. Paul Pioneer Press,* February 28, 1945, p. 1; "10,000 Thrilled as Glider Troops Show Combat Tactics," *Minneapolis Tribune,* February 28, 1945, p. 1, all box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
181. "3,500 Planes from Britain Sear Reich," *St. Paul Dispatch,* March 23, 1945, no page identified; "Glider Flies Remagen Wounded to Hospital in Five Minutes," *New York Herald Tribune,* March 23, 1945, no page identified; "Glider Used as Ambulance," *Minneapolis Tribune,* March 23, 1945, no page identified; *St. Paul Dispatch,* March 24, 1945, p. 1; "All-Out Rhine Assault Is Launched," *Minneapolis Star Journal,* March 24, 1945, p. 1; "Armies Join across Rhine," *Minneapolis Tribune,* March 25, 1945, p. 1; "Rhine Air Crossing Underway," *St. Paul Pioneer Press,* April 1, 1945, no page identified, all box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
182. *St. Paul Pioneer Press,* April 3, 1945, no page identified, box 2, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.
183. Booz, Allen & Hamilton, "Postwar Products Survey," 13–16.
184. Ibid., 46–49.
185. Interview with John E. Parker (OH 99) by Arthur L. Norberg, December 13, 1985 and May 6, 1986, in Washington, D.C., Charles Babbage Institute, The Center for the History of Information Processing, University of Minnesota, Minneapolis, Minn., 12 and 14 (hereinafter referred to as the Parker Interview).
186. Arthur L. Norberg, *Computers and Commerce: A Study of Technology and Management at Eckert-Mauchly Computer Company, Engineering Research Associates, and Remington Rand, 1946–1957* (Cambridge, Mass.: The MIT Press, 2005), 10–11.
187. E.B. Potter, *Nimitz* (Annapolis, Md.: U.S. Naval Institute Press, 1976), 63–67, 81–83.
188. Norberg, 21.
189. Ibid., 25.
190. Jim DeBrosse and Colin Burke, *The Secret in Building 26: The Untold Story of America's Ultra War against the U-Boat Enigma Codes* (New York: Random House, 2004), 79–83.
191. John A.N. Lee, Colin Burke, and Deborah Anderson, "The US Bombes, NCR, Joseph Desch, and 600 WAVES: The First Reunion of the US Naval Computing Machine Laboratory," *IEEE Annals of the History of Computing,* 22:3 (July-September 2000): 37–40.
192. Parker Interview, 14–15.
193. DeBrosse and Burke, 54–56.
194. Ibid., 201; Norberg, 32.
195. Norberg, 27.
196. Ibid. 28–29; Thomas J. Misa, *Digital State: The Story of Minnesota's Computing Industry* (Minneapolis: University of Minnesota Press, 2013), 38–40, see especially note 37.
197. DeBrosse and Burke, 201; Misa, 38–40.
198. Parker Interview, 15.
199. Norberg, 43; Misa, 41–43.

200. Ibid., 31. All that ERA's Articles of Incorporation stated about the purpose of the business was some general language about the development of machinery. These Articles of Incorporation were later amended on January 8, 1946.
201. Ibid. 33.
202. Ibid. 39 and 34; Misa, 45–49.
203. Biographical profile of John E. Parker (1983) in box 1, John E. Parker Collection, Archives Department, National Air and Space Museum, Smithsonian Institution, Washington, D.C.; "New Director Is Chosen by Glenn L. Martin Co.," *New York Times,* November 16, 1956; "John Parker, 89, Dies; Electronics Executive," *New York Times,* December 24, 1989.
204. Raymond J. Snodgrass, *The AAF Glider Program, November 1944–January 1947* (Wright Field, Ohio: Historical Office, Air Material Command, 1947), 39.
205. Ibid., 40
206. Ibid. 88. This historian credits NAC with manufacturing a total of 1,509 CG-4As during the war (p. 87). He also reports that "After V-J Day, Northwestern became engaged in maintenance work for Northwest Airlines, Incorporated" (p. 89).
207. James E. Mrazek, *The Glider War* (New York: St. Martin's Press, 1975), 60.

Notes for Chapter Seven
208. Interview with J. Nicholas Linsmayer, Donald G. Patton, Ingemar Holm, and James N. Johns conducted by John M. Lindley and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
209. Interview with Ingemar Holm, Pat Foss, Kevin Pamperin, Dr. Tom Wier, D. Dale Johnson, Scott R. Ingram, Frank T. Ourada, Joe Messacar, and James N. Johns conducted by John M. Lindley, Donald G. Patton, and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
210. Interview with Terry Baker conducted by John M. Lindley and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society. Baker is the founder, chairman, CEO, and president of the American Aviation Heritage Foundation, a 501(c)(3) nonprofit in Minneapolis, Minn.
211. Interview with J. Nicholas Linsmayer, Donald G. Patton, Ingemar Holm, and James N. Johns conducted by John M. Lindley and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
212. Interview with Ingemar Holm, Pat Foss, Kevin Pamperin, Dr. Tom Wier, D. Dale Johnson, Scott R. Ingram, Frank T. Ourada, Joe Messacar, and James N. Johns conducted by John M. Lindley, Donald G. Patton, and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
213. Ibid.
214. Ibid.
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216. Ibid.
217. Interview with J. Nicholas Linsmayer, Donald G. Patton, Ingemar Holm, and James N. Johns conducted by John M. Lindley and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.
218. Noel E. Allard and Gerald N. Sandvick, *Minnesota Aviation History, 1857–1945* (Chaska, Minn., MAHB Publishing Inc., 1993), 231.
219. Interview with J. Nicholas Linsmayer, Donald G. Patton, Ingemar Holm, and James N. Johns conducted by John M. Lindley and Robert P. Barros in 2013 copies on file at the American Aviation Heritage Foundation, Villaume Industries, and the Minnesota Historical Society.

Notes to the Conclusion

220. Fred R. Kaen, "Aircraft Manufacturer Returns During World War II: Were They War-Hogs?" April 15, 2010, p. 1, downloaded from http://citeseerx.ist.psu.edu/viewdoc/download on October 19, 2016.
221. Bill Norton, *American Military Gliders of World War II: Development, Training, Experimentation, and Tactics of All Aircraft Types* (Atglen, Penna.: Schiffer Military History, 2012), 231–32.
222. Kaen, Ibid. and Mark R. Wilson, *Destructive Creation: American Business and the Winning of World War II* (Philadelphia: University of Pennsylvania Press, 2016), 61–76.
223. Wilson, 164.
224. Ibid., 220 (quotation) and 229.
225. Bill Hakala & Associates, *Engineering Research Associates: The Wellspring of Minnesota's Computer Industry* (St. Paul: Sperry Corporation, 1987), 5. For a more in-depth treatment of how William C. Norris founded Control Data, see Donald M. Hall, *Generation of Wealth: The Rise of Control Data and How It Inspired an Era of Innovation and Investment in the Upper Midwest* (Minneapolis: Nodin Press, 2014), 17–26. See also, Tom Webb, "The Almost Silicon Valley," *St. Paul Pioneer Press,* January 3, 2010, pp. 1D, 4D–5D.