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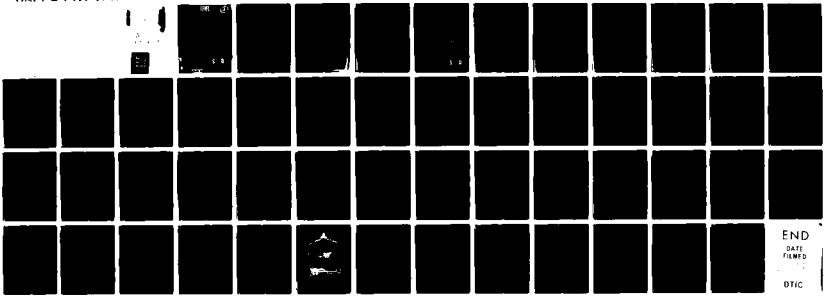

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THE M198 HOWITZER AS A DIRECT SUPPORT WEAPON DURING AMPHIBIOUS OPERATIONS

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A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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B.S., University of Oregon, 1966

Fort Leavenworth, Kansas
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A093 985	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The M198 Howitzer as a Direct Support Weapon During Amphibious Operations		5. TYPE OF REPORT & PERIOD COVERED 6 June 80
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Palm, Leslie N., Major, USMC		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Student at the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Command and General Staff College ATTN: ATZLSW-DC-MS		12. REPORT DATE 6 June 80
		13. NUMBER OF PAGES 44
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Approved for public release; distribution unlimited.

18. SUPPLEMENTARY NOTES

Master of Military Art and Science (MMAS) thesis prepared at CGSC in partial fulfillment of the Masters Program requirements, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Howitzer, M198
Amphibious operations

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

See reverse.

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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The study indicates that the M198 suffers a relative loss of mobility in two critical areas. It requires a greater effort to be transported in the landing craft currently available and it requires an auxiliary mover for positioning in the absence of its prime mover.

The most significant of these deficiencies is the degraded ground mobility. The development of an auxiliary propulsion unit which is an integral part of the howitzer will tremendously improve its maneuverability.

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THE M198 HOWITZER AS A DIRECT SUPPORT WEAPON DURING AMPHIBIOUS OPERATIONS.

(10)

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6 June 1980

Approved for public release; distribution unlimited.

A Master of Military Art and Science thesis presented to the faculty of the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

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Accepted this 11th day of June 1980 by Philip J. Brookes, Director, Graduate Degree Programs.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other government agency. (References to this study should include the foregoing statement.)

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ABSTRACT

THE M198 HOWITZER AS A DIRECT SUPPORT WEAPON DURING AMPHIBIOUS OPERATIONS, by Major Leslie M. Palm, USMC, 42 pages

This study attempts to determine the impact of the M198 howitzer's mobility on its ability to perform as a direct support weapon during amphibious operations. The focus of this analysis is on the weapon's amphibious adaptability, ground mobility and helicopter transportability as compared to the howitzer it is replacing.

The study indicates that the M198 suffers a relative loss of mobility in two critical areas. It requires a greater effort to be transported in the landing craft currently available and it requires an auxiliary mover for positioning in the absence of its prime mover.

The most significant of these deficiencies is the degraded ground mobility. The development of an auxiliary propulsion unit which is an integral part of the howitzer will tremendously improve its maneuverability.

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CHAPTER I

INTRODUCTION

Background

The emergence of the Soviet Union as a world military power after World War II created the potential for military conflict between itself or its satellite countries and the United States and its allies. This possible confrontation caused the United States military forces to assess their weapon systems against those used by the Soviet Union and the communist bloc countries. It was apparent that the direct support artillery weapons used by the U.S. Marine Corps as well as the U.S. Army were significantly outranged by those of their potential adversaries. The need to modernize their artillery weapons was apparent.

Marine Corps leadership desired to retain a relatively lightweight 105mm howitzer system for direct support and participated with the Army in testing various prototypes to replace the M101A1. An Army artillery effectiveness study, "Legal Mix V," conducted in 1977 indicated that for the Army's purposes a 155mm howitzer was more effective than a 105mm howitzer as a direct support weapon.[1] In order to concentrate on 155mm howitzer development, the Army discontinued all 105mm howitzer development programs.[2]

The Army's decision had a significant impact on

the Marine Corps and left it with two alternatives. Either keep the M101A1 as its direct support weapon or adopt a 155mm howitzer to fill this role. Keeping the M101A1 was rejected because of its insufficient range capability and inadequate ammunition inventory. The Marine Corps conducted a comparative study of the towed M114A2, the self-propelled M109A1 and the towed M198 to determine which 155mm howitzer to adopt. The M109A1 was rejected because its size prohibits it from being transported by helicopter. The M114 series howitzer is no longer being produced and is not compatable with the new extended range family of propellants so it was also rejected.[3]

Need for the Study

Although the Marine Corps' comparative analysis determined that the M198 was the best alternative to the M101A1, one question remains yet unanswered. How well will this weapon be able to fulfill the direct support role during amphibious operations? With its larger caliber and increased range, the M198 has potential mobility problems because of its greater size and weight than the weapon it is replacing. The true measure of the effectiveness of a direct support artillery weapon is its ability to provide the required fire support where and when it is needed by maneuver units. These criteria are directly related to a weapon's mobility and take on added significance during amphibious operations.

The maneuverability of a howitzer affects its

ability to be transported ashore and its ability to be prepared to fire from its initial position. The importance of being able to land artillery early in an amphibious assault can be better understood through a brief examination of one of the amphibious operation's fire support doctrinal concepts. Supporting arms planning for an amphibious assault indicates:

> Until field artillery is landed and is ready to fulfill requests for fire support, support normally rendered by artillery must be fulfilled by aircraft and naval gunfire insofar as possible.[4]

The last phrase of this doctrinal concept prompts an examination of the ability of aircraft and naval gunfire to fulfill these requests.

Today improved weapon lethality coupled with precise delivery systems make attack aircraft a formidable means of fire support. The effectiveness of air support depends upon the attainment of local air superiority within the amphibious objective area. A basic precept of amphibious operations states:

> Achievement of local air superiority in the area of operations is a prerequisite for the success of an amphibious operation.[5]

Once air superiority is established, effective offensive air support can be provided to maneuver units to the degree that assets, weather and visibility permit.

Fire support provided by naval gunfire support ships deserves closer scrutiny. During World War II, naval gunfire was a dominant factor in the success of amphibious operations. Following World War II, however, the U.S. Navy's

gunfire capability began to erode. Improved enemy offensive air capability along with sophisticated missiles (both surface and subsurface) posed an increasing threat to the survival of the Navy's fleet ships. On surface warships, guns began being replaced by missiles and sophisticated radars and directors to counter this threat.[6] The effect of this conversion has been that surface warships have changed from offensive to primarily defensive weapons.[7] Table 1 depicts the degree to which naval gunfire capacility has declined from the end of World War II to the present day.

TABLE 1

DECLINE OF NAVAL GUNFIRE

Gun Size	1945[8]	1964*[9]	1979*[10]
16"	116	0	0
14"	162	0	0
12"	30	0	0
8"	227	30	0
6"	444	24	0
5"	3310	1096	328

* Figures are for the active fleet.

All of the tubes listed in Table 1 would not be available for fire support to maneuver units during an amphibious operation. Some of the ships bearing guns would be providing screening or other fleet protection missions and therefore be unable to provide supporting fires during the amphibious assault.

With air support effective but largely dependent on the weather and naval gunfire existent but insufficient, the need to get field artillery ashore as early as possible is readily seen. The ability to bring the M198 ashore quickly to fulfill the direct support role will be critical to the success of future amphibious operations.

Purpose of the Study

The purpose of this study is to determine the impact of the M198's mobility on its effectiveness as a direct support weapon during amphibious operations. To be able to properly analyze this problem, one basic question will be addressed. How difficult will it be to get the M198 to the beach and into its initial firing position? Only by thoroughly examining all facets of this question including amphibious adaptability, ground mobility and helicopter transportability will it be possible to evaluate the new weapon's ability to perform in the direct support role.

Method of Study

A complete analysis of hypothetical and empirical data relative to the weapon system's mobility was made. Amphibious adaptability studies conducted by the Marine Corps were used to analyze the problems encountered in transporting the howitzer from ship to shore. Various Army as well as Marine Corps studies were used to evaluate the ground mobility of the M198 once it is brought ashore. Wherever possible, a comparison of corresponding statistics

for the M101A1 is made to be able to quantify any change in responsiveness of direct support artillery in an amphibious operation.

By comparing the howitzer's physical characteristics with the lift capabilities of naval amphibious ships/craft and Marine Corps' helicopters, an evaluation can be made as to the effort required to get the weapon system ashore. Ground mobility is addressed by analyzing the problems involved with moving the surface landed M198 from the beach to its initial firing position utilizing the prime movers and auxiliary movers presently available to the Marine Corps.

Explanation of Terms

Amphibious Assault Ship (LHA). The LHA is an amphibious ship equipped with a full length helicopter flight deck, a landing craft docking well, and a large storage area for trucks, armored vehicles and other large equipment.

Amphibious Assault Ship (LPH). The LPH is designed primarily to exploit the use of helicopters during amphibious operations.

Amphibious Cargo Ship (LKA). The LKA is primarily used for transporting bulk cargo which is stored in holds. It does not have a landing craft docking well.

Amphibious Transport Dock (LPD). The LPD has a flight deck and a landing craft docking well which gives it the capability to debark vehicles, equipment and personnel by landing craft, amphibious vehicle or helicopter.

Landing Ship Dock (LSD). The LSD is designed to carry loaded landing craft to the objective area. Landing craft are discharged by lowering the stern gate and flooding the well deck until they can move out under their own power.

Landing Ship Tank (LST). The LST is designed to transport and land amphibious vehicles, tanks, combat vehicles and other equipment. Unloading can be accomplished at the bow ramp or stern gate onto landing craft, causeways or piers.

Marine Amphibious Unit (MAU). A MAU is the smallest of the three types of Marine Air-Ground Task Forces. It is composed of a command element, a ground combat element (normally a battalion landing team), a composite aircraft squadron, and a comtat service support element.

Assumptions

The following assumptions have been made for the purpose of this study.

Once the M198 is established in its initial firing position, it is a satisfactory direct support weapon.[11]

Once established ashore the weapon can be sufficiently resupplied with ammunition to be able to provide continuous direct support.

The battery's orgarizational structure and personnel strength will allow maximum effectiveness to be achieved from the weapon system.

The table of equipment for an M198 battery will

be the same as that of an M101A1 direct support battery except for the type of weapon, type and number of trucks and the addition of two rough terrain forklifts.

The Marine Corps will continue efforts to procure the M813, 5 ton truck as the prime mover for the M198 howitzer.

Constraints

This study will focus on a battery in support of a battalion landing team. The problems associated with larger size artillery units will be proportionate to those of a single battery.

Subsequent Chapters

Chapter II presents data concerning the mobility of the howitzer and associated systems as it pertains to an amphibious environment.

Chapter III is a collation and analysis of the data presented in Chapter II. A comparison of the M101A1 weapon system's mobility is made wherever possible.

Chapter IV presents the conclusions concerning the mobility of the M198 in an amphibious environment based on the analysis of pertinent facts as presented in this paper. The recommendations offered are directed towards optimizing the effectiveness of the weapon system's mobility and do not take into consideration budgetary constraints which might inhibit their implementation.

END NOTES

[1]Lieutenant Colonel Richard H. Moore, Major Larry L. Weeks and Captain Dennis A. Morga, "Why The Marine Corps Is Adopting A New Howitzer," Marine Corps Gazette, April, 1979, p. 55.

[2]Ibid.

[3]Ibid., pp. 58-59.

[4]Doctrine for Amphibious Operations, (LFM01), Washington, D. C.: Departments of the Army, the Navy and the Air Force, August, 1967, p. 7-3.

[5]Ibid., p. 7-6.

[6]Rear Admiral Wayne R. Meyers, USN, "The Combat Systems of Surface Warships," U.S. Naval Institute Proceedings, May, 1977, pp. 114-116.

[7]Ibid., p. 122.

[8]Paul Van Leunen, Jr., "Naval Weapons Today," Naval Review, 1965, p. 55.

[9]Ibid.

[10]Jane's Fighting Ships, 1978-79, ed. Captain John E. Moore, RN, FRGS, New York: Franklin Watts INC. 1978.

[11]Major Jackie D. Sims and Captain Donald L. Peek, Force Development Testing and Experimentation Test of the M198 Howitzer System in Direct Support of Light Infantry Operations, Fort Sill, Oklahoma: U.S. Army Field Artillery Board, January, 1979, p. 2-25.

CHAPTER II

WEAPON MOBILITY

An examination of those factors which may influence the ability of an M198 battery to get from an amphibious ship to a firing position ashore is required to be able to determine its potential mobility. The effect of weapon size as it relates to amphibious shipping stowage space and debarkation capabilities is important in analyzing its amphibious adaptability. The effort required to get a battery ashore in landing craft is even more significant. Next, an evaluation of the weapon system's ground mobility will be made to identify potential problems involved in getting it from the beach or landing zone to the initial position. Finally, the study of mobility during amphibious operations will address helicopter transportability of the M198.

Physical Characteristics

The M198's physical characteristics provide an appreciation for the size of the howitzer and establish a frame of reference concerning mobility in an amphibious environment. The weapon's three operational configurations are shown in figure 1. Neither the firing nor the towed positions require further explanation because they are

the same for all other split-trail artillery pieces. The stowed position affords the howitzer a reduction in required storage space and greater potential maneuverability in confined areas.[1] It also allows the M198 to be loaded inside aircraft (C130 and larger). In this configuration; however, the howitzer can not be pulled by its prime mover. The muzzle brake at the end of the tube extends beyond the lunette preventing the weapon from being attached to the truck. With the muzzle brake removed, the howitzer can be towed by the prime mover; however, when replaced it must be inspected by an ordnance mechanic prior to firing. While this is not a lengthy procedure, it would still increase the time necessary to prepare the weapon for action.

The new weapon's dimensions become more meaningful when they are compared to those of the howitzer it is replacing. The data in Table 2 indicate the magnitude of the difference in size of the M198 and the M101A1. The dimensions of these two howitzers are graphically portrayed in Figure 2. Two of the M198's mobility characteristics are of particular significance. The only Marine helicopter which can lift the 15,600 pound howitzer is the CH53E which is scheduled to enter the Marine Corps' inventory in fiscal year 1981.[2] The second feature which has the potential to restrict the new weapon's mobility is the lunette weight of 3,500 pounds in the stowed position. This tremendous weight prohibits the howitzer from being

lifted or positioned by section personnel and therefore requires it to be moved by some other source.

TABLE 2

WEAPON MOBILITY CHARACTERISTICS

	M198	M101A1
Height:	9.5'	5.1'
Length:		
Stowed Position	24.4'	N/A
Towed Position	40.5'	19.8'
Width:	9.1'	7.0'
Lunette Load		
Stowed Position	3500#	N/A
Towed Position	500#	170#
Prime Mover:	M813, 5 ton truck	M35A2C, 2½ ton truck
Weight:	15,600#	4,980#
Crew Size:	11	7

Amphibious Adaptability

The ability of amphibious shipping to offload an M198 battery and the ability of landing craft or helicopters to transport the howitzers from ship to shore dictate how soon the artillery will be able to provide fire support to maneuver units. A battery should be embarked on shipping which has the potential to offload it the fastest once called ashore. Table 3 lists those characteristics which affect a ship's efficiency in carrying and discharging cargo.

TABLE 3

AMPHIBIOUS SHIP LIFT CAPABILITIES

Type Ship	Combat Loading (sq ft)[a]	Landing Craft[b]	Flight Deck Spots
LHA	27,000	4 LCU/7 LCM8	9
LKA	36,500	4 LCM8	1
LPH	3,000	-	7
LPD	13,000	1 LCU/4 LCM8	2
LSD	3,045[c]	3 LCU/9 LCM8	1
LST	16,000	-	1

[a]The figures listed are only representative and may vary for each individual ship.

[b]Only those landing craft capable of transporting an M198 are listed.

[c]With a mezzanine deck installed, the combat loading space is 10,500 but the ship can only transport 1 LCU.[3]

While the ability of ships to transport and debark cargo is important, the availability and capabilities of suitable landing craft are critical factors in rapidly transporting a battery ashore by surface means. The landing craft, utility (LCU) and landing craft mechanized (LCM8) are presently the only small boats capable of carrying an M198 and its prime mover. The LCU, being much larger, has the greater carrying capacity.[4]

The number of landing craft assigned to an amphibicus task force is as important as their cargo carrying capacity when addressing the time required to rapidly land

a battery ashore. The current allocation of small boats to support a MAU is 3 LCU's and 2 LCM8's.[5] The number of landing craft assigned to an amphibious task force may vary depending upon its mission; however, their availability for deployment and the assigned ships' ability to transport small boats are limiting factors. Based on the lift potential of each craft, Table 4 indicates the number required to transport the two artillery batteries ashore.

TABLE 4

LANDING CRAFT REQUIRED TO LIFT
M198 AND M101A1 BATTERIES

	LCU	LCM8
	Entire Battery	
M198	4+	15(stowed only)
M101A1	2+	10
	Howitzers/Prime Movers only	
M198	3	6(stowed only)
M101A1	2	6

Source: Oral Report, Phase I, Marine Corps Artillery Force Structure Analysis, Quantico, Virginia: Potomac General Research Group, November, 1979.

Ground Mobility

The battery must be moved inland to its initial firing position in order to begin providing fire support to the maneuver units once the ship to shore movement has been completed. How quickly this displacement can be accomplished depends upon the ability of the prime mover to tow the howitzer across the beach and over other types

of terrain during all weather conditions.

The M813, 5 ton truck, used by the Army as the prime mover for the M198, has not yet been tested in littoral, or beach and surf, environment. However, Marine artillery units undergoing familiarization training at Fort Bragg, North Carolina with the M813/M198 have commented on the comparative ease with which the truck pulled the weapon through loose sand.[6]

Maneuver capability of this vehicle was determined by an Army performance analysis using a statistical mobility model for European and Mid-East environments.[7] Although this evaluation does provide relative mobility statistics for the M813/M198 combination, actual driving was not done to derive the data.

During "Follow-On Evaluations" of the weapon system, the M813 was used as the prime mover. Test results indicate "The vehicle performed well on dry terrain, wet terrain/muddy roads, slopes, and frozen ground/freeze-thaw conditions."[8]

As a result of testing conducted by the Australian Army in 1977, the M813 was determined to be unsuitable for towing the howitzer in a tropical environment, especially during the wet season.[9]

Another aspect of ground mobility involves situations where the M813, regardless of its suitability, would be either unavailable or incompatible. Unlike the M101A1, the new howitzer can not be manhandled for even the shortest of

distances by its gun crew due to its greater weight. During helicopter displacements this maneuverability is essential for moving the weapon from where the aircraft puts it down to the battery emplacement. This means an auxiliary means of transportation is required. An auxiliary transportation source would also be required aboard ship if the weapons are to be embarked in the stowed position. The Marine Corps recognized this need for an auxiliary mover and tested the DC4000, rough terrain forklift to determine its suitability for filling this role. The results of this evaluation concluded that the forklift could perform adequately as an auxiliary mover under the test conditions.[10] The terrain over which the forklift can maneuver the howitzer is considered to be compatible with that which would be suitable for a helicopter landing zone.

Helicopter Transportability

At this time it is planned initially to assign one squadron, of 15 CH53E's each, to aviation units on both coasts of the United States. These units will be capable of deploying two detachments of six helicopters simultaneously.[11]

This aircraft has successfully lifted the howitzer and 7,500 pounds of simulated ammunition externally while carrying a howitzer section of ten men inside.[12] It has also lifted the M198 externally with a rough terrain forklift and two cannoneers in the cargo compartment.[13] The helicopter achieved an air speed of 110 knots with both

load configurations and experienced no unstable conditions.[14] Figure 4 depicts the lift capabilities of this aircraft, as well as the currently employed CH53D, compared to the weapons and vehicles being discussed in this study.

Summary

The increased size and weight of the M198 over the weapon it is replacing create significant mobility problems which will have to be overcome before it will be able to fulfill the direct support role. Starting with the movement to the objective area, the amphibious shipping requirements for the 155mm battery may affect the space available for the other equipment to be embarked to support the MAU and it may also influence the type of ships needed to support the task force. Additionally, the effort required to take the M198 from ship to shore may impact on how early it can influence the battle. A new dimension in ground mobility also accompanies the new weapon. Its tremendous weight requires an auxiliary mover to move the howitzer in the absence of its prime mover or when it is in the stowed position. Consistent with the increased effort to move the M198 at sea and on land, only the yet-to-be introduced CH53E helicopter can transport the howitzer ashore by air.

.N. NOTES

[1]The process of changing the howitzer from the towed to the stowed configuration (and vice versa) takes the men in its section from two to three minutes to accomplish.

[2]Statement of Major James OBrien, CH53E project officer, in a telephone interview, 7 February, 1980.

[3]Lieutenant T. C. Butler, Ship's Loading and Characteristics Pamphlet, USS Pensacola (LSD-38), Norfolk, Virginia: July, 1979, encl. (3), p. 4.

[4]Navy and Marine Corps Reference Book, (RB110-2), Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, July, 1978, pp. 5-.0 - 5-11.

[5]Statement of Major William Anderson, Amphibious Group Two Embarkation Officer, in a telephone interview, 15 January, 1980.

[6]Based on personal correspondence from First Lieutenant Peter J. Karonis, Commanding Officer, Battery I, 1st Battalion, 10th Marines, 16 November, 1979.

[7]Donald L. Randolph and James H. Robinson, Mobility Performance of Towed and Self-Propelled Artillery and Related Vehicles, Vicksburg, Mississippi: U.S. Army Engineer Waterways Experiment Station, January, 1977, p. 8

[8]Stephen A. French and Frank J. Klein, Independent Evaluation of the M198 155mm, Towed, Medium Howitzer, Falls Church, Virginia: Army Test and Evaluation Agency, April, 1979, p. 15.

[9]Ibid.

[10]Joseph Monolo, M198 Howitzer Auxiliary Mover Presentation, Dahlgren, Virginia: Weapons Systems Department, Naval Surface Weapons Center, September, 1979, p. 4.

[11]OBrien, loc, cit.

[12]Ibid.

[13]Ibid.

[14]Ibid.

CHAPTER III

MOBILITY ANALYSIS

Analysis of the howitzer's mobility data indicate the situations and conditions under which the M198's maneuverability will detract from getting it established ashore to support an amphibious assault. The mobility of the M101A1 weapon system under the same circumstances will be used, when feasible, as a point of reference in evaluating its replacement's relative maneuverability.

Amphibious Adaptability

The first area of examination is the increase in required stowage space resulting from the new howitzer's larger physical characteristics and caliber. This difference by itself does not affect mobility; however, it will affect the type of shipping and embarkation requirements for a Marine Amphibious Unit. An M198 battery requires 64% more stowage area in the stowed position (2304 sq ft) and 88% more (3180 sq ft) in the towed position than the 105mm howitzer battery. 155mm artillery ammunition occupies 57% more cubic feet of storage area than the same amount of 105mm artillery ammunition.

The effect of the difference in required shipping space for the two types of howitzer batteries and their

accompanying ammunition can not be realized simply by analyzing these statistics. The other weapons, equipment and ammunition to be embarked by the landing force also will have an impact on the number and type of ships required to be deployed in support of the task force. Since the kinds and quantities of equipment will vary depending on the task force's mission, it is sufficient to recognize the difference in stowage requirements for the two artillery weapon systems.

An analysis of the principle amphibious ships' lift capabilities and physical characteristics indicates their flexibility and speed, or lack thereof, in debarking large weapons and vehicles.

The break bulk configuration of the LHA requires equipment to be discharged by crane from the cargo holds to landing craft stationed along side the ship. Also, the one helicopter deck spot means a significant increase in loiter time for an aircraft picking up both an internal and an external load.

The lack of a landing craft docking well and a large crane prohibits the LPH from loading heavy equipment into landing craft. Although its flight deck can facilitate rapid debarkation by helicopter, it lacks the combat loading space to accomodate an entire battery.

The LSD's combat loading capacity is insufficient to stow either battery if the well deck is used to stow landing craft preloaded with weapons and equipment sched-

uled to land with the initial assault waves. If the artillery is preloaded in the landing craft for rapid surface delivery, it is difficult to debark the weapons by helicopter should a change in plans so dictate. By installing a deck, referred to as a mezzanine deck, over a portion of the normally open well deck, the ship's storage capacity is significantly increased but its ability to carry landing craft is reduced (see Table 3).

Without a landing craft docking well, the LST must rely on a relatively smooth sea state to safely debark vehicles and large weapons into small boats. Additionally, this ship usually carries the causeway sections used to support the task force's unloading operations. This prohibits helicopters from landing on the ship's flight deck.[1]

The physical characteristics of the LHA and the LPD do not detract from their capability to rapidly offload cargo. The combination of landing craft docking wells and flight decks with more than one landing spot make these two ships the best and most flexible for debarking an artillery battery.

Although the characteristics and capabilities of these amphibious ships do not offer a reduction in the M198's mobility to any greater degree than that experienced by the M101A1, its dimensions do cause a relative reduction in mobility when utilizing landing craft during the ship to shore movement. This is because it is not practical to use LCM8's for this task. The howitzer must be in the

stowed position to fit in this craft with its truck which means an auxiliary mover is needed to both load and unload the weapon. On a hostile shore, where rapid offloading is essential, it is not logical to plan on using such a lengthy debarkation process. Accordingly, the guns and prime movers of an M198 battery are dependent on LCU's for transportation to the beach. In contrast, an M101A1 battery can be surface landed utilizing either LCU's or LCM8's. The result is that during the ship to shore phase of an amphibious operation the new weapon system has a comparative loss of mobility because of the fewer number of small boats capable of taking it ashore and the greater number of loads which are necessary to do so. The resultant loss of mobility can be equated to an initial reduction in fire support capability. This is best understood by examining a simple scenario. All six howitzers of an M101A1 battery can be brought ashore in two LCU's. Only four M198's can be transported to the beach with the same number of landing craft. These four 155mm howitzers can provide just 66% of the fire power produced by the 105mm battery.[2]

Ground Mobility

The firing unit must still travel to its firing position to begin providing artillery support once the small boats have landed the howitzers. The focus of this critical task is the proficiency of the prime mover. The M813's performance in various environments and under different conditions is well enough documented and substantiated

to properly appraise its ability to tow the M198. The Army's overall evaluation of the truck as a prime mover is that it is adequate even though it has to operate at or near its capacity to accomplish the mission. Continually functioning at the limits of its potential; however, may result in a lack of durability over a period of time.[3]

The greatest contrast in ground mobility between the two howitzers does not involve their prime movers, rather it is the M198's need for an auxiliary mover. The testing done by the Marine Corps indicates the MC4000, rough terrain forklift, has some difficulty in turning the howitzer in tight circles.[4] This limitation casts some doubt on the MC4000's utility in positioning the weapon aboard a crowded ship. The test did conclude that the forklift is capable of providing the necessary howitzer mobility in and around a helicopter landing zone if the ground is relatively firm and flat.

While the MC4000 may have some utility as an auxiliary mover for the weapons of an M198 battery, its primary function of cargo handling would certainly add to the overall mobility of the unit. The forklift's ability to move palletized ammunition would prove invaluable in situations where the prime movers or ammunition trucks are not available.

Helicopter Transportability

It is essential for a weapon to have the flexibility of being able to be employed by helicopter in order to be

responsive as a direct support weapon. Comparison of both howitzers' ability to be transported by helicopter provides an indication as to the M198's relative mobility during these displacements. Only the effort necessary to get the weapons (and an auxiliary mover for the M198 battery), their crews and ammunition will be appraised because that is all that is needed to commence firing in support of the ground gaining forces. The number of aircraft sorties necessary to transport these two units to a firing position offers the data needed to make this evaluation.

One CH53E is required to carry each M198 for a minimum of six sorties for a battery. The auxiliary mover can be loaded in the cargo compartment of one of these aircraft. Although both the CH53D and the CH53E have the potential to lift two M101A1 howitzers at one time, it is currently the practice to lift only one at a time. This means the 105mm battery also requires at least six helicopter loads to transport its weapons ashore. The number of personnel and amount of ammunition the CH53E can transport in addition to one howitzer is a function of weight. The combined weight of people and ammunition can not exceed the difference between the weight of the howitzer being carried and the lift capacity of the aircraft. The information provided in Figure 4 indicates the additional amount of cargo this helicopter can carry. Although the weight allocation for personnel and ammunition may vary from load to load, the CH53E has the ability to carry cannoneers and

some ammunition with each type of howitzer.

The results of this comparison indicate the same number of sorties are needed to displace each battery but the M198 is dependent on being transported by the CH53E while the M101A1 can be carried by both models of the CH53 helicopter.

Summary

The relative mobility of the M198 as compared to the M101A1 can be understood through analyzing their amphibious adaptability, ground mobility, and helicopter transportability. The new howitzer's size presents no comparative loss of mobility when being debarked from amphibious ships; however, it does require a greater effort to get ashore using the landing craft currently available. The M813 has proven to be an adequate prime mover for the M198 but an auxiliary mover is necessary in situations where the truck is not available. Finally, the new weapon's helicopter transportability is equal to that of the M101A1 only when the CH53E aircraft is utilized.

END NOTES

[1]Lieutenant (jg) W. T. Driscoll, Ship's Loading and Characteristics Pamphlet, USS Boulder (LST-1190), Norfolk, Virginia: June, 1979, p. 4.

[2]During a ten minute period of sustained firing, one M101A1 can fire 2035 pounds of conventional high explosive projectiles. During the same period of time, an M198 can fire 2024 pounds. Oral Report, Phase I, Marine Corps Artillery Force Structure Analysis, Quantico, Virginia: Potomac General Research Group, November, 1979.

[3]Stephen A. French and Frank J. Klein, Independent Evaluation of the M198, 155mm, Towed, Medium Howitzer, Falls Church, Virginia: Army Test and Evaluation Agency, April, 1979, p. 15.

[4]Joseph Monolo, M198 Howitzer Auxiliary Mover Presentation, Dahlgren, Virginia: Weapons Systems Department, Naval Surface Weapons Center, September, 1979, p. 2.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

The M198 weapon system is capable of being moved from amphibious shipping to an initial firing position by landing craft or helicopter; however, analysis of its maneuverability in this environment indicates it presently suffers a comparative loss of mobility in two critical areas. A greater effort is needed to transport a battery ashore in the landing craft presently available and an auxiliary mover is necessary to provide position area mobility for the howitzer in the absence of its prime mover. The ability to compensate for or overcome these deficiencies will determine how successful the M198 will be in fulfilling the direct support role in an amphibious operation.

Conclusions

The time and effort required to get an M198 battery ashore is affected by the capability of amphibious shipping to accommodate landing craft and the availability of small boats which can transport the weapons. Even though an M198 battery can fit on all the principle ships except the LPH, the best ship on which to embark this unit is the LHA. It offers the shortest amount of time to offload the how-

itzers because its landing craft docking well can accommodate the loading of two LCU's simultaneously. Unfortunately, the availability of these particular landing craft presents a problem. The limited number of these small boats currently assigned to support a MAU necessitates assigning a high priority to their use in taking the weapons ashore as soon as possible. The early dedication of the LCU's to the artillery has an impact on the movement of the other weapons and equipment to the beach. Obviously, a battery equipped with the M198 will always require more small boats to be transported ashore than one using the current howitzer because of its larger size. For this reason, there is a need to increase the number and type of landing craft capable of transporting the new howitzer to provide the commander the flexibility of introducing it in the early stages of the battle without preempting other essential high priority items.

The replacement of the LCM8 with the Landing Craft Air Cushion (LCAC) during the late 1980 time frame will provide a quantum increase in surface transportation capability. The speed of the LCAC, as well as a greater load carrying capacity will reduce the time and effort necessary to take large weapons and equipment to the beach.[1]

The M198's comparative loss of ground mobility is not so apparent as its relative loss of mobility during the ship to shore movement, but it may have a greater impact on its ability to provide fire support to the ground gaining

forces. Although the M813 is adequate as a prime mover, there is a valid requirement to have an auxiliary mobility source for the howitzer when its truck is not available. Even though the MC4000 may have only limited utility aboard ships to position weapons, it has demonstrated its potential to provide the needed mobility for the howitzer during helicopter displacements. However, relying on these rough terrain forklifts as the sole means of providing this maneuverability has significant disadvantages.

Any delay in emplacing a battery may deny essential artillery fires to maneuver units. In a combat scenario in which the battery is taken ashore by helicopter, the additional time consumed in attaching and positioning six howitzers with two forklifts can be the cause of this costly delay.

This ratio of auxiliary movers to howitzers is a potential problem when the survivability if the battery is considered. The capability of enemy target acquisition systems could subject the battery to accurate counterfire long before the prime movers are available to displace the weapons to an alternate firing position. The two forklifts each must make three round trips to complete the subsequent move from the old to the new emplacement with an attendant prolonged exposure to enemy artillery fire.

The disadvantage of relying on these forklifts to provide the necessary weapon maneuverability poses even greater potential problems if the realistic considerations of equipment failures and maintenance requirements are

taken into account.

Recommendations

The mobility of artillery weapons has always been a concern of the military tactician. After World War I, General John J. Pershing concluded that the positional warfare which was fought in Europe during the War was, to a large degree, a result of the lack of mobility of the artillery.[2] The continual determination of artillerymen to improve weapon mobility is captured in an excerpt from a lecture on the replacement of horses with motor transport as prime movers for artillery which was delivered by LTC W. R. Conolly at the Center of Artillery Studies at Treves, Germany, during April 1916.

> Technical progress during the war has always brought about new complications, and these complications have always raised a priori considerable opposition, but experience has shown that progress was a matter of necessity, and it has been found impossible to reject because of complications.[3]

This positive and progressive attitude expressed 64 years ago is still valid today. Although the MC4000 is presently the best means of auxiliary transportation for the M198, the shortcomings associated with its employment for this sole purpose necessitates developing a more efficient system.

A solution to the problem of providing the howitzer with an auxiliary means of maneuverability without having to depend on another vehicle is to design a power source as an integral part of the weapon. This auxiliary pro-

pulsion concept is not a novel idea and was considered for the M198 during its early development.[4] The Field Howitzer 70, developed jointly by Britain, West Germany and Italy employs such a system. This power source can assist the prime mover in moving the howitzer across marginal terrain as well as move the howitzer by itself.[5]

Although a similiar auxiliary propulsion system for the M198 was studied by the Army, it was not pursued because at that time "the standard and developmental cargo helicopters exhibited the capability of lifting loads weighing 7 or 8 tons."[6] The additional weight of the propulsion unit would prohibit the howitzer's employment by helicopter. For the Marine Corps, this weight restriction will no longer exist when the CH53E helicopter becomes operational. With this obstacle overcome, the development of such a system can be undertaken.

The design of an auxiliary propulsion unit for the M198 should incorporate certain features. The engine and trans-axle should be powerful enough to enable the howitzer to negotiate cross-country terrain with a substantial radius of operation. Also, it should be light enough to still permit the CH53E to transport personnel and ammunition with the weapon.

During helicopter displacements, the auxiliary propulsion unit would make possible the positioning of each howitzer in the battery area without relying on the presence of a prime mover or some other vehicle. Additionally, the

survivability of the battery would be enhanced because all weapons could be moved simultaneously to an alternate firing position.

With the auxiliary propulsion system as an integral part of the howitzer the problem of ensuring that an auxiliary mover or even a prime mover is always available to maneuver the weapons in a battlefield scenario does not exist. An additional benefit derived from this means of auxiliary transportation is that storing the M198 in the stowed position becomes more feasible. The restricted turning radius associated with utilizing the MC4000, or similiar type vehicle, would be overcome which would improve its maneuverability aboard ship as well as on land.

Taking into account the possibility of mechanical failure on one or more of the auxiliary propulsion units during tactical operations, the battery is presented with the same mobility problem for the howitzer that currently exists. For this reason, the addition of the two forklifts to a battery's inventory would augment the auxiliary propulsion units by providing an excellent tertiary means of howitzer mobility. Additionally, the MC4000's proven ammunition handling capability offers an M198 unit increased responsiveness and flexibility needed as a direct support artillery battery.

Summary

The M198 is capable of being transported ashore in the same manner as the weapon it is replacing; however,

it suffers a comparative loss of mobility in two critical areas because of its increased size and weight. Carrying the weapon to the beach in landing craft involves more time and assets. Additionally, the need for an auxiliary mover to position the howitzers in the absence of their prime movers increases the time necessary to prepare the battery to fire.

Larger and faster landing craft than those presently in the Navy's inventory will allow the M198 to be brought ashore early without adversely affecting the rest of the ship to shore movement. More critical is the need to develop an auxiliary propulsion unit which is an integral part of the howitzer. Such a system will increase its battlefield responsiveness and improve its survivability.

END NOTES

[1]Scot MacDonald, "JEFF ACV's--50 Knot Amphib Craft," Surface Warfare, May, 1978, p. 3.

[2]Janice McKenney, "More Bang for the Buck in the Interwar Army: The 105mm Howitzer," Military Affairs, April, 1978, p. 81.

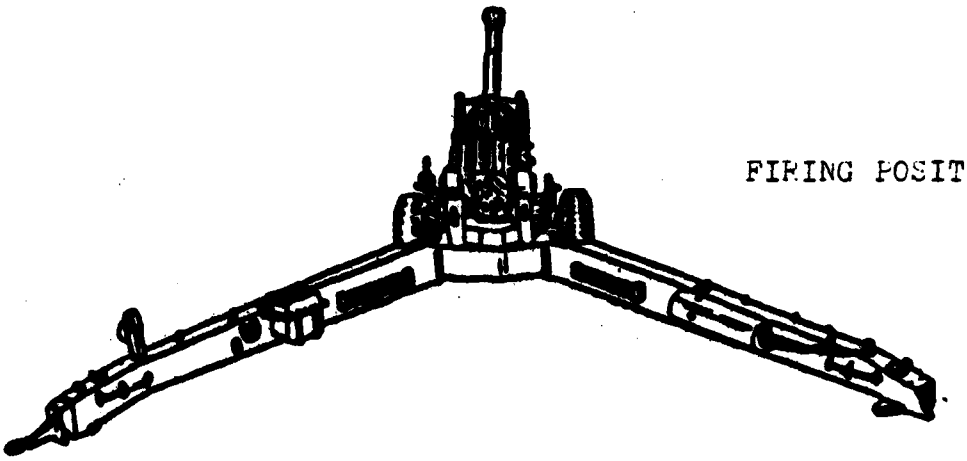
[3]Lieutenant Colonel W. R. Conolly, "Motor Transportation for Artillery," Field Artillery Journal, July-August, 1919, p. 271.

[4]155mm Towed Medium Howitzer, XM198 (U), Research Division Government Affairs Institute, Washington, D. C.: March, 1969, p. 5.

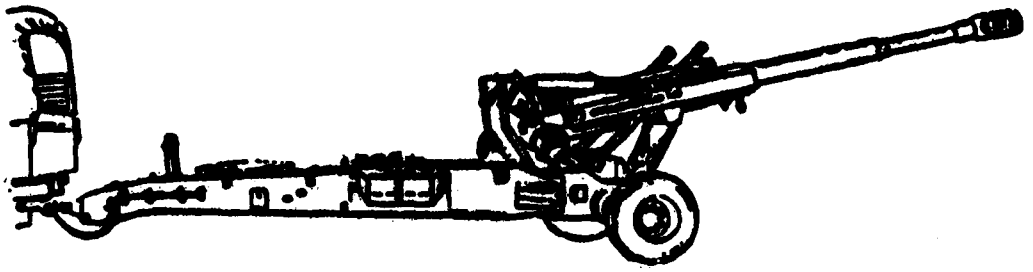
[5]R. B. Pengelley, "FH 70-Europe's First Multi-National Artillery Program," International Defense Review, April, 1973, p. 196.

[6]Research Division, Government Affairs Institute, loc. cit., p.2.

APPENDIX



FIRING POSITION



TOWED POSITION

STOWED POSITION

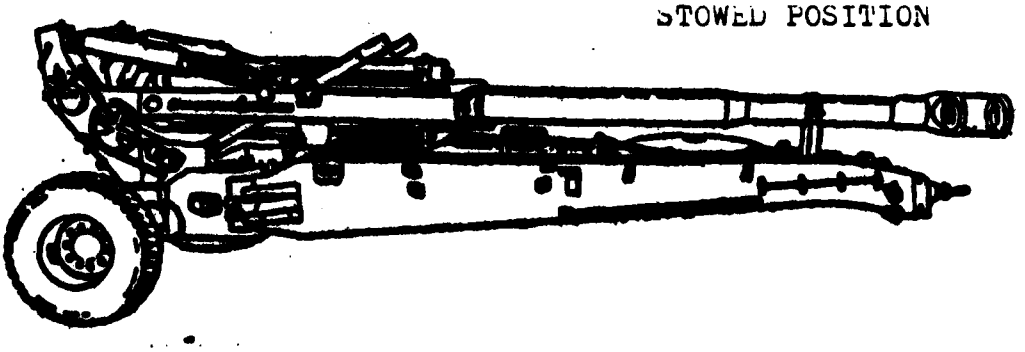
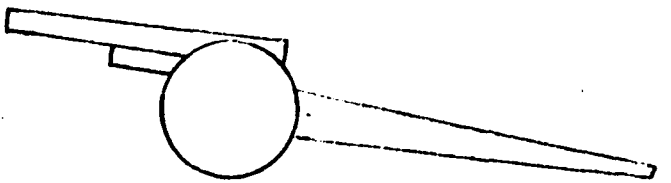


FIGURE 1

OPERATIONAL CONFIGURATIONS

M101A1 105mm

length 19.8'
width 7.0'
height 5.1'



M198 155mm

length 40.5'
width 9.1'
height 9.5'

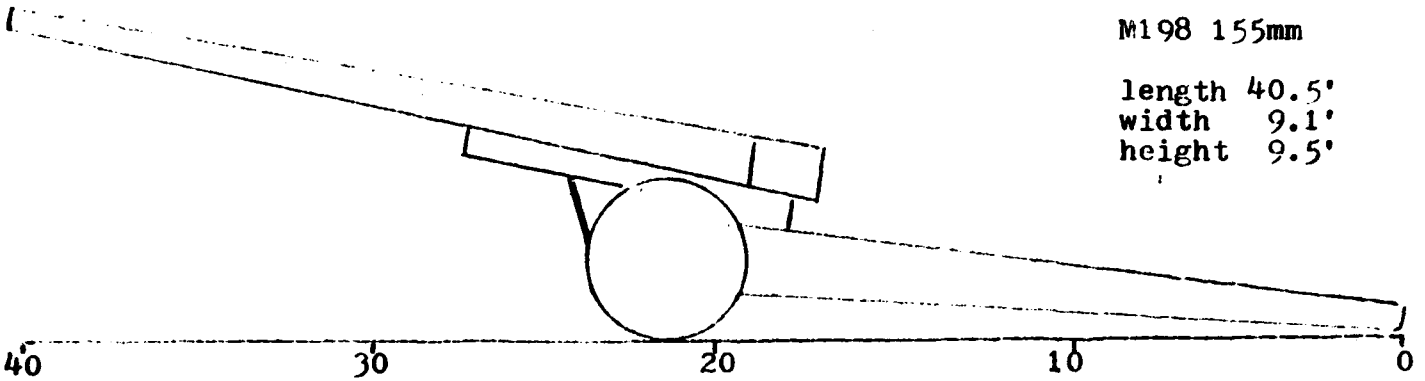


FIGURE 2

SIZE COMPARISON OF M198
AND M101A1 HOWITZERS

Source: Oral Report, Phase I, Marine Corps Artillery Force Structure Analysis, Potomac General Research Group, Quantico Virginia: 30 November, 1979.

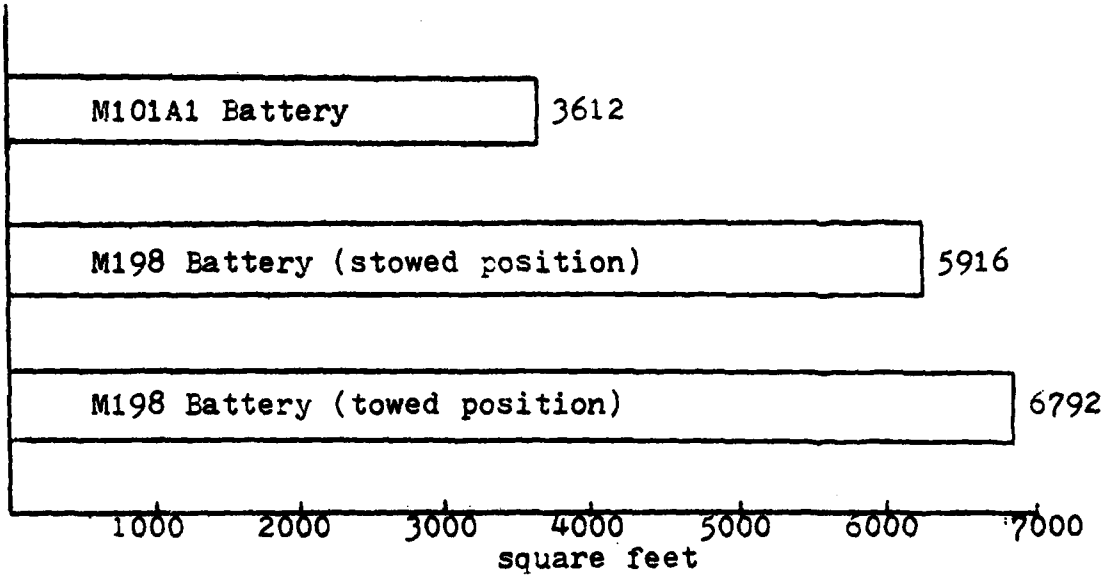


FIGURE 3

STOWAGE AREA REQUIRED FOR
M198 AND M101A1 BATTERIES

Note: The figures in Figure 3 do not take into account the liaison officer and forward observer vehicles which would be included in the supported units' shipping space requirements.

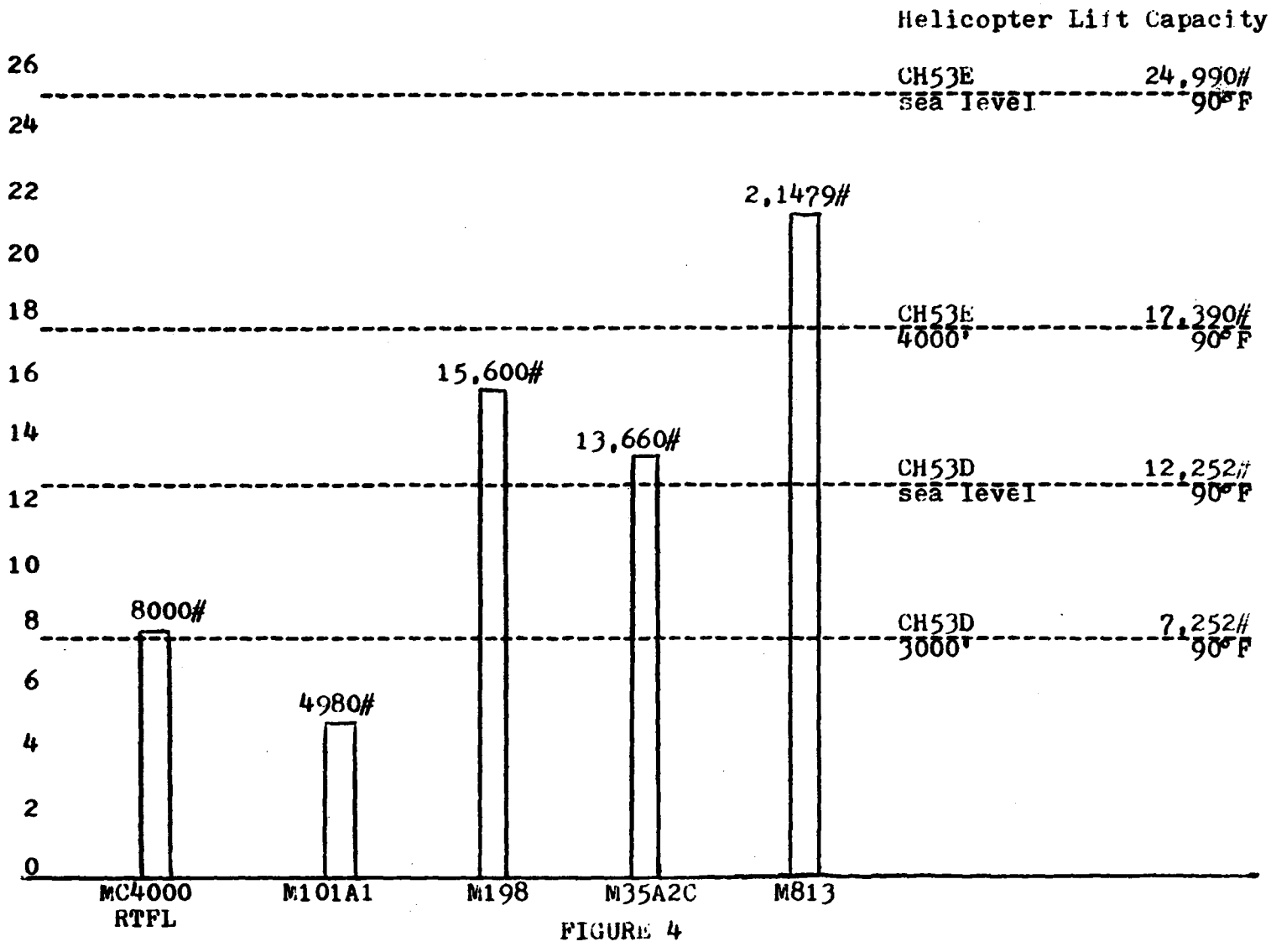


FIGURE 4

HELICOPTER TRANSPORTABILITY

Source: Oral Report, Phase I, Marine Corps Artillery Force Structure Analysis, Potomac General Research Group, Quantico, Virginia: November, 1979.

BIBLIOGRAPHY

Books

Moore, John E., Captain, RN, FRGS, ed. Jane's Fighting Ships 1978-79. New York: Franklin Watts Inc. 1978.

Government Documents

Butler, G. C., Lieutenant, USN. Ship's Loading and Characteristics Pamphlet, USS Pensacola (LSD-38). Norfolk, Virginia: July, 1979.

Doctrine for Amphibious Operations (LFM01). Washington, D. C.: Departments of the Army, the Navy and the Air Force. August, 1967.

Driscoll, W. T., Lieutenant (jg), USN. Ship's Loading and Characteristics Pamphlet, USS Boulder (LST-1190). Norfolk, Virginia: June, 1979.

French, Stephen A. and Klein, Frank J. Independent Evaluation of the M198, 155mm, Towed, Medium Howitzer. Falls Church, Virginia: Army Test and Evaluation Agency. April, 1979.

Monolo, Joseph. M198 Howitzer Auxiliary Mover Presentation. Dahlgren, Virginia: Weapons Systems Department, Naval Surface Weapons Center. September, 1979.

Navy and Marine Corps Reference Book (RB110-2). Fort Leavenworth, Kansas: U.S. Army Command and General Staff College. July, 1978.

Oral Report, Phase I, Marine Corps Artillery Force Structure Analysis. Quantico, Virginia: Potomac General Research Group. November, 1979.

Randolph, Donald D. and Robinson, James H. Mobility Performance of Towed and Self-Propelled Artillery and Related Vehicles. Vicksburg, Mississippi: U.S. Army Engineer Waterways Experiment Station. January, 1977.

Sims, Jack D., Major, USA and Peek, Donald L., Captain, USA. Force Development Testing and Experimentation Test of the M198 Howitzer System in Direct Support of Light Infantry Operations. Fort Sill, Oklahoma: U.S. Army Field Artillery Board. January, 1979.

Whelihan, W. P., Major, USA. Independent Evaluation of the M198, 155mm, Towed, Medium Howitzer Force Development Test and Experimentation. Fort Sill, Oklahoma: U.S. Army Field Artillery School. January, 1977.

United States Army. Field Artillery Organizational System Requirements, 1981-1986 (Legal Mix V) (C). Fort Sill, Oklahoma: U.S. Army Field Artillery School. 1977.

155mm, Towed, Medium Howitzer, XM198. Washington, D. C.: Reaearch Division, Government Affairs Institute. March, 1969.

Periodicals and Articles

Conolly, W. R. Lieutenant Colonel, USA. "Field Artillery Motor Transportation for Artillery." Field Artillery Journal. July-August, 1919, pp. 255-275.

MacDonald, Scot. "JEFF ACV's, 50 Knot Amphib Craft." Surface Warfare. May, 1978, pp. 2-7.

McKenney, Janice. "More Bang for the Buck in the Interwar Army: the 105mm Howitzer." Military Affairs. April, 1978, pp. 80-85.

Meyers, Wayne E., Rear Admiral, USN. "The Combat Systems of Surface Warships." U.S. Naval Institute Proceedings. May, 1977, pp. 110-123.

Moore, Richard H., Lieutenant Colonel, USMC, Weeks, Larry L., Major, USMC and Morga, Dennis A., Captain, USMC. "Why the Marine Corps is Adopting a New Howitzer." Marine Corps Gazette. April, 1979, pp. 51-59.

Pengelley, R. B. "FH70-Europe's First Multi-National Artillery Program." International Defense Review. April, 1973, pp. 195-198.

Van Luenen, Paul, Jr. "Naval Weapons Today." Naval Review. 1965, pp. 37-63.

Other Sources

Anderson, William, Major, USMC. Amphibious Group Two, Embarkation Officer. Telephone interview. 15 January 1980.

Karonis, Peter J., First Lieutenant, USMC. Personal correspondence. 16 November, 1979.

OBrien, James, Major, USMC. CH53E Project Manager. Telephone interview. 7 February, 1980.

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