

Gliders — Rethinking the Utility of these Silent Wings for the Next Millennium

by

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Introduction

Current options for forced-entry operations need a tune up as the tempo and diversity of threats to United States security interests shift from a bi-polar to multi-polar world. Parachute drops and air-assaults by helicopter endure as the only mechanisms for the airborne insertion of troops and equipment. Units equipped as such require an alternative capability to drive or expand doctrine as traditional airborne roles mesh with non-traditional missions and rapid reaction forces continue to constitute the vanguard of crisis management. The answer necessitates fielding a conceptual aviation design that integrates a genuine stealth capability; a simple, yet sophisticated fuselage economical to manufacture; payload dimensions capable of deploying tactical formations; and, a combat radius enabling it to strike over extended distances and terrain barriers. Such an aviation design integral to airborne forces once existed in the inventory of the U.S. Army — the glider. Combat-proven in diverse wartime missions accents the credentials of these silent wings and makes it an attractive candidate for contemporary procurement and deployment. It is the intention of this article to ponder the benefits and potential obstacles to reinstating a glider capability which in turn may stimulate a renaissance of learning with regard to this neglected mode of flight.

Military Background

Born out of myth as an outlet for genuine scientific investigation into the feasibility of human flight, gliding or soaring, as it is commonly known, emerged at the turn of the century as a pastime and competitive sport for the aviation enthusiast, domestic and international.¹ Overnight the trademark of this endeavor, the glider, evolved from a cottage industry to an entrepreneurial venture as manufacturing plants sprang up to fill orders as improved designs came on the market. The outbreak of the First World War stifled glider development though as production lines shifted to a wartime economy and the military demanded propeller-driven aircraft for front-line service. Consequently, interest in soaring waned as newspapers chronicled the heroics of aerial combat over the Western Front. After the war, many industrialists from the allied powers poured funds and expertise into the development of a competitive aviation industry dedicated to powered flight; a move that did little to restore the glider's pre-war reputation as research and development (R&D) focused instead on building high-performance aircraft. On the other hand, a defeated Germany — the cradle of modern glider development — used the art of soaring as the perfect subterfuge to circumvent the Treaty of Versailles.² Since treaty restrictions did not prohibit the operational use of gliders, the truncated Reichswehr under the leadership of General Hans von Seeckt sought to improve aeronautical technology and skill resources vis-a-vis subsidized R&D and civilian training programs; the goal: a cadre of pilots for a future air force.³ Inadvertently, the Allied Control Commission furthered this subterfuge when they relaxed the

most stringent treaty constraints in 1923, on aircraft manufacturing in a move to stimulate industrial recovery; soon mass quantities of affordable gliders of high-quality design and construction were coming off the assembly lines.

The thought, however, of staging a vertical envelopment by means of glider traces its origins to the Treaty of Rapallo negotiated by Von Seeckt and Nikolai Lenin in 1921; this clandestine agreement among other things permitted technical exchanges between the German and Russian general staffs. Of those Reichswehr officers to benefit from this provision was an avid gliding instructor, Colonel Kurt Student. Having unprecedented access to Soviet military maneuvers during the early 1930s Student observed Russian advances in parachute operations were offset by the fact that the technology for delivering heavy weapons to the battlefield was non-existent. Natural fabrics such as silk, simply could not handle the load bearing capacity under extreme stress and fatigue causing the parachute to fail; tougher synthetics like nylon and rayon were still some years off. In his final tour of duty report, Student recommended the general staff take advantage of this deficiency by employing gliders as a cargo and troop transport, a proposal answered with a reply of skepticism and ridicule. Not until the advent of National Socialism could Student, now a major general and Inspector of Airborne Forces, turn his vision of a "heavy drop" into reality. Working with other proponents at the Darmstadt Airborne Experimental Center, akin to the Lockheed Skunk Works, Student co-wrote the milspecs for the first dual-purpose combat glider: the DFS-230.⁴

The very tactics and techniques arrived at by this early investment in glider development paid handsome dividends later on, in furthering the concept and conduct of the "blitzkrieg." As the sensational assault and capture of the supposedly impregnable Belgian fortress of Eben Emael by commandos landed by glider made headlines in 1940, the British enthusiastically reacted to the pivotal role it played in this conquest by forming the Glider Pilot Regiment. The U.S. War Department, on the other hand, was quick to file intelligence dispatches from its attachés stationed in occupied Europe mentioning the glider's importance as a combat weapon. Only after America entered the Second World War did the Army cease neglecting the potential of these motorless aircraft for use in its newly organized airborne divisions that went on to see combat in Europe and the Pacific.

After the war, demobilization eradicated most U.S. and British Army glider regiments.⁵ Four years later in April 1949, a relatively obscure milestone took place on the training ranges near Fort Bragg, North Carolina. Operation Tarheel, a month-long tactical exercise marked the final operational use of gliders by the 325th Glider Infantry: the last such regiment retained on active duty. Before the year was out, the Parachute School at Fort Benning, Georgia cycled its trainees through the last glider familiarization course. On January 1, 1953, the U.S. Army deleted glider landings from the capabilities of its airborne units as multipurpose transport helicopters, aircraft, and heavy cargo parachutes began to enter service. Army Regulation 670-5 issued on September 20, 1956, which authorized a glider superimposed over a parachute to serve as the formal airborne insignia, lives on today as the only indelible reminder of its former existence and contribution.⁶

Why Gliders? Why Now?

When you think of it, the art of war briefly comes down to a simple philosophy: success = my time + my place + my way. With dominance in all three parts victory is certain, two parts and one has a more than likely chance of success, and, with only one, defeat. The key to dominance is to create an unlevel playing ground to your advantage by introducing new doctrine or equipment, or both before your opponent. However we in the United States tend to equate new to mean complex, high-tech, and expensive, a kind of establishment mentality brought on by an abundance of wealth in natural and intellectual resources that has become the opiate of today's military. Such thinking can cut both ways though, especially if a potential enemy ever recognizes first the utility of a piece of simple equipment discredited by the mainstream as obsolete or of little contemporary military value. The reason behind this is clear: an enemy cut off or limited in access to wealth and technology cannot afford to be finicky when their national survival is at stake and so must have any type of edge to create that imbalance. If that gamble pays off on the battlefield, the mainstream must then rethink its position until it establishes qualitative and quantitative superiority. Once the threat is gone, said equipment remains in service long enough for another innovation to come along, then the military discards it and the idea remains dormant until it finds favor again and the cycle repeats. This is the history of the military glider in a microcosm and the starting point to determine if the Army should rethink the utility of these silent wings for the next millennium

The U.S. Army, like the Reichswehr was, is in a period of transition where the future is uncertain as to how it should wisely invest limited resources to fight the next war. The late Secretary of Defense Les Aspin made reference to this fact in 1993: "...the dangers of the new era will reinforce the importance of the Army. It will redefine the Army's missions. And it will require us to reshape the Army so it can respond to those new missions."⁷ In this decade alone, Army deployments have totaled 33 compared to 10 from 1950 to 1989; the vast majority serving in regions and roles suited towards airborne, air-assault, ranger, and light infantry rather than armored and mechanized operations.⁸ However, maintenance and fuel costs for shrinking fleets of transport aircraft and helicopters, the *raison d'être* of these elite forces, are expensive and deployments occasionally time consuming with several simultaneous operations already underway worldwide. Bearing this in mind, it is only logical that the capabilities of the 18th Airborne Corps receive an alternative enhancement since the major combat elements under its command maintain the highest state of alert to meet their assigned operational objective — power projection.

Just as important, to win an active degree of interest by the mainstream and subsequent funding gliders must mirror one or all of the characteristics that are most in demand for equipment suitable for rapid reaction operations in this period of downsizing and reduced budgetary allocations: tactical advantage, multipurpose, simple, cost-effective, a timely initial operational capability (IOC), and available for procurement by all four services. Traits as these expedite the acquisition process and are factors that weigh heavily on the minds of administrators (and legislators) alike when it comes time to vote on allocations of monies. Thus, procuring gliders makes military and economic sense for several reasons.

1. Gliders and glider landings dovetail the individual capabilities in airborne (parachute) and air-assault (helicopter) operations while minimizing the associated hazards. While parachute drops embody an atmosphere of surprise and stealth (to a degree), the trade-offs are vulnerability (as

airlift assets and descending paratroopers — after a static-line jump from 1,200 feet, are in "double jeopardy" from air defense artillery (ADA)); tactical disorganization (as formations disperse over the drop zone (DZ)); and, firepower (lightly armed, paratroopers are defensively weak). Alternatively, air-assaults integrate tactical organization, precision landings, mobility, heavy payloads, and firepower, while trading-off stealth and surprise (as engines and rotorblades disclose the axis of attack) for vulnerability (to an ambush as troops withdraw or dismount from the pickup or landing zone (LZ)). Comparatively speaking, gliders and glider landings prove superior to either style thanks to several inherent traits.

- **Stealth and Surprise** — Recognized as moments where the greatest weakness of the attacker and of the defender occur simultaneously, the outcome of a vertical envelopment depends on initiative and determination. In a non-permissive environment when an unarmed cargo plane or helicopter approaches and departs from an DZ or LZ is the point at which pilots face the greatest danger of being shot down. Ejecting flares to confuse and divert incoming heat-seeking surface-to-air-missiles (SAMs) is the only countermeasure available to a pilot, provided he has the gear at his disposal, but this method is not 100 percent foolproof. Thus, successful concealment of an airborne formation in transit to the target area can negate the potential for detection and offset any military imbalances. Stealth is the key determinant in maintaining total surprise. Without the former, one cannot exploit the latter to its fullest potential. Since a glider's wind-driven propulsion system can maneuver into a gradual or swift descent and has a low metal-content fuselage that does not emit infrared heat its radar signature is negligible. This means it is invulnerable to fixed and man-portable SAMs. Thus, a soundless, low-level glider approach in hostile airspace, especially in a nighttime operation, is liable to inflict a state of paralysis and psychological shock, including paranoia, upon an adversary's economic, social, military, and political infrastructure.⁹

- **Tactical Organization** — Time is of the essence in securing the target area during an airborne assault and minutes can mean the difference between success and failure. Maintaining unit cohesion immediately after landing is therefore essential in bringing its full striking power to bear against a decisive point which may mean fewer casualties and less time mopping up resistance. Luftwaffe Field Marshall Albert Kesselring attributed merit to gliders for adequately filling this requirement: "Gliders, according to their size, hold ten to twenty or even more men, who immediately constitute a unit ready for combat."¹⁰ According to one estimate, a glider infantry company could assemble within five minutes of debarkation, thus ensuring its table of organization and equipment, and (what was more important) its chain of command remained intact.¹¹ Parachute insertions cannot make this statement. Any semblance of organization during a parachute drop, dissipates the moment a chalk of paratroopers exits the aircraft. In a best-case scenario, in ideal weather, a company of parachute infantry requires a minimum of 15 minutes to regroup and recover its equipment.¹² Factor in hostile ground fire, injuries sustained during the jump, parachutes caught on natural- and man-made obstructions, as well as poor climate, and the reaction time declines further. Night drops lead to further disorientation among parachutists. This is especially true in a worst-case scenario where an airlift undershoots or overshoots the DZ and the cross-winds alter the descent. As a result, a motley collection of units emerges which may find itself involved in a series of disjointed attacks lacking any coordination as dispersed paratroopers search for a friendly face in unfamiliar territory. One need only be reminded of the casualties suffered by the 82nd and 101st Airborne Divisions scattered over the flooded

Normandy hedgerows to see the danger. Similar misfortunes continue to occur despite the introduction of the steerable T-10 parachute because mass drops increase the chance of midair collisions between jumpers trying to maneuver and land on target. Regarding the Panama City airfield seizure package during Operation Just Cause, the records of the 18th Airborne Corps Historian noted: "Intent of [the 82nd Airborne] Division was to drop 50 meters east of runway, inside perimeter fence. Actual drop was to east, mostly outside perimeter fence in mangrove swamps; also dropped long furthest [landing] was eight kilometers."¹³

- Payload — As a workhorse, gliders served as an immediate force-multiplier for the offensive and defensive firepower for combat units thanks to its payload capacity; an inherent trait necessary for contemporary airborne operations. Credit went to its cost-effective heavy-lift design. By all accounts, Second World War-era gliders adhered to the principle of constructing a simple, yet durable aircraft since most had fuselages constructed of air-tight canvas wrapped around welded steel tubes and honey-combed plywood, "...a construction technique that provided strength with minimal weight."¹⁴ A lack of complicated flight instrumentation and engines meant very little maintenance and kept costs down resulting in a potentially reusable airframe without diminishing, but rather increasing its lift capability. Most models of that era had cargo and troop capacities greater than or equal to every model of transport helicopter (and some cargo aircraft) currently in Army or Air Force service. Furthermore, the inclusion of hinged cargo doors on either the nose or tail assembly, or both, kept loading and unloading times to a minimum.

Parachute drops and air-assaults, however, require multiple sorties to field enough artillery and prime movers for effective fire missions and adequate mobility. Of the two, air-assault unit guidelines order the dismantling of some vehicle-mounted crew-served weapons into its organic components for overland movement while the squad helicopters to the battlefield to link up with it — a time-consuming process.¹⁵ The location of LZs and DZs in high-altitude environments also affect fuel consumption and weight allowance thereby further restricting the quality and quantity of deployable weapons systems by either method. Provided of course, these systems arrive in working order and no equipment mishaps occur such as parachutes failing to deploy or exposure to ground fire while slingloaded beneath a helicopter; The operational account of Operation Just Cause chronicled one such mishap:

Heavy drop carried out...Lost HMMWV [High Mobility Multipurpose Wheeled Vehicle] carrying Stinger SAMs. Damage to two of eight M-551 Sheridans [light tanks] from DRB[Division Ready Brigade]-1 company of 3d Battalion, 73rd Armor: 1) One initially assessed as probable malfunction; was destroyed in drop. 2) One initially assessed as probable parachute problem stuck in mud and destroyed in place when cannot be extracted.¹⁶

Other variables can exacerbate similar scenarios such as fierce wind currents altering calculated parachute trajectories and depositing heavy equipment in hostile territory.

- Performance — Combat gliders did not yield to the opinion that once an airborne operation was in motion, the entire action necessarily had to unfold according to some predetermined schedule without taking into consideration unforeseen events. A critical assessment of the D-Day airborne landings noted that if tow release occurred at an altitude above 700 feet a pilot could "make a

proper approach and come in slow," an option that afforded him the time to select and divert to an alternate LZ if necessary.¹⁷ Unlike the sports glider though, a military glider could not use atmospheric currents or thermals to remain aloft for a considerable amount of time or even be made to climb due to weight, construction, and design. However, it could execute some evasive maneuvers to land on target depending on the method of soaring: gliding or diving flight.¹⁸

Perfected by the German Luftwaffe with exceptional results, "dive gliding" produced speeds in excess of 125 miles an hour based upon the angle of descent. If spotted, evading ground fire with this method required deploying a braking parachute and making frequent changes in the diving angle or spinning for a short time which refutes accusations that gliders were "compact targets." Furthermore, if release occurred at the right altitude, 13,000 feet, a glider could coast to the target area from as far away as 20 miles before going into the dive.¹⁹ This radical innovation in tactics is still useful because gliders can execute spot landings in a variety of terrain (including built-up areas) in clearings only yards long.²⁰ Although gliding flight was the accepted standard, after-action reports confirmed that most of the several hundred gliders belonging to a division could land on target. Figure One denotes a comparison between the success rate of parachute and glider insertion during the Second World War²¹

Operation	Troops Dispatched		Transport Aircraft/Gliders		Landing Accuracy	
	Parachute	Glider	Dispatched	Effective	Parachute	Glider
Mercury	10,800	648	600/72	480/61	60-70%	80%
Husky/Ladbroke	3,400 (a)	2,075 (b)	226/144	226/54	12%	5%
Neptune	18,100	7,375	1,074/857	1,041/852	30%	70-80%
Dragoon	6,488	2,611	444/413	444/408	50%	90-95%
Market-Garden	21,095	13,781	5,582/2,598	5,080/2,262	90-95%	90-95%
Varsity	8,801	8,196	541/1,346	512/1,330	60-70%	90-95%

(a) American portion (b) British portion

Figure 1. Operational performances of the glider and parachute in combat²²

- Recyclable — Critics contend that the glider had a life expectancy of only one airborne operation since most assaults left the powerless aircraft destroyed beyond repair or unsalvageable. This statement is true as far as those gliders shot down or that skidded to a halt after hitting natural or man-made obstructions.²³ Figure Two below, compiled from the 82nd Airborne Division after-action report for Operation Market-Garden, illustrates most gliders and cargo assigned to individual units landed in serviceable condition, and few casualties were evident.

Unit	Glider				Personnel			Jeep		Trailer		Artillery	
	Intact	Dam	Dest	Miss	Okay	KIA	Evac	Miss	Ser	Unser	Ser	Unser	Ser
Hq & Hq Co, 325th Regt	5	1	2	2	45			15	2	2	2		
Hq & Hq Co., 1st Bn, 325th	9	2			82		2	18	4	2	3	2	
Co. A, 325th Glider Infantry	19	6			348								
Co. B, 325th Glider Infantry	12	3			202		1						
Co. C, 325th Glider Infantry	12	3			206		2						
Hq & Hq Btry Div Arty	5	7	1		43		3	2	7		5		
Btry B, 320th Fld Arty Bn	10	8	9	13	99	1	2	40	4	11	2	5	2
Btry B, 456th Fld Arty Bn	3				11				1		1		1
Btry C, 456th Fld Arty Bn	23	1			117		2		9		4		10
Total	98	31	11	15	1,153	1	12	75	27	15	17	7	13
Percentage	63.2	20	7.1	9.7	92.9	0.9	1	6.1	64.3	35.7	70.8	29.2	76.5

Figure 2. Landing statistics, 82nd Airborne Division, Operation Market-Garden²⁴

There were other circumstances, all preventable. First, retrieval of gliders had a low priority due to combat requirements and hundreds sat on secured LZs for several weeks before recovery aircraft or repair teams received permission to enter the area; by then, exposure to the elements had already taken its toll. Just to give an example, 97 percent of the gliders used by American forces in the Normandy landings were left to rot in narrow pastures in which they landed. Second, limited numbers of qualified recovery crews and pick-up equipment proved insufficient for handling the thousands of gliders involved in a major airborne operation. Third, lax security measures around LZs after an operation led to damage by vandals or theft by civilians who chopped up the plywood fuselages for fuel. Fourth, glider pilots whose job it was to help clear the LZs of spent fuselages and prep them for recovery returned to their staging areas in England, in most cases, three days after landing. Finally, because of a wartime economy tooled up for mass output, logisticians found it easier to replace than recover used stocks with new inventory taken right from the production line.²⁵

2. Gliders are in a class by itself that units equipped as such would have an edge over their parachute and air-assault counterparts that neither can duplicate for certain reasons.

- The fuselage is inexpensive to manufacture, meaning an airborne division could contain hundreds of general purpose-, medium-, and heavy-lift versions: a normal wartime complement for a U.S. division boasted 800 to 900 in its order of battle. The availability of sufficient numbers on-hand enabled six infantry and two field artillery battalions plus headquarters and support personnel to go into battle at once. Contemporary planners with access to similar quantities could earmark enough to sustain training and exercise purposes; provide a replacement pool for losses to normal attrition; and, establish a war reserve to support as many as three successive operations.
- Bayonet strength may increase by as much as 30 percent if one factors in the glider pilots whose military occupational specialty (MOS) reverts to that of an infantryman upon landing.
- For every hour of operational use, helicopters and transport aircraft require several hours of maintenance and a large pool of technicians to keep them flying. A glider requires fewer man-

hours for assembly and routine upkeep: no cumbersome avionics, engines, or extensive wiring exist. Instead, diagnostic tests and preventative maintenance would stress certifying the structural integrity of the fuselage as airworthy before the next deployment.

- Whether in single or tandem tows, pre-stocked and prepositioned gliders in self-deployable theater airborne readiness packages, akin to the POMCUS and Prepositioning Afloat programs, could be effective crisis management tools for accelerating the anticipated deployment schedule of contingency units. Low cost per unit makes this possible. This requires a detailed explanation.

The sole function of transport aircraft and helicopters is to load, shuttle, and unload men and material. With multi-million dollar price tags both cannot loiter for any length of time on the ground as "hangar queens." Thus, neither can serve as a pre-stocked and prepositioned cache for either payload because both are high-priority platforms requisitioned and deployed globally on a daily basis in a variety of support roles that overtax a finite fleet with a different cargo manifest for each sortie. Bearing this in mind, consider the Herculean effort it takes to deploy one of three DRB's belonging to the 82nd Airborne from a cold start.
























Upon receipt of a notification order, DRB-3, acting in a support role, has 18 hours to "push" Division Ready-Force-1 (DRF-1), one of DRB-1's three battalion task forces, into the air "chuted up, loaded, and wheels up."²⁶ Task accomplishment in the designated launch window demands preparation of detailed aircraft movement and loading timetables. These plans must further take into account the transit time for: 1) the arrival of sufficient airlifters from various points of origins; and, 2) DRF-1 to transfer its personnel and equipment from a marshaling area at Fort Bragg, North Carolina for boarding at nearby Pope Air Force Base. Though pre-rigged equipment pallets enhance DRB-1's readiness, it takes time to properly load an airlifter in a configuration that efficiently makes maximum use of the entire cargo bay. Furthermore, if discrepancies in the flight manifest exist unforeseen delays may arise and the DRB may not ready be for immediate loading: during Just Cause, "The USAF walked away from earlier planning meetings with the mistaken impression that the 82nd had [only] 25 loads (i.e., five C-141s' worth) prerigged...In reality, the DRB was loaded in 24 hours, with [the first] plane filled in 10 hours."²⁷

The 101st Air-Assault Division fares no better either since an air-assault DRB is of little military value until the Air Force transports its helicopters to the theater of operations; three to seven helicopters, depending on the model, is the limit the C-17 and C-5B respectively, can haul in a single flight and these have to be partially disassembled to fit into the cargo bay; once in-theater, certification of airworthiness entails mandatory test flights after reassembly — again, a time consuming process. During Desert Shield, it took 13 days for 50 C-5A's and 60 C-141's to transport the initial force package of 2,742 personnel, 117 helicopters, 487 vehicles, and 123 pallets of equipment; the 101st required 10 cargo ships and an additional 46 days for the rest of its 5,258 pieces of equipment to close into Saudi Arabia.²⁸ Alternatively, a helicopter can self-deploy (fly directly from point A to point B under its own power), but only if the location of its staging area is directly adjacent to the nation in question and the weather permits safe passage; attempting this feat by leap frogging through several countries is hardly cost-effective: during the recent crisis in Kosovo it took several weeks for 24 Apache attack helicopters to deploy from Germany to Albania via this method.

Yet troop carrying and pre-stocked gliders with DRB-1's equipment can remain indefinitely parked at Pope AFB in hardened temperature-controlled hangars next to the runway ready to deploy. In an alert contingency, support trucks would reposition the gliders next to the flight line according to a pre-determined layout either functional or organizational. Personnel of DRF-1 would marshal at a holding area at Pope and marry up with their designated gliders. As tow aircraft land, each would taxi up to an assigned serial of gliders where technicians would fasten the tow cables and then transit to the flight line for departure, a procedure that should last no longer than one to two hours on the ground, unless the tugs need to refuel. Days, if not weeks, could be shaved off the estimated time of arrival in-theater via this method because pre-stocked gliders eliminate the proverbial middleman — the loadmaster — from the planning cycle. Planners no longer have to consider, "how many hours to load DRF-1's equipment," rather, "how many tow aircraft can Pope logistically support, receive, and launch at once."

Once airborne, this "glider train" would proceed to a release point conducive towards safeguarding powered airlift assets from unnecessary risk and enhancing a rapid reaction response. Since glider release can occur a significant distance away from the target area, a reduced threat exists from hostile ADA or fighter interceptors across an unfriendly border, as air traffic controllers may never pick up the tow aircraft's radar signature. The advantage of a distant release also means fuel consumption is minimal and the tow aircraft can return to its staging area earlier and embark follow-on forces.²⁹

3. Gliders have endured combat in a variety of geographic regions varying in terrain, climate, missions, and intensities of warfare where rapid reaction forces may deploy in the future. Historical accounts record gliders participated in some sixteen major and minor airborne operations and thousands of other landings in 14 nations (Figure Three) with different terrain and climates. Primarily used for brigade- to corps-sized airhead and seizure and linkup operations gliders also took part in several platoon- to battalion-level envelopments in situations judged by today's standards as special operations or low-intensity conflict (LIC): an assassination attempt, guerrilla/anti-guerrilla ops, sabotage, and, rescues. Overall, the targets were of a diverse nature including, personalities in key leadership positions; a heavy-water production facility, a key component in atomic weapons research; static fortifications; and, lines of communication (LOCs). In some instances, planners favored using the glider for two reasons: first, a conventional ground assault against a fixed target could cost several thousand casualties before capitulation; and second, objectives located in high-altitudes or outfitted with sound-ranging equipment precluded the use of parachutists. Most troops and equipment landed by glider accomplished their D-Day tasks on schedule. While operational failures were few, those that did occur did so either because of inclement weather or poor tactical judgment inconsistent with accepted airborne doctrine.

Date	Location	Operation	Mission	Objective	Task Accomplishment		
1940 	Belgium	Granite	Raid	Fortress	x		
1941 	Greece	Marita	Raid	Bridge	x		
1941 	Greece (Crete)	Mercury	Airhd/Linkup	Afld/Bridge		x**	
1942 	Norway	Freshman	Sabotage	Powerplant			x
1943 	Tunisia*/Italy (Sicily)	Ladbroke	Airhd/Linkup	Bridge	x**		
1943 	Italy	Oak	Rescue	Personality	x		
1943 	Soviet Union	?	Clandestine	Rendezvous	x		
1944 	Yugoslavia	Bunghole	Clandestine	Rendezvous	x		
1944 	France	Deadstick	Airhd/Linkup	Bridges/Guns	x		
1944 	France	Neptune	Airhd/Linkup	LOCs		x	
1944 	France	Dragoon	Airhd/Linkup	LOCs		x	
1944 	Yugoslavia	Knights Move	Capture/Kill	Personality			x
1944 	Holland	Market-Garden	Airhd/Linkup	Bridges	x(a)		x(b)
1944 	Belgium	Repulse	Resupply	Garrison		x	
1944 	India*/Burma	Thursday	Guerrilla	LOCs			x
1944 	France	Vassieux	Anti-Guerrilla	Village	x		
1945 	Philippines	Gypsy TF	Airhd/Linkup	Airfield	x		
1945 	Germany	Varsity	Airhd/Linkup	Forest	x(b)		x(a)
1945 	Hungary	?	Resupply	Garrison	?	?	?
1941-1944 	Soviet Union	N/A	Resupply/Evac	Garrisons	N/A	N/A	N/A
1943-1944 	France (Corsica)	N/A	Evacuation	Garrisons	N/A	N/A	N/A
1943-1944 	Italy (Sardinia)	N/A	Evacuation	Garrisons	N/A	N/A	N/A
1943-1944 	Greece (Rhodes/Crete)	N/A	Evacuation	Garrisons	N/A	N/A	N/A

D-Day D-Plus Failure


*staging area **pyrrhic victory (a) American portion (b) British portion
 German operation § British operation ⊖ American operation ⊕ Allied operation † Soviet operation

Figure 3. Service record of the glider during the Second World War

4. Gliders can handle a wide spectrum of contingencies defined as operations other than war (OOTW).

Complex Emergencies: In the past several years, relief operations in war-torn or underdeveloped nations have shared a common denominator: each depended on air traffic controllers and engineers (as well as expensive privately contracted civilian logisticians) to open, operate, and rehabilitate dilapidated airport and harbor facilities. Once operational, unloading critical items in a permissive (peaceful) or non-permissive (hostile) environment can consume precious time, especially if sealift and airlift assets are urgently needed elsewhere. Poorly maintained lines of communication and a lack of all-terrain vehicles add to the confusion and further slow down getting aid into hands of a displaced person (DP); until said equipment arrives in-theater and engineers repair the road and rail network, perishable food commodities and critical and essential medicines to sustain life accumulate in a warehouse or rot in the open air. Gliders could support future operations (at home and abroad in land-locked or littoral nations) in situations where the economic, social, and political infrastructure has disintegrated to the point it geographically isolates a segment of the population from outside assistance.³⁰

Peacekeeping/Non-Combatant Evacuation — In support of North Atlantic Treaty Organization (NATO) and U.N.-sponsored operations, glider landings and retrievals can quietly reinforce, resupply, rotate, or evacuate contingents besieged in an enclave without alerting the warring factions or subjecting overland convoys to sectarian fighting, bureaucratic entanglements, ambushes, hijackings, mines, checkpoints, or its passengers becoming human shields. Gliders

played a similar tactical and strategic role in the Second World War for reinforcing and evacuating besieged garrisons, American and German.³¹

5. Gliders are special operations-capable for unconventional warfare and LICs. Special operation forces (SOFs) train for years in anticipation of initiating successful small-unit maneuvers lasting only minutes to disrupt, delay, and deceive an opposing force ten times its size, gliders would be a welcomed addition in allowing these elite units to perform their repertoire of missions.

Hostage Rescues/Prisoner Snatches — In the motion picture, *Escape from New York*, the protagonist infiltrates his objective by landing a miniature glider — the "Gullfire" — atop the World Trade Center in an attempt to rescue the President. Fictional as this account is, more plausible scenarios are possible based on historical fact: the rescue of Italian fascist dictator Benito Mussolini³² and the attempted capture of Yugoslav partisan leader Josef Broz Tito.³³ In modern day terms this means SOFs could swoop down on the safe-houses of indicted war criminals, like Radovan Karadzic, Ratko Mladic, and Slobodan Milosevic whose bodyguard would be caught off balance by such an assault, and apprehend them with limited civilian casualties and collateral damage. But without overemphasizing the point too much, had the glider served as the platform of choice for similar scenarios involving SOFs (Iran, Panama, and Somalia) the final tally in casualties for each operation may have been different.

Counter-Terrorism/Counter-Narcotics: The prospect exists for SOFs landed by glider to neutralize terrorist training camps or illicit drug manufacturing facilities; Palestine Liberation Organization splinter groups found it had a role for terror purposes at one time, too. Abu Abbas, the mastermind behind the Achille Lauro hijacking crudely recognized its potential and dispatched Lebanon-based guerrillas into northern Israel by hang-glider in 1981 to drop explosive charges on an oil refinery; the raid failed due to the limited capability of hang gliders in untrained hands.³⁴

Other Clandestine Operations: Reconnaissance: Long-range surveillance patrols could infiltrate developed and under-developed nations where the border is porous and easily penetrable. To conceal the presence of the covert mission underway, the glider could be immediately disassembled, stowed in a cache, and reassembled for pickup by aerial retrieval upon completion. Ferrying guerrillas/operatives: Gliders offer Special Force A-Detachments, Civil Affairs, and Psychological Operations personnel the opportunity to extend their influence to inaccessible hinterland for the purpose of sabotage, winning hearts and minds or political agitation and deception.³⁵ During the Second World War, the Soviet Union regularly employed gliders for similar purposes.³⁶ Invasion scouting parties: In the event that NATO or the UN ever authorizes the use of ground forces to evict a rogue state occupying a sovereign nation SOFs will pave the way for liberation. One may recall the template used in the Soviet invasions of Czechoslovakia and Afghanistan involved shuttling Spetsnaz teams via Aeroflot passenger aircraft to seize key points in and around Prague and Kabul. In similar fashion, SOF personnel dropped from personnel records — "sheep-dipped" — in military jargon and sporting civilian attire, identification, and cover stories would land by glider — a kind of Trojan Horse — and take up assigned posts.

6. Adapting the glider to the rigors of modern warfare, demands the merger of proven equipment designs and innovations introduced during the Second World War with technology currently in service to create a truly cost-effective platform. The best course of action for rapidly fielding a glider capability is to manufacture and modify off-the-shelf designs from the Second World War for contemporary use. Several Allied and Axis models stand out as candidates for adoption in Figure Four based on lift capacity and have cargo bay dimensions to accommodate a variety of modern wheeled and tracked all-terrain vehicles as well as towed artillery. The majority of the gliders represented underwent rigorous field testing and refinement; the payload capabilities are comparable to heavy-lift helicopters and even tactical transport aircraft at one-tenth or less of the unit cost of either; and, background studies and after-action reports on performance in combat exist. Still, others patterned on those used in competitive gliding, "had so-called 'breaking points,' that is, joints of purposely weak construction, which would break first in crash landings or collisions with natural or artificial obstacles. This method brought about a substantial economy in construction...[and] procurement of spare parts..."³⁷ Modification does not entail a massive redesign of the fuselage (unless the intent is to stretch the cargo bay or improve upon aerodynamics, speed, and maneuverability of the airframe to handle the stress of jet-glider tows) rather the uniting of technology from two different historical periods.

Model	Weight (Empty)	Cargo (Tons)	Personnel Capacity	Service Record
ME-321*	26,000 lbs.	24	200	Europe
Ju-322	56,000 lbs.	13	100	N/A
XLRN-1**	N/A	10***	80	N/A
CG-16A	9,500 lbs.	5	42	N/A
Hamilcar	18,000 lbs.	10	40	Europe
CG-10A	12,150 lbs.	5.5	40	N/A
CG-13A	8,700 lbs.	5	40	Europe/Pacific
Ku-8-II	10,000 lbs.	8	32	Pacific
Horsa	8,370 lbs.	4	32	Europe
XLRG-1**	N/A	N/A	24	N/A
Go-242	7,000 lbs.	4	23	Europe
CG-15A	4,000 lbs.	2.5	15	Europe/Pacific
DFS-230V	1,800 lbs.	2	15	Europe
XLRQ-1**	N/A	N/A	12	N/A

*Designated the "Giant," Messerschmitt Aircraft built 200 ME-321s in anticipation of Operation Sealion — the invasion of Great Britain — and it is considered the largest operational glider ever in existence with a cargo capacity equal to Boeing's 707-320B jet and a personnel capacity comparable to the C-130, C-17, and C-141. **Amphibious-capable ***Capable of carrying 3,000 gallons of fuel.

Figure 4. Second World War gliders suitable for contemporary service³⁸

Allied and Axis ingenuity pulled off some of the most simple, yet extraordinary innovations in terms of braking systems, crash-protection, an aerial retrieval system, an jet-assisted take-off (JATO) that still have an essential role to play.³⁹ Whereas portable and compact off-the-shelf technology developed for civilian and defense applications during the Cold War exist that add minimal weight and can be reversed engineered into the fuselage to bridge the gap between those problems solved and those remaining after the military discontinued interest. These include: night vision goggles, global positioning satellite (GPS) receivers, composite materials, etc.⁴⁰

Still, the trick to constructing the gliders within budget at a low cost per unit and ensuring delivery on schedule is to award all contract and sub-contract work only to companies possessing intimate knowledge on the day-to-day manufacturing process of civilian gliders. The reason is simple. Companies in this field are 50 years ahead of the traditional military-industrial complex in terms of technology and design.

7. Gliders are a true joint service platform that promotes interoperability. "Joint" has become the 1990s watchword synonymous with the competition taking place in the U.S. armed forces as inter-service relationships become the means for preserving budgets and guaranteeing additional funding. From several vantage points, beneficial side-effects at the inter-service level are thus obtainable with the introduction of the glider.

Army: Apart from the inherent traits already mentioned in this paper, there are added budget savings. As an effective and cheaper alternative, gliders offer the possibility of diminished wear and tear on the Army helicopter fleet and an extended service life. Subsequently, such measures would pay dividends in the form of annual fuel and maintenance savings and conservation of critical spare parts in high-demand as budget allocations decrease. Compared to attending airborne or air-assault school, glider familiarization training should cost less per trainee (in terms of training aids, aircraft usage, and course length) since instruction primarily deals with the procedures of bracing oneself for a landing; the same would also be true of glider versus helicopter pilot training.

Air Force: Again, the reasons are budget savings, easing the burden on an overstretched airlift fleet, reduced fuel and maintenance costs, and an extended service life for strategic and tactical transports. Figure Five illustrates that adopting off-the-shelf designs such as the German ME-321 that had a payload capacity exceeding the C-130H/J transport means the latter could tow two or three of the former in a single sortie thanks to its light-weight construction.⁴¹ Thus, deploying a division maneuver brigade should require fewer transports and sorties.

Model	Payload	Troops	Light Tanks**	Tow Aircraft	Engines	Weight (empty/max)
ME-321	24 tons	200	Mark IV Panzer	Heinkel-111Z	N/A	26,000/75,825 lbs.
C-130H	20 tons	92/64*	M-551 Sheridan	N/A	Allison T56	72,892/175,000 lbs.

The Heinkel-111Z's five Junkers Jumo 211D-2 liquid-cooled inverted V-12 engines generated a total of 6,000 horsepower to tow a fully-loaded ME-321. The C-130H/J Hercules powered by four Allison T56-A-15 or 2100D3 engines rated at 4,508 hp and 4,591 hp each respectively could generate up to 18,032 hp and 18,354 hp. * — Soldiers/Paratroopers ** — Tanks are of comparable weight.

Figure 5. ME-321/C-130H comparative data⁴²

Take for example, Operation Just Cause which required an airlift package of 51 C-141 aircraft to drop 2,288 paratroopers, 78 M-998 HMMWVs, 12 M-551 Sheridan light tanks, and four M-102 105mm howitzers.⁴³ A glider assault of comparable stature employing heavy- and medium-lift designs from the Second World War would require a total of 24 ME-321's (12 carrying troops and 12 for the tanks), 39 Hamilcars (with space for two HMMWVs each), and two CG-10As for the artillery. A total of 65 gliders which require an equal number of transport aircraft. However, use double glider tows and the airlift package requires only 33 transport aircraft, 18 less than the parachute assault. If the C-17, C-141B, or C-5B serves as the accompanying tow aircraft, the

greater engine thrust of these transports could each convey more than three gliders at once, thereby multiplying the overall lift capability by a factor of several while halving the financial outlay.⁴⁴

Navy and Marine Corps: Doctrinally, amphibious gliders offer the possibility for greater standoff distances and increased operational surprise against littoral regions, two prerequisites for projecting an over-the-horizon capability.⁴⁵ What is more important there is a historical precedent. The Marine Corps and the Department of the Navy pressed vigorously for the activation of glider infantry battalions earlier than did the Army.⁴⁶ However, what started as enthusiasm turned into disenchantment as questions arose as to which service should manage the program as well as pressure to review and expand procurement requirements coupled with delays on the part of contractors. Taken in turn, these debates "...acted as a dissuading force on those who were intent on its development." A year-long joint study quietly shelved the project in 1943 and concluded gliders, whether amphibious or land-based, were of no practical military value and cited, "the Marine Corps had no use for unproven equipment [emphasis added]."⁴⁷ Potential counter-arguments from either service against gliders cannot cite this argument or each would have to reconsider the wisdom of procuring 473 MV/HV-22B Osprey's since it is an untested hybrid with a limited payload capacity of only 24 troops or 20,000 pounds of cargo and a price tag at \$33 million a copy, not to mention a production run scheduled to last 10 to 25 years.

Now the Tricky Part, or Maybe Not?

In the first part of this paper I examined the utility of the glider for contemporary military use. Should the Army feel a proposal to reinstate such a capability worthwhile, two factors threaten to undermine this potential enhancement: bureaucratic entanglements and methodology. The former concerns program management, quality control, and inter- and intra-service rivalry; the latter, doctrine and organization. Without a plan of action to address these points negates the advantages of and could kill any attempt at resurrection either before a Congressional, Department of Defense (DoD), or Army review board. Whereas this may seem like an obstacle, it is not. Similar issues, cropped up during the Second World War where solutions based on lessons learned are to be found.

Climbing the Five Pillars

Before mentioning these issues though it is important to take stock of the complexity involved in translating any operational objective into material reality to understand where in this scheme these pieces fit in. The process is multi-structured. At the core of which is a series of interrelationships of inputs and outputs that "push" the objective along until fulfilling said goal. The action is also perpetual. Since, "ultimately, any 'enhanced' capability becomes a current capability [emphasis added]," the physical presence of which influences the milieu and tactics of an opposing force (OPFOR), and vice-a-versa. Five pillars, each led by a different ensemble, aid this process.⁴⁸

I. Worriers: Their function is to proactively rather than reactively assess, identify, and compare capabilities and critical deficiencies, current and projected, vis-a-vis stated national security objectives. Major influences on, or participating in these "visions of combat environments,"

include: service chiefs, combatant commands, the joint chiefs of staff (JCS), and the Secretary of Defense. The inferences drawn, if serious enough, determine the relevance, and general likelihood, of permitting an enhancement in capabilities to attain the operational objective. On their recommendation and authorization, they direct others to convene and think the matter through.

II. Conceivers. Formulating, defining, and evaluating alternative, yet not necessarily new, concepts to achieve the stated objectives are the responsibility of this group. Side-effects of proposals tendered may entail revisions in doctrine, ideas of employment, tactics, training, and/or organization. This blending of technical and operational know-how, from battle labs, industry, and a "Red Team" vulnerability assessment, allows both to come an understanding on what is feasible and useful in linking requirements with established technology to accomplish specified military tasks. "Proof-of-principle" trials are then undertaken to demonstrate the military worth of the resultant proposal submitted before the next pillar in the hierarchy renders a decision on its ultimate disposition.

III. Deciders. The jurisdiction of this authoritative forum, principally made up of high-ranking DoD and military officials, has the final yes or no on underwriting and funding the proposal.⁴⁹ Accordingly, a decision to officially endorse an alternative concept is a public declaration of confidence that for purposes of national defense, constrained budgets notwithstanding, U.S. forces must acquire this system. Before reaching a verdict though, they must confront several broad, but important, issues. Among the topics tabled for discussion include whether the operational objective addressed and concept proposed are critical and essential to warrant further consideration; second, what substantive changes, if any, are in order to adapt the present force structure to the proposal under cross-examination. Special features, performance and forecasts, especially on cost and date of IOC also figure into the judgment made; any suggested tradeoffs in the preceding are conditional upon presenting evidence that the concept candidate can indeed perform its intended mission. Allocation of monies is contingent upon how available combat and logistical assets intend to use the candidate within the framework of warfare, the cost of which varies at the tactical, operational, and strategic level.

IV. Acquirers. Turning concept into reality is the motivation behind the efforts of a partnership between DoD and service acquisition and program executives or managers; a quest deemed at an end when fully functional production models come off the assembly line. Working to achieve this intended outcome is in itself a process of time-sensitive decisions and critiques over headway gained and management discipline; satisfactory performance of both determines when and whether to proceed into the next development milestone (engineering, manufacturing, full-scale production) on schedule.

V. Organizers. The credibility of the concept does not end with acquisition, only integration, equipping, training, and sustaining can do that. Custodian for shouldering such an awesome burden logically falls to the intended recipient, either one or all armed services — they are after all, the official purveyors of these functions. To meet the IOC timetable, preparations must begin during the previous stage to facilitate interaction and cooperation between the program manager and service commands (procurement, logistical, and operational) so all "ships sail in one direction." Thereafter, the service hierarchy, on the advice of its functional and operational

commands, authorize the table of organization (T/O) and equipment for those particular forces under their stewardship designated to get that system. The responsibility for assisting field commanders in equipping their assigned force elements is handled by the Service Acquisition Command. Furnishing operational commands with the authorized quantities and types of supplies and support equipment for the systems expected service life is the job of a logistical integration agency. Only when there is full compliance with these prerequisites can the service Secretary and Chief report that an enhanced operational capability genuinely exists.

Bearing in mind this process with relation to first half of the paper reveals that it was, in essence, a microcosm, that briefly touched upon points related to the first three pillars. Whereas the issues that follow run the gamut and are difficult to pin down on any one pillar since each overlap the other while introducing parallel concepts.

Program Management

Since the Army discharged the last glider-qualified personnel from its ranks over five decades ago, it must look again to civilian sector to provide the source of knowledge to revive this art of warfare. The modus operandi for reinstatement is the civilian-military staffed glider program instituted by General Henry Arnold (Commanding General, U.S. Army Air Corps). General Arnold, "...firmly believed that a civilian expert knew more on a given subject than any military man. If gliders were the wave of the future, he wanted a civilian in his office to advise him on how to recruit and train glider pilots and on what sort of gliders to buy."⁵⁰ Competitive gliding is where General Arnold summoned experts like 35-year old Lewin Barringer to coordinate the entire program. Other personalities associated with the "gliding club" provided further expertise. The New York-based Elmira Area Soaring Corporation, under the direction of soaring champion John Robinson, established the guidelines for a detailed 30-hour instructional course that trained the initial cadre, at 18 civilian schools in 11 states, and became the standard for all 6,000 subsequent recruits graduated from the program.⁵¹

Thus, the Army should again enlist the expertise of competitive gliding. There are ample numbers of glider pilots worldwide who pursue soaring as a sport and could be contracted out to serve as a cadre. These individuals are an adventurous lot and may find the prospects of employment for what they do best in a hazardous environment tempting; there would be little doubt over their skill and training since the Army would get the best in the field.⁵² Participation on their part can take many forms such as updating the original pilot curriculum with standardized training guidelines already in force among civilian soaring associations. Also invaluable is their familiarization with those companies that manufacture and design gliders so as to know whom the Army should do business with and those to stay away from in terms of reputation, facilities and infrastructure, and customer satisfaction and service.

To avoid the same misunderstandings that arose between the military and civilian coordinators because the latter did not understand the requirements of the former or "speak their language," there is one viable solution. Consult those remaining glider-qualified veterans to serve on a board of review or as an intermediary, to offer constructive advice and recommendations, before senility and death render this forgotten breed extinct. These individuals have first hand experience to set the record straight on what worked and did not work with regard to training,

tactics, and equipment. Their participation, eyewitness accounts, advice, and support would be readily accessible, if not free, since Allied and Axis glider pilot veteran associations exist worldwide.⁵³ In keeping with the Total Army Quality management philosophy, this "idea center" would also insure that any suggestions however bold or radical would receive careful and detailed study

Quality Control

"Discord, a mixture of misdirection and lack of direction, absence of firm goals, and bad management at several levels," best describes the wartime production of gliders in the United States.⁵⁴ Handicapped from access to the skilled labor and techniques of mass production found in the powered aircraft industry, because priority went to combat aircraft, especially after Army Air Corps procurement boasted it would field 5,000 combat aircraft per month, forced glider design firms to license manufacturing rights and award sub-contracts to an "unimposing" industrial group ranging from the food service to brewing industry.⁵⁵ These companies had little or no knowledge of producing precision aircraft components.⁵⁶ Consequently, quality control was hard to monitor throughout the program which cost lives in the field as fuselages occasionally disintegrated while being towed to a landing zone (LZ), thus earning the nickname "plywood coffins." The reason primarily being standardization and interchangeability of parts simply did not exist; indirectly, internal politics had something to do with it. At the onset of the glider program, the government contracted a single engineering firm to manufacture the master jigs and fixtures to universally supply the prime contractors. However, an "over-anxious" Air Corps Material Center ignored that directive and authorized every contractor to build their own machine tools and to forsake interchangeability in favor of meeting production quotas as soon as possible. The confusion caused by these conflicting instructions pushed the timetable back by several months.⁵⁷ A distinct side-effect of these practices was the significant rise in unit price of the same model of glider depending on who was the manufacturer. Out of the 16 U.S. companies licensed to build the 15-seat Waco CG-4A glider, for example, only the Ford Motor Company, a leader in streamlined and efficient mass production, was able to turn it out for \$15,000 per copy — the lowest price on record; the other 15 billed the government upwards of \$25-50,000 for the same unit.⁵⁸

A safeguard to avoid or lessen the likelihood of similar oversight arising in terms of confusing and conflicting signals is to delegating reprogramming authority to the Program Executive Officer guided by a charter defining the relationship between that individual and the Army Acquisition Executive. The real trick though to constructing quality gliders within budget at a low cost per unit and ensuring delivery on schedule is to award all contract and sub-contract work only to companies possessing intimate knowledge on the day-to-day manufacturing process of civilian gliders. The reason is simple. Companies in this field are 50 years ahead of the traditional military-industrial complex in terms of technology and design. However, in the pre-production stage, low-level contacts between the two are necessary for two reasons. First, to ensure a smooth transfer of any defense related components incorporated into Second World War designs. Second, to train executives and skilled workers in the techniques for operating a dual-purpose production line: the first dedicated to multi-year and unit purchases by a single military customer; and, the second for civilian consumption based on the law of supply and

demand. Still, cooperation can extend to the leasing of sophisticated test facilities (e.g., wind-tunnels) that all glider manufacturers may not have access to.

This recommendation goes a long way in furthering the path to acquisition reform espoused under the Bottom-Up Review: 1) maintains "leading edge" technology by looking beyond the dedicated defense industry to commercial sectors where the most significant advances and innovations transpire and thrive; 2) broadens the industrial base for DoD as the number of traditional suppliers shrink to ensure the means are in place to gear up for a wartime economy should it become necessary; 3) integrates military and commercial technologies, for exploitation and exchange by either industry; and, 4) encourages competition which in turn yields more efficient operations while abridging delivery times.⁵⁹

Inter- and Intra-Service Rivalry: In the Second World War, infantry accounted for 36 percent of the U.S. Army; Korea — 33 percent; Vietnam — 22 percent; and, post-Vietnam — 15 percent. That figure now stands at only 11 percent or 54,000 infantrymen out of a post-Desert Storm army totaling 495,000 soldiers grouped into 10 regular divisions and several separate brigades.⁶⁰ The Army would find this adequate if not engaged both at home and worldwide. Unfortunately, with foreign deployments come an urgent need for both firepower and a physical presence, rather than trading off the latter in favor of the former. Subsequently, infantry-intensive operations, combining aggressive patrolling with protection of non-combatants, are on the rise. With the inroads the Bosnia, Haiti, Kosovo, Macedonia, and Sinai deployments are making on this MOS, the Army is hard pressed to retain its strategic reserve of airborne units at full-strength and in fighting trim.

However, the reintroduction of the glider will see bayonet strength increase by as much as 10 to 30 percent, the equivalent of almost a battalion or fourth maneuver brigade respectively, if one factors in the 500-600 (low-end) or 1,600-1,800 (high-end) glider pilots whose MOS reverts to that of an infantryman upon landing. There is a caveat. Reinstating a glider capability will renew the debate regarding the true profession of glider pilots. Sort of like the riddle, "What came first, the chicken or egg?" Only in this instance the question is, "Are they fighters or fliers first?"

Labeled "the most uninhibited individualists in the Army," glider pilots endured criticism from their compatriots for lacking a clearly defined mission.⁶¹ This controversy has its origins in a 1942 directive issued by the U.S. Army Air Corps: "The role of the glider pilot in combat will be primarily to land his glider safely, expedite the rapid debarkation of his passengers, secure his glider on the ground...The glider pilot will participate in ground combat only in exceptional circumstances or after his glider has been wrecked in landing." This official prohibition on direct participation in combat invited criticism from both American and British airborne commanders.⁶²

Avoiding this pitfall demands adopting the argument used to solve the inter-service problem that arose between the RAF and British Army during the establishment of the Glider Pilot Regiment. The latter held the view that flying a glider was incidental to serving as an infantryman while the former insisted gliders and glider pilots were RAF property available for detached service when involved in airborne operations. Both came to an understanding that glider pilots must be a "total soldier" cross-trained in the tactics and equipment of the aviator and infantryman (with training responsibility equally divided) since the importance of the latter superseded the former upon

landing.⁶³ Tailoring this solution to "joint" service relationships could entail a special memorandum of understanding (MoU) establishing a combined Army-Air Force glider training program; MoUs signed in the 1950s resolved similar differences over the ownership and function of helicopters in ground combat operations.

This proverbial Magna Charta would define the roles and missions accorded to each service. The Air Force Academy at Colorado Springs would concentrate on teaching the basics about gliders and gliding (where it is reported to operate one of the largest soaring schools in the world) while the Army School of Aviation at Fort Rucker, Alabama would provide advanced training on tactics and techniques before rotating candidates through the School of Infantry at Fort Benning, Georgia. Official branch affiliation for pilot candidates would remain as Aviation though for combat purposes, as existed in the British system pilots would organize into infantry units with the senior glider officer and a small staff acting as a provisional headquarters to provide command and control. This solution also goes a long way in addressing the criticisms over identity that prevented closer integration between Army Aviation and the traditional branches of the combat arms over accusations the former would "drift away" as the Air Corps did several decades earlier.⁶⁴

Other keys to heading off further intra-service spats in the airborne ranks require instituting for all glider-qualified personnel the rights and privileges pertaining to an elite formation (e.g., hazardous duty pay, qualification badges, headgear, etc) as in parachute and air-assault units; a recognition of service originally denied them for most of the Second World War.⁶⁵ This may lessen, but not totally resolve the problem; bickering still exists in the 82nd Airborne over the semantics that bond a paratrooper to his regiment's past.⁶⁶

Doctrine

Some thoughts on airborne warfare are worth pondering in this discussion. Dedicated parachute and air-assault divisions perform the same role on the battlefield: airhead and seizure and linkup operations. However, neither force, including ad hoc task forces, is specifically trained nor organized from within to fight as combined airborne arms team that integrates the helicopter and parachute assault into a flexible combination at division, brigade or battalion-level. This is in stark contrast to armored and mechanized divisions that continuously train, with the platforms that transport them into battle, for combined arms operations integrating battalions of tanks, infantry fighting vehicles and self-propelled artillery into a cohesive combination of firepower, maneuver, and mass.

Therefore, airborne methods of insertions should not be considered in isolation either. Only through integration, will the tab "Airborne" take on its rightful meaning. The reinstatement of the glider, thus, would lead to questions of how to best employ it alongside the helicopter and parachute in terms of doctrine and organization. Any review committee, akin to the Howze Board on Airmobility, may likely conclude that what is being proposed is the creation of an Airborne Triad. The Airborne Triad is a descriptive term used to denote the synergism of the parachute, helicopter, and glider into a more capable whole for power-projection operations. Such a force mix (Figure Six), like its nuclear-based counterpart, has enough built-in

redundancies as well as compensations to present an OPFOR with a myriad of offensive and defensive problems.

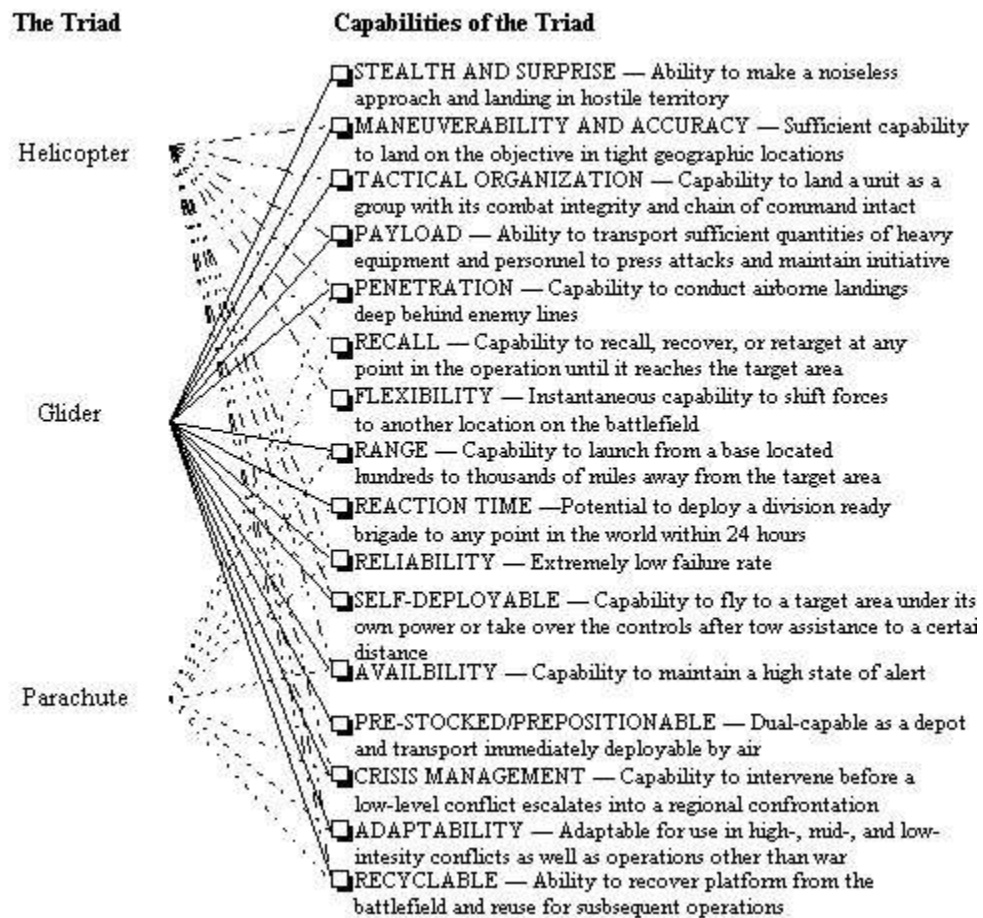


Figure 6. Capabilities of the Airborne Triad

Doctrinally speaking, gliders form the apex of the triad (Figure Seven). It is only logical as an authentic, inherent stealth capability makes it easier to seize objectives quietly and quickly. Parachute and air-assault units, in no definitive order, constitute the second and third tier of this "total airborne" concept; the former to reinforce and expand an airhead while the latter maintains the momentum on the battlefield with pursuit and blocking forces. This indulges a commander the flexibility to commit both in a proper sequence at his own time and place of choosing based on battlefield requirements.

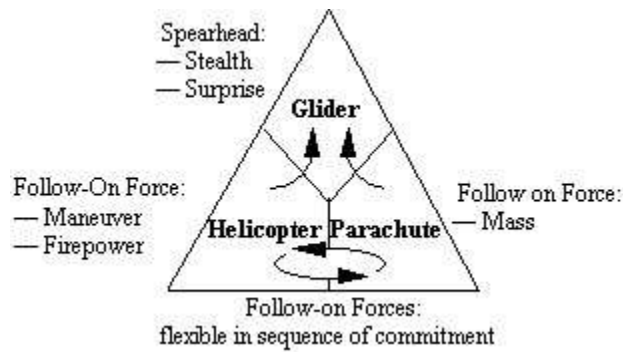


Figure 7. Hierarchy of the Airborne Triad

For the triad to be in proper synchronization, however, airborne doctrine must adhere to the German school of thought that stresses: 1) gliders are fundamentally for attack rather than a follow-on force; and, 2) smother the opposition by landing on top of objectives rather than near it. The U.S. Army violated both principles during the Second World War. Figure Eight shows the comparison of Allied and Axis task accomplishment when using the glider in either role.

Date	Operation	Plan		Role		LZ		Task Accomplishment		
		Mission	Objective	Spear	Follow	Obj	Near Obj	D-Day	D-Plus	Failure
1940	Granite	Raid	Fortress	x					x	
1941	Marita	Raid	Bridge	x					x	
1941	Mercury	Airhd/Linkup	Afids/Bridge		x		x			x**
1942	Freshman	Sabotage	Powerplant	x			x*			x
1943	Ladbroke	Airhd/Linkup	Bridge	x		x			x**	
1943	Oak	Rescue	Personality	x		x			x	
1944	Deadstick	Airhd/Linkup	Bridges/Guns	x		x			x	
1944	Dragoon	Airhd/Linkup	LOCs		x		x			x
1944	Knights Move	Capture/Kill	Personality		x	x				x
1944	Market-Garden	Airhd/Linkup	Bridges	x(b)	x(a)		x			x(a)
1944	Neptune	Airhd/Linkup	LOCs	x(b)	x(a)	x(b)	x(a)		x(b)	x(a)
1944	Thursday	Guerrilla	LOCs	x			x			x
1944	Vassieux	Anti-Guerrilla	Village	x		x				x
1945	Gypsy TF	Linkup	Airfield		x	x				x
1945	Varsity	Airhd/Linkup	Forest		x	x(b)	x(a)		x(b)	x(a)

*could not find LZ **pyrrhic victory (a) American portion (b) British portion

Figure 8. Allied and Axis tactical battlefield employment of the glider, select operations

What the Army never reconciled itself to was the fact that the Germans were quite successful with gliders only because they caught the OPFOR completely by surprise and there were no constructed defenses in place. Instead of landing gliders in geographically confined areas, as the Germans preferred, American planners favored multiple LZs spread out over vast open expanses. A minor deviation like this had important tactical implications. It set the criteria for the selection of LZs in every major allied airborne operation thereafter which proved to be a very reliable planning guide for the Wehrmacht when determining suitable locations for the placement of anti-glider obstacles.

This is because the War Department field manual on airborne warfare emphasized the exact reverse of what German doctrine successfully proved at Eban Emael in 1940: glider landings should occur only after parachutists seized suitable LZs. Such folly came at the expense of the mission as the fog of war descended over the battlefield; most glider landings occurred at dawn or dusk on or after the first day of operations. Post-operation debriefing conferences repeatedly pointed out that while tactical organization marked the appearance of glider infantry, confusion reigned for parachute infantry who were still trying to secure the airhead and regroup at the same time. Furthermore, measuring the gliders true success rate was not about surprise or even taking D-Day objectives, but about calculating the tonnage and personnel delivered daily, important as both are, the pair are only part of the equation.

Though tied to the American concept of airborne operations, their British counterparts found they rapidly achieved their task if they deviated toward the German model. Nowhere is this more evident than in a comparison of Operations Deadstick and Market-Garden. Deadstick pulled off a D-Day coup de main against the Orne River Bridges in Normandy. Six gliders landing in total darkness, only yards away from the two inter-connected bridges, provided the means for a single infantry company to rush the bridges, assault the garrison, and capture these vital transportation arteries, all within twenty-five minutes. Simultaneously, three gliders set down a platoon of combat engineers nearby, and though out-gunned, destroyed a coastal gun battery after fierce hand-to-hand combat. Less than three months later in Holland, the British were quick to forget the success of Deadstick. during the rushed planning and execution of Operation Market-Garden. Assigned an LZ inconsistent with its earlier action, located some eight miles from the objective — Arnhem Bridge, the glider, received unfounded criticism for hampering its seizure by the reconnaissance squadron of the 1st Airborne Division. Colonel Charles S. Chatterton, (CO, the Glider Pilot Regiment) when questioned on the matter after the war, recounted his wartime assertion on the need for an Orne River Bridge-type coup de main: "I saw no reason why we could not do it, but apparently nobody else saw the need for it, and I distinctly remember being called a bloody murderer and assassin for suggesting it."

The Germans learned all too well from earlier airborne operations on Crete that such a gross violation of airborne doctrine can lead to disaster or failure. In planning for Operation Mercury, the High Command held a viewpoint that gliders lost their surprise value after Eban Emael since they were no longer a secret. To signal the start of the operation, instead, parachutists were to drop on and seize three airfields — at first without any definite axis of attack and then expanding zones of control with follow-on forces, landed by glider and transport, until finally they ran together, like oil spots, extending over the island's 170-mile length. This strategy, akin to Napoleon's maxim, "one engages the enemy everywhere, then decides what to do," went awry; as history documents, seizing the objective took two days with extremely high losses in men and material.

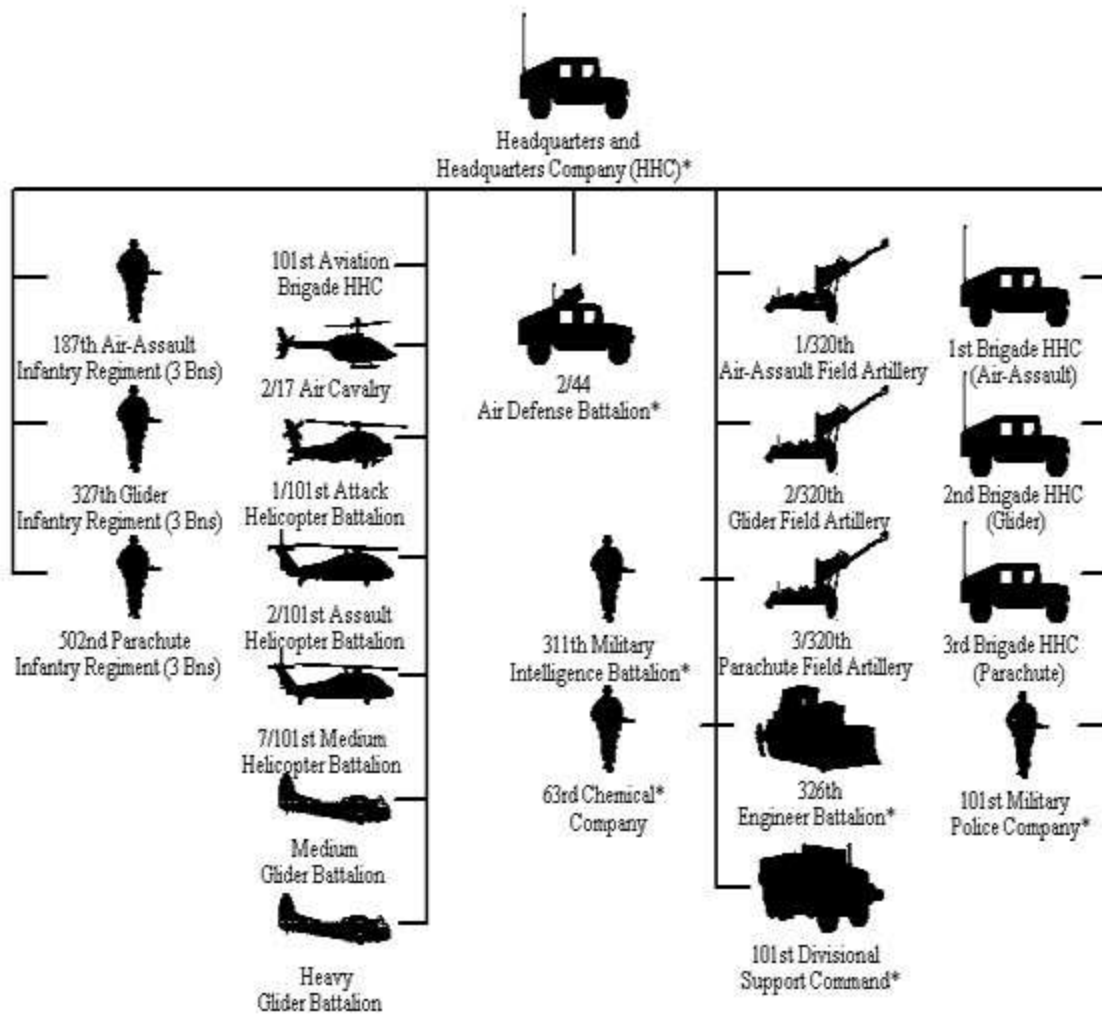
Organization

For proper field evaluation of the Triad, division test designs must mirror its inherent traits: a great capacity for rapid reaction movement; fight in many directions at once; and, suited towards a diverse variety of contingencies. Subsequently, there are two options for interjecting the Triad into the 18th Airborne Corps order of battle.

Option one is to augment an existing light infantry division with gliders to complement the 82nd Airborne and 101st Air-Assault. The 10th Infantry Division already earmarked for Corps use is the perfect candidate. First, its combat to support ratio is heavy in "teeth" — infantry — light in "tail" — vehicles and support personnel, and deployable in 478 airlift sorties (or four days) compared to 985 (or nine to 10 days) required to transport the 82nd; with pre-stocked and prepositioned gliders this may further reduce estimated time of arrival in-theater. Second, it does not gouge parachute and air-assault infantry battalions from its counterparts. On the other hand, with glider infantry of the 10th ID the first to deploy in a crisis — a position traditionally occupied by the 82nd during and after the Cold War — friction between may arise. What is more important, an entire division oriented towards glider landings, as with its counterparts in the 82nd and 101st, lacks or is light in the other two integral components of the Triad. This may prove time consuming and cumbersome during operations as one division commander would have to coordinate with the other two to provide or requisition their share of the Triad. If that is the case, then it defeats the purpose of the Triad since the concept mandates total, immediate, and unrestricted access to all three platforms.

Option two is to convert the 82nd and 101st over to a new force design — the internal Triad. There are four test bed designs.

Alternative (I) — A prototype T/O for an airborne division (Figure Nine) under this heading would comprise three brigades specifically oriented towards either glider, parachute, or air-assault operations with appropriately qualified division artillery, and combat support and service troops attached. At first glance, this force design parallels the ill-fated triple capability (TRICAP) test division of the early 1970s that paired up an armored, air-assault, an air cavalry combat brigade. TRICAP failed according to some accounts because there were too many divergent goals and differing capabilities, whereas this force structure depends almost exclusively on the combat infantryman; the only difference is the method of physical insertion. Still, there is a historical precedence, similar types of airborne divisions, yet only dual-capable, were in service with both sides during the Second World War. Although this practice ended with the phasing out of the glider in the late 1940s, the Army briefly revived the design after airmobility became accepted doctrine.



* — 1/3 deployable by helicopter, glider, and parachute

Figure 9. Division Alternative Concept I adapted to the 101st Airborne

Alternative (II) — The underlying principle of this design (Figure 10) is three components: maneuver, combat support, and combat service support with one-third of each going into battle by glider, parachute, or helicopter. Integration of the Triad is within the brigade rather than by brigade as three separate but equal battalions form the core of the division's three maneuver brigades.

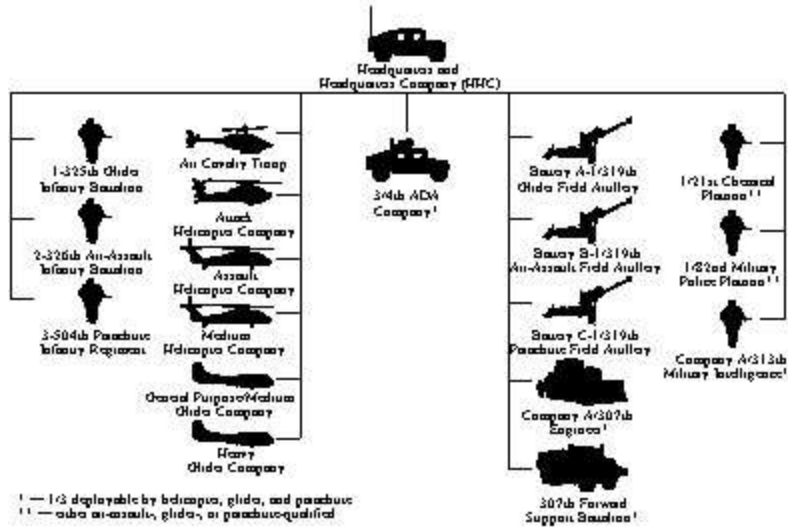


Figure 10. Division Alternative Concept II adapted to a brigade from the 82nd Airborne

Alternative (III) — This concept (Figure 11) borrows from the combined arms battalions that made up the now disbanded Ninth Infantry Division (High-Technology) which paired up motorized infantry, anti-armor, and support companies. Under an airborne incarnation, a division would consist of three brigades of three integrated airborne battalions (Headquarters and Headquarters Company, and four rifle companies with an attached artillery battery and service and support company) each tailored to a configuration heavy in one platform and light in the other two. Since each battalion is self-sustaining the design is readily adaptable to airborne battle groups serving outside the continental U.S. with the Alaskan- and Italian-based Arctic Warfare and Southern European Infantry Brigades.

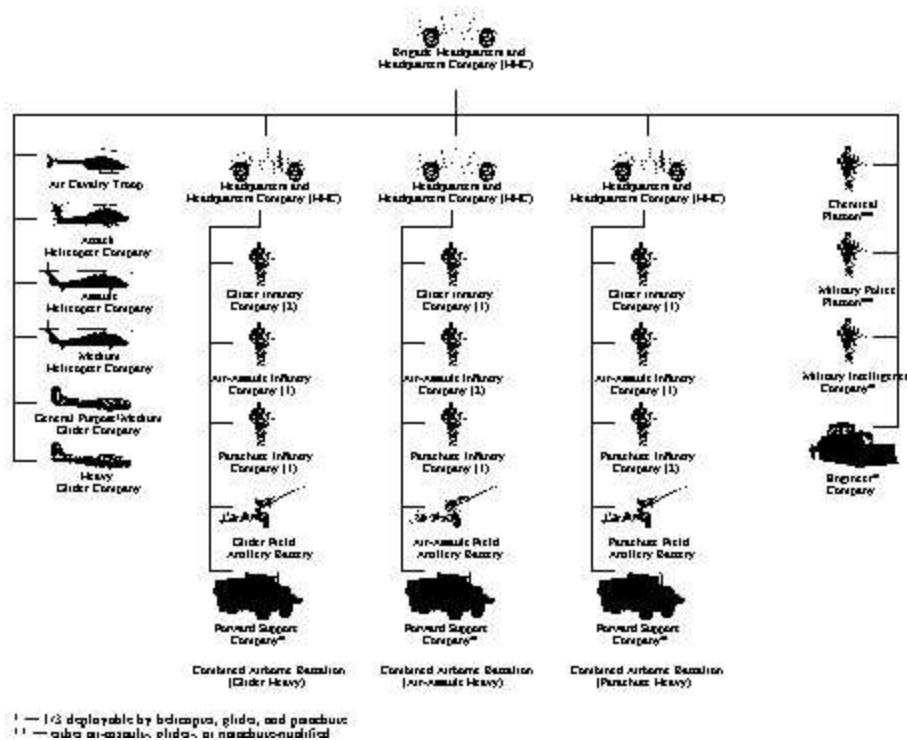


Figure 11. Division Alternative Concept III, prototype division maneuver brigade

Advantages: First, each design promotes "joint" airborne operations and permits a commander to throw a three-fisted response into a vertical envelopment instead of a single division dedicated to one method of insertion. Second, each force mix is more in tune with operational reality: combat parachute drops and air-assaults above brigade level are rare. Third, it "trims the fat" out in terms of the number of assault helicopters and associated support personnel and equipment required while reaping the benefits in maintenance and fuel savings. Lastly, all designs are conducive to promoting close cooperation and coordination among the Triad with regard to planning, logistics, and operations.

Disadvantages: First, normal rotations of brigades through the three six-week increments (alert, training, and support) that make up an 18-week Division Ready Brigade (DRB) cycle are impossible; as spearhead, the glider brigade could never cycle out of the DRB-1 slot. To make it possible for the rotation of all three brigades, every enlisted person and officer in the division would have to be (and remain) qualified in all three methods, in itself an expensive proposition. Take note that this applies only to Division Alternative Concept I. Division Alternative Concepts II and III are able to rotate through the DRB cycle, though the latter could cause friction between regiments or battalions who share different lineage's as they would no longer retain their traditional primary role.

Alternative (IV): Not of the same mold as the others, this design essentially grants the 82nd and 101st the right to retain their current T/O; instead, the glider would augment the division aviation brigade. Advantageously, it gives either division a glider capability while retaining the same number of battalions on jump and air-assault status and associated regimental lineage; German

airborne divisions adopted a similar practice during the Second World War. Only the 82nd Airborne though has the potential to deploy by all three methods since an assault helicopter battalion is already attached to its aviation brigade, a capability secondary to its traditional parachute role. Nevertheless, a major disadvantage is that without an esprit de corps to distinguish glider riders from parachutists or air-assault troops the division may never truly accept or properly employ military gliders in an effort to undermine the Triad.

Any Takers?

One final thought comes to mind. If gliders have a purpose in modern airborne warfare someone in the U.S. Army or another army would have already thought of it? The truth is the Soviet Army rejected American and British post-war assessments that these motorless aircraft had no place in airborne doctrine and maintained three glider infantry regiments in its order of battle from 1946 to 1965. Speculation persisted as late as the 1970s (and may still hold true today) that a cadre of pilots remained on stand-by alert and caches of gliders developed over that 19-year period existed. Furthermore, other nations such as China, India, Turkey, and Yugoslavia, regions of current or potential conflict, fielded military gliders for a brief period during or after the Second World War, and have the potential to do so again. However, the real driving force behind such a question in terms of a contemporary explanation comes down to a disclosure on the matter made by the Chief of Staff of the U.S. Army Airborne Command in 1943. His remark is telling and still accurate: "...one of our basic troubles has been the failure to properly evaluate this new weapon from the topside down." This disclosure explains why the combat glider is perhaps the only category of equipment in modern military history discarded by an army after an exceptional combat record overseas. Though to reiterate, there are still worthwhile roles for the glider should the Army find its wants such a capability. Remember, it is fashionable these days to go "retro" and acquire the accouterments of an earlier, in some ways, more imaginative era for contemporary use and other segments of the defense establishment appear to be drawing that conclusion too: the Joint Chiefs of Staff are currently re-evaluating giant transatlantic airships, similar to those of the 1930s, as heavy transports for armored and mechanized divisions.

With Change Comes Hope

For the issues, ideas, and recommendations mentioned throughout this paper, reform goes a long way, should the opportunity present itself, in making the climb for the glider up the five pillars easier a second time round. Slow to embrace new ways of thinking and doing business the Army has set about reinventing itself from within starting from the top down thanks to the National and Defense Performance Review initiatives. Gone are the days of the rigid, overly centralized, highly regulated, bureaucratic, and passé system of institutionalized group think that pervaded the armed services throughout the 1970s and 80s. Functional commands are now empowered to foster innovation where results not rules, or red tape, is the key to remaining focused on core missions. This "new look" permits those specific commands (e.g., TRADOC, FORSCOM, and AMC), under whose mandate the glider may find itself scrutinized, the freedom to explore that which might not have otherwise seen light or been quickly swept under the carpet. Reinvention labs and waivers of acquisition regulations are some of the mechanisms in place that make this possible.

Conclusion

Reinstating a glider capability requires an open-minded U.S. Army bent on preserving its power-projection capabilities in this critical phase of transition. Anything less is to invite future problems by replicating the mistakes of the past since the glider is within the means of former powers and even the poorest of nations. Keep this in mind. Airborne advocates took notice in 1954 when General James Gavin published an article entitled "Cavalry...And I Don't Mean Horses!" Subsequently, helicopters and airmobility emerged as the guiding theory of like-minded individuals belonging to the "airborne club." Senior officers endorsed the article as part of a concerted effort to gain public support for the Army; a necessity spurred on in part by a declining budget after Korea where the watchwords of the day were "caution, prudence, and thrift." Then, critics questioned the need for funding and maintaining two airborne divisions since massed parachute drops were obsolete on a potential nuclear battlefield. Now, these watchwords echo a similar dilemma in the aftermath of the Cold War as the Army assesses the budgetary side-effects of the Bottom-Up and Quadrennial Defense Reviews: operations and maintenance accounts diminishing; forward deployments multiplying; and, unit readiness to sustain and engage in two major regional conflicts declining as OOTW dominates the minds of planners. When you consider these challenges as a whole the usefulness of exploiting the glider becomes clear.

However, there are bureaucratic and methodological challenges in store if the Army seriously takes an interest in reinstating a capability of that kind. Preparation is half the battle. The first step though is to understand the symbiosis between the overall framework (or life-cycle) for enhancing operational capabilities with its integral elements or pillars. Then from there, areas of contention can be identified and a game plan developed to address concerns early head-on. The glider, unlike other systems vying for notice, learned its lessons five decades ago and solutions exist to head off the same snafus. Like the Phoenix reborn from its own ashes, taking advantage of or improving upon what worked or did not work in the past may prove beneficial in saving time, money, and what is more important, guarantee that airborne forces procure and deploy a credible warfighting tool.

Notes

1. The glider traces its origins to Greek fable of Daedalus and his son Icarus. According to legend, King Minos imprisoned father and son in a labyrinth on the isle of Crete. Having secretly fashioned wings made out feathers and wax Daedalus and Icarus escaped their imprisonment by gliding over the prison wall. Captivated by the experience of flight, Icarus ignored his father's advice to soar low over the water until they reached safety in Sicily. Instead, Icarus flew higher until the temperature of the Sun melted his wings and plunged into the sea and drowned. Attempting to turn myth in reality, successive generations of proverbial Daedaluses determined to fly instead went to their deaths. Several centuries passed before Leonardo Da Vinci's detailed anatomical studies of humans and birds confirmed the futility of man's earlier attempts to fly vis-a-vis arm-powered wing-flapping mechanisms. Compensating for the inadequacies attributed to the human physique, Da Vinci conceived of a flying wing incorporating a system of cables and pulleys to harness the kinetic energy derived from briskly moving the arms and legs; modern-day

hang gliders are nothing more than derivatives of these sketches. Gerald M. Devlin, *Silent Wings*, (New York: St. Martin's Press, 1985), pp. 1-2.

2. German inventor Otto Lilienthal turned Da Vinci's theory into reality four centuries later as he flew a single-wing glider off a Berlin hillside in 1891. A mechanical engineer by trade, Lilienthal had earlier published *Bird Flight as the Basis of Aviation*, a culmination of 10 years of research which essentially upheld Da Vinci's findings. Over the next several years, Lilienthal carried out 2,000 glides in a visionquest, that ultimately cost him his life, to duplicate the dexterity of a bird; constant refinements in design gradually extended flight time, distance, and altitude. Further experimentation discovered that an individual could effect turning maneuvers using the prevailing winds as propulsion if one shifted their weight in the direction they wished to travel. *Ibid.*, p. 4

3. *Ibid.* pp. 16.

4. Specifications required the glider must land a combat-ready formation or cargo on short, uncultivated fields no longer than 75 yards, and unit cost must not exceed 7,500 Reich Marks; the equivalent of manufacturing 10 parachutes. Milton Dank, *The Glider Gang*, (New York: J.B. Lippincott Company, 1977), p. 22.

5. By 1946, the U.S. Army disbanded eight of 11 glider infantry regiments, a separate glider infantry battalion, and seven of 11 glider field artillery battalions. The U.S. War Assets Administration declared gliders' surplus and the public immediately purchased all excess stocks for \$75 each, (original unit cost: \$15-25,000) not for the aircraft itself but for the lumber content in its five shipping crates — enough to build a small ranch-style house. In post-war Great Britain, the Glider Pilot Regiment, after returning from occupation duty in Palestine, saw its strength decrease to only a headquarters and training squadron plus two tactical squadrons. By 1950, a single squadron remained, and the Royal Air Force (RAF) discontinued new intakes of pilots; a year later it abandoned the program and reassigned crews to powered aviation units. Not until 1957 did the British Army officially disband the regiment. Devlin, *op. cit.*, pp. 374-375. Shelby L. Stanton, *World War II Order of Battle*, (New York: Galahad Books, 1991), various pages.

6. History of the Training of the American Paratrooper. Obtained electronically from <http://www.benning.army.mil/fbhome/training/zinhome.htm>.

7. Department of the Army, *The United States Army Posture Statement FY95*, (Washington D.C.: Headquarters, United States Army, February 1994), p. 16.

8. Figures obtained from the constituent newsletter put out by the office of U.S. Representative Rodney P. Frelinghuysen (R-NJ), 11th Congressional District.

9. There is truth in this declaration. Consider the story of German teenager Mathias Rust whose unmolested aerial sojourn over the eastern Soviet Union in 1987 ended with him landing a two-seat Cessna aircraft in Moscow's Red Square. Such an unforeseen contingency sowed a feeling

of consternation within the Politburo and Ministry of Defense and advertised the Soviet Union's vulnerability to penetration by a simple aircraft design.

10. Airborne Operations - A German Appraisal, Pub 104-13, (Washington D.C: Center for Military History, 1989) p. 28.

11. Marcel Baudot, ed., The Historical Encyclopedia of World War II, (New York: Facts on File, 1980) p. 3.

12. Debriefing conferences provided a more realistic picture of the assembly time by either method, but still bear out the statements made. Describing the assembly of his unit in the Normandy hedgerows, a Lieutenant-Colonel Boyd of the 1st Battalion, 325th Glider Infantry explained: "We came in at D plus 1...and landed at seven o'clock in the morning...Out of seven hundred men, we had 600 hundred ready to operate [by] 2pm." His counterpart, a Lieutenant-Colonel Timms of the 2nd Battalion, 507th Parachute Infantry who landed the previous day was not as fortunate: "I had a lot of difficulty in assembling...I never did get with the Battalion until about the fifth day." Ibid. See Debriefing Conference — Operation Neptune, August 1944, pp. 7-9. Obtained electronically from the U.S. Army Military History Institute Digital Library at <http://carlisle-www.army.mil/cgi-bin/usamhi/DL/showdoc.pl? docnum=32>.

13. 870-5a Organizational History Files XVIII Airborne Corps - Operation Just Cause, (Washington D.C.: Center for Military History, 1990) Notebook #1. Corps Historian's Notes. Obtained electronically from <http://www.army.mil/cmh-pg/documents/panama/notes.htm>

14. Devlin, op. cit., p. 62.

15. FM 90-4 Air-Assault Operations devotes an appendix to the procedures for preparing wheeled- and tracked- TOW (tube-launched, optically-tracked, wire-guided anti-tank missile) vehicles for helicopter transport; the number of sorties depends on the vehicle and helicopter. For example, an M-966 HMMWV requires one to two sorties depending if the CH-47 or UH-60 is the preferred transport. In the case of the former, one CH-47 can transport the M-966 with TOW and squad in its internal cargo bay or via external slingload. In the case of the latter, UH-60 #1 transports the TOW Squad (squad leader, gunner, assistant gunner, and ammunition bearer) and the TOW system (optical sight, tripod, missile guidance set, launch tube, and a basic combat load of encased missiles) while UH-60 #2 transports the M-966 via slingload. There is a caveat to this rule that FM 90-4 makes reference to: "Altitude density may preclude the UH-60 being able to lift the M-966. In this case, one UH-60 transports the weapon and squad while the driver of the M-966 must move the vehicle via an overland route to link up with the squad." An M-901 Improved TOW Vehicle requires that the TOW system be removed from the vehicle and either a UH-60 or CH-47 can transport the dismounted system and the squad leader, gunner, and assistant gunner. The driver must move the vehicle overland to link up with the squad. FM 90-4 Air Assault Operations, (Washington D.C.: Headquarters, Department of the Army, 1987), pp. H1-H2. Appendix H.

16. 870-5a Organizational History Files XVIII Airborne Corps - Operation Just Cause, op.cit.

17. Debriefing Conference —Operation Neptune, op.cit., p 9. Text in quotes attributed to Lieutenant-Colonel T.H. Sanford, Executive Officer, 1st Battalion, 325th Glider Infantry.

18. Military gliders had a 1:10 glide ratio compared to 1:22 for its civilian counterpart during the Second World War; in free flight, this meant that for every 10 feet the glider flew forward its altitude decreased by a foot. Modern gliders now have a 1:50 or greater ratio due to modern technological advances in aerodynamics and lightweight components. James E. Mrazek, *Fighting Gliders of World War II*, (London: Robert Hale & Company, 1977), p. 24.

19. The Luftwaffe's first (and only) experiment of this tactic in combat occurred on the Eastern Front in 1943 when a dive-glider assault on the besieged citadel of Velikye Luki safely delivered seven anti-tank guns inside its perimeter. *Airborne Operations - A German Appraisal*, op. cit., p. 53.

20. Operation Eclipse — the contingency plan for an airborne assault on Berlin, contemplated using debris-choked boulevards such as the Unter der Linden and the Wilhelmstrasse (together with the Tiergarten Park) as LZs for some 3,000 gliders. Dank, op.cit., pp. 257-258.

21. Glider serial post-landing tables for the 82nd Airborne Division after Operation Market-Garden indicates that of the 730 gliders that landed on the three designated LZs, 458 or 62.7 percent landed precisely on the LZs and the remaining 272 or 37.3 percent landed within a half-mile to two miles of the LZ. James E. Mrazek, *The Glider War*, op.cit., pp. 293-294. Appendix: Table B, C, D, and E.

22. Of all the Allied operations, Operation Ladbrooke — the British phase of the Allied airborne invasion of Sicily — is the only instance where several bad command decisions stymied the performance of the glider. First, the British pushed for and committed the Glider Pilot Regiment to a night assault to capture the Point Grande Bridge knowing pilots in North African staging areas had not flown for three months. Second, the pilots had nowhere near the 100 hours flying time needed before being considered fit for an operation, let alone the prerequisite night training forbidden under British doctrine. Third, they expected their pilots, in three months time, to master flying American gliders, something none of them had experience with, let alone knew what one looked like since very few were in-theater or properly assembled until just before the operation. By then, each pilot had logged only four-and-a-half hours in 16 practice flights, of which night training accounted for slightly more than an hour. Fourth, an American troop carrier wing that had stateside training in glider operations found itself ferrying paratroopers while an inexperienced wing towed the gliders and prematurely discharged most over the sea at the wrong release point and in a barrage of friendly and hostile fire; some 73 gliders crashed in the water and over 300 soldiers drowned. Figures compiled from Clay Blair, *Ridgway's Paratroopers*, (Garden City, NY: Dial Press, 1985), various pages, Chapter Two: Sicily, Baptism of Fire; Chapter Five: Normandy, The stuff of instant Legend; Chapter Six: Holland, Disaster at Arnhem, and Chapter Nine: Germany, Destruction of the Third Reich. Mrazek, *The Glider War*, op.cit., pp. 64-77, 80-101, 197, 223. Office of the Chief of Air Staff, *Intelligence, Airborne Assault on Holland-An Interim Report*, Wings at War Series No. 4., (Washington D.C: Center for Air Force History, 1992), p. 40.

23. The most numerous of these obstructions were wooden posts — "Rommel's Asparagus" — that measured eight to 12 feet in length and six to 12 feet in diameter planted into the earth affixed with demolition charges. German airborne experts acknowledge that without the explosives a successful landing was possible. *Airborne Operations - A German Appraisal*, op. cit., p. 26. Section I: Passive Defensive Measures.
24. Mrazek, *The Glider War*, op.cit., pp. 293-294. Appendix: Table B, C, D, and E.
25. *Ibid.*, pp. 159-160.
26. Tom Clancy, *Airborne — A Guided Tour of an Airborne Task Force*, (New York: Berkley Books, 1997), p. 233.
27. 870-5a Organizational History Files XVIII Airborne Corps - Operation Just Cause, op.cit.
28. *Six Years after the Storm: The 101st in Desert Shield/Desert Storm, Part I: Preparations for Deployment*. Obtained electronically from <http://www.campbell.army.mil/Euph1.htm>.
29. Operation Turkey Buzzard conducted during the Second World War already validated the feasibility of an intercontinental or intra-theater glider airbridge depicted in the scenario above. Conceived by the RAF Air Transport Command in 1943 the plan entailed towing a manned glider loaded with vaccines destined for Russia, and, aircraft, radio, and engine parts from Canada to England, a distance of some 3,500-miles. The success of this five-leg, 28-hour experimental flight turned the theory of a transatlantic glider "train" service into reality as a tactical and strategic alternative to moving men and material by naval convoys. With the success of Turkey Buzzard the RAF went on to tow 30 gliders from England to Tunisia a record-setting distance of 2,400 miles with just one stopover. Dick Illingworth, "The Angle of the Dangle," *Airforce*, January 1996, pp. 14-15. Mrazek, *The Glider War*, op.cit., pp. 267-268.
30. The former Soviet Union came to that conclusion in the early 1930s, unbeknownst to the outside world at that time, and exploited the glider at first for its commercial value in terms of hauling cargo and passengers into the inaccessible hinterland. "Military use became a coincidental offshoot." Economical to mass produce using few raw materials, the Soviets found gliders offset their lack of technical know-how and an industrial infrastructure needed to turn out enough transport planes demanded of a strained economy. Mrazek, *The Glider War*, op.cit., p. 231.
31. Operation Repulse organized in the midst of the 1944 German winter Ardennes offensive due to a lack of parachute containers and para-packing units in the European Theater of Operations, ferried by glider a replacement field hospital accompanied by four surgeons to the American 101st Airborne Division encircled at Bastogne. The initial serial of 11 gliders landed inconspicuously and unscathed within this tight defensive pocket; subsequent waves had to evade flak from anti-aircraft artillery. Although least known of the contributions towards ending the siege, Repulse resupplied the 101st with 106,291 pounds of cargo at a decisive point in time when surrender was the only other alternative. The Germans mounted similar relief efforts on the Russian Front. At the siege of Kholm in January 1942, cargo gliders landed on the frontlines to

deliver ammunition and equipment to its 3,500 defenders; as the pocket shrank, village streets literally turned into LZs. Moreover, as German control of the Russian and Balkan Fronts receded during late 1943 through 1944, gliders helped evacuated men and material from the Crimea, Sardinia, Corsica, Rhodes, Crete, and Greece. *Ibid.*, pp. 224-229, 261.

32. Mussolini's 1943 rescue, Operation Oak, from the Campo Imperatore Hotel atop the summit of the Gran Sasso located in the Abruzzi Mountains of central Italy is a textbook example of the versatility of a glider. Otto Skorzeny, Hitler's unconventional warfare expert, undertook the assignment of freeing the fascist dictator from house arrest. Ruling a frontal assault out of the question since a cable car controlled access from the valley below to the crest and the altitude precluded a parachute drop Skorzeny opted for a glider assault. Despite four out of 12 glider tow lines prematurely releasing en route and Skorzeny altering the choice of the LZ on approach when the flat alpine meadow turned out to be a ski run, his commandos landed 15 to 20 yards from the resort's entrance. The entire rescue took less than four minutes and resistance was non-existent from the 250 surprised Italian Carabinieri (police) billeted in the hotel. James Lucas, *Kommando-German Special Forces of World War II*, (New York: St. Martin's Press, 1985), pp. 99-100.

33. In terms of the caliber of troops involved and the meticulous detail in its planning, Operation Knights Move, the 1944 Nazi plan for snatching Tito from his mountain stronghold in western Bosnia-Herzegovina was as one appraisal phrased it, a surgical strike of "superior grade." Intending to quietly swoop down on the mouth of Tito's cave headquarters in the Drvar Valley two companies of Waffen-SS glider infantry instead found themselves in the middle of ambush sprung upon landing. Historical accounts attest the Luftwaffe is to blame for this compromise in operational security. Earlier, the Luftwaffe advertised the impending assault by dropping two companies of parachutists to seize and cordon off a nearby village to thwart partisan interference with the gliders scheduled to arrive in the second wave. This tactical error in judgment permitted the mobile partisans to preempt the glider landings with delaying tactics as Tito escaped unmolested. *Ibid.*, pp. 103-26.

34. Neil C. Livingstone, *Inside the PLO*, (New York: Quill/William Morrow, 1990), p. 251.

35. A sideshow to the island-hopping Pacific campaign, the 1944 invasion of southern Burma, Operation Thursday, debuted the glider conveying British-led guerrilla forces into an inhospitable jungle interior to harass, confound, and confuse the Japanese. Assigned to the 1st Air Commando Group and acting in support of British regulars advancing from India, gliders flew 74 sorties to haul over 1,000 of General Orde Wingate's jungle-wise indigenous commandos — the "Chindits"— 165 miles behind Japanese lines at night. Noteworthy exploits within the first 24 hours included the landing of combat engineers and almost 67,000 pounds of construction equipment to prepare a forward airfield with a 5,000-foot runway; and, medevacing the wounded to India by aerial retrieval. Additional sorties resupplied Wingate's American-led counterpart — Merrill's Marauders — that captured a vital transportation hub at Myitkyina in northern Burma. Allied planners recommended similar assaults (on a massive scale) to check a Japanese withdrawal vis-a-vis a series of 500-mile hops along China's coast, but discontinued interest when resources were not forthcoming. Mrazek, *The Glider War*, op.cit., pp. 110-28.

36. In 1943, high-ranking cadres of the Lithuanian Supreme Soviet landed by glider some 600 miles behind German lines to organize partisan networks in the Nazi-occupied Baltics. The extent the Soviets relied on the glider for partisan operations is open to conjecture, but one account makes reference to night landings of agents on frozen lakes and at least on one occasion, a German anti-partisan sweep operation capturing a meadow with 100 discarded fuselages. *Ibid.* p. 230.

37. *Airborne Operations - A German Appraisal*, op.cit., p. 12.

38. Sample cargo bay configurations: ME-321: a 20-ton light tank; or, an 88mm anti-tank gun and prime mover; Ju-322: a light armored vehicle; Hamilcar: two armored cars; two jeeps with trailers; or, a seven-and-a-half-ton armored vehicle deployable within 15 seconds upon landing; Horsa: two one-quarter-ton 4x4 jeeps; or, one 75mm howitzer plus one-quarter-ton 4x4 jeep plus ammunition and crew; CG-10A: one two-and-a-quarter-ton trucks; or two 105mm howitzers; or one 155mm howitzer and a one-quarter-ton 4x4 jeep with ammunition; CG-13A: a 105mm howitzer with a one-quarter-ton 4x4 jeep with ammunition and crew; one one-and-a-half-ton 6x6 truck; or, a tracked armored weapons carrier; CG-16A: two 105mm howitzers with a one-quarter-ton 4x4 jeep with ammunition and crew; KU-8-II: an eight-ton armored vehicle; or, bulldozer; CG-15A: one one-quarter-ton 4x4 jeep and two soldiers; or, a 105mm howitzer with crew. Mrazek, *Fighting Gliders of World War II*, op.cit., various pages.

39. **Braking System:** The Germans developed a method for landing on short, unprepared fields involving the installation of automatic braking rockets situated on the nose assembly. The subsequent backwards thrust created upon the rocket's activation allowed a glider to come to a halt on an LZ only 35 yards long. The super-secret "Credible Sport" short take off and landing aircraft conceived for a second rescue attempt of the American hostages in Iran (and its existence only made public 18 years later in 1997) applied the braking rocket idea; this test-bed design intended for landing in a Tehran soccer stadium made use of a modified C-130 Hercules transport aircraft incorporating anti-submarine and air-to-air missile rocket motors positioned around the cockpit and under the wings to halt the aircraft. **Crash Protection:** The "Griswold Nose" developed in 1943 was a steel battering ram incorporated onto the exterior of a glider's nose. The protection offered by this device allowed occupants of the glider to survive collisions with minimum loss of life. Complimenting the Griswold Nose was the "Corey Skid" a curved segment of laminated wood affixed underneath the cockpit that prevented the glider from flipping over during landings on soft terrain and protected the fuselage from punctures. Both proved an effective combination in saving numerous lives during the airborne assaults over France, Holland, and Germany. **Aerial Retrieval System:** Known as the M-80 Glider Pick-Up Mechanism, an aircraft flying overhead could retrieve a fully loaded glider from the stationary position. Mounted to the exterior of an aircraft, the M-80 used the "fishing rod and reel" principle by means of a boom to ensnare the glider's tow line suspended between two poles. Originally used by the U.S. Postal Service in the late 1930s for rural mail pick-up, the M-80 demonstrated its practicability in both Europe and the Pacific by medevacing the wounded from the frontlines. **JATO:** Heavy-cargo and amphibious-capable gliders face a similar predicament: both demand sufficient thrust to get airborne as quickly as possible. The former may require up to 4,000 feet of runway to obtain the necessary speeds for it and the tow aircraft to lift off. The same is true of the latter which may need more power than a jet catapult on an aircraft carrier can

provide at launch. The installation of ejectable rocket motors under the wings, a technique used during the Second World War, would provide the necessary thrust at modest g forces (under 2g's) considered acceptable to human endurance. Nick Cook, "How 'Credible Sport' made SuperStol a reality," *Jane's Defense Weekly*, 9 March 1997, p. 18. *Airborne Operations - A German Appraisal*, op.cit., p 53. Devlin, op.cit, pp. 116, 125-126.

40. Night Vision: What Second World War glider pilots lacked in terms of a night vision capability, they made up with skill, determination, and bravery (not to mention fear) in carrying out exploits in pitch darkness where there was little margin to compensate for errors or ill-fortune. However, through the miniaturization of electronics and enhanced all-weather magnification, the current generation of portable night vision goggles offers a degree of safety and accuracy for executing a twilight landing. GPS: With an array of satellites encircling the globe in various orbits, hand-held receivers can compute exact geographic locations to the nearest meter. In practical terms, this means a safe touch down in a tight LZ. A precision landing GPS system in service with some civilian airports uses a series of fixed antennas installed at a designated LZ which transmits approach coordinates to incoming aircraft with onboard GPS receivers. Pathfinders or forward air controllers (FACs) outfitted with a portable version of this system could position it before the arrival of GPS-equipped gliders to permit round-the-clock precision landings in any environment and climate. Video Guidance Systems: Used to direct unmanned aerial reconnaissance vehicles, gliders outfitted with similar equipment could serve as a remotely piloted container delivery system (controlled from the tow aircraft or ground-based FACs). Early NASA space shuttle flight trials proved the idea is feasible: glide tests performed by the shuttle *Enterprise* in the late 1970s included a "hands off" maneuver with the orbiter on autopilot while it descended from 8,000 to 3,000 feet under the control of a ground-based microwave guidance system. Composite Materials: Light-weight, but hard-wearing tubular components not prone to disintegrating under excessive fatigue and stress (i.e., titanium, used in prosthetic arms and legs, or carbon fiber alloys), would constitute the structural frame of the fuselage. Detachable Kevlar-based bullet-proof body panels or insulation could reinforce the interior at points where personnel and cargo are most vulnerable to small-arms fire. Kevlar tow cables, as those used in the recent recovery of the Mercury spacecraft — *Liberty Bell 7* — after 38 years on the ocean floor would provide the strength to prevent premature release; a frequent complaint among Second World War glider crews. The composition of the exterior components depends upon whether the model of glider selected for service used the traditional canvas on the frame or all-wood method. As mentioned earlier, the failure to immediately recover expended gliders from the battlefield rendered many permanently unusable because the canvas exterior deteriorated in the wind, rain, and humidity. Preventative measures could entail using a synthetic water- and wind-proof material such as Gore-Tex, commonly used in the manufacture of rugged outdoor clothing, to encapsulate the fuselage. Another alternative is to update the design using a fiberglass exterior, as used in contemporary civilian models, which may improve aerodynamics with less weight. Crash Protection: To overcome the shock of landing, a cargo-restraint system developed for the "Credible Sport" aircraft should be given consideration for inclusion as a standard feature. Intended for a compliment of 150 passengers, this special pallet incorporated aft-facing seats that would give "impact support" rated at 9g's on touch down. Adapting this system to those gliders mentioned above for possible reintroduction would improve upon passenger survivability and comfort during aerial retrieval. Other Features: A wide range of portable add-on options is feasible: commercial air bags, bulletproof plexiglas, drag parachutes,

and inflatable flotation devices to enable emergency amphibious landings. See "Precision landing by GPS set for take-off," *Jane's Defense Weekly*, 12 June 1996, p. 41. Kenneth Gatland, *Space Technology*, (New York: Harmony Books, 1981), p. 278. Cook, *op. cit.*, p. 21.

41. Soviet experiments in the early 1930s perfected the concept of the "glider train," for which it set a record by towing four gliders in a sausage-link configuration. Mrazek, *The Glider War*, *op.cit.*, pp. 231-234.

42. There were plans for a larger version of the ME-321 with a 60- to 70-ton cargo capacity but these never got off the drawing board. Aircraft data from Clancy, *op.cit.*, p. 161. Mrazek, *The Glider War*, *op.cit.*, p. 36.

43. 870-5a Organizational History Files XVIII Airborne Corps - Operation Just Cause, *op. cit.*

44. Jet-glider tow combinations have yet to be verified with military versions, but the space shuttle, which is also part glider, did conduct trials. From August to October 1977, the space shuttle *Enterprise* conducted five free flight tests with glide release occurring from atop a Boeing 747 at altitudes ranging from 17,000 to 24,000 feet and executing turns under no power. Gatland, *op.cit.*, p. 278.

45. For amphibious assaults up to 50 nautical miles offshore, Navy and Marine planners calculate a three-hour cycle as the normal turnaround time for a wave of troops landed by an MV-22B: an hour in transit in either direction, plus a half-hour on each end for loading and unloading. Amphibious-capable gliders can help to lower this cycle to under three hours for reasons associated with its light-weight mass: 1) unassembled or assembled gliders incorporating space-saving technology found on the Osprey such as folding components rather than shipped in bulk CONEX containers give amphibious-assault or aircraft carriers the capability to store enough heavy- and medium-lift versions to transport a battalion landing team in as few sorties as possible; and, 2) the quick retrieval of multiple gliders using one recover aircraft is feasible by daisy-chaining the beached fuselages together so the plane can swoop down and snatch this train. Add to this the Navy employing its fleet of small helium airships as the accompanying tow aircraft and it would bestow upon potential Marine glider units a global reach. Early experimentation by the Navy proved the feasibility of the glider-airship combination: in 1929, the USS *Los Angeles* successfully released a glider mated to its underside at 3,000 feet. Tom Clancy, *Marine*, (New York: Berkley Books, 1996), p. 189. Devlin, *op.cit.*, p. 21.

46. In June 1941, the Department of the Navy's Bureau of Aeronautics undertook design studies on an amphibious glider built to the following Marine Corps milspecs: capable of ferrying a fully-equipped 12-man rifle squad; [it must] "take off and land both on water and on land; transport heavy equipment; be rigged for static-line parachute jumps; and mount exterior machine guns for offensive and defensive use." Though the Navy tendered contracts for and took delivery of 12-, 24-, and 80-place amphibious glider prototypes, none entered service or saw combat, but all underwent successful flight tests, and like its Army counterparts are candidates for contemporary procurement. *Ibid.* p. 68.

47. Mrazek, *The Glider War*, *op.cit.*, p. 185.

48. Glenn A. Kent and William E. Simmons, *A Framework for Enhancing Operational Capabilities*, R-4043-AF, (Santa Monica, California: the RAND Corporation), pp. 16-30.

49. Serving on and testifying before the forum include: the Chairman, or Vice Chairman JCS on the viability of the proposed concept in enhancing capabilities in relation to the stated operational objectives; the Under Secretary for Policy on the political and strategic implications of attaining, or not attaining, the enhancement; the Under Secretary of Defense for Acquisition on the reliability of the concept, equipment, and procurement strategy; the Assistant Secretary of Defense for Program Analysis and Evaluation on whether the proposal is the best way to attain the capability and reasonable in terms of costs; and, the Comptroller as to whether or not the current fiscal budget can finance the program. The final decision though rests in the hands of the arbitrator, in this case, the Deputy Secretary of Defense. *Ibid.*, pp. 25-26.

50. Dank, *op.cit.*, p. 51.

51. Devlin, *op.cit.*, p.41.

52. This would not be the first instance of cooperation between competitive sports and the Army in the transfer of athletic skills for military applications. During the Second World War, the Army recruited famous American skiers and mountain climbers to serve as the cadre of the 10th Mountain Division along with the forest rangers and park and wildlife experts counted among its ranks. Stanton, *op.cit.*, p. 93.

53. In the United States, there is the National World War II Glider Pilots Association; Germany — the Luftland-Fleigerkameradschaft; Great Britain — the Glider Pilot's Regimental Association. Devlin, *op.cit.*, p. 375.

54. Mrazek, *op.cit.*, pp. 62-63.

55. Despite this complication, 14,612 gliders were built during the Second World War, of which a single model, the ubiquitous Waco CG-4A accounted for 13,909 or 95 percent of the total — more than any American bomber, fighter, or transport aircraft manufactured during the same time frame. Devlin, *op.cit.*, pp. 63,373.

56. Four of the 16 prime contractors had never built an aircraft before, which included a furniture and refrigeration company, and a maker of industrial exhibits and displays; only four had aeronautical experience, and of those, only two had the facilities and organizational framework for mass production: Ford Motor Company and Cessna Aircraft. Prime subcontractors were as follows: Steinway and Sons Pianos (wing and tail assemblies); H.J. Heinz Pickle Company (wings); Anheuser-Busch (inboard wing panels); and, the Gardener Metal Products Company, a former coffin manufacturer (steel fittings for connecting wing struts to the fuselage). An inquiry into why the wing of a Waco CG-4A glider broke loose in flight and crashed during a St. Louis war bond rally in 1943 that killed all on board, including, the mayor and several city council members, found that a fitting, not to up to specification, delivered by the last subcontractor mentioned was the cause. *Ibid.*, pp. 63-64.

57. Cancellation of the original tooling contract, then 40 percent complete, also put the government in the red for \$650,000 without a single glider to show for the time, energy, and dollars spent. *Ibid.*, p. 65.

58. Before it lost its contract, the Babcock Aircraft Corporation delivered to the Army Air Corps fifty-four CG-4As at \$51,000 apiece; a more sophisticated P-51 Mustang manufactured during the same period cost \$58,824. The record though went to an unnamed contractor paid \$1.7 million for a single glider delivered and later rejected due to design flaws. *Ibid.*, p. 66. Dank, *op.cit.*, p. 58.

59. Secretary of Defense Les Aspin, Report on the Bottom-Up Review, (Washington D.C.: Department of Defense, October 1993), p. 102.

60. Sir Robert Thompson, ed. *War in Peace*, updated version, (London: Orbis Publishing Ltd., 1985), p. 195. Richard K. Fickett, "Role of Infantry may expand in Future Missions," *Army Times*, 1 August 1994, p. 1. Obtained electronically from the *Army Times* database on the American Online computer information service.

61. Charles B. MacDonald, *The U.S. Army in World War II-ETO: The Siegfried Line Campaign*, (Washington D.C. Center of Military History, 1990) p. 176n6.

62. General James Gavin candidly expressed his opinion on the matter in a post-war interview: "The glider pilot problem was a very serious and troublesome one...In the American Army, the glider pilots lived and worked with the Army Air Corps...the view held...was that once they landed their job was done." Britain's foremost airborne expert General Frederick Browning vehemently criticized this policy and used it in his defense with regard to the handling and subsequent partial failure of Operation Market-Garden. Browning argued the relief of the British 1st Airborne Division at Arnhem was achievable had an assault on the Nijmegen Bridge taken place earlier. The general cites with contempt the 1,000 American glider pilots assigned to Gavin's 82nd Airborne Division, for not being organized and trained to fight as infantry. Devlin, *op. cit.*, p.73. Dank, *op. cit.*, p. 205.

63. Another early decision that paid off for the regiment in times when it lacked adequate support personnel to assemble gliders was to also cross-train the pilots as mechanics. Devlin, *op.cit.*, p. 310. Mrazek, *The Glider War*, *op.cit.*, p.85. Dank, *op.cit.*, pp. 43-44.

64. The trouble, as Matthew Allen penned it in his book, *Military Helicopter Doctrines of the Major Powers 1945-1992*, was that:

[c]ritics saw aviators [in particular, those flying helicopters] as reluctant soldiers and frustrated pilots who only barely kept in touch with the presumed realities of land warfare and who knew little about soldiering and needed an education from the infantry, armor, or other branch...Nevertheless, senior officers were aware that these criticisms had to be addressed — for political and practical reasons. They emphasized that "[Army Aviation] must not be a separate elite organization." New training schemes sought to give aviators "a comprehensive understanding of

the basic operations and, specifically, how [ground] commanders plan and conduct them...

See Matthew Allen, *Military Helicopter Doctrines of the Major Powers 1945-1992*, (Westport, Connecticut: Greenwood Press, 1993), p. 48.

65. Equal pay was the most pressing of the grievances among glider-qualified pilots and combat and support troops; not until mid-1944, two years after the inception of an official glider program, did the Army authorize the same hazardous duty pay as parachutists: \$50 a month for enlisted men, \$100 a month for officers. Devlin, *op.cit.*, pp. 126-127.

66. Tom Clancy makes reference to this in his book *Airborne— A Guided Tour of an Airborne Task Force*:

There is a bit of resentment in the 325th [Airborne Infantry] about this, and troops of the 504th and 505th [Parachute Infantry] like to kid them about "riding" into combat. Such is the mystique of the 82nd that two words, "airborne" and "parachute" can still arouse emotions five decades after the last combat glider landing.

Clancy, *Airborne*, *op.cit.*, p. 210.

67. Situated at the summit of a ridge 150 feet above the Belgian countryside, the fortress of Eban Emael presented a formidable roadblock to the Wehrmacht's blueprint for a mechanized drive through the Low Countries. Impervious to a conventional assault, its man-made and natural obstacles combined with a system of interlocking pillboxes and bunkers defended by heavy artillery and garrisoned by 850 Belgians capable of enduring a siege formed the core of its defenses. The German High Command deemed a parachute assault out of the question since Eban Emael's early warning system included sound-ranging equipment capable of identifying incoming transports' miles away. On the other hand, estimates for subduing Eban Emael by ground attack predicted a six-month siege costing 6,000 casualties before capitulation. Operation Granite, a pre-dawn raid by seventy-eight commandos in nine gliders, ended the debate. Silently landing on the fortress's grass-covered roof, sappers quickly secured this mammoth installation, using hollow-shaped charges to neutralize strongpoints, in three hours and captured a force 10 times its size while incurring only 26 casualties. James Lucas, *Kommando-German Special Forces of World War II*, (New York: St. Martin's Press, 1985), p. 53.

68. Debriefing Conference — Operation Neptune, August 1944, *op.cit.*, pp. 7-9.

69. Ahead of the foot-bound infantry, the squadron was to make a "dash" and secure both ends at once of this "prize" spanning the Rhine. However, a serial of gliders carrying a troop of 22 jeeps (one of four troops) shot-up in an ambush, brought a "flurry of rumors and misinformation." Some accounts claim the squadron could not take its objective because it lacked the jeeps to secure the bridge. Disclaiming the rumors, the squadron's commanding officer (CO) retorted: "It was not due to a lack of jeeps, but to the fact that no one had warned us that the 9th and 10th SS Panzer Divisions were in the area." John L. Lowden, *Silent Wings at War*, (Washington:

Smithsonian Institute Press, 1992), pp. 76-79. Cornelius Ryan, *A Bridge Too Far*, (New York: Simon and Schuster, 1974), pp. 113n, 226n.

70. If one embraces this "establishment" view as valid logic, as the officer who led the Eban Emael raid argued, it follows, one must abstain from launching any method of shock attack since surprise had been forever lost after its first historical introduction on the battlefield. Mrazek, *The Glider War*, op.cit., p. 65.

71. Field Marshall Albert Kesselring scoffed at this tactic stating it was not the best way of beginning an airborne operation:

The exceptionally unfavorable landing conditions should have induced them to land in a single area away from the occupied objectives with their effective defense fire, and then to capture the decisive points (airport and seaport) intact in a subsequent conventional infantry attack at the point of main effort. In doing this it would not have been necessary to abandon the use of surprise local glider landings directly into key points, the possession of which would have facilitated the main attack.

Airborne Operations — A German Appraisal, op.cit., pp. 20-21

72. T/Os for British airborne divisions authorized one glider and two parachute infantry regiments — the correct force mix for operations with the glider in attack; this is without counting the glider pilots which added the equivalent of a second infantry regiment to the total. The U.S. Airborne Command, in accordance with their interpretation of doctrine adopted the 1942 71-series airborne division T/O which grouped one parachute with two glider infantry regiments; two-and-a-half years passed before it endorsed earlier recommendations for a T/O (71T) similar to the British-style. German airborne divisions contained three parachute and one air-landing regiments. Prior to its August 1965 Vietnam deployment, the newly activated 1st Cavalry Division (Airmobile), contained a full brigade of qualified parachutists. This practice ended when the Army found it difficult to provide enough replacements for paratroopers killed in action to maintain its other two airborne brigades already in-theater, the 173rd and the 1st Brigade of the 101st, at authorized strength. John Ellis, *World War II: A Statistical Survey*, (New York: Facts on File, 1993), p. 219. Stanton, op. cit., pp. 10-11,15. Shelby L. Stanton, *The Rise and Fall of an American Army*, (Novato, CA: Presidio Press, 1985), p. 53n3.

73. Had the Clinton Administration opted for an invasion of Haiti under Operation Uphold Democracy in 1994, it would have marked the first three-brigade combat drop of an airborne division, the 82nd, since the Second World War. During Desert Storm, the 101st Air-Assault performed the largest helicopter envelopment ever mounted at once in combat moving an entire brigade 93 miles into Iraq. Tom Clancy, *Airborne*, op. cit., p. 195.

74. This design may also extend a glider capability to mechanized infantry, similar to the dramatic change in air-assault doctrine after the 1987 revision of FM 90-4: "...all infantrymen and their supporting arms counterparts must be prepared to execute air-assault operations when the situation dictates. Mechanized infantry units of the heavy division...must be proficient in the

conduct of air-assault operations [emphasis added]." FM 90-4 Air-Assault Operations, op.cit., p. 1-2.

75. Mrazek, *Fighting Gliders of World War II*, op.cit. Appendix.

76. Devlin, op.cit., p. xiii.

77. Nick Cook, "Giant airships: shifting the load of the future," *Jane's Defense Weekly*, 28 October 1995, p. 4.

78. Gavin postulated helicopters could maintain the offensive momentum on a nuclear battlefield. Allen, op.cit., pp. 4,6.

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