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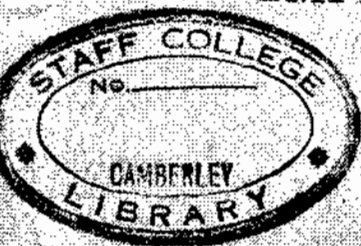
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COMBINED OPERATIONS

PAMPHLET No. 18

LANDING SHIPS-TANK

**DESCRIPTION & OPERATIONAL
EMPLOYMENT**



1944

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The Chief of Combined Operations.

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LANDING SHIPS TANK

DESCRIPTION AND OPERATIONAL EMPLOYMENT

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LANDING SHIPS TANK

DESCRIPTION AND OPERATIONAL EMPLOYMENT

SECTION I—GENERAL DESCRIPTION OF LANDING SHIPS TANK CLASSES AND FUNCTIONS

1. The landing ship tank (LST) is designed for long range overseas operations. It is a large ocean going ship with great endurance, and adequate living accommodation for army personnel embarked on a long voyage. The LST can also be used for short range operations.

LST(1) Maracaibo class—general description

2. The first LST to come into service in this country were not specially built. They were converted tankers, known as Maracaibos, so called because the tankers from which they were converted were shallow draft vessels specially built for the conditions met with in the Gulf of Maracaibo in Venezuela. The conversion has been successful and these vessels have done valuable work.

A conversion, however, can never be wholly satisfactory and these ships have certain disadvantages which have been overcome in the later LST.

3. There are three Maracaibos, Bachaquero, Misoa and Tasajera. Bachaquero and Misoa are ships of 5,100 tons displacement loaded, Tasajera about 1,000 tons smaller. They are steam driven with a maximum speed, fully loaded, of 10 knots, at which their endurance is 6,000 miles. Their loaded beaching trim is about 4 feet 2 inches forward and 15 feet aft, which means that they can only be used on steep beaches. With a beach gradient flatter than 1 in 50, artificial means of bridging the gap between the end of their ramps and the shore is required. They have a bow door hinged at the foot, which when lowered, forms support for a ramp. There is also an extension ramp which, with the main ramp, gives a total length of 72 feet. Both ramp and extension are constructed of steel and can carry a forty ton tank. Unlike modern LST, the Maracaibos are not designed to carry vehicles on their upper deck. Space can however be found on the upper deck, above the wing compartments, to stow about eight large vehicles. As there is no truck lift, such vehicles must be handled by shore crane or by the ship's derricks. After the tank deck has been unloaded, vehicles of suitable dimensions, stowed on the upper deck, can be lowered to the tank deck by the ship's derricks through the hatches at the after ends of the wing compartments, and can thence be unloaded over the ramp.

4. Tank and vehicle stowage on the lower deck is divided into compartments by two fore and aft bulkheads.

The wing compartments will each carry nine heavy tanks or a larger number of light tanks or vehicles. Tasejera does not carry quite so many. Height is the limiting factor, being only 9 feet 6 inches. The low ceiling makes General Grants, Shermans and Churchills somewhat difficult to stow, and in some cases fouls the waterproofing equipment. Headroom in the central space is 9 feet at the forward end but decreases to 6 feet 6 inches aft, with the result that the central space is of little use for anything except small vehicles, guns, limbers and bren carriers.

Between the bow doors and the forward end of these compartments there is a marshalling space, but manoeuvring either in this marshalling space or in the tank and vehicle stowage is not easy owing to the congested and obstructed nature of the space available.

5. The ships have two 25-ton derricks which can plumb the stowage spaces through hatches at the after end of the wing compartments. Light tanks and vehicles can be loaded or unloaded by means of these derricks, off or on to a quay, or from or into landing craft tank (LCT) alongside. There are also two 10-ton derricks plumbing the central compartment. These can be used to load or unload light vehicles.

6. In addition to their own complement, the Maracaibos can carry 12 officers and 195 other ranks. The accommodation, however, is not up to the standard provided in the later LST.

LST(2)—general description

7. The LST(2) is an American built vessel of 3,776 short tons (3,371 long tons) displacement when loaded and in ocean going trim. Maximum speed is about 10 knots, but the ships should not be expected to maintain more than about 8 knots on an ocean passage. After mass production of prefabricated parts these ships have been assembled in 16 days.

8. LST(2) have bow doors, abaft which is a simple ramp hinged at the bottom and raised or lowered by chains. When raised, the ramp forms a watertight door, and when lowered, it forms a short steep ramp down to the beach.

9. LST(2) carry guns or vehicles on the upper deck as well as in the tank deck, and have a lift for vehicles between the two decks. This is situated just abaft the forecastle and is of simple design; it is raised or lowered by wires from the ship's windlass. It can lift 10 tons, but is rather slow in operation taking 56 seconds up and 52 seconds down. The lift platform is secured at upper deck level, and a small vehicle may be stowed on the platform provided the stops are placed in position under the platform.

A large hatch in the upper deck, forward of the superstructure, gives access to the tank deck; but LST(2) have no crane, and use of the hatch therefore depends upon finding a berth under a heavy shore crane.

Certain LST(2) of the replacement programme are fitted with a ramp to the upper deck in place of a lift. Further details regarding ramped LST(2) are included at Appendix H, paragraphs 5 and 8.

10. LST(2) have accommodation for 12 officers and 165 other ranks in addition to the ship's complement. Armament consists of six 20 mm Oerlikon and one 12 pounder (sited aft).

11. As the number of LST(2) available greatly exceeds the number of LST(1), references in this pamphlet refer mainly to the former. Diagrams of the LST (2), showing profile, top deck and second deck, and tank deck respectively, are given at Appendices, A, B and C.

LST(3)—preliminary details

12. A new LST, to be known as the LST(3), is now being built in the United Kingdom and Canada. This LST will have approximately the same capacity as the LST(2) and a speed of about 13 knots. Designed beaching draughts are 4ft 7in forward and 11ft 6in aft, when carrying 500 tons cargo load.

13. LST(3) will carry either two harbour launches or two landing craft assault (LCA) at davits, and will be capable of carrying three more LCA in chocks on the upper deck at the expense of vehicle lift. The three LCA on the upper deck can be hoisted out by two 15-ton derricks on either side of the upper deck.

LST data

14. Details of dimensions, speed, range, naval complement, and repair and maintenance facilities, etc, for the various types of LST are given in Appendices D, E and F.

SECTION 2—ORGANISATION AND HANDLING OF LST

Organisation

15. The British organisation of LST is into divisions, flotillas and squadrons (or groups):—

(a) Division	.....	.....	.....	6 LST
(b) Flotilla	.....	.....	.....	12 LST
(c) Squadron (or group)	.....	.....	.....	2 or more flotillas

Position of senior officers of flotillas and squadrons and their staffs

16. The captain in command of a squadron, and the commander in command of a flotilla, are normally in command of their own LST as well as their squadron or flotilla. Squadron and flotilla staffs will usually be dispersed among the various ships of their squadron or flotilla, and not necessarily accommodated in the ship of the senior officer.

Beaching and retracting of LST(2)

17. LST(2) have two rudders, one abaft each propeller. This arrangement makes ships very handy even with slight headway, but does not assist them when they have stern way on, in which state they are very difficult to handle. They have a high freeboard and are therefore considerably affected by wind.

18. These vessels cannot easily keep station at less than one-and-a-half cables (300 yards) distance; if they are turned to line abreast before beaching, they will then be 300 yards apart and take up a large amount of space.

It is considered that the best formation for beaching is in fine quarter line or double quarter line, ships beaching in succession, close to each other.

19. If the beach is suitable, the vehicles from the tank deck can be landed in a few minutes (say 5 to 10 minutes per ship). When the tank deck is cleared, the ship should retract, get her vehicles off the upper deck and lined up on the tank deck, and then re-beach in shallower water.

This manoeuvre is very profitable on beaches steeper than 1 in 50 as no time is lost in getting the last vehicle ashore, and the ship does not present a stationary target the whole time.

This method of unloading LST is set out fully, together with its advantages and disadvantages, in Section 4, paragraphs 52-54.

Spacing on a shallow beach

20. On a shallow beach, LST should not be beached with a gap of less than 100ft, i.e. twice the beam of the ship.

Use of the kedge anchor

21. LST of all types are fitted with a kedge anchor operated by its own capstan. The primary use of the kedge anchor is to enable LST to retract from the beach, and it should be used for this purpose in all conditions with the possible exception of a steep beach and a light load.

A subsidiary function of the kedge is to assist in keeping a beached LST square on to the beach, while loading or unloading is in progress.

SECTION 3—EMBARKATION FOR OPERATIONS

Responsibility for preparation of loading plan

22. The principal military landing officer (PMLO) on the divisional staff is responsible for the landing tables which are the basis of the divisional loading plan. The naval force commander will then allot LST to assault groups, whereupon each brigade, assisted by the military landing officers (MLOs), will prepare detailed stowage plans in conjunction with the commanding officers of the units concerned.

23. Owing to the almost infinite variety of tanks, vehicles and guns, of different types and sizes, which might constitute a load for a LST, any figures given in this pamphlet are intended for guidance only.

Planners should try out their LST loadings in advance, by fitting pieces of cardboard, cut to scale to represent tanks, vehicles or guns, into a similar scaled plan of the tank deck and the upper deck of the ship to be loaded. Sufficient space should be left between vehicles to enable fires to be dealt with if they break out. Such plans must show all obstructions on the decks such as hatches, ventilators, etc, and should be checked for accuracy beforehand. Thereafter the loading plan should be prepared in diagrammatic form, showing the stowage position of each tank, vehicle, etc. These in turn should be clearly

marked with their priority number for off-loading. A key should be attached to each plan clearly describing each tank, vehicle or gun and the unit to which it belongs. Copies of these plans must be submitted for approval to the senior officer assault group (SOAG), and to the commanding officer of the LST concerned.

24. The closest liaison must be maintained between the commanding officers of the LST and the military officers responsible for planning and loading. It is for the PMLO or his representative to decide what he wishes to load, but it is the responsibility of the ship's commanding officer to ensure that his vessel does not exceed the beaching draughts ordered.

Details of accommodation in LST for personnel and vehicles are given at Appendix H.

Responsibility for loading

25. **Naval**—The naval authorities at the place of embarkation are responsible for providing naval embarkation officers, whose duties will be :—

- (a) Calling ships to loading points as required.
- (b) Organising naval berthing parties.
- (c) Arranging for the provision of fuel, stores, ammunition, etc., for the ships.

26. The commanding officer of each ship will assume the responsibility for the safe loading of his vessel, to include :—

- (a) The safety of the ship and of the men and equipment on board.
- (b) Ensuring that holds are clean and chocks and lashings are at the ship's side unless otherwise ordered.
- (c) Having the ramp ready for lowering as soon as the ship is secured at the loading point.
- (d) Being ready at all times to haul off or go ahead if required, to allow for a falling or a rising tide.
- (e) Ensuring that the ship does not swing while vehicles are being driven on.
- (f) Being ready to haul off without delay as soon as loading is completed.
- (g) Ensuring that sufficient room is left between vehicles in the tank space for extinguishing fires, should they break out.

27. **Military**—Movement control embarkation staff, in conjunction with the military OC troops detailed for the particular ship, are responsible for seeing that the LST is loaded in the proper tactical order as detailed in the loading plan. The commanding officer of the ship will co-operate to the fullest extent, subject to maintaining his vessel in a sea-worthy condition and being able to fight its armament.

An assistant military landing officer (ship) (AMLLO (ship)) may be appointed to the ship, in which case his duties will be to ensure that the ship is loaded in accordance with the loading plan and unloaded in conformity with the ship's landing table.

Each individual driver will be prepared to manoeuvre his vehicle as directed by the appointed loader, and to secure his vehicle when it has reached its correct position.

Detailed loading procedure

28. Vehicles will arrive at the embarkation point in serial order as detailed on the loading plan. This order will be the reverse of priority of landing and in consequence the upper deck will be loaded first under normal conditions.

In the early stages of an operation, the LST may retract after discharging its vehicles from the tank deck, and remain afloat off shore while vehicles from the upper deck are moved down into the tank deck. This will mean that vehicles which were stowed aft in the upper deck will then be forward in the lower deck and will therefore land first.

29. The actual loading of each vehicle is a unit responsibility, although movement control staff will assist when considered necessary and give orders as to where each vehicle will be stowed. This control will necessitate four checkers, at the ramp, the lift, on the tank deck, and on the upper deck. The loading of guns, trailers, etc., is the responsibility of the unit to which they belong, who will provide the necessary parties if manhandling is necessary. The rate of loading 3.7 inch mobile equipments, tank transporters, and other heavy dumbloads is slow, even with experienced crews, and this should be borne in mind in planning the time-table for loading.

Loading of upper deck

30. Providing drivers, loaders, and working parties are properly trained, it is possible to load a vehicle on the upper deck every 2½ to 3 minutes. Vehicles usually find it easier to drive forward up the ramp and on to the lift, and to turn on the upper deck, where there is ample room. But the last two or three vehicles for the upper deck should be driven up the ramp and on to the lift backwards, as, owing to the space taken up by vehicles previously embarked, there will be no room for them to turn on the upper deck.

Use of garage jacks to assist in close stowage

31. The use of garage jacks is of great assistance in manoeuvring vehicles into position on the upper deck of LST when the maximum number of vehicles has to be carried, especially in the positioning of the last few vehicles for stowage on the upper deck.

By the use of garage jacks the vehicle load on the upper deck can be increased by about 25 per cent. If maximum stowage is not contemplated, the additional manoeuvrability attained by the use of jacks is not so valuable. It should be noted that if jacks are used to move vehicles into position, they will also be required to move them out. Extra manpower is not necessary as the drivers of the vehicles can do all that is required.

Two garage jacks should be allotted to each LST(2) when maximum stowage is contemplated. These should be 5-ton hydraulic lifting jacks, as with this type of jack it should be possible to move all vehicles within the capacity of the 10-ton lift of the LST(2).

Loading the tank deck

22. Lift guides and ramps should be removed before loading of the tank deck is begun. Small vehicles and certain types of guns can be driven or towed forwards on to the ship, and turned round on board before being finally stowed. Large vehicles, and any which are loaded right forward should be reversed into the LST.

As soon as all vehicles have been correctly stowed, the ships will move off from the embarkation point. The positioning of chocks and the securing of vehicles by lashings etc, will be completed while the vessel is moving to its waiting position. This work will be done by the detachments travelling with each vehicle, under the direction of the commanding officer of the ship.

All personnel who are to travel in the ship must remain on board once their particular vehicle has been embarked. All other personnel assisting in the loading will clear the ship immediately their task is completed.

Loading as a cargo carrier for operations not involving beaching

33. The maximum cargo capacity for LST(2), operating as a cargo carrier, when it is not necessary to beach the ship for discharging cargo, is 2,100 long tons with the ship in ocean condition, giving a draft of 8 feet forward and 14 feet 4 inches aft. Owing to structural limitations, the maximum load which can be carried on the upper deck is about 350 tons.

Loading at a hard

34. Harbs are normally designed to accommodate LST(2) with a vehicle load of 500 tons plus 120 tons of fuel and fresh water, in which condition draughts are 3 feet 1 inch forward and 9 feet 6 inches aft. This load may be exceeded if the unloading facilities permit, or if the LST is not expected to retract at low tide. These figures will, of course, vary with the quantity of fuel, stores and water on board. Immersion may be taken as 33 tons per inch.

35. Loading from a hard, through the ramp to the upper deck, will take 2½ minutes per vehicle. The loading of the tank deck will average about 2 minutes per vehicle, those stowed aft taking less time than those finally stowed forward, as the latter will require more manoeuvring to get into position. It is estimated that with trained personnel 2½ hours will be required for embarking the full load. With loads containing awkward vehicles, or when personnel have had only limited experience in loading LST, up to 4 hours should be allowed for this operation.

Ballast should be discharged as the loading progresses. The ship must be kept waterborne and the depth of water below the ramp prevented from becoming too great. Ventilating fans must be kept running throughout the loading.

36. Two or three portable Christchurch ramp extensions should be carried in each LST(2) to facilitate loading of awkward equipment, i.e. articulated vehicles, trailer loads and vehicles with a large overhang at the rear, or with a small belly clearance.

Facilities for embarked personnel

37. **Medical facilities available for use by the troops embarked.** A naval medical officer is usually only carried in flotilla officers' ships, but each LST is fitted with a sick bay, staffed by one or more sick berth attendants, and is available for use by the military medical personnel. The naval medical stores normally carried in each LST are only for use by the ship's company.

The military medical officer is responsible for making arrangements with the ship's naval medical staff for dealing with military casualties.

LST can be modified to take casualties by the fitting of close stowage bunks either side of the tank deck. These bunks do not reduce the payload. See paragraphs 90-94.

38. **Cooking and messing arrangements for the troops embarked—**Joint arrangements for cooking should be made by the petty officer cook in charge of the ship's galley and the sergeant cook (or senior cook) of the embarked troops. Messing is a naval responsibility, but the Army will provide rations when large numbers of prisoners of war are embarked. The standard of naval messing provided must necessarily deteriorate progressively according to the number of passengers embarked over and above the number which the ships were designed to accommodate. It should generally be possible, by improvisation, to provide at least one hot meal a day and ships are expected to do the best they can. The troops embarked will be expected to help in the galley. Details of messing, provisions, and fresh water victualling arrangements are given at Appendix G.

39. **Mess traps—**Provision of mess traps to army other ranks is not normally necessary as they carry their own knives, forks, spoons and cups. It may, however, be necessary in isolated cases to issue such articles. In such cases, the OC troops will arrange to draw the necessary items in bulk and will sign for them. He should make his own arrangements for subsequent distribution and collection. All mess traps will be issued on loan. The OC troops will be responsible for their return to the ship in good condition before the troops disembark. Losses or damage will be charged against those responsible.

40. **Bedding—**Bedding will be provided by the ship. The OC troops will be responsible for the drawing and subsequent return of supplies in bulk. All articles lost or damaged will be charged for.

41. **Fresh water—**LST may have to operate for long periods without the opportunity of refilling their fresh water tanks. For this reason the strictest economy must be impressed on the troops embarked. The OC troops is responsible for seeing that there is no waste of fresh water by the troops embarked.

42. **Space available for conferences, etc.—**The only accommodation in a LST for conferences etc. is the wardroom, which can accommodate about 30 persons a time (seating for only about half that number).

Defence measures—embarked personnel

43. **Organisation of action, fire and abandon ship stations—**The organisation of "action," "fire" and "abandon ship" stations for the troops embarked is decided between the first lieutenant of the LST and the military OC troops. These arrangements should be

embarked and practised as soon as possible after the troops are embarked. "Alarm stations" will be thoroughly practised so that all personnel embarked know where to go and what to do in the event of emergency.

Arrangements are usually as follows :—

- (a) "Action stations"—The military personnel man the two forward Oerlikon guns, and their own weapons on the upper deck.
- (b) "Fire stations"—A military fire picquet will be on duty continuously, keeping, in particular, a continuous watch on the vehicles in the tank deck.
- (c) "Abandon ship"—Troops will be allocated to Carley floats, ten of which are provided.

Further details are given in paragraphs 12 to 15 of Appendix J.

44. **Responsibility for disposition and fire control of military anti-aircraft weapons**—The responsibility for the disposition of military anti-aircraft weapons is that of the captain of the LST in conjunction with the OC troops.

The captain of the LST is responsible for giving the order for such weapons to open fire. The order will normally be passed first to the army officer in charge of these weapons, who will be stationed near the bridge.

SECTION 4—SEA PASSAGE AND PREPARATIONS FOR BEACHING

Behaviour of LST at sea

45. The large initial stability of all types of LST, due to the relatively shallow draughts required for the beaching condition, produces an extremely fast rolling characteristic. In the case of LST (2), when in ocean going condition, the period of roll may be as short as six seconds for the complete cycle.

Particular care is therefore necessary in securing all cargo, vehicles and equipment before leaving port, and to ensure that securings do not work loose while on passage.

Maintenance of vehicles while embarked

46. The maintenance of all military or R.A.F. vehicles and equipment while embarked in LST is the responsibility of the units to which the vehicles and equipment belong. Use of the ship's repair and maintenance facilities, when necessary, should be arranged through the engineer officer of the ship. Details of repair and maintenance facilities in each type of LST are given at Appendix F.

Duties of military personnel embarked

47. Order and cleanliness are of vital importance while on board. Military personnel must therefore realise :—

- (a) The naval officer in command, the captain, is in complete charge of the ship and all personnel on board. His orders will be obeyed without question.
- (b) The appointed OC troops is in command of all military and RAF personnel and will issue all orders affecting their duties while on board.
- (c) Military and RAF personnel should avoid getting in the way of the crew; gear etc, should not be touched without specific instructions.
- (d) Smoking rules will be enforced; all ranks should be warned of the danger of fire at sea.
- (e) Cleanliness and tidiness are essential; other troops will probably be using the ship as soon as it is available.

Specimen details for inclusion in OC troops orders in LST are given at Appendix J.

Preparations for beaching

48. General—Final preparations should be begun well before the hour set for beaching. The ship's company will probably be wholly engaged with the naval preparations for beaching, and the following items will be carried out by the military and/or RAF personnel embarked :—

- (a) All dunnage, tank chocks, etc., will be removed from the tank deck, the vehicles being then held by chains alone.
- (b) All tanks and other vehicle engines will be turned over to ensure that they will start.
- (c) Ventilation of the tank deck will be checked while engines are being tested.
- (d) If any tank or other vehicle is out of commission, arrangements will be made for getting it clear of the others or for towing it on to the beach.
- (e) Fuel in tanks and vehicles will be "topped up".
- (f) About two hours before arrival, if weather permits, the tank and vehicle lashing chains will be removed, the tank deck will be cleared, and lights and ventilation will be tested. Chocks should be left under the wheels of all heavy vehicles and trailers, to counter the effect of the ship stopping suddenly when she beaches. Hand brakes will be on, and vehicles left in gear.
- (g) Fifteen to thirty minutes before landing, all ventilating fans will be checked to ensure they are operating at full capacity, and the warming up of tanks and other vehicles will then begin.
- (h) Once vehicle engines are warmed, they should be switched off. Drivers will sit ready in their vehicles, crews of armoured fighting vehicles will mount, gun detachments etc, will stand by their equipment.

Time of beaching and last meal for military personnel

49. The commanding officer of the LST will inform the OC troops, as far in advance as possible, of the expected time of beaching, in order that the last meal for the troops may be adjusted accordingly.

All personnel who are to land should have a hot meal an hour before 'standing to'. If the disembarkation is to be carried out at night, all white lights in troop spaces should be switched off as soon as this meal has been finished, leaving only darkened red lights in vital alleyways or companion-ways, so as to accustom men's eyes to the dark.

Beaching on a rising or falling tide

50. The following factors should be considered when planning the time at which LST are to beach.

Unless special equipment for bridging the water-gap is to be used (see Section 5) or unless the beach has a slope of about 1 in 30 or steeper, the operation should, if possible, be timed so that the beaching will occur about an hour before high water, in order to provide the maximum length of time before the change in tide appreciably affects the ship. The importance of this timing will depend on the amount of rise and fall of tide.

51. A period of $1\frac{1}{2}$ to 2 hours must be allowed for the discharge of a full load of vehicles from a beached LST. However, in order to effect the quickest possible rate of discharge, and at the same time to reduce to the minimum the time during which each LST has to remain on the beach, the method outlined in the following paragraph is recommended where circumstances permit.

52. LST should be beached only for the time necessary to clear the tank deck, i.e. a period of 5 to 10 minutes. The ship should then haul off, and another should take her place. The time, from the moment of first ship's beaching to the moment of the next ship beaching in her place, should not be more than 20 minutes. By the time the fourth ship of a series has retracted, the first LST should have been able to transfer all her upper deck vehicles on to the tank deck and be ready to beach again.

53. The naval advantages gained by this method are :—

- (a) Ships are exposed to enemy action when on the beach for the minimum period of time.
- (b) Ships waiting to beach can be kept moving, or even be kept out of range of the beach defences.
- (c) In certain localities where the tidal movement can be fairly accurately forecast, ships can beach and unload successfully on a falling tide; for the time actually on the beach is short, and the amount of fall of tide may be compensated by the amount the ship is lightened by the discharge of the heavier portion of her load.

54. The possible military disadvantages are :—

- (a) The heavy load, comprising tanks, guns, bulldozers, etc., is disembarked first from all LST, after which there will be an hour's delay before all the lighter vehicles disembark. This might be overcome by loading units tactically by decks and

not by ships, i.e. by loading unit "X" into tank decks of LST "A" and "B", and unit "Y" into upper decks of LST "A" and "B". In such cases the procedure detailed in paragraph 83 of bringing down vehicles from the upper deck during delays, would have to be abandoned. Further, tactical loading by decks would only be possible if the unit to be loaded on the upper deck contained no tanks or heavy vehicles.

- (b) Heavy flows of traffic come at 20 minute intervals, instead of the initial tank deck rush, followed by a steady stream of vehicles at 2 to 3 minute intervals.

SECTION 5--BRIDGING THE WATER GAP

General nature of the problem

55. On beaches steeper than 1 in 30 the depth of water at the shore end of LST ramps will be so small that vehicles and men can get ashore virtually dryshod. When the beach gradient is about 1 in 50, the depth of water at LST ramp will be small enough for waterproofed "B" vehicles to get ashore, but some equipment may be necessary to land vehicles dryshod, and so avoid the necessity for waterproofing. On flatter beaches, some method of bridging the water gap between the point where LST beach and the shore will be necessary.

The equipment available can be divided into two categories:—

- (a) Causeways.
(b) Ferries.

Causeways

56. Causeways are not usually suitable for water gaps of more than 300 feet, on account of the amount of equipment that is required, the difficulty of handling, and the number of moorings necessary. The possibility of having to bridge runnels must be borne in mind when estimating the length required. Causeways will normally be made from United States naval lighterage (NL) equipment. Particulars are given in paragraph 60 *et seq.*

Ferries

57. Where the water gap is over 300 feet, ferrying craft are necessary and may be either LCT or specially designed rafts such as Rhino ferries.

It is probable that, in the future, rafts about 140 feet long and 21 feet wide will be provided for use either as a causeway or as a ferry. It is intended to fit LST(3) for carrying these rafts on deck, and for launching them over the side without listing the ship. This equipment will be carried in certain LST only; where it is carried, no vehicles can be carried on the upper deck.

58. Where there is a considerable rise and fall of tide, the problem can be solved by using a ferry. In this case the LST can be kept *afloat*, so that she can clear the beach area as soon as she has discharged her load. A floating causeway would normally be too long to be practical under these conditions.

Responsibility for the provision and operation of means of bridging the water gap

59. (a) The Navy is responsible for the provision and operation of any means of bridging the water gap which forms part of a ship's equipment, also for the provision and operation of landing craft for use in the ferry service.
- (b) The Navy is also responsible for the operational control, in accordance with the Army requirements, of all craft taking part in the ferry service, including amphibians while afloat.
- (c) The Army is at present responsible for the provision and operation of all means of bridging the water gap other than those detailed in paragraph (a).
- (NOTE—The NL pontoon equipment when carried in LST is considered to be part of the ship's equipment).

United States NL pontoon causeway

60. For use as causeways United States NL equipment is usually assembled in two units, each unit 175 feet long by 14 feet wide by 5 feet deep. By use of these two units, a causeway of any length between 170 and 340 feet can be obtained by altering the amount of overlap to suit the particular water gap. In certain parts of the world where shorter water-gaps are likely to be met, it may be desirable to make the causeways shorter than 175 feet.

It is not practical to construct longer units than 175 feet from NL equipment as this is the maximum length that is safe for towing, and is also the maximum length that can be carried on the sides of LST. In addition to these methods of transport, lengths of about 150 feet can be carried on the top deck of LST and launched overside. This of course reduces vehicle carrying capacity of the LST, but may be necessary where conditions are likely to preclude the other two methods of transport. The LST must be specially fitted either for deck or for side carriage.

Transport of NL pontoon causeway to scene of operation

61. (a) **Towing**—This is the simplest method of transport, but it is unsuitable in adverse weather conditions. The two causeway units are secured rigidly together side by side and may be towed by LST, the LST (2) being provided with a suitable towing winch aft. A causeway in tow will reduce the speed of LST (2) by about $1\frac{1}{2}$ knots.
- (b) **Preparation for towing**—The two units are connected at deck level by the same links and pins used for the assembly of the units. In order to facilitate uncoupling, the pins should if possible be drilled for $\frac{5}{16}$ inch cotter, inserted from the bottom upwards and secured by the cotter on deck. The units should be tied at the bottom by the four heavy tie rods at each end. These tie rods should be fitted with a quick release device, such as a pelican hook in the centre, to facilitate uncoupling. In the event of links and tie rods

not being available, the units may be connected by passing tank securing chains round the longitudinal angles, shackled to their own part and set up bar taut by a bottle screw. This should be done to both top and bottom longitudinals.

The towing bridle may be made fast to pad eyes in the centre line of each unit. If these are not fitted, a chain cable may be passed under the centre longitudinals, over the next longitudinal, and under the outside fore and aft girders, the ends being shackled together. This cable can then be used as a towing bridle. All flooding pipes should be secured and plugged.

- (c) **Top deck and side carriage**—Certain fittings are necessary to enable causeways to be carried on the top deck or on the sides of LST, but manoeuvrability of the ship is not restricted as by a tow, and the causeway is safe in worse weather conditions than if towed. When side carried, units are hoisted by use of ship's own gear, but special care is necessary to ensure that no units contain water when preparing to hoist.

Preparing to beach

62. After releasing from the top deck or from side carriage, or uncoupling after towing, both units must be brought alongside the LST on the same side of the ship, usually to starboard. They are secured in position by breast lines and springs rove as slip ropes, and in addition a line is taken from the capstan through the bow fairlead, aft along the causeway, and secured to the after end of the outside unit.

The positioning ship must draw 18 inches more than the operational draught of other LST.

Beaching the causeway

63. LST should approach the beach at easy speed (6 or 7 knots) and as soon as she grounds the causeway units are cast off and allowed to surge freely ahead. The end of the causeway is then pulled back to the LST by use of the line to the capstan, and the position of the causeway is adjusted by an amphibian, or by a line to a bulldozer. When necessary to anchor the shore end of the causeway, two anchors are employed (one to starboard and the other to port) placed at the high water mark at an angle of approximately 45 degrees to the causeway. The causeway officer determines the exact siting of the anchors, taking into consideration conditions of wind and current. After the anchors are placed, the anchor cables are hove taut and belayed to prevent movement of the causeway.

Modified "positioning ship" method

64. The following modified positioning ship method has been found the most satisfactory method of discharging LST where several LST have to make use of the same causeway.

- (a) The positioning ship launches and beaches the pontoon causeway in the normal manner, beaching with a foot more to her draft than operational trim.

- (b) The causeway is then fitted to her own ramp and is unloaded.
- (c) Twenty minutes before completion of unloading the next ship is called alongside. This ship secures at the distance necessary to take the end of the causeway under her ramp, and floods down.
- (d) The positioning ship, being empty, is hocked off, leaving the second ship firmly on the bottom, with the causeway in position.
- (e) This process is repeated until all LST are unloaded.

The Rhino ferry

65. The Rhino ferry is a raft of NL equipment 175 feet long by 43 feet wide by 5 feet deep. It is provided with two 160 HP engines for manoeuvring, but a tug of NL equipment 43 feet long by 21 feet wide, fitted with two 160 HP engines is used in addition. The deck space is sufficient to clear a LST in two trips, and the Rhino can unload and retract, even on flat beaches with a rapidly falling tide, by use of a bulldozer to push it off. Light draught is 1 foot 9 inches, and the Rhino draws an additional foot for every 180 tons of load.

Towing

66. The Rhino ferry is normally towed by LST, the towing winch being used, and is fitted with proper bridles and pad eyes. Great care should be used in securing the tug to the Rhino. Notes on the towing of the Rhino ferry by LST are given in Appendix K. Coupling arrangements are set out in detail in Appendix L.

Preparations for coupling to LST ramp

67. The Rhino ferry will be towed about 75 fathoms astern of its tug, assisted by the outboard propulsion units on the Rhino. It will pass round the stern of the LST and will be towed from aft to forward as close to the side of the LST as possible. It is most important that fenders are in readiness during this operation, as some LST have projections on the side which will cause severe damage to the Rhino barge if they come in contact with it. As the tug passes ahead of the LST, it slows down and commences to shorten the tow. The Rhino checks its way by use of outboard engines, and as it passes the bows of the LST the centring wire is passed on board by a heaving line thrown from the deck of LST. The end is then shackled to a length of chain passed round the centre longitudinal girder of the Rhino just forward of the fender posts. Great care is needed to prevent the centring wire fouling the outboard engine next to the LST.

The Rhino is stopped as soon as it is ahead of the LST, and is manoeuvred towards the ramp of the LST by means of the outboard engine.

Coupling to LST ramp

68. Bow doors of LST are open to maximum extent, and the ramp is lowered till the end is about 5 feet above water.

LST should be provided with a reel on upper deck, with at least 75 fathoms of 2½ in or 3 in steel wire rope (SWR). This wire is passed through a snatchblock ("A" in diagram at Appendix L) on the upper deck, and round and over two guide sheaves then down through the

deck to the ramp. It is passed through the hole in the centre of the end of the ramp, and a good length is flaked down on top of the ramp. The tail of a heaving line, held by a man on the upper deck, is bent on to the wire which should end in a soft eye. This wire is known as the centring wire.

The side lines are also prepared on the upper deck. These must be at least 40 fathoms long, and may be 2½ in or 3 in SWR or 5 in or 6 in manilla. They are passed out through the fairleads on either side of the bows, and heaving lines are bent on ready for casting.

69. When the centring wire has been made fast on the Rhino, the bight of the wire, between the snatchblock 'A' and the reel on the upper deck of the LST, is turned round the capstan, and the slack taken in as the Rhino approaches the LST. As soon as it is close enough, heaving lines are thrown from the upper deck of the LST and the side lines are passed to the Rhino. The ends of these are secured to the bollards one third of the way down the Rhino barge, they are then made taut at the discretion of the officer on the fore'sle of the LST, by use of the drum ends of the lift winch. They will then be well above, and clear of, the engines of the Rhino.

Cross wires, with hooks on ends, are passed from snatch blocks on either side of the Rhino's stern by means of heaving lines thrown by the Rhino crew. They are then hooked by the LST crew into pad eyes on the sides of the LST ramp furthest from the side of Rhino where they originate. The cross wires are then hove taut by the Rhino crew using hand tackles.

Before the LST ramp is lowered, the centring line must be slacked off. It is then unshackled from the Rhino, the side lines keeping the LST and the Rhino together.

Use of LCT for ferrying between LST and shore

70. LCT can be used for ferrying between LST and the shore, but this operation can only be carried out in good weather conditions.

Certain LCT(5) have had sections of their bulwarks made removable so as to enable them to secure broadside on to an LST ramp, which then rests on the deck of the LCT(5). Vehicles from the LST can then proceed direct into the deck of the LCT(5). When using this method, it has been found advisable to secure one LCT(5) across the bows of the LST and use her as a pierhead up to which other LCT(5) come to load. She will herself carry the last load off the LST.

In the case of LCT(6), a removable bolted plate is fitted to the stern. For unloading direct from the tank deck of an LST, the LCT(6) must secure stern on to the LST ramp.

LCT not fitted with movable bulwarks can only embark vehicles from the LST by securing ramp to ramp. This is a lengthy and more difficult proceeding and can only be carried out safely in conditions of flat calm.

The Christchurch ramp

71. This is a portable extension ramp measuring 15 feet by 4 feet by 1 foot, and is used to reduce the acute angle between the ship's ramp and

the beach or hard. It is especially useful for awkward vehicles, etc. Two of these extension ramps are required when loading and unloading vehicles, etc., as each ramp is only 4 feet wide. This type of extension ramp (Class 24) can be manhandled into position and can be stowed in the tank deck when not in use.

The provision, maintenance and operation of these extension ramps is a naval responsibility.

SECTION 6—DISEMBARKATION

Naval responsibilities for disembarkation

72. The commanding officer of the LST is responsible for all matters concerning the disembarkation which in any way affect the safety of his ship. He must in particular ensure that all fans in the tank deck are in full operation before the tanks commence warming-up.

The taking of soundings between ramp and dry land is a naval responsibility. This may be done by a special hydrographic party in cases where one is provided, or by naval beach commando personnel.

The first lieutenant of the LST will normally exercise a general supervision over the unloading of his ship.

Military responsibilities for disembarkation

73. The OC troops is responsible for informing the commanding officer of the LST of the maximum depth of water which the vehicles aboard can wade, and for ensuring that vehicles and personnel are ready to proceed ashore at the time fixed for beaching.

On receipt of information from the commanding officer of the LST that the ship is in position for disembarkation, the OC troops is responsible for giving the order to drive off.

The AMLO (ship), if appointed, is responsible that all vehicles, personnel, stores, etc., are discharged in accordance with the ship's landing table.

Unshackling and unchocking of vehicles

74. The commanding officer of the LST is responsible for giving the order (through the OC troops) in time for vehicles to be unshackled, and chains and chocks stowed away, before the ship is due to beach. This work is an army commitment.

Vehicles and tanks with other than metal tracks may safely be unshackled even when there is considerable movement on the ship, as the brakes and springs will provide sufficient check, provided the vehicles are stowed in true fore and aft line. Steel-tracked tanks however are liable to slide over the deck.

If securing chains have been taken off, vehicles should be put in gear and all hand brakes locked hard on. Officers and men should be warned that there will be a considerable jerk on beaching, and that they must not stand between vehicles.

Responsibilities in disembarking loads

75. The unloading of beached LST including the provision of the necessary labour, is an army responsibility and is controlled by the PMLO, working through the beach MLOs and AMLOs and the ship's AMLO (when appointed).

The operation of the ship's gear will however be done by the ship's company under the supervision of the first lieutenant of the LST.

Disembarkation—sequence of events

76. The commanding officer of the LST will have warned the OC troops of the expected time of beaching as far in advance as possible, in order that the military preparations for disembarkation can be completed before the ship is due to beach.

77. In cases where the LST is to unload direct on to the beach, the following procedure should be adopted :—

- (a) It is the commanding officer's responsibility to tell the OC troops the depth of water at the foot of the ramp; both he and the OC troops will know the depth of water through which vehicles can safely wade. If this is exceeded at the point where the LST beaches, it is their joint responsibility to contact naval and army personnel on the shore to provide an alternative method of landing.
- (b) As soon as the ship has grounded, the commanding officer of the LST will order the ramp to be lowered, and will arrange for soundings to be taken to find out the depth of water at the ramp's end and between the ramp and the shore (checking for runnels, etc.) if this has not already been done by the naval beach commando or survey party. He will inform the OC troops when there is no more than the maximum permissible depth of water.
- (c) The OC troops, on receipt of this report, will immediately give the order to drive off.

78. Where causeway or other bridging equipment is to be used to discharge LST, the following procedure should be adopted :—

- (a) The first lieutenant, stationed at the control station above the forward end of the tank deck, will be in contact with another of the ship's officers stationed on the foc'sle head, who will be supervising the bringing of the causeway to the ship and securing it in position. As soon as that operation is completed, the ship's officer on the foc'sle head will inform the first lieutenant at the control station that ramp and causeway are in position and ready for disembarkation to commence.
- (b) The first lieutenant will then, and only then, switch the coloured light above the ramp-door to green, as the signal for the tank deck vehicles to drive off.

79. In the procedures detailed in paragraphs 77 and 78 above, the first lieutenant of the LST normally exercises a general supervision over the unloading of his ship, in conjunction with the ship's AMLO (if appointed).

Vehicles will be driven off in accordance with detailed instructions laid down in Combined Operations Pamphlet No. 31—Driving Instruction for Combined Operations. When trailers are accompanied by personnel, these personnel must be prepared to manhandle the equipment at any stage during the disembarkation. This especially applies if a sandy foreshore has to be crossed. Pushing parties to assist vehicles will be provided by the beach group, but all ranks must be prepared to assist.

Unloading of vehicles from LST

80. **Provision of beach road mats**—Tanks are liable to dig a hole some six feet inshore of the end of the ramp. Fresh, unpitted ground may sometimes be found for disembarkation by moving the ship forward up the beach or by finding a new position for the ramp by a slight swinging of the vessel. To avoid pitting, the later models of LST(2) carry a length of cyclone track immediately inside the bow door. This can be pulled out by a bulldozer. It is difficult, however, to get it back into the tank deck. An alternative roadway, a short length of which can be carried if required, can be made up as follows:—

10ft lengths of 2in tubular scaffolding can be fastened together at 1ft centres by SWR or cordage. On either side of this, coir matting should be securely fastened.

The laying of such a roadway is an army responsibility.

If beach road mats are not available, the playing of fire mains on a soft sand beach has a binding effect.

81. **Time required for discharge**—All tanks and vehicles on the tank deck can be discharged ashore in under ten minutes. Vehicles should be kept moving forward during discharge to hold the bows down. Vehicles on the upper deck must be lowered to the tank space by the lift. The guides to this lift cannot be fitted however until the larger vehicles and tanks have been discharged. The fitting of these guides takes about $4\frac{1}{2}$ minutes, after which the lift will transfer one vehicle every $2\frac{1}{2}$ minutes so that the rate of discharge is decreased. On a shallow beach, ramp extensions will have to be fitted, to reduce the drop at the foot of the ramp. See paragraph 71.

82. **Discharge of heavy towed loads**—When heavy towed loads, such as Jahn trailers, are driving down the ramp of LST grounded on a beach, a vehicle should be attached behind the trailer in the LST by a rope, and used as a brake. If this is not done, there is a danger of the trailer taking charge and forcing the prime mover down the ramp sideways, forming a jam at the bottom of the ramp. If the trailer is fitted with brakes, these should be employed while moving down the ramp, but released in time to enable the prime mover to drive properly through the water.

83. Whenever there is a delay in disembarking vehicles, those on the upper deck should continue to be brought down and stowed on the tank deck, ready to leave when traffic permits. If a dry-shod landing has been achieved, the crews of all vehicles waiting their turn to land, should start stripping water-proofing, thereby saving time in the beach transit areas ashore.

84. **Necessity for drivers to proceed down ramp at slow speed**—Tank and other vehicle drivers will drown their engines unless they proceed down the ramp at a reasonably slow speed to avoid splash effect; but the speed must be fast enough to prevent the engine from stalling or choking when the throttle is opened.

Unloading of stores by amphibians

85. **Loading of amphibians**—Amphibians can be successfully loaded and unloaded from the LST while at sea. Full details are given in Combined Operations Pamphlet No. 30—Employment of Amphibians.

86. **Unloading of stores carried on LST(2) by amphibians**—Stores may be carried either on the tank deck or on the upper deck of LST(2). When stores are carried on the tank deck, and if the ship is beached and discharged by means of amphibians (or motor transport if there is no water gap), only two of the amphibians or vehicles can be loaded simultaneously. LST carrying stores in the tank deck will normally be supplied with roller runway to assist in moving stores to the door, and also for transferring the upper tiers of stores into vehicles.

87. When stores are stowed on the upper deck of LST, they will normally be placed where it is difficult to stow vehicles. When discharging stores from the upper deck of LST it is possible to load five amphibians simultaneously on the tank deck, two amphibians being loaded by 25 or 30ft. wooden chutes from the after hatch and three by the elevator, as shown in the diagram at Appendix M. The loading time for the five amphibians should be about 12 minutes.

Amphibians can enter the tank deck of beached LST in almost any weather conditions in which it is safe for LST to beach. In favourable weather conditions amphibians can also, by the above method, discharge LST lying off-shore.

The LST(3) will carry a 5-ton mobile crane which will assist the discharge of heavy or awkward stores.

88. **Use of the 25ft or 30ft wooden chute**—By use of 25ft or 30ft wooden chute, stores can be slid gently down from aft on the upper deck into the amphibian, landing with considerably less force than if they were lowered by derrick or crane.

89. **Safety precautions when launching amphibians off the ramp**—An efficient safeguard when swimming amphibians off the ramp is to lead a wire from the bow fairlead of the LST. The end of the wire is taken down and secured to either the bow or stern of each amphibian (depending on whether it disembarks bow or stern first) before the amphibian goes down the ramp. The length of the wire should be adjusted so that it takes the weight of the amphibian just before it becomes water-borne. This wire will prevent the amphibian from plunging too deeply, and will assist it at the most critical moment when it becomes water-borne. This procedure adds little to the time of discharge and should be used when disembarking amphibians whenever the sea is anything but quite calm. Notes on launching amphibians from LST are given in Appendix N.

SECTION 7—USE OF LST FOR EVACUATION OF CASUALTIES

Use of modified LST(2) to take stretchers

90. A number of LST(2) have been fitted for the evacuation of casualties from beaches. The modifications necessary for this purpose are :—

- (a) The fitting of three-tier stretcher racks along the port and starboard tank deck sides. These will take 120 stretchers and can be swivelled flat against the side when not in use.
- (b) The fitting of a steriliser and sink (with water laid on) on the after bulkhead of the tank deck.
- (c) The provision of special lighting and fittings to take curtains so that a portion of the after part of the tank deck can be screened off for use as an emergency operating theatre.
- (d) Where the casualty evacuation plan includes the hoisting aboard of casualties in six-stretcher frames from amphibians alongside, it will be necessary to provide a mobile crane to operate from the upper deck of the LST(2).

91. On tidal beaches it will rarely be possible to load into LST dryshod, and there will normally be a water gap. The best method of evacuating casualties from a beach to LST(2) is by DUKW or LVT.

The use of a six-stretcher frame loaded into a DUKW or LVT greatly reduces both the manhandling of the patient and the loading time. The stretcher cases can then be embarked into the LST (2) by driving the amphibian either into the tank deck, or if fitted with a six-stretcher frame, alongside, and unloading it by a mobile crane on the upper deck.

With the former embarkation is made easier if the forward tanks of the LST are flooded and the end of the ramp submerged. A movable ramped platform about 4ft. 6in. high, carried in the tank deck, will facilitate unloading.

92. If the six-stretcher frames are being used, they should be arranged in two rows of 18 and secured to the deck. The patients can then remain on the tank deck for the whole voyage. In this way a total of 336 patients can be accommodated, 216 in the six-stretcher frames and 120 in the stretcher racks along the tank deck sides.

If single stretchers only are being used, 120 of these can be carried in the stretcher racks at the sides of the tank deck, and an additional 80 can be accommodated on the floor of the tank deck provided that they are securely lashed down.

A number of walking wounded can be accommodated in the troop decks, but if a full load of stretcher cases is being carried, the number of walking wounded should not exceed 50.

93. These modifications entail no loss of vehicle stowage space in the tank deck.

94. LST fitted for the evacuation of casualties are not marked with the Red Cross, since on the outward passage they will perform their normal function.

SECTION 8—CARRIAGE OF LCT ON LST**Carriage of LCT(5) or (6) on upper deck of LST(2) or (3)**

95. **General**—One LCT(5) or (6) can be carried on and launched from the upper deck of a LST(2) or (3) and this has been found a practical method of transportation for an ocean passage to the scene of operations. This method, however, entails reduction in the normal MT or stores lift of the LST since, if a LCT is carried, no MT and only a very small quantity of stores can be accommodated on the upper deck.

96. **Hoisting the LCT aboard LST**—To hoist a LCT, complete, aboard a LST a crane of 125 tons is required. If cranes of this capacity are available at both ends of the voyage, it is possible to hoist a LCT directly on to blocks on the upper deck of the LST, secure it for sea, and then hoist it off at the end of the voyage.

If a 125-ton crane is not available, a LCT can be broken up into three parts, each of which may be hoisted aboard separately by a 50-ton crane. This is the best method for carrying the maximum number of LCT aboard a given number of LST, as in this way five sections of LCT may be carried aboard each LST.

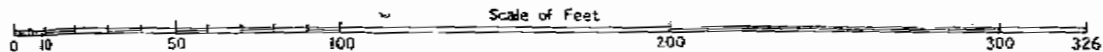
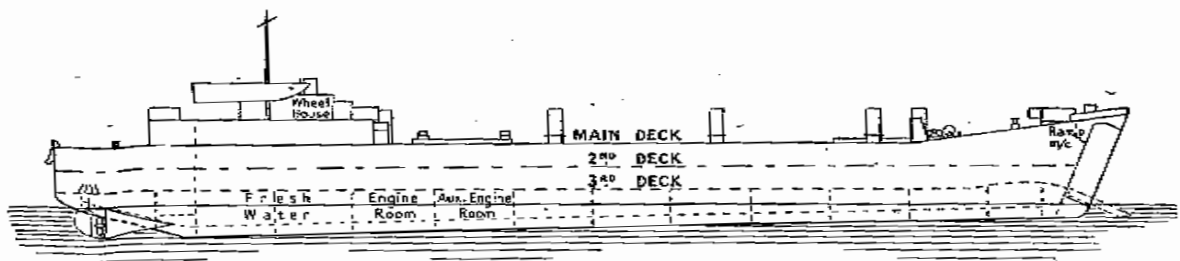
97. **Crew required for launching**—A launching crew should consist of two officers and twenty men.

98. **Launching**—Launching is carried out by heeling the LST to an angle of $11\frac{1}{2}$ degrees. The LCT will then, when released, launch herself.

It is probable that, with an inexperienced crew, the entire launching operation from the start until the cradle has been removed will require six to ten hours and the operation should commence soon after sunrise so as to have the maximum number of daylight hours available.

LST (2) - PROFILE

APPENDIX A



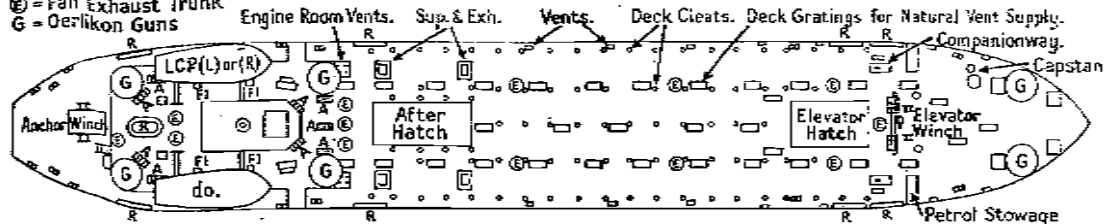
PLAN OF LST(2)-TOP AND SECOND DECKS

APPENDIX B

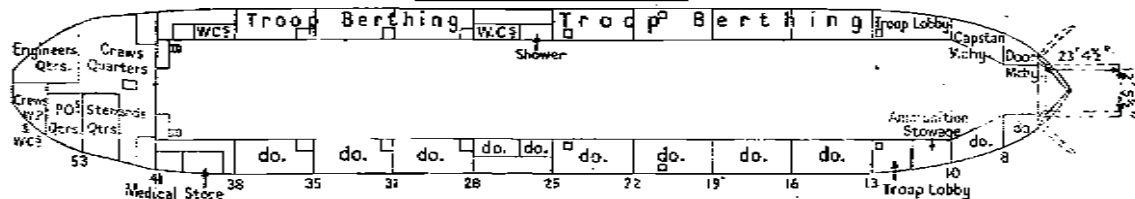
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- F = Fan Intake Trunk
- ⊖ = Fan Exhaust Trunk
- G = Oerlikon Guns

R = Life Raft

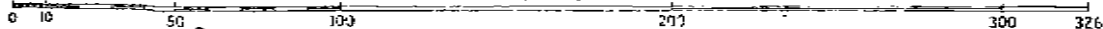
PLAN OF TOP DECKS



PLAN OF SECOND DECK



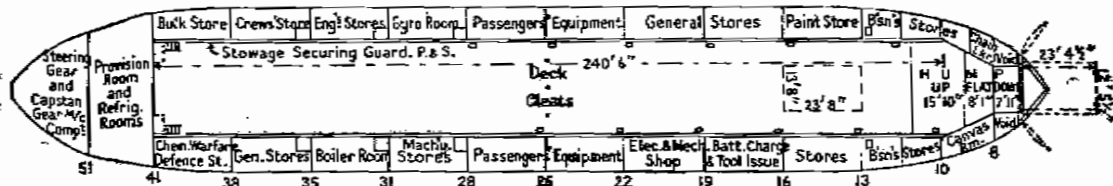
Scale of Feet



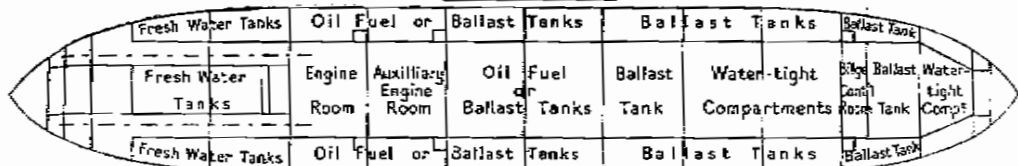
PLAN of LST (2) - THIRD (OR TANK) DECK AND HOLD

APPENDIX C

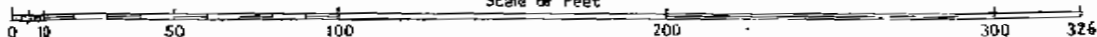
PLAN OF THIRD OR TANK DECK



PLAN OF HOLD



Scale of Feet



APPENDIX D

DIMENSIONS, SPEED AND RANGE OF LST

	LST(1) Maracaibo Class	LST(2)
Length (overall)	383ft	327ft 9in
Beam	64ft	50ft 1½in
Mean draught (a) Fully loaded	10ft 8in	11ft 2in
(b) In beaching condition	9ft 7in	6ft 3½in
Displacement (light)—long tons	3,500	1,468
Gross tonnage—long tons	4,890	3,371
Speed maximum fully loaded	10 knots	10 knots
„ economical cruising speed fully loaded	8 „	8½ „
Range at maximum loaded speed	6,000 miles	12,000 miles
„ at economical cruising speed, loaded	7,200 „	15,000 „
Dimensions of tank deck, storage space ...	Two wings 223ft by 16ft Centre 128ft by 32ft	273ft by 28ft 4in

APPENDIX E

NAVAL COMPLEMENT,
ARMAMENT AND CRAFT CARRIED IN LST

1. Naval complement of LST

	LST(1)	LST(2)	LST(2) When employed as ship of captain LST	LST(2) When employed as ship of commander LST
	'Maracaibo'			
Officers	14	5	13	9
Ratings	84	64	73	72

2. Armament of LST

	Bachaquero	Misoa	Tasajera
LST(1)	3 2-pounders	26 Oerlikons	8 Oerlikons
'Maracaibo'	2 4 inch mortars	(on 13 twin	(4 twin mountings)
Class	6 Oerlikons 20mm	mountings)	3 Oerlikons
		2 4 inch smoke	(single mountings)
		mortars	2 4 inch smoke
LST(2)	6 20mm. Oerlikons		mortars
	1 12-pounder (sited aft)		
	4 PAC (parachute and cable).		

3. Protection of LST

LST(1) 'Maracaibo'	Steel (DIHT) screens to guns and canopy to engine-room skylight. Plastic armour to compass platform and bridge.
Class	
LST(2)	Steel (15)bs STS) screens to guns, steering position and conning tower.

4. Craft carried in each type

LST(1) 'Maracaibo'	2 (hoisted by derricks).
Class	
LST(2)	2 or 6 LCP(R) or LCV(P)—Depending on whether ship is fitted with 2 or 6 davits. 1 LCT(5) or (6) at expense of MT on deck (see paragraph 98).
	Note: DUKWs can also be carried at davits of LST(2), but must be unladen.
LST(3)	2 x 36 foot harbour launches at gravity davits, or 2 LCA in lieu for operations. 8 LCA in chocks hoisted at derricks. 1 LCT(5) or (6) at expense of MT on deck.

APPENDIX F

REPAIRS AND MAINTENANCE FACILITIES IN LST

1. **Maracibo Class**—These ships have no proper workshop, but are fitted with a power operated drilling machine and grindstone.

2. **LST (2)**—Some of these ships are equipped with a small workshop and in some cases machine tools such as electric pedestal drilling machines and electric bench grinders are provided; in addition, flotilla leaders also carry a lathe.

Oxy-acetylene welding equipment (cutting and burning) is also carried, and battery charging equipment is fitted for the charging of tank batteries.

APPENDIX G

MESSING, PROVISIONS AND FRESH WATER VICTUALLING ARRANGEMENTS UNDER OPERATIONAL CONDITIONS FOR TROOPS EMBARKED

1. The Navy is responsible for messing on voyage (sea passage ration) and for emergency provisions (voyage ration—ship's reserve) for the troops embarked.

(The terms "sea passage ration" and "voyage ration—ship's reserve" are the army equivalents of the naval terms "messing on voyage" and "emergency provisions" and should be employed in correspondence with army authorities).

2. **Messing on voyage (sea passage ration)**—It is the responsibility of the naval authority concerned to ensure that, before the commencement of exercises or operations, the stocks of provisions normally carried are augmented, sufficiently to provide a satisfactory standard of messing for army personnel for the maximum period during which they are likely to be embarked.

3. **Emergency provisions (voyage ration—ship's reserve)**—Emergency provisions carried under operational conditions should be sufficient for a minimum of three days for the total number of personnel borne and embarked for passage, the stocks normally being adjusted as necessary on this basis.

4. **Water**—Ships should carry sufficient water to provide during the anticipated period of passage, plus three days, one gallon per man per day for each person embarked. Stocks should be kept topped up to maximum capacity consistent with the requirements of the correct beaching draft.

5. **Bedding**—Army personnel when embarked for passage, and naval personnel embarked solely for passage, will be provided, on loan, with bedding from naval resources on the following scale :—

1 Hammock (marked) with clews and lanyards

3 Brown blankets (marked)

(NOTE.—The above are issued to army personnel for the period of the voyage only and must not be taken off the ship by the troops when disembarking).

6. **Vomit bags**—These will be issued to army personnel embarking for passage by the army authorities. Spare bags are carried by the ship.

7. **Lifebelts**—These will also be issued to army personnel embarking for passage by the army authorities.

8. **RAF personnel**—Wherever army personnel are mentioned in the above paragraphs, the same arrangements will also apply to RAF personnel.

9. **Officers' messing**—Army, RAF and Dominion officers, when embarked in HM ships for operations, will be victualled and will pay the usual mess subscription, except during periods when operational conditions render it impracticable for mess bills to be rendered and collected. Under such conditions, the allowance authorised in KR AND AI ARTICLE 1696 will be credited to the mess concerned and no mess subscription charged.

10. Food stowage and fresh water

Maracaibo Class

(a) Food stowage :—

Meat for 40 days.

Vegetables for 14 days.

Refrigerated space for 6,000 lbs. of meat.

Dry stores including flour for 90 days.

Maximum daily baking capacity 300 lbs.

(b) Fresh water :—

In tanks for domestic use 380 tons.

Distillation plant capacity 2 to 3 tons per day.

LST (2)

Meat (boneless) for 90 days (approx.).

Potatoes for 21 days.

Green vegetables for 14 days.

Dry provision including flour for 90 days.

In tanks for domestic use 448 tons.

Distillation capacity nil.

APPENDIX H

ACCOMMODATION IN LST FOR PERSONNEL AND VEHICLES

1 Accommodation in each type

(a) **Naval personnel**—All types of LST have accommodation for naval personnel as per complement. Any increase in naval personnel carried involves a corresponding reduction in the accommodation available for army personnel.

(b) **Military personnel**

'Maracaibo' Class	LST(2)
12 officers and 195 other ranks	12 officers and 165 other ranks

NOTE :—In LST(2) the maximum number of personnel to be embarked for over 48 hours in fine summer weather should not exceed 300 to 350. Up to 500 could be embarked for short sea voyages such as cross-channel passages.

(c) **Considerations affecting numbers embarked**

- (i) Each prime mover should have two drivers.
- (ii) Fighting vehicles need full crews.
- (iii) Guns should be accompanied by detachments.
- (iv) (i) above should be reduced to one driver rather than affect (ii) or (iii).

These considerations must be taken into account by planners.

2. Capacity in tanks and vehicles

(a) **LST(1) 'Maracaibo' Class**

(i) Port wing space	9 Sherman or 9 Churchill tanks	} Cannot be accommodated if equipped for 6ft wading.
(ii) Starboard wing space	" " " " " "	
(iii) Marshalling space	4 Sherman or 4 Churchill tanks (alternatively vehicles or guns may be carried in the above spaces).	
(iv) Centre space	11 low vehicles, such as carriers.	

(b) **LST(2)**

- (i) Tank deck 20 Sherman or 18 Churchill tanks, 20 3 ton vehicles or proportionate number of vehicles or guns according to size.
- (ii) Upper deck 21 laden 3 ton GS lorries and one 15-cwt. GS truck or proportionately greater number of smaller vehicles or guns according to size.

3. Restrictions as to size and height of vehicles in LST

(a) LST(1) 'Maracaibo' Class

(i) Width of ramp	10ft
(ii) Height in wing and marshalling space	8ft 6in
(iii) Height in centre space	7ft forward decreasing to 5ft aft

(b) LST(2)

(i) Width at bow door entrance	13ft
(ii) Height at entrance	14ft
(iii) Tank deck height	12ft
(iv) Height at lift entrance on tank deck	12ft
(v) Capacity of lift	10 tons
(vi) Dimensions of hatches:—	
After hatch	29ft 6in x 12ft 6in
Elevator hatch	23ft 8in x 13ft 8in

4. Notes on restrictions to size and height of vehicles in LST(2)

- (a) The effective size of the lift to the upper deck is 23ft. 6in. by 13ft. 6in., and no vehicle intended for upper deck stowage must exceed these dimensions.
- (b) The lower deck of LST(2) has a restricted clearance, and tank crews must be warned to lower the 2.5in turret guns as far as possible.
- (c) In traversing the upper deck, Bren carrier drivers must exercise great care that their tracks do not run over, and so damage, the ventilator covers.
- (d) High vehicles, such as 3-ton breakdown lorries, should not be loaded on the upper deck, owing to lack of clearance between the top of the breakdown lorry and the upper deck when the breakdown lorry mounts the base of the elevator.
- (e) Tank transporters should be loaded only with light equipment or stores. If tanks, or heavy equipment with a high centre of gravity are loaded, there is risk of the load shifting while coming down the ramp, or of the vehicle being damaged seriously in the event of over-articulation.
- (f) 3-ton GS lorries can be stowed three abreast on the tank deck, and vehicles can be stowed five abreast on some parts of the upper deck, provided at least one of the five rows consists of small vehicles. This close stowage, although it allows more vehicles to be carried, is not ordinarily recommended. The very exact manoeuvring of the vehicles required to get them into place considerably retards loading and unloading, and the close stowage resulting causes congestion on board, and somewhat interferes with the efficient working of the ship, so that access to the vehicles and passage of personnel along the decks becomes difficult.

- (g) With the use of shore cranes either hatch can be used for loading or discharge, but as the elevator platform rests on the tank space below, this must be strengthened if it is intended to place weights exceeding ten tons on it.
- (h) The ramp lowers to the maximum angle of 23.4° below the horizontal. With its end supported on a hard or beach, it will carry a weight of 50 tons, but if it is supported by its chains only the maximum load is 30 tons.
- (j) The use of garage jacks to assist in close stowage of vehicles is described in paragraph 32.

5. Later types of LST(2)—Provision of ramp from tank deck to upper deck in place of elevator—Later types of LST(2) will have a ramp from upper deck to tank deck in place of elevator. The ramp slopes up from the forward end of the tank deck and pivots at the after end and can be hoisted clear of the tank deck when tanks embark. A 15-ton derrick is also stowed on the starboard side of the after superstructure to plumb the after hatch.

The substitution of the ramp in place of the elevator makes no difference to numbers or dimensions of vehicles which can be embarked as compared with the elevator fitted LST(2), except for long wheel based vehicles, which if stowed in the tank deck, would foul the small projection under the deck ramp when going over the hump.

6. Clearance in LST(2) fitted with ramp from tank deck to upper deck in place of elevator—

- (a) Headroom for vehicles stowed on tank deck is 12ft. 1in. (as in elevator fitted LST(2)).
- (b) Headroom for vehicles passing down the ramp from upper deck is 11ft. 3in.
- (c) Headroom for tanks and vehicles lowered through ramp stowage hole and travelling aft is 10ft. 9in.

APPENDIX J

SPECIMEN DETAILS FOR INCLUSION IN OC TROOPS
ORDERS IN LIST

1. The.....(Unit) will have port berthing accommodation.
The.....(Unit) will have starboard berthing accommodation.
2. Lifebelts will be drawn at..... hrs. (as soon as possible after embarkation).
3. There are ten Carley floats. Port side even numbers (2-4-6-8-10) starboard side odd numbers (1-3-5-7-9). At the earliest opportunity the OC troops will divide army personnel into ten equal groups, each group detailed to a Carley float. These floats will always be the army's emergency station.
4. When at sea, lifebelts will always be worn.
5. Owing to the smallness of the ship's crew, the Army will, if possible, man the two for'd Oerlikons continuously (personnel doing this should be detailed to 1 and 2 Carley floats). Light machine guns will also be a great asset to the ship's anti-aircraft defence.
6. Army food will so far as possible be prepared in ship's galley by ship's cooks with assistance as necessary from military cooks.
Meal times for army personnel will be as follows : 0800, 1300, 1530 and 1800 hours.

Mess traps and blankets can be supplied to army personnel embarked as passengers on loan from the ship. NCOs are to make application to the OC troops. NCOs are responsible for seeing that all items are returned to the OC troops, for return to the ship prior to disembarkation.

Failure to return items prior to disembarkation will involve the cost of the items being recovered from the individuals concerned.

7. Upper deck to be swept down by Army. Bedding of men sleeping on upper deck to be cleared by 0700 hrs. Upper deck is to be swept down by 0800 hours each morning and half an hour after each meal.

8. Troop decks will be cleaned up by 1000 hours and 2030 hours each day and clear of troops for inspection by the First Lieutenant and the Orderly Officer detailed by OC troops.

9. The tank deck is out of bounds at all times at sea, except to men on duty or by special permission.

10. Smoking—Smoking is prohibited at all times in the tank deck and within 30 feet of upper deck transport or anywhere on the upper deck after "darken ship" has been piped.

Smoking is permitted elsewhere and on troop decks.

11. Watertight doors—All doors marked "X" will be kept closed with all clips on at night; those marked "X^k" will have the two marked clips on.

Parties detailed by OC troops

12. Fire picquets will be posted in the control room and at the after end of tank deck. (This duty will be carried out the whole period of transit).

13. One NCO and two men are detailed to each fire main on upper deck. (3 starboard side, 3 port side) which will be manned at "Action stations" and "Fire stations."

14. One NCO and eight men are detailed for damage control. (They will muster in the galley flat at "Action stations" and "Fire stations").

15. The following system of alarms is in force on board—

(a) Action Stations—

(i) For air attack, a succession of short rings on the alarm bell; all personnel will remain under cover as far as possible below decks in compartments with escape hatches, or direct access to upper deck.

(ii) For submarine attack a continuous ringing of the alarm bell; all troops will stand by their army emergency stations. (It must be noted that this signal is to stand by the Carley Floats and not to abandon ship).

(b) Fire Stations—a prolonged ringing on the fire bell, situated in the galley flat.

Water economy

16. The strictest economy will be exercised with regard to the use of fresh water.

APPENDIX K

NOTES ON THE TOWING OF THE RHINO FERRY BY LST

1. The Rhino is very heavy and dead on tow, but is docile and follows round corners easily.

2. On the other hand, the tug is extremely lively, and bobs about and snatches at its tow. Tug and Rhino are not suitable companions on the same tow. The two together are also most unhandy to bring alongside on arrival at the destination.

3. It is not a practical proposition for Rhino or tug crews to remain on board except on a short passage. There is no protection and they are quite helpless should the tow part, being without compass or chart or facilities to use them, besides being a source of anxiety to the commanding officer of the LST towing.

4. A long tow 80 to 90 fathoms is necessary and convenient. It is essential, however, that speed and/or drum tension is adjusted so that the tow is always kept in the water.

5. The Rhino tows well on an 8in manilla hawser, but this cannot be used conveniently in LST(2). In LST(2) the 6½in kedge wire is suitable, but a manilla spring, with slips and swivel is most necessary. (See detailed recommendations below).

6. LST towing Rhinos should be routed so as to obtain the maximum benefit from favourable tidal streams.

7. Passage speeds on tow are unlikely to exceed 6 knots in fine weather and 4 knots in moderate weather.

Time must also be allowed on arrival for stopping, getting the Rhino alongside, transferring the crew and warming up the engines.

8. Any extra weight on the Rhino will add to the difficulty of towing, and cut down speed. It is considered that 30 tons should be the maximum dead weight allowed, i.e. a bulldozer and crane or a bulldozer and two 3-tonners.

9. For towing, the Rhino ramps should be triced up as far as they will go, i.e. about 45 degrees, and chocked up by a large cross timber underneath, the whole being lashed immovably. Time required for this is about 2 hours. A tackle is also required to trice the ramps right up.

10. Outboard engines should be wound up to the extreme vertical position for passage.

11. Engines should be covered with tarpaulins securely lashed down, or else waterproofed.

Towing arrangements recommended

12. Rhinos—The Rhino towing span consists of two legs of about 15 fathoms joined to a monkey face.

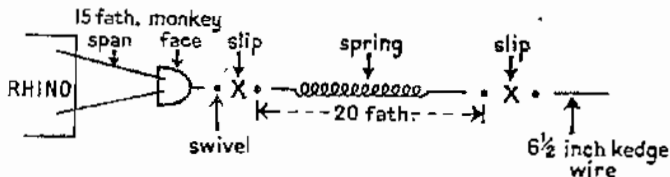
13. The following additional gear is required between the monkey face and the eye of the LST's $6\frac{1}{2}$ inch kedge wire.

(a) A 20 fathom spring, consisting of 12in or 14in manilla (10 fathoms) with a 5-fathom wire pendant ($6\frac{1}{2}$ in or equivalent) at each end.

(b) A swivel piece.

(c) Two towing slips, with towing shackles as necessary.

14. The intended arrangement is as shown below :



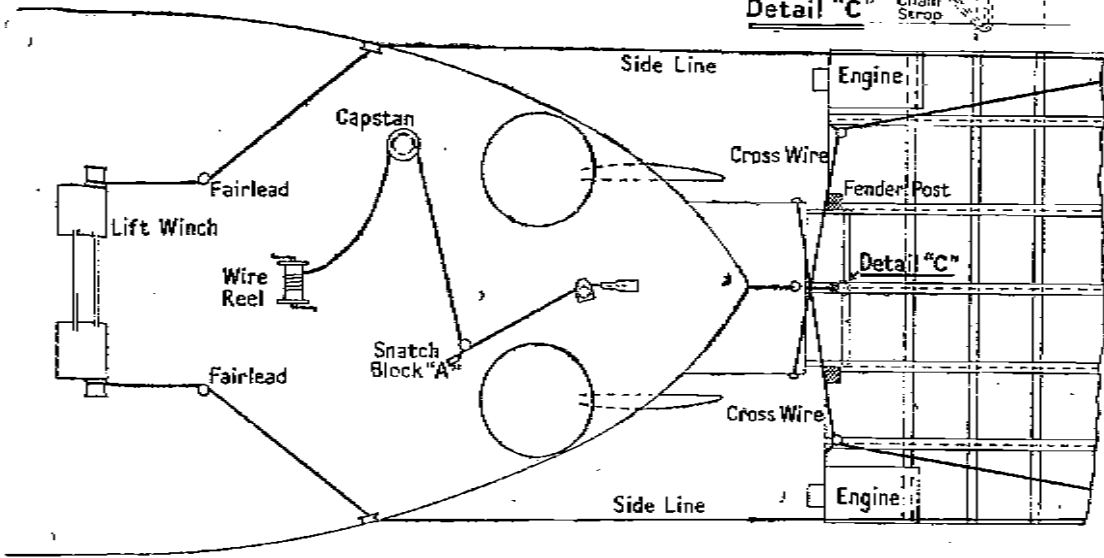
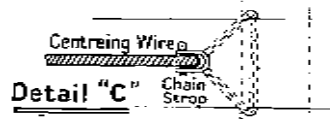
15. The object of two slips is to enable tow to be cast off readily when required, either from the Rhino or the LST. Gear is available to under-run the tow on board the Rhino. (Delay is caused by shackles.)

16. If LST(1) are required to tow Rhinos, 8in manilla with at least 90 fathoms veered is suitable. Stern kedge wires cannot be used without additional fairlead fitting, as these ships have no arrangement for hanging the stern anchor.

17. Tugs—It is recommended that tugs be towed, if necessary in tandem, by trawlers or corvettes accompanying the LST with the Rhinos. A $3\frac{1}{4}$ in wire should be sufficient.

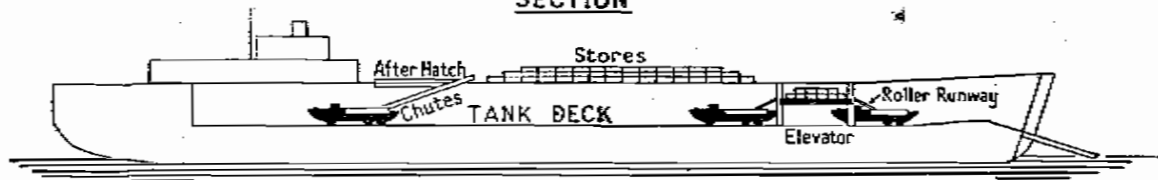
APPENDIX L

RHINO FERRY COUPLED TO LST (2)



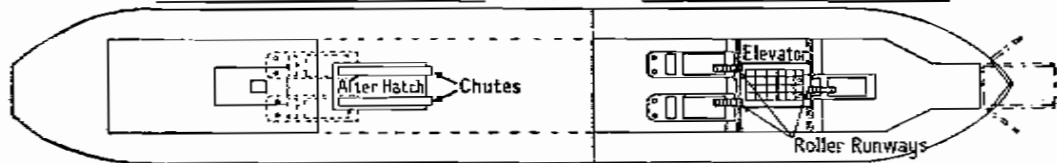
DISCHARGE OF STORES FROM LST (Mk 2) BY AMPHIBIANS APPENDIX M

SECTION



HALF PLAN - UPPER DECK

HALF PLAN - TANK DECK



Scale of Feet 10 50 100 150 200

APPENDIX H.

NOTES ON LAUNCHING AMPHIBIANS FROM LST

Launching in a swell

1. When launching amphibians in a swell, the LST should manoeuvre so that she is stern on to the sea, and then go slow astern with her ramp doors fully open. This will help to break up the sea or swell.

2. The LST ramp should be fully lowered on to the ramp chock, and the ramp chains should be left slack to avoid the risk of their parting under the strain.

3. Strong steel springs can be inserted in LST ramp chains to provide them with an extra amount of "give".

4. To recover the ramp in case the chains part in heavy seas, a recovery wire can be rigged from the centre of the ramp, and led through a block in the bows to the foc'sle winch. The height of the recovery wire must be kept out of the way during the discharge of amphibians or vehicles.

Emergency launching of amphibians without the use of LST ramp

5. If the ramp hinges get strained and cannot be worked, LST can still launch those amphibians which are loaded on the tank deck.

The LST can manoeuvre under the lee of a transport, or any convenient ship which provides enough shelter, and hoist the amphibians outboard through the lift opening.

