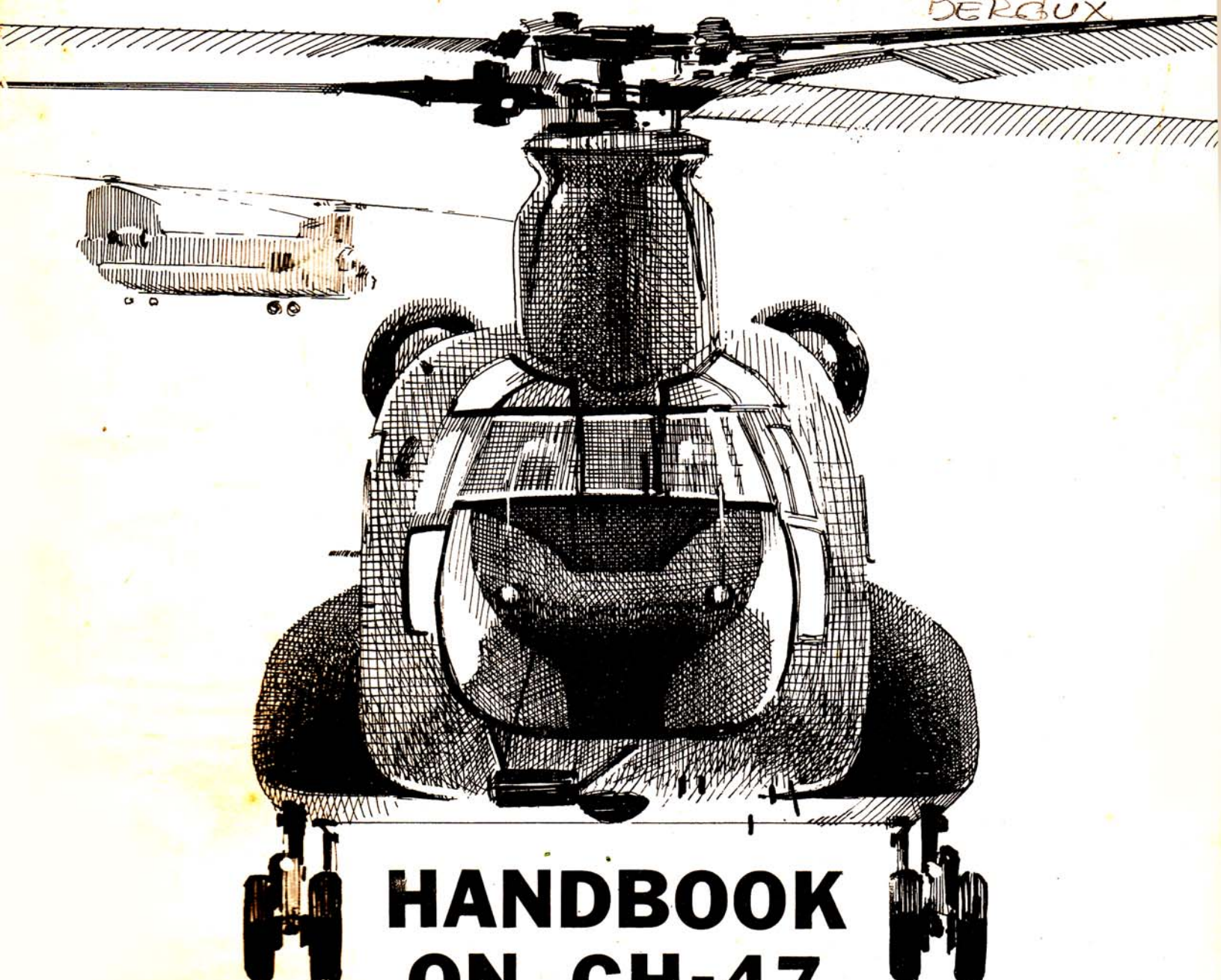


Bergdux



**HANDBOOK
ON CH-47
(CHINOOK)**

**EMPLOYMENT & UTILIZATION
IN VIETNAM**

OCTOBER 68

FOR THE GROUND UNIT COMMANDER

THE GROUND TROOPS'

HANDBOOK FOR

CH-47 (CHINOOK)

UTILIZATION AND EMPLOYMENT

IN VIETNAM

(INCLUDES SECTION ON CH-54 SKYCRANE)

HQ USARV 1968

Figures and Page Numbers

Figure 1	Cargo Hook	Page 8
Figure 2	Rescue Seat - Forest Penetrating	Page 9
Figure 3	Troop Ladder	Page 9
Figure 4	Troop Seating Installation of the CH-47A	Page 12
Figure 5	Litter Installation of the CH-47A	Page 12
Figure 6	Troops Leaving Helicopter	Page 13
Figure 7	Close-up of Hook-up	Page 15
Figure 8	Correct Way to Hold Doughnut	Page 15
Figure 9a	1st Step - Choker Hitch	Page 22
Figure 9b	2nd Step - Choker Hitch	Page 22
Figure 9c	3rd Step - Choker Hitch	Page 22
Figure 10a	Wrapping Canvas on Sling	Page 23
Figure 10b	Final Taping of Canvas Wrapping	Page 23
Figure 11	Angularity Factor Chart	Page 26
Figure 12	Most Desirable Lighting Arrangement for CH-47 Night Landing Area	Page 34
Figure 13a	Endless Sling "Doughnut"	Page VII- 3
Figure 13b	Anchor Shackle	Page VII- 3
Figure 13c	Medium Clevis (Size 3)	Page VII- 3
Figure 13d	Large Clevis (Size 5)	Page VII- 3
Figure 14a	3 Loop 9ft Sling	Page VII- 4
Figure 14b	2 Loop 9ft Sling	Page VII- 4
Figure 15a	A22 Bag Liner	Page VII- 5
Figure 15b	A22 Bag	Page VII- 5

Figure 16	Sling Cargo Net (Metal Octagonal)	Page VII-6
Figure 17	Doughnut Failure Caused by Twisting Action of Load	Page VII-7
Figure 18	Strap Failure Caused by Rubbing Against Metal	Page VII-7
Figure 19 thru 34	(To be added as later supplement to manual)	
Figure 35	Over-all Dimensions of the CH-47	Page XV-1
Figure 36	Cargo Compartment Dimensions of the CH-47A	Page XVI-1
Figure 37	CH-54 Lifting a 2 1/2 Ton Truck	Page XVII-8

INTRODUCTION

This handbook has been prepared to assist ground unit personnel in recognizing the capabilities and limitations of the CH-47 (CHINOOK) helicopter and to provide a common understanding between the supporting aviation and supported ground units regarding its employment. The Chinook is relatively new to the Army inventory and a large number of personnel assigned to duty in Vietnam have not previously been afforded the opportunity to work with this aircraft. This handbook has been compiled from what is considered to be the best currently available information on Chinook employment and utilization in the Vietnam tactical environment, with emphasis on airlift of cargo and equipment. The procedures set forth in this handbook are the results of thousands of missions, extensive support of various ground units, and a great deal of trial and error. It would be impossible to give credit to everyone who has contributed to this pamphlet since contributions were made by virtually every unit in the theater. Acknowledgement is extended to the 1st Aviation Brigade for the cooperation and assistance which made publication of this handbook possible. Users are encouraged to submit recommended changes or comments to improve this handbook, to Headquarters, United States Army Vietnam, ATTN: AVHGC-DST, APO San Francisco 96375.

Table of Contents (Continued)

CHAPTER 9	EXTRACTION OPERATIONS
CHAPTER 10	PREPARATION OF A NIGHT LANDING AREA
APPENDIX I	REFERENCES
APPENDIX II	WEIGHTS OF COMMON ITEMS
APPENDIX III	TYPICAL LOADS
APPENDIX IV	LOADING PLAN AND PASSENGER MANIFEST
APPENDIX V	CHECK LIST FOR CARGO RIGGING
APPENDIX VI	MISSION REQUEST FORM
APPENDIX VII	EQUIPMENT USED FOR RIGGING EXTERNAL LOADS
APPENDIX VIII	RECOMMENDED LIST OF RIGGING EQUIPMENT BY TYPE ORGANIZATION (To be added as later supplement to manual)
APPENDIX IX	METHODS OF RIGGING TYPICAL LOADS (To be added as later supplement to manual)
APPENDIX X	METHODS OF LOADING CARGO BAGS AND NETS (To be added as later supplement to manual)
APPENDIX XI	ARM AND HAND SIGNALS
APPENDIX XII	LOAD CARD FOR RESUPPLY OPERATIONS
APPENDIX XIII	AERIAL MOVEMENT AND RESUPPLY CHECKLIST
APPENDIX XIV	RIGGING OF TACTICAL VEHICLES (To be added as later supplement to manual)
APPENDIX XV	CH-47 OVERALL DIMENSIONS

Table of Contents (Continued)

APPENDIX XVI

CH-47 CARGO COMPARTMENT
DIMENSIONS

APPENDIX XVII

CH-54 UTILIZATION AND EMPLOYMENT

c. FM Radio Set (AN/ARC-54): Provides two-way communications and a homing capability within the tactical frequency modulation band of 30.00 to 69.95 megacycles on 800 channels in 50kc increments. The range is limited under normal conditions to approximately 80 miles. The homing capability is used to great advantage during tactical operations. When a ground station is transmitting, a position indicator on the helicopter instrument panel shows whether the helicopter is left, right, on a heading to, or over the transmitter. Therefore, when a ground station is requested by the helicopter pilot to "key" its transmitter switch, the pilot is then able to home in to the station.

SECTION V - CARGO LOADING AIDS

The Chinook has a number of features to facilitate loading of cargo. Only those of interest to ground unit personnel are described below:

a. Cargo Hook System: A cargo hook (Figure 1) which can accept a load to a maximum of 16,000 pounds (8,000 pounds allowable cargo load (ACL) in this theater of operations) is provided to attach external loads. The position of the cargo hook allows the load to be suspended beneath the center-of-gravity of the helicopter. The hook is suspended by means of a carriage, from a removable beam which is mounted inside the rescue hatch located at the bottom of the fuselage. The hook also contains a spring-tensioned keeper which prevents accidental loss of cargo. The cargo hook system is normally operated electrohydraulically, but can also be opened pneumatically or manually. A load can be released from the cargo hook by the aircraft commander or pilot from the cockpit, or by the flight engineer or crew chief from the cargo compartment. Provisions for emergency release of cargo from the hook are installed, should failures to the helicopter's hydraulic or electrical systems occur. CH-47B has a 20,000 pound capacity hook, but is normally limited to a 10,000 pound load by ACL.

b. Winching System: a 3,000 pound capacity, hydraulically operated winch is permanently mounted on the floor in the right-hand forward cabin section. The winch has 150 feet of 1/4 inch cable and is capable of winching up to 12,000 pounds of cargo, with the aid of four pulley blocks through the rear cargo door. The winch has two reeling speeds: (1) for cargo loading (20 ft/min) and, (2) for hoisting (100 ft/min). The winch can be controlled from the cockpit or from the cargo compartment

c. Hoisting System: The hoisting system is used for air rescue and for aerial loading of smaller general cargo through the utility hatch in the underside of the fuselage. The cargo hook assembly must be removed from the utility hatch before using the hoisting system. The hoisting system differs from the winching system only in the manner in which the cable is reeled. Hoisting operations require the winch cable to be reeled overhead in the cabin fuselage section and the hoist load capacity is limited to a maximum of 600 pounds. The winch cable hook is used for hoisting operations together with a cable cutter which provides a means for quickly severing the cable in the event of emergency. The hoisting system can be used in conjunction with the following equipment:

(1) Stokes Litter (FSN 6530-783-7810): The Stokes Litter is a rigid aluminum frame basket type litter which can be used to extract wounded personnel from an otherwise inaccessible area. The litter is hoisted from the ground at a near vertical angle to permit access through the helicopter's rescue hatch. If there is a necessity to extract an individual through dense foliage, two Stokes' Litters may be strapped together face-to-face to provide complete protection to the individual.

(2) Mountain Rescue Litter (FSN 6530-783-7600): The Mountain Rescue Litter is a semi-rigid poleless canvas-type litter which can be used for the same purpose as the Stokes Litter. However, this litter does not offer the same protection during the extraction through dense foliage. Its main advantage is ease of storage and transport.

(3) Rescue Seat, Forest Penetrating: The Rescue Seat, Forest Penetrating (Figure 2) is a three-legged aluminum device which can accommodate two personnel and can be used to either extract personnel from, or lower them into, otherwise inaccessible areas. Nylon straps are located in the top of the rescue device to aid in holding an injured person to the seat; however, personnel carried on the rescue seat should be ambulatory.

(4) Trooper Ladder: This device can be used to off-load troops into, or extract them from, otherwise inaccessible areas. The Trooper Ladder is mounted on the rear ramp of the helicopter and can be used in lengths of 60 and 120 feet. Figure 3 shows a view of the ladder installed. Although its employment is tactical, operations has

proven practical in emergency situations, utilization of the Trooper Ladder is extremely hazardous for the following reasons:

(a) Both the helicopter, while hovering, and the troops, which deployed on the ladder, are extremely vulnerable to hostile ground fire, even from a single sniper.

(b) While hovering at altitude, the helicopter is in the maximum danger area, aerodynamically, should a mechanical malfunction occur.

(c) Exceptional pilot skill is required to keep from drifting to avoid entangling the ladder with obstacles, and to maintain constant altitude. This operation fatigues the pilot rapidly.

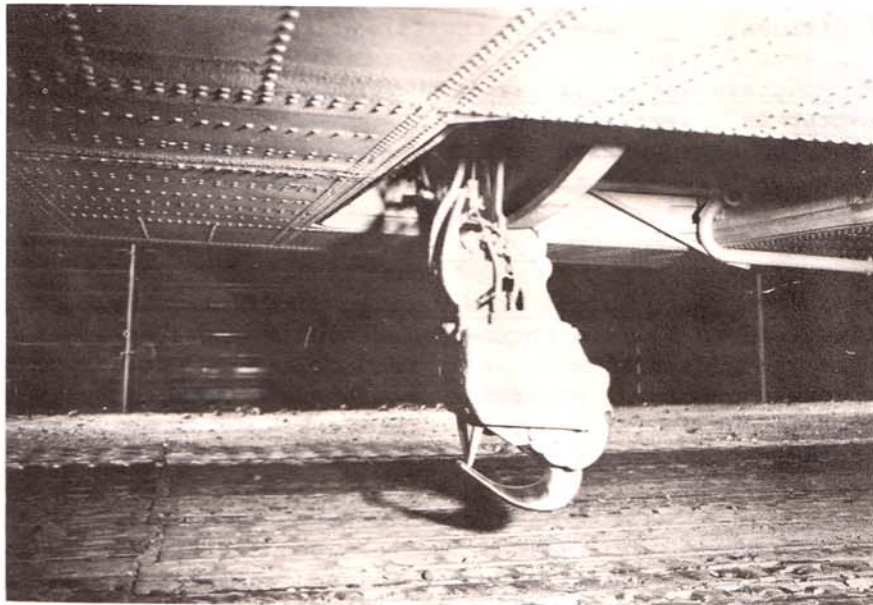


Figure 1 Cargo Hook



Figure 2 Rescue Seat, Forest Penetrating



Figure 3 Troop Ladder

CHAPTER 2 - CAPABILITIES AND LIMITATIONS

SECTION I - GENERAL

1. As presently organized, one CH-47 company (16 aircraft) can furnish continuous operational support, during visual flight conditions, if a total of not more than six helicopters are committed. In order to keep six helicopters in continuous operation, the Chinook unit will often utilize ten or eleven aircraft during the course of the day. The additional aircraft are used to replace aircraft requiring scheduled or unscheduled maintenance and to accomplish repair parts pickup and transport of crews and equipment to the field for on-site repair. Maintenance and support for the CH-47's is based on 60 hours per aircraft per month or 960 hours per month for the 16 aircraft. It is common for the six aircraft, when being properly utilized, to exceed forty flying hours a day. If this were continued over a thirty-day period the unit would fly 1,200 hours or 240 hours over what has, in view of current support, proven to be a realistic program. Since most CH-47 units support several tactical units, it is extremely important that the maintenance posture of the Chinooks be maintained at a high level to preclude a collapse of Chinook support with the resultant adverse effects on supported units' support requirements.

2. The design gross weight of the CH-47A is 28,500 pounds, with an alternate or maximum allowable gross weight of 33,000 pounds for normal operations. The CH-47B maximum allowable gross weight is 40,000 pounds.

3. Cargo may be loaded internally or sling loaded externally. The allowable cargo load (ACL) for the Chinook, with a full load of fuel, is 8,000 pounds *. This ACL is computed by considering the average basic weight of the CH-47, adding those variable items which remain substantially constant (i.e., oil, crew, armament, and standard and emergency equipment), and including a full load of fuel. An 8,000 pound ACL will permit a radius of action of 75 nautical miles, with 30 minutes fuel reserve. The CH-47B has a 10,000 pound ACL*.

4. The Chinook has a total fuel capacity of 620 gallons (4,036 pounds),

* This is applicable for operation at or near sea level. When operating at higher altitudes contact supporting CH-47 unit for ACL.

which gives a total flying time of 1 hour and 45 minutes. The amount of fuel carried may be varied under certain circumstances to allow more cargo to be transported (for short haul operations such as river or obstacle crossings, the Chinook can transport 11,000 pounds with minimum fuel). However, it is emphasized that for planning purposes loads should not exceed 8,000 pounds (10,000 pounds for planning purposes with the CH-47B and up to 14,000 pounds with special preparations).

5. The limitations upon CH-47 employment in a tactical area follows:

a. Local security must be provided by supported unit in order to permit sustained operations into unsecured areas.

b. Capabilities are significantly reduced during darkness, reduced visibility, and severe weather.

c. Extensive support maintenance is required during sustained operations.

d. Continuous POL resupply-in-volume is required.

SECTION II - SEATING CONFIGURATION

As shown in Figure 4, troop seating capacity in the Chinook is 33. This provides a seat and safety belt for each man. It is desirable for safety reasons that each passenger have a seat and safety belt; however, under emergency conditions the Chinook can transport up to 40 troops (at 240 pounds per man) with a reduced fuel load and a radius of action of 25 nautical miles. Up to 50 ARVN soldiers can be tactically loaded in the aircraft, but some will be required to be seated on the floor.

SECTION III - LITTER CONFIGURATION

As shown in Figure 5, provisions for 24 litters are available. The two one-man seats in the aft section of the cargo compartment may remain in place to accommodate medical attendants. It is not necessary to remove the troop seats in order to install the litters. The CH-47 may, therefore, augment aeromedical evacuation from the tactical zone.

SEAT INSTALLATION

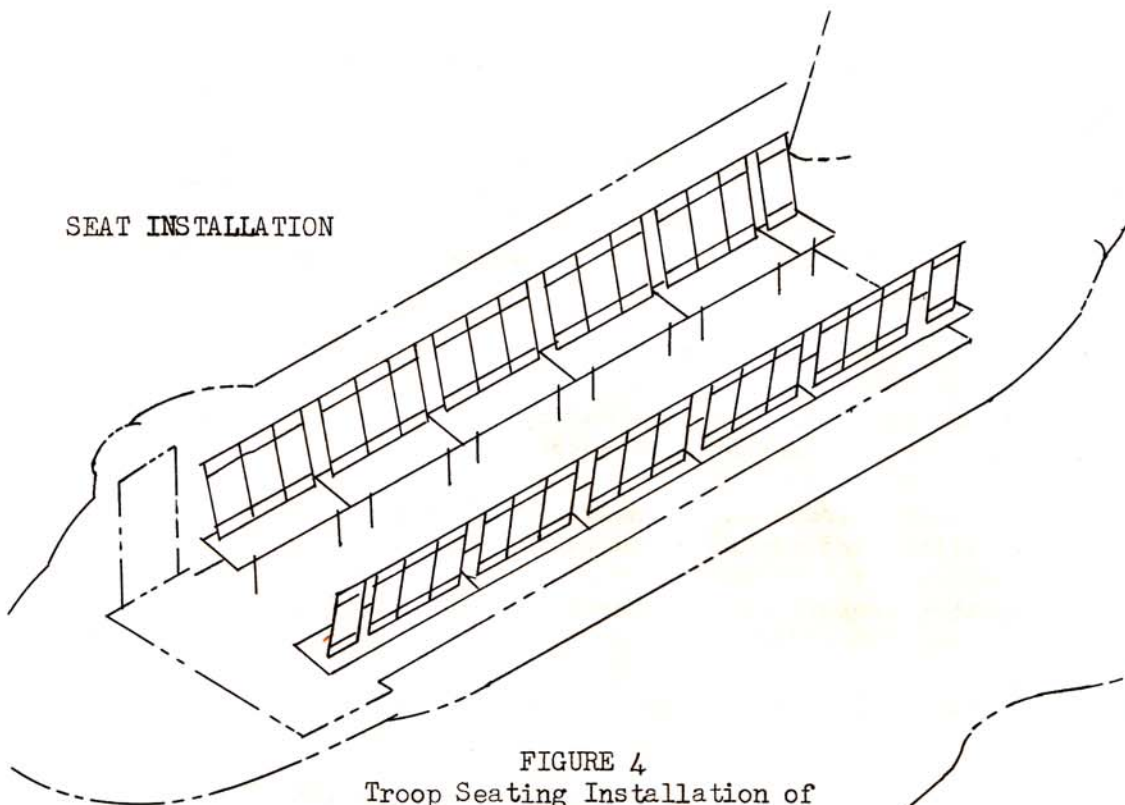


FIGURE 4
Troop Seating Installation of
the CH-47A

LITTER INSTALLATION

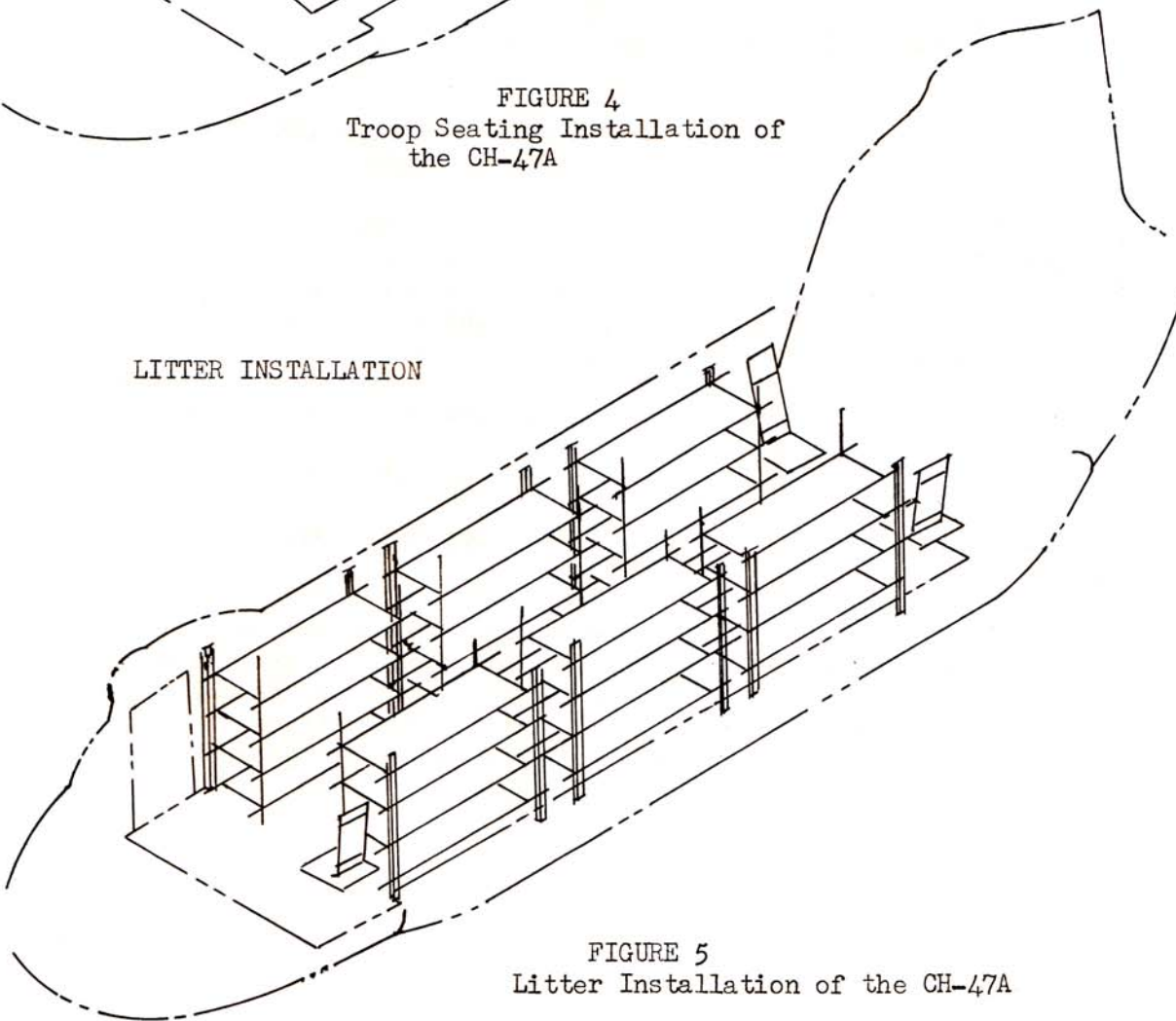


FIGURE 5
Litter Installation of the CH-47A

CHAPTER 3 - SAFETY CONSIDERATIONS

1. The following general safety precautions are required during Chinook operations:

a. No smoking within 50 feet of the helicopter on the ground, take-off, or landing, or at any time when fuel fumes are present.

b. It is preferable for troops working in the vicinity of a CH-47 to wear ear plugs or cotton for noise protection. Goggles should be worn, if available.

c. All vehicles and back-pack radios must have whip antennas either removed or tied down while near the Chinook.

d. Areas directly in front of, and the rear of, the aircraft should be avoided. Approaches to, or departures from the helicopter should not be made from, or to the direct front or rear. Front rotor blade clearance is less than six feet from the ground. Engine exhaust temperatures to the rear range from 200°F at 55 feet to 900°F at 10 feet. The preferred approach-departure route is at 90 degrees to the side of the aircraft (see Figure 6).



Figure 6 - Troops Leaving Helicopter

e. Weapons must be cleared before entering the helicopter, and must be unslung and carried a port arms, or slung muzzle down when entering and leaving the aircraft.

f. Except under emergency conditions, all cargo should be tied down or otherwise secured to prevent movement in flight.

g. Passengers are encouraged to have sleeves rolled down for protection against fire.

h. Seat belts will be utilized.

i. Whenever practical, no exposed personnel, tents, loose equipment, or trucks with canvas should be positioned within 50 meters of a Chinook landing area. The high velocity rotor wash up to 100 mph, and associated flying debris during Chinook operations may cause damage to any structure within 60 meters of a landing area. Further, such precautions will also prevent foreign object damage to engines or rotor blades.

2. The following safety precautions should be observed when participating in external load operations:

a. Prior to hooking up the load to the helicopter, the hook-up man should use a grounding rod, if available, to touch the cargo hook to discharge static electricity which may be present on the hook. This precaution is particularly appropriate during the dry season.

b. The hook-up man should wear ear plugs and goggles.

c. The hook-up man should hold the Doughnuts as high in the air as possible. If the Doughnuts are the type with steel keeper bolts, he must insure that the belts are in the three or nine o'clock position when the Doughnuts are placed on the helicopter's cargo hook, to prevent metal-to-metal contact and wear on the Doughnuts. The flight engineer will direct the pilot over the load and the hook-up man should not attempt to "chase" the cargo hook.

d. After hook-up, the hook-up man should rapidly move away from under the helicopter and the load.

e. In the event of an emergency during hook-up, the helicopter will attempt to avoid all obstacles by moving toward a clear area for immediate landing. Hook-up men must be cautioned to remain alert and move away quickly from the aircraft, should the aircraft move erratically.

3. The Chinook has nine emergency entrances and exits. There are three hand fire extinguishers aboard the aircraft. The battery is located in the forward section of the left fuel pod and can be reached only from outside the helicopter.



Figure 7 Close-up of Hook-up

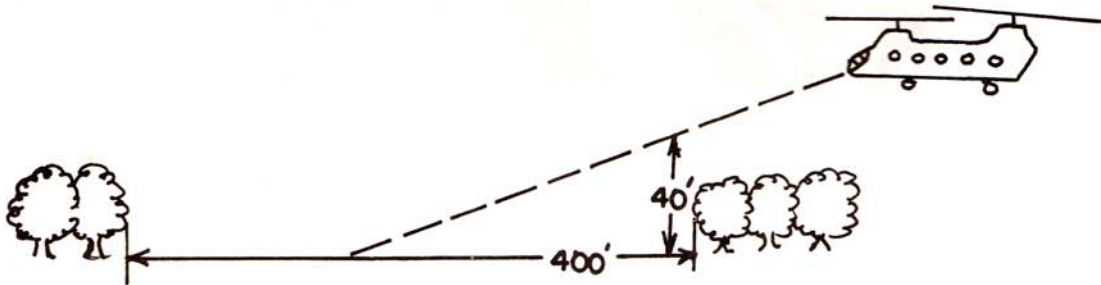


Figure 8 Correct Way to Hold Doughnut

CHAPTER 4 - PLANNING THE AIR MOVE

SECTION I - SELECTION OF PICKUP AND LANDING ZONES

1. A typical landing area which will accommodate one CH-47 should measure at least 100 yards in length and 35 yards in width. To accommodate additional CH-47's an additional 50 yards in length per helicopter will be required. 35 yards in width for each additional Chinook will be required to land abreast. The approach and departure ends of the area must be clear of high obstacles and wires. An obstacle clearance ratio of 10:1 is required. That is, for every one foot of barrier height on the approach or departure path of the helicopter, the touchdown point in the landing zone should be ten feet away from the barrier. For example:



Because the barrier (in this case, trees) is 40 feet high, the landing area for the Chinook must be 400 feet from the trees.

2. A thorough inspection of the proposed landing area should be conducted by supported personnel. If possible, a grassy area rather than a dirt one should be used, particularly during the dry season. During a recent operation, six CH-47's experienced engine malfunctions due to excessive dirt ingestion. Further, since the Chinook sits very close to the ground, the area should be clear of large ruts, holes and stumps. If a clear area is not available, panels or obstruction markers, clearly visible to the pilot, should mark these obstructions. The landing area should not be located close to tents, buildings, or antennas, and all items of equipment lying loose on the ground or on vehicles must be secured to prevent the helicopter rotor wash from blowing articles into personnel, aircraft, or vehicles. Items such as empty sandbags, papers, and rags can, and have, been ingested into engines causing complete engine failures.

SECTION II - AIRLIFT PLANNING

1. An Army unit would never attempt a road march or organize a convoy without a plan. The same approach applies to an airlift involving Chinooks. The supported ground unit should always prepare a loading plan, no matter how abbreviated it must be, because of operational circumstances. With more time available, planning should be more detailed. Following are recommended steps in airlift planning:

a. Determine what you are going to move (personnel and equipment).

b. Determine the priority for movement of these items.

c. Prepare the load plan accurately and conscientiously. Plan loads based on an ACL of 8,000 pounds*. Each load should approach the ACL as closely as possible to realize the most efficient and economical employment of the Chinook. Appendix III contains a list of typical loads for the CH-47. Appendix IV shows a suggested format for a loading plan and passenger manifest. Units to be supported by CH-47B aircraft should coordinate with the supporting unit to determine the appropriate ACL for that altitude.

2. At least one officer and one NCO should be designated in advance to supervise the preparation and positioning of loads and to establish loading priorities. Loads, particularly vehicles, must be rechecked immediately prior to the airlift, for overweight conditions. Loads rigged for external lift must be checked for proper rigging and to insure that slings and clevises are in a serviceable condition. For proper methods of rigging see Chapter 5. Appendix V shows a suggested checklist which may be used as a guide when checking rigging.

3. Plans must be made for refueling the supporting helicopters. The Chinook uses large quantities of JP-4. Normal fuel consumption for one aircraft is between 250-300 gallons per hour. During multi-ship lifts, fuel requirements become a significant factor, and should be a matter of vital concern to both supporting and supported units. The supporting aviation unit commander is responsible to plan aircraft refueling and to coordinate refueling time, place and facilities with the supported unit commander. Each aircraft must shut down during every second refueling stop to make necessary maintenance checks, therefore, the resulting time lost must be accounted for and detailed consideration given in the overall planning for the operation. Proper coordination and planning will prevent wasted time and efforts and

* This is based on operation at or near sea level. When operating at higher altitudes, contact your supporting CH-47 unit for ACL.

will insure the most expeditious and successful accomplishment of the mission.

4. Success or failure of an operation can very well depend on the weather condition existing in the area. During periods of prevailing adverse weather conditions, planning should be flexible enough to allow for unfavorable weather. Continuous weather checks may be necessary and through close coordination, both supporting and supported units must be able to react promptly when the weather improves to a point where flights may be conducted safely.

5. If the area into which the Chinook(s) will be transporting personnel, equipment, or cargo, is not secure, the supported unit must arrange for gunship escort or other forms of security.

6. If after supported unit planning is completed there remain unresolved problems which the supporting Chinook unit can answer or assist with, the appropriate Aviation Battalion Operations Center should be contacted. The center will, in turn, consult the Chinook unit providing support for assistance. When time permits and the magnitude of the operation warrants, supported units are encouraged to arrange for a planning conference with the supporting Chinook company as far in advance as possible.

7. Appendix VI shows a suggested format for a CH-47 mission request.

8. Appendix XIII gives a comprehensive checklist for the ground supervisor.

CHAPTER 5 - PREPARING LOADS FOR MOVEMENT

SECTION I - INTERNAL VERSUS EXTERNAL LOADING

1. Both internal and external loading have a place in CH-47 operations. Many loads are not suitable for external airlift and conversely, many other loads are. Whenever possible, external loading should be employed in order to minimize helicopter ground time and thereby increasing aircraft utilization. Loading up an external load to a CH-47 will require only a fraction of the time (as little as 30 seconds) as that required to load the same load internally. Further, in case of emergency, an external load can be jettisoned to minimize possible damage. However, successful sling load operation requires sufficient quantities of slings and net equipment to prepare the loads in the hands of the supported unit. Advance preparation of the loads will prevent excessive delays and unproductive aircraft time.

2. Another very favorable feature of airlifting external loads is that relatively less ground area is required when the CH-47 is not required to land in order to load or unload cargo. This factor becomes critical after successive lifts of cargo, personnel, and equipment into an area have resulted in congestion.

SECTION II - INTERNAL LOADING

1. If a load is better suited for an internal airlift, the following procedures should be used:

a. Loads should be banded to pallets if possible. Weight should be clearly marked on each pallet as it is prepared for quick reference when preparing the loading plan.

b. There are two ways to load pallets on the aircraft. If there is a low bed trailer available, conveyor rollers can be placed on the bed of the vehicle and the pallets placed on the rollers. Upon arrival of the Chinook, the pallets are pushed or winched from the trailer onto the rollers in the bed of the Chinook. The other method is by use of the forklift. However, there are two distinct disadvantages to using the forklift: (1) Many aircraft have been damaged by forklifts and, (2) forklifts are generally in short supply and long delays frequently occur when units rely on a forklift for loading.

c. When preparing equipment for internal loading in the Chinook care must be taken to insure that the load will enter and exit the aircraft. Dimensions of the cargo area are shown in Appendix XVI. In general, antennas must be removed and stored. On 3/4 ton trucks, the spare tire and top bows must be removed, and the windshield must be folded down. Vehicle fuel tanks should not be more than two-thirds full. When driving a vehicle into the helicopter, it is recommended that the driver wear goggles to protect against the aircraft's auxiliary power unit (APU) and engine exhaust blasts to the rear of the helicopter.

d. Adequate personnel and supervisors should always be on hand to accomplish loading and/or unloading.

2. Personnel to be transported:

a. Will be properly manifested.

b. Will be organized and oriented for efficient loading.

c. Will not be transported without I. D. tags.

d. Will remove or hold down antennas of back-pack radios.

e. Will clear all weapons. Rifles will be unslung and carried at port arms or slung muzzle down, when entering and exiting the Chinook. When seated, weapons will be held butt to floor between the legs.

f. Will exit the helicopter upon signal from the flight crew or troop commander.

SECTION III - PRINCIPLES OF RIGGING
EXTERNAL LOADS

1. TM 55-1520-209-10, subject: Operators Manual Army Model CH-47A Helicopter, states "External loads must not be rigged entirely with steel cable (wire rope) slings. A nylon vertical riser of at least six feet in length must be placed between a steel cable sling and the cargo hook to dampen vibration tendencies. Nylon and chain leg slings and pure nylon slings must have at least six feet of nylon in each leg."

2. The mechanics of rigging external loads for airlift by the CH-47 helicopter, starting with the aircraft's cargo hook and progressing to the load, can basically be described as follows:

a. A sling, cargo, A/D, 3-loop, 6 ply, 10,000 pound capacity or a sling, endless, 10,000 pound capacity, (derated to 7,500 pounds) FSN 3940-675-5001, commonly called the "doughnut", is the attaching link between the helicopter's cargo hook and whatever comprises the load. Two doughnuts are always used unless the doughnut is a manufactured component of the sling, in which case one doughnut will suffice.

b. The doughnuts are normally attached to the slings, either by a clevis or by use of a choker hitch. The clevis is preferred because the choker hitch causes excessive sling wear*.

c. Clevises are frequently used to connect the sling legs to the load when the sling legs are attached to the doughnuts by a choker hitch, as in the case of the M101 Howitzer. When the clevis is the connecting link, contact between doughnuts and clevis should be on the clevis bolt **.

d. In the case of the cargo net, most loads will permit connecting the corners of the net and the two doughnuts with a clevis. If this method cannot be used, a single leg, not to exceed six feet in length, may be used between the net and the doughnuts. A four leg sling can also be used in which case one leg is attached to each corner. Most cargo net loads are cylindrical or round in shape and are not inclined to twist or oscillate in flight. This characteristic permits use of single line suspension from the aircraft to the load.

e. Nylon material is extremely strong in comparison to other fabric material. The major disadvantage to the problem of heat and wear when it comes in contact with metal or similar materials under pressure. It should be noted that most nylon sling equipment is designed with cotton buffer pads where the sling comes in contact with the clevis or attaching points (Figure 9). These pads prevent wearing, burning and eventual failure of the nylon sling. The pads should always be kept in place. In some cases it may be advisable to tape these pads

* A doughnut may be an integral part of the manufactured sling and can be attached to the cargo hook directly.

** Vehicle lifting shackles will not be substituted for clevises.

to provide greater security and prevent detachment. In the event these pads become separated from the sling, it is imperative that these insulators be replaced prior to further use. Scrap canvas can be used for this purpose.



Figure 9a. 1st Step-Choker hitch

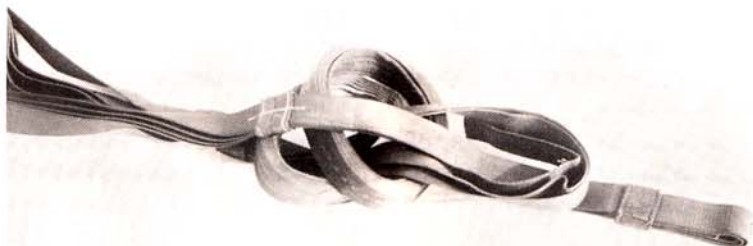


Figure 9b. 2nd Step-Choker Hitch



Figure 9c. 3rd Step-Choker Hitch

f. As indicated above, nylon slings must be padded or insulated at any point where the sling comes in contact with the load. Figure 10 depicts how to properly insulate these slings. Numerous sling failures have occurred through failure to adequately insulate sling legs. Canvas is the most suitable material for this purpose. Materials such as sandbags provide only limited protection.

g. Sling equipment must be stored with care and frequently inspected for dry rot and other damage. It should be stored in accordance with parachute drying procedures.



Figure 10a Wrapping Canvas on Sling

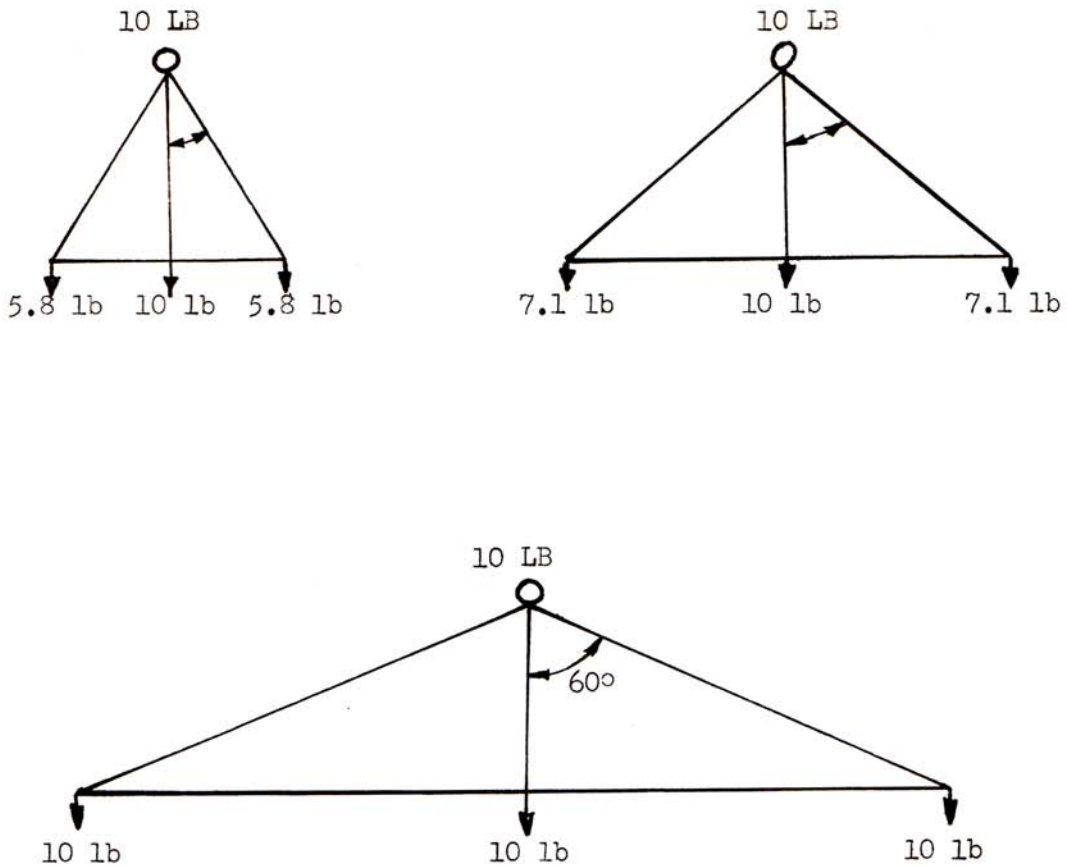


Figure 10b Final Taping of Canvas Wrapping

Method of attaching Cargo Sling to Sling, Endless, 10,000 pound capacity (doughnut), using choker hitch (cotton liner inside sling should be kept in place flush against the sling). Care must be taken to assure that liner will not be torn out. Replace with canvas liner if missing.

h. Symetrically shaped loads such as conex containers tend to twist and oscillate in flight, particularly when they are lightly loaded. Rigging similar to that described in Appendix IX for loads of this type, should always be utilized. A single line suspension to the aircraft offers the least resistance to oscillation and twisting and should only be used for high density, round, or cylindrical loads.

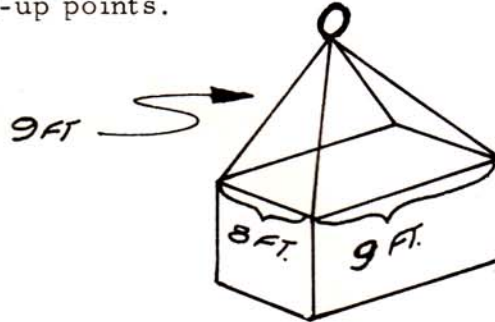
3. The optimum sling leg lifting angle measured from the vertical is 30 to 45 degrees. Minimum sling tension would result from a vertical lift. Tension increases as the angle from the vertical increases, reaching maximum tension when the sling legs are horizontal with the load. However, if the sling load lifting angle is less than 30 degrees, load stability is affected and rotating or swinging motion of the load during flight may result. The increase in sling leg load with an increased angle is indicated in the following diagrams:



4. Determining the proper sling length which will provide a 30-35 degree lifting angle can be accomplished as follows:

a. Measure the distance between hook-up points on a given side of the load.

b. The sling length should be the same as the longest distance between the load and the hook-up points.



EXAMPLE: The maximum distance between hook-up points on a side of the load shown above is nine feet. Therefore, the sling leg length should be approximately nine feet.

5. Determining the proper sling strength can be accomplished as follows:

a. Determine the maximum angle from the vertical at which the sling or any leg of the sling will be used.

b. Using this maximum angle, obtain the corresponding angularity factor from the chart (Figure 11).

c. Multiply this angularity factor by the total load to be lifted. Then double this factor to provide ample safety.

d. The result is the necessary sling strength required, and is used to select a sling having the corresponding lift capacity.

<u>ANGLE IN DEGREES MEASURED FROM THE VERTICAL</u>	<u>ANGULARITY FACTOR</u>
85	11.473
80	5.579
75	3.863
70	2.924
65	2.366
60	2.000
55	1.743
50	1.555
45	1.414
40	1.305
35	1.220
30	1.154
25	1.103
20	1.064
15	1.035
10	1.015
5	1.003
0	1.000

FIGURE 11
Angularity Factor Chart

SECTION IV - EXTERNAL LOAD
RIGGING EQUIPMENT

1. The equipment used for rigging external loads is shown in Appendix VII. Also shown are examples of common failures involving this equipment.
2. A recommended list of equipment, by type organization, considered a minimum to support CH-47 airlift operations is shown in Appendix VIII. Appendix VIII is to be developed at a later date. Use current unit data.

SECTION V - PREPARATION AND RIGGING
OF TYPICAL EXTERNAL LOADS

The methods of rigging typical loads externally airlifted by CH-47 are shown in Appendix IX. Throughout this section, one (1) sling cargo, air delivery, 3-loop, 6 ply, FSN 1670-753-3630 may be substituted for the sling, endless, nylon webbing, 10,000 pound capacity, 10 inches long, FSN 3940-675-5001, when the latter is listed under the rigging equipment required.

CHAPTER 6 - ORGANIZATION OF THE PICKUP ZONE

1. The loads should be segregated and positioned in the pickup zone in accordance with the unit's loading plan and in such a way that the helicopters can land in front of an internal load or in back of an external one. Combination loads should be placed to allow the Chinook to land, load the internal cargo from the rear, and then move forward to pick up the external load. An area for loading internal loads should be located as far as possible from the sling load pickup area.
2. Sufficient area must be available to accommodate the number of Chinooks employed safely.
3. Whenever possible, internal cargo should be loaded while the helicopters are refueling, to avoid unnecessary ground time.
4. To reduce manpower and time requirements, considerations should be given to loading the cargo in the nets on a truck at the supply point. Loaded nets can be lifted directly out of or into a vehicle cargo bed of sufficient size.
5. External loads should be combined whenever possible; i.e., loose rations in a cargo net attached to water trailer as a piggy-back load.
6. A system for designating loads to incoming aircraft should be pre-arranged. The best system is the use of smoke implemented by instructions over the radio.
7. Communications should be handled by the pathfinders or unit personnel operating in that capacity. Communication should be on a clear frequency and the radio set should be located near persons able to make decisions concerning the move.

CHAPTER 7 - CONDUCT OF THE MOVE

SECTION I - RESPONSIBILITIES

The supported unit is responsible for having ground crew signal men and hook-up men trained and available. The supporting CH-47 company will provide assistance as requested by the ground unit to train these personnel.

SECTION II - USE OF PATHFINDERS

1. Normally, the Chinook company will provide pathfinder support unless the supported unit has organic pathfinders available. The first helicopter landing in the PZ and LZ will drop off the CH-47 pathfinders. The pathfinders will work with the ground unit's loading supervisor/air movement officer or NCO.

2. The pathfinders, or in their absence, the supported ground unit personnel will:

a. Check loading plans for accuracy and completeness.

b. Check loads for location, rigging and security. A check list for cargo rigging is shown in Appendix V.

c. Using FM radio, direct the helicopters to the appropriate landing, parking, loading, or unloading area. Smoke grenades and landing panels, well secured to the ground, when available, will be used to mark these locations. When smoke is used, it should be placed 15 feet in front of the point where the nose of the aircraft is desired. For external loads, the smoke should be placed at the desired release point of the sling load. The pilot will set the load next to the smoke. CAUTION: Use of smoke can cause fires.

d. The following information should be radioed to the helicopter upon its approach to the pickup or landing zone:

(1) Enemy situation (if applicable).

(2) Wind direction and velocity.

(3) Direction of approach (heading in degrees).

CHAPTER 8 - RESUPPLY OPERATIONS

The principles involved in rigging and loading cargo for, and the method of conducting, resupply operations are basically similar to those pertaining to movements discussed earlier. However, attention of the supported ground unit is invited to the following general recommendations. They are the result of experience gained during past operations, and have contributed to the safe and timely accomplishment of resupply operations conducted by CH-47 helicopters.

- a. Loads should be planned on a priority of movement basis, and each load should weigh as close to 8,000 pounds as possible*. Experience during past resupply operations has shown that the use of a load card greatly assists in organizing and expediting a resupply operation. The load card is given to the aircraft crew when the load is placed aboard the aircraft or prior to the hooking up of an external load. The suggested format for such a load card is shown at Appendix XII.
- b. External airlift should be used whenever possible, utilizing A22 cargo bags, or cargo nets. A22's are ideally suited for pre-loading ammunition, rations, or ice. When cargo nets are utilized, scrap canvas liners are helpful for holding objects in the net and for helping distribute the load stresses.
- c. An adequate supply of sling and net equipment should be available. The supporting transport helicopter company must be notified if supplementary sling equipment is required.
- d. When feasible, items should be removed from bulky crates and boxes when utilizing external airlift. Ammunition should be transported in fiber cartons rather than in boxes or in the steel jungle pack; the savings in weight ranges from 13 to 24 pounds per round. Also, ammunition boxes and the jungle pack containers must be removed from the artillery site, causing more cargo handling and expenditure of aircraft time.
- e. To resupply water, the desirable method is to externally airlift 250 or 500 gallon fabric water drums. A second method is to externally airlift a 1 1/2 ton, 400 gallon water trailer. The least desirable method is to transport 5 gallon water cans internally.

* This is based on operations at or near sea level. When operating at higher altitudes, contact your supporting CH-47 unit for ACL. 10,000 pounds for CH-47B. Same altitude restrictions apply.

f. Return flights from the resupply drop-off area should be utilized by the supported unit to back-haul expended ammunition brass and any other equipment or material which is practical to return to the supply point.

g. Radio should be monitored continuously prior to and during resupply operations and personnel capable of making decision regarding resupply should be immediately available.

CHAPTER 9 - EXTRACTION OPERATIONS

The general methods and procedures used in the employment of CH-47 helicopters during extraction operations are basically the same as used in moving a ground unit to the field. However, as with resupply operations discussed in Chapter 8, there are specific operating practices peculiar to the extraction of ground elements by Chinooks.

a. Security of the area is of vital importance to permit aircraft as large as the CH-47 to operate safely in a forward area. Extraction of an artillery unit must be planned by the ground element so as to provide adequate security until the last cargo load departs the pickup zone. Air cover, in the form of armed helicopters must be requested by the supported ground force for pickup zones located in marginally secure areas.

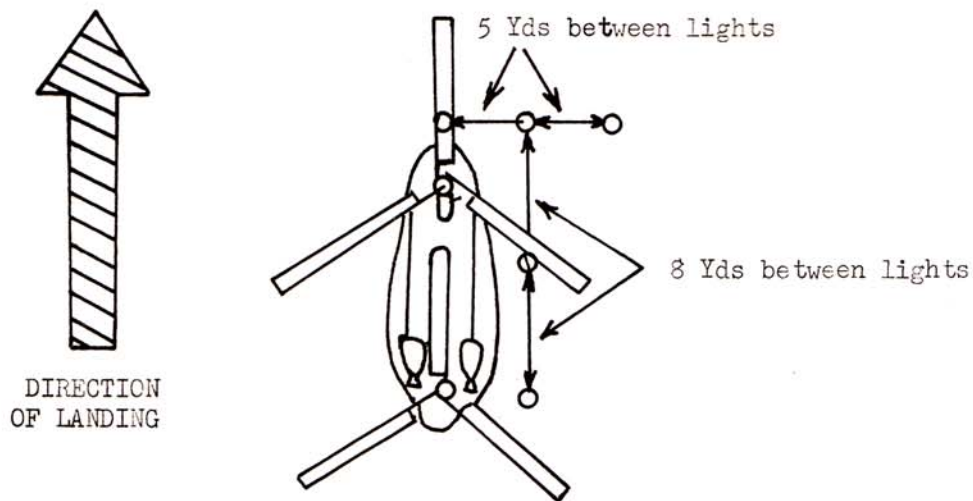
b. Cargo comprised of difficult-to-load items of supply and equipment must be planned to be moved out first. This will take advantage of the greater manpower available at the pickup site during the initial part of the move.

c. Loads must be planned and coordinated to avoid the necessity of having the Chinooks shut down in the pickup zone. Fuel consumption rate is high, whether flying or parked on the ground with engines running. Unproductive ground time at the pickup site reduces the number of sorties between refueling, resulting in more time than required for extractions.

CHAPTER 10 - PREPARATION OF A NIGHT
LANDING AREA

Night operation in unprepared landing areas can be extremely hazardous because of unmarked obstructions and greater possibility of losing visual reference when dust is present. However, if an emergency exists requiring Chinook support, the supported unit must try to arrange some form of lighted landing area. Methods of lighting a landing area are shown in Figure 12. If neither a night lighting set, nor vehicles are available, the landing area may be ringed with flashlights as a last resort. Five gallon oil drums, filled with a gasoline-oil mixture can be used as flare pots and are quite effective. These can be placed in a large square around the landing area.

MOST DESIRABLE LIGHTING ARRANGEMENT FOR CH-47 NIGHT LANDING AREA:



(Helicopter will land to the left of the Tee)

ALTERNATE METHOD OF LIGHTING CH-47 NIGHT LANDING AREA:

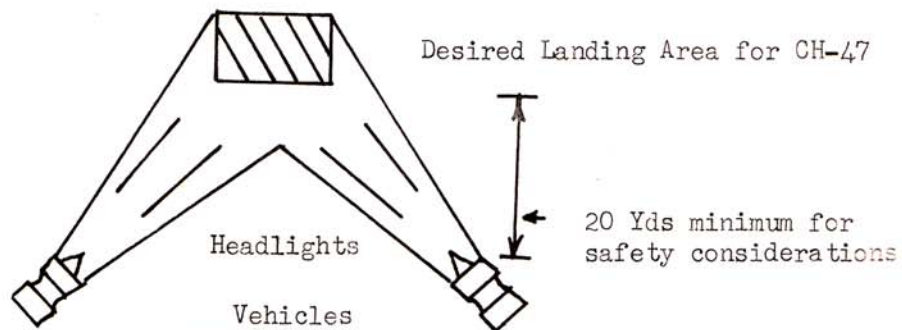


FIGURE 12

A P P E N D I X I

R E F E R E N C E S

1. Army Regulations

AR 95-13

Safety Procedures for Operation and
Movement of Army Aircraft on the
Ground

2. Field Manuals

FM 55-15
FM 101-10

Transportation Reference Data
Staff Officer's Field Manual

3. Technical Manuals

TM 55-450-11

Air Transportability Guidance: Exter-
nal Sling Transport of US Army
Materiel Using Air Delivery Cargo
Slings, FSC 1670 by US Army Helicopters
Airdrops of Supplies and Equipment,
General

TM 10-500

TM 55-450-8

Air Transportation of Supplies and
Equipment: External Transport
Procedures

TM 55-1520-209-10

Operators Manual CH-47 Helicopter

4. Technical Bulletins

TB 55-46

Standard Characteristics for Trans-
portability of Military Vehicles and
Equipment

5. Other

1st Aviation Brigade Handbook
1st Air Cavalry Division Airmobile
Techniques and Procedures
Aeroquip, Universal Cargo Sling
Operating Instructions BUL 274

APPENDIX II

WEIGHTS OF COMMON ITEMS

Vehicles

$\frac{1}{4}$ Ton Truck	2350 (+ 100 lbs w/Radios)
$\frac{1}{4}$ Ton Trailer	600
$\frac{3}{4}$ Ton Truck	5700 (+ 200 lbs W/W)
$\frac{3}{4}$ Ton Trailer	1350
$1\frac{1}{2}$ Ton Water Trailer	2900 (Empty)
400 Gal (Fiberglass)	6300 (Full)
$1\frac{1}{2}$ Ton Trailer	2750
Mechanical Mule	900

Artillery

M-101 Howitzer w/Shields	4990
M-101 Howitzer w/o Shields	4600
M-102 Howitzer	3100
105 MM ammo per Rd in Box	60
in Carton	47
in Steel	
Jungle Pack	71
155 MM Howitzer Projectile	95
Powder	35

30 Rds 105MM Ammo in Fiber Containers	1450
---------------------------------------	------

POL (External Loads Only)

	55-Gal Drums	500-Gal Drums (Collapsible)
Gasoline	373	3300
JP/4	410	3550
Diesel Fuel	432	3800
Lub Oil	472	4300

Miscellaneous

Water Can w/5-Gal	45
C Rations	25
81MM Mortar w/Fuze, Box of 3 Rds.	53.5
4.2 MM Mortar w/Fuze, Box of 2 Rds.	81.7
Rice, 100 Kilo Bag	220

APPENDIX III

TYPICAL LOADS

The following typical loads which can be airlifted by CH-47 helicopters are offered as representative; obviously, such a list cannot be all-inclusive. Standardization of loads by supported ground units will greatly expedite airlift by CH-47 and will assist in reducing the time required for planning and liaison with the supporting helicopter company.

33 Personnel*	7920	1-3/4 Ton Truck	5900
Cargo	<u>80</u>	W/W	
Total Weight	8000	Driver	240
		Cargo in Truck	<u>1860</u>
1-1/4 Ton Truck	2350	Total Weight	8000
1-1/4 Ton Trailer	600		
17 Personnel	4080	2-Collapsible Fuel	7100
Cargo in Trailer	<u>1000</u>	Drums (500 Gal	
Total Weight	8030	ea., external)	
		2-Personnel	<u>480</u>
1-3/4 Ton Truck	5900	Total Weight	7580
W/W			
1-1/4 Ton Trailer	600	2-1/4 Ton Trucks	6290
Driver	240	w/106 RR	
Cargo	<u>1250</u>	7-Personnel	<u>1680</u>
Total Weight	7990	Total Weight	7970

*Based on 240 lbs per individual. This includes the weight of the individual and his proportionate share of hand-carried supplies and equipment including crew-served weapons up to, but not including, the 106MM RR and 4.2 inch Mortar.

The following typical loads are offered as a basis for planning the airlift by CH-47 of a 105MM Howitzer Battery:

Load #1 (Battery FDC)

1-1/4 Ton Truck w/radios	2450
1-3/4 Ton Trailer	1350
8 Personnel	1920
Section Equip on Trailer	600
Add'l Personnel or Cargo	<u>1680</u>
(Internal)	
Total Weight	8000

Load #2 thru 7 (105MM Howitzer Section)

1-105MM Howitzer w/shields (External)	4990
Sec Equip strapped to How	300
30 Rds Ammo in Fiber Containers (External)	1450
3 Personnel	720
2 Fuze Boxes	160
6 Cases C Rations	150
5 Water Cans 5 Gal	<u>225</u>
Total Weight	7995

or

1-105MM Howitzer w/shields (External)	4990
30 Rds Ammo in Fiber Containers (External)	1450
6 Personnel	1440
S/A Ammo, Water, Rations, Tools	<u>110</u>
Total Weight	7990

NOTE: If 105MM Howitzer is without shields, 400 lbs of additional cargo or equipment may be added.

Load #8 thru 10

66 Boxes Ammo (132 Rds) (External)	7950
---------------------------------------	------

or

160 Rds Ammo (in Fiber Containers) (External)	7600
--	------

Load #11

1-3/4 Ton Truck	5700
1-1/4 Ton Trailer	600
Driver	240
Cargo in Truck and Trailer	<u>1460</u>
Total Weight	8000

CH-47 LOADING PLAN AND PASSENGER MANIFEST

APPENDIX IV

CH-47 LOADING PLAN AND PASSENGER MANIFEST

Load #	Acft #	Description of Cargo	Unit Wgt	Total Wgt	Passenger Names
1		105 How. w/o shields, & tool chest 30 Rds. 105 Ammo 3 Boxes fuzes @89# 3 Water cans & S.A. Ammo 6 Personnel w/duffel bags	4,600 1,540 267 160 1,440	8,007	S/Sgt Willard PFC Wilson CPL Black PFC Blue PFC Williams PFC George
2		1/2 Ton truck w/radio & gear 3/4 Ton tlr w/4 radios 2 Gp Med (800), 1-3kw gen 2 SA Ammo (150) 10 Personnel w/duffel bags	3,000 2,600 2,400	8,000	LT Ball, SP4 Green S/Sgt Head, SP4 Jones Sgt Gee, PFC Cox Sgt Brown, PFC Smith SP5 Smart, PFC Bill
3					
4					
5					
6					

APPENDIX V

CHECK LIST FOR LOAD PREPARATION

1. Loading plans should be prepared in three copies; one for unit, and one each for pathfinders in PZ and LZ.
2. An officer or NCO from the supported unit should be readily available to the pathfinders in the PZ and LZ.

External Rigging

1. Always perform a detailed visual inspection of all sling equipment prior to rigging the load. Equipment found to be frayed, burned, or worn (minor surface wear is normal) should be declared unserviceable and destroyed if not repairable. After inspection, nylon slings should be wrapped with canvas at possible chafing points (Figure 10).
2. Cable nets (NOTE: Not recommended for use unless absolutely necessary):
 - a. There should be an equal number of rings between attachment points (five rings on each drawstring; drawstrings properly positioned).
 - b. General condition of nets.
 - c. Maximum load of 2,000 pounds.
3. Rope nets: Canvas liner used if small objects included in load.
4. A22 Cargo Bag:
 - a. Slings are attached to the A22 Delta rings with small clevises or shackle anchor screws.
 - b. Bag must be loaded correctly to provide equal stress on all four sides.
5. 105mm Howitzer: Cargo slings must be wrapped with canvas or similar material wherever they contact the howitzer. Particular attention

should be given to insulation in the hole on gun casting which piggy-back sling passes through. Failure to insulate the sling from the sharp edges of the casting will result in loss of the load.

Internal Loads

1. 1/4 Ton Truck:
 - a. Wirecatcher removed.
 - b. Antenna securely tied down.
2. 3/4 Ton Truck:
 - a. Spare tire removed.
 - b. Windshield folded down.
 - c. Bows removed.
 - d. Only one side antenna mount permitted on each vehicle.
 - e. Load not to exceed 800 pounds.
3. 3/4 Ton Trailer (Normally pulled by 1/4 Ton Truck): External transport of the 3/4 Ton Trailer is recommended unless a 1/4 ton vehicle is used as a prime mover. For internal loading remove the top bows. Overall height of trailer should not exceed 76".

APPENDIX VI

CH-47 MISSION REQUEST

1. Mission Requested by: (Complete Unit Designation - Co, Bn, Bde, Div)

2. Requesting Officer: _____
3. Mission Date: _____ Number CH-47's Requested: _____
4. Initial Reporting Instructions:
 - a. Acft Report to: _____
 - b. Coordinates: _____
 - c. Time: _____
 - d. Ground Contact: _____
(Call sign - frequency)
5. Mission Itinerary and Instructions:
 - a. LZ: _____ Coordinates: _____
 - b. LZ: _____ Coordinates: _____
6. General Mission Information:
 - a. Type Cargo to be Airlifted: _____
 - b. Number of Lifts: _____
 - c. Number of Internal Loads _____ External Loads _____
 - d. Special Equipment Required from Supporting CH-47 Unit: _____

 - e. Special Mission Instructions: _____
 - f. Release Time: _____

APPENDIX VII

CARGO SLING AND NET EQUIPMENT USED FOR RIGGING EXTERNAL LOADS

<u>FSN</u>	<u>NOMENCLATURE</u>	
1670-753-3798	Sling Cargo Aerial Del 13,500 lb 2 loop, 4 ply	8' O/A 1g
1670-753-3790	NOTE: De-rated to 6,500 lbs	9'
1670-753-3791		11'
1670-753-3792		12'
1670-753-3793		16'
1670-753-3794		20'
1670-753-3788	Sling Cargo Aerial Del 20,000 lb 3 loop, 6 ply	3'
1670-753-3630	NOTE: De-rated to 10,000 lbs	8'
1670-753-3631		9'
1670-823-5040		11'
1670-823-5041		12'
1670-823-5042		16'
1670-823-5043		20'
3940-298-3985	Sling Cargo Paulin: Cotton duck 12X12 Ft Nom O/A Dim	
3940-542-4698	Sling Cargo Net 14' sq 7 7/8" Mesh 2½ Circ Rope, 10,000 lb Cap	
3940-675-5001	Sling Endless: Nylon Webbing 10,000 lb Cap 10" Lg 1 3/4" W (De-rated to 7,500 lbs)	
3940-675-5002	*Sling Endless: Nylon Webbing 2,500 lb Cap 4 Ft Lg 1 3/4" W	
3940-675-5003	*Sling Endless: Nylon Webbing 2,500 lb Cap 8 Ft Lg 1 3/4" W	
3940-774-8507	*Sling Cargo Net: Metal Octagonal 2,500 lb Rated Cap	
3940-856-7998	*Sling Set Cargo Universal Type Set No 1 5,000 lb Cap	
3940-892-4375	Sling Cargo Net: Nylon 12X12 Ft, 4,500 lb Cap	
1670-902-3080	Sling Nylon 4-Leg Aeroquip 1b Cap 15,000	
1670-242-9169	Bag Cargo Aerial Del A-22, 2,000 lb Cap	
1670-090-5354	Clevis Assy Suspension Bolt and Nut Type Size 5	
1670-360-0304	Clevis Assy Suspension Bolt and Nut Type Size 3	
4030-185-0490	Shakle Anchor Screw	
3990-360-0248	Binder Loan	
1670-678-8562	Clevis, G12	
4020-240-2146	Cord, Nylon, Type III 550 lb Cap	
8135-808-6446	Cushioning Material, Cellulosic, Longitudinally Compressed	
1670-360-0340	Fastner, Strap, Cargo Tiedown, Quick-fit	
1670-783-5988	Link Assembly, Single, Suspension or Extraction, Quick-release, Type IV	
1670-753-3928	Pad, Honeycomb	
3940-892-4375	Sling, Cargo, Nylon 12X12' Anti-static treated	
3940-892-4372	Sling, Cargo, Nylon 10'X10'	

4020-231-2581	Rope, 3/8" Diameter
1670-360-0540	Strap, Tiedown 15'
8135-266-5016	Tape, Pressure-sensitive, 2 inch
8305-268-2411	Webbing, Cotton, 80 lb

* Not desirable for normal use.



Figure 13a. Endless Sling "Donut"



Figure 13b. Anchor Shackle



Figure 13c. Medium Clevis (Size 3)

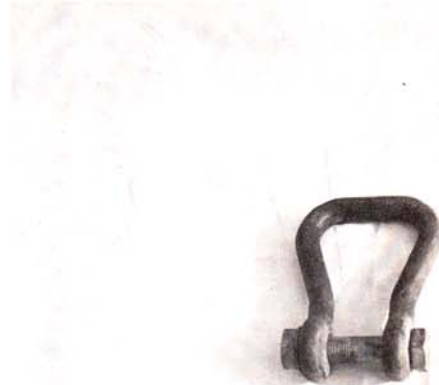
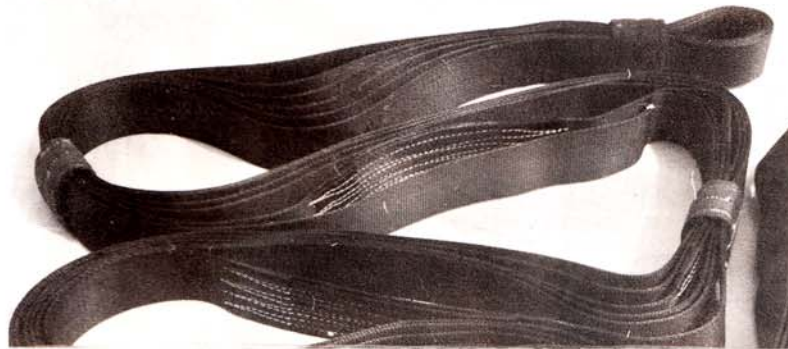
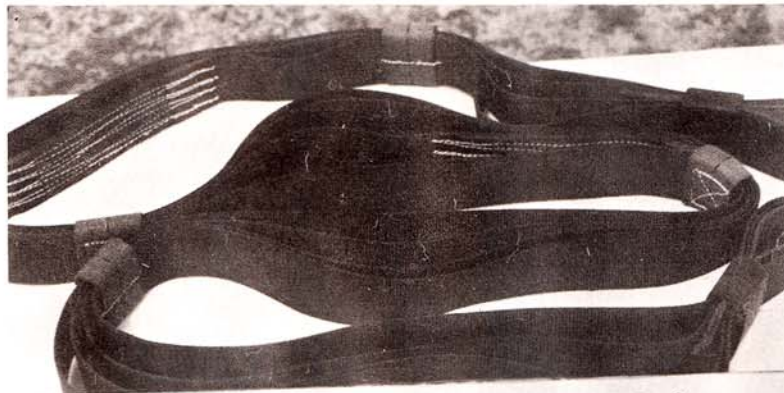


Figure 13d. Large Clevis (Size 5)



SLING GARGO 3 LOOP 9ft
10,000 LB. CAPACITY
FSN 1670-753-3631

Figure 14a 3 Loop 9 ft Sling



SLING GARGO 2 LOOP 9ft
6,500 LB. CAPACITY
FSN 1670-753-3790

Figure 14b 2 Loop 9 ft Sling



Figure 15a A-22 Bag Liner

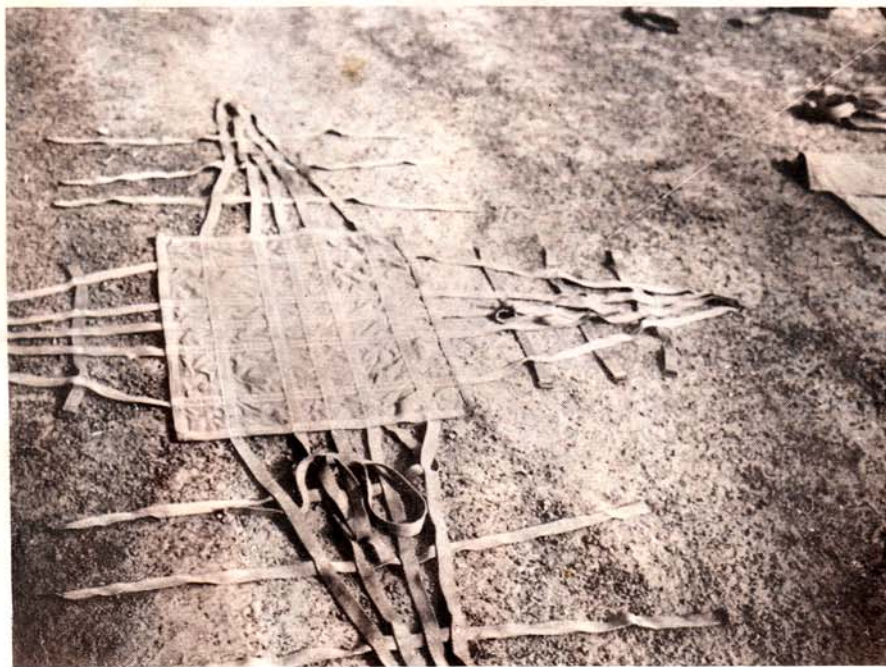


Figure 15b A-22 Bag



Figure 16 Sling Cargo Net (Metal Octagonal)

Limited standard; no longer being procured. Personnel must be trained to safely use this sling. Brass keepers holding steel web together separate under stress of loads in excess of 2,000 pounds. Limit loads in this cargo net to 2,500 pounds.

COMMON FAILURES OF SLING EQUIPMENT

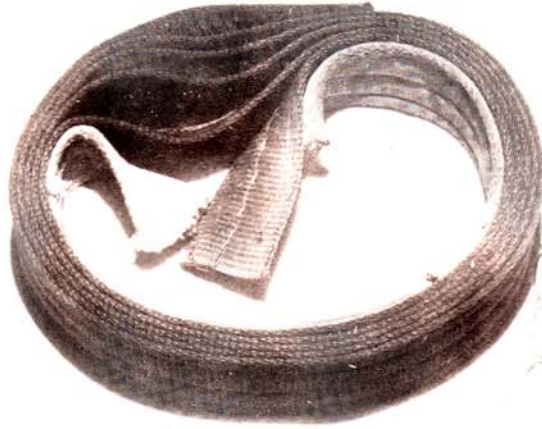


Figure 17 Doughnut Failure Caused by Twisting Action of Load



Figure 18 Strap Failure Caused by Rubbing Against Metal

APPENDIX VIII

Recommended list of rigging equipment by type organization:

NOTE: This information will be passed on as a supplement at a later date. Individual unit list should be developed after consulting personnel from your nearest CH-47 unit.

APPENDIX IX

Methods of Rigging Typical Loads:

NOTE: This information will be passed on as a supplement at a later date. TM 55-450-11 should be used as a guide for rigging typical loads.

APPENDIX X

Methods of Loading Cargo Bags and Nets:

NOTE: This information will be passed on as supplement at a later date. TM 55-450-11 should be used as a guide for rigging typical loads.

APPENDIX XI
ARM AND HAND SIGNALS



DESIRED LANDING
DIRECTION
Arms rigid & overhead



STOP or HOLD
Arms crossed above
head, palms turned
toward helicopter



MOVE FORWARD
Elbows flexed, palms at
eye level facing inward,
move arms repeatedly back-
ward, beckoning onward



MOVE REARWARD
Hold hands down by side;
face palms forward & with
elbows straight, repeatedly
move arms forward & backward



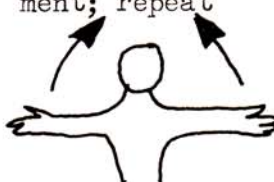
MOVE RIGHT
Extend left arm
horizontally side-
ways. Swing right
arm in front of
body to indicate
direction of move-
ment; repeat



MOVE LEFT
Extend right arm
horizontally side-
ways. Swing left
arm in front of
body to indicate
direction of move-
ment; repeat



HOVER
Extend arms
horizontally
sideways



MOVE UPWARD
Extend arms horizon-
tally to the side,
beckoning upward with
palms turned up



MOVE DOWNWARD
Extend arms horizon-
tally to the side,
beckoning downward with
palms turned down



LAND
Cross and extend arms
downward in front of the body

NIGHT SIGNALING: At night, signals will be given by using batons or flashlights, one in each hand. Signals will be identical to day signals except the STOP signal will be made by crossing batons or flashlight beams before the face. When using flashlights, care must be taken to avoid blinding the pilot.

APPENDIX XII

LOAD CARD FOR RESUPPLY OPERATION

LOAD CARD	
SORTIE _____	DATE _____
UNIT _____	CONTENTS OF LOAD
LOCATION _____	_____
CALL SIGN _____	_____
FREQUENCY _____	REMARKS _____
REMARKS _____	

APPENDIX XIII

AERIAL MOVEMENT AND RESUPPLY CHECKLIST

<u>YES</u>	<u>NO</u>	<u>ITEM</u>
		1. Has the mission been properly requested to include current call signs, locations, and exact number of sorties desired?
		2. Has liaison from the supporting aviation unit been requested and completed?
		3. Have the PZ and LZ supervisors been thoroughly briefed?
		4. Have load cards been prepared for each load?
		5. Has each load been re-checked for proper rigging and for weight?
		6. Are the loads ready for movement at the prescribed time?
		7. Have personnel that are to be transported been briefed to unload weapons and how to enter/exit the aircraft?
		8. Are PZ and LZ communications manned, operational, and on the same frequency as given on the mission request?
		9. Is adequate smoke available on call?
		10. Are sufficient personnel on hand to load and unload internal loads?
		11. Have PZ and LZ been cleared of all trash and other items which could be blown around by rotor wash?
		12. Have dusty landing areas been watered or oiled?
		13. Have provisions been made for night lighting of landing areas?
		14. Are sling load and internal load areas separated by enough distance to handle simultaneous operations?

AERIAL MOVEMENT AND RESUPPLY CHECKLIST (CONT'D)

- | <u>YES</u> | <u>NO</u> | <u>ITEM</u> |
|------------|-----------|---|
| | | 15. Are adequate refueling facilities available within twenty to thirty minutes flying time? |
| | | 16. Are spare rigging items available? |
| | | 17. Have provisions been made to allow for aircraft crew meal and maintenance breaks? |
| | | 18. Is someone readily available at the PZ and LZ to make timely decisions and to conduct further coordination? |
| | | 19. Have cancelled sorties been reported through mission request channels? |
| | | 20. Are the LZ and PZ secure? |
| | | 21. Has coordination with supporting or co-located artillery been completed? |
| | | 22. Is current artillery information available and have provisions been made to keep the aviators informed? |
| | | 23. Have the aviators accompanying pathfinders been thoroughly briefed? |

This checklist may be locally reproduced for use by supported units.

APPENDIX XIV

Rigging of Tactical Vehicles:

NOTE: This information will be passed on as a supplement at a later date. TM 55-450-11 should be used as a guide for rigging typical loads.

APPENDIX XV

OVERALL DIMENSIONS

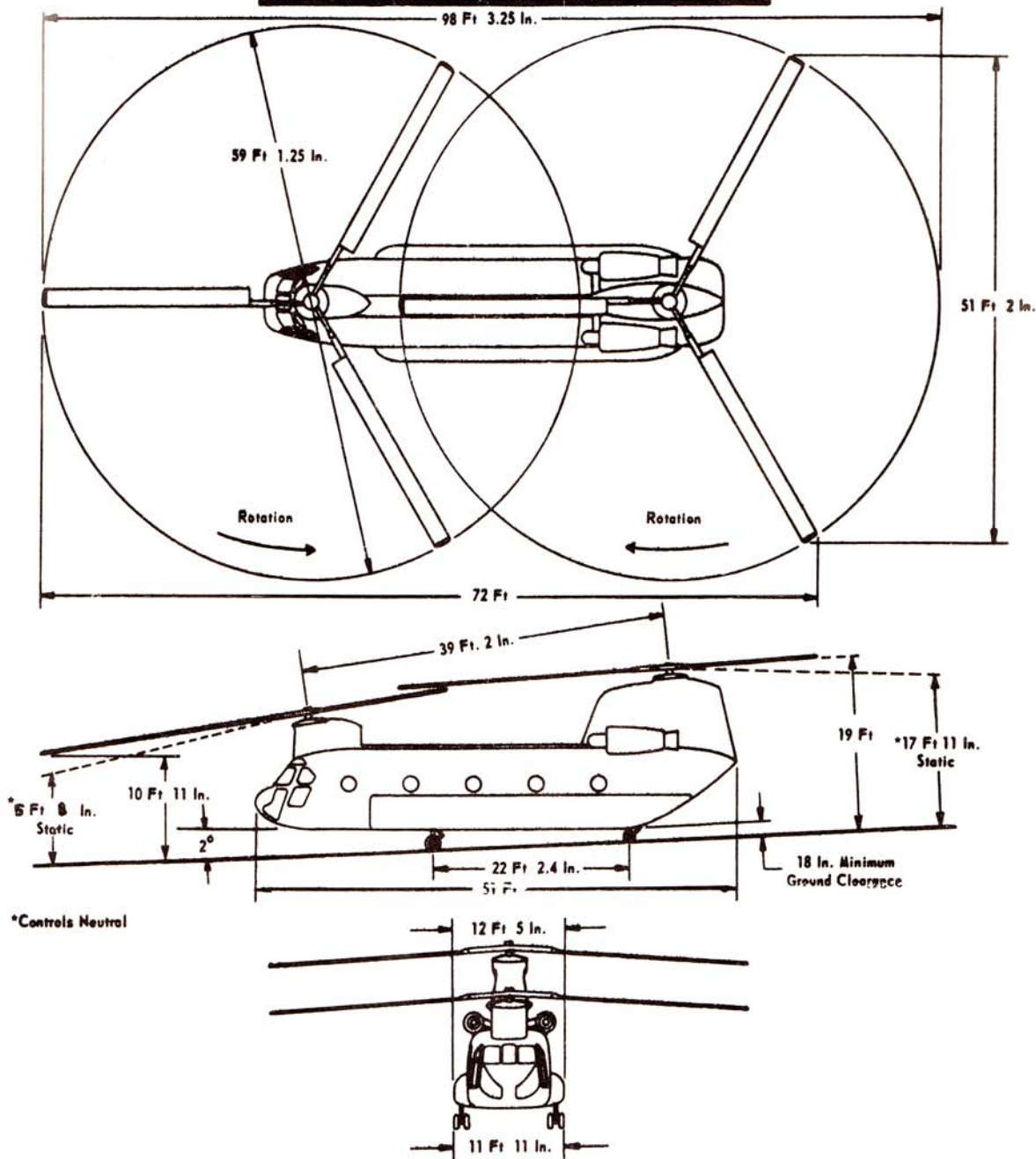
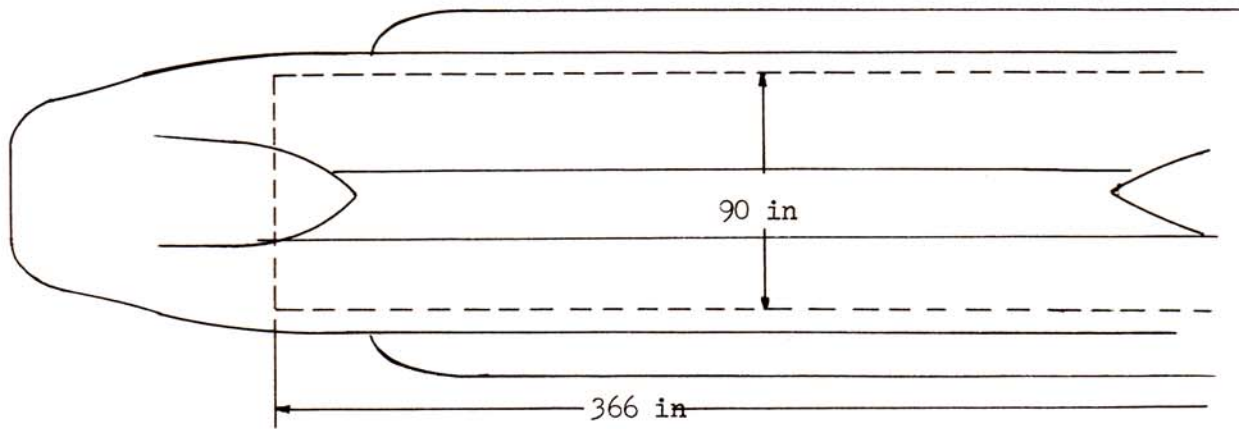
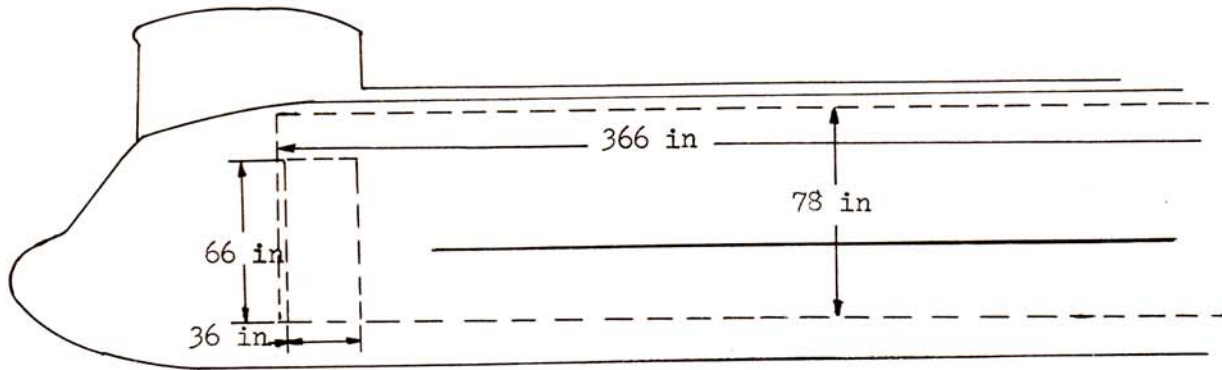


Figure 35 Overall Dimensions of the CH-47

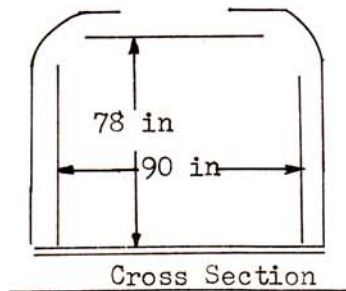
APPENDIX XVI



Top View



Side View



Cross Section

Figure 36 Cargo Compartment Dimensions of the CH-47A

APPENDIX XVII

CH-54 Utilization and Employment

1. Purpose. The purpose of this appendix is to familiarize using units with the operational capabilities of the CH-54 (Skycrane) helicopter and to outline items necessary to consider when employing this aircraft.

2. General. The CH-54 (Skycrane) helicopter is a twin turbine heavy lift helicopter. Its maximum gross weight is 42,000 pounds. The following data is provided for information:

a. Overall Dimensions: Length (main rotor tip to tail rotor tip) 88 feet, 5 inches.

b. Height: Top of tail rotor 25 feet, 5 inches.

c. Main rotor diameter: 72 feet.

d. Fuel:

(1) JP-4 (alt JP-5).

(2) Consumption: Maximum gross weight 3,600 - 4,000 per hour. Without load 3,200 pounds per hour.

e. Endurance:

(1) All tanks full, 2 hours, 15 minutes.

(2) Main tanks only, 1 hour, 20 minutes.

(3) Normal operations use main tanks only.

f. Airspeed:

(1) Without a load - sea level to 2,000 feet, 115 knots.

(2) At maximum allowable gross weight sea level to 2,000 feet, maximum 95 knots. Average cruise at gross weight, 80 knots.

g. Capabilities:

(1) Cargo capacity to 18,000 pounds external loading with reduced fuel and range.

(2) Normal operations, 14,000 - 16,000 pound load.

(3) Level flight and landing capability with one engine at maximum gross weight.

h. Instrument flight: May be performed, but is not recommended with external loads.

3. Type Missions Performed: The full potential of mission capability is limited only by the ingenuity of those involved in the planning phase. Typical missions are:

a. Lift of equipment weighing between 8,000 and 18,000 pounds.

(1) Engineer equipment: Any piece of equipment which does not exceed the weight limitations and distances described in paragraph 4, below and which lends itself to sling or 4 point hook-up, may be transported. Equipment weighing more than 18,000 pounds may be moved by disassembly and reassembly at destination.

(2) Artillery battery (155mm): These may be lifted intact with section equipment tied securely onto the trails. The equipment must be secured so as not to drop off in flight. Total weight of 155mm Howitzer plus equipment should be approximately 14,000 - 15,000 pounds.

b. Ammunition: Can be loaded in A22 bags, cargo nets, or rigged on pallets.

c. POL in collapsible bladders: This load should be rigged in groups of four 500 gallon bladders for normal operations, although five bladders may be transported over a reduced distance.

d. Aircraft recovery: Aircraft weighing less than 18,000 pounds may be recovered subject to the radius of action limitations described in

paragraph 4, below. The 100 foot hoist cable gives the CH-54 the capability of recovering downed aircraft from areas with limited accessibility.

e. Discharge of cargo from vessels anchored in the stream. The CH-54 can discharge entire vessels or can selectively remove high priority cargo for delivery to inland locations.

f. Lifting of pre-positioned bridge sections: The CH-54 can position bridge sections as long as 55 feet, thereby quickly removing obstacles to ground movement.

g. The CH-54 has the capability of emplacing loads very exactly, which is particularly advantageous in placement of towers and other equipment which requires a precise landing on a prepared base or restricted location.

h. External loading is accomplished by one of two methods, single point suspension and four point suspension.

(1) Single Point Suspension: The normal means of external loading. Gives full advantage to the cable and winch assembly which may be used to extract loads from inaccessible areas. It provides the quickest hook-up procedures and is generally used when transporting bulky loads. The weight and configuration of the load may dictate slower airspeeds than originally planned. A light load (less than 8,000 pounds) may in fact be dangerous to carry single point. On-the-spot decisions by the aircraft commander must be made regarding each light load.

(2) Four Point Suspension: The four point suspension system may be used to lift loads which lend themselves to four point hook-up. Using the four point system usually eliminates the need for rigging. Disadvantages of using the four point suspension system instead of the single point sling are:

(a) The CH-54 must be able to land at pickup and drop-off sites.

(b) An average of 5 minutes time is necessary to make a four point hook-up or release.

(c) The jettison capability during flight does not have an emergency back-up system.

i. Special purpose module-pod: Personnel or cargo may be carried in the pod. Limitations to utilizing this system are:

(1) The pod is presently restricted from passenger use except in tactical emergency.

(2) Weights as opposed to radii described in paragraph 4, below, are reduced by the weight of the pod which is 3,500 pounds.

(3) The attachment or detachment of the pod to the helicopter requires approximately 30 minutes and must be accomplished on level ground.

(4) The 12 inch ground clearance of the pod when on the ground or attached to the helicopter make utilization in rough areas impractical.

(5) There are seats for 67 passengers in the special purpose module.

4. Radius of mission from fuel source: The following can be used as a guide in determining mission feasibility. Whenever there is a doubt whether or not the mission can be accomplished - call the supporting helicopter company.

a. Loads weighing over 14,000 pounds, but less than 18,000 pounds require special planning (winds, weight, extra equipment aboard the aircraft may have to be removed).

b. Loads 17,000 pounds and under where fuel is available at drop-off site:

<u>Weight of Load</u>	<u>Distance to Drop-Off</u>
17,000 pounds	21 N M
16,000 pounds	38 N M
15,000 pounds	55 N M
14,000 pounds	73 N M

c. Loads 17,000 pounds and under where fuel must be obtained by returning to pick-up site:

<u>Weight of Load</u>	<u>Distance to Drop-Off</u>
17,000 pounds	13 N M
16,000 pounds	25 N M
15,000 pounds	35 N M
14,000 pounds	48 N M

d. Odd shape loads which may limit airspeed below 60 knots must have radius of action determined by special planning. An example of this would be a Chinook rigged with drogue chute.

5. Rigging - Responsibility of Unit Being Supported:

a. Rigging of loads must be accomplished prior to the CH-54's arrival. The CH-54 has no cockpit room for passengers or rigging materials.

b. Rigging of loads should be in accordance with applicable technical manuals for items of equipment being rigged.

c. It is imperative that proper strength and serviceable rigging materials be used.

d. Considerations peculiar to the CH-54 are:

(1) Rigging straps should be as short as possible commensurate with the proper rigging techniques (short straps provide for low hover and therefore more effective power utilization of the helicopter).

(2) Two hook-up men must be available to hook each load. One man must catch the hook while the other inserts the clevis.

(3) The only acceptable hook-up devices are:

(a) One large steel clevis with "U" down, FSN 1670-090-5354.

(b) Sling, endless, nylon, 15,000 pounds, FSN 1670-902-3080.

(4) Under no circumstances should two 10,000 pound doughnuts be used. Two doughnuts side by side in the hook may cause the hook to malfunction.

e. Hook-up personnel should wear goggles or a protective mask and leather work gloves.

f. On missions where the helicopter must hover to emplace a piece of equipment, sufficient personnel should be available to manhandle the equipment into position (normally at least eight men).

g. Static electricity: The CH-54 hook accumulates a small static electricity charge. Although it is uncomfortable, it will not hurt ground personnel. However, it is considered to be a fire hazard when hauling fuel drums and a static probe should be used to ground the hook before pickup. Fabrication and use of the static probe may be accomplished as follows:

(1) A static probe may be fabricated from two ammunition box rods, or suitable substitutes, connected by approximately twenty-five feet of insulated wire or cable. One rod must be firmly grounded. The other rod, with an insulated handle to protect the ground handler, is used to contact the hovering helicopter to discharge electricity generated.

(2) Contact the aircraft with the probe as high above the load as possible. In the case of fuel bags, it is conceivable that a static spark could ignite the fuel if contact with the hook were made too close to a leaky rollagon.

6. Fire support: The CH-54 has no armament to suppress enemy ground fire and therefore requires gunship support on missions where enemy fire is anticipated. Passive measures of defense are employed as a matter of course. Normally missions which originate and terminate in secure airfields are flown without gunship escort, unless weather conditions require low flight over "hot" areas.

7. Weather: Normal helicopter weather operating limitations are applicable. In addition, due to the inherent instability of the single point cargo system and the lack of suitable sling load display instruments, it is not presently recommended to fly sling loads under instrument conditions.

8. Coordination: When possible, using units should coordinate directly with the supporting unit either by personal liaison or by telephone. Details on rigging and mission timing can be finalized at this time.

9. Blowing debris: Rotor wash speeds for the CH-54 at maximum gross weight approximate 120 knots. The landing zones picked should therefore be clear of tents, and buildings. An LZ with a radius of 200 feet should be selected. Equipment, ponchos, boxes, and other debris must be policed

up regularly in the LZ. Canvas, if ingested by the Skycrane's rotor system, would almost certainly cause a major accident.

10. Necessary information for mission requests:

- a. Type equipment to be lifted.
- b. Weight of equipment.
- c. Exact location of pickup zone.
- d. Exact location of drop-off zone.
- e. Frequency and call sign of pickup zone.
- f. Frequency and call sign of drop-off zone.
- g. Time to arrive at pickup zone.
- h. Fire support team coordination as necessary.
- i. Status of rigging (load must be rigged prior to CH-54's arrival).
- j. Additional information.



ONE OF THE "CRANES" SHOWS ITS MUSCLE by lifting in a two-and-one-half ton truck during the air support missions in the operation.

Figure 37 CH-54 Lifting 2½ Ton Truck

APPENDIX XVIII

CHECKLIST TO INSURE MAXIMUM USE OF CH-54 FLYING CRANE

1. Pickup and drop-off zones, well policed and located away from tents and situated so that the CH-54 can approach and depart into the wind without over-flying the camp.
2. Serviceable rigging material must be used to preclude failure in flight and subsequent loss of load.
3. Hook-up personnel must be equipped with protective mask or goggles and leather work gloves. They must be well briefed to eliminate their fear of the cargo hook, thus facilitating the cargo hook-up.
4. Sufficient prepared loads of 14,000 - 16,000 pounds to keep the CH-54 working without delay. If there are lighter loads to be carried program them to be carried first when the CH-54's fuel load is greatest then move the heavier loads on subsequent trips as the CH-54 burns off fuel.
5. All loads must be attached to the CH-54's cargo hook with a metal clevis.
6. All items carried on equipment being moved must be properly secured so that it arrives at its intended destination.
7. Call signs and frequencies must be the same ones listed on the mission request. Personnel should be on the radio 30 minutes prior to scheduled reporting time. Alternate call signs and frequencies if available should be listed on the mission request.
8. Smoke grenades should be available at the pickup and drop-off zones.
9. Single point pressure refueling nozzle (FSN USAF 4730-289-0096) should be provided in refueling areas to speed up refueling operations and reduce maintenance problems.