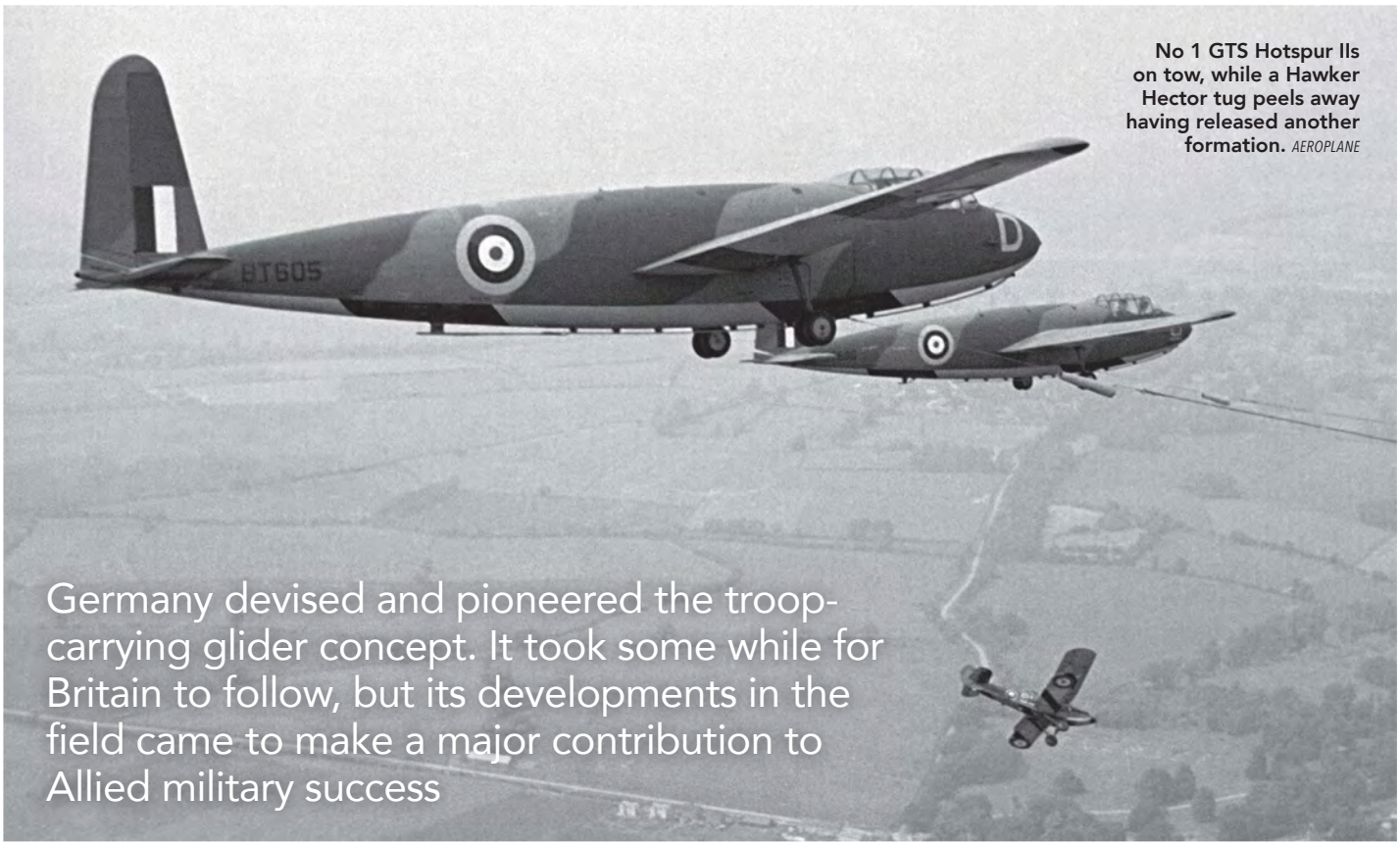
Waco CG-4A 42-77451 was built by the Ford Motor Company in Kingsford, Michigan, and was towed into action by a C-47 from the 439th Troop Carrier Group at Upottery, Devon. CHRIS SANDHAM-BAILEY

17 IN-DEPTH PAGES

D-DAY ASSAULT GLIDERS

WORDS: PROF TIM JENKINS

The impressive scene at Tarrant Rushton, Dorset, on the evening of 6 June 1944. Handley Page Halifax tugs of Nos 298 and 644 Squadrons prepare to take into the air a phalanx of troop-carrying gliders, mainly General Aircraft Hamilcars but led by two Airspeed Horsas. KEY COLLECTION



No 1 GTS Hotspur IIs on tow, while a Hawker Hector tug peels away having released another formation. AEROPLANE

Germany devised and pioneered the troop-carrying glider concept. It took some while for Britain to follow, but its developments in the field came to make a major contribution to Allied military success

Allied expectations that the Versailles Treaty, signed on 28 June 1919, would successfully discourage a technologically inquisitive and modern German society to simply abandon previous achievements in the field of aviation proved extremely naïve. Consequently, the desire to beat the restrictions placed on flying became an obsession that, to observers throughout the world during the 1920s and 1930s, simply manifested itself in the apparently innocuous pastime of sport gliding. In reality it became the origin of the assault glider tactic.

Many frustrated former pilots from the Imperial German Army Air Service of the Great War embraced the sport, but the glider became much more than a symbol of defiance. During the 1920s, Karl Student formulated his vision for the future application of gliders as a military weapon operating in conjunction with parachute forces as a combined airborne force. Secretly, the Deutsche Forschungsanstalt für Segelflug (DFS, or German Gliding Research Institute) conducted exploratory military research for the German aero industry that included, amongst others, experiments that contributed towards the gestation of the Messerschmitt Me 163 Komet rocket-powered interceptor. However, its most important work was the development of the DFS 230 military assault glider, based on a sailplane originally designed for high-altitude meteorological research and later adapted for use by airborne forces.

Germany was not the only nation to recognise that the existence of organised national gliding and soaring clubs had potential military benefits. The British also identified the importance of air-mindedness among the civil population and offered financial incentives to cadets to complete their basic gliding qualifications. An article in *Picture Post* published on 9 December 1939 observed, "There is a national advantage in the existence of a large number of trained glider pilots which is recognised by Governments who assist with subsidies payable to the clubs. The British Government allots £5,000 a year for this purpose, and this year has given an additional £7 per head for each Air Defence Cadet who qualifies for a certificate, the total number being limited to 700."

> "Churchill was disappointed to learn about the lack of progress made in both the parachute and glider development programmes"

A staged depiction of Wehrmacht troops storming forth from a freshly landed DFS 230. BUNDESARCHIV

The DFS 230 was principally designed to alleviate one of the fundamental deficiencies facing all airborne forces, namely the limited carrying capacity of parachutists during their descent to a target. German parachutist forces (Fallschirmjäger) were being developed simultaneously with the glider programme and were dependent upon weapons containers that were dropped into action simultaneously. The containers for essential supplies such as ammunition had to be located

before the parachutists could move off the drop zone to their objective. As a result of these restrictions, the German military realised that another method was required for the delivery of heavier weaponry and supplies if the airborne units were to become tactically effective. It was this requirement that facilitated the concept and development of the assault glider as a weapon of modern warfare.

A variety of cargo or 10 fully armed troops, including two pilots seated in tandem, could be carried by the DFS 230. The glider entered full-scale production during 1937, allowing nearly two years for the perfection of the assault glider technique before the outbreak of the Second World War. Consequently, in 1938 Fliegerdivision 7 (the 7th Air Division) not only comprised parachute forces but also a small glider unit and an auxiliary force of Junkers Ju 52/3m transports for glider-towing and air-landing duties. By September 1939, Fliegerdivision 7 comprised three parachute regiments, the 1. 2. and 3. Fallschirmjäger-Divisionen, and airborne support units which included the assault glider force.

At the outbreak of war Fliegerdivision 7 moved into Poland with the tactical remit of exploiting any air-landing opportunities. The Polish campaign presented no opportunity to deploy airborne forces as the Wehrmacht had over-run Poland long before a suitable airborne objective could be identified, a phenomenon frequently — and frustratingly — experienced by Allied airborne forces following Operation 'Overlord' in 1944. However, when the Fliegerdivision was finally given the opportunity to participate in combat operations during the invasions of Norway, Denmark and the Low Countries, its success and its psychological effects upon the civilian population and military authorities had a spectacular impact on the development of Allied military strategy for the remainder of hostilities.

DEVELOPMENT OF BRITISH GLIDER FORCES

Following Operation 'Mercury' in May 1941, during which Crete was seized successfully by German airborne forces alone, Prime Minister Winston Churchill's demands for the creation of a British airborne force intensified. He declared that he had lost patience with being "fobbed off with one doubtful and experimental policy" after another. On 27 May, Churchill wrote the following minute to Gen Hastings Ismay, his senior military assistant, for circulation at the Chiefs of Staff Committee: "This is a sad story… I feel myself greatly to blame for allowing myself to be overborne by the resistances which were offered. One can see how wrongly based these resistances were when we read the Air Staff paper in light of what is happening in Crete, and may soon be happening in Cyprus and in Syria."

Churchill was also disappointed to learn about the lack of progress made to date in both the parachute and glider development programmes. He complained bitterly that everything "had been produced on the smallest possible scale", resulting in Britain always being "found behindhand of the enemy."

However, progress had been made, at least, in issuing operational requirements for the British glider force. Towards the end of 1940 the Ministry of Supply issued specification X10/40 for the first Allied assault glider. The tender was awarded to General Aircraft Ltd, which set to work on the production of the prototype GAL48 Hotspur. It made its maiden flight in February the following year. The Hotspur was quite closely based upon the DFS 230 in terms of dimensions and payload. However, unlike its German counterpart, it was never used operationally. Even before the initial contract for 200 aircraft had been completed, the military authorities decided that the glider carried too small a payload for operational deployment and it was relegated to the training role.

Had the Hotspur been deemed suitable for combat, British glider operations may well have been attempted during 1941. The decision effectively delayed the first operational use of assault gliders by the British until the larger Airspeed Horsa was brought into service in the summer of 1942. Nevertheless, the Hotspur proved a useful training aircraft that was specifically designed for its intended purpose, unlike the types destined to perform in the towing capacity.

On 28 October 1940, Fg Off Douglas Davie departed Manchester's Ringway airfield tasked with the examination of civilian gliders for impressment into service with the Glider Training School (GTS). During the period of detachment Davie was temporarily attached to No 41 (Maintenance) Group headquarters, which had previously compiled a list of gliders in civilian ownership throughout the country that required inspection pending possible selection for use. Glider types included the Kirby Kite, which would be towed by tugs such as the Avro 504 and Hawker Hart. However, with the delivery of the larger Hotspur imminent it was decided that the school required more room, and on 28 December 1940 the unit was relocated to RAF Thame, Buckinghamshire. At Thame the unit was equipped with the Hawker Hector as a glider tug, these machines arriving en masse in late February 1941.

The German success during Operation 'Mercury' served to spur the British still further in the development of their airborne capability, and by November 1941 a full-scale training programme for 400 army glider pilots was announced. It seems likely that the appointment of Maj Gen Browning the previous month as the first general officer commanding (GOC) of the newly created 1st Airborne Division was also a catalyst for expansion. Consequently, the Glider Training Squadron underwent significant reorganisation in order to meet increased training demands.

On 1 December 1941 the unit was divided into Nos 1 and 2 Glider Training Schools based at Thame, and within three weeks these units were incorporated into the Glider Pilot Regiment commanded by Lt Col J. F. Rock. The regiment was set at two battalions strong, each consisting of six companies of sergeant pilots recruited on the same voluntary basis as parachutists. Unlike their American colleagues, British glider pilots were also fully trained fighting soldiers and were expected to revert to that role once they had successfully delivered their cargo into battle, be it human or material.

The British press was soon taking an interest in airborne developments, and *The Times* reported on 27 June 1942 that, "Each troop carrying glider will be piloted by a soldier, so

Specification	Operational requirement	Description	Glider	Manufacturer
X10/40	OR87	Troop-carrying glider (seven troops)	Hotspur I	General Aircraft Ltd
X22/40	OR87	Production order	Hotspur II	General Aircraft Ltd
X23/40	OR87	Production order	Hotspur II	General Aircraft Ltd
X25/40	OR98	Troop-carrying glider (14 troops)	Hengist	Slingsby Sailplanes
X26/40	OR99	Troop-carrying glider (24-36 troops)	Horsa	Airspeed
X27/40	OR100	Cargo glider capable of carrying seven-ton Tetrarch tank	Hamilcar	General Aircraft Ltd

that as soon as he has landed his craft he will be able to play his full part in the land fighting. Every glider pilot is a volunteer, and they have been drawn from almost every unit of the Army. The medical and educational standards required of a glider pilot are much the same as for RAF pilots of powered aircraft and it is gratifying to hear from the commanding officer of a training station which I have just visited that there is no shortage of volunteers."

The expansion of the glider training programme not only required further recruitment from the ranks of the army, but an increased contribution from RAF resources in both personnel and equipment. Apart from the demand for glider-towing aircraft and the crews to fly them, this needed a commitment in terms of training aircraft and instructors.

Flying training for the glider pilots was the responsibility of RAF elementary flying training schools, where students qualified on types such as the de Havilland Tiger Moth before converting to gliders. Regarding the need for tug aircraft and crews, on 15 January 1942 RAF Army Co-operation Command formed No 38 (Airborne Forces) Wing, specifically detailed to provide aircraft for facilitating training and operational deployment.

GAL's Twin Hotspur came about in 1942 as an effort to produce an interim alternative to the Horsa. However, the only prototype, MP486, did not perform well. *AEROPLANE*

No 1 GTS stayed at Thame when the training was divided into two separate establishments in December 1941. However, by the early summer of 1942 there was a desperate need for a larger airfield to meet training requirements, and after careful deliberation Croughton was selected. On 19 July 1942 No 1 GTS began relocating and it was fully operational at its new home the following month.

On the same day that the school began its move, headquarters Flying Training Command issued a document entitled 'Notes on Glider Training' and a standard flying syllabus for all trainee pilots. The booklet opened by telling new recruits, "The function of the Glider Training School is to produce pilots with sufficient knowledge and skill to handle gliders efficiently on the ground and in the air", "In order that full use may be made of the equipment and space available, great importance should be attached to the ground organization and to the co-ordination of the tug pilot, glider pilot and ground crew", and that, "Good ground organization, coupled with a high standard of flying discipline, will enable a maximum numbers of tows to operate without interference or delay."

The insistence on good ground organisation in order to enable a maximum number of tows is a good indication of just how tight the training schedule for new recruits proved to be. Glider pilot H. N. 'Andy' Andrews noted while training in the Hotspur, "The stick (mostly the spade grip) was reasonably easy to use, and sensitive. However, perhaps the hardest thing of all to get used to was the position of the legs and feet in close relation to the nose, the skid and, ultimately, the ground in landing. There were twin wheels under each wing, originally designed to be jettisoned, but actually used in position. It was found to be much easier to manoeuvre on the ground and quicker, therefore, for practice flights."

The schedule was particularly labour-intensive for RAF personnel. Each tow line for an individual glider and tug combination required a groundcrew consisting of at least five men. These comprised an NCO in charge of groundcrews, a rigger of the tug tow-rope (who also acted as relay signaller), a rigger of glider tow ropes, two or more aircraft charge hands, and a tractor driver.

The flying syllabus was split into a series of daylight and night-time flying exercises, both dual and solo, which each student had to pass in order to gain their wings. It was extremely intensive, and only when an instructor was confident in a pupil's ability could he start the final exercises, which comprised practice flights made with 'live loads'. On completion these pilots would progress to heavy glider conversion units for training on the much larger Horsa or Hamilcar.

SLINGSBY'S FAILED CONTENDER

One other glider prototype was produced to the early operational requirement. On 1 January 1941 Slingsby Sailplanes invited officials to inspect its mock-up of the Hengist, which had been designed to specification 25/40. The aircraft experienced numerous construction difficulties, not least due to regular updates to Ministry of Aircraft Production specifications which required extensive conferences. Finally, in February 1943 contractors from Slingsby began to undertake trials at the Airborne Forces Experimental Establishment with a Hengist and Whitley tug combination.

On 18 March 1943, flight tests revealed that the centre of gravity of the Hengist was some 5in beyond the aft limit. All trials had to be abandoned on 2 April due to the dangerous recurrence of the fault. Despite continued efforts and experiments, the prototype force-landed at Acaster on 4 April and was damaged once again following a similar incident at Sherburn the following day. The Hengist's future was increasingly in question, and by 1943 it was already far behind the Horsa programme. Ultimately, despite extensive research and development, the Hengist was deemed incapable of satisfying the tactical and operational requirements of the airborne forces and never entered production.

Hengist prototype DG573 during trials in October 1942, showing the under-fuselage rubber air bag provided to help the airframe take the loads experienced on landing at high weights. ALAMY

AIRSPEED HORSA

A Horsa is waved off by groundcrew as the next Short Stirling tug prepares to move into position. KEY COLLECTION

DEVELOPMENT

Glider operations were not undertaken by the British until the Hotspur was superseded by the entry into service of the Airspeed Horsa, designed and manufactured in response to specification X26/40. Airspeed began design work on the Horsa in December 1940 at Salisbury Hall, Hertfordshire. The move there came after Airspeed was purchased by the de Havilland Aircraft Company, although the firm continued to manufacture under its own name. The project was closely supervised by Airspeed's technical director, Hessell Tiltman, and the first prototype made its maiden flight on 12 September 1941.

British gliders were built almost entirely from wood, principally because it remained a relatively cheap material in comparison to metal alloys, and gliders were deemed disposable. Additionally, wooden construction facilitated dispersed manufacturing among non-specialised industries without putting excessive pressure on aircraft manufacturers and shadow factories. Consequently, glider components were invariably made by the furniture and motor industries, with each factory focusing on specific components. Austin Motors, for example, completed some 368 Horsa fuselage sections and 798 centre fuselage sections between 1942 and 1945 at the Castle Bromwich factory in Birmingham.

Interestingly, an order was also placed for the manufacture of 800 Horsas by the Indian firm Tata for use in the Middle East, although the temperature had severe effects upon the structural capability of the glued laminates. The project was eventually abandoned in 1942, the resources built up by Tata being re-allocated to aircraft repair in the Calcutta region and the assembly and supply of aircraft spares in Bombay.

In the UK, individual sections were transported to RAF stations upon completion and assembled by resident maintenance units. This method of manufacture is the primary reason why the Horsa made such rapid progress from drawing board to service and subsequent operational deployment, which occurred in November 1942.

Horsa production increased steadily as the war progressed. In 1943 the Minister of Aircraft Production noted, "By the end of 1942, 629 had been delivered, on an original order of 2,400, which has now been reduced to 1,575 (706 this year and 240 in 1944) bringing it into line with a revised War Office requirement of 985 this year and 645 in 1944, subject to review in June 1943. The heavier operational Hamilcar has just begun to appear, 120 being scheduled for delivery by the end of this year, and the balance of the total order of 194 in 1944". By the end of World War Two, approximately 4,000 Horsas had either been produced or were in various stages of assembly.

> "The method of manufacture is the primary reason why the Horsa made such rapid progress from drawing board to service"

A September 1941 view of the first prototype Horsa, DG597, at Fairey's aerodrome at Harmondsworth. KEY COLLECTION

The original specification required a glider capable of carrying 29 fully armed troops or a variety of supplies and equipment. To ease unloading, the Horsa I had a detachable tail section. This design was improved in the Horsa II which had a hinged cockpit, similar to its American counterpart the Waco CG-4A, making the process of loading and unloading far more practical in combat conditions.

Following the accidental discovery that a Jeep could be loaded into a Horsa with remarkably little modification, the process of unloading the glider became a major area of investigation. Although a Jeep could technically be manoeuvred into the fuselage through the loading door, there was incredibly little room and the process was cumbersome and time-consuming. Naturally, this was highly unsuitable for use on the front line, and in early 1944 Airspeed began investigating possible solutions. Its preferred option comprised the application of explosive bands, known as a 'surcingle', around the rear of the load-carrying

ABOVE: Civilian workers with a newly delivered, still disassembled Horsa at Brize Norton. KEY COLLECTION
ABOVE RIGHT: The Horsa II introduced a hinged nose, rendering the loading and unloading of cargoes such as Jeeps easier. KEY COLLECTION

compartment for removing the tail. Nevertheless, despite being fitted to gliders during operations in Normandy, the official history records that it was never used "in view of the loud noise it made on explosion" and, possibly, due to the dangers associated with the use of such an accelerant on a wooden aircraft.

A mechanical solution was achieved whereby the tail was bolted to the fuselage by means of eight quick-release nuts, a pair of heavy-duty wire-cutters were supplied to cut the control cables and the 'surcingles', although carried, were relegated to emergency use only. The Horsa Is that were so modified in readiness for D-Day were termed 'red', while those left unmodified were dubbed 'white'. The Horsa II, despite its hinged nose, retained the quick-release design incorporated into the 'red' MkIs, so that if the particularly vulnerable cockpit was damaged during landing, unloading could be achieved through the removal of the tail.

IN SERVICE

The first Allied application of the assault glider technique took place in 1942 and demonstrated the complexities of such operations with fatal consequences. Codenamed 'Freshman', this was an ambitious attempt to capture the Norsk Hydro Vemork plant in the Telemark region of Norway. A force comprising two Horsas towed by Handley Page Halifaxes departed RAF Skitten, Caithness, on 19 November, but it soon became apparent to the tug crews that the promise of good weather over Scandinavia and a full moon to aid the location of the target would not be forthcoming. In an attempt to escape the thick cloud above, one of the combinations flew below the cloudbase to aid navigation. In the confusion the Halifax (W7801) struck the side of a mountain, killing the crew, while the Horsa (HS114) made a forced landing, killing the pilots and injuring several of the glider's occupants.

> "By the start of Operation 'Overlord' in 1944 the delivery of airborne forces by Horsa had improved considerably"

The other combination was more fortunate and approached the Norwegian coastline at 10,000ft where, as promised, the weather finally began to improve. Unfortunately, the Rebecca/Eureka navigation device that was to guide them to the target area was unserviceable, making it impossible to locate the plant. Unable to find the target in deteriorating weather conditions Sqn Ldr Wilkinson, his Halifax running low on fuel, was forced to turn for home with the Horsa still in tow. Crossing the coast, the combination was further hampered by heavy cloud and icing conditions which resulted in the two aircraft parting, probably due to the tow rope icing, and consequently breaking. The second Horsa (DP349) crashed a short distance from its counterpart and all the survivors were captured and executed by the Germans. The failure of the operation, and the loss of a tug aircraft and crew, did little to convince sceptics in Britain of the potential of airborne forces. However, Horsas aero-towed by Halifaxes to North Africa were used in Operation 'Husky', the Allied landings in Sicily during July 1943, and the concept began to gain more of a foothold.

By the start of Operation 'Overlord' in 1944 the delivery of airborne forces by Horsa had improved considerably. The task given to the British 6th Airborne Division was to seize strategic objectives and communication centres to the north-east of Caen. This flank included the double obstacles of the River Orne and the Caen Canal and the higher ground that dominated the area to the east. The capture of the higher ground also necessitated the elimination of the coastal defence battery at Merville. Without securing this area the enemy could interfere with the British landings on Gold, Juno and Sword Beaches and rake them with artillery fire.

Seizing the bridges was vital too, as they carried the main coast road by which the Germans could attack the British and Canadian flank. Ultimately, all the airborne objectives were secured but

Men of an unidentified unit ready for the D-Day assault. The Horsa could carry up to 29 fully equipped troops. KEY COLLECTION

not without the inherent difficulties of transport aircraft failing to locate drop zones and scattering small parties of parachutists many miles from their objectives.

The most successful Allied airborne operation on 6 June was the British assault on the bridges over the River Orne and the Caen Canal, subsequently renamed Horsa and Pegasus Bridges respectively in honour of the British airborne forces. The objectives were allotted to D Company of the Oxfordshire and Buckinghamshire Light Infantry, commanded by Maj John Howard, and the force was transported in six Horsas during Operation 'Deadstick'. Not only was Howard's force the smallest unit to be allocated an objective on D-Day, but it effectively spearheaded the Allied airborne assault. The operation went entirely according to plan, with both bridges being quickly secured. This was thanks to remarkably accurate flying by the glider pilots, who managed both to locate the bridges in the darkness and land literally on top of their objectives, allowing the infantry to achieve complete surprise.

Howard's small-scale coup de main operation is arguably the finest example of the successful deployment of Allied glider-borne forces during the entire conflict, one certainly on a par with the German airborne assault on the Belgian fortress of Eben Emael in May 1940. It remains a tribute to the devastating capability of airborne forces when deployed strategically against a clearly defined objective.

A pre-invasion training exercise, staged for the benefit of an official photographer — on operations, it was unlikely that troops would emerge from such an intact Horsa, as many images from Normandy and Arnhem illustrate. KEY COLLECTION

Following the Normandy landings, the Horsa was used during Operation 'Market Garden'. On Sunday 17 September 1944 the 1st Airlanding Brigade was transported in 320 gliders in support of the 1st Parachute Brigade. This initial lift proved successful. Lt D. Holdsworth, intelligence officer with the 2nd Battalion of the Devonshire Regiment, made this assessment of the initial landings and confirmed the scale of the air plan: "It was a Sunday afternoon, just about the time for lunch, when to our left was to be seen the first signs of the manner in which the next battle was to be fought. Pot bellied aircraft carrying parachutists, and protected by fighter aircraft, flew across our front in a north-easterly direction. They were interspersed by aircraft towing gliders. By comparison with the weaving fighter aircraft, the gliders, their towing aircraft and the troop carriers seemed ridiculously slow, cumbersome and vulnerable."

> "Operation 'Deadstick' went entirely according to plan. This was thanks to remarkably accurate flying by the glider pilots"

The 1st Airlanding Brigade was tasked with securing the landing zones to enable the safe delivery of the remaining members of the division, while the men of the 1st Parachute Brigade began to assemble their equipment and advance into Arnhem via three codenamed routes. The protection of the landing zones was crucial to ensure that subsequent airlifts were able to be delivered safely. However, the neeed for such security and the lack of available transport aircraft to deliver the entire division in one lift severely

Horsa I LF912 formed part of the third wave of Operation 'Tonga', the British 6th Airborne Division's element of 'Overlord'. Crewed by SSgt V. Davies and Sgt L. Cavalli, it landed near Ranville. CHRIS SANDHAM-BAILEY

Halifax tugs were used from the outset of the Horsa's operational career. KEY COLLECTION

ABOVE: Its RAF roundels painted out and replaced with American 'stars and bars', this Horsa was used on the second front in France by US IX Troop Carrier Command. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION
ABOVE RIGHT: The view of a Horsa from the rear of a Stirling tug en route to Arnhem in September 1944 as part of the First Allied Airborne Army. KEY COLLECTION

compromised the fighting strength of the airborne forces on the first day of the battle when they still maintained the element of surprise, and was a key factor in the British defeat at Arnhem.

The final operational use of the Horsa in the Second World War was during Operation 'Varsity' on 24 March 1945, when approximately 400 gliders were used to deliver the 6th Airlanding Brigade. The main objective was the capture of the town of Hamminkeln, but considerable German anti-aircraft fire and smoke from the battlefield made it incredibly difficult for the pilots to identify their landing zones. However, despite the confusion the brigade secured all of its objectives successfully.

The remaining 121 Horsas in storage at Cosford were downgraded to non-effective airframe status on 30 June 1950 and disposed of by burning, a task recorded as "practically complete" by 31 January 1951. The final reference to the type at Cosford was on 31 October 1954 when 15 Horsa airframes were collected by a private purchaser, presumably for materials.

INSIGHTS

Despite its popularity among the British, the Horsa proved unpopular with the Americans following its use during the Normandy campaign. On 14 December 1944 Gen Matthew Ridgway, commander of XVIII Airborne Corps, noted, "There is a deep seated repugnance to the Horsa glider among American airborne troops. In art this is well founded. Since we now have available in this Theatre an adequate number of CG-4s, and an ample number of glider pilots trained in their use, I wish to use the CG-4 to the exclusion of the Horsa in every situation where this is possible."

Although Ridgway did not specifically detail the reasons behind the dislike of the Horsa, his disposition is abundantly clear. It is likely to be that the aircraft was considerably more difficult to manoeuvre than its American counterpart.

One interesting aspect of the Horsa was that the original aircraft had been developed as a means of increasing the capacity of bomber aircraft to carry parachute troops. This is evident on the MkI by the inclusion of the two passenger doors on either side of the fuselage to enable simultaneous exits by sticks of parachutists. The Airborne Forces Experimental Establishment conducted a series of flight trials at Sherburn-in-Elmet between April 1943 and March 1944 that had the potential to fundamentally alter the entire character of glider-borne operations in the final years of the war.

The report, not issued until May 1944, stated the following reasons for the enquiry: "[To] investigate whether the Horsa I glider was suitable for paratroop operations involving the dropping of sticks of troops simultaneously from both fuselage doors together with containers from the wing cells, and if so the most suitable installation was to be determined and tested, making the minimum possible modifications and additions to the airframe."

Under this arrangement the tug aircraft would also contain a stick of parachutists or be bulk-loaded with supplies for use by the parachutists once they had landed. It alluded to the fact that the Horsa had been conceived with this

A NOSE FOR TESTING

Perhaps the most surprising contribution of the Horsa was in the gestation of the de Havilland DH106 Comet. The cockpit was used for development of the jet airliner's four-crew flight deck and perfected by means of a modified Horsa towed by a Halifax to determine the optimum visibility. A 1952 article in *Flight* reported that a mock-up of the proposed Comet cockpit was fitted to a Horsa because the glider's fuselage diameter was the same dimension as the rear bulkhead of the jetliner's nose. DH chief test pilot John Cunningham was frequently found during the winter of 1946-47 at the Horsa's controls while the pilot of the tug scoured the sky for rain storms.

Horsa I TL349 flying with the DH106 Comet nose attached. KEY COLLECTION

purpose in mind: "In the original design of the Horsa, at a stage when it was considered that the glider might be required for paratrooping, certain equipment was incorporated including two strong points in the fuselage, and container racks in the wings with a manually operated release in the fuselage. This equipment was not used as the requirement was held in abeyance for a considerable time. When the glider was again considered for paratrooping and tests were put in hand at this establishment it was found that the above equipment was unsatisfactory and a considerable amount of modification was necessary. This report covers paratrooping from the Horsa whether or not simultaneous dropping from the tug and glider occurs, and a drill and technique have been included which are applicable in both cases."

Investigations may well have been revived following reports of German forces employing the technique in training, and operationally during the invasion of Crete. The US Military Intelligence Service reported in December 1942, "It has often been reported that in training, men jump by parachute from gliders. Some observers reported that this method was used in Crete, but the reports are unconfirmed. It is certain that glider-borne troops do not normally wear parachutes (in Crete they had life jackets), and are technically not parachute troops. Moreover, the DFS 230 is most unsuitable for the dropping of parachute troops."

> "The Horsa proved unpopular with the Americans. Gen Matthew Ridgway noted, 'there is a deep seated repugnance to the Horsa'"

Despite never being used operationally, the concept of the 'airborne caravan' technique possessed considerable advantages. The most obvious was the increased number of parachutists capable of being deployed at any one time. The need for a purpose-built aircraft for use by airborne forces remained the most restrictive factor in Britain's capability to launch independent divisional-strength airborne operations and resulted in a dependence upon the co-operation of US troop carrier commands. The employment of the Horsa to extend the parachute-carrying capabilities of obsolete bombers, therefore, could have reduced British reliance upon American assistance and provided more in the way of autonomy.

The aftermath of the very successful Operation 'Deadstick'. The lead Horsa, flown by SSgts Jim Wallwork and John Ainsworth (the example at right), landed within feet of its objective at what became known as Pegasus Bridge. Maj John Howard was on board. KEY COLLECTION

GENERAL AIRCRAFT HAMILCAR

A Tetrarch light tank exits from a Hamilcar under its own power. KEY COLLECTION

DEVELOPMENT

The production of the Horsa and Hamilcar is evidence that the British military was prepared to develop, from the earliest stage of its inception, an airborne force of considerable size and capability. This development not only comprised the design and production of the gliders themselves, but also specialist combat materiel such as the Tetrarch tank carried by the Hamilcar. Despite such ambitious beginnings, however, the operational capabilities of Britain's airborne forces were continually handicapped by the availability of sufficient transport aircraft once the larger gliders entered service. The only aircraft capable of towing a fully laden Hamilcar was the Halifax.

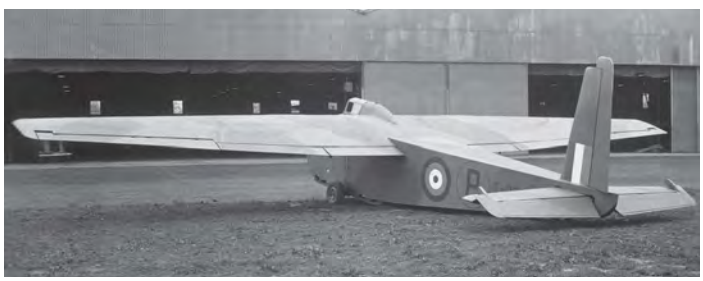
The Hamilcar was designed to carry a formidable variety of equipment up to a combined military load of 7.8 tonnes. This could include the Tetrarch MkIV tank, designed by Vickers-Armstrongs in the 1930s; the Light Tank (Airborne) M22, or Locust, designed by Marmon-Herrington; two Bren gun universal carriers; two armoured scout cars; a 25-pounder gun or 17-pounder anti-tank gun with tractor; a Jeep and universal carrier; self-propelled Bofors guns; Bailey pontoon bridge equipment; or 48 panniers of equipment and ammunition.

The operational requirements for the Hamilcar were constantly being updated, and the variation of loads necessitated the design and manufacturing of specialist anchorage equipment so there was no movement during flight. The complexity of the load combinations may well have resulted in the delayed introduction of the type into operational service.

The official British history of the *Design and Development of Weapons* during the Second World War observed in relation to aircraft design and manufacture, "When the airframe was single in design and construction; when its design was not linked with the hazards of a parallel engine development; when the operational requirements were simple and above all did not impose on the design a multiplicity of operational roles; when the 'users' made up their minds early and did not find themselves under the compulsion to modify the original design by stages; where new and identical capacity not previously engaged in the design and production of other types could be brought in, it proved possible to put airframes (in this case gliders) into the air with very little trouble or delay."

The success of the Horsa and Hotspur was definitely not repeated with the Hamilcar. On award of contract, General Aircraft promised that 50 Hamilcars would be delivered against operational requirement X27/40 by the end of 1941. However, the first prototype, DP206, only made its maiden test flight on 27 March 1942 and total production did not exceed 50 until 1944. Consequently, by the autumn of 1942, the Ministry of Aircraft Production had become so concerned at the production rate that it appointed an industrial panel comprising three non-aviation specialist executives to carry out an investigation into the company. The panel issued its report on 24 September 1942, concluding that GAL had severely overestimated its own capacity to meet the contract and that its original predictions were wildly ambitious.

Inadequacy among the GAL senior management meant the main sub-contractors responsible for component manufacture, principally the Birmingham Railway Carriage and Wagon Company and the Co-operative Wholesale Society, could not achieve production targets through lack of materials and fixings. On 28 July 1942 the ministry set up the Hamilcar Production Group, which effectively



The GAL50 was a half-scale prototype of the Hamilcar. Serial T-0227 crashed at the end of its maiden flight in September 1941. KEY COLLECTION

assumed control of the sub-contractor framework. The capability of General Aircraft was further scrutinised by the Select Committee on National Expenditure, which was desperate to obtain a copy of the report prepared by the members of the industrial panel.

Nevertheless, glider manufacturing as a whole steadily increased as the war progressed, as suggested in a 1943 munitions report by the Minister of Aircraft Production: "By the end of 1942, 629 had been delivered, on an original order of 2,400, which has now been reduced to 1,575 (706 this year and 240 in 1944) bringing it into line with a revised War Office requirement of 985 this year and 645 in 1944, subject to review in June 1943. The heavier operational Hamilcar has just begun to appear, 120 being scheduled for delivery by the end of this year, and the balance of the total order of 194 in 1944."

Despite improvements and additional administrative resource, the poor performance of General Aircraft remained restrictive. Only 344 Hamilcars had been completed by the time production ended in 1946.

A beautiful study of a No 644 Squadron Halifax towing a Hamilcar I. INTERNATIONAL BOMBER COMMAND CENTRE

IN SERVICE

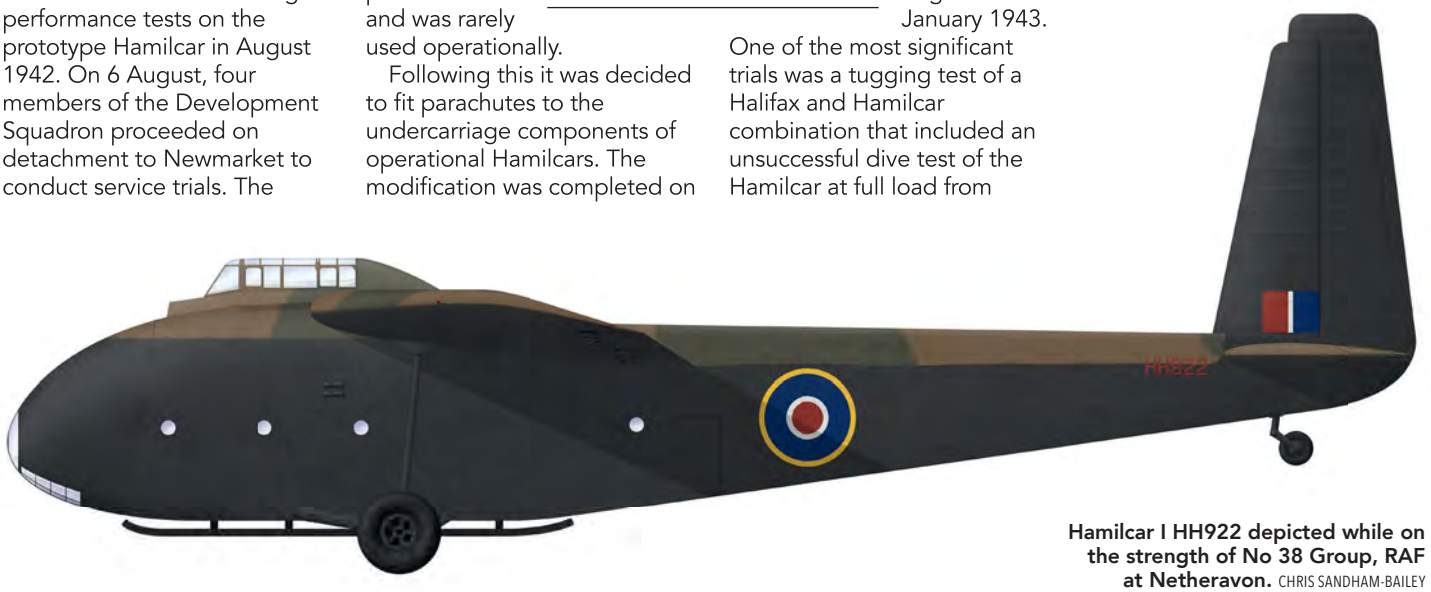
The Airborne Forces Experimental Establishment was tasked with undertaking performance tests on the prototype Hamilcar in August 1942. On 6 August, four members of the Development Squadron proceeded on detachment to Newmarket to conduct service trials. The functionality of the Hamilcar was soon under evaluation and on 18 August a conference was held to discuss the procedure for the jettisoning of its undercarriage. Both the Horsa and the Hamilcar had the capability to jettison their undercarriages to reduce drag and increase their effective operational towed range, but the procedure proved problematic and was rarely used operationally.

> "The poor performance of General Aircraft remained restrictive. Only 344 Hamilcars were completed"

Following this it was decided to fit parachutes to the undercarriage components of operational Hamilcars. The modification was completed on 3 September and the first tests of this installation were conducted at Newmarket the next day. Final service trials went ahead there on 8 September, but the Hamilcar was damaged owing to the collapse of the undercarriage during take-off.

Poor weather hampered performance trials in late 1942 and further testing began in January 1943. One of the most significant trials was a tugging test of a Halifax and Hamilcar combination that included an unsuccessful dive test of the Hamilcar at full load from 10,000ft. It was recorded that, on landing, the nose door opened and was consequently ripped off, which caused damage to the glider's wings and fuselage.

On 2 July 1943 the British Air Commission in Washington extended an invitation, on behalf of the Ministry of Aircraft Production, to the US Department of Agriculture for representatives of the Forest Products Laboratory to visit England. The exchange was for the purpose of "strengthening the present collaboration



Hamilcar I HH922 depicted while on the strength of No 38 Group, RAF at Netheravon. CHRIS SANDHAM-BAILEY

between our two countries on researches into the uses of timber in aircraft construction", and a report entitled 'The Use of Wood for Aircraft in the United Kingdom' was published in June 1944.

"The specific aspect of interest in relation to the Hamilcar", it said, "was that the US delegation conducted a visit to General Aircraft Limited to analyse the techniques utilised in its construction. The most significant aspect of this evaluation was that the Hamilcar had been designed by means of mathematics alone and consequently the aircraft had undergone little or no prototype trial before issue to the Airborne Forces Experimental Establishment for performance tests and modifications". Although the report recognised that the manufacturing techniques were the most effective then available, it did consider the Hamilcar to be "slightly above the best size for an all-wood construction from the point of view of maximum strength for the weight."

Following modification the Hamilcar design proved technically successful. However, the difficulties associated with production and supply severely limited the type's use on military operations. It was only employed on three occasions. The first was during Operation 'Tonga', the British airborne contingent of Operation 'Overlord', from 5-7 June 1944. Some 30 aircraft delivered a variety of support vehicles, artillery and Tetrarch light tanks.

On 8 June the British War Cabinet's weekly résumé reported how airborne forces had been dropped in darkness during the early morning of 6 June: US troops in the south-east of the Cotentin Peninsula, where they took Ste-Mère-Église and St-Martin, and British troops east of the River Orne, where they captured intact two bridges over the river at Ranville. "About 1,300 transport aircraft and 147 gliders were employed in this operation, which was reinforced on the evenings of the 6 and 7 when over 1,000 transport aircraft and a large number of gliders were employed; 33 transport aircraft are missing from these operations."

The first prototype Bristol Mercury-powered Hamilcar X, LA704. KEY COLLECTION

Despite their fearsome cargo capacity, Hamilcars accounted for less than a third of the total British gliders deployed. The second operation in which the type took part was 'Market Garden' in September 1944, when 27 examples supported the 1st Airborne Division. Finally, 48 Hamilcars were used on Operation 'Varsity' during the Rhine crossing in March 1945.

The high all-up weight of the Hamilcar resulted in numerous incidents during operational deployments, including engine failures of tug aircraft en route that resulted in the gliders being forced to cast off before they reached their objective. Even when it was located, the Hamilcar was such a large, slow-moving aircraft that it was an easy target for anti-aircraft fire. Overall, less than a third of those manufactured were used operationally.

INSIGHTS

Scientific research was conducted at the Royal Aircraft Establishment during late 1941 into the problem of keeping glider landing speeds as low as possible during the delivery of troops and supplies to the battlefield. In the case of the Horsa and Hamilcar the aircraft were equipped with substantial, pneumatically controlled flaps supplied from compressed air bottles.

In his memoirs, *Arnhem Lift*, Glider Pilot Regiment member Sgt Louis Hagen described the importance of using the flaps during Operation 'Market Garden' missions: "Half flaps down and our gliding angle steepens suddenly. Another fifteen degrees to starboard and we are just about over our landing area. Full flaps down and our nose is now pointing directly to the ground. The flaps keeping our speed constant and just above stalling speed."

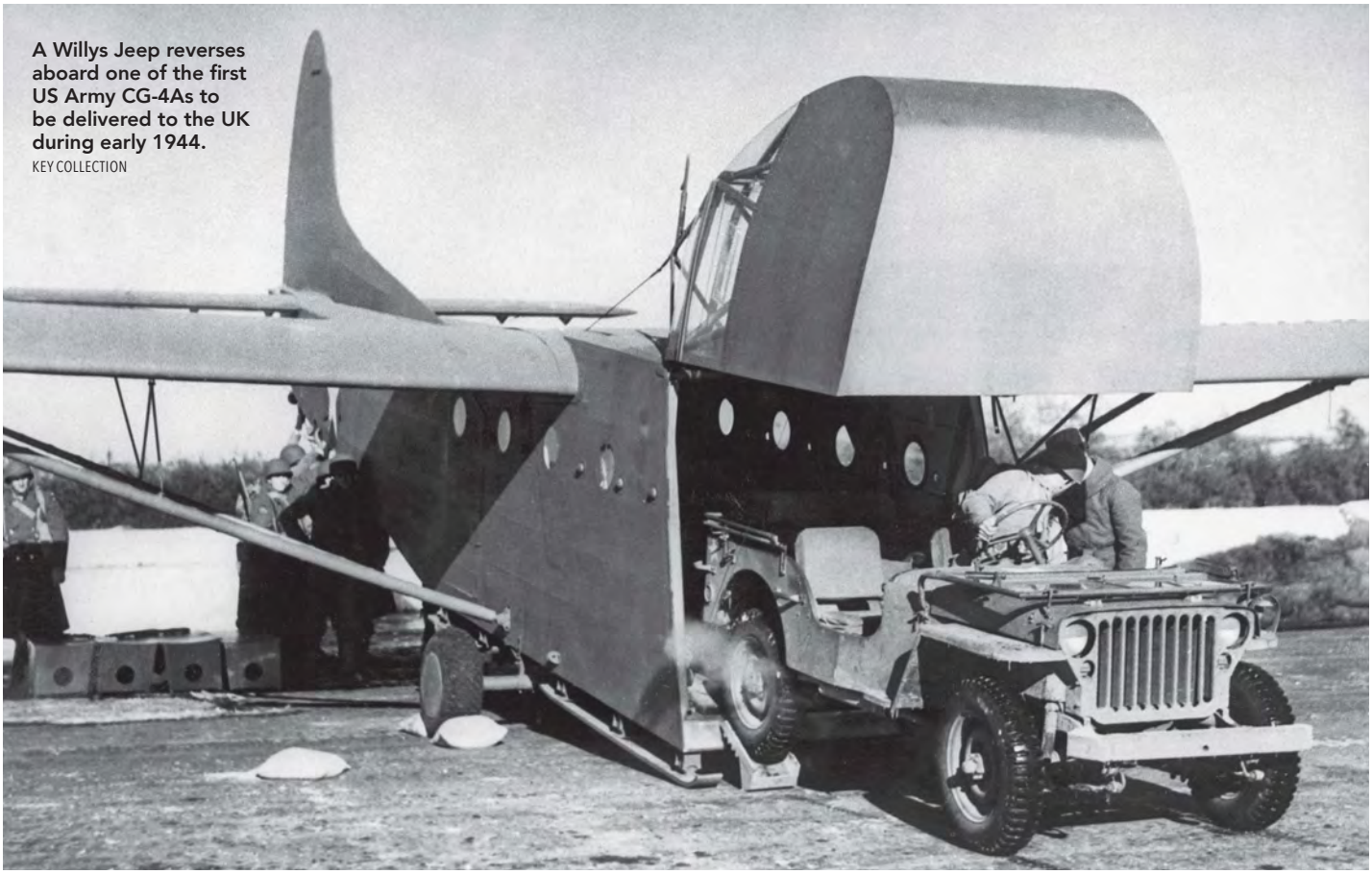
A more ambitious technique was investigated by Owen and Young, two aeronautical engineers based at Farnborough. The concept was based upon the ignition immediately prior to landing of cordite charges which would act as an injector, channelled through ducts in the wings. The air could then be manipulated to flow over the flaps and subsequently sucked over the ailerons to maximise lift and thus reduce landing speeds.

Following wind tunnel tests to ascertain the practical arrangement of duct designs, a scheme for large-scale investigation was recommended. However, research was abandoned after it was realised that the results would not be ready in time to allow full production to commence. The introduction of such an accelerant into the structure of a wooden wing root does appear ambitious but it is a good example of the type of solutions envisaged in the development process, however impracticable they were operationally.

The all-up weight of the Hamilcar and Horsa made them most vulnerable during take-off. Therefore, the RAE undertook experimentation with rocket assistance in an attempt to alleviate the forces expended on the tug aircraft, when engine oil temperatures were found to increase disproportionately. The rockets were attached directly to Horsas and Hamilcars in order to increase take-off speed simultaneously with the tug aircraft. Trials took place during 1943, and although deemed successful it was noted that the technique required further significant technological development. It was never used operationally.

Post-war, the utilitarian design of the Hamilcar afforded the simple installation of two Bristol Mercury engines, through which it became a powered freighter, known as the MkX and first flown in February 1945. The introduction of such powerplants did not alleviate the requirement for a Halifax tug aircraft completely, but it did mean that once the desired altitude had been reached the engines could be throttled back for economy, and a Hamilcar X and Halifax tug combination could provide an operational range of more than 600 miles. *Flight* envisaged "that the Hamilcar X might be very useful to a civil concern" pending the availability of Halifaxes. Unfortunately, neither military nor civil operators took it up, probably due to the introduction of dedicated airlifters such as the Bristol 170.

WACO CG-4A



A Willys Jeep reverses aboard one of the first US Army CG-4As to be delivered to the UK during early 1944. KEY COLLECTION

DEVELOPMENT

The Waco CG-4A was the standard military glider for US airborne forces and was used on a number of occasions by British airborne troops following the policy of shared materiel resource that existed throughout the war. Flight tests and training were conducted throughout 1942 and the aircraft was first deployed operationally in Sicily during July 1943. In British service the glider was named the Hadrian in keeping with the existing series of names based on warriors from antiquity — Hotspur, Horsa and Hamilcar — and was first received at the Airborne Forces Experimental Establishment on 21 February 1943 for flight trials.

However, unlike its British counterparts the Hadrian's fuselage was of tubular steel construction, while the wings were manufactured from wood. The aircraft could accommodate 15 troops or carry a variety of cargo such as a Jeep, artillery pieces or motorcycles. It was designed with two different types of undercarriage configuration. The first was known as 'training gear' and comprised wheels with pneumatic tyres, hydraulic brakes and spring oleo shock absorbers. The 'tactical' landing gear could be jettisoned after take-off in a similar way to the early Horsas.

The nose of the Hadrian was hinged to aid the loading and unloading of cargo and comprised an ingenious system for the efficient delivery of a Jeep. This was operated by means of attaching a cable and pulley system from the nose of the glider to the rear bumper of the vehicle. When the Jeep was driven forward the movement pulled the nose of the glider up and automatically uncoupled when it had left the airframe. Naturally, the nose could be opened and closed by hand when accommodating alternative cargo.

Production of the CG-4A was far in excess of its British counterparts, with more than 12,000 manufactured by a variety of different companies including the Ford Motor Company. Its plant in Kingsford, Michigan alone turned out some 4,190 examples. There were several efforts at building powered versions, of which only the Northwestern Aeronautical Corporation's PG-2A, with two Ranger L-440-7 radial engines, reached limited production — to the tune of just 10 units. Meanwhile, a derivative of the standard CG-4A glider was the CG-15, with a shorter wingspan, better aerodynamics and other refinements, one significant result of which was a higher towing speed. Some 473 examples were built.

C-47s and CG-4As training at Oujda, French Morocco, on 17 June 1943, less than a month before the invasion of Sicily. US ARMY

IN SERVICE

Following the conquest of North Africa, the Allies turned their attention to the capture of Sicily and Operation 'Husky'. The invasion plans included the deployment of vastly increased numbers of airborne troops to be used in the capture of key obstacles such as bridges and road junctions in advance of the seaborne landings. Although the objectives in Sicily were far better-suited to airborne assault than those previously attempted in North Africa, a

CG-13A: LARGER, HIGHER, FASTER

When the US Army sought a larger successor to the CG-4A, Waco's XCG-13 was among the contenders. Able to accommodate 30 people (or 42 with an extra row of benches in the fuselage), reach a top speed of 175mph, attain a maximum altitude of 12,000ft and carry loads of up to 10,200lb, it was flight-tested in 1943 and ordered for production, by now fitted with a tricycle undercarriage. Some 135 examples of the CG-13A were built by Ford and Northwestern Aeronautical, but the type took part in just one operational mission, a single example joining six CG-4As to deploy artillery and Jeeps to Aparri in the Philippines during the battle for Luzon in June 1945. Supporting the 11th Airborne Division, this had the distinction of being World War Two's last glider-borne operation, and the only one in the Pacific theatre. Small numbers found their way to Europe: the 313th and 349th Troop Carrier Groups, part of IX Troop Carrier Command, had CG-13As on strength, while two such machines came to the UK's Airborne Forces Experimental Establishment for trials. ***Ben Dunnell***

CG-13A KL163, named *Wee Maggie*, during 1945's trials with the Airborne Forces Experimental Establishment. KEY COLLECTION

lack of tug crew training and preparation once again resulted in high — and, at first, irreplaceable — casualties.

The British airborne contingent for the operation was increased to include the entire 1st Airborne Division supported by the 1st Airlanding Brigade. The latter's objective was initially the capture of the Ponte Grande Bridge, which spanned the canal at the entrance to the sea port of Syracuse. Once secured the brigade was expected to take and secure the entire port in anticipation of the arrival of the seaborne forces.

Some 2,000 men from the brigade embarked from North Africa on the evening of 9 July 1943 in Horsas and Hadrians, towed by C-47s from the USAAF's 51st Troop Carrier Wing and a small detachment of aircraft from No 38 Wing, RAF. However, despite having the honour of spearheading Operation 'Husky', adverse weather conditions and inexperienced tug crews ensured that the initial landings resulted in tragedy, with many releasing their gliders too far from the coast. British forces experienced greater success when they next employed the Hadrian during Operation 'Thursday', the airborne element of the second Chindit campaign in Burma during March 1944.

In US Army service the CG-4A was utilised during airborne operations in Sicily, North Africa, Burma and Europe. On D-Day the Waco machines flew on Missions 'Chicago' and 'Detroit' in support of the 101st and 82nd Airborne Divisions respectively. The missions each comprised 52 gliders making pre-dawn landings, carrying a mixture of supplies and air-landing troops in support of the parachute forces. An additional 208 gliders, including Horsas flown by American pilots, were flown in on the evening of 6 June to provide additional support, and further supply missions were carried out the following day. During Operation 'Market Garden', approximately 1,800 American gliders were despatched into the Netherlands, and a further 900 took part in Operation 'Varsity' in March 1945, in what became the largest airborne lift of the Second World War.

The CG-4A could be used on tasks that were unsuitable for its British counterparts, such as supplying resistance fighters in Yugoslavia. Perhaps the most famous operation associated with the type was the rescue from New Guinea of some of those on board C-47 42-23952 *Gremlin Special*. The Skytrain crashed into a mountain during a pleasure flight over the Shangri-La valley on 13 May 1945, leaving three survivors stranded at the foot of an isolated valley. CG-4As were landed in the valley, loaded the survivors, and were recovered via the 'snatch' technique to the safety of their base in Hollandia.

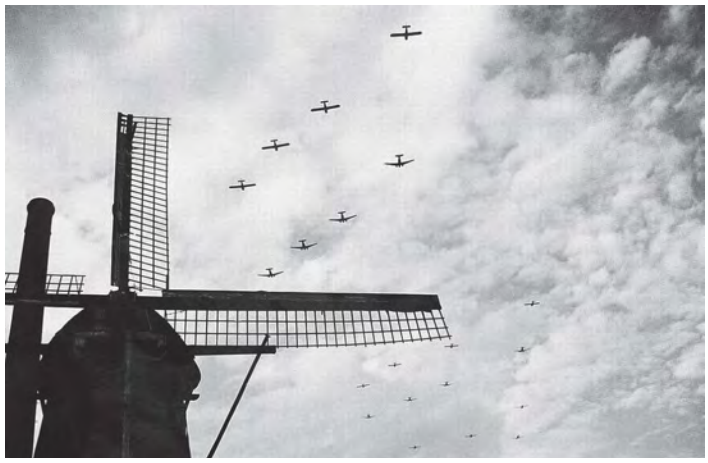
Following the type's brief service career with the British airborne forces, the operations records book for No 9 OTU recorded on 30 November 1945 that 17 Hadrians had been accepted by the unit and prepared for long-term storage, while a further 10 arrived the following month. Policy dictated that the majority of airframes were stored in the open, and consequently damage was sustained by 19 gliders during high winds on the night of 29-30 January 1946. The remainder were eventually scrapped by civilian engineers from Airspeed on 31 October 1946. The Waco gliders soldiered on a little longer with the post-war US Air Force, some ski-equipped CG-15A versions seeing service on Arctic research missions.

At the end of June 1943, the initial Hadrian I for the RAF, FR579, completed the first trans-Atlantic flight by a glider when it was ferried on tow behind a Dakota. On board the Hadrian, named *Voo-Doo*, was more than 3,300lb of cargo including medical supplies for the USSR. KEY COLLECTION

INSIGHTS

The CG-4A, unlike the Horsa or Hamilcar, was light enough to be recovered from a landing zone by means of a 'snatch' if it could be sufficiently repaired to airworthy condition in the field. The method involved the erection of a scaffold in front of the glider with the tow rope draped across the top. A C-47, modified to include a piece of apparatus similar to the

A famous June 1944 image of CG-4As beginning their descent into the Normandy bocages, having just been released by their C-47 tugs.
NATIONAL ARCHIVES AND RECORDS ADMINISTRATION



En route to the 'Market Garden' Arnhem landings, C-47s and CG-4As fly over the southern Dutch town of Bergeijk.
NATIONAL ARCHIVES AND RECORDS ADMINISTRATION

arrester hook used by naval aircraft for landing on carriers, could fly in low and snatch the rope to retrieve the glider. This method was used to evacuate wounded from the battlefield. The Airborne Forces Experimental Establishment even trialled the technique for the Horsa using a Dakota tug in early 1944, but it was deemed impractical.

> "The CG-4A was light enough to be recovered from a landing zone by means of a 'snatch' if it could be repaired"

Following limited success in Normandy, an American service detachment successfully repaired and marshalled serviceable gliders on purpose-built airstrips around Son and Grave ready for retrieval by C-47s in the aftermath of 'Market Garden'. However, despite the efforts of the American engineers, inclement weather greatly hindered the recovery operation and the strips were soon waterlogged. By 18 December 1944 the engineers had successfully recovered 199 gliders from the Eindhoven area, 59 had been marshalled ready to fly away and were awaiting recovery, and it was estimated that 112 would be ready by the following day. A further 15 CG-4As were considered sufficiently repairable and would be ready for recovery in the next week.

Despite the dedication shown by IX Troop Carrier Command to recover equipment, Col Price stated in a report after visiting the airstrips that, "only a small percentage of the gliders retrieved in this manner were operational when landed back at a Troop Carrier Command base. Some of the gliders developed flutter in the wings and tail surfaces and were aborted before they reached their destination". In total, official figures show that 485 US military glider pick-ups were carried out in the course of 27 different operations, most of them during 'Market Garden' and 'Varsity'.

PICK-UP LINES: THE VIEW FROM THE COCKPIT

With a small fleet of five Dakotas and Hadrians, the RAF's Glider Pick-up Unit had only a brief existence. Formed at Zeals, Wiltshire, in January 1945, it transferred to Ibsley, Hampshire during March. A final move to Ramsbury, Wiltshire took place on 29 October, but it disbanded on 15 November.

The technique was both rudimentary and dramatic. Two poles, about 15ft high and firmly secured, had a cable draped between them and then extended out from the poles to the waiting glider, forming a triangle. The idea was for the Dakota to fly across the field at about 20ft with its hook trailing and snatch the suspended cable, so scooping up the glider. As the slack was taken up, the nose of the glider would go down and the tail rose before leaping into the air. The strain on the glider was great, as was that on the Dakota. The glider would have weighed in at around a third of the tug aircraft's own weight.

RAF Dakota III TS434 about to snatch a Hadrian II. *AEROPLANE*

For training purposes, the Hadrian was ballasted with concrete blocks to represent an operational load. Having successfully snatched the glider into the air, the trainee pilot would complete one circuit before releasing his charge and returning to his home base.

Then in training on the Dakota with No 1336 Transport Support Conversion Unit at Welford, Berkshire, Jim Tilley found himself at Ramsbury on 30-31 October 1945. He said, "I was always glad to be in the 'Dak' and not in the glider! We had to watch for the fall-off in speed as we made the snatch. Within six to seven seconds the waiting glider, at the other end of the tow line, would go from stationary to over 100mph, becoming airborne quickly. There were horror stories of pilots who had lowered their hook and come down low too early, so that when they arrived at the practice field, they'd got an apple tree and two hawthorn bushes in tow…"

Steve Richards

ANALYSIS

The era of the troop-carrying glider came to quite an abrupt end

By the end of 1944, military strategists were beginning to believe that the assault glider would have little operational use post-war, particularly after the technological development of the helicopter. However, AVM Sir Conrad Collier — deputy air officer commanding-in-chief of Transport Command — believed they could still serve on certain airborne operations, but only when the destruction of more valuable aircraft types could be negated. "Gliders have a strong claim to employment and survival for special airborne operations", he wrote. "Even if helicopters could be developed capable of landing and rising vertically, it might still be found more economical to use gliders at points where enemy action could be expected to cause the destruction of the majority of craft affecting the landing. On the other hand the glider is less economical than the powered aircraft for normal air supply operations, provided that powered aircraft are available which can carry the same bulky equipment as gliders. Eventually it may be found that development of the parachute or of the rotor may enable us to land bulky equipment and numbers of troops by means of parachute and rotor. Developments of this sort would constitute a threat to the survival of the glider."

The Allied assault gliders had an operational life of little more than two-and-a-half years. Small-scale training was undertaken in Britain during the immediate post-war era, but mainly for experimental purposes once the refinement of the helicopter began in earnest. Questions were raised in parliament in February 1947 as to the fate of the remaining gliders and whether they had been considered for use by the Air Training Corps, sale into private hands, or breaking-up for materials. The Secretary of State for Air, Philip Noel-Baker, said, "Since the end of the war, 1,295 gliders belonging to the Royal Air Force have been declared surplus to our needs, and 982 have been scrapped on the authority of the Ministry of Supply". Baker confirmed that a further 300 had been bought on the private market for use as gliders, but that the sale for raw materials had proved difficult as they contained "very hard laminated plywood which takes a great deal of labour to break down and is almost unsaleable, even as firewood."

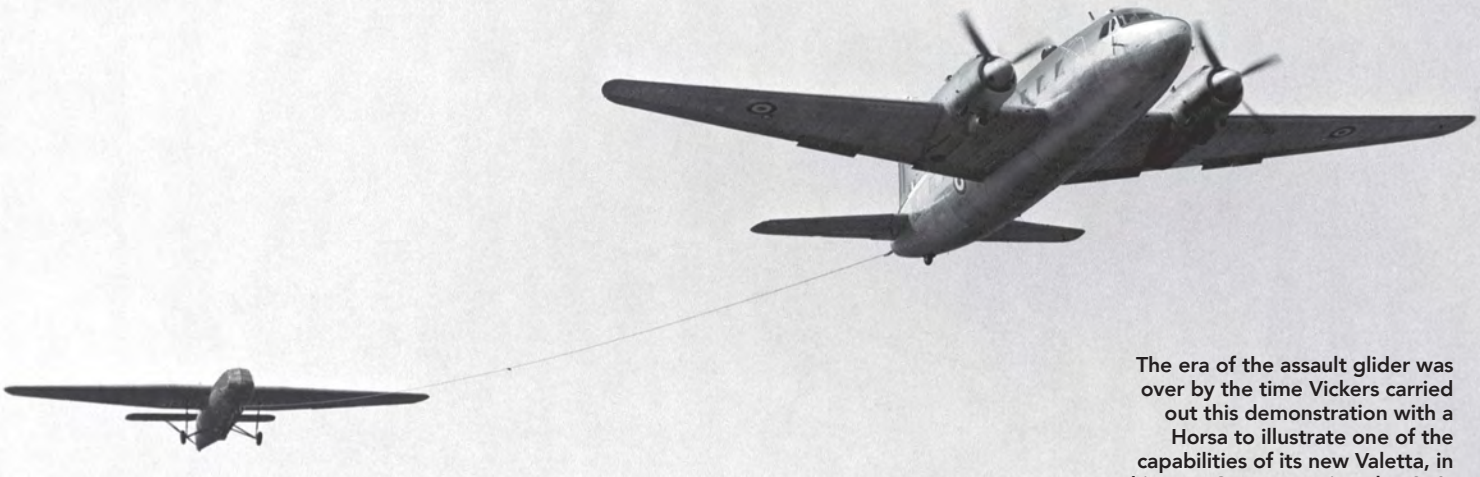
> "AVM Collier believed gliders could still serve on operations, but only when the destruction of more valuable aircraft types could be negated"

Despite the difficulties of breaking the gliders up for materials a contractor from Southbourn, Hampshire, experimented with converting Horsa fuselages into houses in 1947 in order to combat housing shortages. There are many examples of glider fuselages becoming containers for storage purposes. US Air Force use of CG-4As continued for a few years more, but only on a limited basis, for again the type's usefulness was at an end.

Despite the relatively high production figures of all British glider types, very few were saved for posterity, and there sadly remains a gap in museum collections when it comes to complete examples. The Army Flying Museum at Middle Wallop has Horsa I LH208 (marked as KJ351) and a substantial section of Hamilcar I TK777. By contrast, numerous CG-4As have survived.

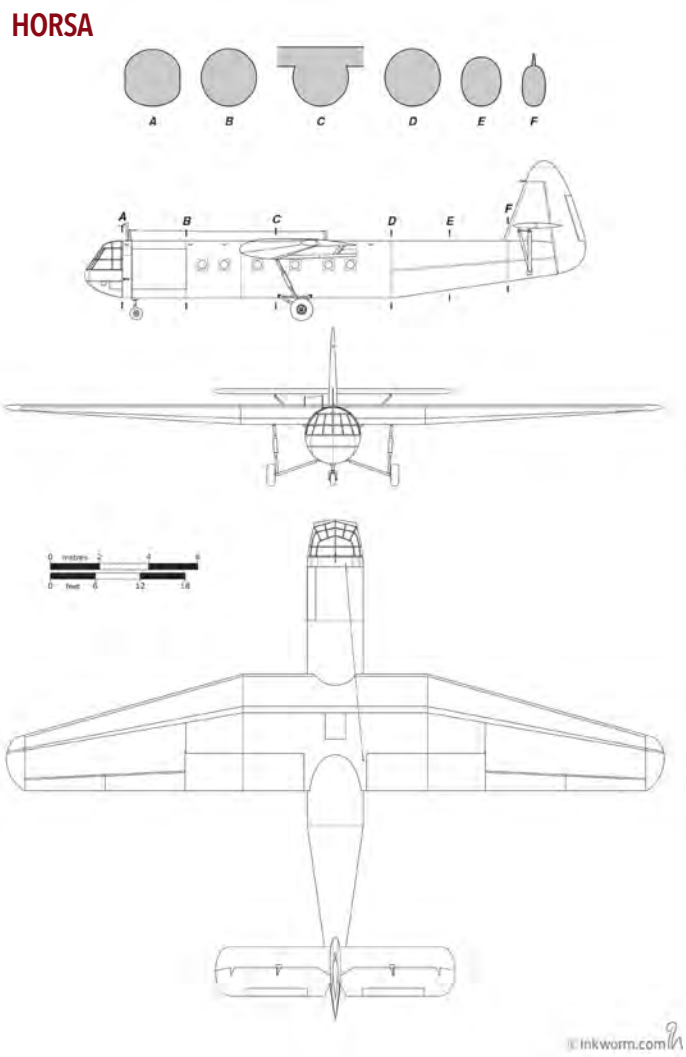
SPECIFICATIONS

	Wingspan	Length	Passengers	All-up weight	Military load
Horsa	88ft (26.8m)	67ft (20.4m)	29	15,500lb (6.9 tonnes)	6,900lb (3.1 tonnes)
Hamilcar	110ft (33.5m)	68ft (20.7m)	40	36,000lb (16.1 tonnes)	17,000lb (7.8 tonnes)
Hadrian	83ft 8in (25.5m)	48ft 4in (14.7m)	15	7,500lb (3.4 tonnes)	3,750lb (1.7 tonnes)

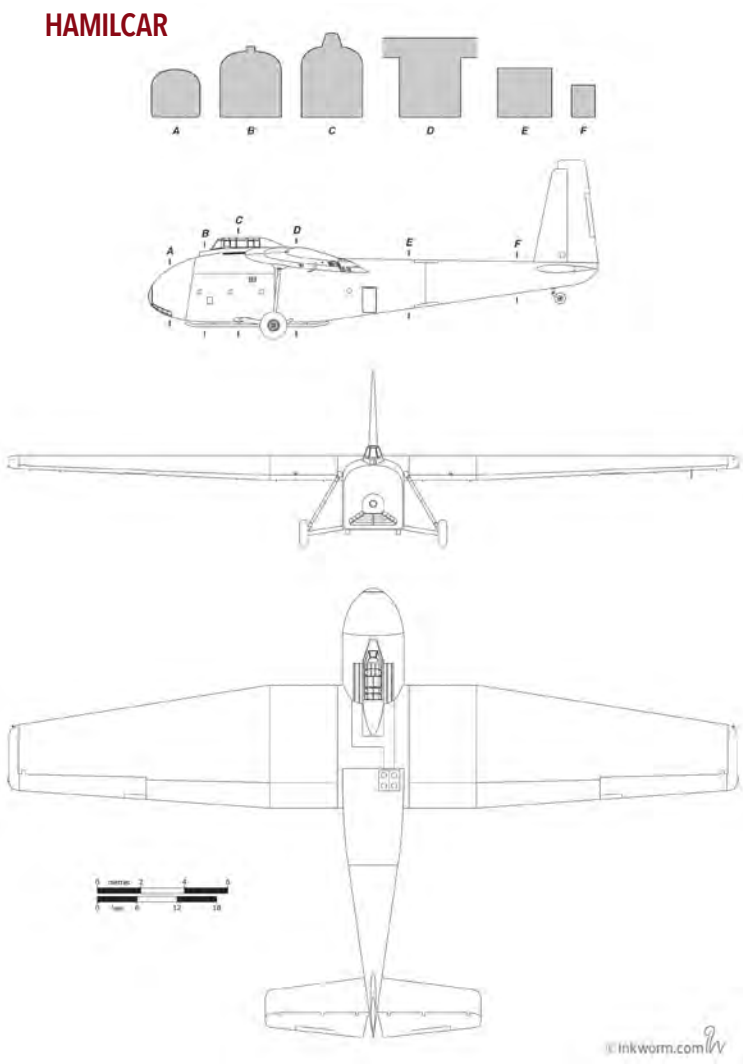


The era of the assault glider was over by the time Vickers carried out this demonstration with a Horsa to illustrate one of the capabilities of its new Valetta, in this case C1 VW161, in July 1950.
KEY COLLECTION

HORSA



HAMILCAR



CG-4A