Austere Recovery of CARGO GLIDERS

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DOD (Klosterman)

Glider pilots receive final instructions before takeoff on D-Day plus 1

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Cargo gliders and their recovery technique offer proven capabilities that can revolutionize tactical sustainment. The technique also provides comprehensive expeditionary resupply that is fast, safe, and economical. This technology overflies the improvised explosive device threat as well as terrain lacking sufficient airports, seaports, and roads. Improving the speed, range, and efficiency of resupply hastens operational success and reduces casualties and materiel loss.

The increasingly nonlinear expeditionary battlefield stretches current resupply capabilities, including the entire seabased supply chain; rotorcraft ranges, capacities, and speeds; and tactics involving beachheads and ground convoys. The ship-to-objective maneuver and distributed operations of expeditionary maneuver warfare are effective vanguard multipliers to frontline strategies. However, the security, operational availability, throughput, timing, and expense of their rearguard logistical support are issues when considering counterstrike, maintenance, higher elevations, and weather. Resupply across the "last tactical mile" to the warfighter is a challenge for tactical heavy airlift. The issues include unsecured lines of communication, seabase connectors, and unsophisticated ambushes.

The surprising delivery vehicle proposed for these challenges is derived from the World War II U.S. Army Air Force Cargo Glider, which predates helicopters, precision technologies, and intelligence preparation of the battlefield. Cargo gliders are usually remembered for their invasion application, and those aboard have earned a respected place in military history. While the system's delivery effectiveness during early vertical invasion remains an emotional topic, the modern logistical implications of a cargo glider system were unrecognized until now. Cargo gliders were a multiplier to air cargo transport, and they can be considered an austere transport capability when combined with an effective operational recovery technique.

This article discusses a launching technique that was used more than many realize. With reconsideration, it could become a modern force multiplier. Herein the incomparable U.S. snatch pickup history is described from a systems engineering viewpoint, with two World War II pilots, Gerald Berry and Lee Jett, providing invaluable insights. Right out of flight training, they became specialized tow pilots. The experience of these and other tow pilots offers fresh insight into the use of a historical system. It is given from the perspective of snatch pickup recovery. Its influence on the development of the largest cargo gliders is described, and a future concept is conceived.

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Snatch Pickup

The Marines first demonstrated aerial snatch pickup with leather dispatch bags in 1927 using a surplus World War I DH–4 biplane.[1] The All American Aviation Company, directed by Richard DuPont, applied this technique to rural airmail pickup in the 1930s.[2] In 1941, the glider snatch was developed using towlines made of DuPont Corporation's nylon. Escalating through heavier sailplanes, this technique transitioned in 1942 at the Army Air Corps test and experimentation facilities near Dayton, Ohio, for postinvasion cargo glider recovery. There, an Army Air Corps captain, Lee Jett, learned from a great test team, refining the technique by experimentation.

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Jumping ahead to England in the spring of 1944, newly arrived C–47 pilot Lieutenant Gerald "Bud" Berry was qualified in 1 day with three snatch pickups. He made the first Normandy snatch pickup above an austere field in an airplane called a tug. Its pickup arm extended a steel cable and hook to catch the glider's towline. The ground station had two poles with the towline looped tightly between them. The towline was caught and the winch onboard the tug paid out steel cable for several hundred feet. A preset clutch slowed and then stopped the cable payout. The reusable nylon towline stretched under the load. The glider accelerated 0.7 G into tow in 6 seconds.

The tug's climb got the glider airborne quickly, primarily so they could both clear obstacles. The glider could climb faster than the tug. Lee Jett described a training incident in which an inexperienced glider pilot nosed too high during snatch climb out. The cable contacted and momentarily raised the tug's elevator. The elevator fabric was damaged and later replaced. A pushbutton-activated pyrotechnic was devised for emergency cable separation.

Late in 1942, contracts were let for pickup equipment in the 8,000- to 16,000-pound range. A 1946 film of routine experimentation shows Jett snatching a 25,000-pound cargo glider.

Demonstration of runway takeoff with dual, towed cargo gliders occurred first at Wright Field, was later rehearsed before Operation *Neptune*,[3] and then was implemented in Operation *Varsity*. It is still occasionally performed with modern recreational sailplanes.

The sequential snatch of two gliders was demonstrated in July 1942. In the following years, Jett's expert crew was photographed transferring the towline off the winch between pickups.

At least three wartime glider factories had snatch pickup for production delivery. Jett performed some 2,500 cargo glider and non-glider snatch pickups stateside. It was routine for him to snatch gliders from fields after towline breaks, typically during cross-country transfers. Towline separation was the main problem during snatch pickup. Neither Jett nor Berry recalls ever missing the ground station, as less experienced pilots sometimes did. When another pilot repeatedly delayed recovery operations, Berry followed him in, surprising the glider's crew after the predicted miss.

In the field, 485 cargo glider snatch pickups were documented across 4 theaters, and in 19 months they concluded half of the 8 major combat missions. Table 1 is the first comprehensive snatch pickup list.

European Theater Operations. Lee Jett's legendary mentor, Major Lloyd Santmyer, was dispatched to North Africa for Operation *Husky* recoveries, but those gliders were no longer airworthy. Bud Berry towed one glider in Operation *Dragoon* but is unaware of any pickups in that operation. From table 1, of the total of 4,161 gliders sortied, 12 percent (485) were snatch recovered. Historians are surprised by this number and the variety of snatch pickups; the glider recovery infrastructure was initially discouraged on any significant scale in the European theater.

Waco CG–4A glider at National Museum of the U.S. Air Force

U.S. Navy Air Force

Table 1. U.S. Cargo Glider Operations and Snatch Pickup

Theater and Mission	Date	Glider Sorties*	Snatch Pickups
EUROPE			
Operation *Husky* (Sicily)	July 9, 1943	136	0
Operation *Neptune* recoveries (Normandy)	June 23–25, 1944	517	13
Operation *Dragoon* (Southern France)	August 15, 1944	407	unknown
Operation *Market Garden* recoveries (Holland)	October-December 1944, February 1945	1,900	256
Operation *Repulse* (Bastogne, Belgium)	December 26–27, 1944	61	0
Remagen medical evacuation (Germany)	March 22, 1945	2	2
Operation *Varsity* recoveries (Germany)	April 1945	906	148
CHINA-BURMA-INDIA			
Exercise recoveries	January 9, 1944	16	16
Two covert actions (Chindwin, Burma)	February 28–29, 1944	5	1
Operation *Thursday* (Burma)	March 5–11, 1944	97	2 (R†)
Prisoner capture (Inywa, Burma)	March 11, 1944	4	3
Six delivery sites (Burma)	March 18–May, 1944	55	0 (R)
Medical evacuation, LZ Aberdeen (Burma)	March 21–22, 1944	6	1 (R)
Chindits ambushed (Mandalay, Burma)	1944	5	5
Family evacuation (Burma)	September 1944	1	1
Operation *Capital* medical evacuation (Burma)	October 1944	25	25
Radar shipment (Mawlaik, Burma)	February 12, 1945	5	5
PACIFIC			
Operation *Gypsy Task Force* (Philippines)	June 23, 1945	7	0 (R)
"Shangri La" valley rescue (New Guinea)	July 2, 1945	3	3
ARCTIC			
Alaska rescue	December 14, 1948	1	1
Greenland ice cap rescue attempts	December 17 and 25, 1948	2	3
TOTALS	27 Missions/Operations	4,161	485

* Each mission's count. Missions successfully securing a runway did not require snatch pickup.
† *R* denotes missions that successfully secured a runway; snatch pickup was not required.

Later, based on the return (or rather the lack of return) after Operations *Neptune* and *Dragoon*, this policy was reversed for post–Operation *Market Garden* in the first large-scale attempt at recovery. Unfortunately, an October 1944 storm wrecked an additional 115 gliders earmarked for pickup. Then the Battle of the Bulge suspended Bud Berry's work. His squadron delivered 50 gliders for Operation *Repulse* in a wholly successful resupply landing at Bastogne. Those gliders absorbed ground fire, and the ensuing conditions meant Berry's recovery skill was unneeded. His other theater "first" was a combat medical evacuation of a glider ambulance at the Remagen bridgehead just prior to Operation *Varsity*. Otherwise, all European snatch pickups were postinvasion salvage.

China-Burma-India and Pacific Theaters. These theaters demonstrated novel cargo glider applications in successful invasion, transport, and rescue operations. The Army Air Corps had several special warfare groups before the official formation of the Air Force Special Operations Wings. Lee Jett helped train codename PROJECT 9 pilots in glider snatch prior to their departure to China-Burma-India (CBI). They became the 1st Air Commando Group and utilized 150 cargo gliders to perform a series of successful disruptive actions starting with Operation *Thursday*. They transported and supplied the British coalition Chindit army in preventing the Japanese invasion of India by establishing a series of forward operating bases hundreds of miles behind enemy lines.

Training experimentation developed a straight-in final approach from 200 yards out rather than the traditional four-leg pattern. In a preparatory exercise in January 1944, 16 gliders landed in an unexpectedly muddy landing zone (LZ) and were snatched out the following morning. Two gliders were recovered the next month in a covert insertion behind enemy lines.[4]

Two snatch pickups provided an emergency replacement bulldozer to resume constructing the temporary airstrip codenamed CHOWRINGHEE during Operation *Thursday* out of the Broadway LZ. In waiting for this nightfall delivery, the CHOWRINGHEE gliders were saved by being pulled into the jungle. This is notable in that they could have been dismantled and buried. CBI forward bases used conventional tows for surviving gliders off the recently established runway. Two damaged gliders left behind at

the successful but now abandoned CHOWRINGHEE field were strafed and set afire by a confused enemy. This played a part in delaying the discovery of the Broadway LZ. Later, five gliders out of Broadway delivered Chindit troops into a small clearing north of Mandalay. Anticipating this tactic, an enemy patrol surprised them. The Chindits immediately engaged them in a fierce firefight. Meanwhile, the circling tow planes dropped in low to release tow ropes. The gliders were hastily turned around and ground stations were assembled. Troops and crew reboarded the gliders and all aircraft escaped.[5] An undocumented mission resulted from a British officer's request to evacuate his Burmese family, who were at risk from routed enemy stragglers. Under a sniper threat, this snatch pickup took place from the jungle road in front of their home.[6]

Gliders compiled impressive statistics moving brigades, battalions, and supplies in combat. It was common during conventional transport for the CG–4A model to gross around 9,000 pounds, or 38 percent beyond rated payload capacity. CBI towlines failed when their dual towed, significantly overloaded gliders surged simultaneously during descent over mountains. Nor did glider designers envision an unusual payload with airlifted armies. Thousands of pack animals were transported, including horses, mules, and bullocks. CBI casualties were typically evacuated by C–47, light plane, and once in an R–4 helicopter. But in Operation *Capital*, 2 tugs towed 4 gliders to deliver 31,000 pounds of materiel and, in 25 snatches, evacuated 123 casualties from a location codenamed KATE.

The final documented CBI snatch pickups were at a shipping-receiving location by a river bank. It was easiest to bring gliders to the cargo and then snatch them for delivery to a radar installation.

Operation *Gypsy Task Force* would have had gliders depart by conventional runway tow rather than snatch pickup. The well-publicized "Shangri La" valley rescue used snatch pickup to extract crash survivors in the far inland jungle at a 5,000-foot elevation near hostile territory.

Arctic Rescues. Postwar arctic rescues used cargo gliders and snatch pickup. CG–15A models had winterized conversions. Snatch pickup was demonstrated on the (presumed frozen) Arctic Ocean likely as part of a training exercise. There were two separate arctic rescue operations in December 1948. In Alaska, the pickup of six men from a downed transport was a successful historical footnote. Interestingly, the Greenland ice cap pickups were not successful.

On December 7, 1948, an Air Force C–47 crash-landed in the Greenland interior at 8,000-foot elevation without injury to the crew.[7] The first rescue plane crashed. Next a glider was delivered. In 30 minutes, its crew set up for snatch pickup, but the towline snapped just as the glider became airborne. A second snatch repeated the problem. High winds destroyed the glider overnight.

On Christmas Day, a second glider failed again when its nose was destroyed by towline whip-back. The still-uninjured survivors and rescuers were finally evacuated after 3 weeks by a ski-equipped C–47 using jet-assisted take-off rockets. Unlike the powered aircraft, there is no official accident report for the two gliders, so why the towlines broke during the only documented snatch pickup failures remains a mystery.


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Left: Two-man crew of CG–4A glider
Above: Jeep is loaded aboard CG–4A before invasion of Holland

two damaged gliders left behind at the abandoned CHOWRINGHEE field were strafed and set afire by a confused enemy

Glider Evolution to Snatch Pickup

While not a discipline until after this era, the influence of systems engineering principles guided the evolution of the invasion glider toward austere recovery.

The CG–4A was the renowned World War II invasion glider, which was built by 16 prime contractors across the United States. The model was intentionally low technology so nonaviation manufacturing industries could convert to war production on a large scale. Many saw it as a vehicle for one-way delivery of Army infantry to unimproved landing zones, where the gliders would be abandoned. While, by aircraft industry standards, it was indeed a low-tech assembly with budget-conscious materials, the reality was much different than expected:


Courtesy Gerald C. Berry (Yves Tariel)

C–47 recovers CG–4 glider from Normandy landings

- The CG–4A had 70,000 parts.
- Subcontracting for those parts proved problematic.
- Many converted production industries failed to deliver useful quantities.
- Targeted production cost for disposable delivery was never achieved.
- Assault operations proved unexpectedly dangerous for still-maturing insertion tactics.
- The towline mounting was off-axis, inefficient in snatch pickup, and hence, reuse.
- One glider was snatch-recovered for every eight sorties. The majority of missions attempted it.

A significant majority of cargo gliders *did* deliver successfully to unimproved LZs. However, not much of military significance was recovered postinvasion. For many reasons, the high-volume European theater failed in large-scale retrieval:

- The invasion mindset did not contemplate reuse for the next major assault; each assault was to be the last.
- Effective countermeasures were employed.
- Gliders were treated akin to trailers; they were not assigned call numbers and were referenced by model number.
- While those forward would disagree, from a planning perspective, there was a robust supply of fresh inventory.
- Gliders landed intact within tree-lined fields, preventing the snatch maneuver.
- Components did not survive prolonged or harsh exposure to the elements and were scavenged by troops and locals.
- Thus, there was a dearth of snatch training and equipment for air and ground crew.

Nonetheless, glider snatch pickup did occur far more often and in more ways than expected in the other theaters. Follow-on glider development emphasized survivability and capacity. Assets that survived were reused. Consequently, greater pickup capacity developed in the last generation of cargo gliders as designers looked beyond the European theater.

The Pacific theater had less reliable lines of communication because of its topology. This had a significant influence on expeditionary logistics. Compared to the Atlantic and overland supply lines of Europe, the Pacific island-hopping depots had transfer complexity, as well as hostile and sea environment threats. An end link to that supply chain was larger capacity gliders than the CG–4A. Table 2 lists production cargo gliders by weight. It includes the two XCG–10 prototypes later converted into CG–10As.

The design of the CG–4A was good enough to press into wartime service. However, it and even its intended successors, the CG–15A and CG–13A, were not well engineered by modern standards. They were produced with unacceptable performance shortcomings. The baseline model for any modern comparison starts with the last and greatest production cargo glider model, the Laister-Kauffman CG–10A. The operational CG–10A was an impressive feat of engineering. It was high-tech for the day and produced by one vendor. Passing a mature test and acceptance process, at V–J Day the CG–10A was in full-rate production for the upcoming invasion of Japan. Features that were firsts for U.S. aircraft include:

- rear doors under a high tail
- strongest, lowest floor at the time
- landing gear to the sides of the fuselage rather than under the wings
- quadruple-disc hydraulic brakes

Table 2. Production Cargo Gliders by Weight

Model	Weight (lbs.)	Wingspan	Speed
CG–4A	3,500–7,500	83 feet, 8 inches	41–150 mph
CG–15A	4,000–8,035	62 feet, 2 inches	53–180 mph
XCG–10	7,980–15,980	105 feet, 0 inches	50–150 mph
CG–13A	8,900–19,100	85 feet, 8 inches	80–190 mph
CG–10A	12,000–32,000	105 feet, 0 inches	50–180 mph

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Jeep aboard CG–10A cargo glider

- capacity to carry a 2½-ton truck or 155-mm howitzer
- capacity to carry 60 paratroopers
- thick wing skin
- largest proven-successful, nearly all-wood aircraft (the only structural metal was in the nose for snatch pickup).

Epilogue

In all, the United States produced 14,471 cargo gliders. In-theater missions sent 4,161 gliders (including reuse). There were at least 485 in-theater snatch pickups. Hardly an exception, these were arguably routine. Attempts are known to have followed 17 of 27 missions and operations. (Details of any Operation *Dragoon* recovery remain unknown.)

After World War II, production terminated and development faded. Many in the glider production industry had actually envisioned a bright future in commercial passenger service, which never occurred. Lee Jett interviewed with a company called Winged Cargo, which hauled fresh produce in surplus CG–4As, but the company did not last. Rather, bulk transport turned to runway-based powered flight and air assault to helicopters. The Marines developed vertical envelopment in 1947. Helicopters overcame their practical shortfalls and continue to offer tactical precision in austere transport.

Likewise, the blossoming seabased supply infrastructure proved unjustified in light of ensuing expeditionary logistics. The Cold War established forward bases with invasion supply links typically less than 600 miles by sea. Combining the helicopter with forward land bases essentially masked their individual logistical disadvantages, including centralized depots, high maintenance, fuel consumption, and short delivery legs. This combination then effectively extinguished the expeditionary advantages of cargo gliders and snatch pickup in austere logistical transport.

The Future

This backdrop will hopefully encourage a rediscovery of the efficiency that the snatch pickup of cargo gliders offers. Expeditionary logistics is changing from the Cold War supply infrastructure. The seabase is replacing forward land bases. But the nonlinear battlefield is restrained by a resupply chain that remains linear. The stretching of the seabase's unsecured lines of communication and the restricted space afloat now expose those aforementioned supply chain disadvantages. The use of rotorcraft from the seabase is ideal for many aspects of expeditionary maneuver warfare, but not for comprehensive sustainment on the scale required of the seabase maneuver element. Modeling of the year 2015 seabase performance for value in technology improvement[8] has led to a seabase-centric connector concept. Then the search for similar military experience uncovered these insights into World War II accomplishments. Snatch takeoff roll distances are close to supply ship helipad dimensions even with multi-ton payloads. Sea motion is mitigated by a balloon intercept similar to the surface-to-air recovery system used in the 1960s.[9]

Preliminary Newtonian modeling of glider launch forces shows snatch pickup to be physically viable from flight decks, abeam across helipads, and even the littoral water surface. Performance modeling of seabased maneuver sustainment ashore using only snatch pickup of logistics gliders shows a capability from over two to four times the delivery requirement. Ashore, ever-increasing land clearing and development—including road networks, parking lots, sports fields, and stadiums—make glider landing zone selection less predictable, while amphibious landing locations and convoy routes become more so as those options decrease. Weapons effects used to be the limiting factor to the expeditionary battlefield. Now it is its logistical support to the warfighter.

As with any new heavy airlift system, snatch pickup of cargo gliders implies many novel interfaces between expeditionary air and ground logistics communities. It will be both a technical and cultural challenge to fit into these communities' missions. Overland and from the sea, modernized glider snatch—carefully reconsidered—augments austere cargo delivery in overlapping options for paradrop and air, ground, and water surface connectors. **JFQ**

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CG–4A converted to carry medical litters

NOTES

[1] Leon B. Spencer, "WWII U.S. Army Air Force Glider Aerial Retrieval System," available at <www.silentwingsmuseum.com/images/Web%20Content/WWII%20USAAF%20Glider%20Aerial%20Retrieval%20System.pdf>.

[2] Charles L. Day, *Silent Ones: WWII Invasion Glider Test and Experiment* (Lambertville, MI: CLD Publications, 2001); personal communications.

[3] Charles J. Masters, *Glidermen of Neptune: The American D-Day Glider Attack* (Carbondale: Southern Illinois University Press, 1995).

[4] R.D. Van Wagner, *Any Place, Any Time, Any Where: The 1st Air Commandos in WWII* (Atglen, PA: Schiffer Publishing, 1998).

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[6] Tim Bailey, "My Experiences as a World War II Glider Pilot with the First Air Commandos," *Silent Wings Museum Newsletter* (March 2001).

[7] John L. Frisbee, "Valor: Greenland Rescue," *Air Force Magazine* 81, no. 3 (March 1998), available at <www.afa.org/magazine/valor/0398valor.asp>.

[8] Gary S. Schebella, Sea Base Concepts of Operation and Logistics Technology Applications (Performance Analysis and Investment Strategies), JMS System Science Corporation, April 2006.

[9] G. Robert Veazey, "Surface to Air Recovery System, STARS," *Friends Journal* (Summer 1996).