PROPOSAL • MOBILE WARFARE WITH THE S-64



PROPOSAL

MOBILE WARFARE WITH THE S-64

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Sikorsky Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION • STRATFORD · CONNECTICUT

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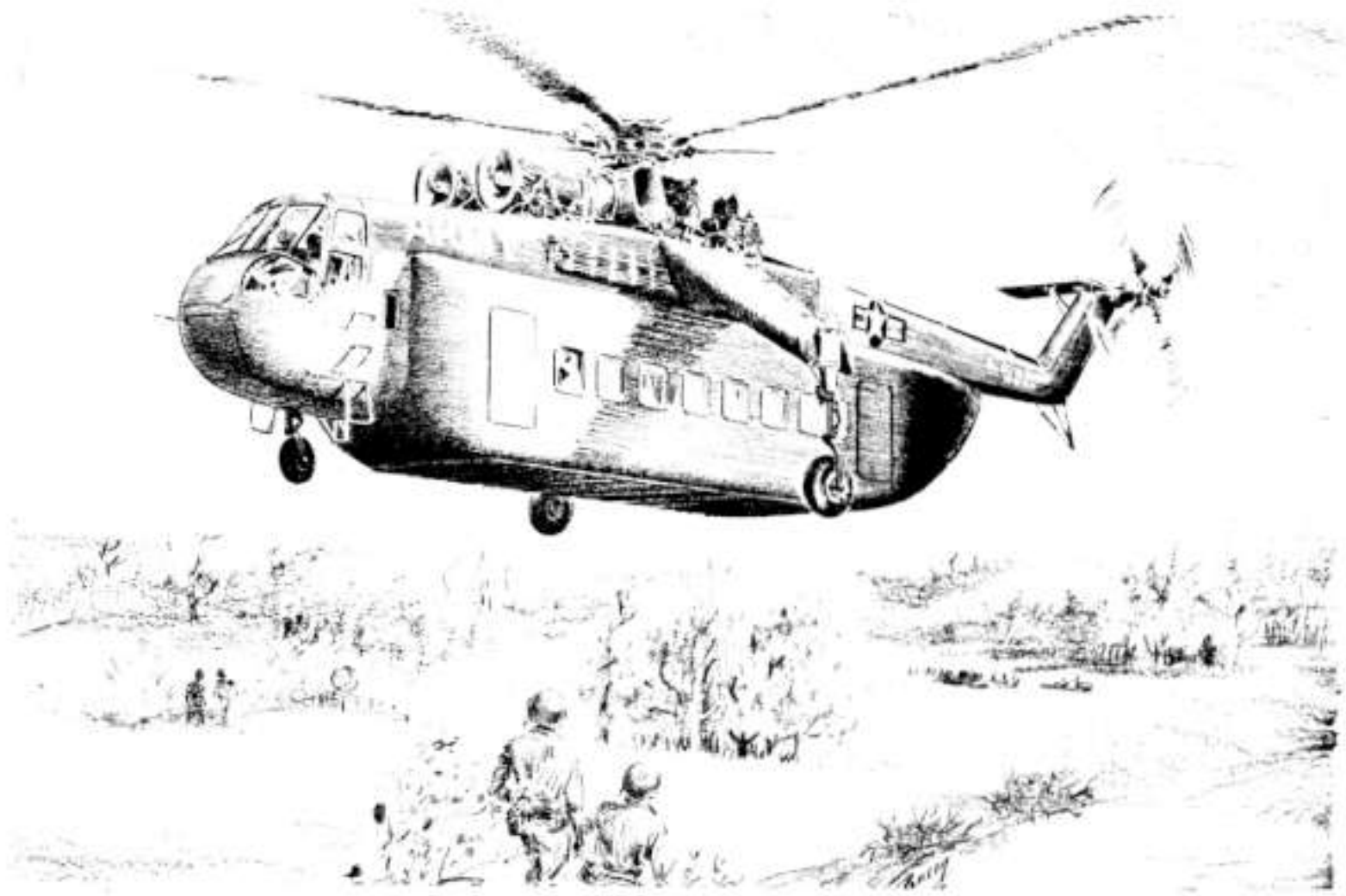
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Sikorsky Aircraft

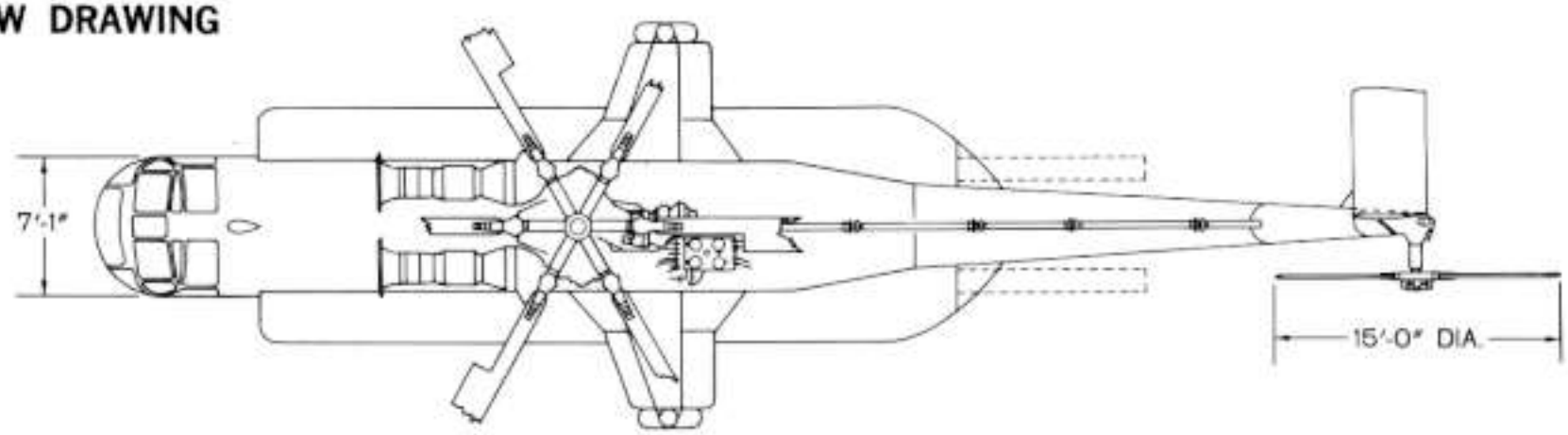


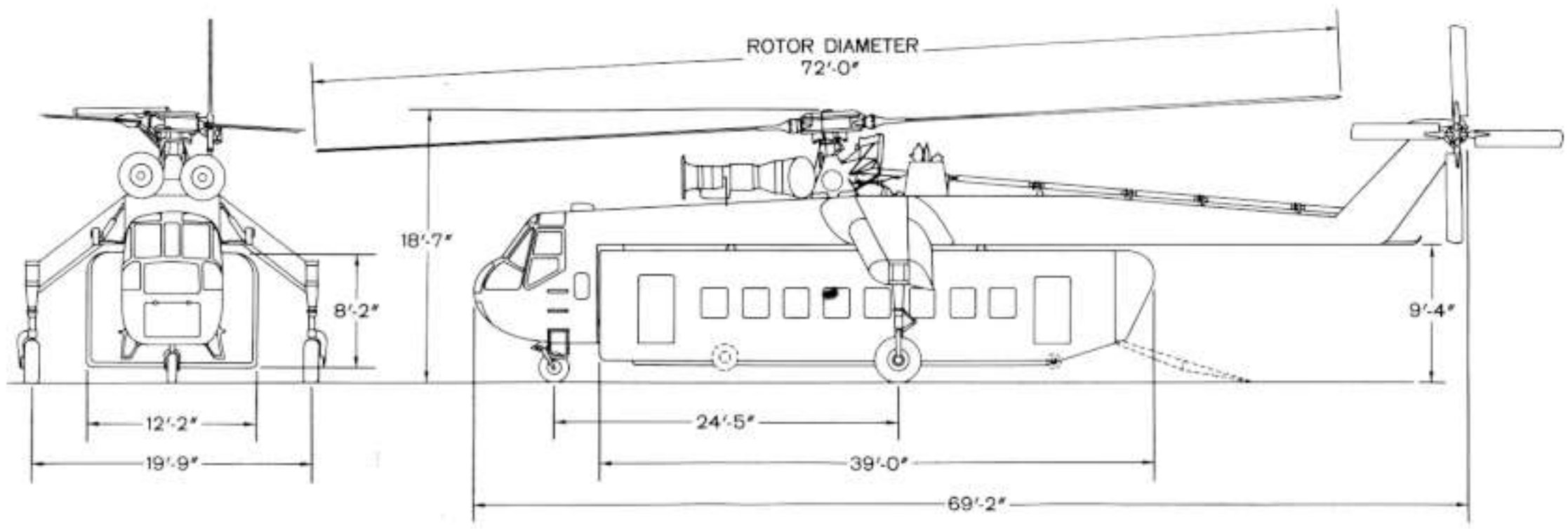
In response to recurring requests from the U.S. Army for industry support toward improved mobility of the armed forces, Sikorsky Aircraft has proceeded to develop a line of heavy lift helicopters with universal carrying capabilities. During the past ten years over ten million dollars of Corporation funds have been expended to design, build, and test the vehicle which would fill the Army's need. Starting with the concept of a prime mover which is readily convertible in a few moments to any mission, Sikorsky designed, built, and flew the Model S-60 demonstrator. This piston-engine helicopter proved conclusively that the concept demanded a modern production aircraft. With this aircraft a large and mandatory improvement in mobility of the Army could be assured.

Today the S-64 is flying. It is a new and more powerful manifestation of our faith in the concept and represents our determination to fulfill the urgent Army requirement for improved mobility approaching that already demonstrated by the USSR. The S-64 is ready for the Army and awaits Army support.

Lee S. Johnson

S-64 HELICOPTER • 3 VIEW DRAWING





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INTRODUCTION: THE S-64 HEAVY-LIFT HELICOPTER

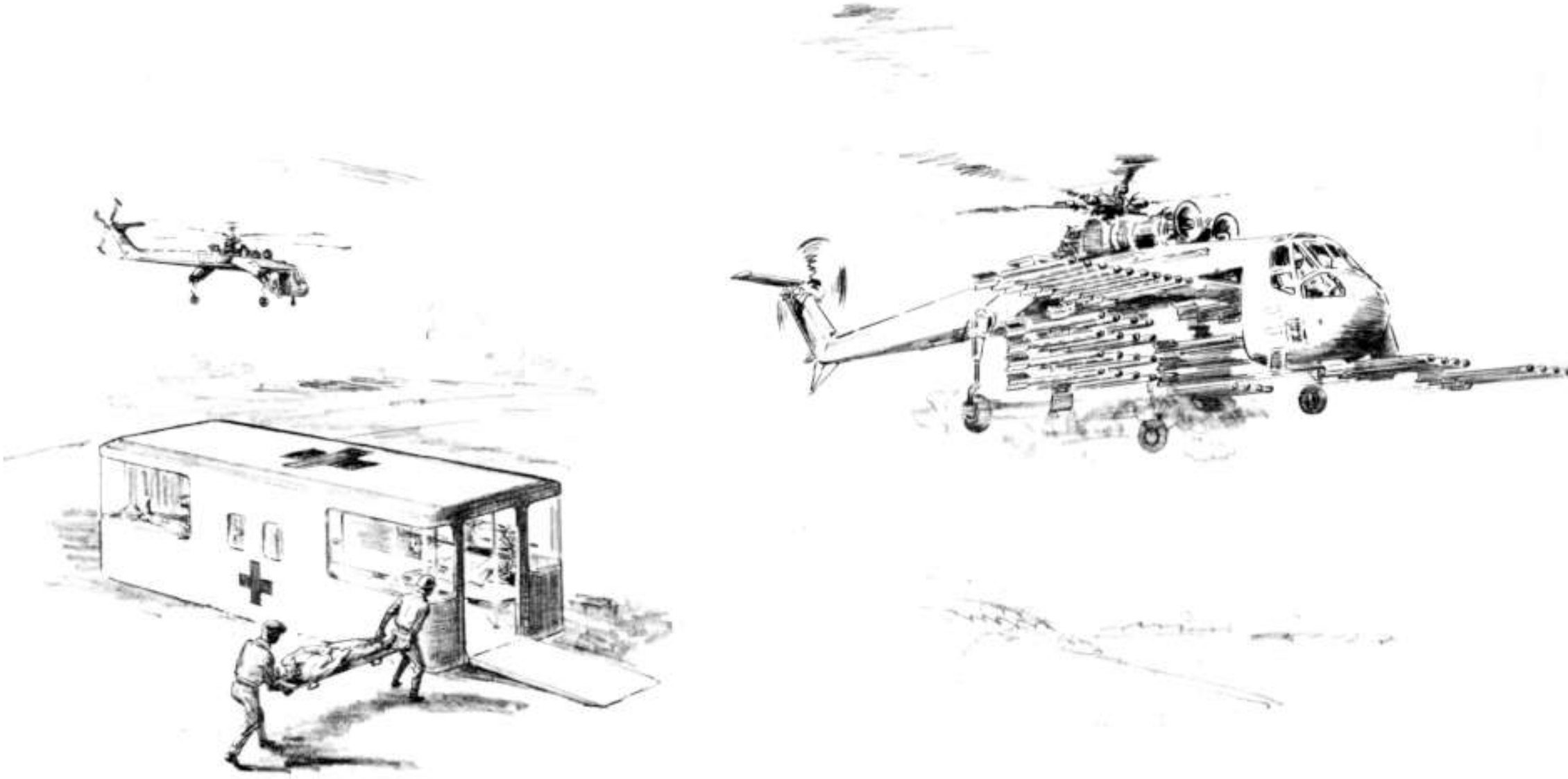
Stated and well advertised needs of the Army have been responsible for construction of the S-64, which has been designed and manufactured from private financial support. Recent additional support has been received by the sale of initial quantities to the Federal Republic of Germany.

The design of this aircraft embodies features and characteristics which have been demanded by the Army. Paramount among these features are: versatility, heavy load capacity, good flight characteristics, safety of operations, durability, reliability, ease of accessibility and maintenance, elimination of features not vital to function, producibility, and low cost of manufacture and operation.

In the design of this aircraft, actual military operational techniques and procedures were given very careful consideration. In addition, realistic application was given to existing military specifications.

In the past warfare operations, a significant majority of missions required loads to be attached externally. New combat functions, such as firepower surveillance, also demand external attachment. The S-64 is the first helicopter designed specifically for external loads. The configuration is able equally well to handle loads on a winch and cable, loads snubbed up against the fuselage after being straddled on the ground, or internal loads either in the conventional manner or pre-loaded in detachable pods.

The following applications are illustrative of important missions which may be performed with this one basic aircraft; it is certain that the Army will envision many additional applications to explore the versatility of the S-64. It would take a multitude of ground and fixed wing equipment to perform all these tasks: a tremendous saving in money and time can be effected by the S-64. Sikorsky Aircraft will appreciate the opportunity to cooperate and assist in any way in these developments.



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APPLICATION TO COMBAT FUNCTIONS

The S-64, a conventional helicopter, can accomplish all of the missions that have helped to make the helicopter a vital part of the Army's mobility tactics. . . starting in World War II and including the current crises in Viet Nam.

Because it is more powerful than any other helicopter now in the U. S. Army inventory, the S-64 performs all the presently practiced missions best, i.e., troop transporting, cargo carrying, rescue missions, etc.

The S-64 is more than just "another" helicopter. It is capable of carrying more payload faster and farther than any other helicopter now in operation or under development in the free world. Versatility of configuration, as well as versatility of mission performance, is incorporated in the S-64. Its standard general purpose cabin may be detached and special purpose cabins substituted for it. Or, the helicopter may be operated without its cabin to increase both size and load capabilities, while enhancing visibility of the loading area.

The S-64 has many new features that will give the U. S. Army fresh possibilities for air mobility. . . new missions and applications, previously beyond the realm of possibility, will become hard facts and an integral part of the U. S. Army's mobility tactics. Some of the features are:

Wide bay loading area - The S-64 taxis over bulky loads; or flat bed trucks can bring cargo direct to attachment points.

STOL capabilities - With loads securely snugged beneath the boom, the S-64 makes running takeoffs.

Convertibility - The S-64 converts from a cabin transport to a pure external loader and back again in a five-minute, one-man operation.

Versatile loading - The S-64 configuration carries odd sizes and shapes; it offers an optional cargo hoist; it carries special purpose pods and rigs - fuel tanks, armored platforms, aircraft launching and retrieval gear, rocket launching, small arms firing.

New loading methods - an aft facing seat with controls, and instrument panel gives the pilot full command of loading operations; one man can lift, position, and attach a load to the S-64 automatically.

Some applications based on these features are offered on the following pages. These applications are an important nucleus of some of the tangible, new ideas for combat mobility that are both feasible and practical with the S-64.

CONVENTIONAL HELICOPTER TRANSPORT CONFIGURATION

The removable cabin section is delivered with each S-64, thus providing a vehicle within the Army inventory that includes all the mission capabilities of the conventional helicopter.

The S-64 has larger internal capacity than a conventional helicopter because of its detachable cabin section. The universal pod section can carry either 60 combat troops or 48 litter patients, or 6 tons of internal cargo over a distance of 100 nautical miles. Cargo of up to 10 tons can be carried a short distance. Modern internal cargo carrying features, such as rear loading capabilities and impact resistant cargo flooring, are included in the pod.

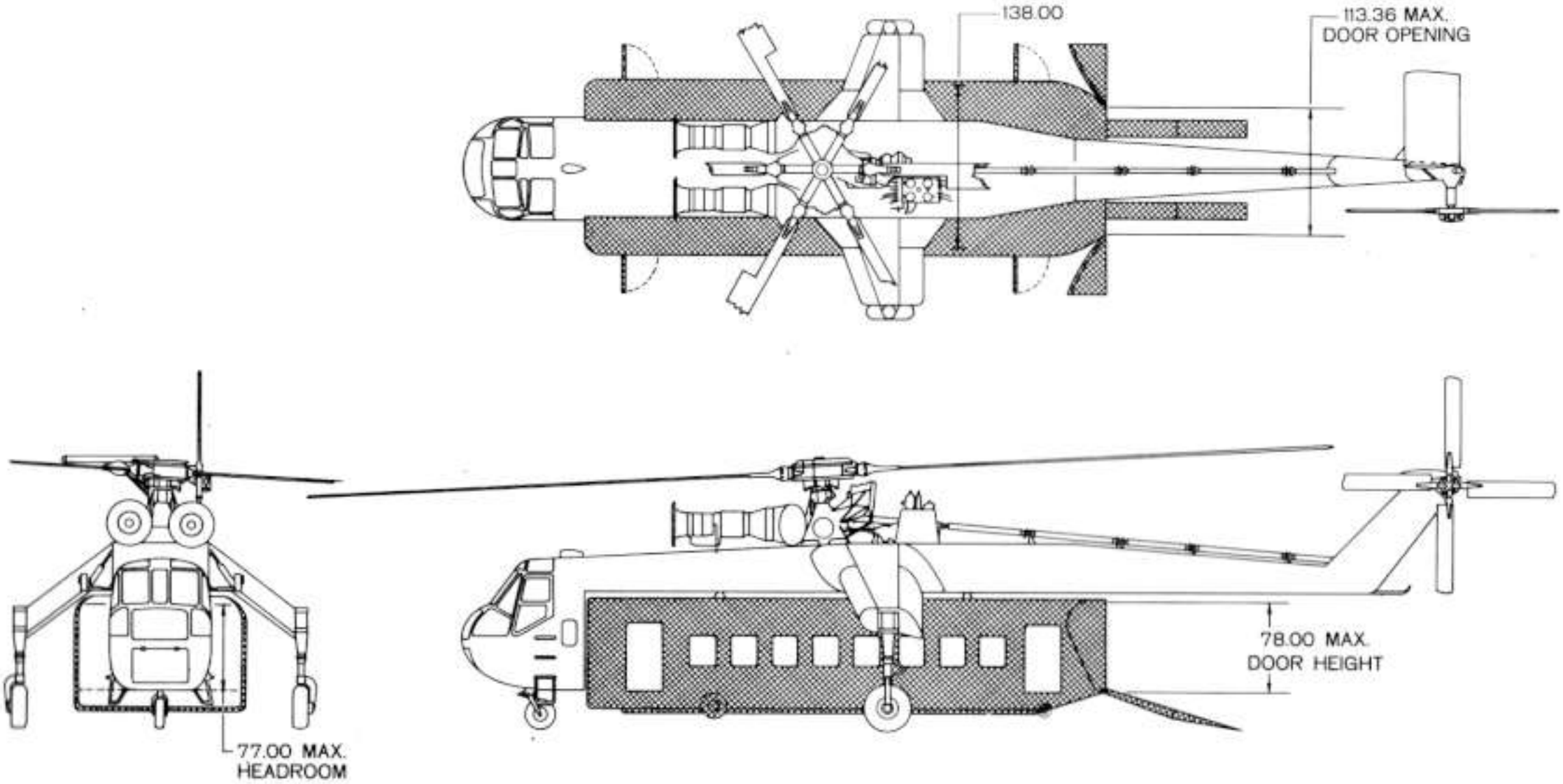
As shown in the accompanying sketch, the normal fuselage and cabin section of the helicopter is removable when logistic support for transporting suspended equipment or cargo is required. When the cabin section is separated from the S-64, the helicopter is quickly converted to a versatile and highly functional vehicle which can be utilized for any of the Army's logistic functions that require external loading.

The S-64's removable cabin feature also allows for the adaption of alternate pods of varied configuration. A variety of individual missions can be flown without affecting the availability of the aircraft.

Some suggested uses of this basic removable cabin are as follows:

Command and Control Facilities
Vehicle and Aircraft Repair
Portable Living Quarters
Portable Infirmary
Portable Power Generating Facilities
General Issue Supply Facilities

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CABIN VOLUME - 2,207 CU. FT.

S-64 WITH DETACHABLE POD

EXTERNAL LOADING CONFIGURATION

The S-64 helicopter configuration performs functions that are vital to modern warfare concepts. Both logistic and tactical combat mobility have been greatly enhanced in the Korean and similar type conflicts, and more recently through field trials, by the use of conventional fuselage type helicopters. These aircraft have proven to be invaluable for transporting cargo and providing mobility of armament.

Actual combat operations have shown that at least 80% of all helicopter cargo and weapons movements are accomplished by means of external loads. Suspending cargo beneath the helicopter, as opposed to carrying it inside the cabin, reduces the loading and unloading time to a matter of seconds - a vital consideration under combat conditions. In addition to making the operation safer, external loading permits maximum utilization of the aircraft for in-flight transportation by avoiding the time and labor consumed in loading and unloading internal cargo.

Knowing of these experiences and of the preferred method of transporting cargo and weapons, Sikorsky Aircraft initiated studies and investigations which have led to the development of the S-64 aircraft. . . the best vehicle for carrying external loads. This aircraft best fulfills established requirements because it is capable of accepting and delivering an external load more rapidly than other helicopters, thereby reducing aircraft exposure.

The result of extensive study and design is a cargo carrier which has no cabin weight, an unprecedented view of the load from the cockpit, and load support points high up near the c. g. of the aircraft.

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WIDE LOADING AREA

Loads of over nine feet high or 18 feet wide can be hoisted into the cabin area, retaining running takeoff and landing capability. Loads of any size can be suspended below the wheels.

LOGISTIC SUPPORT

The S-64 with the cabin portion removed is proposed as the optimum vehicle for general logistic support. The accompanying sketches show two principal means of accomplishing logistic support by S-64. In addition to the precedent which has been well established for external load carrying versus internal loads, an analytical investigation further supporting the S-64 configuration is shown in the graph on the next page, which plots tons of load carried per hour versus distance for three modes of transportation. It is clearly shown that the S-64 configuration excells over both the conventional fuselage helicopter and surface vehicles.

This graph illustrates clearly the advantages accrued by the S-64 special configuration, which permits rapid loading and unloading. The loading and unloading feature enables the S-64 to out perform both the conventional fuselage helicopter and existing ground vehicles. Experience with the S-60 Flying Crane has shown that external loads of the size transported by the S-64 require from one to two minutes for each loading and 30 seconds to one minute for the unloading operation. In comparison, from 20 to 45 minutes is required to load, spot, and secure similar type cargo in a conventional fuselage helicopter. Ten to thirty minutes is required to unload this type of aircraft.

A refueling time of 20 minutes (.33 hrs.) was assumed for both the S-64 and the equivalent conventional fuselage helicopter. The equivalent conventional fuselage aircraft was calculated to have a 20 knot higher cruise speed (115 knots versus 95 knots) than the S-64 crane type.

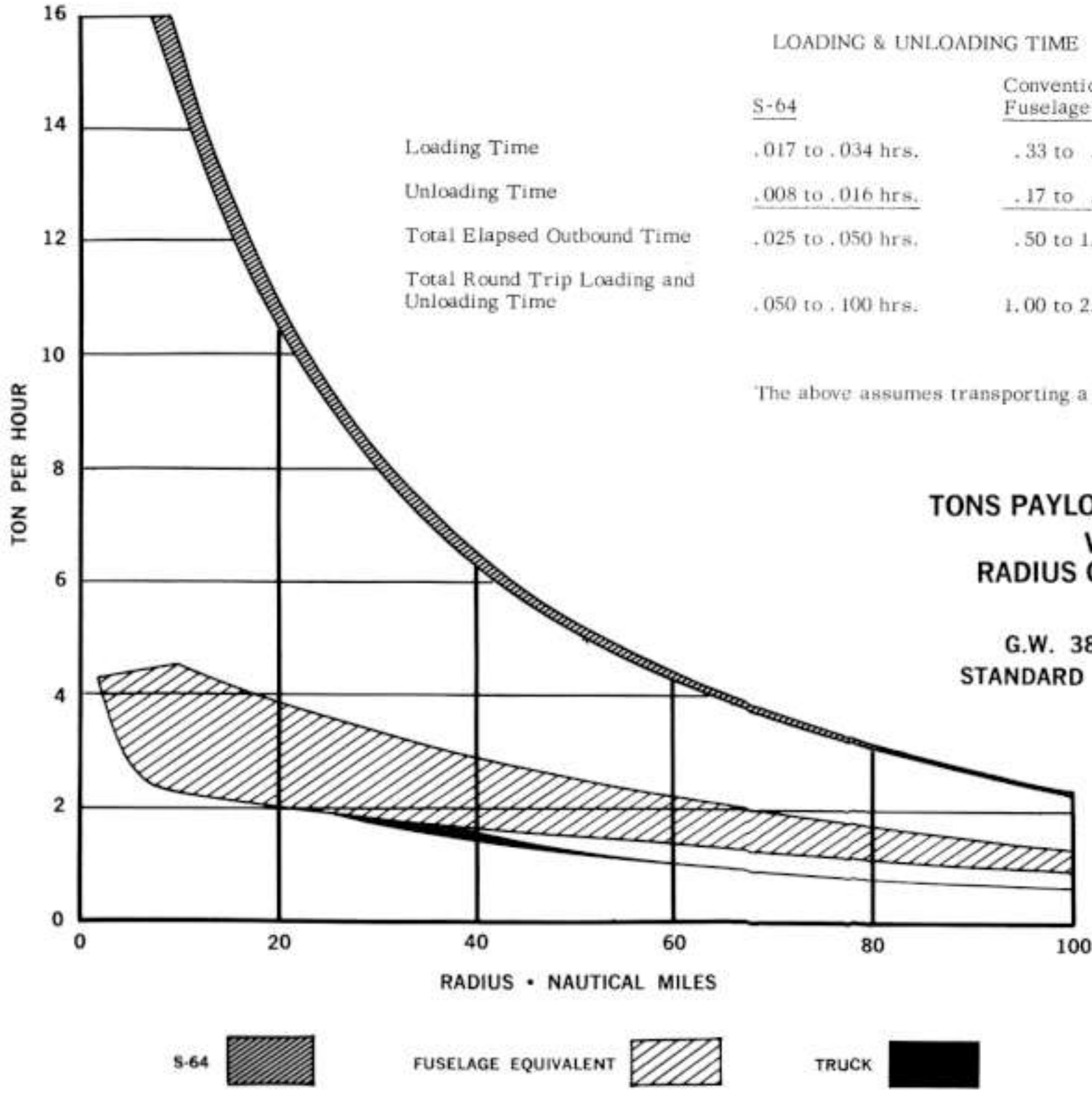
An average speed of 20 mph was assumed for the truck, with no reduction in payload for any of the various mission radii from 0 - 100 nautical miles. The same initial payload that was applicable to the S-64 was assumed for the truck. This figure, corrected for a 15% increase in road mileage as compared to air distance and converted to knots, is 15 knots.

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LOADING & UNLOADING TIME

	S-64	Conventional Equiv. Fuselage Helicopter	Truck
Loading Time	.017 to .034 hrs.	.33 to .75 hrs.	.25 to .5 hrs.
Unloading Time	.008 to .016 hrs.	.17 to .50 hrs.	.08 to .25 hrs.
Total Elapsed Outbound Time	.025 to .050 hrs.	.50 to 1.25 hrs.	.33 to .75 hrs.
Total Round Trip Loading and Unloading Time	.050 to .100 hrs.	1.00 to 2.50 hrs.	.66 to 1.5 hrs.

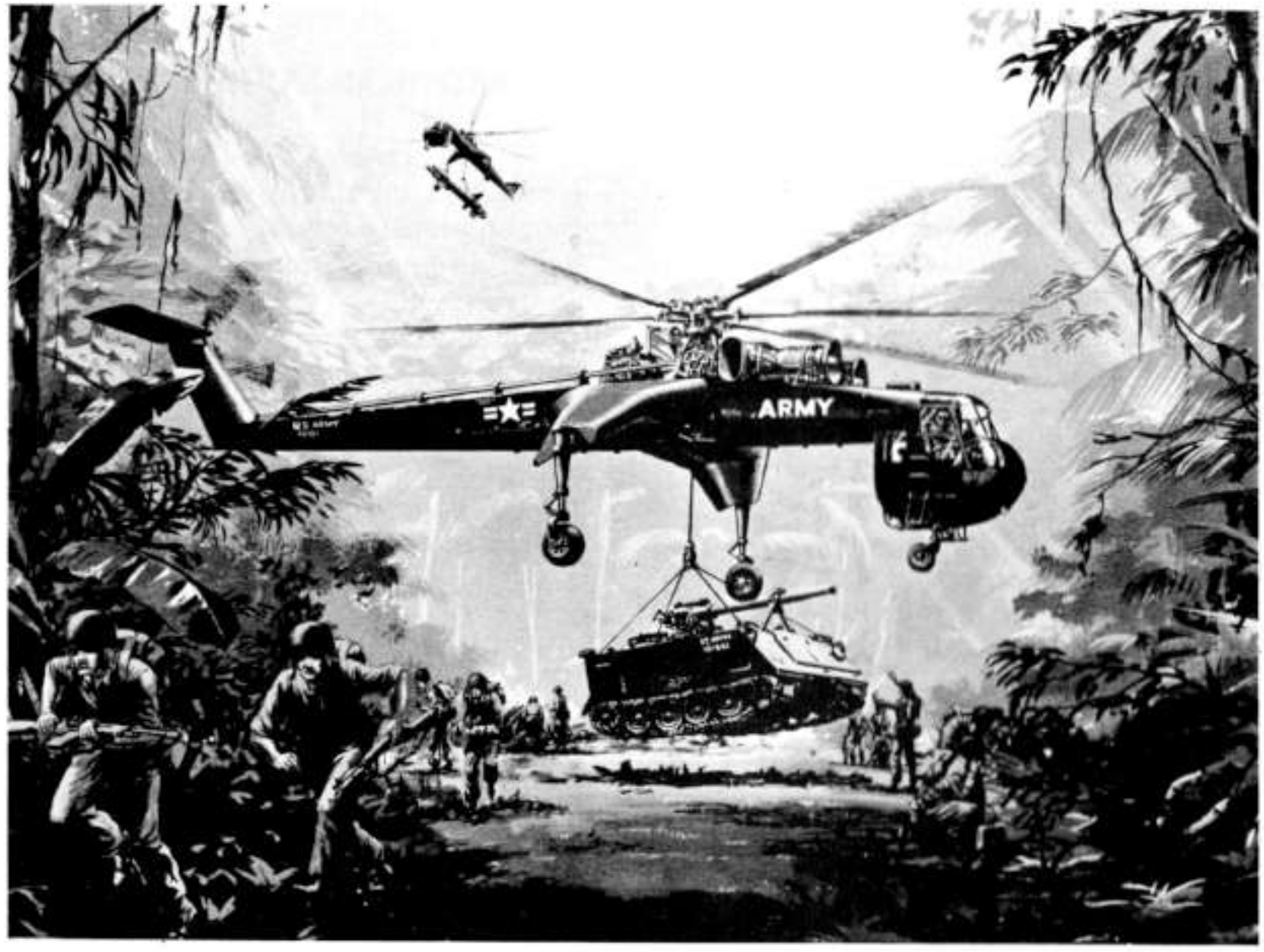
The above assumes transporting a full load both inbound and outbound.





EXTERNAL CARGO SECURED ABOVE WHEELS

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EXTERNAL CARGO ON WINCH CABLE

TRANSFER OF FUEL, LIQUIDS, AND SEMI-LIQUIDS

It is understood that one of the most difficult logistics problems involves the support of fast moving, advanced forces with fuel. By virtue of the configuration and lift capability of the S-64, fuel can be supplied to widely dispersed and highly mobile forces in spite of the existence of poor terrain conditions.

Investigations have determined that rubber type "pillow tanks" are available and can be adapted with little effort to the S-64. A standard 2,600 gallon "pillow tank" can be suspended in the fuselage cavity. 2,100 gallons of fuel can be delivered to a site 100 nautical miles from the S-64's point of origin. After delivering the fuel, the S-64 can return to its point of origin without being refueled. In an urgent situation, the overload capability of the S-64, which is 43,000 pounds maximum gross weight, can be utilized to increase the delivered fuel load from 2,100 to 3,100 gallons for the 100 nautical mile radius mission. These figures are based on the delivery of JP type fuel, at 6.5 pounds per gallon.

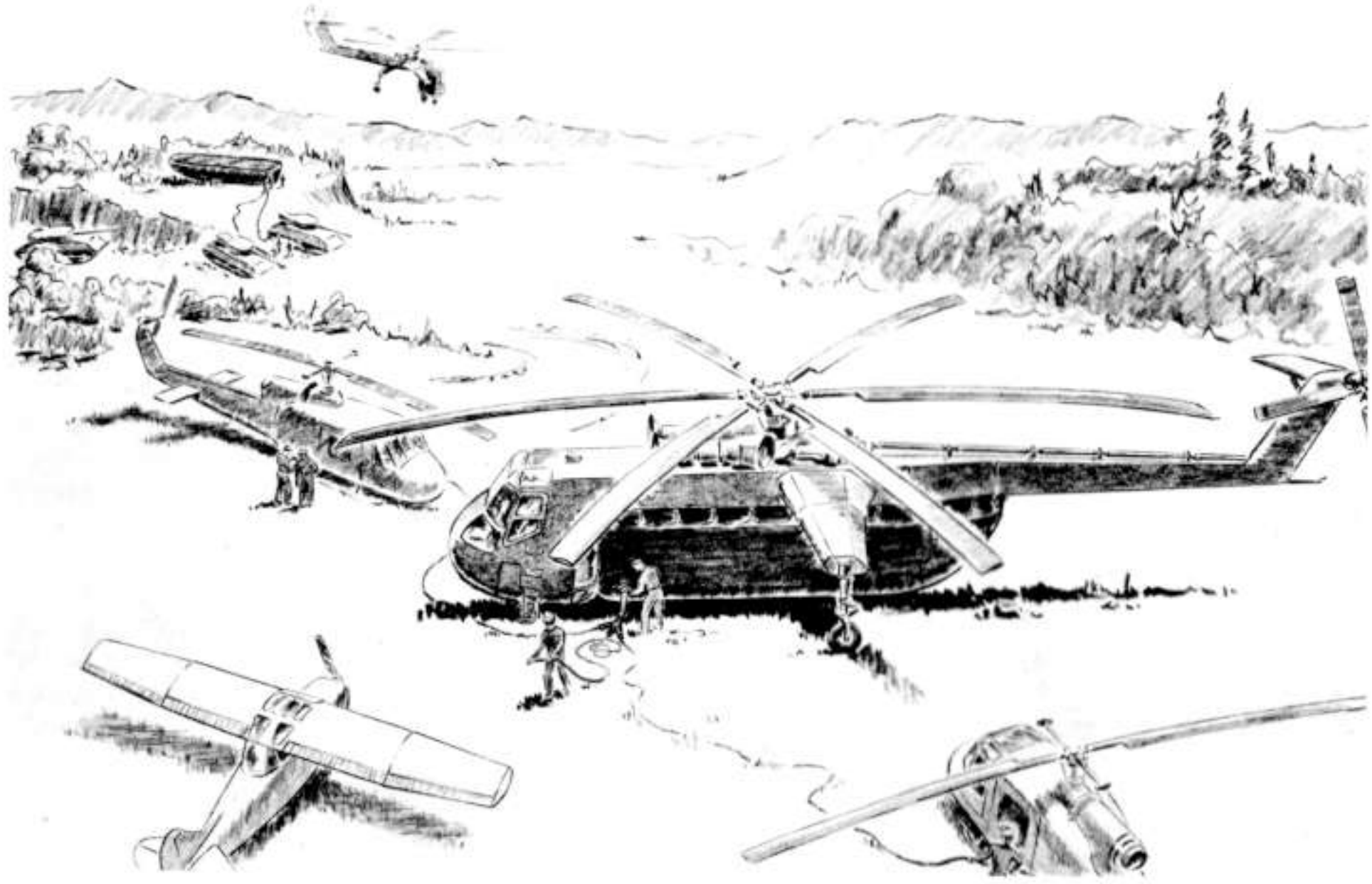
In terms of a logistic example, six armored tanks located 100 miles from the fuel depot, could be completely refueled with 376 gallons of fuel each, in approximately one hour.

In the accompanying illustration, an S-64 is shown delivering fuel with its cell attached to the aircraft. In the background, a fuel cell which was detached almost instantaneously from another S-64 rests on a hill as it refuels two tanks. By releasing the fuel cell, the S-64 can return for an additional supply of fuel or for other materials, while mechanized units are refueled at will by gravity feed from high ground or by either electric or hand operated methods.

Use of this type of cell is not confined to fuel; any liquid or semi-liquid can be stored in it, such as milk, powder, water, or exotic chemicals.

No feasibility study is required for implementation of this concept. Implementation requires only design, evaluation, and production.

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FUEL TRANSPORTATION

ARMORED PLATFORM FOR TROOPS AND SENSITIVE LOADS

A major advantage of the S-64 is that it can offer additional protection for troops and sensitive loads by instantly attaching an armored platform or armored pod. This extra protection is particularly applicable to moving troops into areas where there is a high concentration of small arms fire. In addition to offering protection, this armored platform will allow the airborne passengers to fire in almost any direction for sterilization of the landing area.

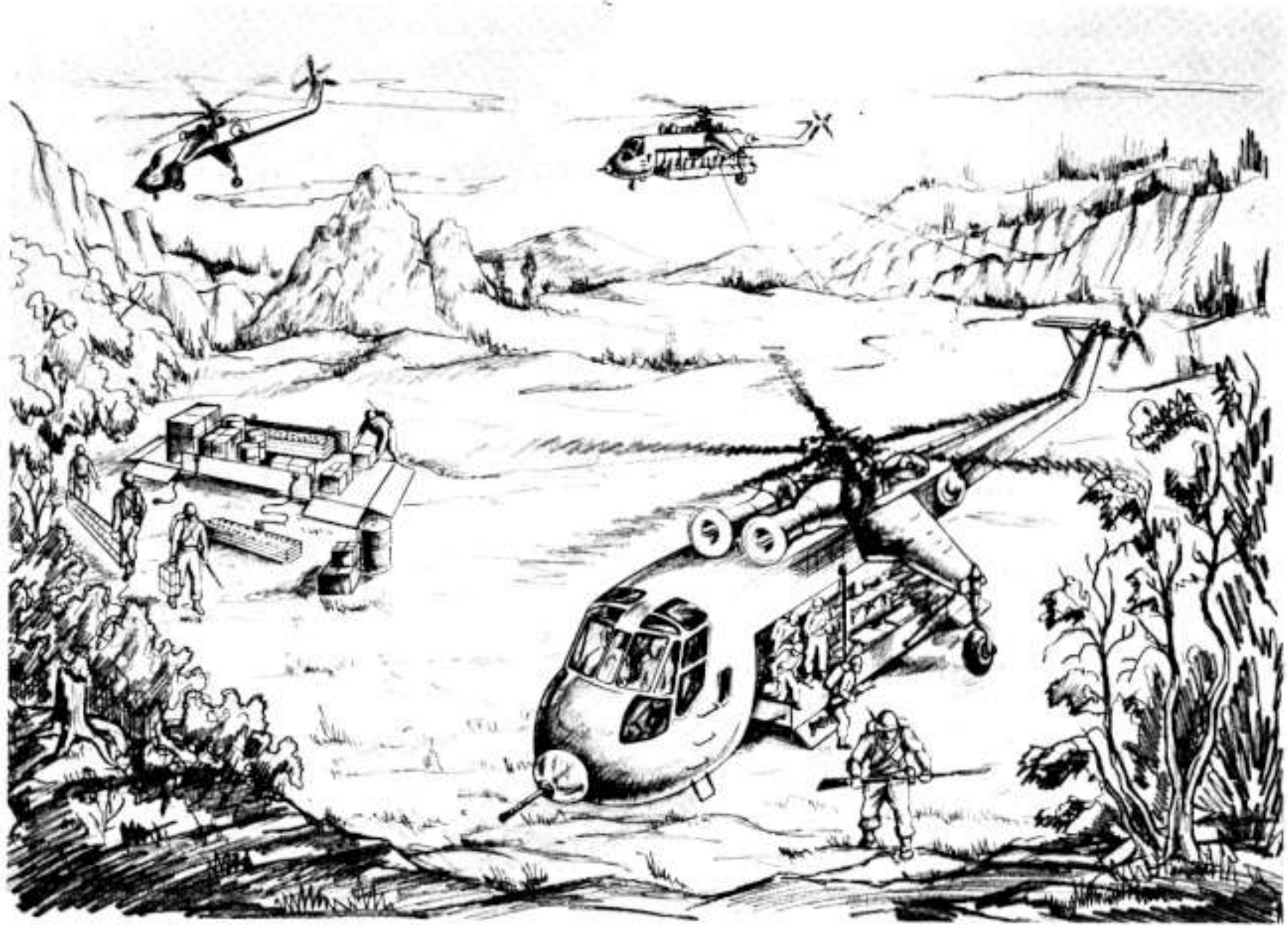
In the illustration on the opposite page, an armored platform is shown which has a floor and sides of 1/4" armor plate. The weight of this platform is estimated to be approximately 3, 400 pounds; and it is approximately 30 feet long and 8 feet wide. Attachment of this platform to the aircraft leaves a normal payload capability which permits the transportation of 45 combat troops 100 nautical miles. Planned growth of the S-64 will extend this capability to at least 60 combat troops.

Armor installation for conventional aircraft is normally included as fixed weight and must remain as a burden to the aircraft until removed. By quickly removing the S-64 armored platform, the S-64 returns to a full payload condition. Another advantage is gained because the armored platform provides a significant amount of protection to the aircraft crew and to sensitive areas of the aircraft itself when subjected to fire from ground elements.

Utilization of armored platforms is not limited to the protection of personnel and the aircraft. It is also applicable to other sensitive loads for which armor protection may be desired, such as fuel, ammunition, missiles, and chemicals.

This system requires only design, evaluation, and production.

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ARMORED PLATFORM

SUPPORT OF MISSILE AND ARTILLERY SYSTEMS

To illustrate the capability of the S-64 for supporting missile and artillery systems, a typical example of an operational unit of each type is presented.

I. Pershing Missile

The Pershing is a solid propellent, selective range, surface-to-surface, two-stage ballistic missile. The Pershing system, including a mobile Transporter-Erector-Launcher, can be air transported by the S-64 to an unprepared site, erected, and fired in a matter of minutes. With this mobility, the system can be included in the Army's family of smaller weapons. In its unique capacity of supporting the Pershing missile system, the S-64 eliminates many of the large vehicles and mobile equipment normally associated with the ground transportation version of this system, e.g., the missile and launcher can be preassembled and carried as a unit, thus obviating several trailers and slings, at the launching site.

The following table indicates the capability of the S-64 in the Pershing missile support role. A team of three S-64 aircraft can transport in one operation an entire Pershing missile system, including the first missile, up to 50 nautical miles. These same aircraft can then be used to support the existing site, or for establishment of a new base. The entire mission can be accomplished in 35 minutes.

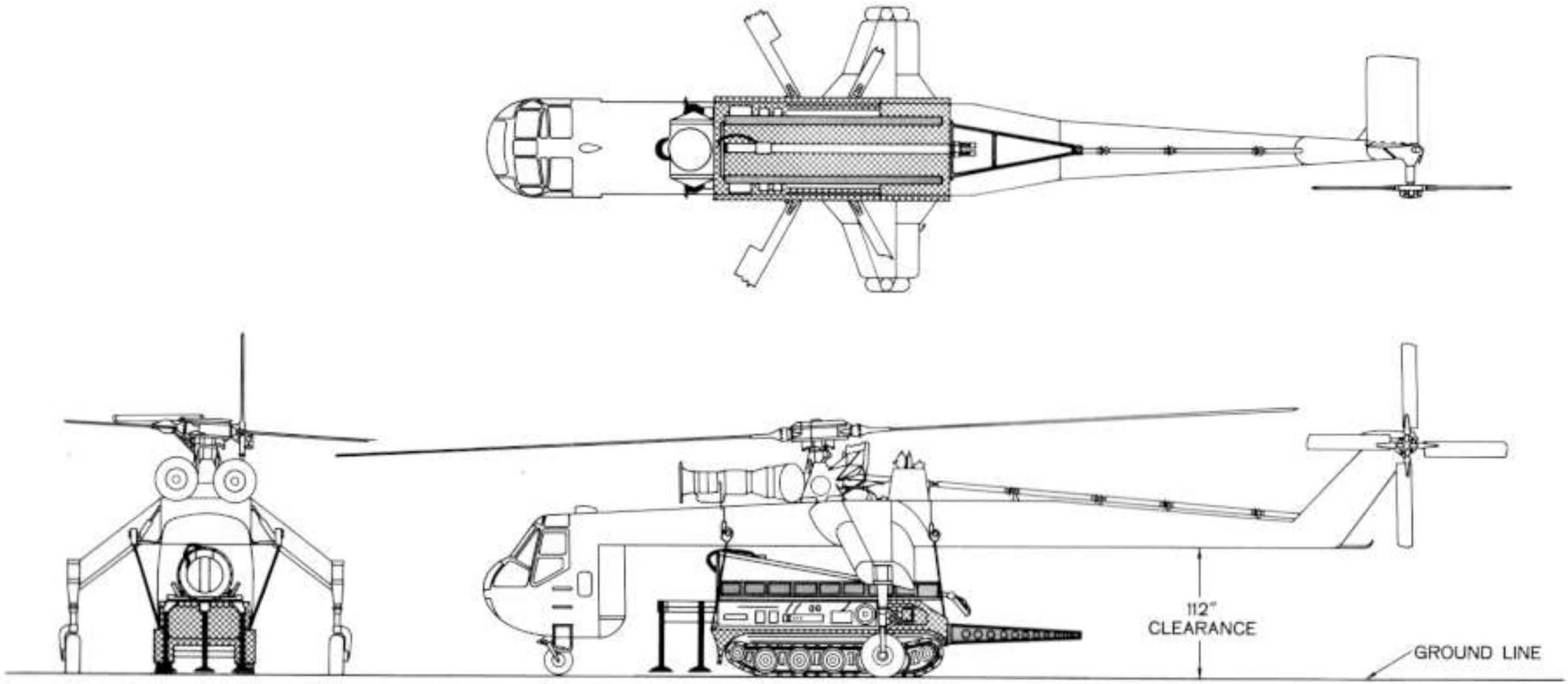
	WEIGHT
1st S-64	
Transporter-Erector-Launcher	6, 170 lbs.
Missile	10, 225
	16, 395 lbs.
2nd S-64	
Fire Control Pack	5, 036 lbs.
Facilities Distribution	---
Trailer (Electricity and Air)	4, 636
Generator Set, 5 KW	529
Winterization Kit	483
Azimuth Laying Equipment	758
	11, 442 lbs.
3rd S-64	
Truck, 3/4T, M-53	5, 350 lbs.
Communications Pack, AN/TRC-80	4, 241
Primary Power Pack	3, 170
	12, 761 lbs.

NOTE: The above data were extracted from "Transportability Data - Pershing Missile System," dated April 18, 1961, published by Headquarters, U. S. Army Ordnance Command, Redstone Arsenal, Alabama.

II. Howitzer, 155 mm. M1 or M1A1 with M1A2 Carriage

The total weight of this unit is 6.4 tons (12, 800 lbs.) and can be easily transported by the S-64. In addition, one S-64 can carry up to 177 rounds of ammunition for this weapon in an armored troop carrier.

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XM474E2 TRACKED CARRIER WITH T.E.L. ERECTOR LAUNCHER

AIRBORNE LAUNCH AND RECOVERY OF FIXED WING AIRCRAFT

The configuration of the S-64 is excellent for launching and recovering fixed wing aircraft. A brief study was conducted recently to determine the feasibility of this concept. It was concluded that this concept is entirely feasible, provided certain techniques are utilized.

The aircraft selected for the study was the Mohawk, a high speed reconnaissance aircraft organic to the immediate battle area, which requires an airport or prepared surface for repeated and safe operation.

The S-64 will carry this aircraft in a fully loaded condition and can operate at speeds above the stall of the Mohawk. Utilization of the air launch and recovery technique increases the effectiveness of the Mohawk by providing it with an effective VTOL capability. If prepared take-off and surfaces are not available, or are not possible, the S-64 launch and recovery system can launch the Mohawk and provide the services of a high speed reconnaissance and attack aircraft that would not otherwise be available.

This concept is not limited to the Mohawk aircraft. The technique could be used for drone recovery, launch and recovery of other aircraft with a gross weight within the lifting capacity of the S-64, and a stall speed not exceeding the speed of the S-64.

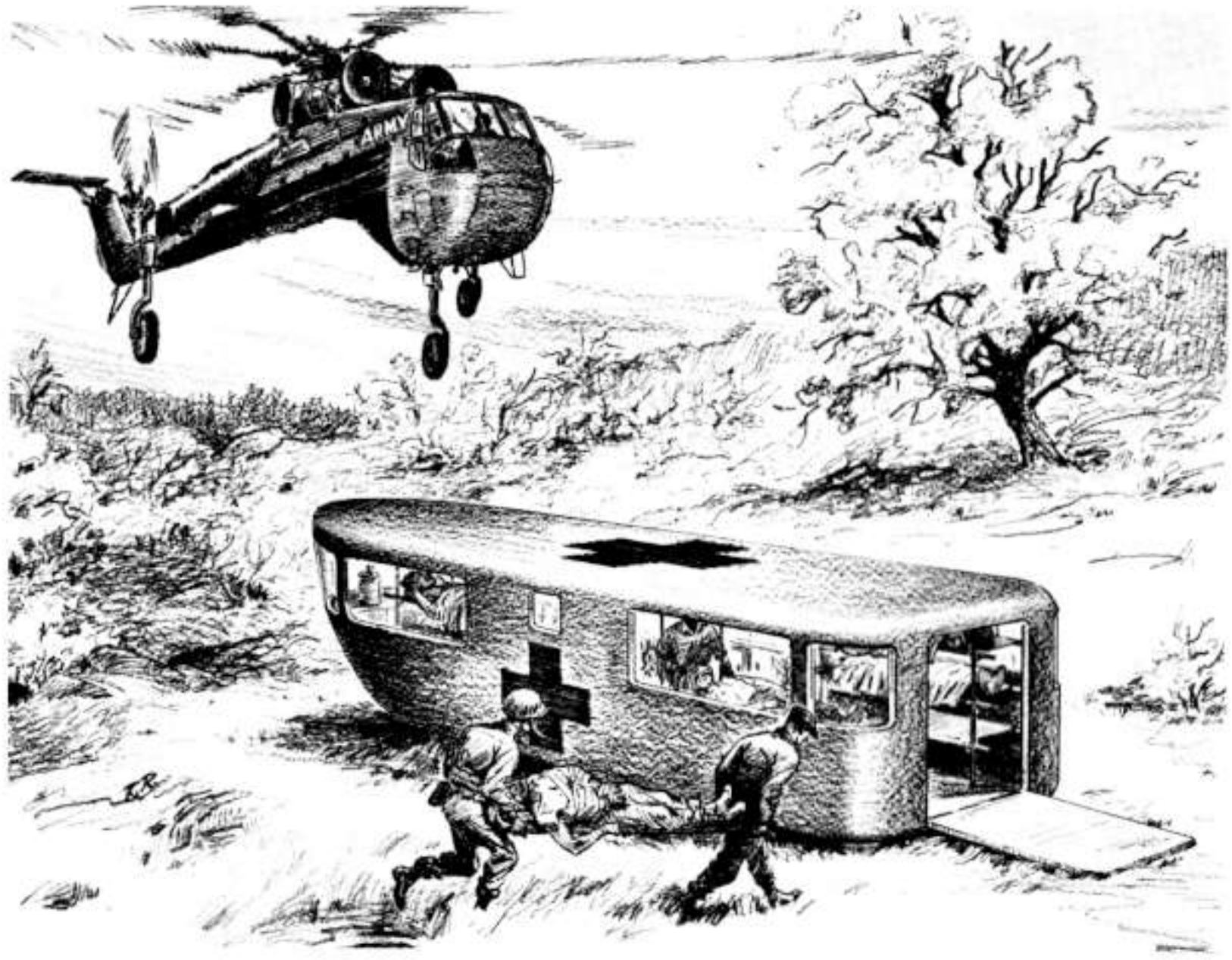
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AIR LAUNCH & RECOVERY OF MOHAWK



RECOVERY OF A DOWNED CARIBOU



EVACUATION & AID TO WOUNDED PERSONNEL

TOWING WITH THE S-64

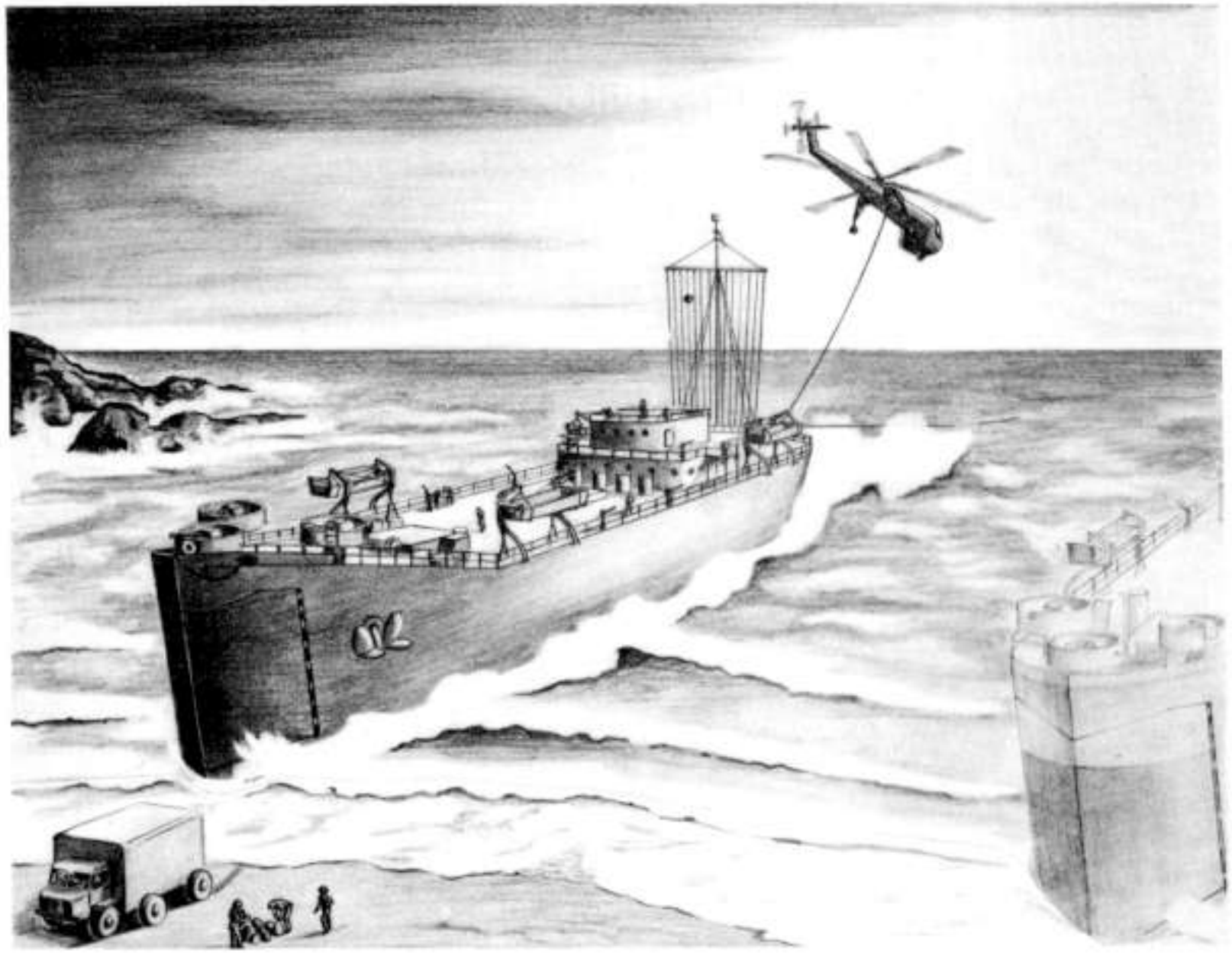
There are a multitude of situations and conditions which require utilization of a helicopter for towing. The winch, which can be provided with the S-64 as standard equipment, is ideally suited for quick adaptation for towing as well as for pure lift.

In a tow condition of flight, the S-64 can exert a 35,000 pound force. This force is equal to that exerted routinely by a locomotive engine towing seventy 50 ton cars at 55 miles per hour over a level track. It is also equal to the breaking strength of a 5/8" steel cable. The S-64 can exceed the breaking strength of this cable with a steady pull.

The illustration on the opposite page shows the S-64 in a tow role. This illustrates a typical situation of a landing craft in need of assistance for disengagement from the beach. The situation could involve a disabled tank, a large truck in the mud, land minesweep equipment, or a cargo sled train towed at high speed over artic terrain.

Considerable tow work was accomplished with the prototype aircraft, the S-60. This work involved the development of two types of tow equipment and included actual demonstrations of launch, tow, and in flight recovery of naval minesweep equipment. These operations were successful and fulfilled expectations.

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TOWING LANDING CRAFT

MOBILE FIREPOWER

In the past, helicopters have not been fully utilized for direct application of firepower under actual conditions of warfare. The S-64 opens the possibility for a large increase in capability in this vital combat function.

For the firepower function, application of a wide variety of armament is feasible and practical. These firepower systems range from basic to sophisticated systems, as visualized in the descriptions and illustrations following.

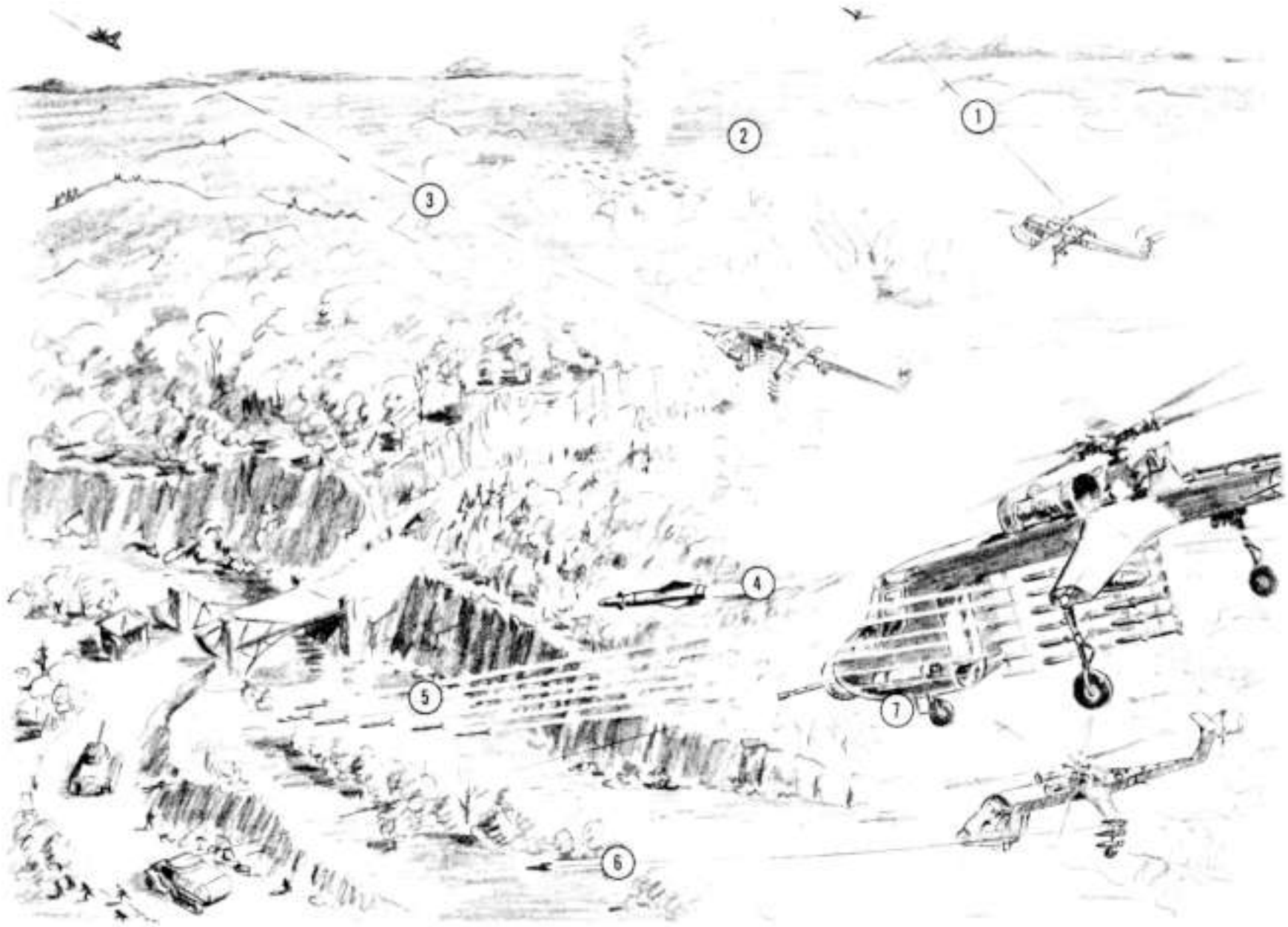
There are many armament systems now in inventory and more advanced systems currently under development which could be considered in lieu of those selected for the illustration of this concept.

The accompanying sketch shows the S-64 in a combat helicopter configuration carrying an array of unguided missiles plus three 20 mm. cannon pods.

The 20 mm. remote control cannons are located in a manner that gives the helicopter protection against an attack from above, as well as against small arms fire from the ground. One gun is mounted in a turret on each side of the helicopter. The chin mounted gun covers the forward area below the helicopter. The system that controls the firing of the cannons through the main rotor utilizes a device which determines the range to the rotor plane from gun azimuth and elevation information received from the turret. This device also selects the lead angle required for the bullet to clear the rotor blade. This system requires a study program to determine the most effective means, mechanical or electronic, or a combination of both, of achieving operational status.

Three unguided missiles considered for the combat helicopter are the 2.76 inch rocket, the ZUNI rocket and the LOKI rocket. The 2.76 inch rocket, which can be used with a variety of warheads, offers particular advantage through the use of a target marking warhead. When the combat helicopter encounters a target it cannot immediately destroy, a target marking rocket, which gives off a smoke signal, is fired at the target to identify the target area. The 2.76 inch rocket

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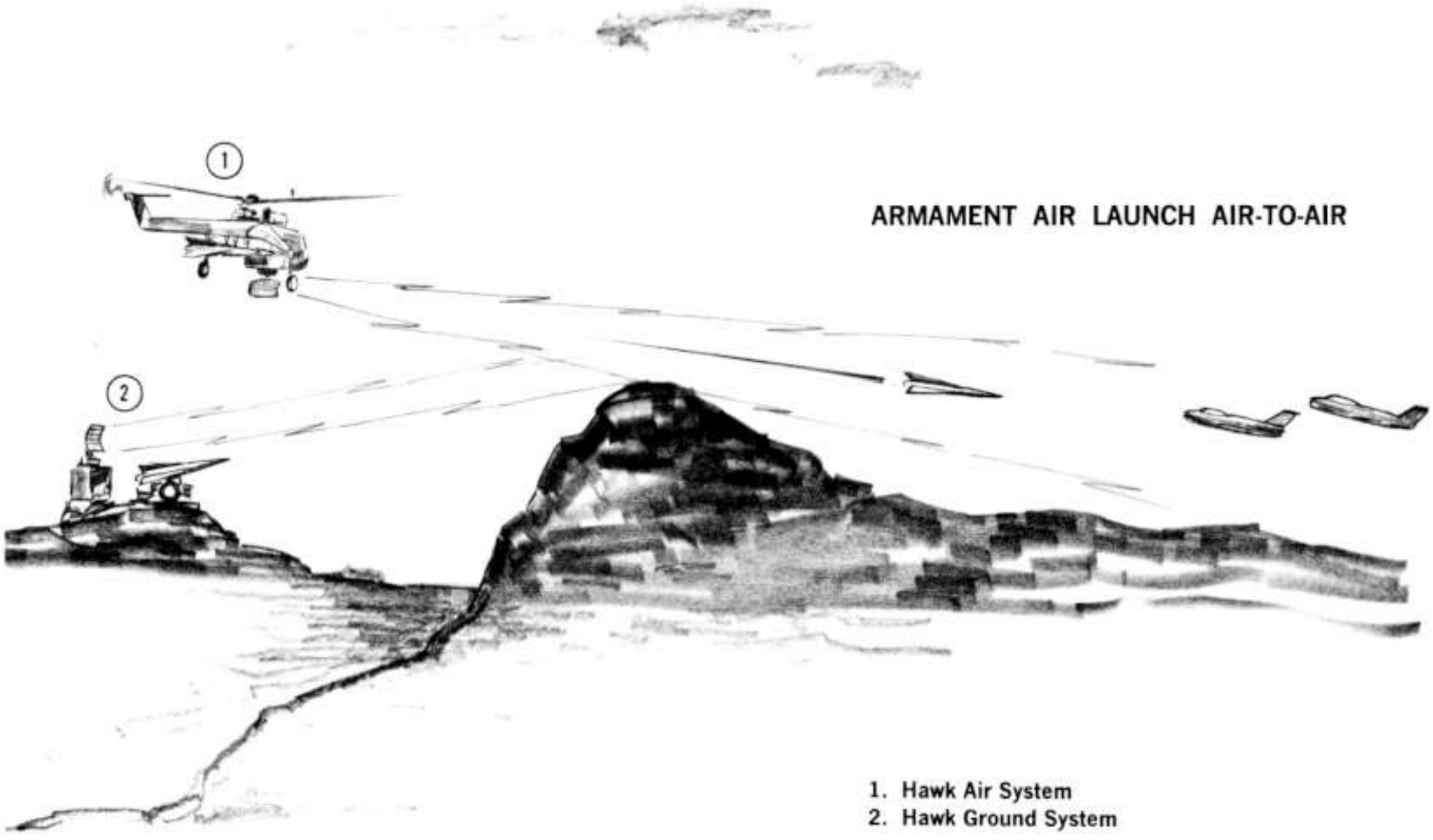
1. Side Turrets — 20mm
2. Target Marker
3. Nose Turret
4. Bullpup
5. LOKI or ZUNI
6. SS-11B
7. Vulcan

ARMAMENT AIR LAUNCH

AIR TO GROUND

AIR TO AIR

ARMAMENT AIR LAUNCH AIR-TO-AIR



1. Hawk Air System
2. Hawk Ground System

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will be rack mounted and is capable of being fired individually or in salvos.

The 5 inch ZUNI missile, capable of carrying a variety of conventional warheads, is a 5 nautical mile weapon specifically designed for all weather air-to-ground fire. Equipped with a high explosive fragmentation warhead, the 110 inch-long, 170 pound ZUNI will provide the S-64 combat helicopter with a large capability for delivering suppressive area fire against ground troop concentrations.

The 24 pound LOKI rocket is an anti-tank missile which is designed specifically for helicopter employment. The 66 inch-long ballistic weapon, when fired in salvos, provides the S-64 combat helicopter with the ability to destroy tanks, armored vehicles, trains, or other point targets.

Because of the helicopter's maneuverability, possible mounting configurations permit the unguided missiles to be pointed outward, in any direction. An optical range-finder type sight will be used which has the capability of being turned to pre-selected positions that correspond to the alignment of the particular missile or missiles to be fired. The helicopter can then be maneuvered until the target is aligned in the sight. The optical sight will have mechanical coupling which will rotate the sight about a horizontal axis, to adjust for ballistic trajectories, and about a vertical and horizontal axis to adjust for the geometric relation between the missile mounting position and the location of the sight.

There are at least two guided missiles readily adaptable at this time. They are the SS-11B, and the Bullpup. The SS-11B is a wire guided missile which has a two nautical mile range and is designed specifically for destruction of tanks or other heavily armored targets. The Bullpup is a radio command (visual reference) guided missile which has a 3 to 6 nautical mile range. The warhead can be either high explosive or nuclear. This missile has been successfully fired from a Sikorsky H-34 type helicopter.

Radio and wire guided missiles are capable of only minor alterations in their flight course, therefore, they must be initially aimed. The same optical range-finder type sight that is used for the unguided missiles will be used with the guided missiles.

The controlling mechanisms for the guided missiles will be installed on the missile pod with a control stick in the cockpit or a separate control station. The control stick will be capable of controlling wire or radio controlled missiles through a selection switch and circuitry which will determine which control mechanism is excited by the control signals. The control stick will have its own supporting frame so that it can be installed or removed quickly.

The S-64 combat helicopter will require protection from opposing helicopters and fixed wing aircraft. Homing missiles, such as the 24 pound infrared homing REDEYE or SIDEWINDER, can be used to provide protection.

A further concept considers the S-64 carrying the HAWK type anti-aircraft missile system to provide self protection, and protection for other helicopters under escort, against high performance interceptors. The relatively long range capability of a semi-active homing guided missile, such as the HAWK, offers a distinct advantage in that the helicopter may be able to initiate defensive counterfire before the intruder aircraft is close enough to begin its attack.

The launch and guidance from the helicopter of a missile, such as HAWK, has pronounced advantages over a ground launch system. The airborne unit could be moved over large distances quickly. The effectiveness against low flying aircraft would be increased due to elimination of line of sight limitations imposed on ground radar. The airborne radar would be more effective than ground radar for area surveillance.

All weapon information in this section has been taken from commercial publications. It is certain that the military has other systems available which would be more suitable and effective. This contractor does not have full knowledge of all advanced missile development programs, and it is certain that the Army has other systems available which would be more suitable for more advanced effort.

DESCRIPTION OF THE S-64

The S-64 is an 8 - 10 ton payload helicopter which has a six-bladed main rotor, and is powered by two Pratt & Whitney JFTD12-1 turbine engines. It is designed for carrying external loads, towing, aircraft and missile launching and retrieving, transportation of cargo and personnel, armament launch, and for carrying a variety of detachable cabin, cargo, or special purpose pods.

The airframe is constructed in the universal task configuration. This section is provided with seating for pilot, copilot, crane operator, and two observer personnel. The crane operator's seat faces rearward for hoist operations, and is equipped with both flight controls and hoist controls.

Flight controls consist of cyclic control stick, collective control stick, rudder pedals, gas generator control switches, power turbine trim switches, and automatic flight control system. The rear facing operator has electrical cyclic and directional controls with a standard collective control stick. A power anticipator is installed between the engine fuel control and collective control stick.

Three tandem servos are installed on the main rotor head and a single tandem servo on the tail rotor. Two independent hydraulic systems are provided for operation of the tandem servos. A third hydraulic system is provided for operation of the auxiliary servo system. A fourth hydraulic system is provided for operation of the winch and/or engine starting.

The alighting gear is a fixed tricycle type, and a retractable tail skid is provided. "Kneeling" of the main gear is provided through a range of 8 inches. This provides ground clearance for large loads which are attached in the "kneeled" position.

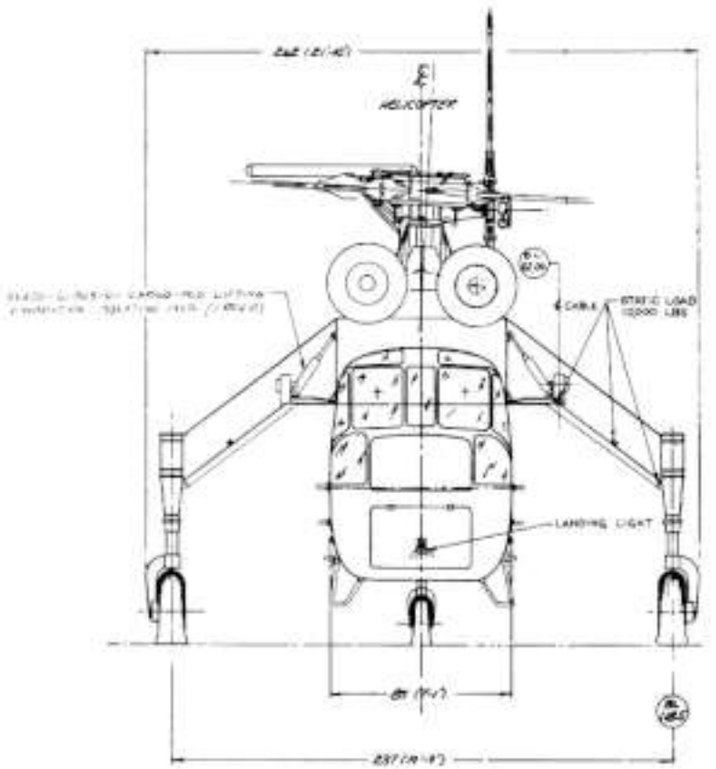
A removable cargo hoist is mounted directly under the main transmission. A quick release hook can release the load automatically on load touchdown, or manually from the ground, or electrically from any crew seat.

Multiple attachment points are provided to support external loads directly from the fuselage structure, and four "load levelers" hoist large objects from the ground to a snubbed position under the fuselage.

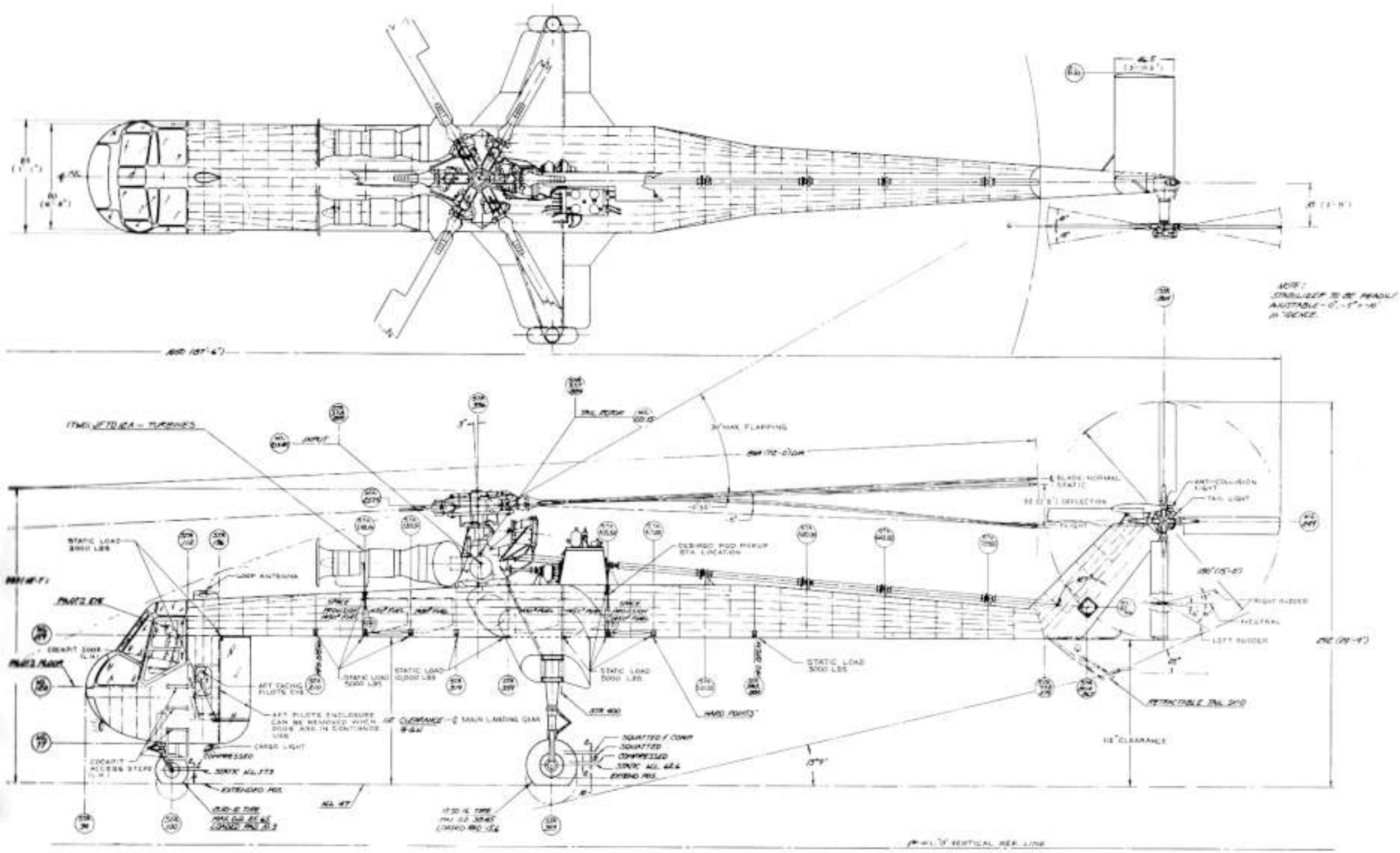
S-64 SPECIFICATIONS

Design Gross Weight	38,000 lbs
Overload	43,000 lbs
Design Load Factor	2.5 g
Limit Sink Speed	8 fps
Power Loading	7.05 lbs/sq ft
Disc Loading	9.34 lbs/sq ft
Blade Loading	121.1 lbs/sq ft
VL/GW	54.5 %
Fuel Capacity	1340 gal
Main Rotor	6 blades
Diameter	72 ft
Blade Chord	23.65 in
Tail Rotor	4 blades
Diameter	15 ft
Blade Chord	13.5 in
(2) Pratt & Whitney Turbine Engines	
Model	JFTD-12A-1
NRP (each)	3200 HP
MRP (each)	4050 HP
TOP (each)	4620 HP
Trans Rating	5400 HP

GENERAL ARRANGEMENT



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(TWO) JFTD 12A-1 TURBINES
INPUT
STATIC LOAD 3000 LBS
LOOP ANTENNA
PILOT'S EYE
COPILOT'S FLIGHT
AFT CACHING PILOTS EYE
AFT PILOTS ENCLOSURE CAN BE REMOVED WHEN DOOR ARE IN CONTINUOUS USE
COCKPIT ACCESS STEPS
CARGO LIGHT
EXTENDED
RETRACTED
STATIC LOAD 5000 LBS
STATIC LOAD 10,000 LBS
DEBRIS POD PICK-UP STA LOCATION
STATIC LOAD 5000 LBS
STATIC LOAD 5000 LBS
HARD POINTS
SQUATTED F COMP
SQUATTED
COMPRESSED
EXTEND POS.
30° MAX FLAPPING
BLADE NORMAL STATIC
ANTI-COLLISION LIGHT
TAIL LIGHT
RIGHT RUDDER
NEUTRAL
LEFT RUDDER
RETRACTABLE TAIL SKID
112" CLEARANCE
NOTE:
STABILIZER TO BE PARALLEL
ADJUSTABLE -0°, -5° + 10°
IN FLIGHT.

FEATURES

Power

Twin P & W JFTD-12A-1 Turbines
Accessible all around - no cowling
Mounted forward of all accessories and rotor parts

Main Rotor

Six BIM blades - extended life
Self-oiling rotor head
Ground clearance, deflected - over 13 feet

Tail Rotor

Four blades
Ground clearance - over nine feet

Landing Gear

Tricycle type - clear loading area
Retractable skid protects tail rotor
Main gear kneels 8 inches for load pickup
Energy absorption strut

Fuel

Located near engines - short fuel lines

Cargo Equipment

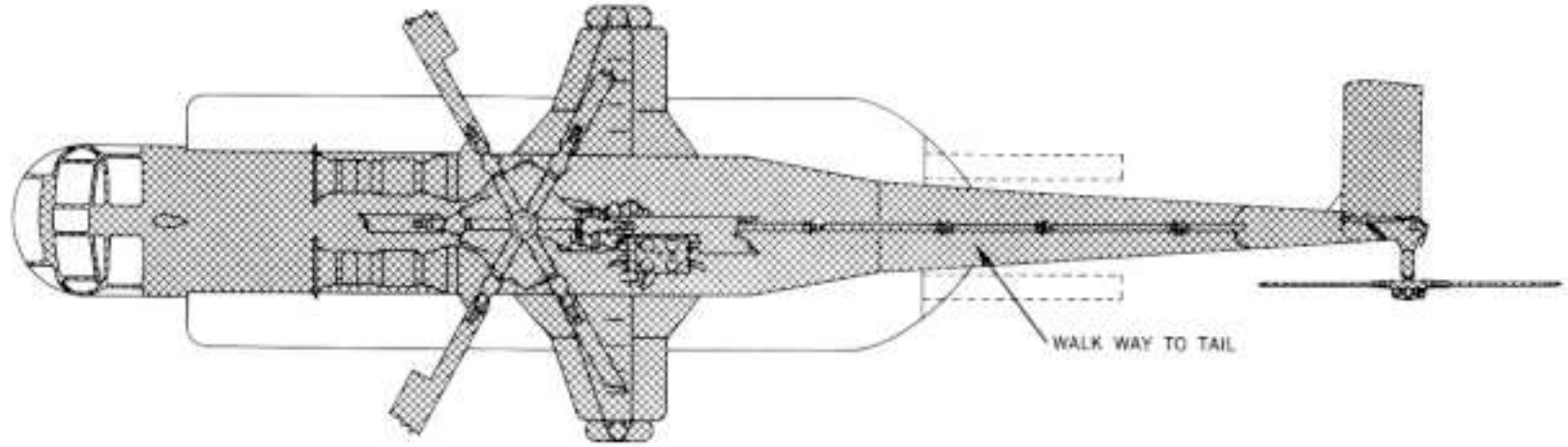
Hoist - adequate for full payload lift and towing
Four load levelers for quick attachment
"Hard Points" located in pairs along fuselage

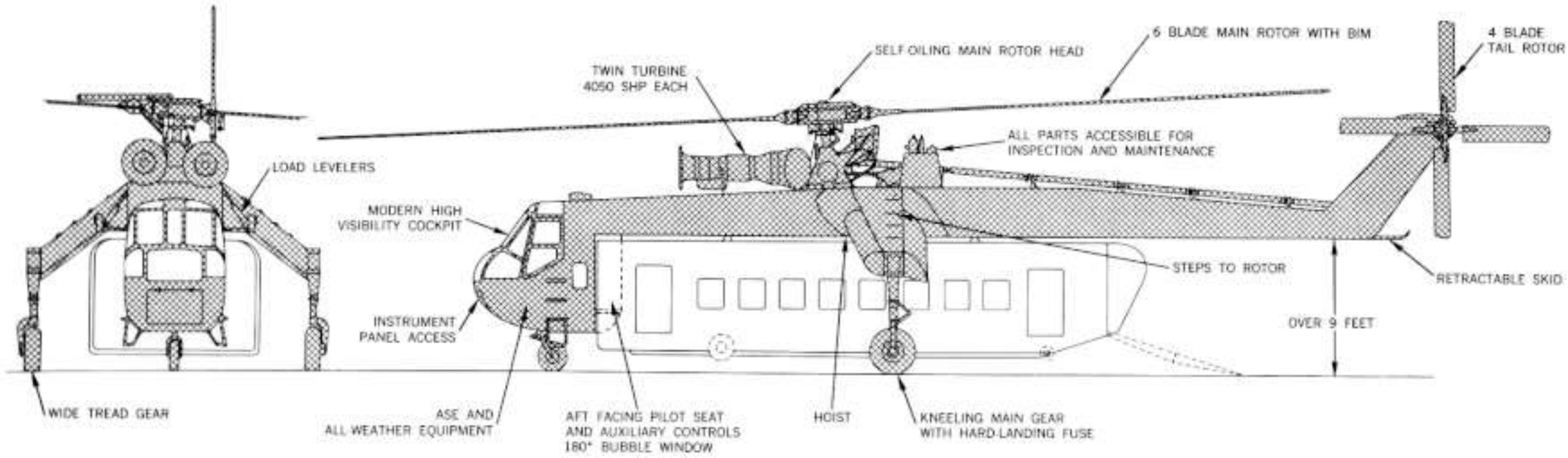
Equipment for All Weather Navigation

The Sikorsky Automatic Stabilization Equipment relieves the pilot of the heavy flight loads transmitted through the controls and provides attitude accuracy when picking up or unloading cargo.

A Doppler navigation system is added as an option for instrument flight and all weather operation. In use, the system displays the aircraft position in space at all times. The ground position location with the aircraft heading, drift angle, altitude, ground speed and terrain obstructions are clearly indicated.

The Doppler is the basis for the automatic flight control system (AFCS). In use, the system can literally fly the aircraft on a predetermined course, from point to point, at a given altitude and come to a hover at the destination, all automatically and accurately.





FEATURES OF THE PRODUCTION S-64

ALL WEATHER NAVIGATION AND TERRAIN AVOIDANCE

In order to satisfy operational requirements from prepared and unprepared sites without reliance on long range radio aids, an Integrated Doppler Navigation System is proposed. The system obtains ground speed information by the use of microwave FMCW doppler radar techniques and is similar to the system already developed for the HSS-2.

The AN/APN-118 Aircraft Navigation Set that is in development by Sperry Gyroscope for the U. S. Army will satisfy the operational requirements of the missions described in this proposal. This selection will reduce engineering costs to the U. S. Army because most of the development work has been accomplished.

System Features

The outstanding features of this system are:

A. Lightweight, FMCW Doppler radar which measures aircraft velocities through zero.

B. Accurate computation of absolute altitude.

C. Heading and vertical accuracies obtained with unfloated gyros.

D. System ready for use within 150 seconds under normal temperature environments. Self-testing is built in.

E. A plotting board display uses standard Army universal transverse mercator maps and aeronautical charts. (Heading and position are constantly displayed.)

F. A Fire Control System accepts Doppler drift angle, ground speed, and ground track.

G. RIDG Platform System provides attitude and azimuth reference for the helicopter Automatic Flight Control System (AFCS).

Terrain Avoidance System

A terrain avoidance system is available for "tree top level" operation under all weather conditions. Flying at "tree top level" makes the helicopter less vulnerable to all types of detection. The probability of visual detection is decreased by being able to fly during poor weather conditions.

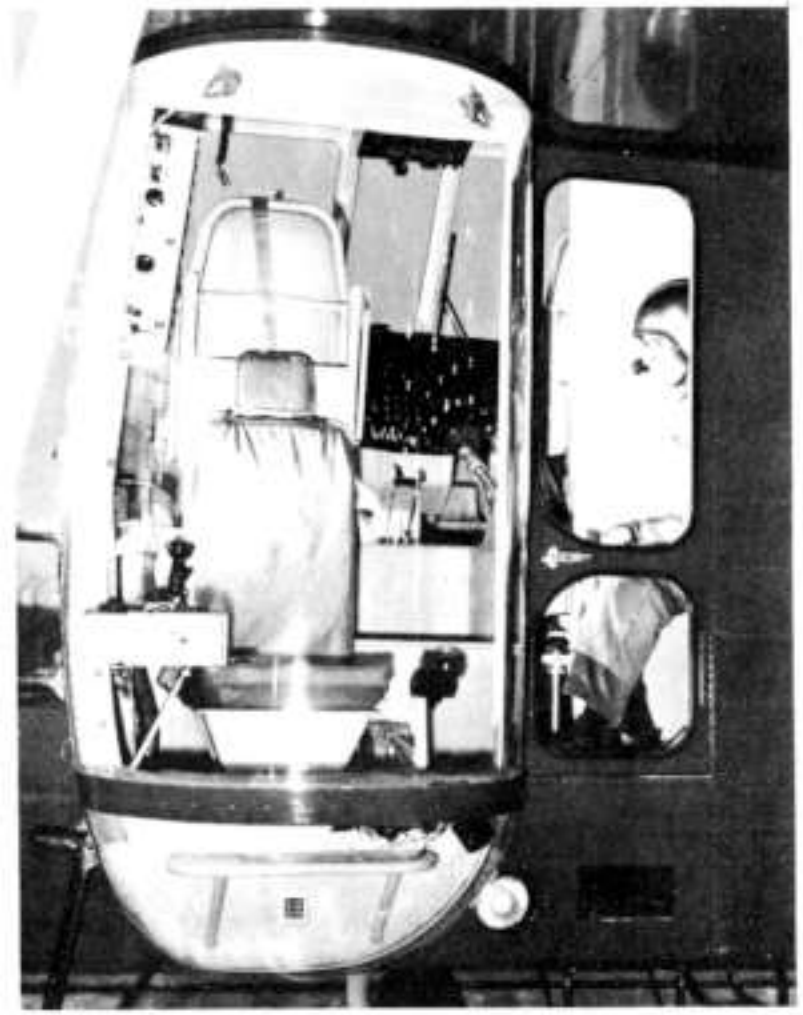
Terminal Guidance System

A terminal area navigation system, such as the Remote Area Instrument Landing System which was developed by the Army and tested in an H-34 at Fort Huachuca in 1961, provides the positive control required where terminal approach and landing conditions require accurate operations under all weather conditions.

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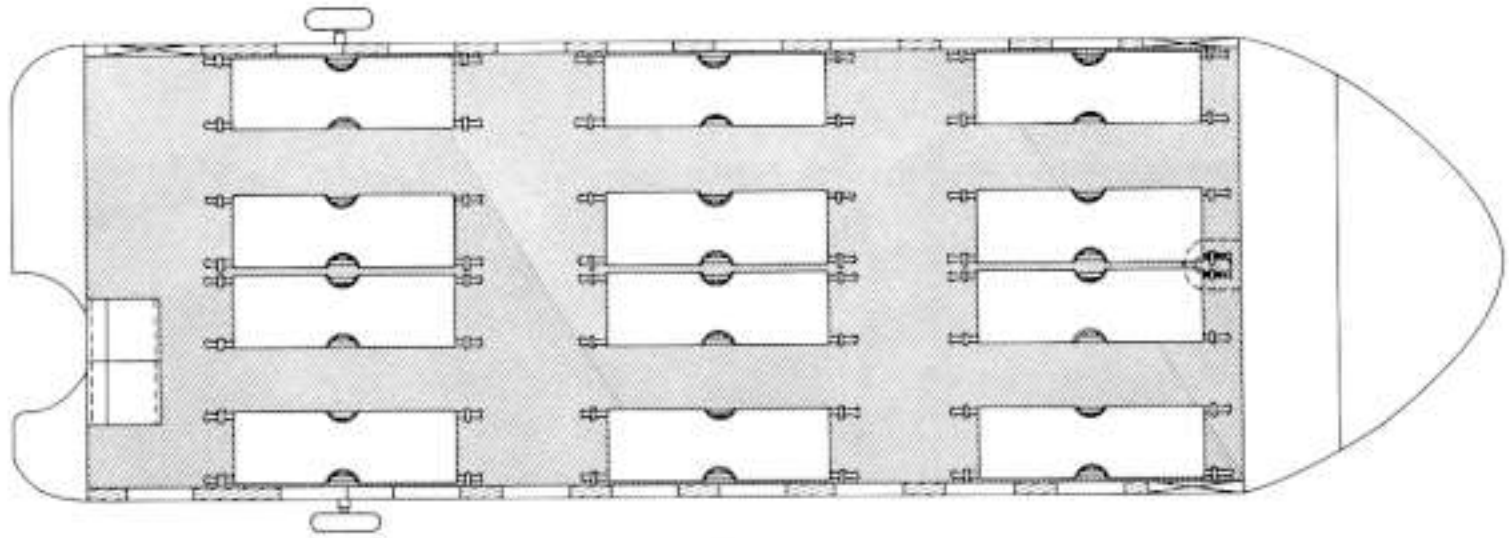
Wide Visibility



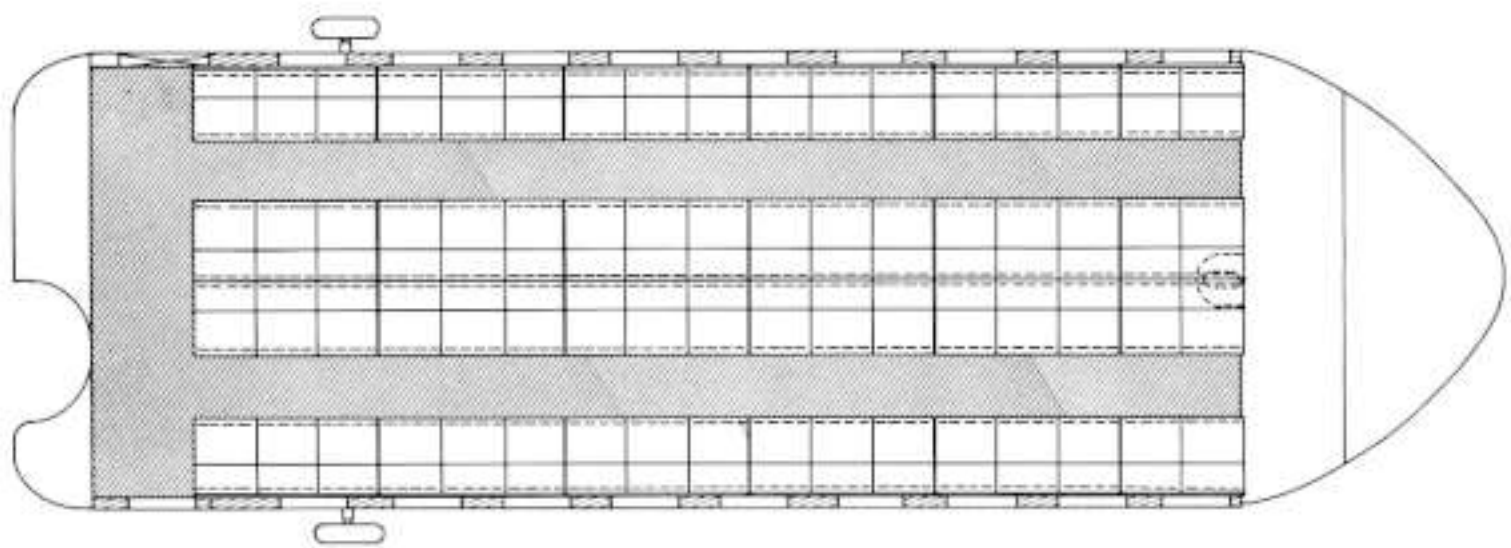
Aft-facing Seat

COCKPIT

TROOP SEAT & LITTER ARRANGEMENT

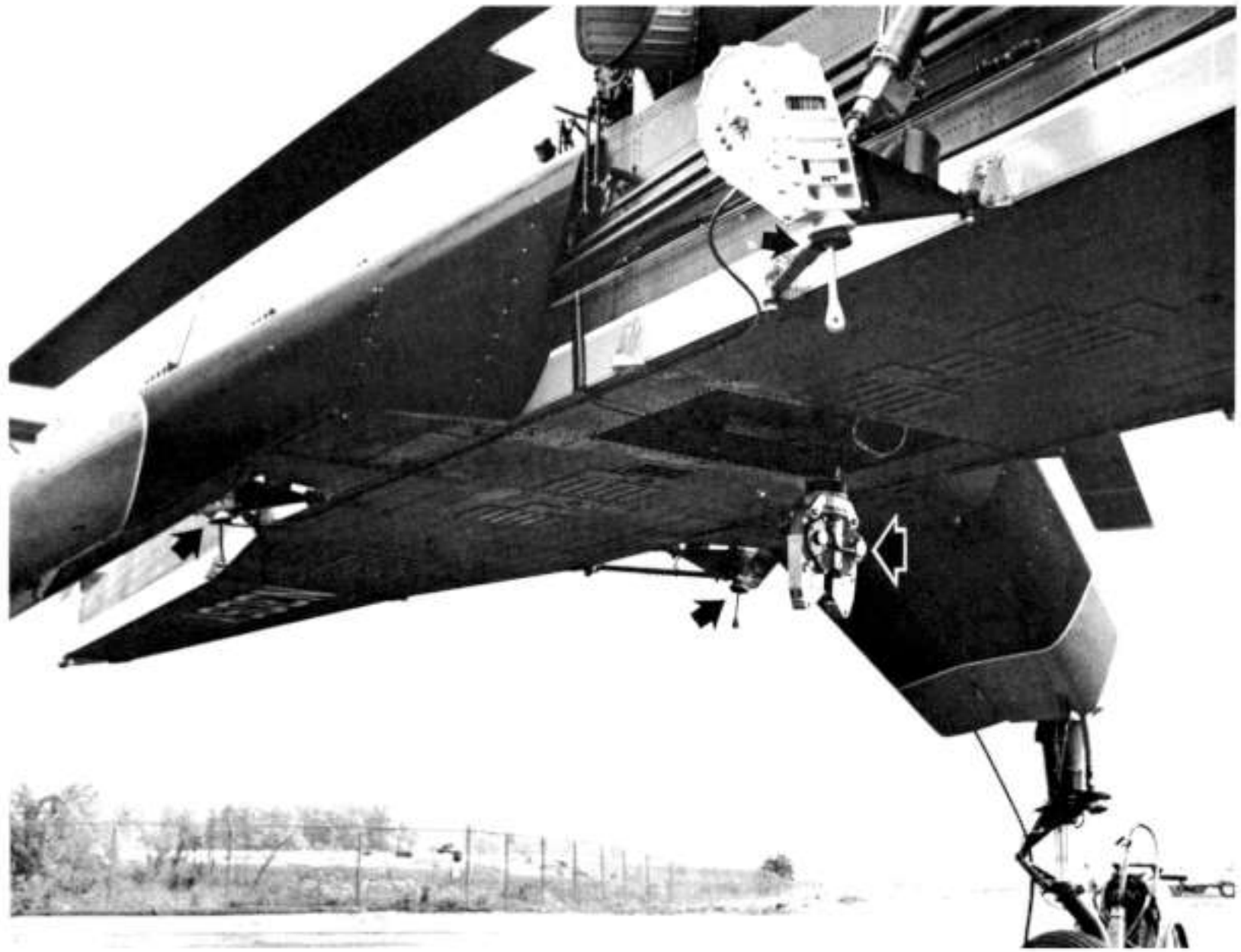


48 LITTERS PLUS 2 TROOP SEATS



68 TROOP SEATS

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Four Load Levelers (three shown)

Winch and Cargo Hook

CARGO HANDLING

PERFORMANCE OF THE CURRENT S-64 HELICOPTER

Gross Weight	38,000 lbs
Useful Load	20,760 lbs
Cruise Speed, at sea level with external load drag of 12 square meters	95 kts
Max. Speed, at sea level with external load drag of 12 square meters	106 kts
Max. Speed, at sea level with faired pod	145 kts
Vertical Rate of Climb, at sea level	800 ft per min
Hover Ceiling, out of ground effect	6,000 ft

Max. Range — 600 nautical miles 2 engines

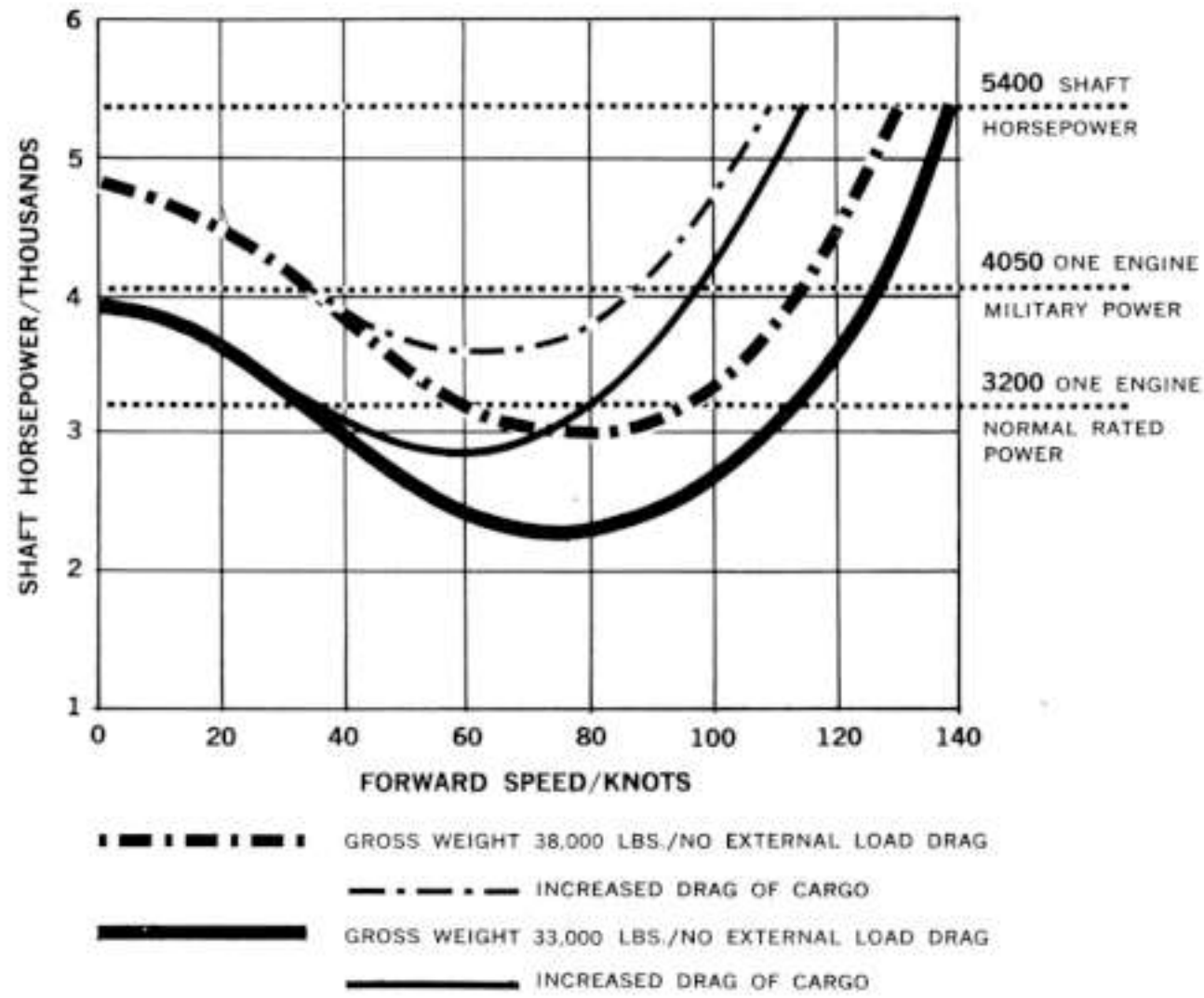
800 nautical miles with single engine cruise

CONDITIONS

Sea Level — Std. Day + 10% reserve fuel

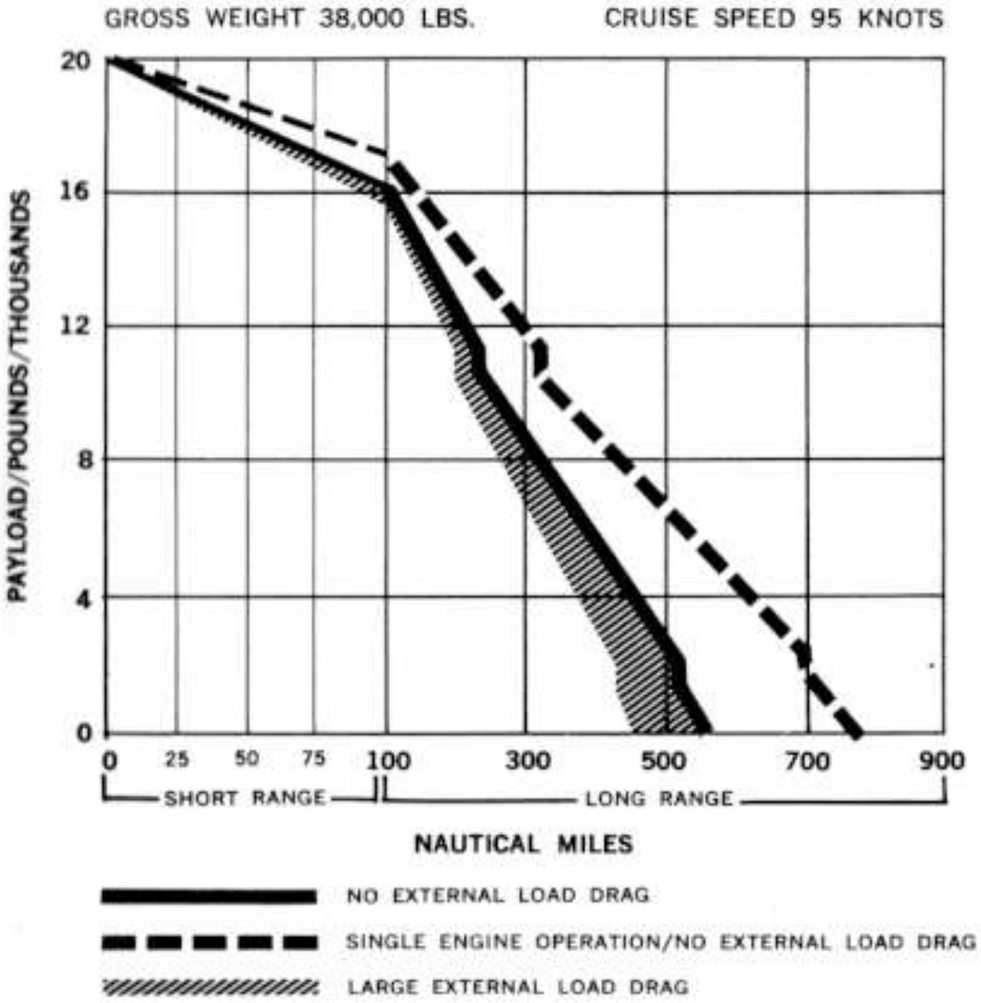
Accommodations — Crew of 3 + 2 passengers

SPEED

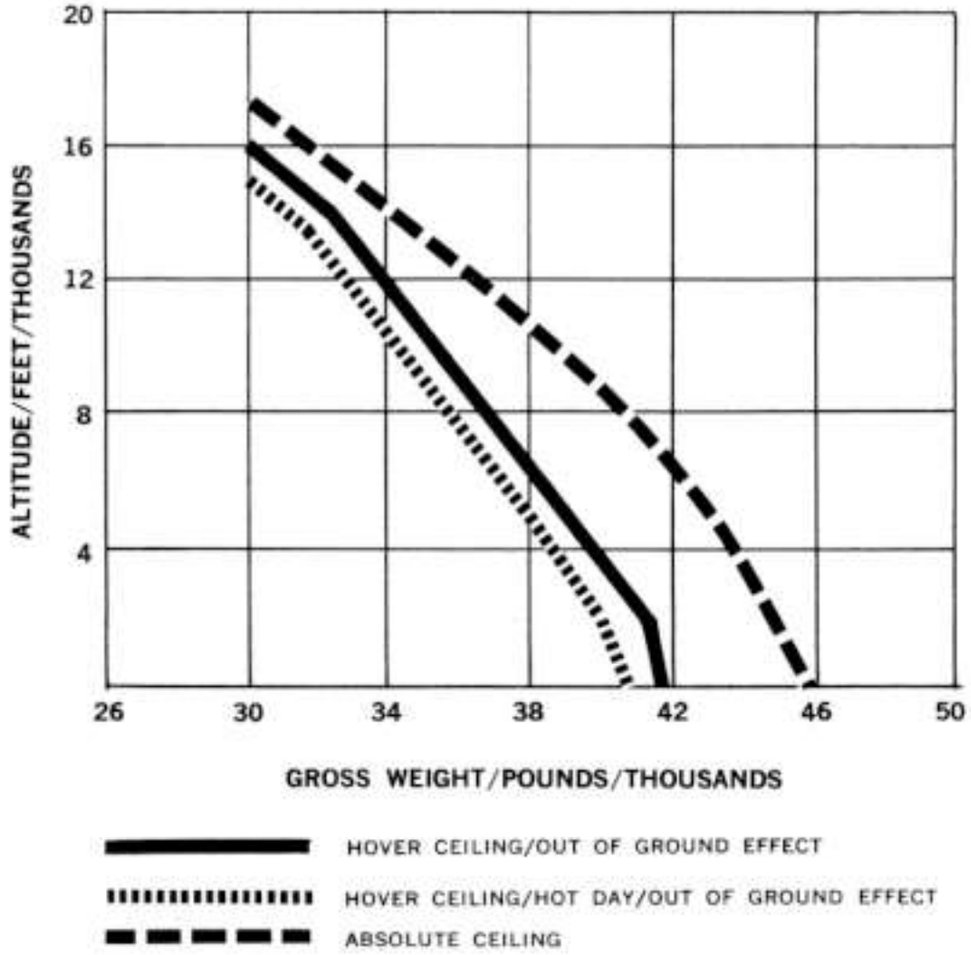


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RANGE



CEILING



INTERCONTINENTAL MOVEMENT OF THE S-64

Movement of the S-64 to overseas locations can be accomplished by either ship, fixed wing aircraft, or by flying the helicopter between land masses or ships positioned at specific intervals.

Overseas movement through the use of ships offers two possible means of transporting the S-64. In the first situation, a number of S-64's can be disassembled and stored on one ship. When disassembled, the compact sections of the aircraft occupy a relatively small area of the ship, in comparison to the space required in the assembled stage. Its fuselage shape and design allow easy breakdown, rapid reassembly and expedient deck handling.

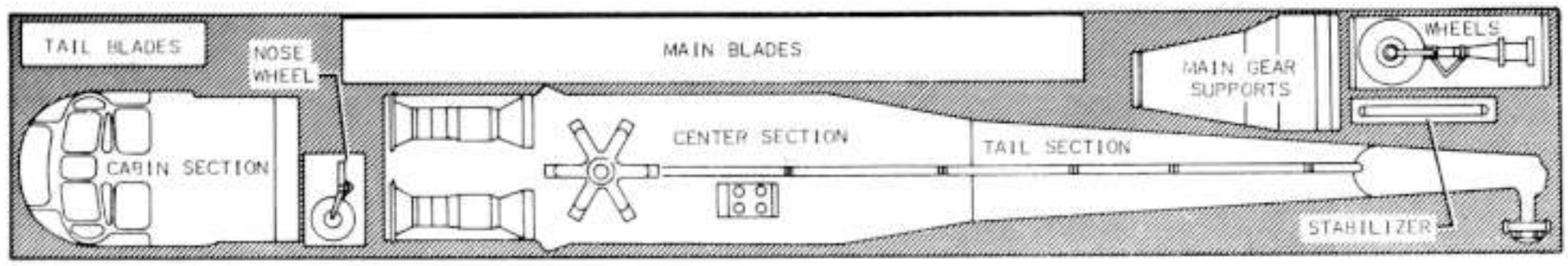
As an alternate method, the helicopters would utilize a number of ships, located at specific intervals, which would be equipped with landing platforms to permit the S-64 to fly from ship to ship. A practical interval between ships would be approximately 700 miles.

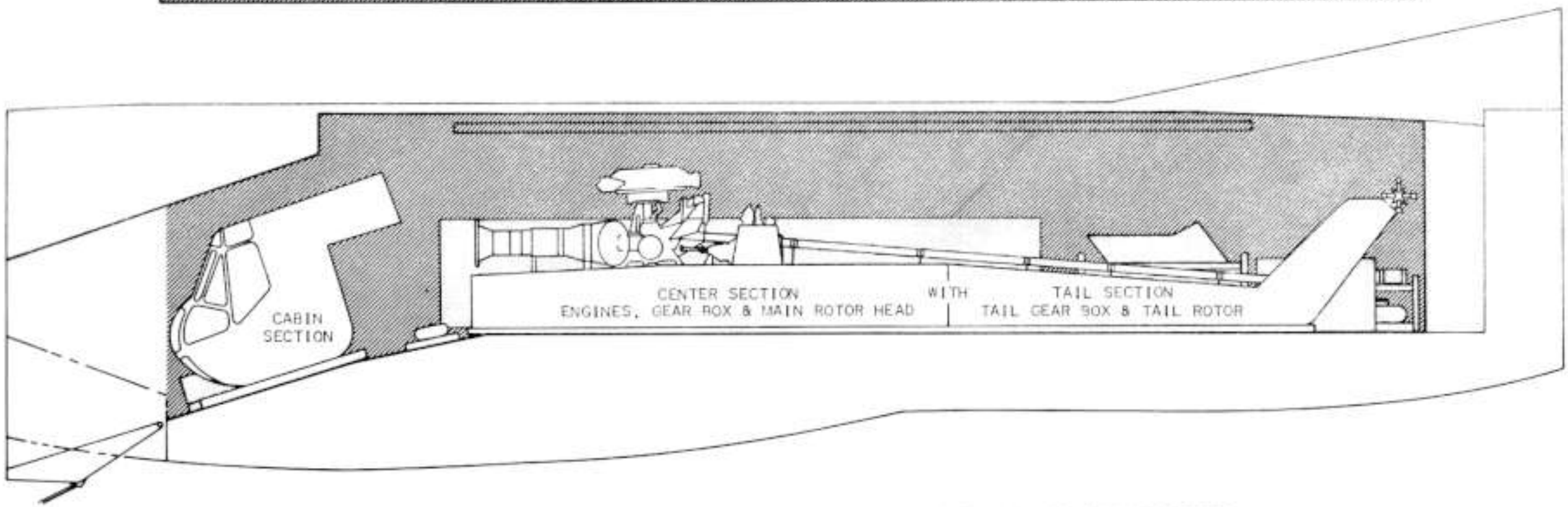
When transporting the S-64 through the use of fixed wing aircraft, the helicopter can be either stored or, with additional development, may be towed. Again, the S-64's configuration is easily stored because of its fuselage shape and design which allow for easy breakdown and compact storage. The accompanying sketch shows a typical breakdown of the S-64 for storage in a C-124 airplane.

Towing the S-64 by fixed wing aircraft is another method which may be used for overseas movement. This method eliminates the disassembly and reassembly steps. Flight tests have been made to prove the feasibility of towing by fixed wing aircraft, but further development must be accomplished to exploit this concept.

Sikorsky Aircraft will be pleased to conduct an investigation of the application of these various methods to different situations of warfare, if desired.

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AIR SHIPMENT OF ONE S-64 HELICOPTER IN A C-124 GLOBEMASTER

TRANSPORTABILITY

DEVELOPMENT STATUS

The S-64 Skycrane was developed from studies and investigations made by Sikorsky Aircraft over a period of ten years. The S-64 is the second aircraft of its type. In order to test and evaluate this concept, Sikorsky Aircraft designed and first operated a predecessor, the S-60, in 1959. The S-60 was extensively demonstrated at most of the military installations on the Eastern Seaboard, transporting various type of cargo from missiles to bridge sections and personnel.

The demonstrations with the S-60 aircraft proved conclusively the ability to land with a cargo, release it, move over to a second load, hookup to the load, and take-off within one minute.

Design of the S-64 was begun in 1959. Two aircraft have been constructed and have reached flight status. A third aircraft will be completed in September of 1962.

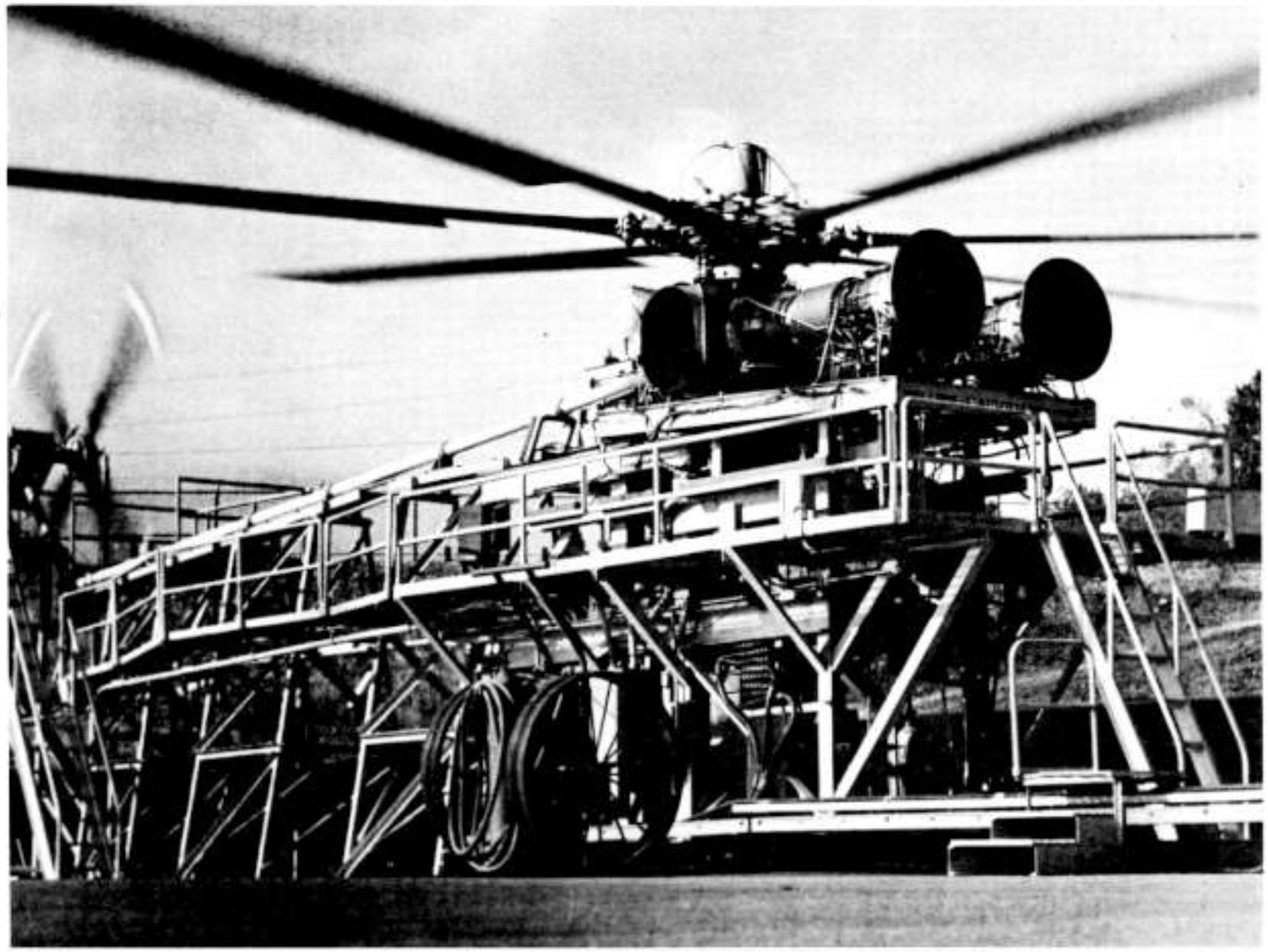
Extensive static tests and laboratory tests have been completed. Back-to-back regenerative transmission test, lubrication tests, fuel system functional tests, ground vibration surveys, and endurance running of the dynamic components on an engine rotor test stand, shown in the accompanying photograph, have also been completed. The dynamic components of the aircraft, consisting of power plants, transmissions plus shafting, and rotors, have successfully completed 250 hours of endurance testing on the engine rotor stand. Maximum power input during the endurance running has been 5600 horsepower. At this power, measurements have indicated that the S-64 will have a rotor thrust capability of approximately 60,000 pounds.

During rotor stand testing, single engine operations were simulated by the transmission system absorbing the maximum power output of a single engine of 4,050 horsepower.

During its first ten flight hours, the S-64 has been operated with ease at a forward flight speed of 120 knots. The excellent handling characteristics and the very low vibrational level at these speeds indicate that this machine can be flown at much higher speeds and requires low maintenance, and has excellent durability and dependability.

The concept embodied in the proposed S-64 has been thoroughly studied and evaluated and represents a United Aircraft corporate expenditure for national strength of $10,000,000. The S-64 aircraft, during its design and development phase from 1959 through 1962, represents an expenditure of $8,000,000 funded entirely by United Aircraft Corporation.

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TEST OF S-64 COMPONENTS

Sikorsky Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION • STRATFORD · CONNECTICUT

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