World War II Glider Assault Tactics

GORDON L. ROTTMAN

ILLUSTRATED BY PETER DENNIS

ELITE • 200

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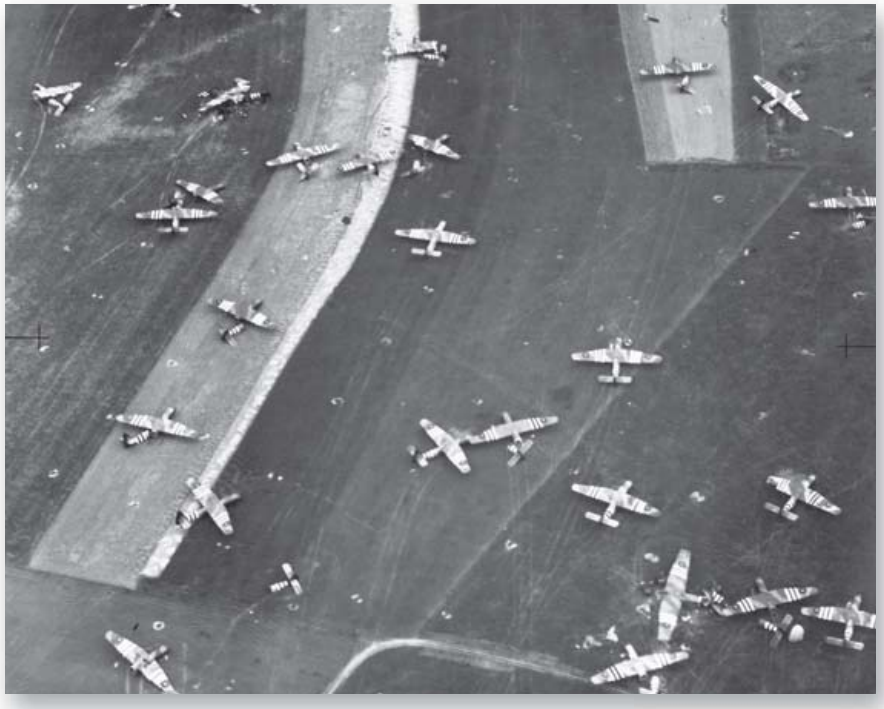

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Series editor Martin Windrow

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INTRODUCTION

Gliders came of age as a military tool in World War II, providing a means of delivering troops, equipment, and supplies onto a battlefield. Glider troops were, from the operational standpoint, air assault troops equivalent to today's helicopter-delivered airmobile units. Their use was relatively short-lived; there were few post-war instances of glider use, and "glider-riders" were relegated to history by the 1950s after an active combat period of only ten years.

The two-man crew of a Gotha Go 242; they were provided with armored seats and an armored cockpit floor. The insignia is that of one of the two 12-plane Gotha *Staffeln* of a *Schleppgruppe*; the third *Staffel* of each had DFS 230s. (Private collection)

Previously, gliders or "sailplanes" had carried only one or two men, and were mainly used for basic pilot training and sport competition. But just about anything can be adapted to military use, and troop-carrying gliders capable of transporting a squad or more were developed just before the war. It was not long before even larger models were developed, carrying more troops, heavy cargo, artillery, antitank guns, jeeps, and even light tanks.

Much has been made of the danger of glider landings, leading to these craft being called "Flying Coffins," "Purple-Heart Boxes," and "Tow Targets." Landings could certainly be hazardous, especially at night, when gliders were released too close to, too far from, or over the wrong landing zones. While there was an increased degree of danger, however, it was probably no worse than that faced by men debarking from landing craft on defended beaches crowded with obstacles. There were many successful glider operations in which the force committed experienced few crashes and casualties, especially when conducted in daylight with suitable landing zones and experienced tug-aircraft crews.

The value of gliders in World War II is difficult to assess. The numbers of troops delivered to the battlefield were relatively small. There was certainly a value in introducing infantry units accompanied by artillery and mortars in the enemy's rear; even if the landing was expected, the enemy could not know when or where it would take place, in what strength, nor with what objectives. The most noteworthy operations were the mass airlandings of American and British troops in Normandy in June 1944, in the Netherlands that September, and as part of the leap over the Rhine in March 1945. A less heralded but successful operation was the delivery and resupply of British "Chindit" deep-penetration brigades behind Japanese lines in Burma in March 1944. Gliders could also be employed to fly in reinforcements of men, equipment, and supplies to ground troops, and the Japanese used them in this way in the embattled Philippines.

"Glider Rider"

Oh, once I was happy, but now
I'm Airborne, riding in gliders all tattered and torn,
The pilots are daring, all caution they scorn,
And the pay is exactly the same.

We glide through the air in our flying caboose,
Its actions are graceful just like a fat goose,
We hike on the pavement till our joints come loose,
And the pay is exactly the same.

Once I was infantry, now I'm a dope,
Riding in gliders attached to a rope,
Safety in landing is only a hope,
And the pay is exactly the same.

** Composer unknown. Sung to the tune of "That Daring Young Man on the Flying Trapeze"*

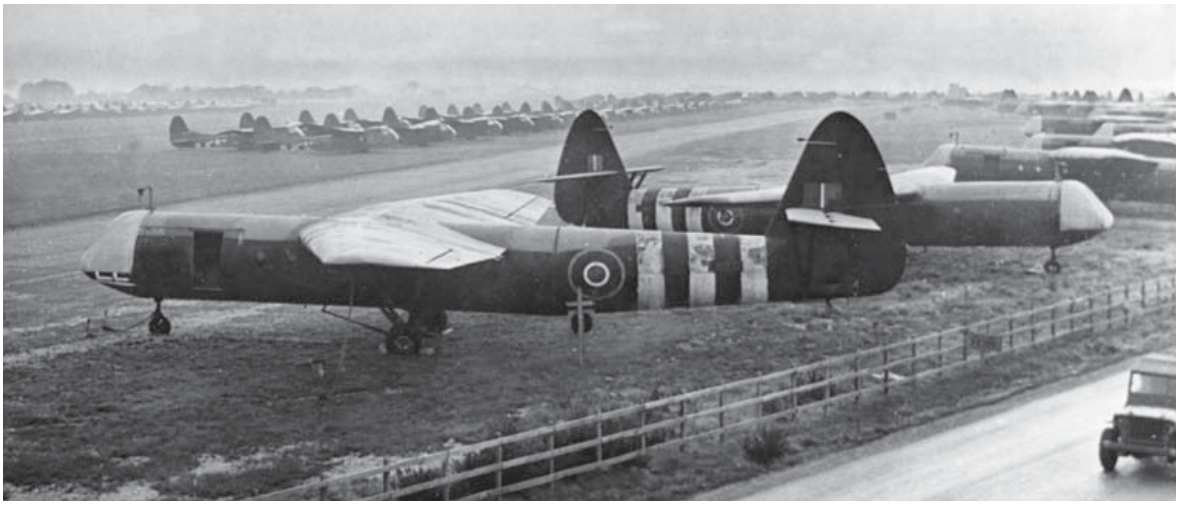
Among the most valuable glider operations were small-scale precision attacks – *coups de main*. Examples are the German seizure of Fort Eben Emael in 1940 and their rescue of Mussolini in 1943, and the British attack on "Pegasus Bridge" in the early hours of D-Day. While gliders were often committed in conjunction with paratroopers, and were integral to airborne divisions, they were sometimes employed alone. Small supporting operations also proved valuable, such as flying surgical teams into besieged Bastogne, and the rescue of crash survivors in New Guinea.

This book will not examine specific battles in any detail, since there are other Osprey books covering most of these.[1] Instead, this text devotes the available space to a discussion of the characteristics of military gliders, how they functioned, their capabilities and limitations; pilot training, tug aircraft, and how glider and tug units integrated; and the organization, equipment, and weapons of glider infantry and artillery units. The focus will be on US, British, and German glider operations, since the Soviet Union and Japan made only limited use of gliders.

Origins

While it is a matter of debate, it is believed that the first person to be carried aloft in a heavier-than-air craft in sustained gliding flight was an unidentified ten-year-old boy, in a machine built by Sir George Cayley of Brompton Hall, Yorkshire, which was towed downhill into a breeze by manpower at some date in 1852 or 1853. (Shortly afterward, Sir George sent his coachman up in it; the coachman survived, but according to an eyewitness he immediately

1 Some relevant Osprey titles are listed on the inside back cover of this book. Others are: Battle Orders 4, *German Airborne Divisions: Blitzkrieg 1940-41*; BTO 15, *German Airborne Divisions: Mediterranean Theater 1942–45*; BTO 22, *US Airborne Units in the Mediterranean Theater 1942–44*; BTO 25, *US Airborne Divisions in the ETO 1944–45*; Campaign 24, *Arnhem 1944*; CAM 178, *The Rhine Crossings 1945*; CAM 147, *Crete 1941*; CAM 210, *Operation Dragoon 1944*; CAM 251, *Sicily 1943*; CAM 257, *Salerno 1943*; CAM 249, *Vercors 1944*; and Men-at-Arms 139, *German Airborne Troops 1939–45*.



RAF Horsas lined up awaiting the Netherlands operation in September 1944, their Plexiglas canopies covered for protection; on the far side of the runway are Waco CG-4As. The 750 Wacos acquired by the British (who called them "Hadrians," to fit their sequence of glider names) usually retained their US markings, and are seldom seen painted with RAF roundels. (Tom Laemlein/ Armor Plate Press)

quit his job.) In 1856, Frenchman Jean Marie Le Bris flew a glider launched from a horse-drawn cart. The German Otto Lilienthal became known as the "Glider King," making 2,000 highly publicized hang-glider flights from 1891 until a deadly crash in 1896 made him the first known glider fatality. In the meantime, in 1884 John J. Montgomery made the first manned, controlled, heavier-than-air glider flights in America, launching off a Californian mesa, and continued experimenting until he too crashed in 1911.

Soaring became a popular sport in the early 1920s, and it was not long before glider competitions for range and endurance evolved. In 1920, a German set a record by flying 2km (1¼ miles) in two minutes; 11 years later the distance record was 272km (169 miles). In post-World War I Germany, where developing powered aircraft was initially prohibited but civilian aircraft were permitted from 1922, government-sponsored glider programs spread the interest. Gliding was demonstrated at the 1936 Berlin Olympics, and would have been recognized as a qualifying sport in the canceled 1940 Tokyo Olympics. By 1937 Germany had produced some 50,000 glider pilots, many of whom would subsequently become Luftwaffe aircrew.

The first officially recognized glider organization was the Rhön-Rossitten Gesellschaft (RRG), which not only pioneered sport gliding in Germany but inspired its spread throughout the world. In 1933 the RRG was broken up by the Nazis, and the Deutsche Forschungsanstalt für Segelflug (German Research Institute for Sailplane Flight, DFS) took over glider development, to include military gliders. The Flieger-Hitler-Jugend (Flying Hitler Youth) and the Nationalsozialistische Flieger-Korps (National Socialist Flying Corps, NSFK) took over youth and adult glider training and competition. In 1937 the Germans built a meteorological research glider carrying a pilot, two meteorologists, and research instruments; this would be the forerunner of German troop-carrying gliders.

Gliding emerged as a sport in Russia in the early 1900s, with Soviet government-sponsored activities from 1923. The OSOAVIAKhIM (Union of Societies of Assistance to Defense and Aviation-Chemical Defense of the USSR) was formed in 1927 to provide youths and adults with all forms of pre-military training, and included a glider-training program. By 1934 the USSR had 57,000 glider pilots (hereafter, GPs), and in 1941 it held 13 of the 18 world soaring records.

Pre-World War II sport gliders were one- and two-man sailplanes of very light construction, designed for speed and range. The Soviets began experimenting with multi-place gliders in the early 1930s. The initial effort was to develop powered freight-gliders carrying a ton of cargo; these were towed aloft and then released, using a low-powered engine to extend their range to deliver freight to far-flung regions, augmenting the inadequate rail and road systems. By 1935 the Red Army was experimenting with troop-carrying gliders. Marshal Mikhail Tukhachevsky held theories about deep operations into the enemy's vulnerable rear to "vertically outflank" him, and his influence added emphasis to the glider and parachute effort. Since at that time the Soviets permitted the Germans to operate a secret fighter-pilot school at Lipetsk, Luftwaffe officers observed Soviet glider demonstrations, which in their turn influenced German concepts.

It is a matter of debate whether it was Gen Kurt Student, future commander of the *Fallschirmtruppen* paratroopers, or Gen Ernst Udet, another Luftwaffe innovator, who first urged further development of troop-carrying gliders. Student viewed them as a means to rapidly land assault units to make direct attacks on enemy positions; Udet thought of them as a means of covertly landing small numbers of troops in the enemy rear to seize key objectives such as bridges and road chokepoints. In the event, the Luftwaffe would employ them for both types of mission.

On May 10, 1940, ten German gliders delivered 78 paratroopers atop the strategic Belgian artillery fortress of Eben Emael near Liège – the first combat use of gliders. Against odds of at least ten to one the paratroopers neutralized the fortress in less than half an hour with minimal casualties, and its 1,100-strong garrison surrendered the following day. A year later 750 glider troops were landed on Crete to support 10,000 paratroopers, 5,000 airlifted mountain soldiers, and 7,000 sea-delivered troops. The glider contribution was small, but they aided in seizing key objectives. By now the Allies had been taught the value of gliders, and set out to employ them on a large scale themselves.

US glider pilots with a Waco CG-4A in England, 1944. For combat missions pilots were often seen wearing M41 or M43 field uniform, sometimes complete with web leggings. Shearling-lined leather flying jackets were warm, but too cumbersome for field wear, and once on the ground they made pilots conspicuous among ground troops. For the Normandy invasion the IX Troop Carrier Command had 584 C-47 transports/glider tugs, and nearly 1,120 Waco gliders, each of them requiring two pilots. Since casualties were always proportionately heavier among pilots than among the troops they carried, operations thereafter were dogged by pilot shortages. (Tom Laemlein/ Armor Plate Press)

THE GLIDERS

One- and two-person sailplanes for recreation and pilot training were extremely lightweight; they were designed slim to cause the least possible drag, and had long, narrow wings for greater lift. They could either be towed aloft by a small single-engine aircraft, or towed along the ground by a vehicle or a power winch until they achieved launch speed. Once aloft, pilots soared from thermal to thermal – the rising hot air reflected by open fields or built-up areas – to reach higher altitudes. Possessing a high "glide ratio" – horizontal distance vs. altitude loss – they could stay aloft for long periods and fly long distances. Such a ratio might be around 20 or 30:1 (i.e., in the latter case , for every 30ft of horizontal flight the sailplane lost only 1ft of altitude). Landings were made on grass airfields, using belly skids.

Military glider characteristics

Military gliders had to be larger and less streamlined, since they had to carry from a minimum of eight to considerably greater numbers of troops, or heavy equipment, cargo, and even vehicles. While they had to be relatively lightly constructed they still had to be robust enough to lift heavy loads, and to withstand landings on irregular ground with a high probability of striking obstacles. While it was hoped that they could be recovered and reused, this was seldom possible; most gliders making combat landings were simply abandoned, to be stripped of anything useable and the remains burned. The British did dismantle many, however, and transported them home for refurbishing, and the Americans "snatched" some flyable gliders back into the air with low-flying C-47s (see Plate H).

Military gliders often had a boxy fuselage to maximize load space, but circular or oval cross-section designs were common. Most had high-set wings – level with the top of the fuselage. Gliders were typically built of wooden framing, aluminum or steel tubing, or combinations of both, covered with thin plywood or aircraft fabric, or plywood covered with fabric; "doped" fabric (coated with

A

US WACO CG-4A CARGO GLIDER

1: Left side (with cutaway)
2: Split plan view (top & underside of left wing)
3: Interior: pilot and front right-hand passenger

The CG-4A was by far the most numerous model employed by the US; it was known to Americans simply as the "Waco." The typical finish was olive drab upper and side surfaces and light blue undersurfaces. The three white and two black "invasion stripes" were applied around the wings and fuselage of troop carriers and gliders on June 3, 1944, three days before the Normandy landings.

The cargo capacity was 4,060lb. In addition to two pilots the Waco could carry 13 seated troops, on 4x three-man bench seats and a jump seat; or six litter- (stretcher-) cases plus two seated casualties or attendants. Some or all of the bench seats were removed when carrying crew-served weapons, jeeps, trailers, light engineering equipment, or supplies; typically, three troops could be carried in addition to the weapon or vehicle load.

Loading and unloading were conducted through the raised nose (see Plate G); there were troop doors on both sides under the trailing edge of the wings, and two emergency "kick-out" panels below the leading edges. The later version (illustrated here) had permanently attached wheels in addition to landing skids; the earlier model had jettisonable wheels for takeoff and relied solely on skids for landing. The official speeds were: towing, 150mph; glide descent, 72mph, with a stalling speed of 40mph; and landing, 60mph.

4: Ludington-Griswold nose modification

The "Gris" nose, seen on some gliders in Normandy, the Netherlands, and for the Rhine crossings, featured reinforcing struts to give increased protection to the pilots and passengers. This view also shows the addition of the wide Cory nose skid between the two smaller skids, which allowed a lower nose angle when landing without the skids digging in. All these modifications helped to reduce casualties.

5: US glider pilot's wings

This badge of qualification from training was introduced in September 1942.

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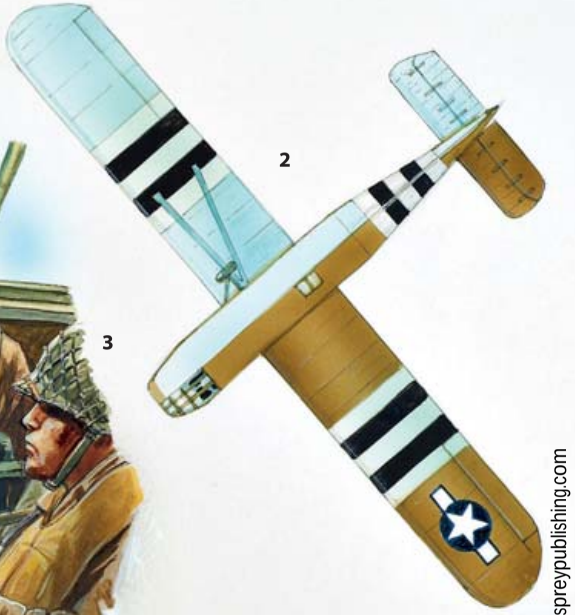

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Waco CG-4As under tow by C-47 transports in a tight formation – "a pair of pairs." Both tug and glider pilots had to pay close attention to relative positioning; a glider swaying around could cut another's tow-rope. (Tom Laemlein/Armor Plate Press)

a plasticized lacquer) was quite tough, airtight, and waterproof. Usually there was a mix of skin-covering materials on different components. Landing gear might be skids or wheels; many had wheels for takeoff which were jettisoned once airborne, the landing being undertaken on skids.

Troop or cargo doors might be on one or both sides; alternatively, the nose or tail sections might open for cargo loading and unloading by means of ramps that were stowed aboard. Troop seats were often ranged along the cargo compartment's sides facing inward, but might be positioned crossways and facing forward or rearward. Seats were removable in order to accommodate heavy equipment or bulk cargo, and cargo tie-down points were provided. Seatbelts were fitted; once belted in, the troops had little to do except hang on for a sometimes turbulent ride. They hand-held their weapons (though the Germans provided racks), and were ordered to remain seated – moving about the compartment only made the pilot's job harder. No flashlights were permitted, so as to preserve the pilots' night vision. Typically there were few fuselage-side vision ports for the troops, though these would have helped them orient themselves before debarking. Being designed for either troops or cargo, gliders had to carry a certain amount of sandbag ballast when undertaking training flights so as to maintain the necessary center of gravity.

Most gliders had two pilots in case of a casualty, sitting side-by-side and well forward. Well-designed cockpits (though not all were) provided a wide field of vision to aid in locating the LZ, and downward vision immediately below the nose was highly desirable. Gliders were provided with minimal instruments: those aboard a US Waco CG-4A included airspeed indicator, climb indicator, turn and bank indicator, altimeter, compass, and switches for instrument, landing, and recognition lights. All were important, but monitoring of the airspeed was essential. The pilot had to pay attention to speed when lifting off, ensuring that the glider reached the specified speed before leaving the ground. He needed to ensure the tug aircraft was not going too fast or too slow; that the glider was at the correct speed when it was released; that speed was reduced as he approached the LZ, but remained above stalling speed (when lift could not be maintained); and that he was traveling at the correct landing speed before touching down.

Flight controls were basic: a steering wheel or yoke to operate wing ailerons and tail stabilizers, plus foot pedals to operate the rudder. The typical military glider had virtually no climb capability owing to its weight and

a design that maximized cargo space. When they were released from their tug aircraft they immediately began to lose altitude, and the LZ or an emergency alternate had to be within sight. Their typical glide ratio was 10:1, the glider losing 1ft of altitude for every 10ft of horizontal flight; however, the small German DFS 230s had a ratio of 18:1, and in May 1941 they were released 2–5 miles off the Cretan coast from an altitude of 5,000ft. During the 1945 Rhine crossing US gliders were released from 400–800ft; half were hit by ground fire, though only six were shot down. During the same operation the British released at 2,500–3,500ft, having two-thirds hit and ten downed. Typical towing speeds of troop-carrying gliders were in the 150–160mph range, but they could safely be towed at up to 30mph faster. Stall speeds were 50–70mph, and landing speeds just above that.

Glider flying

There might be intermittent turbulence as the tug maneuvered to join the formation and at cruising altitude. Clear air turbulence was common during the flight, i.e. when the aircraft flew through areas with different temperatures (hot air rises, cool air drops). What was erroneously called an "air pocket" was an area of cooler air that caused the aircraft to suddenly drop – usually only a few feet, but it felt like more to the passengers.

Tug aircraft were usually twin-engine transports or medium bombers, and the Germans also used the Junkers Ju 52 trimotor transport. For lighter gliders and short-range tows single-engine aircraft were occasionally used, but seldom for operational missions. Heavier cargo gliders required the power of four-engine bombers.

Gliders were sometimes double-towed, i.e. a tug towed two gliders from the same hook on two separate ropes, one longer than the other. A very real concern was that the glider on the shorter rope might get entangled with the longer, so both pilots had to remain constantly alert to maintain a 75ft separation. A double-tow also placed greater strain on the tug, increased fuel consumption, and required longer runways. The British never used double-

The details of the CG-4A's tow-rope connection; note the telephone cable tied to the rope with slack loops, to allow for tow-rope stretch. (Tom Laemlein/Armor Plate Press)

Training in England, the gliders were wheeled into takeoff position and their tow-ropes were laid out ready to be connected to the gliders and tugs by glider mechanics, who would push the gliders into position behind the tugs. These tow-ropes are not fitted with telephone wires. (Tom Laemlein/Armor Plate Press)

tows operationally, and the US made only limited use of them in Burma and for the 1945 Rhine crossing.

Glider pilots also had to closely watch their vertical distance above or below the tug's line of flight. Flying too high or too low might break the tow-rope or affect the flight characteristics of either the tug or the glider. Depending on the type of tug and the airspeed, there were preferred angles slightly above or below the tug's line-of-flight in order to experience less turbulence. At night this positioning was maintained relative to the "V" pattern formed by the tug's wingtip and tail lights.

The standard tow-rope for the US CG-4A was 350ft long and of $^{11}/_{16}$in diameter. Made of nylon, it would stretch an additional 25 percent its length; this made it less likely to break, though this was still a common occurrence. The rope did not remain under constant tension, but repeatedly stretched and slackened off owing to winds and air turbulence, both natural and caused by prop-wash. A broken rope could be disastrous if over water or enemy-controlled territory, or when there were no suitable LZs nearby. For double-tows, 350ft and 425ft ropes were used. The British used 300ft-long, 2in-diameter hemp or manila ropes for the heavier Horsa and Hamilcar gliders. The small German DFS 230 used 40m (130ft), 60m (200ft), 100m (330ft), and 120m (400ft)-long ropes, depending on airfield space.

A special release hook had to be installed on tug aircraft. Some tugs were purpose-built with hooks, but these often had to be installed in the field, along with a release lever in the cockpit. The rope-connector and release on gliders might be in the center of the nose or above or below it. Some gliders used a yoke or "Y" ropes – a long rope dividing into two shorter lengths, each attached to a connector on one wing.

Intercommunication

Communication between the glider and tug pilots was essential. Telephones or wire intercoms were the logical choice, but led to problems. The Americans first taped telephone wire to the tow-rope, but soon found that while the rope stretched, the wire did not. It was then taped to the rope allowing plenty of slack between each tape point; but violent, excessive stretching would still

break the wire, as did abrasion when dragged down the runway during takeoff. The British first wrapped the wire around the rope, then wove it into the rope's core. While this protected it from abrasion, and the thick hemp rope did not stretch much, the wire could still break. Small short-range radios were to be fitted late in the war, but while the mountings were provided in new CG-4As at the factories few radios actually reached units.

One of the most effective means of day and night communication was an Aldis blinker lamp flashing simple codes – e.g., green meant "LZ spotted, release now." This was used from the astrodome just aft of the C-47's cockpit, and British bomber tugs had similarly located astrodomes. Waggling wings and fishtailing tails were also used as ad hoc signals, as were flashing wingtip lights.

Releasing the tow-rope

The most important signals were to alert the pilot that the LZ was near and that the tug was releasing the rope. Both the tug and glider pilots could release the rope, but each was to alert the other before doing so. If the tug had to abort its takeoff it would immediately release, and the glider swerved off the runway to avoid it. An inflight emergency en route to the LZ might be caused by enemy action (fighters, flak), tug engine problems, bad weather, or loss of visual contact. There were incidents in which the tug took severe evasive action and/or sped up to avoid flak without first warning the GP to release. If exceeding the safe tow speed, gliders had to release. The tug/glider formation would try to avoid clouds and fog; this frequently led to formations breaking up when skirting around bad weather, and even to lone tugs straying off course, never to rejoin the formation. Within clouds or fog GPs could not see the tug, and it took only moments for them to become disoriented as to their position relative to it. The tug pilot could not simply yank the glider into position behind him like a truck towing a trailer; the glider would quickly drift to one side or too far above or below the tug's line-of-flight, and endanger other aircraft in the formation. In such a situation gliders had to release and make their way out of the cloud or fog, taking a chance on colliding with tugs and other released gliders, and praying that there was an LZ within range.

In emergencies tug pilots were urged to avoid releasing their tow if at all possible, as there was a good chance its passengers would be lost (see below, "Glider Operations/Sicily"). It was also essential that they warn the GP they were releasing and, if at all possible, allow him to actually execute the release himself. This was because if the rope was overly taut (or even fairly slack) it might spring back into the glider's nose, causing severe damage or even killing the pilots. The released rope could also damage a wing, or wrap around it and thus prevent the ailerons from functioning. The GP would release the rope at his end as soon as he realized the tug had released. Failing to release a rope still attached to the nose would result in it trailing to the rear, perhaps snagging a tree when landing.

Normally, when the GP visually located the LZ and released his end of the tow, the tug would turn away from the line-of-flight to avoid maneuvering gliders, and retained the rope for a short time to ensure that falling ropes did not cause any undue hazard. Sometimes, rope-dropping areas were designated so that ropes could be recovered later; this was always done in training, with even the rope-drop altitude specified. Ropes were not to be dropped on hard runways or rocky areas, so as to avoid abrasion.

The results of a disastrous landing in Germany, March 1945: a CG-4A with its nose compartment completely crushed, and fabric shredded from the fuselage. Note the drag parachute dangling from the tail and, in the foreground, airdrop supply containers. (Tom Laemlein/Armor Plate Press)

Glider landings

"Every landing is a crash-landing" was a glider pilots' catchphrase – "a planned accident." While pilots of powered aircraft looked down on GPs, they overlooked the unique challenges that the latter faced. The GPs had no second chances in the case of too long or too short an approach; they could not abort the landing and come around for another attempt. Once released, they had to land at their first attempt, and could not remain aloft while they looked for a better LZ. They *had* to be good every time.

The route map, usually handled by the copilot, was marked with checkpoints easily (in theory) identified from the air, including at night. These might be an island, town, river confluence (particularly easy to identify in daylight or on a moonlit night), highway or railroad junction, or any distinctive terrain feature. There were instances when ships were on-station with searchlights pointed vertically upward to serve as a checkpoint at sea. Routes were planned to avoid known enemy flak concentrations, or flying

A less dramatic scene in Normandy: two CG-4As and a Horsa lie in a field edged with the dangerous obstacle of a tree-lined hedgerow. For D-Day some 300 Horsas were supplied to the US forces for their ability to carry heavier loads, and pilots were impressed by their handling qualities. While there were complaints of deadly crashes involving US-flown Horsas in Normandy, this may have been due to overloading; there were 25 or 28 troop seats, but the British specification for the "A load" was for only 22 occupied seats, and for safety they often limited the load to 15 fully equipped troops. In his memoir *Glider Infantryman*, US veteran Don Rich recalled his impressions of flying in a Horsa after the Waco: "The Horsa seems like a giant bathtub being pulled through the air… and in it I can feel the turbulence more." (Tom Laemlein/Armor Plate Press)

over friendly invasion fleets (see below, "Glider Operations/Sicily"). The tug pilot would notify the GP when a checkpoint was sighted. The final checkpoint was termed the "initial point" (IP) – this had to be very easy to identify, and provided a compass azimuth to the LZ, which was within sight from the IP.

Ideally, pathfinders on the LZ marked it with colored smoke, not only to identify it but also to give pilots a wind indicator. Such marked LZs were a rare luxury, however, and were impossible when conducting surprise attacks like Eben Emael, Gran Sasso, and Pegasus Bridge. For large-scale operations the LZ (usually identified by a letter) was not a single open field, but a large area that was probably crisscrossed by hedgerows, fences, walls, tree lines, and roads. The area selected was simply one with fewer natural and man-made obstacles than other areas. They were chosen for their absence of mines, posts, and flooded areas, the scarcity of high obstructions (tall trees, power lines, towers, etc.), and their proximity to the troops' objectives, but none were ever ideal from the viewpoint of the glider pilots.

As with takeoffs, landings were conducted into the wind to provide greater lift. Release altitude varied but had to be fairly high, often 4,000–5,000ft, owing to the low glide ratio of fully loaded gliders. They were usually released within 3 miles of the LZ, and often much closer. Having smaller gliders with a higher glide ratio, the Germans often released high and made a long, shallow approach (as at Eben Emael), or released above the objective and spiraled tightly down to land on a point LZ (as at Gran Sasso). While high-altitude release was necessary, the higher the release the more difficulties the GPs might encounter: winds can blow at different speeds and in different directions at different altitudes.

Often the tugs and gliders would pass the LZ with a tailwind, and then release. While descending, the gliders would bank in the necessary direction, then turn into a headwind for the final approach. Upon release the passengers were aware of an almost immediate drop, though slight, and the ride was generally smoother now they were out of the tug's prop-wash. Above the faint sound of rushing wind passengers might hear gunfire, and closer to the ground they could make out the engine noise of vehicles on nearby roads. Depending on the landing ground's composition, vegetation, and obstacles, landing could be quite noisy, followed by an immediate silence once the sliding glider stopped, except for battle sounds and shouted orders to get out.

A Horsa bearing American markings in a Normandy field; some were seen with British roundels on the wings and US stars on the fuselage sides, demonstrating their interchangeability between British and US units. Evidently the jeep this glider carried could not be unloaded in the normal manner, since the passengers have used entrenching tools and hatchets to batter a large side opening in the plywood fuselage. (Tom Laemlein/Armor Plate Press)

The pilots wanted to approach the LZ at a shallow angle of descent, and since they might have to clear obstacles they often maintained the higher end of the acceptable range of landing speed; this provided additional lift to allow the pilot to pull back on the steering wheel to clear low obstacles before touching down. Walls, hedgerows, power lines, tree stumps, posts, ditches, gullies, sunken roads, and similar surprises could be disastrous. Running into a low wall, a ditch or a gully could cause the glider to flip over, as could the skids digging into soft ground, and a tree or post tearing off one wing caused a ground-spin or flip. For later operations the Americans retained wheels on their gliders, to allow the brakes to be used to help swerve around obstacles. Heavy equipment like a jeep or AT gun tearing loose from its restraints with the shock of landing could wipe out any passengers and often crashed right through the nose. (There were instances when such loads broke loose in mid-air en route. If they rolled backward, the glider plummeted to the ground in an irrecoverable tail-first dive; if they slid forward, they usually tore through the cockpit and nose.)

The distance a glider required to come to a halt was highly variable; it depended on touchdown speed (which could not be powered back or increased, as with a powered aircraft), angle of approach, glider weight, surface composition – grass (wet or dry), bare earth, sand, rocks – and obstacles on the landing zone. As one pilot related to the author, "It all depended on how many trees, brush, ditches, stone walls, and hedgerows you went through." Of course, the shorter the landing distance the better; some pilots even aimed for brush and hedges (though not hedgerows, which usually incorporated a berm or field wall) in order to slow down. In some cases barbed wire was wrapped around skids, or a pilot might rock the nose forward to increase friction. Landing slides could vary from 50ft to 200ft, or even more.

As the glider came to a rest the passengers immediately unbuckled their seatbelts and opened the exits; at least they did not have to worry about the risk of fire, as there was no fuel. If there was equipment aboard, some of them released the restraints and prepared to unload it while the rest opened the nose or removed the tail section; tools were available to aid them in cutting open the fuselage, and ramps or channels were carried. One or more first aid kits were stowed aboard gliders; smart troops took these with them, or medical personnel recovered them later. Pilots and passengers quickly departed from landing sites, since they drew enemy fire and troops. (Enemy soldiers routinely searched abandoned gliders for souvenirs, or anything of use or of intelligence value; it was not uncommon for pilots to leave maps behind in their haste.)

* * *

Besides airlanding troops and cargo, gliders were also considered as a means of delivering paratroopers. One concept was to load paratroopers in both the tug and the glider. This would reduce the number of transports, and with the glider following just above the tug's line-of-flight the paratroopers could jump from both aircraft simultaneously. However, this placed a heavy strain on the tug's engines and increased its fuel consumption, and it was also difficult for paratroopers to move about inside and exit from cramped gliders. Another idea was to load the tug with paratroopers and the glider with non-paratroopers; the glider would be released, and the tug would fly on to the paratroopers' DZ. While the US, UK, USSR, and Germany all tested these concepts, paratroopers never jumped operationally from gliders.

GLIDER TYPES

American gliders

The US Army Air Forces began testing gliders in July 1941, and the **Waco CG-4A** (see Plate A) entered production a year later. Of some 16,000 cargo and training gliders procured by the armed forces, 14,000 were Wacos. The Waco CG-4A cargo glider was designed by Weaver Aircraft Company, whose initials spelt "WACO" (since the aircraft was not named for the city in Texas, this was pronounced "wayco," "wacko" or "wahco" depending on whom you ask). Sixteen companies built a total of 13,909 CG-4As – more than any other US aircraft except for B-24 bombers and P-47 and P-51 fighters. Production began in late 1942, but manufacturing delays limited their operational use in 1943. In all, 5,991 were shipped to Europe, 2,303 to the Mediterranean, and 504 to the Pacific; 150 of the latter were forwarded to India. Each Waco was shipped overseas in five large crates; they were assembled at airbases, a process requiring almost 250 man-hours each which was often hampered by insufficient printed instructions and available skilled manpower. Several other designs of glider were adopted, usually with higher capacity, but few were built in any numbers before the war's end.

The boxy-looking CG-4A was considered one of the uglier glider designs, but pilots were pleased with its performance, and thousands were used as trainers owing to their ease of handling. The fuselage was of fabric-covered steel tubing with a honeycombed plywood belly and lower nose. The wide, straight wings were built of wood spars and braces clad in fabric-covered plywood.

The Plexiglas canopy provided excellent vision for the side-by-side pilots. The entire nose (including the pilots' seats) could be rotated up and back to give access for loading and unloading. The tail could be lifted and propped up with two support poles to tilt the open nose downward, allowing a jeep or other equipment to be loaded. To unload, the nose section was cranked up by hoisting cables and then held in place by a 7ft prop. If the load was a jeep,

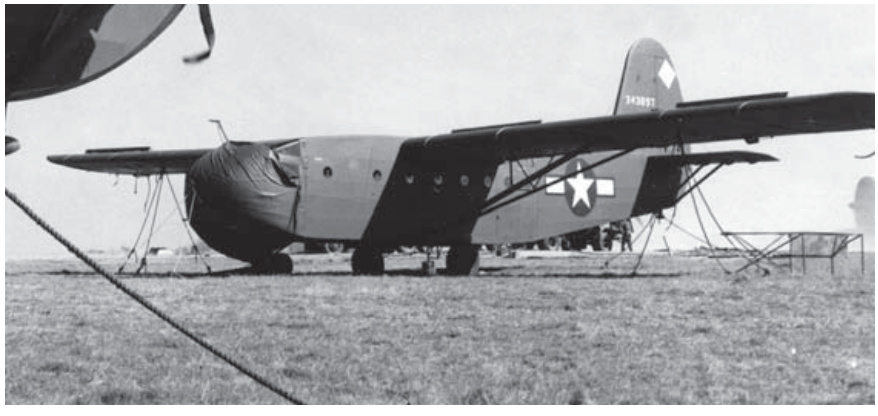
This CG-4A being loaded ready for Operation *Market* in September 1944 is fitted with the Ludington-Griswold nose and large Cory nose skid. Two support poles prop up the glider's tail to tip the nose forward to allow easy loading and unloading. The right-side troop door is open, and the triangular kick-out emergency panel under the wing leading edge can be seen leaning against the fuselage. (Tom Laemlein/Armor Plate Press)

A CG-4A lifts off the runway just before its tug aircraft takes off; most takeoffs were relatively smooth. As the tug taxied down the runway slack was taken up in the tow-rope, which was usually laid out in zigzags rather than a straight line; there would be a few jolts as speed was gained, but the glider was lifted smoothly into the air rather than being jerked. At this stage, pilots had to ensure that their lighter glider did not suddenly achieve more lift than the tug and climb rapidly higher to yank the tug's tail upward, causing both to crash. (Tom Laemlein/Armor Plate Press)

its engine was started during the landing approach, and it was then unhooked from the tie-down straps and driven slowly forward. A cable attached to the jeep's trailer-hitch raised the nose, which locked in place as the jeep moved forward, and a pair of short ramps were pushed out by the jeep. When locked, the cable automatically detached from the jeep, which could be driven out seconds after landing.

The CG-4A could carry 15 combat-loaded troops on removable wooden bench seats – seven down each side, plus a jump seat – or alternatively seven litters, or up to 4,060lb of cargo. This might be a 37mm M3A1 or British 6-pdr/57mm Mk II AT gun, a 75mm M1A1 or 105mm M3 "snub-nose" pack howitzer; or a ¼-ton jeep, ¼ -ton trailer, and motorcycles. Compact engineer equipment designed for glider and aircraft transport included the Clarkair CA-1 bulldozer, Case SI wheeled tractor with front-loader, Adams 11-S towed grader, ½-ton two-wheel dump trailer, LaPlant-Choate Q carryall scraper, or a compacting roller.

Towing speed was 110–120mph, by a variety of tugs: C-46, C-47, and C-54 transports, P-38 fighters, A-25 attack aircraft, or B-25 bombers. A total of 143 Wacos were needed for the two-battalion glider infantry regiment, 59 for a battalion, and 11 for a rifle company. Four Wacos were needed for a rifle platoon, with the company headquarters and weapons platoon split between the two rifle platoons' gliders and a ninth one. The division artillery headquarters needed 16 gliders, a glider artillery battalion 68, and a battery 26. The engineer battalion headquarters and the glider engineer company needed 10 and 29, respectively. The AA battalion required 112 gliders, with



The Waco CG-13A could carry up to 40 troops, or twice the cargo of a CG-4A, but here the lightly constructed glider still needs tie-down ropes to anchor it against high winds. The only use of the CG-13A in a combat landing involved a single glider employed during the war's final airborne operation on Luzon on June 23, 1945, but others were used for resupply missions in Europe. (Tom Laemlein/Armor Plate Press)

18 for each of its six batteries. The divisional service support companies needed 7 for the ordnance, 50 for the quartermaster, 5 for signal, 36 for medical, and 10 for the division headquarters company and MP platoon.

The larger **Waco CG-13A** was a 30-seat glider capable of carrying 8,000lb, twice as much as the CG-4A; 37 of the production run had center seats added to allow 40 troops to be carried. Of similar design to the CG-4A, the CG-13A could be towed by a C-46, C-47, or C-54 transport, or a B-17 or B-24 bomber. The nose could be lifted hydraulically. It could carry the short-barreled 105mm M3 or the standard M2A1 howitzer, a jeep with ammunition trailer and crew, or a 1½-ton cargo truck, but not the M22 (T9) Locust light tank. Production began in September 1943; of the 132 CG-13As built, 81 were sent to Europe, where they flew only cargo-delivery missions. Five went to the Pacific, where one was employed in the war's final airborne operation.

British gliders

The first British glider to see widespread use was the General Aircraft Limited **Hotspur Mk II**, of which 997 were built. Its capacity of only seven troops made it inadequate for combat, but it saw considerable use as a training glider.

The primary British gliders were the **Horsa Mk I and II** built by Airspeed Limited (see Plate B). It was originally intended that the Horsa would drop paratroopers; the awkwardly converted bombers that the RAF was then using in that role for lack of anything better had only a limited capacity. As Dakotas (RAF C-47s) became available this requirement was canceled, and the Horsa

Normandy, June 6–7, 1944. Cows shelter under the wing of a remarkably intact Horsa with US markings – proof that not all glider landings were destructive. The roughly applied "R15" on the fuselage side indicates the lift's serial number. (Tom Laemlein/Armor Plate Press)

A Horsa with the tail section removed to allow the cargo to be unloaded using the channel ramps carried inside. The load might have been a jeep towing a 75mm pack howitzer, 6-pdr AT gun, or trailer. Note the hastily painted invasion stripes; with only three days' warning to paint large numbers of aircraft, the work was sometimes sloppy. (Tom Laemlein/ Armor Plate Press)

became the principal troop carrier. Apart from its metal floor and a large Plexiglas canopy for the side-by-side pilots, it was built almost entirely of wood, to conserve strategic materials and to put the country's woodworking factories to productive use. Its tricycle undercarriage was retained for landing. The Mk I's large cargo compartment had 25 seats and the Mk II had 28; it could alternatively carry two jeeps, or a jeep with either a trailer or a 6-pdr AT gun or 75mm pack howitzer, with ammunition and a partial gun crew. There was a troop access door aft on the right side, and cargo was loaded, albeit with difficulty, through a large forward fold-down door on the left side; a jeep barely fitted through this even at an awkward angle, so loading required excessive time.

After the Rhine crossing on March 24–25, 1945, a Hamilcar with its nose section swung open has offloaded a Universal carrier of 6th AL Brigade. Being light, and agile across country, these versatile vehicles were used by airlanding troops in many roles; the Hamilcar could carry two at a time. (IWM BU 2617)

B

BRITISH AIRSPEED HORSA Mk I ASSAULT GLIDER

1: Left side view (with cutaway)

2: Split plan view (top & underside of left wing)

The unwieldy looking Horsa was one of the larger assault gliders, 67ft long in comparison with the Waco's 48ft 3¾in; its lengthy interior reminded some passengers of a London Underground rail carriage. In training, Horsas were usually painted in standard RAF dark green and dark earth camouflage with yellow undersurfaces, the latter with four broad black diagonal stripes under each wing and three under the belly – considered a necessary measure, because its back-swept wing leading edges gave its silhouette a rudimentary similarity to that of the Heinkel He 111 bomber that was all too familiar to British gun crews. For night operations like the Normandy landings it was painted black on the fuselage sides and all undersurfaces, and here sports the usual "invasion stripes."

The Horsa had two removable seats forward of the loading door, bench seats along both sides and three seats across the rear of the compartment, for a total capacity of up to 28 men in the Mk II. For its original intended role as a paratroop transport it had two troop doors aft of the wings, and four small bays for parachute cargo containers under each wing. On the left side immediately aft of the flight deck was a large cargo-loading door with an inset troop door, and when lowered (as illustrated) this served as a loading ramp; however, it proved too flimsy for heavy loads, and had to be supplemented with separate steel ramps. In its intended role it had not been envisioned that the Horsa would have to load anything bigger than a motorcycle; here, two soldiers are folding the little 1942 Welbike, a 71lb motor scooter intended for scouts and dispatch riders (in fact, seldom used). In its new airlanding role the big Horsa could carry a 6-pdr AT gun with its towing jeep; two loaded jeeps; a jeep and a loaded ¼-ton trailer; a jeep with a mounted 20mm AA cannon; or a jeep with a 75mm pack howitzer, some ammo and part of the gun crew. The problem was that maneuvering these long, rigid loads in through the side cargo door at an angle was frustratingly difficult and time-consuming. As described in the text, the need for much more rapid unloading was met by cutting the fuselage in two just behind the wings with a "surcingle" of detcord, or unfastening quick-release bolts and cutting the control cables. Vehicles could then be extracted straight backward, using 11ft 10in channel ramps.

3: Interior, troop seating

The passengers had a four-point harness with a cone-and-pin quick release, the wire cables being anchored to the structural ribs of the fuselage. While the Horsa Mk I could theoretically carry 25 men, the load was normally limited to 22 or even 15 troops.

4: Beret badge, Glider Pilot Regiment

5: Army Flying Badge

Introduced in April 1942 for all Army-qualified pilots (at that date, principally artillery spotters), this was worn on the upper left breast of the battledress blouse and service jacket.

6: Second Glider Pilot Brevet

Introduced for glider copilots in August 1944.

7: Badge for glider-trained infantry

All ranks wore this on the right forearm of the battledress blouse.

3

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A comparatively fast means of unloading was obviously needed, and was provided. The whole tail section from just aft of the wings could be neatly removed by firing a "surcingle" – a band of detonating cord that cut the construction bolts. Passengers dragged the cut tail section to the side, ramps were emplaced, and the equipment was rolled out. An alternate method was developed by which eight bolts were removed with supplied wrenches, wire-cutters also being provided to cut the control and electrical cables (the detcord was still carried, however, as a backup). Horsas with these quick-release bolts were designated "Red Horsas" and those without as "White Horsas."

The Horsa Mk II had a hinged nose that swung to the right for easier loading and unloading, though some Mk IIs were fitted with the quick-release tail-section bolts – "Blue Horsas" – in case the nose was too heavily damaged to allow it to be opened. The Mk II could carry 7,380lb of cargo to the Mk I's 6,344lb. Other differences included the means of attaching tow-ropes; that of the Mk I attached under the nose, while the Mk II used a Y-shaped yoke that divided to attach to each wing. The Mk I had a theoretical capacity for rifles and Bren guns to be fired from top and belly hatches and the paratroop side doors, but this unnecessary feature was deleted from the Mk II. Between 4,000 and 5,000 Horsas were built, of which 400 were used by the US because of their capacity to carry heavier weapons than the CG-4A.

The largest glider used by the Allies was the General Aircraft Limited **Hamilcar Mk I** (see Plate E), developed by the British to fulfill the perceived need for a heavy-cargo glider to deliver artillery, larger AT guns, engineer equipment, bulk ammunition and supplies, and light armor. Production totaled 334 examples; while about the same length as the Horsa, the 110ft wingspan made them the largest wooden aircraft in operational use. The forward end of the fuselage was bulbous to accommodate heavy cargo, with the cockpit high on top seating the two pilots in tandem, protected by a bulletproof canopy and minimal armor. Aft of the high, wide wings the fuselage was comparatively narrow. The landing gear consisted of a pair of large wheels and a tailwheel, plus belly skids. The wheels were not jettisoned; once the landing glider came to a halt, if the undercarriage was still intact the pilots let the air out of the tires and drained the fluid from the landing gear hydraulics to lower the glider's belly. This allowed vehicles to exit through the hinged nose, which swung to the right. The nose had a Plexiglas cone, and the underside was also glazed to allow the pilots to see downward during landing.

The Hamilcar could typically carry a 25-pdr gun-howitzer or a 17-pdr AT gun with its prime mover; two Universal ("Bren gun") carriers; three jeeps; three tank-drawn ammunition and fuel Rotatrailers; a light bulldozer; combinations of the light, compact US engineer equipment (see under Waco CG-4A, above); or 40 troops. Its unique value was believed to be that it could carry one light tank, either a Vickers Mk VII Tetrarch or a US M22 Locust (though in the event the powerful 17-pdr AT gun was far more useful).

The theoretical airlanding TO&E for a British airborne division called for 392 Horsas and 48 Hamilcars, but the 1st and 6th Abn Divs were not identically organized, and each operation called for different loads.

German gliders

With its head start in this field, Germany produced a number of unique designs. The most widely used was the Deutsche Forschungsanstalt für Segelflug (German Research Institute for Sailplane Flight) **DFS 230**, an

The DFS 230 was designed to make short landings; it could be provided with a drag parachute, as here, which reduced its landing speed by almost half over a short distance. For trials some were even fitted with nose-mounted braking rockets. (Bundesarchiv 1011-568-1531-32)

assault glider carrying only nine troops (see Plate C). Actual production was by Gothaer Waggonfabrik, which built 2,230 examples.

In fact classified as a *Lastensegelflugzeug* (cargo-carrying glider), this small aircraft was ruggedly built with a fabric-covered welded steel tubular frame, and high wings of fabric-covered plywood. It had a pair of jettisonable wheels for takeoff, and landing was accomplished by means of a centerline skid extending from the nose to midsection, plus a tail skid.

The single pilot sat well forward; behind him the passengers sat astride centerline seats, the first five facing forward and the last four backward. Side windows were generously supplied to allow passengers to orient themselves before landing, and some DFS 230s were fitted with machine guns (see Plate C). Twelve DFS 230s were required to deliver a 120-man company, and up to 50 for a battalion. The four rear seats could be removed to accommodate crew-served weapons, a motorcycle, munitions, etc., but the inability to remove the five forward seats limited its usefulness for delivering cargo. Later production models added or rearranged the side doors to improve loading and exiting, and despite its limitations the DFS 230 was extensively used to deliver light loads. The Luftwaffe even employed workshop gliders outfitted with machine tools, welding rigs, spare-parts lockers, and workbenches; fighter and dive-bomber (Stuka) groups on the Eastern Front would tow these from base to base as they advanced or retreated.

A larger assault glider (though in fact never used in an assault) was the

Gotha Go 242 gliders under tow over the Eastern Front, probably by Ju 52s or He 111s; the Ju 87D-2 was also modified to tow them, with a strengthened rear fuselage and a combined tailwheel/hook. The tow cables were from 80m (264ft) up to 300m (990ft) long. While never employed in combat assaults, the Go 242 proved to be an excellent cargo-hauling glider. Note the different camouflage patterns within this small formation. (Bundesarchiv 1011-641-4549-15)

Gotha Go 242, which arrived in mid-1941. Gothaer Waggonfabrik built 1,528 of these, of which 133 were later converted to Go 244 twin-engine powered transports. The Go 242 was built of steel tubing and bracing covered with fabric, with wings, twin tailbooms, and tail unit of plywood. There were troop hatches in both sides, along with several vision ports. Although the Go 242 mainly served as a cargo glider, it could be armed quite heavily; there was provision for up to eight MG15 machine guns, though usually only two or three were fitted. The high-winged design with twin tailbooms allowed for a hinged tail section to the central fuselage that could be raised to load and unload cargo. It could carry a Kübelwagen light car, 3.7cm AT gun, 7.5cm infantry gun or similar equipment, and there were seats for 23 passengers; some later models were fitted to jump paratroopers.

The early versions had jettisonable wheels for takeoff, a sprung nose skid, and two skids aft of the nose skid, one on each side of the belly beneath the wings. Later models had fixed wheels and belly skids, while the nose skid was replaced by a wheel assembly that could double as a skid. As with the DFS 230, some were outfitted as aircraft workshops, and others as unit command posts to control fighter units operating from forward airfields. In North Africa, Go 242s were extensively used to transport supplies and troops. They were employed for the same purpose on the Eastern Front, as well as to supply advancing columns or to deliver supplies and reinforcements to encircled units, and eventually to evacuate troops from the Crimea peninsula. A headquarters designated the Grossraum-Transportfleiger-Führer ("Large-capacity Transport Leader") was established in Warsaw to control glider and tug units on the Russian Front.

The largest glider ever built, and the largest operational aircraft built in World War II, was the **Messerschmitt Me 321**; aptly called the *Gigant*

C

GERMAN DFS 230 ASSAULT GLIDER

1: Left side view (with forward door removed)
2: Split plan view (top & underside of left wing)
3: Front view

The DFS 230 was small compared with Allied gliders; it had a single pilot, and carried only nine combat-equipped troops straddling centerline bench seats in the very narrow fuselage (see **3**). The pilot entered and exited via his side-hinged canopy; so did the front five passengers in the early versions, which had only one troop door centered beneath the wing on the right side and one left-side door aft of the wing. On later models, as illustrated, a second left-side door was added ahead of the wing; here it has been removed to show the cramped conditions for the five forward-facing passengers. Later models also had a viewing port low on each side of the nose, with or without Plexiglas, which gave the pilot a good view of the ground while landing. The most common camouflage finish was a conventional upper-surface splinter pattern of dark green or black-green and light green, often with mottling downward onto the pale blue side surfaces. The fuselage letter/number codes illustrated are unidentified, but are based on a photo of a glider on a southern Italian airfield in 1943.

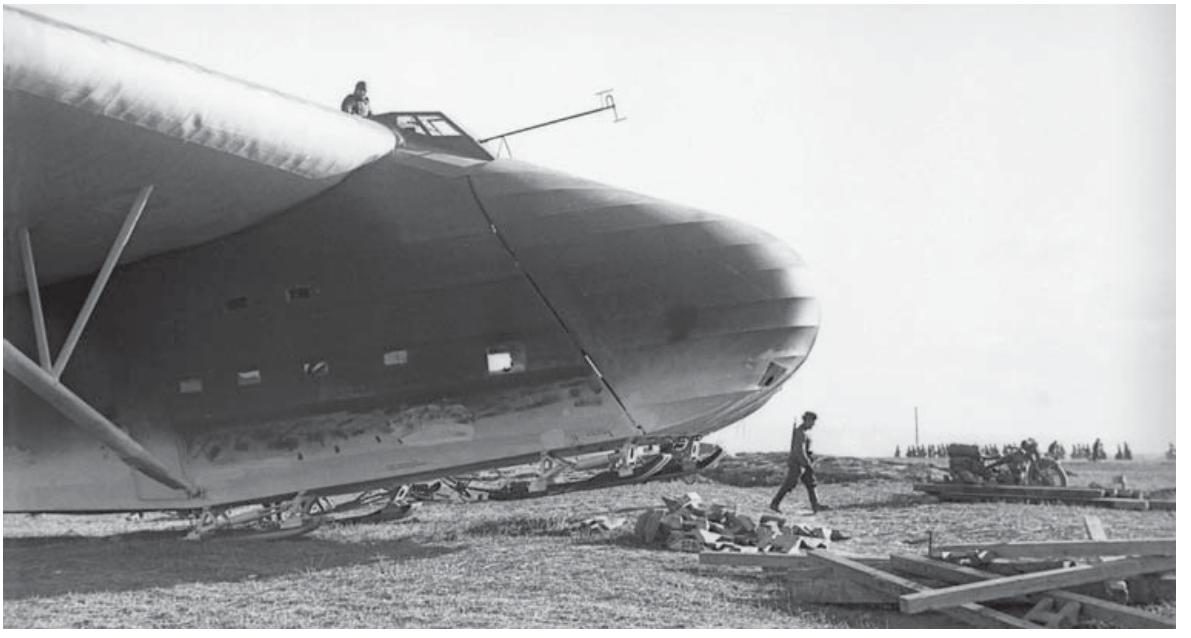
The carrying capacity in addition to nine fully equipped troops was limited to just under 270kg (600lb). An infantry squad *(Gruppe)* could be carried with their light machine gun (with or without its heavy tripod for sustained fire) and six 100-round ammunition carriers. Alternatively, a platoon headquarters *(Zugtrupp)* could carry a two-component Torn. Fu.d radio set. The bench seat for the four rearward-facing passengers could be removed to accommodate any larger cargo; in terms of equipment this was limited to a motorcycle, or the disassembled components of lighter crew-served weapons: the 8cm mortar, 7.5cm recoilless Leichtgeschutz 40 light/mountain gun, or 2.8–2cm "squeezed-bore" schwere Panzerbüchse 41 AT gun.

4: Nose detail with machine guns

The DFS 230 was one of the few armed gliders. In a dorsal hatch behind the pilot one of the forward passengers stood on the seat to man (mainly for air defense, but also for suppressive fire after landing) a mounted 7.9mm MG15 machine gun; this had a 75-round saddle magazine, and a spherical metal spent-case collector underneath. Sometimes a 7.9mm MG34 belonging to the embarked squad was attached to external brackets on the right of the nose. It was cocked and cleared by a cable-operated retractor; fired by the forward passenger thrusting his right arm out of a zippered flap in the fabric skin; and fed by a belt passing through another slot. A curved metal shield was added to protect the fabric from muzzle-blast. In theory the pilot would shout fire orders, but as the weapon could not be trained there was no chance of hitting anything that was not directly in front of the aircraft's ever-changing line-of-flight during descent.

5: Luftwaffe glider pilot badge

Like those for other aircrew categories, this *Segelflugzeugführer-Abzeichen* qualification badge was worn low on the left breast.



The massive size of the Me 321 *Gigant* ("Giant") *Grossraumlastensegler* ("large-capacity cargo glider") is apparent here; it was 92ft long and had a wingspan of 180ft – 40ft wider than that of the B-29 Superfortress strategic bomber. A key factor in its relative lack of successful service was the scarcity of suitable tug aircraft, such as the Junkers Ju 90 and the extraordinary "twin" Heinkel He 111Z. (Bundesarchiv 1011-267-0144-12A)

("Giant"), which had a 180ft wingspan. Inspired by the perceived need for transport capacity for the anticipated invasion of Britain, it could airlift 16 tons: a medium tank; a 15cm howitzer with its halftrack prime mover; AT and AA guns of up to 8.8cm; two trucks; other heavy weapons, or bulk supplies including, for example, 52 fuel drums.

The Giant was built of steel tubing and wooden spars covered with fabric. The pilots sat high, just forward of the wing; the first 100 machines had one pilot, and the second 100 two plus a mechanic. Huge clamshell nose doors opened outward to reveal a cavernous cargo compartment designed to accommodate a standard railroad flatcar load. There were troop doors in the fuselage sides aft of the wings. When carrying up to 140 troops or 60 litters a two-story double deck was installed; there were numerous side ports for both levels, and armament was four MG15s. Despite its size, the Giant had only two main landing wheels and a small nose wheel; these could be jettisoned and the landing accomplished on skids, but in fact they were usually retained so the Giant could be towed home. The Me 321 was extensively used to haul equipment, supplies, and personnel to North Africa and around the Eastern Front.

The problem was getting the Giant off the ground with the available tug aircraft. It required a 4,000ft runway; initially a Junkers Ju 90 four-engine transport was used as a tug (and then only with an empty Me 321). Only 18 Ju 90s had been built, and since there were no other aircraft capable of the feat the *Troikaschlepp* towing technique was developed, using three Messerschmitt Bf 110C twin-engine fighters in a "V" formation. Predictably, this proved costly in accidents, since flying in tight formation with triple tow-ropes required rare skill. Consequently, Heinkel designed the He 111Z (for *Zwilling* – "twin"): two conjoined He 111H-6 (later, H-16) bombers connected by a common wing, with five engines (one outboard of each fuselage, and three on the central wing). Even this still required rocket-assisted takeoff, with four rockets under each wing being dropped by parachute after they burned out.

Glider characteristics

This describes the most widely used gliders, but not trainers or experimental or limited-use types. All gliders had a two-man crew, except for the DFS 320 with one, and the Me 321 with three.

Model	Empty weight	Cargo weight	Passengers	Wingspan	Length
USA:					
Waco CG-4A	3,440lb	4,060lb	14	83ft 8in	48ft 3¾in
Waco CG-13A	18,900lb	10,200lb	30 or 40	85ft 7in	54ft 3in.
Britain:					
Airspeed Horsa I	8,156lb	6,344lb	22*	88ft	67ft
Airspeed Horsa II	8,370lb	7,380lb	28	88ft	68ft
GAL Hamilcar	18,000lb	17,500lb	40	110ft	68ft 6in
* Three more seats were available, but this was the maximum safe load.					
Germany:					
DFS 230	1,800lb	2,800lb	9	72ft 1⅓in	37ft 6in
Gotha Go 242	7,000lb	8,000lb	23	79ft	52ft 6in
Me 321	26,000lb	44,000lb	140	180ft 5⅓in	92ft 4¼in

Only 12 He 111Zs were built, and owing to this shortage of suitable tugs many *Giganten* were scrapped. Some were converted into powered Me 323 six-engine transports, but most of the 198 Me 323s were in fact purpose-built, with greatly reinforced wings and more robust landing gear. Most of these lumbering giants were lost on the North Africa run.

TUG AIRCRAFT

Glider-towing was difficult at best and potentially dangerous, the more so with double-tows. The tug had to strictly maintain specific takeoff, climbing, and cruising speeds, and to avoid sudden changes of altitude and course even if it came under fire. Increasing or decreasing speed had to be done gradually. The tug pilot was in command of the tug-glider combination, but he was not supposed to release the glider unless absolutely necessary and then only after alerting the glider pilot; likewise the glider pilot was to alert the tug if he was releasing.

Douglas C-47 transports tow CG-4As above flooded French fields. Even without the complications of night navigation and formation-keeping, towing a glider was more difficult and tiring than flying a single heavily loaded aircraft; the tow-rope repeatedly slackened and then tightened, with the danger of it breaking. Long-distance tows were especially grueling on pilots, making two-man crews an absolute necessity. (Tom Laemlein/Armor Plate Press)

The view from the tail turret of a Handley Page Halifax bomber of 644 Sqn RAF converted as a glider tug, as it lifts off from RAF Tarrant Rushton, Dorset, with a Hamilcar heavy glider on the end of a 400ft tow-rope. (IWM CH 18852)

A common complaint was poor navigation on the tug's part, resulting in GPs not having sufficient time to visually locate the LZ even if they were near it. It was not uncommon for glider formations to find themselves scattered and quite distant from their LZ owing to poor navigation, winds blowing the formation off course, clouds and fog, flak, and inexperience in maintaining formations.

While a variety of transports, bombers, and other aircraft – even twin-engine fighters – were employed as glider tugs, the most widely used were the twin-engine Douglas C-47 Skytrain/Dakota transport by the Allies, and the Junkers Ju 52 three-engine transport by the Germans. Numerous bombers and other aircraft were certified as tugs, but seldom used. The British used four-engine bombers for their larger gliders even after sufficient C-47s became available, and the Germans used aircraft other than the Ju 52 out of necessity.

Tug units

Note that the terms used by different air forces for units of different sizes are easily confused. USAAF units were termed, from larger to smaller, Wing, Group, and Squadron, while equivalent RAF units were termed Group, Wing,

Normandy, during the early evening of D-Day: an RAF Halifax bomber/tug and a Hamilcar heavy glider photographed above the Ranville landing zones. This view dramatizes their relative sizes. The wingspan of the Hamilcar, at 110ft, was 6ft wider than that of its four-engine tug, and its 68ft fuselage was only 3ft shorter than that of the Halifax. (Tom Laemlein/Armor Plate Press)

Most common tug aircraft

United States Army Air Forces:
Curtiss A-25 Shrike single-engine attack aircraft (SB2C Helldiver)
Curtiss C-46 Commando twin-engine transport
Douglas C-47 Skytrain twin-engine transport
Lockheed P-38 Lightning twin-engine fighter
North American B-25 Mitchell twin-engine bomber
Douglas C-54 Skymaster four-engine transport
Boeing B-17 Flying Fortress four-engine bomber
Consolidated B-24 Liberator four-engine bomber

Royal Air Force:
Douglas C-47 Dakota twin-engine transport
Armstrong Whitworth Albemarle twin-engine bomber
Armstrong Whitworth Whitley twin-engine bomber
Short Stirling four-engine bomber
Handley Page Halifax four-engine bomber

Luftwaffe:
Henschel Hs 126 single-engine reconnaissance aircraft
Junkers Ju 87 Stuka single-engine dive-bomber
Messerschmitt Bf 110 twin-engine fighter
Heinkel He 111 twin-engine bomber
Junkers Ju 52 three-engine transport
Junkers Ju 90 four-engine transport
Heinkel He 111Z five-engine glider tug

Soviet Air Forces:
Douglas C-47 Skytrain twin-engine transport (Lend-Lease)
Lisunov Li-2 twin-engine transport (license-built C-47)

and Squadron respectively. The equivalent Luftwaffe units were the Geschwader, Gruppe, and Staffel, each normally comprising three of the next smaller unit.

The USAAF C-47s and C-46s were organized into 24-plane troop carrier squadrons. The British employed glider-tug squadrons usually with 24 aircraft, sometimes more, of varied and often mixed types, since British gliders were heavier than the US CG-4A. Some units were converted from bomber squadrons. Both the USAAF and RAF squadrons might be used for resupply drops and other transport missions in addition to glider-towing.

German tug units were initially designated Kampfgeschwader/Kampfgruppe zur besonderen Verwendung ("bomber wing/group for special employment" – KG/KGrzbV), but were redesignated Transportgeschwader during 1943. They also formed Schleppgruppen für Lastensegler ("towing groups for cargo gliders"), with two squadrons each of 12x Go 242s and one of 12x DFS 230s as well as the tugs.

To give an idea of the scope of Allied tug units: the USAAF IX Troop Carrier Command units committed to towing gliders during the Normandy invasion included the 50th TC Wing (439th–442nd TC Groups) and 53rd TC

Over Italy, 1943, Junkers Ju 87 dive-bombers tow DSF 230s, here with 100m (330ft) ropes. The Stuka tugs were used for short-range cargo delivery flights, and to tow their own units' mobile workshops fitted in gliders. (Bundesarchiv 1011-567-1523-35A)

Wing (434–438th TC Groups). Each of a wing's four groups had four squadrons, each with 13x C-47s. Prior to the invasion the establishment was increased from 52 aircraft per group to 73, of which nine were spares. For Normandy, some 2,100 CG-4As were shipped to Britain in crates. At first unskilled civilian labor was used to assemble them, but even when USAAF personnel were substituted they too proved inadequate, and many gliders were judged unflyable. A rush effort was implemented, and 1,118 serviceable Wacos were actually available by D-Day. The British also provided US units with 301 Horsas for heavier cargo.

In the RAF, 38 and 46 Groups were the principal troop airlift and glider-tug units. For Normandy 38 Group had ten squadrons, with 22 bombers each, to tow almost 1,100 Horsas and 30 Hamilcars.

GLIDER PILOTS

Each country had different requirements and standards for glider pilots. The physical and skill requirements were lower than for powered aircraft, and they were often looked down on by "real" pilots (though the special challenges of their trade are described above, and many GPs had at least minimal powered-aircraft experience). While there were some commissioned officers in command and staff positions, in most forces the actual GPs were sergeants, although the USAAF had a special warrant rank of "flight officer." The US and UK lacked the prewar government-sponsored glider programs that gave Germany and the Soviet Union an abundance of potential military pilots (though in the event both countries would use fewer gliders than the US and UK). Their need for GPs was so pressing that commanders of Army units were ordered to post notices calling for volunteers, and to release any man who applied.

A glider pilot (right) chats with a glider mechanic; the chalked name above his head is typical of the glider pilots' necessarily dark sense of humor. The mechanics assembled the crated gliders when they arrived; performed repairs; maintained instruments, control systems, lights, etc; and served as ground crews, to position gliders for takeoff and hook up the tow-ropes. (Tom Laemlein/Armor Plate Press)

America

In 1942 the US Army unrealistically forecast the need for 12,000 GPs, though there were virtually no gliders nor training facilities. The first GPs undertook sailplane training at contracted civilian schools; these taught totally different skills than those needed for flying cargo gliders, but at least they offered some basic air experience. Few US soldiers initially volunteered, and there were few qualified civilian GPs. The main source was cadets who had failed conventional pilot training, but even these were limited in number, since many pilot "washouts" went on to qualify as bombardiers and navigators with commissioned rank. Standards were reduced for GPs, allowing a maximum age of 32 (later, 35) as opposed to 26 for powered aircraft. They could also possess 10/100 vision correctable to 20/20 by spectacles, but otherwise they had to pass standard flight physicals. This allowed men

who had private pilots' licenses to become GPs despite not meeting full military standards.

While there were standard course lengths and required numbers of flying hours, these were often not met due to shortages of gliders, tugs, and instructors. The Preliminary Plane Gliding School lasted five weeks, with 40 hours in Piper Cubs practicing dead-stick (unpowered) landings and day and night instruction. There were 23 such schools operated by civilian contractors, and on graduating students received their "glider wings" to boost morale, even though their training was far from finished. The Elementary-Advanced Glider School lasted one week with eight flying hours in sailplanes, plus one week and eight hours in cargo gliders. There were seven of these schools, later replaced by Advanced Glider Schools at nine Army airfields. From May 1943, all advanced glider training was conducted at South Plains Army Air Field, Lubbock, Texas, which graduated the majority of the eventual 6,000 glider pilots. Glider mechanics were trained at Sheppard Field, Texas to assemble and maintain the craft.

A glider mechanic (left) and pilot tape AN-M14 thermite incendiary grenades to framing struts in a CG-4A. After the troops or cargo have been unloaded on the LZ, the grenades will be ignited to burn the hulk. The pilot wears a dark brown B-3 winter flying jacket and a B-1 summer flying cap. (Tom Laemlein/Armor Plate Press)

Initially GP students were made staff sergeants when accepted for training, and upon graduation they were made "flight officers," equivalent to a warrant officer. This rank was created in July 1942 as a result of a dispute between the USAAF (who wanted GPs to be part of the troop carrier squadrons), and the Infantry (who wanted them to be infantrymen who additionally knew how to fly). On its creation, existing staff sergeant GPs were promoted to the new rank. Flight and warrant officers had officer privileges; however, they were not commissioned by Congress but warranted

Two IX Troop Carrier Command pilots discuss their mission; their CG-4A is fitted with the Ludington-Griswold nose reinforcement and the wide Cory skid, and the tow-rope is already hitched on. The right-hand pilot wears a dark brown B-6 winter flying jacket while the other wears an olive drab B-11 model. (Tom Laemlein/ Armor Plate Press)

by the War Department, and were regarded as "third lieutenants." Glider pilots' flight pay was 50 percent extra in addition to their base pay.

American GPs were assigned to troop carrier squadrons as augmentees, two GPs for each of the 24 (or occasionally 48) gliders, and glider mechanics were also assigned. They were informally organized as a GP flight or section within the squadron. Troop carrier squadrons conducted practice in formation flying and navigation towing gliders, but troops were rarely carried on these flights.

American GPs had a rather turbulent relationship with the "real" pilots in their TC squadrons, being viewed as second-class pilots. However, it was common for GPs to fly as copilots in the squadron's C-47s owing to copilot shortages, and also for C-47 copilots to copilot gliders. Copilots were not only necessary in case of casualties, but to help handle turbulence, which was exhausting (it was bad enough during the Rhine crossing that pairs of pilots had to switch over every 15 minutes). Glider copilot shortages were such that even infantrymen were sometimes asked to volunteer, given a few minutes' ground instruction, and then handed control en route to an LZ. This was often the case during Operation *Market* in the Netherlands, since GP casualties in Normandy had not been made up. Major General James Gavin of the 82nd Abn Div commented: "Fortunately, the Waco is not too hard to fly or land. But having to do it for the first time in combat is a chastening experience…."

Britain

British GPs were assigned to the Glider Pilot Regiment, an Army organization, but were attached to RAF transport groups to fly RAF gliders. Again, who GPs were to belong to was a point of contention between the RAF (which owned the gliders) and the Army (whose troops they had to transport, and who they were expected to fight alongside once on the ground). The Glider Pilot Regt was authorized in December 1941 and established on February 24, 1942. Along with the Parachute Regt (formed from existing Parachute Bns on August 1, 1942), and the Army pilots assigned to RAF Air Observation

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HAZARDS OF GLIDER LANDINGS; NORMANDY, JUNE 1944

In the 1940s large, sprawling fields and pastures were rare in much of Europe, where most agricultural land was divided into small, centuries-old holdings by hedgerows – earth berms overgrown with tightly interwoven bushes incorporating trees, stone walling or cattle fences, and often flanked by drainage ditches. While today's electricity pylons carrying power lines were much less evident then, even a few scattered shade-trees for cattle could make an otherwise usable field dangerous. Some areas were deliberately flooded by the enemy closing canal sluices or damming rivers; this would not stop a glider, which could land in water in a short distance, but a depth of 1–3ft would make it very difficult for troops to move or to haul heavy weapons and supplies.

To deny gliders large, open landing zones in northern France, Field Marshal Rommel ordered the emplacement of tens of thousands of posts in likely fields; these anti-landing obstacles *(Luftlandehindernis)* were popularly called *Rommelspargel* – "Rommel's asparagus." The wooden posts were 6–12in in diameter and 13–16ft long, with 8–12ft protruding above ground. Farmers were supposed to plant them at a ratio of up to 1,000 per square kilometer, but they were often sparser. They sometimes had wire strung between the tops and diagonally between tops and bottoms; some were topped with trip-wired mines or grenades, but these were often stolen by the Resistance. In the event, natural obstacles caused more damage than posts, but in the south of France during Operation *Dragoon* some 300 Allied casualties were attributed to them. Of necessity, gliders were lightly constructed, and it was often the pilots who suffered worst in bad landings.

Glider pilots **(left foreground)** in training wore standard flying outfits such as the B-10 intermediate jacket and A-9 intermediate trousers over wool shirts and trousers, but the flying trousers might be discarded for operations. There was no standard equipment for pilots, and individuals used whatever they chose. Officially pilots carried only M1911A1 pistols, but most acquired M1 or M1A1 carbines, M1 Thompson SMGs (as here), or M3 "grease guns." Pilots were issued maps showing larger areas than their passengers or paratroopers, and these proved useful when the landings were scattered, as happened to the 101st Abn Div's "Mission Chicago" early on the morning of D-Day.

Glider pilot insignia

Glider pilots were awarded special "wings," different enough from those of qualified powered-aircraft pilots to ensure that they would not be confused. On operational flights pilots typically wore the same field uniforms as their passengers, although US and German pilots often wore USAAF and Luftwaffe flight clothing.

The **American** Glider Pilot Aeronautical Rating Badge, introduced in September 1942 (see Plate A5), was similar to the regular 3⅛in silver spread-wing Pilot Badge, but with a shield bearing a "G" (said by glider men to stand for "Guts"). In the CBI, alternative yellow-metal wings locally made up in India had a fancier "G" on a disc (see Plate F2). The wings were worn over the left breast pocket. Most units wore the Army Air Forces circular ultramarine-blue patch on the left shoulder, displaying a red roundel on a white star centered on golden-orange V-shaped wings. Army Air Forces branch-of-service colors were ultramarine blue and golden-orange, and their collar insignia was the Air Corps winged propeller.

Both types of **British** GP wings were embroidered on black wool backings. The elaborate Army Flying Badge, also worn by AOP spotter pilots and introduced in April 1942, was 5⅛in across, with the gold and red lion-and-crown royal crest centered on pale blue wings (see Plate B5). The Second Glider Pilot Badge, introduced in August 1944, was only 3in wide and plainer, with a centered yellow circle enclosing a yellow "G" (see Plate B6). Both badges were worn above the left breast pocket. Glider pilots wore a regimental shoulder title at the top of both sleeves of the battledress blouse: a light blue felt arc with "GLIDER PILOT REGT" in dark blue. Below the title on both upper sleeves was the square, maroon Airborne Forces formation patch with a light blue Pegasus (flying horse) motif, and below it a straight "AIRBORNE" tab in the same colors. Over the left eye on the maroon Airborne Forces beret they wore a silver-colored regimental badge (see Plate B4).

The only distinction worn by **German** GPs was the Luftwaffe *Segelflugzeugführer-Abzeichen* (Glider Pilot Badge – see Plate C5), approved in December 1940. This pin-back metal badge was worn low on the left breast pocket; an aluminum thread-embroidered version on a blue-gray cloth backing was withdrawn from wear in May 1942. The badge could not be worn in conjunction with other Luftwaffe flying badges, but qualified GPs could also display the *Fallschirmschützen-Abzeichen* (Paratrooper's Badge). GPs wore the same golden-yellow branch-of-service color *(Waffenfarbe)* uniform piping and collar-patch backing as other Luftwaffe flying personnel and paratroopers.

Post squadrons (i.e. artillery spotters), these organizations comprised the new Army Air Corps (to which the Special Air Service was added in 1944).

The GPs were recruited from the Army, assigned to the Glider Pilot Regt, and trained by the RAF to fly gliders under RAF control. They had to pass a flight physical and meet other RAF requirements. They first attended six weeks of selection at the Glider Pilot Regt depot at Tilshead, Wiltshire; Brigade of Guards instructors maintained high standards, and washouts were "returned to unit." Those who passed selection then attended one of four 12-week Elementary Flying Training Schools (Nos 3, 16, 21, 29), getting 20 flying hours on open-cockpit Tiger Moth biplanes. This was followed by one of five 12-week Glider Training Schools using the small Hotspurs. They then progressed to No 21 or 22 Glider Operational Training Unit (later, Heavy Glider Conversion Units) for six weeks in Horsas; selected individuals were trained to fly Hamilcars, and if successful were posted to the Glider Pilot Regt's C Squadron. The final step was the two-week Battle Course, to learn infantry battle drill and weapons employment, including German types. With shortages of GPs, in early 1944 a "second glider pilot" or copilot course was implemented of only three weeks' duration. Glider pilots were sergeants and staff sergeants; a sergeant GP drew 12 shillings 6 pence per day (more than six times the base rate for an infantry private).

The Glider Pilot Regt suffered 60 percent losses at Arnhem in September 1944, and since sufficient replacements were not yet available for the Rhine crossing in March 1945, 1,500 experienced RAF sergeant and officer pilots were drafted (unwillingly) into the regiment. Besides being quickly trained in Horsas, they received limited ground combat training. Sixty percent of the GPs lost during the Rhine crossing were drafted RAF pilots.

Germany

The typical Luftwaffe glider pilot (Segelflugzeugführer) was a senior NCO of Unterfeldwebel or Feldwebel rank, who had passed the "A" and "B" tests following previous glider training. They received no powered-aircraft instruction, but were well grounded in the principles of flight, weather, and flying techniques. They undertook six weeks' military glider training, including blind flying and spot landings, at Ausbildungskommandos für Lastensegelflug (Training Commands for Cargo Glider Flight), and also received ground combat training. The glider schools operated at Dörnberg, Hildesheim, Rhön, Rossiten, and Syat, and pilots were awarded the Glider Pilot Badge upon graduation. They were then assigned to a transport wing, or to airlanding squadrons – subunits of Luftlandegeschwader 1 with DFS 230s, or Luftlandegeschwader 2 with Go 242s. Flight pay (Fliegerzulage) was about 50 Reichsmarks a month (roughly equivalent to US $20, or £5 sterling).

Glider pilots in ground combat

An issue that was not always fully resolved was what GPs were supposed to do once their passengers had disembarked.

The British had the most effective and structured solution to this question. In January 1944 the Glider Pilot Regt's existing 1st and 2nd Bns were redesignated as two "wings" with three or four "squadrons" each. A squadron, commanded by a major, consisted of an HQ "flight" and four glider flights, each with four officers and 48 NCOs commanded by a captain or lieutenant. In practice, flights were cross-attached between squadrons as missions required.

Once the troops were delivered the GPs formed into rifle units. On paper, a wing equated to a lightly armed rifle battalion, squadrons to companies, and flights to large platoons; in reality, owing to casualties and scattered landings, these ad hoc units were much understrength, and lacked crew-served weapons. Nevertheless, GPs were expected to maintain a high standard of military training. Armed with Sten guns, rifles, and pistols, they fought alongside the infantry if necessary. More often they guarded unit HQs, artillery positions, and prisoners, formed a reserve, and secured critical sites in the rear. They were to be evacuated as soon as possible, though not before the wounded.

Since German glider operations were on a small scale there were few Luftwaffe GPs on the ground. They were indistinguishable from paratroopers, were trained in infantry skills, and normally fought alongside their passengers, typically armed with an MP40 machine pistol and a handgun.

This well-known but striking photo from the Arnhem fighting shows British glider pilots skirmishing on September 23, 1944 in the ruins of Oosterbeek, where they held two strongpoints in the perimeter. The Glider Pilot Regt was trained for ground combat; after a landing they formed ad hoc platoons and companies which were put at the disposal of Airborne division commanders for such duties as their light armament allowed. At Arnhem, of some 1,200 British GPs who landed, 229 were killed and 469 wounded or captured – a casualty rate of just under 60 percent. (IWM BU 1121)

British Glider Pilot Regt, September 1944

Regimental HQ

No. 1 Wing (RAF Harwell)	**No. 2 Wing (RAF Broadwell)**
A Squadron:	*C Squadron:*
No. 1 Flight	No. 6 Flight
No. 17 Flight	No. 7 Flight
B Squadron:	*E Squadron:*
No. 3 Flight	No. 11 Flight
No. 4 Flight	No. 12 Flight
No. 19 Flight	No. 25 Flight
No. 20 Flight	
D Squadron:	*F Squadron:*
No. 5 Flight	No. 14 Flight
No. 8 Flight	No. 15 Flight
No. 13 Flight	No. 16 Flight
No. 21 Flight	
No. 22 Flight	
G Squadron:	
No. 9 Flight	
No. 10 Flight	
No. 23 Flight	
No. 24 Flight	

Note: Two RAF wings equipped with Dakota transports and Hadrian (CG-4A) gliders were raised in India in late 1944 for operations in the Far East had the war continued. Besides RAF GPs, they included the former members of the Army's 10 Independent Sqn, Glider Pilot Regt that had operated in the Mediterranean and Middle East. The wings were disbanded between October 1945 and July 1946 without ever conducting operations. In December 1944 they consisted of:

No. 343 Wing RAF	*No. 344 Wing RAF*
No. 668 Squadron	No. 671 Squadron
No. 669 Squadron	No. 672 Squadron
No. 670 Squadron	No. 673 Squadron

The Americans were the least organized in regard to the GPs' ground role. They had no preplanned subunit organization like the British, nor precise guidelines for employment. The main reason for this was because they belonged to the Air Forces, who did not want to see them used as infantry – much time, effort, and expense had gone into their training. Most were directed to assemble at an artillery or other unit's command post to perform security, and await evacuation. The reality was that most GPs, being independent-minded, simply did what they wanted. They had latitude in selecting weapons, and while only authorized a pistol most acquired a carbine or submachine gun; they typically carried a day's rations and minimal field gear. Many attached themselves to parachute units; some guarded prisoners, and marched them to the rear; others were put to work in command posts, or even pressed into service as officers' aides. In Normandy, many headed straight to the beaches to hitch a boat ride back to England, but in one instance in the Netherlands 300 GPs reinforced the 505th PIR when it came under counterattack.

GLIDER-DELIVERED UNITS

Both US and British glider-delivered forces were comprised of assigned units rather than individual volunteers. In the British case there were numerous changes of personnel while units underwent training and shook down in their new role, and in both cases individuals would be reassigned if they proved prone to airsickness or an inordinate fear of flying.

British airlanding troops received extra Airborne pay of 1 shilling per day (so increasing by 50 percent a private's base rate of 2s), and sported insignia that marked them out as members of an elite: the prestigious maroon beret, and the Airborne Forces sleeve patch and title. A point of contention between the flamboyant US volunteer paratroopers and the non-volunteer "glider-riders" was that the latter received no extra hazardous-duty pay, nor special insignia other than a glider cap patch (which in 1944 was replaced with a

universal parachute-and-glider patch for all airborne troops). Nor could they wear paratrooper's uniform items, including (initially) the coveted jump boots. Glider-men felt second class, and veterans are quick to point out that "glider-man" is found in no dictionary. They finally received a hazardous-duty pay supplement on June 4, 1944, but only half that paid to paratroopers – $25 per month for enlisted men and $50 for officers. However, in recognition of their casualties in Normandy, glider pay was doubled to match jump pay one month later.[2]

US glider troops undertaking a group prayer prior to loading aboard a CG-4A. Above the medic (right) the kick-out emergency exit can be seen. (Tom Laemlein/Armor Plate Press)

The US airborne division was organized in theory with two glider infantry regiments (GIR) and one parachute infantry regiment (PIR), the opposite to the ratio employed by the British. With experience, the reality became somewhat different. The 82nd Abn Div began life with one glider and two parachute regiments, with a third PIR added in mid-1944. The 101st Abn Div maintained two GIRs, but one was split in mid-1944 to provide third battalions to the 82nd and 101st's GIRs, and the division had two or three additional PIRs attached. By early 1945 the other divisions had each given up their second GIRs and received a second PIR.

The capabilities of the glider-borne units in US and British airborne divisions were drastically different. Even with two GIRs, the US airborne division fielded only four glider battalions, each of three companies with two platoons each, for a total of 12 companies and 24 platoons – six companies and 12 platoons in a single GIR. In early 1945, with the addition of a third battalion, and third platoons to the companies, the one-GIR division had nine glider-borne companies with 27 platoons.

On the British side, the single divisional airlanding brigade had three battalions each with four companies, with four platoons apiece – 16 platoons in a battalion, or 12 companies and 48 platoons in the brigade. Granted, four-platoon companies were somewhat unwieldy, requiring a broader span of control and not being as agile as a three-platoon company; additionally, such an organization required many more tugs, gliders, and pilots. However, in the initial stages of an assault landing such an abundance of troops generally allowed an adequate force to assemble.

US glider unit organization

The Glider Infantry Regiment (GIR) possessed only two rifle battalions of three companies, for a total of 1,806 troops. It owed its compact size to glider

2 For an approximate comparison of relative US/British army pay: under the Bretton Woods agreement of 1940, the US/UK exchange rate was pegged at just over $4 US to £1 sterling, so $1 equated to roughly 5 shillings (in pre-decimal currency the pound comprised 20 shillings, each of 12 pence). In late 1942 the US private soldier's base monthly pay (7th grade) in the USA, without any of the available supplements, was $30, or roughly £7 10s 0d (£7.50) sterling. The British private's basic monthly pay was £3 0s 0d. Thus the Tommy's classic complaint about the difficulty of finding female company when off duty: there was nothing wrong with the Yanks, except that they were "overpaid, oversexed, and over here..."

US Army Glider Infantry & Artillery units

Unit	*Abn Div*	*Period active*
88th Glider Infantry Regiment	13th	1942–45
187th GIR	11th	1943–49
188th GIR	11th	1943–45 (became prcht)
189th GIR*	13th	1943
190th GIR*	13th	1943
193rd GIR	17th	1943–45
194th GIR†	17th	1943–45
325th GIR†	82nd	1942–47
326th GIR	13th	1942–46
327th GIR†	101st	1942–45
401st GIR†	101st	1942–45
88th Airborne Infantry Battalion*	Abn Cmd	1941–42 (to 88th GIR)
550th AIB	FABTF**	1941–45
319th Glider Field Artillery Battalion	82nd	1942–47
320th GFAB	82nd	1942–48
321st GFAB	101st	1942–45
472nd GFAB	11th	1942–49
602nd Field Artillery Battalion (Pack)	FABTF	1944 (temporarily glider)
674th GFAB	11th	1943–45 (became prcht)
675th GFAB	11th	1943–49
676th GFAB	13th	1943–46
677th GFAB	13th	1943–46
680th GFAB†	17th	1943–45
681st GFAB	17th	1943–45
907th GFAB	101st	1942–45
80th Airborne Antiaircraft Battalion	82nd	1942–46
81st AAAB	101st	1942–45
152nd AAAB	11th	1943–46
153rd AAAB	13th	1943–46
155th AAAB	17th	1943–45

Notes:

* Never deployed overseas; personnel transferred to other units.

† Only four of the 11 GIRs actually conducted glider assaults: the 194th & 327th GIR once each; parts of the 401st attached to the 325th & 327th, and the 325th, twice each.

**FABTF = 1st Airborne Task Force.

capacity, which was even more restrictive than that of C-47 transports. The regimental Headquarters Company consisted of a regimental HQ, company HQ, HQ platoon (operations and intelligence sections, reconnaissance group), communication platoon, and two AT platoons (4x 37mm guns each). The Service Co had a company HQ and regimental HQ and transportation platoons. There was also a company-size Medical Detachment.

The glider infantry battalion had an HQ company and three rifle companies. The HQ company had a battalion HQ, company HQ, mortar platoon (6x 81mm), and heavy machine gun platoon (4x HMG). The rifle company had an HQ, only two rifle platoons, and a weapons platoon (2x

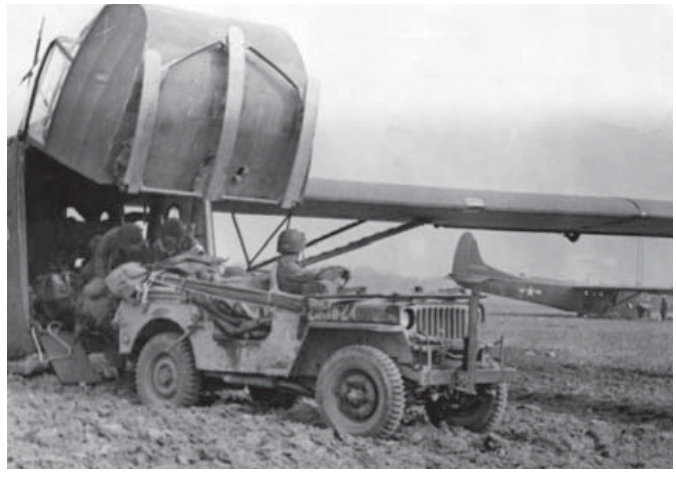
During resupply missions into Normandy soon after D-Day, Wacos plow onto a landing strip prepared by engineers. Once the scheduled missions have been completed the rolls of 3in-square mesh track (SMT) will be laid to make the runway more durable for fighter-bombers. (Tom Laemlein/Armor Plate Press)

LMG, 2x 60mm mortar). The rifle platoon had an HQ and three rifle squads; the former included a 60mm mortar crew, but these were usually given to the weapons platoon. Separate glider infantry battalions were designated the 88th and 550th Airborne Inf Bns; it was the 88th that originally tested glider tactics.

The December 1944 TO&E, implemented in early 1945, saw the addition of a third battalion to the GIR plus a third platoon to each rifle company, giving an increase to 2,975 troops with 863 in each battalion. It was not implemented until March 1945 in Europe, and July 1945 for the 11th Abn Div in the Pacific theater. Third battalions were obtained from disbanded glider regiments: 1st and 2nd Bns, 401st GIR became the 3rd Bns of the 327th and 325th GIRs, respectively (and had already been attached to those regiments since March 1944). The 193rd GIR and 550th Abn Inf Bn were deactivated to fill out the 194th GIR. Crew-served weapon allocation changed to 8x HMGs instead of four, and 6x 57mm AT guns replaced the 8x 37mm guns.

The 384-man Glider Field Artillery Battalion (GFAB) had an HQ and service battery, and two howitzer batteries each with 6x 75mm pack howitzers (instead of the standard FA battalion's three 4-gun batteries), plus a medical detachment. Four of the battalions were rearmed with 105mm M3 "snub-nose" howitzers: the 320th in February 1943; 907th, March 1944; 675th, January 1945; and 677th & 680th, February 1945. The shield was removed from the M3A1 carriage so that it could be carried in a glider. The other units retained 75mm pack howitzers for glider insertion, and might receive the 105mm pieces when they linked up with a sea-landed or overland echelon.

A jeep being unloaded from a CG-4A in Germany, March 1945; note the narrow nose skids on this glider, compared with the wide Cory skid. Jeeps were flown in fully loaded with cargo and equipment and with a full tank of gasoline. British airlanding troops also used jeeps, with 904 on the inventory of an airborne division.



The 505-man Airborne Antiaircraft Battalion was unique to airborne divisions and was considered a glider unit. On paper it included an HQ and HQ detachment, three automatic weapons batteries, three machine-gun batteries, and a medical detachment. The TO&E allotted 8x 37mm AT *or* 40mm AA guns per "automatic weapons" battery, in two 4-gun platoons. Initially Batteries A–C

had only 37mm AT guns, but by 1944 they had 57mm guns; they never actually possessed 40mm AA guns and were purely AT units, leading to them being called "AT batteries." The machine-gun batteries, lettered D–F, had 12x .50-cal guns each and were referred to as "AA batteries." In practice unnecessary for solely air defense, they were employed against ground targets.

Glider infantry regiments were also supported by a 103-man Engineer Co (Glider) from the division's Airborne Engineer Bn (Cos A and B in a division with two GIRs).

US glider troops' uniforms

American glider troops wore the same field uniforms as other ground troops. From 1942 their only specific distinction was the "glider patch," a circular embroidered insignia worn on the left front side of the garrison cap (right side for officers, who wore their rank on the left). It had a light blue background for infantry and red for artillery and engineers, with a white border and white glider motif. In August 1944 it was replaced with a similar patch with medium blue backing, red border, and a white glider superimposed on a white parachute; this was worn by both glider and parachute troops. Branch colors worn as piping on enlisted men's garrison caps were: infantry, light blue; artillery, red; engineers, interwoven red and white. Glider troops were also (belatedly) authorized jump boots at this time.

The Glider Badge was finally authorized for glider troops in June 1944. Worn over the left breast pocket, it had the same silver upswept wings as the Parachutist Badge, but with a front view of a CG-4A glider rather than a parachute. To earn it, a man had to be attached to a glider or airborne unit and to have satisfactorily completed a course of instruction – involving at least one practice glider landing with combat equipment – or to have participated in at least one combat glider mission into enemy-held territory. It was discontinued only in May 1961, although glider training had ceased in 1948 and was eliminated as a unit requirement in January 1953.

British airlanding unit organization

The war establishment of an 806-man British airlanding infantry battalion called for a battalion HQ, support and AA/AT companies, and four rifle companies. The support company possessed an HQ, and signals, transport, administrative, pioneer, reconnaissance, and mortar platoons (4x 3in mortars). The rifle company had a headquarters, support section (2x 3in mortars), and four rifle platoons, each with three sections. Platoon weapons included three Bren guns, and a 2in mortar and PIAT antitank projector with the HQ element. From 1944 the support company's four mortars and the rifle companies' eight mortars were consolidated into a mortar group, with two platoons of six tubes each, for more effective fire control. In practice the AA/AT company was organized differently from the official establishment. It was supposed to have two AA platoons, each with two jeep-drawn trailers bearing 20mm Hispano-Suiza automatic cannon on No.2 Mk II "spider" ground mounts. These were not needed for air defense and proved ineffective for antitank use, so the AA element reorganized into a machine-gun platoon with 8x .303 Vickers MMGs; most units later reorganized again into two 4-gun platoons. The company's two AT platoons each had four jeep-drawn 6-pdr guns.

The airlanding battalions, with four companies each of four platoons, gave the division's airlanding brigade 48 platoons, nearly the same strength as the sum of its two parachute brigades, each composed of three battalions

During an exercise at RAF Netheravon in December 1942, British airlanding troops unload Matchless 3G/L motorcycles, the standard British service machine, from a Horsa; they were intended for use by scouts and couriers. The Horsa's cargo door is lowered to serve as a loading ramp, but it was too fragile for the heavier loads. (IWM H 26215)

with three companies of three platoons (totaling 54 platoons). The airlanding brigade headquarters also included a defense platoon.

Each airborne division possessed a battalion-size Airlanding Light Regiment, Royal Artillery, with three batteries each divided into two 4-gun troops with US 75mm pack howitzers. One battery normally supported each of the division's parachute and airlanding brigades. The 1st Abn Div's 1st AL Lt Regt RA had batteries numbered 1, 2, and 3; the 6th Abn Div's 53rd (Worcestershire Yeomanry) AL Lt Regt RA consisted of 210, 211, and 212 Batteries. In the Far East, the 44th (Indian) Abn Div had the 159th Prcht Arty Regt RA, with 553, 554, and 555 Batteries. Each of the divisions in Europe possessed two Airlanding Light Anti-Tank Batteries RA (1st Abn Div, 1st & 2nd Btys; 6th Abn Div, 3rd & 4th Btys), each battery having four troops of 4x 6-pdr AT guns (prior to 1943, 2-pdr guns) and two troops with 4x 17-pdr guns. The 1st Abn Div's 1st Lt AA Bty had three troops each with 8x 20mm cannon; the 6th Abn Div's 2nd Lt AA Bty had one troop of 18x 40mm Bofors Mk I guns on Mk IV mounts, and two troops each with 24x 20mm cannon. The 20mm Hispano-Suiza cannon were replaced in March 1944 by 20mm Polsten guns; both types had No.2 Mk II mounts, and were towed on jeep trailers.

The 52nd (Lowland) Infantry Div was trained as an airlanding division in July 1944; it was to have been used at Arnhem, but was never employed in that role, and went on to fight as conventional infantry.

British airlanding troops' uniforms

British airlanding troops wore the same combat uniform as paratroopers, including the rimless steel jump helmet, and the Denison smock over Airborne-style battledress with enlarged trouser pockets. After completing glider training, infantry wore a 1¾in khaki oval patch on the right forearm of battledress, showing an embroidered Horsa glider in light blue with black thread detailing; reportedly, the oval was occasionally edged with a traditional

British Airlanding Brigade units

As throughout the Army, the infantry components of "tactical" formations (brigades, equivalent to US regiments) were numbered battalions of different traditional regional regiments, which continued to reflect this "tribal" identity by title and uniform distinctions.

The 31st (Independent) Brigade Group was a regular formation that had returned from India, trained for mountain warfare; in the UK in 1941 it was based in South Wales in counterattack reserve for Western Command. It was redesignated in October 1941 as 1st Airlanding (AL) Bde Grp of 1st Abn Div, this being simplified to 1st AL Bde on March 10, 1943. In December 1943 it provided two of its original five battalions (2nd Bn Oxfordshire & Buckinghamshire Lt Inf, and 1st Bn Royal Ulster Rifles) for the new 6th AL Bde, 6th Abn Div. Subsequently, in November 1944, 14th AL Bde was raised for 44th (Indian) Abn Div for operations in the Far East.

Unit	*Assigned dates*
1st Airlanding Brigade Group (from March 1943, 1st AL Bde)	Dec 41–Aug 45
1st Battalion, Border Regiment	Dec 41–Aug 45
2nd Bn, South Staffordshire Regt	Dec 41–Aug 45
2nd Bn, Oxfordshire & Buckinghamshire Light Infantry	Dec 41–May 43
1st Bn, Royal Ulster Rifles	Dec 41–May 43
7th (Galloway) Bn, King's Own Scottish Borderers	Dec 43–Aug 45
458th Light Battery, Royal Artillery	Dec 41–July 42*
1st AL Lt Bty, RA (redesignated from above)	July–Sept 42*
223rd Anti-Tank Bty, RA	Dec 41–June 42*
1st AL AT Bty, RA (redesignated from above)	June–Sept 42*
9th Field Company, Royal Engineers	Dec 41–June 42*
1st AL Reconnaissance Co, Royal Armoured Corps	Dec 41–March 42*
1st AL Recce Sqn, RAC (redesignated from above)	March–Dec 42*
1st AL Bde Grp Company, Royal Army Service Corps	Dec 41–Apr 42*
181st Field Ambulance, Royal Army Medical Corps	Dec 41–March 42*
1st AL Bde Grp Provost Section	Dec 41–June 42*

Note:
* The brigade's non-infantry units were all transferred to division control between March and December 1942.

6th Airlanding Brigade	Apr 43–Apr 46
12th Bn, Devonshire Regiment*	July 43–Oct 45
2nd Bn, Oxfordshire & Buckinghamshire Light Infantry	May 43–Apr 46
1st Bn, Royal Ulster Rifles	May 43–Apr 46
1st Bn, Argyll and Sutherland Highlanders*	Oct 45–Apr 46
195th Field Ambulance, Royal Army Medical Corps	May 43–Apr 46

Note:
* 1st A. & S.H. replaced 12th Devons in October 1945.

14th Airlanding Brigade	Nov 44–Jan 47
2nd Bn, King's Own Royal Regiment (Lancaster)*	Nov 44–Feb 45
2nd Bn, Black Watch (Royal Highland Regt)	Nov 44–Jan 47
4th Bn (Outram's), 6th Rajputana Rifles	Nov 44–Jan 47
6th Bn, 16th Punjab Regiment*	Apr 45–Jan 47

Note:
* 6/16th Punjabis replaced 2nd King's Own in April 1945.

color of the parent regiment. (This badge was not authorized by the War Office, so must have been produced and distributed on the initiative of Airborne Forces.) All units displayed on both upper sleeves the Airborne Forces' maroon square formation patch with a light blue Pegasus motif, and below this a straight "AIRBORNE" tab in the same colors. The traditional cap badge of their parent regiment or corps was worn above the left eye on the maroon Airborne Forces beret (in white, yellow or bronze metal, or economy wartime plastic of the same colors).

In addition to their new Army Air Corps uniform distinctions, the constituent units of the AL brigades retained their parent regiment's "designation" (arc-shaped shoulder titles in regimental/corps colors, mostly as specified in ACI 905 of June 12, 1943). Infantry units normally wore white lettering on scarlet. Exceptions included the 2nd South Staffords, who wore yellow serif lettering "S. STAFFORDS" on maroon (the often illustrated yellow-on-maroon title "SOUTH STAFFORD" incorporating a glider motif in fact dates from the 1950s); the 1st Royal Ulster Rifles, who wore black lettering on rifle-green; and the 2nd Black Watch, who instead of a title wore a large tartan patch of complex shape. The 1st Argylls wore white-on-red "A. and S.H." titles for some time after these were officially replaced by a white-and-red diced patch from December 25, 1943. (A number of unofficial formats of regimental titles were also to be seen, usually on "best BD" for walking-out. British Army shoulder titles are a complex subject; for details, see Brian L. Davis, *British Army Uniforms & Insignia of World War Two*, Arms & Armour Press, 1983, particularly pp.103–107.)

A British corporal section leader of 1st Airlanding Bde, 1st Abn Div coordinates the landing zone with the pilot of a Hotspur glider during an exercise in the UK. With a capacity of only seven passengers the Hotspur was too small for the efficient delivery of troops in combat operations, but it was widely employed for training. Both soldiers wear the rimless Airborne steel helmet, the pilot over his flying helmet and earphones. The Pegasus formation insignia used by both 1st and 6th Abn Divs is painted under the cockpit; the corporal wears it as a patch on his upper sleeve, between his parent corps' curved shoulder title (which seems to be "ROYAL SIGNALS" in white on blue), and the straight "AIRBORNE" tab in light blue on maroon. (IWM TR 171A)

German airlanding units

If necessary, any German paratroopers or other troops could conduct glider operations, and there was no specialized training other than practice in rapid

Luftwaffe paratroops practice rapidly debarking from a DFS 230. This is the later model, with two exit doors on the left side and a larger cargo door on the right, as in Plate C. The front few men could also exit through the cockpit after the pilot had jumped out. The machine gunner could provide covering fire while the passengers got out, but note that he has had to pull his legs up out of their way and sit on the rim of the dorsal hatch. (Bundesarchiv 1011-568-1529-27A)

A 12-ton capacity SdKfz 8 halftrack artillery prime mover is loaded into a Messerschmitt Me 323 six-engine transport for shipment across the Mediterranean. This view of the motorized conversion of the Me 321 glider is relevant in that it shows the size of the clamshell nose doors; the glider could also accommodate loads of this size and weight. (Bundesarchiv 1011-628-3486-13)

debarking and unloading. The only dedicated German glider unit was Luftlande-Sturm-Regiment 1 (Airlanding Assault Regt 1), which was raised from trained paratroopers. The original unit was formed in November 1939 from elements of Fallschirmjäger Regiment 1 (Parachute Light Infantry Regt 1), under the title Versuchsabteilung Friedrichshafen (Experimentation Battalion Friedrichshafen, named after its location). It was soon redesignated as Sturmabteilung Koch (Assault Battalion Koch, named after its commander), to seize Fort Eben Emael in Belgium in May 1940.

In the fall of 1940 the Assault Battalion Koch was redesignated I Bataillon, Luftlande-Sturm-Regiment 1, and II and III Bns were added; IV Bn, a heavy

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BRITISH HAMILCAR Mk I HEAVY GLIDER; NORMANDY, JUNE 6, 1944

Towed by an obsolescent Short Stirling four-engine bomber, the Hamilcar could carry a 25-pdr gun-howitzer or, more usually in the airlanding role, a 17-pdr AT gun with a Morris C8 Mk III artillery tractor (a cut-down version of the standard Quad tractor used for the 25-pdr); or two Universal ("Bren gun") carriers; one 3in mortar carrier and 10 motorcycles; one carrier and a jeep; three jeeps; three Rotatrailers (tank-drawn ammo and fuel trailers); one Caterpillar D4 bulldozer; various combinations of compact US engineer equipment; or 40 troops.

A capability in which optimism was invested was that it could alternatively carry one light tank – either a British Vickers Mk VII Tetrarch or a US M22 Locust. The tank could barely fit aboard the Hamilcar, and the three-man crew had to stay inside their vehicle throughout the flight. On the approach to landing the engine was started up, with hoses venting the exhaust. When the glider slid to a halt the tank driver pulled a release cable that unfastened its shackles, and as the tank moved forward a mechanical device swung the glider's nose section to the right. With the glider's landing wheels lowered the tank could drive straight out without the need for ramps, and if the landing damaged the nose mechanism it could simply burst out through the plywood; either way, it could theoretically be in action 15 seconds after landing.

The Hamilcar did its job effectively (especially in delivering the extremely valuable 17-pdr AT gun to support airborne assaults); but the lightly armed, thinly armored airborne tanks, with their limited cross-country performance, proved an operational disappointment. In Normandy 30 Hamilcars were used, of which 20 carried Tetrarchs. In the Netherlands, 39 Hamilcars were allocated to bring in 17-pdrs, Universal carriers, and engineer equipment, but due to weather, accidents, and the deteriorating situation on the ground only about two-thirds made it. For the Rhine operation, 48 Hamilcars carried the same loads plus nine Locust tanks, only one of which arrived operational.

The plate shows a Tetrarch emerging from a Hamilcar at about 9.30pm on the evening of D-Day, June 6, during Operation *Mallard*. The unit War Diary identifies the LZ only as "Ranville," but other sources name it as LZ "W" near St Aubin. Records are contradictory, but it seems that 29 of the 30 Hamilcars arrived, though one crashed into another on the LZ, disabling two Tetrarchs. Either 18 or 20 Hamilcars unloaded Tetrarchs of A Sqn and Regimental HQ, 6th Abn Armd Recce Regt; many of them got their tracks badly tangled with the parachutes that already littered the LZ, and these had to be burned off.

weapons unit, followed in late 1940. From June 1942 onward the battalions were parceled out to replace destroyed battalions of parachute regiments, and the staff became the staff of Division Meindl in Russia. The battalions operated independently, and were all absorbed into parachute regiments by May 1944.

In late 1939 the Germans had trained the 22. Infanterie (Luftlande) Division for air transport and glider delivery. It was employed in the Netherlands in June 1940, but was never again used in that role. The 91. Infanterie (Luftlande) Division was converted in March 1944 as a counter-invasion reaction force, but was never employed as such.

German glider troops bore no special **uniform distinctions**, being indistinguishable from the Fallschirmjäger; they wore the same Luftwaffe uniforms and equipment including the special jump helmet, smock, and boots. In the early war years they wore the Fallschirmschützen-Abzeichen (Paratrooper's Badge), but by mid-1944 few troops assigned to the Fallschirmtruppe were in fact parachute-qualified.

Weapons

For the most part, glider units employed the same small arms and light crew-served weapons as paratroopers and conventional infantry, though the allocation would often be different, with sometimes smaller numbers of heavier weapons. Support weapons such as the 75mm M1A1 pack howitzer, 57mm/6-pdr AT gun, and 20mm and 40mm AA guns were towable by jeeps.

The US 75mm M1A1 pack howitzer with M8 carriage was used by both the US and British glider artillery. Originally designed to be broken down into pack-animal loads, with the addition of the M8 airborne carriage it could be broken down into nine parachute drop loads, but also fitted into US and British gliders fully assembled. Besides the towing jeep, a second jeep with a ¼-ton trailer was provided to carry ammunition. The British had previously used the 3.7in Mk I mountain howitzer on Mk IVP carriage, which was replaced by the pack 75mm in early 1943 (the 3.7in had a 5,900yd range, while the 75mm reached out to 9,760yd). The US also used the 105mm M3 "snub-nose" howitzer, which eventually armed one GFAB per division. While more powerful than the 75mm pack, its range of 8,295yd was about 1,500yd shorter, and only about two-thirds the range of the standard 105mm M2A1.

US glider artillerymen raise the nose of an early-production Waco CG-4A (note the lack of skids under the nose) to load a 75mm M1A1 pack howitzer of a GFAB. The M8 gun carriage was specially designed for airborne troops, and this same combination was used by the Airlanding Light Regts of the Royal Artillery in the British airborne divisions. (US Army)

The US license-built the 57mm M1 AT gun based on the British 6-pdr Mk IV gun on a Mk II carriage, and the ammunition was interchangeable. Unfortunately neither American nor British-made versions fitted into Waco or Horsa gliders, so within both US and UK airborne divisions they were replaced with British-made 6-pdr Mk II guns on the Mk III airborne carriage, which fitted in a Horsa; this had narrower wheel spacing, folding trails, a smaller shield, a repositioned elevating hand wheel, and a different towing eye.

Given the small capacity of the DFS 230, German weapons such as the 3.7cm Pak.35/36 light AT gun and 7.5cm Geb.G.36 mountain

gun had to be delivered either by the larger cargo gliders or airlifted in by transports. The 7.5cm le.IG.18 light infantry gun was not a true artillery piece but a close support weapon; it had a 3,550m (3,905yd) range, less than half that of the US 75mm pack. The 7.5cm l.G.40 light gun was a recoilless rifle, weighing only 320lb and achieving a 6,800m (7,480yd) range. It fired the standard high-explosive round of the 7.5cm mountain gun and the AT round of the 7.5cm F.K.16 field cannon, but with special recoilless cartridge cases.

Airborne light tanks

The UK and US developed light tanks capable of being delivered by gliders, both with three-man crews. One hundred of the 17,000lb-weight Vickers-Armstrong Mk VII Tetrarchs were built, most of them mounting a 2-pdr gun and 7.92mm MG but a few with a 3in (76mm) howitzer for infantry close support. Of the total, 20 were issued to the 6th Abn Div's battalion-size 6th Abn Armd Recce Regt, which also used armored carriers and jeeps. Records are slightly vague, but 18–20 Tetrarchs were delivered in Normandy on the evening of D-Day by Hamilcar gliders operated by the specially trained C Sqn, Glider Pilot Regt, though two were lost in a landing crash. They proved inadequate against German armor and fortifications, and on August 6 the tank squadron of 6th Abn Armd Recce Regt began to re-equip with shipped-in 75mm-gun Cromwell tanks.

The 16,000-lb US M22 (T9) Locust light tank, armed with a 37mm gun and a .30cal MG, was designed to be carried under a modified Douglas C-54 Skymaster four-engine transport as well as in a Hamilcar glider. Seventeen Locusts were assigned to the British 6th Abn Armd Recce Regt, but were replaced with Tetrarchs before D-Day owing to mechanical and armament problems. Some were later reissued, and six out of the eight committed to the 6th Abn Div's Rhine crossing survived landing. Some broke down or suffered battle damage in their only action; they contributed little, and were soon classified obsolete.

GLIDER OPERATIONS

Glider "tactics" were limited, since they were a method of entry onto the battlefield, not of actual combat. Some of the most successful missions were small precision attacks involving 6–10 gliders with a roughly company-size force, usually to seize key objectives. Only a few of these were conducted, but most were successful owing to surprise – not only because the use of gilders had not been anticipated by the defenders, but because their silent approach and delivery of troops on top of the objective allowed defenders little reaction time.

The Germans conducted a prewar demonstration (albeit under ideal circumstances) in which a platoon of paratroopers jumped from Ju 52s. Landing, removing their parachutes, recovering their weapon containers, checking and distributing the weapons, and assembling for action, took them 15 minutes. However, 70 troops who were landed in 10 gliders required only three minutes from touchdown to assembly with weapons in hand.

Glider troops needed much less specialized training than paratroopers, and untrained infantrymen could be oriented in a few hours. They only required instruction in boarding, securing cargo, opening doors and nose or tail sections, and practice in rapid unloading.

Most operations were of battalion or regimental/brigade size, with two to four battalions. These typically supported a major offensive – overland, from the sea, or crossing a major river. The glider-delivered force could "vertically outflank" seas, rivers, swamps, and mountains as well as enemy frontline forces. Typically, each battalion was assigned an objective such as a road intersection, causeway, bridge, town, etc. They secured it either to allow the advancing main forces to pass through, to deny it to the enemy, or to block enemy reinforcements and counterattacks. They might reinforce troops already engaged, or commence attacks in other directions or on unexpected flanks.

The British preferred to send in the gliders first to secure DZs for the follow-on paras. The Americans favored the opposite approach, with paratroopers securing LZs for gliders. Each option had its pros and cons; since paratroopers were often scattered they were seldom able to secure LZs, but dropping small pathfinder parties to at least mark LZs proved valuable.

Landing zones were selected as close as practical to objectives, within a mile or two but out of direct fire range, but this of course depended on the terrain. In the larger operations it was often complained that too little attention had been paid to selecting identifiable and clear LZs best suited to the tactical situation. Usually company assembly areas were designated on readily identifiable terrain features such as a crossroads, but with gliders scattered and intermixed, and visibility on the ground restricted by vegetation, assembly was problematic. Small groups would go toward the sound of the guns and, as with paratroopers, this caused confusion among the enemy, with Allied soldiers appearing "everywhere." An advantage glider troops enjoyed over paratroopers was that at least squads and platoons landed more tightly

One of the British landing zones north of Ranville, Normandy, on D+1; visible are 30 abandoned Horsas, most of them with the tail section removed, and (bottom right, above three of them) a single damaged Hamilcar. All of these landed on the evening of D-Day. When coming in to land there was no way for a glider pilot to communicate with other pilots; he just had to pick his spot and go for it, trusting to luck that no other pilot was heading for the same patch of grass. In 1996 a veteran of G Sqn, No. 1 Wing, Glider Pilot Regt who flew in the first lift at Arnhem recalled that on LZ "S" about 120 gliders landed within 20 minutes, with few mishaps. When asked how they had managed to avoid one another, he simply said "Have you ever driven in Madrid?" (IWM HU 92976)

grouped rather than being scattered individually, so glider-men could assemble in larger groupings faster than paratroopers.

Glider-men were accompanied by artillery, mortars, and AT guns, plus jeeps and trailers to tow them and haul ammunition, and medical aid stations. The glider-delivered artillery also provided support to paratroopers. After the initial glider assault landing, the next day or night troops could be reinforced by additional lifts landed on secured, cleared, and marked LZs. Ammunition and supplies were flown in with reinforcements. Engineers accompanied the "glider-riders" to clear follow-on LZs, breach minefields, erect roadblocks, and provide demolitions support.

Glider landings would occur during or soon after the parachute assault. The glider troops might support or reinforce the paratroopers, but more often had their own objectives. Contact by patrols and messengers as well as by radio and wire was established between units. Whether glider-men or paratroopers, they were part of the same division, and once on the ground they fought as a division.

Problems were experienced by both American and British formations due to parachute and glider units being structured differently – different proportions of platoons, companies, and battalions. It proved difficult, for example, for a US glider regiment with two battalions totaling 12 platoons to relieve a three-battalion parachute regiment with 27 platoons, and to continue the same mission. This prevented standard infantry tactics from being used, and, as described above, in 1945 the GIRs were reorganized similar to the PIRs.

Major operational changes were also ordered in early 1945, drawing on experience gained in the Netherlands. Airborne divisions were now to conduct their assault in one massive lift of paratroopers and gliders. They were to be inserted as close as possible to objectives – no more long approach marches. Operations would be conducted in daylight only, and protected by fighters and fighter-bombers; and link-up with ground forces had to be assured within 24 hours, within range of medium artillery.

The abandonment of night assaults was of great benefit. The cover of darkness was seldom necessary to protect the landings from enemy fighters, since it was anyway essential for the attacking force to possess air superiority. Small-arms fire posed little threat to landing gliders from ranges of more than a few hundred yards, and the gliders quickly disappeared from sight below trees. Daylight burned off fog; this allowed aircrews to maintain formation, positively identify checkpoints and LZs, and make safer landings, and troop assembly was easier and faster.

Thorough training of tug crews was essential, not only in the practical aspects of glider-towing but in formation-keeping, navigation, and acquiring the confidence to remain steady when receiving flak. It was important for tug units to have a training relationship with glider units. Glider pilots also required lengthy training, but there were often shortages: casualties were high, aggravating the shortfall in the numbers available. In the August 1944 southern France operation, 125 glider troops were injured and none killed out of 2,250; however, 16 GPs were killed and 37 injured out of 660.

The success of glider operations varied significantly. For instance, on D-Day evening 175 of the 82nd Abn Div's gliders were scattered by clouds and flak, resulting in most crashing outside their three LZs with only eight undamaged; casualties were 33 dead and 124 wounded/injured. At the same time 256 British 6th Abn Div gliders were spared clouds and experienced only light flak, so only ten gliders failed to land on their LZs.

SUMMARY OF ALLIED GLIDER OPERATIONS

Sicily; Operation *Ladbroke,* July 9, 1943

With limited airlift capacity, British 1st Abn Div committed its 1st AL Bde to take the Ponte Grande bridge near Syracuse by night, ahead of the paratroop brigades which were tasked with seizing other objectives. The advice of specialist officers was rejected by the staffs, and the outcome taught the Allies a number of harsh lessons, at a high price in lives.

(1) Training of tug and glider units was inadequate, both separately and jointly. Delays in delivering, assembling, checking, and repairing damaged Wacos limited rehearsal to two unrealistic daylight exercises. British glider pilots rushed out to Tunisia to make up the shortage had no previous experience of Wacos or of night-flying, and received very inadequate training. A late switch in Gen Montgomery's plan resulted in the US 51st TC Grp, which lacked tug experience, being assigned to 1st AL Bde, while the tug-experienced 52nd TC Grp was tasked with dropping 82nd Abn Div paratroopers.

(2) Taking off by 6pm on July 9, the formations of 146 Wacos and 8 Horsas encountered strong winds, bad visibility, and AA fire from Allied shipping that they overflew. The tugs took evasive action in the darkness, and many released early; either 65 or 69 gliders (accounts differ) came down in the sea, including 47 of the 134 carrying British infantry, and 252 soldiers drowned. In addition, the invasion fleet and shore AA opened fire on the transports carrying the US 504th PIR, shooting down 23 out of 144 aircraft at a cost of 229 lives.

(3) In the confusion, navigation was very poor. Only 52 Wacos and 8 Horsas made landfall, with just 12 of them reaching their LZs and the others that survived the flight landing anything up to 25 miles away.

Despite these failures, a single weak platoon of the 2nd Bn South Staffords in one Horsa landed at the Ponte Grande, captured it, and disabled the rigged explosives. With stragglers who eventually brought the total to 87 men, they held it under increasing counterattacks until 3.30pm on July 10, when the last 15 unwounded men ran out of ammo and surrendered. (Ground troops arrived and recaptured the Ponte Grande intact 45 minutes later.)

C-47s release their tows over the Netherlands, September 1944. Near the upper left corner the smoke marking the landing zone can just be seen, and Wacos and Horsas have already landed all over this area – see Plate G. (Tom Laemlein/Armor Plate Press)

On July 12 the 82nd Abn Div's 325th GIR boarded gliders, along with the 80th Abn AA Bn and the 319th and 320th GFABs, to be administratively delivered to Gela to reinforce the paratroopers who had jumped in on July 9–11. The mission was canceled due to the British glider disaster on the 9th, and the troops remained in Tunisia as reserves.

On July 13 the 1st Abn Div's 1st Prcht Bde was dropped in, together with 11 Horsas and 8 Wacos carrying AT guns and support, to take the Primasole Bridge near Catania, but failed to hold it.

In the aftermath, many improvements were ordered – in training of all personnel, preparation and marking of

aircraft, in-flight intercommunications, operational planning, and insertion of pathfinders. Gliders were never again to be released at night over the sea.

Burma: Operation *Thursday,* March 5–August 27, 1944

One of the more successful Allied airlanding operations is the least known. The US 1st Air Commando Group supported the British/Indian Army "Chindit" deep-penetration operations behind Japanese lines in Burma with, among other aircraft, 150 Wacos (see Plate F). The Chindits operated in four-battalion brigades, out of improved natural clearings serving as airheads and supply bases. In February 1944, 16th (British) Bde marched in overland, with glider-delivered assistance to cross the Chindwin river. The true airborne phase commenced on March 5 with the insertion of 77th (Indian) Bde at location "Broadway." The first lift was 54 gliders using double-tows, and after pathfinders laid flare paths 37 landed safely. Hundreds of C-47 and glider sorties delivered 111th (Indian) Bde at "Chowringhee," and by March 13 there were 9,000 men on the ground, with artillery and 1,350 pack-mules. From March 22 the 14th (British) and 3rd (West African) Bdes flew into "Aberdeen," and cross-country columns set up further strongholds at "White City" and "Blackpool." While a drastic change to their strategic deployment in April led to the brigades being worn away by late August in conventional operations for which they had not been prepared, they had been successfully resupplied by airlift and gliders for many weeks.

Normandy; Operation *Neptune*, June 6–7, 1944

The two US airborne divisions employed their single GIRs differently. The **101st Abn Div's** 401st GIR was split, with its 1st Bn going to the 101st's 327th GIR as a third battalion, and 2nd Bn going to the 82nd's 325th GIR. Following the 101st's paratroopers were 52 gliders delivering AT guns and supplies. The 101st's 327th GIR and 321st and 907th GFABs arrived by sea. The **82nd Abn Div's** 325th GIR landed by glider. Three glider-delivered reinforcement missions arrived on D-Day evening. One for the 101st with 32 Horsas landed at LZs "E" and "O"; two for the 82nd, with 37 Wacos and 149 Horsas, mainly delivered the 319th and 320th GFABs at LZs "E" and "W." The 82nd's 325th GIR and other much-needed reinforcements arrived on the morning of D+1 in 150 Wacos and 50 Horsas. The units fought on the ground until mid-July.

The **British 6th Abn Div** secured the eastern flank of the British beachhead. Preceding the paras were six Horsas bound for LZs "X" and "Y," with platoons from D Co, 2nd Bn Oxfordshire & Buckinghamshire Light Infantry under Maj John Howard. After a pinpoint landing at Bénouville at 16 minutes past midnight, the 90 men in the first three Horsas successfully seized the strategic bridge over the Caen Canal ("Pegasus Bridge"). One Horsa went astray, but the two other glider-loads captured the Orne River bridge to the east; both bridges were secured within 15 minutes, and were held until relieved. Three more gliders were supposed to support the attack by 9th Bn, Prcht Regt on the Merville Battery, but only one arrived. Para sappers cleared the Main LZ near Ranville, where before dawn 47 Horsas and 2 Hamilcars arrived with the division HQ, AT guns, medical elements, and reinforcements – 15 other gliders did not make it. The main glider lift with the bulk of 6th AL Bde arrived at LZ "W" near St Aubin on D-Day evening, with 250 Horsas and 29 Hamilcars delivering infantry, artillery, AT guns, reconnaissance troops including Tetrarch light tanks, and support.

CG-4As lined up on their takeoff runway for the Rhine crossing. Note the glider pilots drawn up in ranks, left of center; to make up shortages caused by previous casualties some 300 C-47 pilots were drafted in as glider copilots. Operation *Varsity* was the largest single glider-lift operation of the war, with 8,196 troops carried in 1,305 gliders. (Tom Laemlein/ Armor Plate Press)

They were fed into battle piecemeal along the beachhead's eastern front, to reinforce the paras as necessary. It was not until September that the division was returned to England.

Southern France; Operation *Dragoon*, August 15, 1944

The US/British 1st Abn Task Force (FABTF) air-assaulted near Le Muy in support of the US Seventh Army amphibious assault. The parachute assault was conducted at night; the 407 gliders (including 50 British Horsas) came in after sunrise, but too early and still hampered by fog. The gliders delivered HQs, artillery, AT guns, engineers, and supplies onto LZs "A" and "O," including airlanded elements of the British 2nd Independent Prcht Bde Group. Some lifts were unable to locate LZs and returned to Italy; they returned that evening, but became intermixed with other scheduled lifts. An early evening lift delivered the 550th Abn Inf Bn, and the 602nd Field Arty Bn, temporarily organized as a GFAB, also arrived by glider. Regardless, it was considered the most effective of airborne assaults. The FABTF fought on until disbanded in November.

F

UNCONVENTIONAL GLIDER LOADS; BURMA, MARCH 1944

Perhaps the most versatile use of gliders was by the USAAF 319th Troop Carrier Sqn (Commando) of the 5318th Unit ("1st Air Cdo Group") in Burma, in support of Operation *Thursday* in March 1944. This included the second British Chindit operation, when six long-range deep-penetration brigades of British, Gurkha, and West African troops were inserted 150 miles behind Japanese lines. Five of the six brigades were flown in, and they were then supplied entirely by air. Colonel Philip Cochran's unique 1st Air Cdo Grp flew recon, ground attack and medical evacuation missions as well as providing logistic support, but the 319th TC Sqn, with 13 C-47s and 150 Waco gliders, was crucial to the operation. It flew in engineer equipment to create airstrips, then troops and heavy weapons; resupplied the strongholds that were established; and would later withdraw men and assets both by airlift and by "snatching" gliders – see Plate H.

For carrying heavy weapons, ammo, and supplies across rugged jungle terrain the Chindits relied upon mules and pack-horses, of which 3,147 and 547 were flown in, respectively (plus 250 bullocks for meat "on the hoof"). Some came in aboard straw-lined gliders; the animals had to be well secured, and some were actually sedated for the flight to prevent sudden movements shifting the center of gravity, especially when landing. Here the Waco's nose is held open by a 7ft timber post and its tail is tilted upward by props. The side doors are also being used to speed unloading – here, of 80lb grain feed sacks and boxes of 14-man "compo" rations.

1: Glider pilot On his flight jacket he wears the 1st Air Cdo Grp patch; the central motif was a winged, pale-gray mule's head holding a Gurkha *kukri* knife in its teeth. The pilot's khaki garrison cap is piped with USAAF blue and orange-yellow, and bears on the left front a flight officer's rank bar.

2: Locally produced CBI glider pilot's wings

3: Flight Officer's rank bar

Netherlands; Operation *Market*, September 17–19, 1944

Operation *Market* – the airborne phase of *Market-Garden* – commenced with three divisions flying into the Netherlands in the largest-ever airborne operation. The **US 101st Abn Div** went in north of Eindhoven, where 70 Wacos delivered the 377th PFAB rather than dropping it in. The **82nd Abn Div** landed further north, south of Nijmegen, with 50 gliders delivering AT guns of the 80th AA Bn. Glider losses were minimal. The main American glider effort was on D+1, when bad weather delayed the planned morning lifts until the afternoon. The 82nd's 319th and 320th GFABs, 456th PFAB, and the rest of the 80th AA Bn arrived, with most of the 454 gliders landing near the LZs. The 101st's 327th GIR (minus 1st Bn) came in with engineer and medical elements in 450 gliders.

The D+2 lift of the 82nd's 325th GIR was canceled. On D+3 the reinforcement mission for the 101st, with the 1/327th GIR, 321st and 907th GFABs and part of the 81st AA Bn, experienced problems, and only 209 of 385 Wacos reached the LZ. The lift for 1/327th GIR was canceled. The delivery of the 325th GIR was again canceled on D+4. On D+6 the 325th GIR finally arrived with the rest of the 80th AA Bn, but only 348 Wacos out of 406 made it. The units fought on in the Netherlands into November.

Meanwhile, the **British 1st Abn Div** was tasked with seizing bridges in Arnhem town and high ground to the north, but would have to be inserted several miles from the objective. The 1st AL Bde flew into LZ "Z" northwest of Arnhem with 345 Horsas and 13 Hamilcars at the same time as the first paradrop in the early afternoon; but 35 of the gliders did not make it, including those with most of the recon unit's armed jeeps. The glider troops established a lodgement for the next day's lifts as the paras began to march toward Arnhem, but the operation was hampered both by faulty radios and by unexpectedly vigorous German reactions. The next day, 286 Horsas and 15 Hamilcars arrived on LZ "S" with more infantry and artillery, but only after being delayed by fog until the late afternoon. The glider troops continued to protect the DZs and LZs as the paras battled in and on the approaches to Arnhem. On the third day, 35 gliders arrived with AT guns, but suffered serious losses. Despite the securing of the Eindhoven and Nijmegen bridges by the US 101st and 82nd Abn Divs, British XXX Corps' armored advance up the single highway from the south was repeatedly delayed.

The situation continued to deteriorate, with 1st Abn Div bottled up in Arnhem and Oosterbeek; as their plight worsened the British 52nd Div, trained for airlanding, offered a brigade for glider delivery, but was never committed. The Polish 1st Independent Para Bde was not dropped until the 21st, south of the Lower Rhine, but could not cross the river to link up with 1st Abn Div, and little of the airdropped supplies fell within the perimeters. On the night of September 25/26 the airborne troops were evacuated south across the river; of the 10,000 who had gone in, only 3,000 came out.

Germany; Operation *Varsity*, March 20, 1945

The US XVIII Abn Corps delivered two divisions across the Rhine in one massive late-morning lift. The **US 17th Abn Div's** 194th GIR, 680th and 681st GFABs, 155th AA Bn, engineers, and support troops followed immediately behind the paratroopers in 906 Wacos (578 of them double-towed). Only a small number of gliders failed to land on LZs "N" and "S" beside the Diersfordter Wald; many were hit by fire, but few lost. The 17th Abn Div remained in action until the war's end. (An additional 926 Wacos

were held in reserve for Operation *Choker II*, a planned Rhine crossing near Worms by 82nd and 101st Abn Divs which was never required.)

The **British 6th Abn Div** dropped north of the 17th Abn, on LZs "N," "O," "P," "Q," and "U." The 6th AL Bde went in near Hamminkeln in 392 Horsas and 14 Hamilcars, 80 of which were lost. The operation was a success, but was deemed not to have been worth the cost, since the ground forces experienced little difficulty in crossing the Rhine. The 6th Abn Div continued to fight until VE-Day.

March 1945: a British Horsa glides into a landing zone in Germany during the Rhine crossing operations, as US 17th Abn Div paratroopers assemble in the foreground. (Tom Laemlein/Armor Plate Press)

Small US glider operations

With Bastogne under siege, the 101st Abn Div was desperate for ammunition. On December 26, 1944, 11 Wacos were flown in with surgical teams and ammunition. The next day another 50 gliders were sent in under terrible weather conditions; only 35 made it, but they saved Bastogne.

The last airborne operation of World War II took place at Camalaniugan on Luzon in the Philippines on June 23, 1945, when a reinforced battalion of the 11th Abn Div jumped in as a blocking force. A parachute artillery battery was delivered by glider using six CG-4As and one CG-13A – the only glider combat operation in the Pacific.

On July 2, 1945, three Wacos were "snatched" out of a New Guinea valley carrying survivors of a C-47 crash and the rescuers who had parachuted in to clear an LZ.

SUMMARY OF GERMAN GLIDER OPERATIONS

Belgium; Eben-Emael, May 10, 1940

As part of Operation *Yellow*, the German onslaught on the Low Countries, a team codenamed Sturmgruppe "Granit" (Assault Group "Granite") from Sturmabteilung Koch made history by seizing the strategic Belgian artillery fortress of Eben Emael near Liège. The whole battalion operation involved 362 men (including GPs), 42 DFS 230s, and 58 Ju 52 tugs and transports,

December 27, 1944: troops under siege in Bastogne unload urgently needed artillery ammunition from a CG-4A; these African-American troops are from the 333rd or 969th Field Artillery Bns (155mm Howitzer). Eleven Wacos also delivered desperately needed surgical teams and medical supplies to the besieged 101st Abn Division. (Tom Laemlein/Armor Plate Press)

Crete, May 20, 1941: a crash-landed DFS 230 with two of its passengers lying dead beside it. They are probably from Hptm Sarrazin's 4. Kompanie, I Bataillon, Luftlande-Sturm-Regt 1, which took heavy casualties at the hands of 22nd NZ Inf Bn on the slopes of Hill 107. Many of the landing gliders were taken under heavy fire before the passengers could find cover – always a danger when landing extremely close to the objective. From this angle the large right-side door under the wing is visible, and we look straight through it to the left rear door. (IWM E 3064E)

to seize the fort and three nearby bridges. The Eben Emael force, Sturmgruppe "Granit," was assigned 11 gliders and tasked with making a point landing atop the fortress; two DFS 230s suffered broken tow-ropes, but the 60-odd troops who did land neutralized the casemates within 30 minutes, and the bottled-up Belgian garrison of about 1,100 men surrendered the following day. Ten gliders and about 24 parachute-jumpers were assigned to each of the three bridges, of which two were seized intact. This first combat use of gliders was extremely successful, and the Germans hushed up the fact that gliders were employed.

Greece; Corinth Canal, April 26, 1941

Six DFS 230s landed almost atop the canal's strategic bridge, which was rigged for demolition by the retreating British Commonwealth forces, and the attackers quickly seized the bridge and a defending AA battery. Two battalions of Fallschirmjäger-Regiment 2 followed, and disconnected firing wires, but a hidden Australian 40mm Bofors AA gun opened fire and detonated the charges. Light artillery was later delivered by six gliders.

Crete; Operation *Mercury*, May 20, 1941

While this was Germany's largest airborne operation, only 72 DFS 230 gliders were employed, of which 11 either crashed or landed in the wrong area. Immediately before paratroopers dropped, they delivered two companies (3. & 4.) of I Bataillon, Luftlande-Sturm-Regt 1 to attack the vital Maleme airfield, and two more companies (1. & 2.) to eliminate AA batteries near Suda and Canea, respectively. The Maleme force successfully captured

G THE GLIDER ASSAULT; NETHERLANDS, SEPTEMBER 1944

This representative scene depicts US CG-4A gliders towed by C-47 tugs during Operation *Market*. Glider serials were formations of up to 48 aircraft in "pairs of pairs" – i.e. four tugs and four gliders. The "pair of pairs" flew in echelon formation, with the following aircraft stepped back from the leader, who released his glider first and then banked away. Large serials were spread out in a lengthy stream of aircraft, as the tow-ropes were 350ft long – seven times the length of the glider.

On August 9, 1944 the black-and-white "invasion stripes" on the upper surfaces were ordered painted over on most aircraft; from December 6 only the fuselage stripes were permitted, and these too were ordered painted over before the March 1945 Rhine crossing. Nevertheless, many aircraft including gliders retained upper-surface stripes.

1: Inbound "pair of pairs" of tugs and gliders prior to turning onto final approach.
2: Tugs banking away after releasing their gliders, to avoid MG fire from the farm complex below.
3: Released CG-4A banking sharply left to begin its turn toward the LZ.
4: CG-4As making their approach run to the LZ into the wind.
5: "Pair of pairs" approaching release point for another LZ, off the plate to the right.
6: Gliders from an earlier serial abandoned on the LZ; they include two US-flown Horsas for heavy weapons.
7: Yellow smoke sent up by pathfinders to mark leading edge of primary LZ, and indicate wind direction.

A ground crewman checks the cargo load of a DFS 230. In the *Lastensegelflugzeug* (cargo glider) role it could carry up to 2,800lb, but the inability to remove the front five centerline seats limited its usefulness, since items had to be crammed in around and on top of these. (Bundesarchiv 1011-565-1407-06A)

important high ground despite taking heavy casualties. The Suda company's 15 gliders were badly scattered, and the survivors ran out of ammunition and were captured; but despite only six of their nine gliders landing near Canea, 1. Kompanie took their objective. Gliders also delivered the staffs of the Luftlande-Sturm-Regt and 7. Flieger-Div (though a crash killed the division commander, GenLt Süssmann, after the tow-rope broke). The ultimately successful airborne phase of the invasion of Crete made the world at large aware of the potential of gliders and paratroopers, though the very high cost in paratroopers dissuaded the Germans from ever again mounting such a large-scale airborne assault.

Russia; Cholm, January 21–May 5, 1942

The encircled force defending the city of Cholm held out until relieved after 105 days. It was resupplied by airdrop; 81 Go 242s were committed over time, 56 landing with supplies and reinforcements.

Italy; Operation *Oak*, September 12, 1943

The deposed dictator Mussolini was held prisoner in the Campo Imperatore hotel high on the Gran Sasso mountain plateau northeast of Rome. Led by SS-Maj Otto Skorzeny, handpicked members of his SS-Sonderverband zbV Friedenthal and Fallschirmjäger-Lehr-Bataillon 2 were delivered on this small and difficult LZ by ten DFS 230s (two others failed to take off), and successfully rescued *Il Duce*.

The seating of 23 troops in a Go 242A is demonstrated in Russia. Besides cargo, they were used to fly reinforcements in to encircled forces when units became trapped in a *Kessel* ("cauldron"). On the Go 242B-3 model the single tail cone was split into clamshell doors for easier loading. Note the two MG15 machine guns mounted on the right side. (Bundesarchiv 1011-641-4546-17)

Yugoslavia; Operation *Knight's Move*, May 25, 1944

This dramatic raid was intended to capture Marshal Tito in his Partisan headquarters at Drvar. Besides a massive ground assault, one-third of 500. SS-Fallschirmjäger-Bataillon landed in 34 DFS 230s followed by the rest of the battalion jumping in. Tito escaped, and the Germans suffered heavy losses.

France; Vercors, July 21, 1944

A major operation was conducted in southern France against this redoubt of the *Maquis*, employing various security and military forces including Vichy French *Milice* working with the Germans. Two companies of Fallschirmjäger-Bataillon Jungwirth were landed in 20 DFS 230s and two Go 242s ahead of the ground forces that were closing in on the town.

Hungary; Budapest, February 5–13, 1945

The Hungarian capital was encircled by the Red Army and resupply drops had little success. Three attempts were made to land Go 242s on an athletic field: on February 5, two out of 11 made it; on February 11, 36 out of 48 landed; but on February 13 all 20 tugs and gliders were lost.

ASSESSMENT

The Go 242 was also used to evacuate casualties out of encirclements. The Germans did not have the "snatch" type of retrieval system used by the Americans (see Plate H). Entrapped forces had to possess a secure airfield, on which transports or bombers could land to tow out gliders that had previously flown in with supplies and reinforcements. (Bundesarchiv 1011-641-4550-29)

The concept of delivering troops, heavy weapons, and supplies by glider was basically sound. Most paratroop-dropping aircraft had a relatively small troop and cargo capacity; they were unable to drop complete artillery pieces, and high-capacity cargo parachutes had not yet been developed. Gliders potentially provided a desirable capability to land heavy weapons, equipment, and large numbers of troops in the enemy's rear reasonably close to planned objectives. The enemy's inability to anticipate where all the possible landing areas might be or to cover even a small number of them offered further advantages of surprise and confusion. Glider troops would not land as scattered as paratroopers. They could arrive with heavier weapons and sufficient ammunition and supplies to sustain them, and a small number of vehicles to improve mobility, tow heavy weapons, and carry ammunition and radios.

The practical problems were several. One was simply to train enough pilots; another was to build enough gliders, get them to where they were needed, and assemble them on a timely basis. Providing sufficient glider tugs was another problem, since transports were needed for many other missions. As with paratroop transports, it proved extremely difficult to effectively train tug crews in navigation and identifying release points and LZs, and to instill the skills and discipline necessary to maintain formation in marginal weather and/or when under fire from flak.

Even well-trained and experienced tug crews found it almost impossibly difficult to deliver gliders to the correct LZs at night, even in moon- and starlight, and unpredictable winds and weather might send them significantly astray. Glider pilots had to land wherever they ended up and had no second chances; since gliders were unpowered, if they were released too early, too late, or off course, they could not fly to a better LZ. It was often impossible for them to avoid natural and man-made obstacles, which their lightly built gliders could not withstand. Because of this, units were not always able to assemble as quickly as desired due to landing in the wrong places, getting intermingled with other troops, and attempting night movements over

Troops in Russia file aboard an Me 231. The *Gigant* could carry up to 140 troops or 60 litters, making it the largest capacity troop carrier in World War II (many references cite 200 passengers, but this is incorrect). A double deck was installed when carrying troops, converting the compartment into two "storys." Note the join of the clamshell nose doors, not yet fully closed. (Bundesarchiv 1011-267-0144-13A)

US casualties are transferred from a ¾-ton ambulance into a Waco CG-4A for retrieval from the Remagen bridgehead. A Waco could carry seven litters and an aidman. (Tom Laemlein/ Armor Plate Press)

difficult terrain. Casualties were often high, especially during night operations.

Even so, there was still tactical value to be gained by putting hundreds or even thousands of troops on the ground in a short time. There were some operations in which casualties were inordinately high, but overall the casualties suffered in crashes and to ground fire were comparable to or even lower than those suffered in assaults across open beaches. Nevertheless, it was decided that night operations were too costly and had too high a

H

GLIDER RETRIEVAL; OPERATION *THURSDAY*, BURMA, 1944

Other than gliders, aircraft of the 1st Air Commando Group supporting the British Chindits were identified by five narrow diagonal white stripes around the fuselage; this C-47 also shows the question-mark tail insignia of the 319th Troop Carrier Squadron.

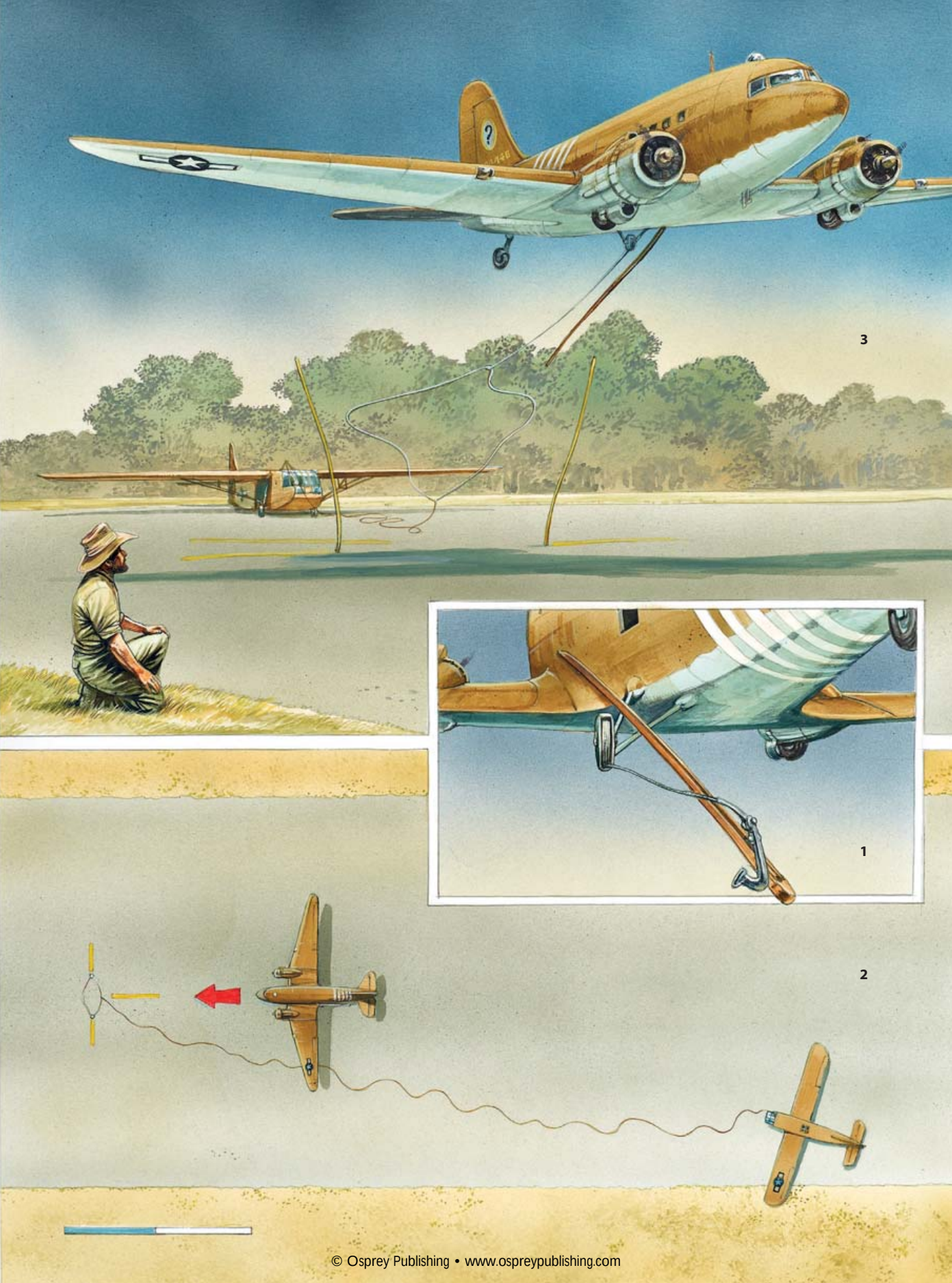
During the interwar "Banana Wars" US Marine aviators had snatched message-containers from ground troops, and later this technique was also practiced by US Postal Service pilots. In 1941 All American Aviation developed winch equipment, and testing began to ascertain whether a powered aircraft could "snatch" up a grounded glider. At first small training types were used, but by early 1943 larger gliders were being safely retrieved, and in July 1943 the M80C glider pick-up mechanism was adopted. Installing it in the left forward part of a C-47's cargo compartment was a major undertaking; it involved a large hydraulic winch system for 1,000ft of ⅝in steel cable, with hot air exhaust and air intake vents, an emergency explosive cable-cutter system, an electric lowering/raising system for a 20ft hook-arm, and other components.

1: The hook-arm and external cable spool/cutter were on the left underside of the fuselage aft of the wing. Inside, the winch's friction clutch was set to match the weight of the loaded glider.

2: A cleared strip of ground 600–700ft long was needed, and twice that if the glider would have to clear 50ft-high obstacles. Two 12ft poles (usually painted yellow) were set up near the approach end 20ft apart, and marked each side and on the centerline with a "T" of 14ft-long yellow panels. An 80ft rope was formed into a loop and loosely attached to the top of these "clothesline" poles, and from the bottom of the loop a 225ft tow-rope ran back left of the airstrip centerline at a 10-degree angle for 150–200ft, attaching to the glider set 40ft off the centerline. These offsets were precautions to prevent the tug's hook-arm from snagging the glider itself during the run-in.

3: The hook caught in the rope loop; this came free from the poles, and the hook from its supporting arm. The tension pulled 600–900ft of the cable out of its tube through the tug's belly; this, together with a 25 percent stretching of the 225ft nylon tow-rope, greatly reduced the snatch-shock on the glider. The glider accelerated to 0.7G within about 3 seconds, and was airborne in less than 200ft; the tug lost 25–40mph of airspeed, but quickly accelerated to 120mph as the cable was reeled in and the hook-arm was raised parallel to the belly. In an emergency the tug pilot could fire an explosive cartridge to cut the cable and release the glider.

Troops, casualties, and equipment could be loaded in "snatch" gliders, and this proved to be a safe and effective procedure. It could even be carried out at night, with lights on the pole-tops and other alignment lights along the airstrip.



This C-47 painted with invasion stripes is making its run to snatch a CG-4A off a pickup zone. The lowered 20ft hook-arm is about to snag the pickup rope suspended between two "clothesline" poles – see Plate H. (Tom Laemlein/Armor Plate Press)

potential for failure, so after June 1944 daylight glider operations became the norm. Among the most effective operations were those involving a small number of gliders with highly trained crews landing well-rehearsed troops to assault high-value targets.

Glider training dwindled after the war. The US Army redesignated and reorganized parachute and glider infantry regiments as dual-capable airborne infantry regiments in 1947–48. Little actual glider training was undertaken; it ceased altogether in 1949, and was dropped as a requirement on January 1, 1953. The British retained gliders on a limited scale until 1957, and the Soviets ceased using them in about 1959. None were employed operationally after World War II, and helicopters eventually took over the air-assault mission. There was a significant gap in airlanding capabilities between gliders and helicopters; it would not be until 1962–65 that the US Army fielded a viable helicopter-borne airmobile force, and most other armies did not have dedicated air-assault forces until the late 1960s or early 1970s. The roles and missions of modern helicopter-borne air assault forces can truly be said to be the successors of the pioneering World War II glider forces – vertical envelopment with troops, weapons, and supplies delivered in the enemy's rear.

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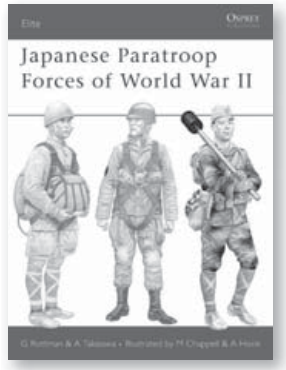

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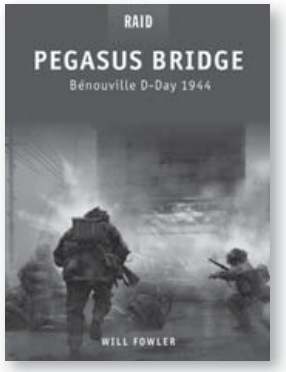

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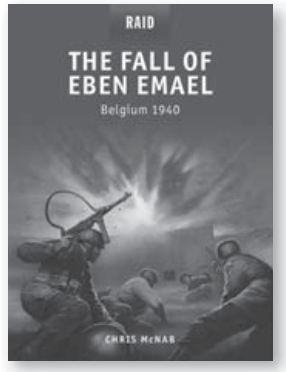

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Abbreviations used in this text:

AA	antiaircraft
Abn	Airborne
AL	Airlanding
AT	antitank
Bde	Brigade (British – equivalent US Regt Combat Team)
Bn	Battalion
CO	commanding officer
Div	Division
DZ	drop zone
FABTF	1st Airborne Task Force
GFAB	Glider Field Artillery Battalion
GIR	Glider Infantry Regiment
GP	glider pilot
Grp	Group
HMG	heavy machine gun
LMG	light machine gun
LZ	landing zone; in British usage, "landing area," but LZ is used throughout this text
PFAB	Parachute Field Artillery Battalion
Prcht	Parachute
RAF	Royal Air Force
Regt	Regiment
TO&E	Table of organization and equipment
USAAF	United States Army Air Forces