

WWII U.S. Army Air Force Glider Aerial Retrieval System

Compiled by Leon B. Spencer, former WWII Glider Pilot

The architects of the U.S. Army Air Forces glider program determined in the spring 1942 that the large troop and cargo carrying gliders under development were simply too expensive to be abandoned after one combat mission. The cheapest unit price for a 15-place CG-4A was \$15,580, while some companies charged much more. The fields and pastures in which gliders landed were usually too small and the terrain too uneven for a plane to land and retrieve the gliders. Another means of recovery had to be found. To find an answer to their problem the Air Force turned to Richard C. duPont, a 1930s national glider soaring champion and the president of All American Aviation of Wilmington, Delaware. Several years earlier, DuPont's company had developed an aerial retrieval system to pick up U.S. Postal Department mail pouches from the ground by an aircraft on the fly, and had demonstrated to U.S. Air Corps officials at Wright Field, Ohio, on 18 July and 22-28 September 1941 that aerial retrieval of gliders was feasible.

The aerial retrieval of objects from the ground was not new in aviation. The U.S. Marines were using a rudimentary aerial pickup system as early as 1927. The system was simple but functional. A wire with a weight on the end was trailed behind a surplus World War I de Havilland single-engine D.H. 4 biplane. As it flew over the ground station the trailing wire engaged a rope loop suspended between two poles to which was attached a leather pouch, probably containing dispatches.

In 1939, Richard duPont teamed with Dr. Lytle S. Adams, a dentist/inventor from Morgantown, West Virginia, and formed the All American Aviation Company in Wilmington, Delaware, duPont's hometown. Dr. Adams had designed an aerial retrieval system in 1938 but lacked the financial resources to develop and market his product and needed a partner with money. Mr. duPont, a member of the wealthy E. I. DuPont family, was the perfect choice. Their new company performed a number of experiments with Adam's system and made some improvements. On 12 May 1939, All American began operating on a demonstration basis two mail routes extending from East Coast cities along strings of small towns through the Appalachian Mountains to Pittsburgh, Pennsylvania. The company used a specially equipped single-engine Stinson SR-10C monoplane to pick up U.S. Postal Service mail pouches on the fly at rural towns having no airport.

To satisfy the requirements of the Postal Service All-American Aviation fitted its aircraft with the company's AAS-4 internal cable winch with a braking mechanism. A cable ran through guides to an external boom mounted on the

fuselage and then to a hook at the end of the boom. The system functioned much like a fishing rod and reel. The pickup airplane would fly low (approximately 20 feet above the ground) over the pickup station and hook a nylon loop stretched between two poles approximately 12 feet above the ground. Just as the hook snagged the loop the pilot would pour on the power and climb away at a fairly steep angle, dragging the mailbag behind the plane on the cable. At the moment the hook made contact the winch would feed out cable to absorb the inertial energy of the pouch weight. The operator would then retrieve the pouch by rewinding the steel cable.

The aerial retrieval demonstrations conducted by AAA July and September 1941 used the Model AAS-4 pickup winch installed in a company Stinson SR-10C high-wing monoplane. The Stinson successfully snatched a 500 pound gross weight "Midwest Utility" glider containing a weighted pilot dummy from the ground. Following the demonstrations, AAA issued a report proposing that they could build a system to pick up heavier gliders.

During further tests in 1942, All American Aviation used the Stinson SR-10C to successfully snatch a two-place, Schweizer XTG-3 military training glider from the ground at Clinton County Army Air Field (CCAAF), Wilmington, Ohio. Mr. duPont himself piloted the glider. As a safety feature the company aircraft was equipped with cutting knives mounted in front of the wheels in the event that the tow rope should snag on them. During further demonstrations a propellorless Piper Cub was successfully snatched from the ground.

That same year glider aerial retrieval demonstrations were conducted at CCAAF with the larger and heavier 9-place Waco XCG-3 troop/cargo glider. A twin-engine, Douglas B-23 Dragon bomber equipped with the newly developed AAA Model 40 system was used as the pickup aircraft. Like duPont's Stinson, it too was equipped with cutting knives mounted forward of the landing gear. Colonel Frederick Dent, head of the Glider Branch at Wright Field, piloted the XCG-3 for the first test in December 1942. It proved successful.

Army Air Force contracts to AAA were let in 1942 to provide pickup equipment initially for training gliders, and finally for gliders weighing from 8,000 to 16,000 pounds. A new Model 80 heavy-duty pick up system was subsequently designed incorporating improved braking systems that made use of a "time delay" function where the first several drum rotations had a reduced braking force to allow the drum to accelerate without applying high cable loads, and then the final brake force was gradually applied until the preset line tension was established. Much of the credit for the successful development of the M-80 system belongs to the AAF's Captain Chester Decker, who first tested its military application and who taught its use at Laurinburg-Maxton AAB, North Carolina, to hundreds of power pilots.

Initial flight testing of the M-80 system was conducted at AAA's DuPont Airport in Wilmington, Delaware, in the first half of 1943, but subsequent primary testing was switched to CCAAF. An 182¹ foot nylon tow rope, 15/16 inches in diameter, was initially used for the Waco CG-4A tests. One end of the tow rope was connected to the nose of the glider, while the other end was connected to a closed loop of nylon rope, 80 feet in circumference, which was draped over the top of two 12 foot stanchions spaced 20 feet apart and positioned ahead of and slightly to the right of the glider.

The use of tow ropes made of nylon fiber developed by the E. I. DuPont Company greatly enhanced glider "snatch pickups." This fiber, when woven into a rope, was elastic. It would stretch 25% to 30% of its length and thus absorb much of the shock as the glider became airborne. The rope would then return to its original length. Because of this characteristic, the average acceleration for pickup was only 7/10 of one G, which according to AAF Manual No. 5-17, lasted about 6¹/₂² seconds. This is significant if you consider that pilots catapulted from an aircraft carrier experience 2¹/₂ G's. The glider would usually become airborne in no more than 200 feet.

Twin-engined Douglas C-47 transports were the primary aircraft used to test the Model 80C pickup system. Several were retrofitted with the device for the tests. The M-80C Glider Pick-up Mechanism, as it was officially designated by the AAF, consisted of a controllable, motor-driven, energy absorbing drum containing 1000³ feet of flexible 5/8" steel cable, twin pulleys, torque tube, hydraulic cylinder and explosive cable cutter controls. The mechanism was bolted to the floor on the left side of the cabin about six feet from the front bulkhead of the aircraft. The reel was equipped with friction clutch that could be adjusted for different glider weights and speeds. The amount of cable played out was directly proportional to the weight of the glider and the nature of the acceleration of the glider after the pickup. Under most circumstances the cable pay-out was usually less than 600 feet. The maximum designed load of the pick-up unit was 8,000 pounds.

Modifications evident from the outside of a C-47 included a plug-style access panel mounted within the aircraft's door frame and an adjustable, exterior mounted, 20 foot wooden arm on the left side of the fuselage that could be raised or lowered electrically. At the end of the arm was a polished steel hook. Steel cable from the energy absorbing drum was secured to the hook. In the stowed position, the hook, arm and cable assembly was secured to the fuselage forward of the cargo door. It was accessible through the open cargo door. The pole was held in a level position for takeoffs and landings, and was adjustable so it could be locked down at a 45 degree angle during glider retrieval.

In addition to the normal crew of a pilot, copilot, crew chief and radio operator, the retrieval aircraft required a winch operator. The aircraft crew chief and radio operator assisted the winch operator if necessary. The winch opera-

tor's function was to properly set the pickup drum clutch snubbing adjustment, which was based on the glider's weight and the aircraft's proposed speed at the instant of the cable hook/glider rope loop engagement. The drum manufacturer (General Aviation) provided a chart with recommended snubber settings for various glider weights/aircraft contact speeds, etc. The shock of the initial contact with the nylon rope was the critical moment that placed the greatest stress on the flexible steel cable. At the very instant of "snatch" the winch operator's judgment received its most critical test. A misjudgment could result in a broken cable and possible severe injury to the operator or damage to the aircraft, or both.

When retrieving a glider the tow plane approached the pick-up station at a 45 degree angle about twenty feet above the terrain at 130 to 145 miles per hour IAS, depending on the gross weight of the glider. At the moment the tow rope was snagged by the aircraft's trailing hook the winch drum began to feed out cable rapidly, then more slowly as the brake took effect. Some of the initial shock was absorbed by the unwinding cable and the elasticity of the nylon tow rope. In a matter of about seven seconds³ the glider would accelerate from 0 to 120 miles per hour IAS and would become airborne in as little as sixty feet. At the same time the extra weight of the glider slowed the tow plane to about 105 mph. Slowly, the cable drum braked to a full stop and then reversed. The glider, now 500 or more feet behind the tow plane, was slowly winched in to the tow rope hook.

In July 1943, Major Louis B. Magid, Jr., on the staff of the Airborne Command at Fort Bragg, North Carolina, tested the AAA glider retrieval system and its associated technique. In these tests a C-47 flying at 140 miles per hour snatched a glider off the ground. Within seconds from the time the C-47's tow-hook seized the glider rope slung between two upright poles, the glider was in the air and flying at 120 miles per hour. Tests were also conducted with gliders equipped with skids only as take-off gear. Major Magid reported that the engines of the tow plane showed less strain during the pickup than during a conventional take-off.

While the year 1943 was one of great achievement for the aerial pickup technology, it was a sad year for the AAA Company because of the death of its founder, Richard C. duPont. He had accepted an assignment as a special assistant to the Army Air Force chief, General H. H. Arnold, in June 1943, and was tasked to oversee the Army's glider program. At March Field, California, on 11 September 1943, while flying aboard a Bowlus XCG-16 test glider it entered into a spin shortly after being released from the tow plane. DuPont bailed out, but his parachute failed to open fully and he was killed. He was awarded the Distinguished Service Medal by the AAF posthumously in recognition of his services to the war effort.

Once the aerial retrieval system became operational glider pilot students at the Glider Crew Training Center at Laurinburg-Maxton Army Air Base were required to participate in at least one snatch pickup as first pilot, and one as copilot. As the need for gliders became more acute at glider pilot training bases it was not uncommon for CG-4As to be snatched rather than shipped from the manufacturers' plants. This was frequently the case at the Ford Plant at Iron Mountain, Michigan; the Gibson Refrigerator Plant at Greenville, Michigan; and the Waco Plant at Troy, Ohio.

Glider snatch pick-up was employed by the USAAF in the European and China-Burma-India (CBI) theaters during World War II. Pick-up teams retrieved downed gliders from the battlefields of France, Burma, Holland and Germany. Extant records note that thirteen gliders were retrieved from Normandy, France, two hundred fifty-six⁴ (256) from Holland following Operation Market-Garden, and one hundred forty-eight (148) from Germany following Operation Varsity.

On 21 June 1944, Captain Roy Sousley and ten other glider pilots from the 437th Troop Carrier Group were sent to Normandy to begin preparations for the retrieval of the gliders used in the invasion. Sousley had orders from Ninth Air Force to conduct a survey of the entire American airhead area and then send back to England a report on how many gliders could be retrieved by using the aerial snatch method. The results were far worse than anticipated. Every one of the Horsas and all but 13 of the 292 CG4As were found to be either located in heavily treed fields inaccessible to the snatch plane, or damaged beyond repair by rough landings, German shelling, or vandals, some of them American soldiers. The 13 CG-4As were snatched out of Normandy on 25 June and returned to England.

Reacting to pressure applied by General Arnold, who had been greatly displeased with glider recovery operations in Normandy and Southern France, General Brereton undertook a vigorous effort to retrieve as many gliders as possible from Holland. Between 25 September and 1 October, three repair teams of 150 glider mechanics each were sent to Holland to salvage the damaged American gliders that were scattered all over the liberated portions of that country. The weather during that period was horrible. On 17 October a storm blew across Holland, wrecking 115 gliders that had been completely repaired and readied for aerial snatch pickup. By mid-December, when salvage operations ended, only 281 American gliders had been snatched out of Holland.

On 22 March 1945, an historic medevac glider mission took place in Europe. Two CG-4As landed in a clearing near the Remagen, Germany bridgehead to evacuate twenty-five severely injured American and German casualties. Each glider was fitted with six stretchers suspended by nylon straps on each side of the cargo area. Once loaded the gliders were successfully snatched from their landing site by a C-47 transport and flown to a military hospital in France.

An Army nurse from the 816th Medical Evacuation Squadron, Lieutenant Suella V. Barnard (or Bernard), volunteered to accompany and care for the wounded enroute. She became the only nurse to participate in a glider combat mission during WWII.

A second high profile glider mission was carried out following the crash of a C-47 in Hidden Valley, New Guinea, on 13 May 1945. Two paratrooper medics jumped at the crash site five days later to care for the injured survivors, two soldiers and a WAC corporal while rescue plans were formulated. It was decided that the safest method of rescue was to land a CG-4A glider at site ten miles below the crash site and retrieve it by snatch pickup. On 20 May, Captain Cecil E. Walter, Jr. and eight additional paratroopers jumped below the survivor's campsite to locate and clear a site for the glider to land. It took three trips to extract the survivors and the rescue team from the valley. This remarkable rescue mission is fully described in Colonel Edward T. Imparato's book, "Rescue from Shangri-La," published in 1997 by Turner Publishing Company of Paducah, Kentucky.

Once the retrieval of a single glider was perfected experiments began at CCAAF to retrieve two gliders with a single tow plane. In this operation, two gliders were properly lined up with two separate tow ropes and two separate ground stations for holding each pickup loop. The C-47 tow ship picked up the first glider and then circled back and snatched the second glider. The difficulty in the double retrieval was the transfer of the first tow rope from the winch pickup cable to the normal tow point on the tail of the tow plane. This was necessary so the winch cable and pickup hook could be reset on the boom in order to pick up the second glider.

On the double pickup the following method was used to remove the first glider pickup loop from the hook and transfer it to the tow release on the tail of the C-47; First, one end of a doubled nylon rope was tied off to a tie down ring in the floor of the C47. The cable winch then reeled the pickup loop near the door of the C-47. A gaff hook was used to insert the free end of the doubled line through the pickup loop and bring the free end of the doubled rope back into the door. The free end of the doubled rope was then hooked to the working end of a double block and tackle. The block and tackle was used to pull the pickup rope loop and pickup hook to the edge of the door of the C47. The free end of the short doubled rope was secured to another tie down ring and the block and tackle removed. A pre-attached short tow rope running to the tow socket of the tow plane tail was connected to the loop and the pickup hook removed from the loop. To release the tow rope from the short double holding rope and allow the tow rope to go to the tow socket, the double rope was chopped through with a fire axe. The pickup hook was reset in the pickup arm and the second glider was picked up and towed on the winch cable. The procedure took less than fifteen minutes.

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The C-47 for the first test was flown by Lt. Lee Jett, with Louie Winters as crew chief, and other CCAAF enlisted men handling the winch and associated operations. Lt. John Bryant piloted the first glider snatched, and Lt. Joseph Mollinary piloting the second glider.

See Attachments A through F for a pictorial view of the USAAF Glider Aerial Retrieval System.

Note:

- 1 - The length of the tow rope was subsequently increased to 225 feet.
- 2 - AAF Manual No. 50-17, "Pilot Training Manual for the CG-4A Glider," Page 44, notes that the winch drum could accommodate 1,057 feet of 5/8" steel cable.
- 3 - Some say as little as 3 seconds, while others say about 6 seconds. AAF Manual No. 50-17 shows about 6½ seconds.
- 4 - Some records say as many as 281.
- 5 - In Colonel Young's book, "Into the Valley," published in 1995 by PrintCom, Inc, Dallas, Texas, he states that it took 900 men two months to repair the gliders.

Source Data: The data was extracted from a number of sources: (1) Gerard M. Devlin's book, "Silent Wings," published in 1985 by St. Martin's Press, New York; (2) Colonel Charles H. Young's book, "Into the Valley," published in 1995 by PrintCom, Inc, Dallas, Texas; (3) James E. Mrazek's book, "Fighting Glider of World War II," published in 1977 by St. Martin's Press, New York; (4) Charles L. Day's book, "Silent Ones - WWII Invasion Glider Test and Experiment," published privately in 2001; (5) AAF Manual 50-17, "Pilot Training Manual for the CG-4A Glider," dated March 1945; (6) AAF Manual 51-129-2, "Pilot Training Manual for the C-47 Skytrain Aircraft," dated 15 August 1945; (7) USAAF Handbook AN-01-25LA-1, "Pilot's Flight Operating Instructions for Army Models C-46 Series Airplane," dated 15 December 1944.

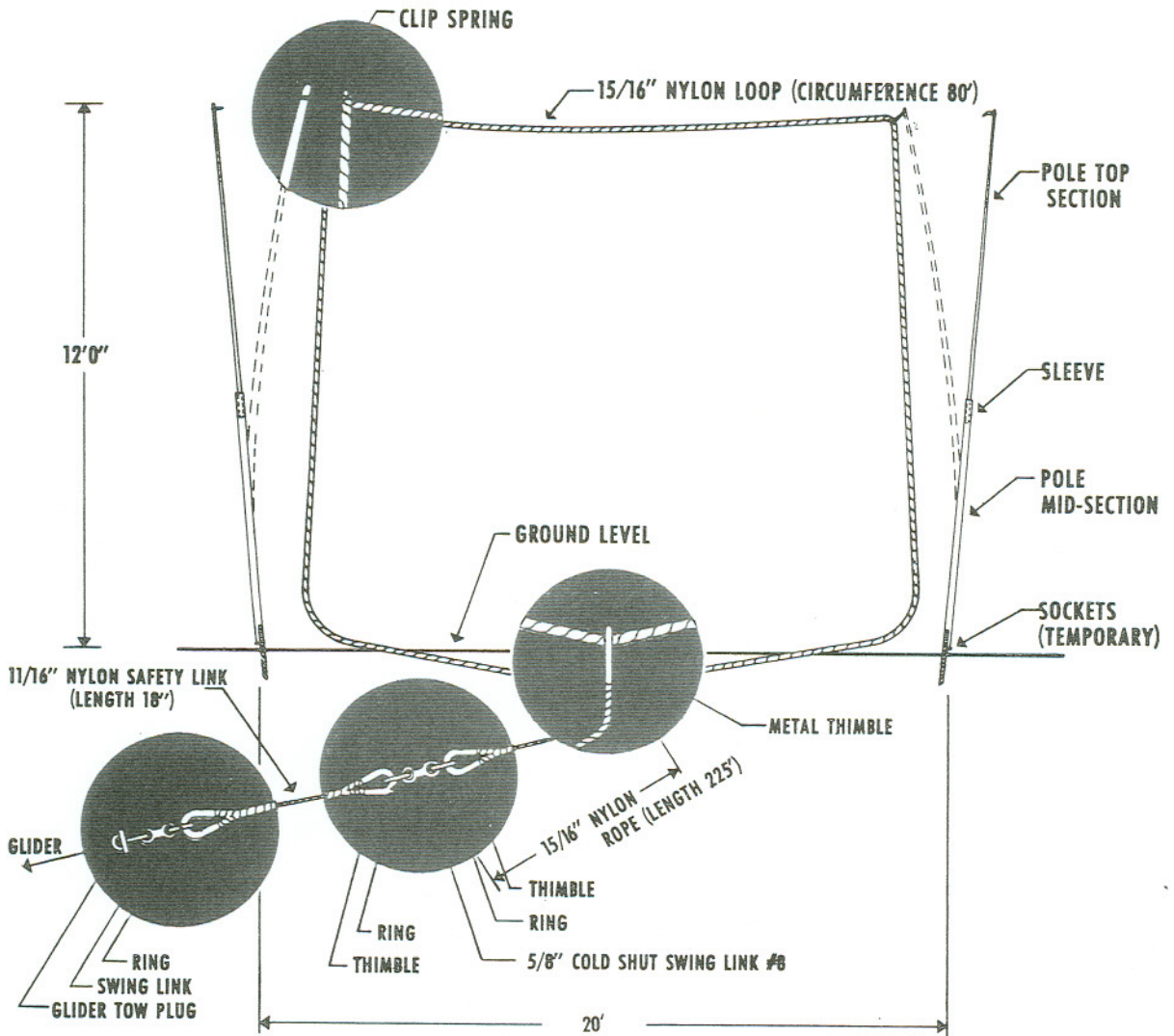




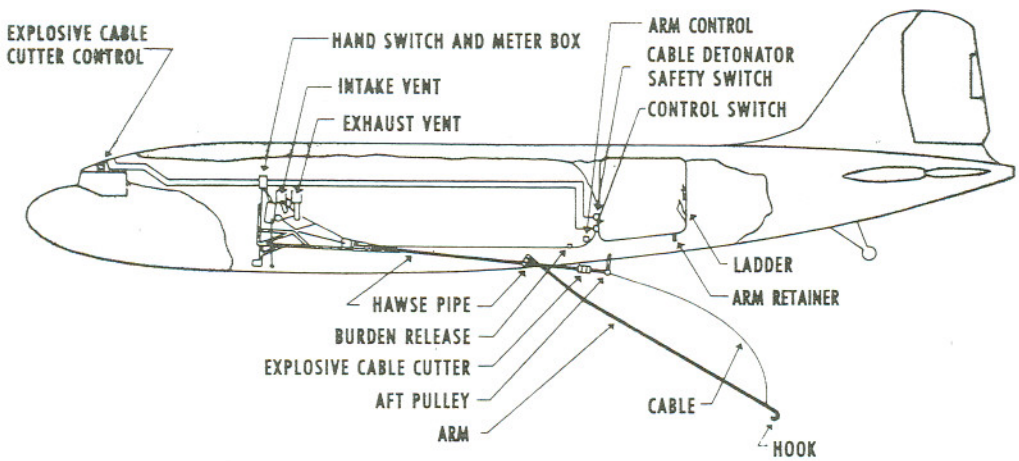
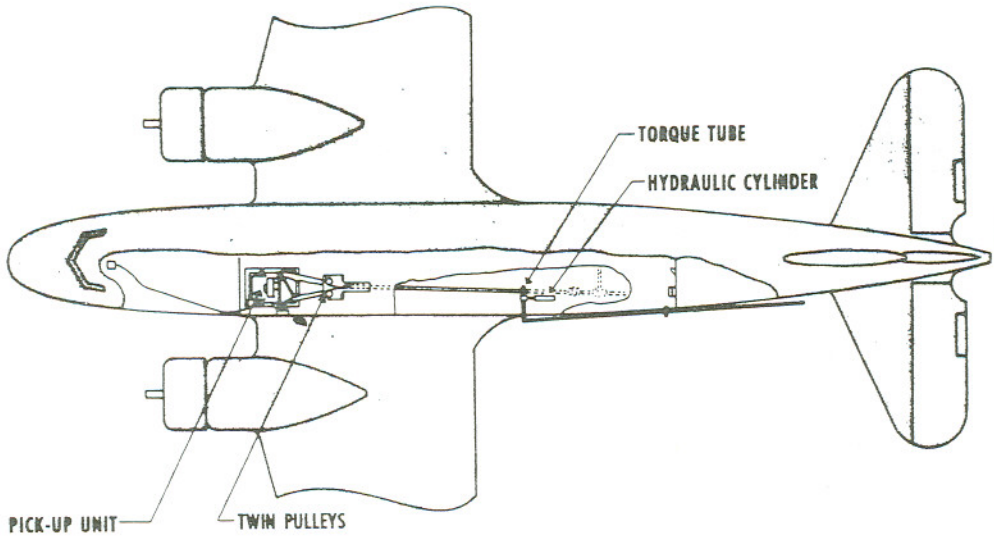


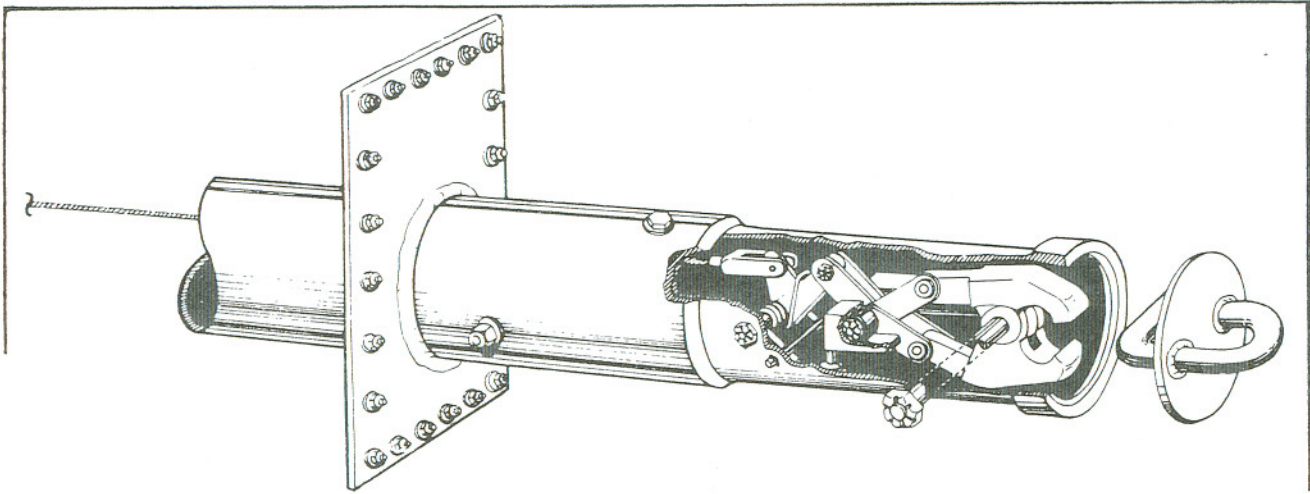
ATTACHMENT "B"

GLIDER PICKUP GROUND STATION UNIT

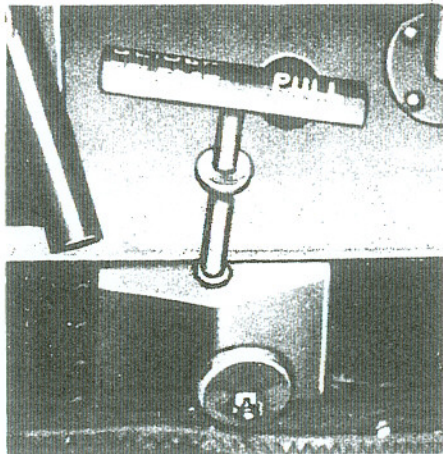


GLIDER PICK-UP UNIT





Glider Tow Release Mechanism



Glider Tow Release Handle

