

NR-12957
COMBINED OPERATIONS STAFF NOTEBOOK

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COMBINED OPERATIONS
STAFF NOTEBOOK

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COMBINED OPERATIONS STAFF NOTEBOOK

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ABBREVIATIONS USED IN COMBINED OPERATIONS

1	Advanced beach signal station	ABSS
2	Advanced landing ground signal section ..	ALGSS
3	Air support signals unit	ASSU
4	Assault force gunnery officer	AFGO
5	Assault signal office	ASO
6	Assistant beachmaster	ABMr
7	Assistant military landing officer	AMLO
8	Assistant military landing officer (ship) ..	AMLO(Ship)
9	Assistant sea transport officer	A/STO
10	Assistant staff officer bombardment ..	A/SOB
11	Beach dressing station	BDS
12	Beach maintenance area	BMA
13	Beachmaster	BMr
14	Bombardment calling wave	BCW
15	Bombardment control headquarters	BCHQ
16	Bombardment liaison officer	BLO
17	Bombardment liaison wave	BCW
18	Bombardment Spotting Instructions ..	BSI
19	Chief bombardment liaison officer	CBLO
20	Chief of Combined Operations	CCO
21	Combined Operations bombardment unit	COBU
22	Combined Operations experimental estab- lishment.	COXE
23	Combined Operations Headquarters	COHQ
24	Combined Operations pilotage party	COPP
25	Combined Operations stores depot	COSD
26	Combined training centre	CTC
27	Commander bombardment units	CBU
28	Commander naval bombardment	CNB
29	Commando	Cdo
30	Deputy naval officer in charge	D/NOIC
31	Deputy senior officer assault group	D/SOAG
32	Director of Combined Operations	DCO
33	Flotilla Officer	FO
34	Forward observation officer	FOO
35	Forward observer bombardment	FOB
36	Landing craft obstruction clearance unit	LCOCU
37	Landing craft recovery unit	LCRU
38	Landing ship tank pontoon barge unit ..	LSTP/BU
39	Main beach signal station	MBSS
40	Military landing officer	MLO
41	Mobile base maintenance unit	MBMU
42	Mobile bombardment communications unit	MBCU

Abbreviations for Combined Operations—contd.

43	Mobile land repair unit	MLRU
44	Mobile landing craft advanced base ..	MOLCAB
45	Mobile naval air base	MONAB
46	Naval commander assault force	NCAF
47	Naval beach commando	NBC
48	Naval beach signal section	NBSS
49	Naval liaison officer bombardment ..	NLOB
50	Naval lighterage pontoon	NL pontoon
51	Naval officer build-up	NOBU
52	Naval officer in charge	NOIC
53	Naval section bombardment troop ..	NSBT
54	Naval section bombardment unit	NSBU
55	Operation signal equipment depot ..	OSD
56	Principal beachmaster	PBMr
57	Principal military landing officer	PMLO
58	Royal Air Force landing officer	RAFLO
59	Senior bombardment liaison officer ..	SBLO
60	Senior officer administrative and build-up group.	SOBG
61	Senior officer assault group	SOAG
62	Senior officer ferry craft	SOFC
63	Senior officer landing ship tank group ..	SOLSTG
64	Senior officer naval detachment and naval liaison officer (transport).	SOND and NLO(T)
65	Senior officer support squadron	SOSS
66	Special boat section	SBS
67	Squadron gunnery officer	SGO
68	Staff officer (bombardment)	SOB
69	Tank unit landing officer	TULO
70	Unit deployment officer	UDO
71	Unit landing officer	ULO

ABBREVIATIONS FOR LANDING SHIPS, CRAFT AND BARGES, AMPHIBIANS AND AIRCRAFT

	<i>Title</i>	<i>Short Title</i>
LANDING SHIPS		
1	Landing ship, carrier (derrick hoisting) ..	LSC
2	Landing ship, dock	LSD
3	Landing ship, emergency repair	LSE
4	Landing ship, emergency repair (landing craft).	LSE(LC)
5	Landing ship, emergency repair (landing ship).	LSE(LS)
6	Landing ship, fighter direction	LSF
7	Landing ship, gantry	LSG
8	Landing ship, headquarters (command) ..	LSH(C)
9	Landing ship, headquarters (large) ..	LSH(L)
10	Landing ship, headquarters (small) ..	LSH(S)
11	Landing ship, infantry (large)	LSI(L)
12	Landing ship, infantry (medium)	LSI(M)
13	Landing ship, infantry (small)	LSI(S)
14	Landing ship, infantry (hand hoisting) ..	LSI(H)
15	Landing ship, medium	LSM
16	Landing ship, personnel	LSP
17	Landing ship, tank	LST
MAJOR LANDING CRAFT (U.S. LANDING CRAFT)		
18	Landing craft, administration	LCQ
19	Landing craft, flak	LCF
20	Landing craft, gun (large)	LCG(L)
21	Landing craft, gun (medium)	LCG(M)
22	Landing craft, gun (tower)	LCG(T)
23	Landing craft, headquarters	LCH
24	Landing craft, infantry (large)	LCI(L)
25	Landing craft, infantry (small)	LCI(S)
26	Landing craft, support (large) mks II and III).	LCS(L) (2) and (3).
27	Landing craft, support (rocket)	LCS(R)
28	Landing craft, tank	LCT
29	Landing craft, tank (armoured)	LCT(A)
30	Landing craft, tank (emergency repair) ..	LCT(E)
31	Landing craft, tank (rocket)	LCT(R)
MINOR LANDING CRAFT (U.S. LANDING BOATS)		
32	Landing craft, assault	LCA
33	Landing craft, assault (hedgerow)	LCA(HR)
34	Landing craft, assault (obstruction clearance).	LCA(OC)
35	Landing craft, control	LCC
36	Landing craft, emergency repair	LCE
37	Landing craft, mechanized	LCM

Abbreviations for Landing Ships, Craft and Barges, Amphibians and Aircraft—*contd.*

	<i>Title</i>	<i>Short Title</i>
Minor Landing Craft (U.S. Landing Boats)—<i>contd.</i>		
38	Landing craft, navigation	LCN
39	Landing craft, personnel (large)	LCP(L)
40	Landing craft, personnel (medium)	LCP(M)
41	Landing craft, personnel (nested)	LCP(N)
42	Landing craft, personnel (ramped)	LCP(R)
43	Landing craft, personnel (small)	LCP(S)
44	Landing craft, rubber	LCR
45	Landing craft, support (large)	LCS(L)
46	Landing craft, support (medium)	LCS(M)
47	Landing craft, support (small)	LCS(S)
48	Landing craft, vehicle	LCV
49	Landing craft, vehicle (personnel)	LCV(P)

LANDING BARGES

50	Landing barge, vehicle	LBV
51	Landing barge, emergency repair	LBE
52	Landing barge, kitchen	LBK
53	Landing barge, oiler	LBO
54	Landing barge, water	LBW

AMPHIBIANS

55	Landing vehicle, tracked	LVT
56	Landing vehicle, tracked (armoured)	LVT(A)
57	Landing vehicle, wheeled	LVW

NOTES

(a) Since the final letter "s" has been used to indicate "small" when referring to landing craft, "s" is not used to indicate the plural.

(b) Australian landing craft are designated ALC followed by a number which denotes the type.

**Abbreviations for Landing Ships, Craft and Barges, Amphibians
and Aircraft—contd.**

	<i>Title</i>	<i>Short Title</i>
AIRCRAFT		
60	Air observation post	Air OP
61	Air/sea rescue	AS R
62	Coastal fighter	CF
63	Communication	COM
64	Fighter	F
65	Fighter bomber	FBR
66	Floatplane	FP
67	Flying boat	FBT
68	General reconnaissance	GR
69	Ground attack	GA
70	Heavy bomber	HB
71	Light bomber	LB
72	Medium bomber	MB
73	Night fighter	NF
74	Photographic reconnaissance	PR
75	Rocket projectile	RP
76	Single-engine fighter	SEF
77	Strategical reconnaissance	Strat R
78	Tactical reconnaissance	Tac R
79	Transport (long range)	T-LR
80	Transport (medium range)	T-MR
81	Torpedo spotter reconnaissance	TSR
82	Torpedo fighter	TF
83	Twin-engine fighter	TEF
84	Very long range	VLR

**Abbreviations for Landing Ships, Craft and Barges, Amphibians
and Aircraft—*contd.***

ABBREVIATIONS (US)

Aircraft carrier

- 1 Aircraft carrier .. CV
 2 Aircraft carrier
 (light) CVL
 3 Auxiliary aircraft
 carrier (escort) CVE
 4 Seaplane carrier .. CVS

Auxiliary

- 5 Administration
 flagship .. APF
 6 Advance base dock ABD
 7 Advance base sec-
 tional dock .. ABSD
 8 Aircraft carrier
 (escort) .. CVE
 9 Aircraft repair
 ship ARV
 10 Aircraft rescue
 vessel AVR
 11 Aircraft supply
 ship AKV
 12 Aircraft transport APV
 13 Airship tender
 (lighter than air) AZ
 14 Ammunition ship AE
 15 Artillery barge .. APB
 16 Base repair ship ARb
 17 Cable repairing or
 laying ship .. ARC
 18 Cargo, attack .. AKA
 19 Cargo ship .. AK
 20 Catapult lighter .. AVC
 21 Cavalry transport APC
 22 Coastal transport
 small APc
 23 Collier AC
 24 Combined Opera-
 tions communi-
 cations head-
 quarters .. AGC
 25 Crane ship .. AB
 26 Deep hold cargo
 ship AKD
 27 Destroyer tender AD
 28 Distilling ship .. AW
 29 Gasoline tanker .. AOG
 30 General stores
 issue ship .. AKS

A

- 1 AB Crane ship
 2 ABD Advance base dock
 (repair ship)
 3 ABSD Advance base sec-
 tional dock
 4 AC Collier
 5 ACM Auxiliary minelayer
 6 AD Destroyer tender
 7 AE Ammunition ship
 8 AF Provision storeship
 9 AFD Mobile floating dry
 dock
 10 AG Miscellaneous
 auxiliary
 11 AGC Combined Opera-
 tions communi-
 cations headquarters
 12 AGD Seagoing dredge
 13 AGL Lighthouse tender
 14 AGP Motor torpedo boat
 tender
 15 AGS Surveying ship
 16 AH Hospital ship
 17 AK Cargo ship
 18 AKA Cargo, attack
 19 AKD Deep hold cargo
 ship
 20 AKN Net cargo ship
 21 AKS General stores issue
 ship
 22 AKV Aircraft supply ship
 23 AL Lightship
 24 AM Minesweeper
 25 AMb Minesweeper,
 harbour
 26 AMc Minesweeper
 coastal
 27 AN Net laying ship
 28 AO Oil, or fuel oil
 tanker
 29 AOG Gasoline tanker
 30 AP Transport
 31 APc Coastal transport
 (small)
 32 APA Transport, attack,
 or landing ship,
 infantry
 33 APB Artillery barge
 34 APC Cavalry transport

Abbreviations (US)—*contd.***Auxiliary**—*contd.*

31	Heavy hull repair ship ..	ARH
32	Heavy machinery repair ship ..	ARM
33	High speed destroyer transport	APD
34	Hospital (ship) ..	AH
35	Labour transport or barrack ship	APL
36	Landing craft control, mark I ..	LCC(I)
37	Landing craft control, mark II ..	LCC(2)
38	Landing craft infantry (large) ..	LCI(L)
39	Landing craft mechanised, mark III	LCM(3)
40	Landing craft mechanised, mark VI	LCM(6)
41	Landing ship, dock	LSD
42	Landing ship, medium ..	LSM
43	Landing ship, tank	LST
44	Landing ship, vehicle ..	LSV
45	Lighthouse tender	AGL
46	Lightship ..	AL
47	Mechanised artillery transport ..	APM
48	Miscellaneous auxiliary ..	AG
49	Mobile dry dock	ARD
50	Mobile floating dry dock ..	AFD
51	Motor torpedo boat tender ..	AGP
52	Net cargo ship ..	AKN
53	Net laying ship ..	AN
54	Non-mechanised artillery transport ..	APN
55	Ocean tug (auxiliary) ..	ATA
56	Ocean tug (fleet)	ATF
57	Ocean tug (old) ..	ATO
58	Oil, or fuel oil tanker ..	AO
59	Provision store ship ..	AF

A—*contd.*

35	APD ..	High speed destroyer transport
36	APF ..	Administration flagship
37	APG	Supporting gunnery ship
38	APH	Transport fitted for evacuation of wounded
39	APL	Labour transport, or barrack ship
40	APM	Mechanised artillery transport
41	APN	Non-mechanised artillery transport
42	APP	Troop barge, class A
43	APR	Rescue transport
44	APS	Transport submarine
45	APT	Troop barge, class B
46	APV	Aircraft transport
47	AR	Repair ship
48	ARb	Base repair ship
49	ARB	Repair ship, battle damage
50	ARC	Cable repairing or laying ship
51	ARD	Mobile dry dock
52	ARDC	Repair dock, concrete
53	ARG	Repair ship, internal combustion
54	ARH	Heavy hull repair ship
55	ARL	Repair ship, landing craft
56	ARM	Heavy machinery repair ship
57	ARS	Salvage vessel
58	ARV	Aircraft repair ship
59	AS	Submarine tender
60	ASR	Submarine rescue vessel
61	ATA	Ocean tug (auxiliary)
62	ATF	Ocean tug (fleet)

Abbreviations (US)—contd.

Auxiliary—contd.	
60	Repair dock, concrete ARDC
61	Repair ship AR
62	Repair ship, battle damage ARB
63	Repair ship, internal combustion .. ARG
64	Repair ship, landing craft ARL
65	Rescue transport .. APR
66	Rescue tug ATR
67	Salvage vessel ARS
68	Seagoing dredge .. AGD
69	Seaplane tender .. AV
70	Seaplane tender (destroyer) .. AVD
71	Seaplane tender (small) .. AVP
72	Submarine rescue vessel ASR
73	Submarine tender AS
74	Supporting gunnery ship .. APG
75	Surveying ship .. AGS
76	Transport .. AP
77	Transport, attack or landing ship, infantry .. APA
78	Transport fitted for evacuation of wounded .. APH
79	Transport, submarine .. APS
80	Troop barge, class A APP
81	Troop barge, class B APT
82	Water tanker .. AWK

Battleship

83 Battleship BB

Cruiser

84 Battle cruiser .. CC
 85 Flying deck cruiser .. CF
 86 Heavy cruiser .. CA
 87 Large cruiser .. CB
 88 Light cruiser .. CL

A—contd.

63 ATO Ocean tug (old)
 64 ATR Rescue tug
 65 AV Seaplane tender (large)
 66 AVC Catapult lighter
 67 AVD Seaplane tender (destroyer)
 68 AVP Seaplane tender (small)
 69 AVR Aircraft rescue vessel
 70 AW Distilling ship
 71 AWK Water tanker
 72 AZ Airship tender (lighter than air)

B

73 BB Battleship

C

74 CA Heavy cruiser
 75 CB Large cruiser
 76 CC Battle cruiser
 77 CF Flying deck cruiser
 78 CG Coastguard vessels
 79 CL Light cruiser
 80 CM Minelayer
 81 CMc Minelayer, coastal
 82 CV Aircraft carrier
 83 CVE Auxiliary aircraft carrier (escort)
 84 CVL Aircraft carrier (light)
 85 CVS Seaplane carrier

D

86 DD Destroyer
 87 DE Escort vessel
 88 DL Destroyer leader
 89 DM Light minelayer
 90 DMS Minesweeper, high speed

I

91 IX Unclassified

Abbreviations (US)—*contd.***Destroyer**

- 89 Destroyer .. DD
 90 Destroyer leader.. DL
 91 Escort vessel .. DE

District craft

Barges—

- 92 Fuel oil .. YO
 93 Gasoline .. YOG
 94 Oil storage .. YOS
 95 Pontoon stowage YPK
 96 Sludge removal YSR
 97 Stevedoring .. YS
 98 Torpedo testing YTT
 99 Water .. YW

Boats—

- 100 Ambulance .. YH
 101 Chambers, sub-marine rescue YRC
 102 Coastguard vessels .. CG
 103 Degaussing vessels .. YDG
 104 House .. YHB

Derricks—

- 105 Floating.. .. YD
 106 Seaplane wrecking .. YSD
 107 District auxiliary, miscellaneous .. YAG
 108 Diving tenders .. YDT
 109 Dredges .. YM
 110 Ferry-boats and launches .. YFB
 111 Floating dry docks YFD
 112 Floats, car .. YCF
 113 Gate vessels .. YNg

Lighters—

- 114 Aircraft transportation .. YCV
 115 Ammunition .. YE
 116 Ash .. YA
 117 Covered .. YF
 118 Garbage .. YG
 119 Open .. YC
 120 Open cargo .. YCK
 121 Open landing .. YLA
 122 Torpedo transportation .. YFT

L

- 92 LCC(1) Landing craft, control, mark I
 93 LCC(2) Landing craft, control, mark II
 94 LCI(L) Landing craft, infantry, large
 95 LCM(3) Landing craft, mechanised, mark III
 96 LCM(6) Landing craft, mechanised, mark VI
 97 LCT(6) Landing craft, tank, mark VI
 98 LSD Landing ship, dock
 99 LSM Landing ship, medium
 100 LST Landing ship, tank
 101 LSV Landing ship, vehicle

P

- 102 PC Submarine chaser, 173-ft.
 103 PCE Patrol craft escort vessel, 180-ft.
 104 PCE(R) Patrol craft escort (rescue), 180-ft.
 105 PCS Submarine chaser, 136-ft.
 106 PE Eagle
 107 PF Frigate
 108 PG Gunboat or corvette
 109 PGM Motor gunboat
 110 PR River gunboat
 111 PT Motor torpedo boat
 112 PTC Motor boat, submarine chaser
 113 PY Yacht
 114 PYc Yacht, coastal

S

- 115 SC Submarine chaser, 110-ft.
 116 SM Minelaying submarine
 117 SS Submarine

Abbreviations (US)—contd.**District craft—contd.**

	Lighters— <i>contd.</i>	
123	Motor mine-sweepers ..	YMS
124	Net tenders ..	YN
125	Net tenders (tug class) ..	YNT
126	Patrol vessels, district ..	YP
127	Pile drivers ..	YPD
128	Pontoons, salvage	YSP
129	Scows, heating ..	YHT
	Tugs—	
130	Harbour (large)	YTB
131	Harbour (medium)	YTM
132	Harbour (small)	YTL
133	Motor ..	YMT
134	Workshops, floating ..	YR
	Mine vessels	
135	Auxiliary minelayer ..	ACM
136	Light minelayer ..	DM
137	Minelayer ..	CM
138	Minelayer, coastal	CMc
139	Minesweeper ..	AM
140	Minesweeper, coastal ..	AMc
141	Minesweeper, harbour ..	AMb
142	Minesweeper, high speed ..	DMS
	Miscellaneous	
143	Unclassified ..	IX
	Patrol vessel	
144	Eagle ..	PE
145	Frigate ..	PF
146	Gunboat or corvette ..	PG
147	Motor boat, submarine chaser ..	PTC
148	Motor gunboat ..	PGM
149	Motor torpedo boat	PT
150	Patrol craft escort (rescue), 180-ft.	PCE(R)
151	Patrol craft escort vessel, 180-ft. ..	PCE

Y

118	YA	Lighter, ash
119	YAG	District auxiliary, miscellaneous
120	YC	Lighter, open
121	YCF	Floats, car
122	YCK	Lighter, open cargo
123	YCV	Lighter, aircraft transportation
124	YD	Derrick, floating
125	YDG	Degaussing vessels
126	YDT	Diving tenders
127	YE	Lighter ammunition
128	YF	Lighter, covered
129	YFB	Ferry-boats and launches
130	YFD	Floating dry docks
131	YFT	Lighter, torpedo transportation
132	YG	Lighter, garbage
133	YH	Boats, ambulance
134	YHB	Boat, house
135	YHT	Scows, heating
136	YLA	Lighter, open landing
137	YM	Dredges
138	YMS	Motor mine-sweepers
139	YMT	Tugs, motor
140	YN	Net tenders
141	YNg	Gate vessels
142	YNT	Net tenders (tug class)
143	YO	Barge, fuel oil
144	YOG	Barge, gasoline
145	YOS	Barge, oil storage
146	YP	Patrol vessels, district
147	YPD	Pile drivers
148	YPK	Barge, pontoon stowage
149	YR	Workshops, floating
150	YRC	Chambers, submarine rescue
151	YS	Barge, stevedoring
152	YSD	Derricks, seaplane wrecking

Abbreviations (US)—contd.

Patrol vessel—contd.		Y—contd.	
152	River gunboat .. PR	153	YSP Pontoons, salvage
153	Submarine chaser, 110-ft. .. SC	154	YSR Barge, sludge removal
154	Submarine chaser, 136-ft. .. PCS	155	YTB Tugs, harbour (large)
155	Submarine chaser, 173-ft. .. PC	156	YTL Tugs, harbour (small)
156	Yacht .. PY	157	YTM Tugs, harbour (medium)
157	Yacht, coastal .. PYc	158	YTT Barge, torpedo testing
Submarine		159	YW Barge, water
158	Minelaying submarine .. SM		
159	Submarine .. SS		

SYMBOLS FOR LANDING SHIPS, CRAFT & AMPHIBIANS

1. The following symbols are designed for use on surface plots :-

(a) *Destroyer*



(b) *Merchant ship*



(c) *Landing ship*



(d) *Major landing craft*



(e) *Minor landing craft*



(f) *Amphibians*



2. In order to show the type of landing ship or craft, the third (and when applicable the fourth) letter of its title will be inserted in the symbol :-

(a) LSI (L)



(b) LCT (R)



(c) LCA



(d) LVT



DEFINITIONS FOR COMBINED OPERATIONS

(For Index see Part 1 e 25)

GENERAL TERMS

1. **Assault phase**—The period from the arrival at the lowering position until the covering position has been firmly established.
2. **D day**—The day on which H hour occurs. Days after D day will be known as D plus 1, D plus 2 etc ; days before D day will be known as D minus 1, D. minus 2 etc.
3. **Fire support phases**—Fire support aspects of a seaborne landing may be considered in three phases :—
 - (a) **Phase I—Preliminary bombardment**—Any preparatory sea or air bombardment that may take place before the seaborne attack starts. This may be a period of days or months before the attack.
 - (b) **Phase II—The seaborne attack**—This phase covers the run in, from the time that the assaulting forces come within range of the coastal defences until the touch-down of the leading waves. It is generally covered by the pre-arranged joint fire plan.
 - (c) **Phase III—The establishment of the covering position and the subsequent advance inland**—This phase starts at the touch-down, and continues until the army is firmly established with all its own supporting weapons, and can provide normal tactical support. By the end of this period no support other than that for a normal land battle is needed ; but naval support may still be needed up to the limit of the range of the naval guns, especially on the flanks.
4. **H hour**—H hour is the time when the first waves of assault ships, craft or amphibians are planned to touch-down on the assault beach, *ie* strike the beach.

NAVAL TERMS

5. **Allocation and attachment of ships and craft**—Ships and craft are said to be allocated to a naval formation when they are an integral part of it for permanent general administration. They are said to be attached to a formation when they are transferred to it from their parent formation temporarily for specific duties.

As an example, the support craft of a support squadron are allocated to a build-up group for administration, and attached temporarily to an assault group for the assault phase.

6. **Approach**—In the case of landing craft carried in landing ships the approach is from the lowering position to the touch-down, or, in the case of amphibians, from the launching position to the touch-down. For landing ships and major landing craft that proceed under their own power, the approach is from the lowering position, or the dispersal point, to the touch-down. For landing craft carrying reserves, the approach is from the waiting position to the touch-down.

7. **Assembly ports**—Ports at which ships and craft assemble before sailing for an operation.

8. **Beach**—A part of the shore suitable for the disembarkation of personnel, vehicles or stores. It is controlled by a beachmaster.

For the purpose of measurement the length of a beach is the distance along the water's edge at mean high water springs.

In the assault, landing beaches are named after the code letter of the sector in which they are located, followed by one of the following colours :—

RED : WHITE : GREEN : reading from left to right facing inland.

9. **Bombardment control headquarters**—A naval headquarters which is set up to control naval support during the assault. It is commanded by a commander naval bombardment.

BCHQ will operate afloat, in the LSH(L), until the naval commander orders it to proceed ashore, when it will continue its functions at the highest army headquarters with which the naval assault force is operating.

10. **Build-up group**—This group comprises the ships and craft necessary to transport stores and vehicles of an assault division, together with any landing ships needed to carry landing craft and amphibians to be used in the build-up of the force. In addition, craft of the support squadrons are allocated to the group, and it will also include maintenance and repair ships and craft. The group is under the command and administration of a senior officer build-up group.

11. **Classification of landing ships, craft and barges**—Landing ships, craft and barges for use in Combined Operations are classified into :—

- (a) Landing ships—all types over 200 feet in length (except LCT(8)).
- (b) Major landing craft—all landing craft under 200 feet in length which cannot be readily hoisted by ships (and LCT (8)).
- (c) Minor landing craft—all types that can be readily hoisted on board ships.
- (d) Landing barges—all barges or lighters converted from commercial use for naval service.

12. **Dispersal point**—The position at the end of the voyage at which the assault groups and ships in convoy disperse to pass through the lowering positions off their respective assault beaches.

13. **Division**—Normally consists of six landing ships or craft.

14. **Dry out**—A landing ship, craft or barge is said to dry out when the falling tide leaves her no longer waterborne. In some circumstances ships, craft or barges may have to dry out before their load can be disembarked.

15. **Ferry service**—The ferry service is a naval organisation which is designed to facilitate rapid unloading of ships by means of landing craft, barges and amphibians. The ferry service is controlled by the senior officer ferry craft.

16. **Final assembly**—The assembly of all components of a naval assault force, including support ships, prior to their actual sailing for the operation.

17. **Flight**—A formation of landing ships, craft or amphibians. A flight will generally contain a complete unit together with any attached troops, and may be organised into waves to ensure that the unit lands in the correct tactical formation.

18. **Flotilla**—Landing ships, craft and barges are formed into flotillas which normally consist of 12. This number is not rigid and will be altered to fit operational requirements or, in the case of minor landing craft, the hoisting capacity of ships. A flotilla may consist of more than one type of landing craft.

19. **Headquarters ships and craft**—The naval and military commanders will exercise command and control of the assault phase, at their various levels, by setting up their joint headquarters afloat in headquarters ships and craft. The RAF (or naval air arm where applicable) will be represented down to and including divisional level (assault force headquarters ship). There will also be an air representative in the reserve brigade headquarters ship acting as stand-by to the assault force headquarters ship.

- (a) At corps (or army level if applicable), the headquarters ship will be a landing ship headquarters (command) (LSH(C)). It will contain the headquarters of the naval force commander, the corps (or army) commander and the air commander.
- (b) At divisional level the headquarters will be a landing ship headquarters (large) (LSH(L)) and will be the headquarters of the naval commander assault force, the divisional commander and an air commander or his representative.
- (c) At the brigade level the headquarters ship will usually be a landing ship headquarters (small) (LSH(S)) and will be the headquarters of the senior officer assault group and the assault brigade commander.
- (d) At the battalion level the headquarters for the assault will be a landing craft headquarters (LCH) and will contain the deputy senior officer assault group and the assault battalion commander.

Headquarters ships and craft are specially fitted for naval, military and air communications.

20. **Landing craft obstruction clearance units**—Naval parties trained in the technique of clearing passages through shallow water for the assault. They operate from specially equipped craft or amphibians allocated to them as part of the assault lift. They are responsible on the beaches for detecting, clearing and maintaining

clearances seaward of where craft ground, and, in estuaries, the clearance of booms and obstacles to allow the passage of assault craft.

21. **Landing craft recovery units**—Naval parties trained and equipped to carry out emergency repairs, salvage and recovery of minor landing craft on the beaches. They will also help, if needed, in the repair of major landing craft, where such repairs are within the scope of their equipment.

22. **Launching position**—The position from which the amphibians are launched from their carrier landing ships or craft. This will be further inshore than the lowering position.

23. **Lowering position**—The position from which the assault is launched, and where the landing ships stop or anchor to transfer the assault troops to their assault craft.

24. **LST group**—This group comprises the ships necessary to transport the reserve brigade, and any divisional troops, of an assault division, also the LST which are normally attached to each of the assault groups for the assault. The group is under the command and administration of a senior officer landing ship tank group.

25. **LST pontoon barge unit**—Each LST carrying NL pontoons as part of the ship's equipment will carry a naval party (additional to the ship's normal complement) known as an LST pontoon barge unit to work the pontoon equipment.

26. **Mobile base maintenance unit**—Allocated to each MOLCAB to operate base maintenance and emergency repair equipment. It includes a first aid hull, electrical and engine repairs (to supplement repair facilities afloat), and facilities for radio and radar maintenance.

27. **Mobile landing craft advance base**—Provides the facilities for a temporary base for the maintenance of landing craft and accommodation for some 2,000 landing craft personnel. Essential portions of a MOLCAB can be erected within seven days and the remainder in a month. It can be divided into two sections so that either half a MOLCAB can be used for small requirements, or to enable one section to be moved forward in advance of a second section. Its functions are:—

- (a) A temporary advance base where an assault force is assembling.
- (b) An advance base set up in captured territory directly after the assault.
- (c) A base at which a build-up group can re-form, recuperate and refit between operations.

Amenities are provided to include canteen and recreational facilities; and an EFI ration store. There are also a 100-bed hospital, a laundry and cobblers and hairdressing facilities.

28. **Mobile land repair unit**—A naval mobile engineering party completely self-contained and lorryborne, with its own workshops, power etc, commanded by a naval engineer officer. In the early

stages of an operation the unit can be landed for the repair and salvage of landing craft. It will normally move into a port immediately after its capture to assist in getting the port repair facilities into working order.

29. Mobile naval air base—Part of the organisation for the rapid provision of facilities, at airfields or air strips, for the training and maintenance of naval air squadrons which have disembarked from carriers operating in advance of existing bases.

30. Naval assault force—A formation of landing ships and craft sufficient to lift a military formation, such as a division, to the assault or immediate follow-up. An assault force will usually contain two assault groups, a support squadron, a LST group and a build-up group. Assault forces are usually designated by a letter, *eg* Force "A". The assault force is under the command of a naval commander assault force.

31. Naval assault group—A formation of landing ships and craft of appropriate types to lift a military formation, generally a brigade group, to the assault or immediate follow-up. In an assault force, lifting a division, there will normally be two assault groups each lifting one assault brigade. If commandos are being used, they will be lifted in a third assault group. The assault group is under the command of a senior officer assault group. Assault groups are usually designated by the force letter and a number, *eg* "A1."

32. Naval beach commando—A unit trained in the control and handling of landing craft on the beaches. It is designed to handle the landing ships, craft and barges of an assault brigade group, and any other ships, craft and barges landing on the same beaches. It is commanded by a CO naval beach commando and is divided into three beach parties, each commanded by a beachmaster.

33. Naval beach signal section—Specially trained parties of naval communications personnel landed to maintain communications (largely by V/S and R/T) between the naval beach organisation and ships and craft in the assault area.

34. Organisation of landing ships infantry (large)—In an assault force, LSI(L) are normally organised into assault groups, each of three ships.

35. Organisation of landing ships tank, landing craft and landing barges—These are normally organised into flotillas of 12 and divided into divisions of six and sub-divisions of three. Two or more flotillas form a squadron.

36. Passage—The voyage between the sailing and the lowering position, or the dispersal point.

37. Points of departure—A position through which all groups leaving a particular harbour or anchorage will pass at stated times, *eg* East Gate, Spithead.

38. **Sailing**—The time at which ships and craft pass the harbour boom gate or entrance, or in cases where these do not exist, the time of leaving sheltered water such as an anchorage or the passing of a pre-determined departure point.

39. **Sector**—A sub-division of the coastline chosen for an assault. Sectors will cover the whole coastline, whatever its nature—beach, cliff, rock etc. Their limits should be geographical features which can easily be identified either from charts, maps or air photographs. The length of a sector may be anything from 100 yards to 3,000 yards, but will seldom exceed the latter figure. Sectors will be designated by the phonetic alphabet, lettered from right to left facing inland, starting with ABLE. They may be sub-divided into not more than three beaches.

40. **Squadron**—Two or more flotillas.

41. **Sub-division**—Normally of three landing ships or craft.

42. **Support squadron**—This squadron consists of flotillas of major support craft which will be attached to the assault groups for an operation. When not so attached, they will be under the command of the senior officer support squadron who will be responsible for their operational training. These flotillas are allocated to the senior officer build-up group (who is their administrative authority) and attached as needed to the assault groups for operations.

43. **Touch-down**—The moment at which a landing ship, craft or amphibian grounds on the assault beach.

44. **Turn round**—In an assault landing, this term means the time taken for a landing ship, craft, amphibian or barge to complete the cycle of its trip, *ie* loading, passage to the shore, unloading, and the return passage to its loading port or ship.

45. **Waiting position**—A position at which groups of landing craft are to wait :—

(a) Before receiving orders to proceed into land when carrying reserve troops.

(b) After unloading, while awaiting further orders.

46. **Water ambulances**—Craft converted to carry stretcher cases and walking wounded. Six water ambulances may be carried by a hospital carrier.

47. **Wave**—A sub-division of a flight. All the landing craft or amphibians of each wave should touch-down at the same time.

ARMY TERMS APPLICABLE TO THE ASSAULT

48. **Air support signals unit**—An army signals organisation which provides an independent wireless network for the transmission of messages concerning all aspects of air support. The section headquarters will be with the headquarters of the highest military formation, and tentacles will be attached to army and air force headquarters down to brigades and tactical air force wings.

49. **Assault formations**—Formations which are tactically organised and equipped to carry out the initial attack on an enemy coast, and to which a separate allocation of landing ships and craft is made.

50. **Assault scale**—The assault scale is the minimum number of men, vehicles and equipment which will enable the assault formation to fulfil its role, bearing in mind the task in hand, the type of country and the length of time which will elapse before the formation can receive further supplies of transport and equipment.

51. **Build-up formations**—The main body of the expeditionary force, landed to fulfil the major military task for which the operation has been undertaken. They may have to rely on returning ships and craft of the assault and follow-up formations. In a long range assault, depending on the length of the passage, this may not be possible and build-up convoys may need their own allotment of shipping.

52. **Combined Operations bombardment troop**—Is responsible for the shore observation of naval gunfire, normally on a front of one division. It is commanded by a major RA as senior bombardment liaison officer and includes one staff officer bombardment, seven forward observers bombardment (FOBs), seven bombardment liaison officers (BLOs), together with NCOs and naval communications ratings. FOB parties are for attachment to assaulting battalions and the BLO parties are for liaison with gunnery staffs of bombardment ships.

53. **Combined Operations bombardment unit**—A unit responsible for the shore observation of naval gunfire in a Combined Operation. It consists of a headquarters and three troops, and is commanded by a lieutenant colonel RA known as the chief bombardment liaison officer. One troop is normally allocated to a divisional front.

54. **Covering position**—The position which must be secured in order to gain sufficient space for the assembly of the follow-up formations and the development of the beach brigade area. The general line of the covering position should be far enough from the beaches to ensure the freedom of the landing places and the anchorage from ground observed artillery fire.

55. **Embarkation concentration area**—This is an area in which a formation is concentrated, still as a complete formation, before movement to the marshalling area.

56. **Embarkation regulating point**—This is a check point in the vicinity of ports or hards where ships and craft loads are halted for purposes of control before moving to the embarkation point.

57. **First (or immediate) objective**—The area which must be captured in order to enable the landing and deployment of reserve troops. Its attainment should also prevent direct small arms fire being brought to bear on the beaches.

58. **Floating reserve**—Consists of units or formations which are tactically loaded in landing ships or craft and retained offshore under the control of the divisional (or possibly brigade) commander. It should be easily manoeuvrable and capable of being quickly diverted to land on the most suitable beaches.

59. **Follow-up formations**—These formations will be landed to exploit the success of the assault formations. They will be tactically loaded and will have their own allocation of ships and craft from the build-up. The follow-up formations will not be tactically deployed. Their role, which is more comprehensive than that of the assault formations, may have objectives such as the capture of airfields or important centres of communications, and the delaying of enemy reinforcements.

60. **Hard**—A prepared section of the shore or harbour where personnel or vehicles embark in landing ships, craft or barges under the joint control of a military embarkation staff officer and naval hard-master.

61. **Landing table**—There are four types :—

- (a) *GHQ/army/corps/divisional landing table*—A table showing a general order of priority of landing for all units and sub-units not included in the brigade landing table.
- (b) *Brigade (and unit) landing table*—A table showing in detail the allocation of units, sub-units, and vehicles of an assault brigade group and attached troops to landing ships, craft and amphibians. Each landing ship, craft and amphibian load is given a landing table serial number in accordance with the priority in which it is to arrive at its destination.

The unit landing table is the extract in greater detail of such entries appearing in the brigade landing table as are applicable to the unit.

- (c) *Unit sheet*—The allocation of units to landing ships, craft and amphibians by units.
- (d) *Ship sheet*—The allocation of units to landing ships, craft and amphibians by ships or craft.

62. **Light scale**—The light scale is the minimum number of men, vehicles and weapons necessary to enable a force to fulfil a further task *not* possible with an assault scale. This scale will depend on the task, the country, and the time which must elapse before the full war establishment can be landed.

63. **Marshalling area**—This is an area, normally 5 to 10 miles from the coast, to which personnel and vehicles are moved in readiness for embarkation and where units are marshalled into ship and craft loads.

64. **Waterproofing**—The method of preparing and protecting vehicles and equipment for their passage through water.

65. **Ammunition landing section RAOC**—Technical RAOC personnel who are present during loading, who move to the theatre in the same ships and who are available on the far shore to assist in the identification and sorting of ammunition during the unloading of the ships and coasters, and may work either in the holds of ships, on the beaches or in transshipment areas. There will be one port ammunition detachment allotted to each beach group.

ARMY TERMS APPLICABLE TO BEACH ORGANISATION

66. **Assembly areas**—Areas within the beach brigade area to which personnel and vehicles, either by units or formed detachments, are directed after leaving the beach transit areas. Here parties are reconstituted into units and formations. The beach brigade commander is responsible for their organisation and control. For this purpose he has a small staff. Unit guides are provided by the formation concerned.

67. **Beach area**—The beach area of a beach brigade (or beach group) includes the beaches and the beach transit areas.

68. **Beach brigade**—A formation designed to maintain an assault division (and to land and maintain such additional follow-up and build-up divisions as necessary) through its beaches. A beach brigade is composed of a headquarters, beach brigade troops, and two beach groups. Additional beach groups may be placed under command if necessary.

69. **Beach brigade area**—The area which is developed by a beach brigade. It normally contains two beach group areas.

70. **Beach brigade signal company**—Contains a headquarters section, two beach group signal sections, an operating section and a wireless section. A line section is attached. This company is responsible for army signal communications within the beach brigade area. In addition to internal communications, the beach brigade signal company will be responsible for communications to higher formations, to adjacent beach brigades, and communications for ferry service control. It is not equipped with enough line sections to complete detailed line communications; these will have to be attached as necessary.

71. **Beach exits**—Natural or developed outlets from the beach to hinterland for vehicles and/or personnel.

The term includes outlets used by vehicles returning to the beach.

72. **Beach framework**—The layout of temporary roadway on the beaches. It comprises feeders, laterals and beach exits.

73. **Beach group**—A beach group is responsible for the movement of personnel and vehicles, and stores from landing ships, craft, amphibians and barges across the beaches to assembly areas and dump areas inland respectively. By the landing and delivery to dumps of ammunition, petrol, supplies and stores, beach groups build up the reserves needed to maintain the force ashore until the beach maintenance is discontinued. The beach group is divided into a headquarters, a beach wing and a beach maintenance area wing.

74. **Beach group area**—The area which is developed by one beach group. It contains the beach area and the beach maintenance area. Each of two beach groups operating under a beach brigade may have its own beach maintenance area. Where two beach groups are working side by side there may only be one beach maintenance area containing the combined dumps and installations of both beach groups, being directly under the control of beach brigade.

75. **Beach lateral**—A track running laterally above high-water mark along a beach which is in use for landing vehicles or stores. It forms part of the beach framework, and should normally be of double width to permit two-way traffic.

76. **Beach maintenance area**—That part of the beach brigade (or beach group) area in which are set up the installations for the maintenance of the force. It includes the dumps, workshops, headquarters etc, of the beach maintenance area wing, but excludes the beaches. It will normally include the assembly areas.

77. **Beach maintenance area wing**—A component of the beach group. It is responsible for the establishment of the dump area, and for the receipt, storing and issuing of the various stores.

78. **Beach maintenance pack**—Beach maintenance packs, consisting of standard quantities of replacement equipments and spares, fill the gap between maintenance by landing reserves and the establishment ashore of advance ordnance depots. They are intended to maintain equipments for 30 days, and constitute first and second echelon repairs, being brought ashore as soon as facilities for second echelon repairs exist in the area.

79. **Beach maintenance workshops REME**—A unit of beach brigade troops. It is responsible for the establishment in the beach group area of drowned vehicle parks and workshops for the repair of drowned vehicles. Vehicles are recovered to the workshop by the beach recovery section REME.

80. **Beach medical unit RAMC**—A unit of the beach group able to establish a beach dressing station and to man a casualty evacuation post. It includes sanitary and malaria control personnel for employment in the beach group area. There are no personnel in this unit for the collection of wounded.

81. **Beach ordnance company RAOC**—A unit of the beach group. It is responsible for the storage and issue of ammunition and ordnance stores from dumps in the beach maintenance area.

82. **Beach recovery section REME**—A unit of the beach group. It is responsible for the recovery of vehicles that become casualties on craft, in the sea or within the beach brigade area. The section is not responsible for repairs and recovery inland nor from the drowned vehicle park.

83. **Beach transit areas**—Areas sited within the beach area to which the beach organisation direct personnel and vehicles as soon as they have landed, in order to clear the beaches as quickly as possible. In beach transit areas, craft loads will reform into sub-units or detachments and move on to the assembly areas; personnel will dump their lifebelts; vehicle drivers will carry out the first stage of removing waterproofing.

84. **Beach wing**—A component of the beach group. The beach wing is responsible for the army organisation on the beaches for the landing of stores and vehicles from landing ships, craft and barges (in conjunction with the naval beach organisation), and for their passage to the beach transit areas, transshipment areas or dumps.

85. **Casualty evacuation point**—A site on the beach from which casualties are embarked, under the control of the casualty evacuation officer, into landing ships, landing craft and amphibians.

86. **Drowned vehicle park**—An area into which vehicles which have become casualties on the beach, or which have failed to wade ashore, are towed by recovery vehicles for repair.

87. **Feeder**—A beach track leading from the beach lateral (just above high-water mark) to suitable places where landing ships, craft or barges can beach and unload vehicles or stores, or where wheeled amphibians can drive ashore. It forms part of the beach framework.

88. **First key plan**—A sketch or map showing the proposed layout of the beach brigade or group area, rear maintenance area, or other area, through which it is proposed to maintain the troops. It forms part of the maintenance project.

89. **Landing reserves**—These constitute an advanced holding of vital ordnance stores, sufficient to maintain the force for 30 days. They are tactically packed and each set contains spares etc, which are appropriate to the equipment of the brigade group to which it is allotted, and which can be handled by first echelons only (*ie* units and light aid detachments). Landing reserves are brought ashore at an early stage of a Combined Operation.

90. **Maintenance project**—The plan of the combined administrative staff and services for the maintenance of the forces during an operation. It must be produced simultaneously with the operational plan.

91. **Port detachment (petrol) RASC**—Technical RASC personnel who are present during loading, who move to the theatre in the same ships and who are available on the far shore to assist by means of the stowage plan in the unloading of petrol. There will be one port detachment (petrol) to each beach group.

92. **Port detachment (supplies) RASC**—Technical RASC personnel who are present during loading, who move to the theatre in the same stores ships and who are available on the far shore to assist by means of the stowage plan in the unloading of supplies. There will be one port detachment (supplies) to each beach group.

93. **Second key plan**—The layout of the area covered by the first key plan as amended or confirmed after reconnaissance of the ground.

94. **Stores landing section RAOC**—Technical RAOC personnel who are present during loading, who move to the theatre in the same stores ships and who are available on the far shore to assist in the identification and sorting of stores during the unloading of stores ships and coasters, and may work either in the holds of ships, on the beaches or in stores transshipment areas. There will be one port stores landing section allotted to each beach group.

95. **Stowage**—The stowage of stores in ships may take one of the following forms according to the nature and stage of the operation :—

- (a) *Tactical stowage*—When the ship is loaded so that stores can be discharged in a pre-determined order. Tactical stowage will probably be employed for ships of the assault convoy only.
- (b) *Composite stowage*—When a ship is loaded with two or three types of commodities only.
- (c) *Normal or maintenance stowage*—Stowage to the maximum carrying capacity of a ship without taking operational considerations into effect.

96. **Transshipment area**—An area established in the beach area and close to the beaches, where, in order to shorten their turn round, amphibians unload their stores, which are then carried forward to the dumps by MT.

97. **Working companies**—Labour with the beach group is provided by three companies, each consisting of a headquarters and 10 sections. Companies will be allocated as follows :—

- (a) One company to the beach area wing.

Sections will assist the port operating companies, will form crews for amphibians used in a maintenance role, unload ships and craft on the beaches, assist the crane operating unit in handling nets of palletised stores, and work in the transshipment areas.

- (b) Two companies to the beach maintenance area wing.

Sections will be employed handling stores etc, in the beach maintenance area. Also providing stretcher bearers for the beach medical unit and labour for the field company RE if no other labour is allotted for this purpose from other resources.

ROYAL AIR FORCE TERMS

98. **Advanced landing ground signal section**—A self-contained unit with its own establishment of personnel and transport designed to supply the nucleus of a station signals section at an advanced landing ground immediately it is captured. The section provides VH/F, R/T and homing for aircraft, and H/FWT point to point.

99. **Contact car (air)**—A reconnaissance car equipped with a radio set and manned by an experienced pilot. It is used for contact with reconnaissance aircraft over forward areas. Contact cars (air) will be attached to forward brigades and may be used for directing ground attacks on to specific targets. They will operate on the "ground attack and Tac R wave".

100. **Fighter direction tender**—A converted landing ship tank in which radar and communications equipment has been fitted on a smaller scale than in the landing ship fighter direction. In short range operations the fighter direction tender will operate either instead of, or as a radar consort to, the landing ship fighter direction.

101. **Forward control post**—A FCP controls aircraft supporting a particular army formation (corps or division). It has communication with the army formation concerned, and wireless communication with the group control centre (when ashore), with air support signals unit tentacles, and with aircraft.

102. **Forward direction post**—Consists of a GCI (ground controlled interception) sited to perform the function of a local control for day fighter cover in addition to its normal function as a part of the group control centre.

103. **Group control centre**—The element of a tactical air force composite group which is responsible for the tactical handling of all aircraft of the group, in accordance with the detailed plan. The group control centre assumes the dual functions of both group and sector control when established ashore.

104. **RAF airfield headquarters**—A unit which provides the administrative and minor servicing facilities necessary to enable up to three operational squadrons to be accommodated at, and to operate from, an airfield. The commanding officer of an airfield headquarters is the commanding officer of all units located on his airfield.

105. **RAF beach squadron**—Composed of a headquarters, which is attached to beach brigade headquarters, and a number of beach flights corresponding to the number of beach groups operating in the beach brigade. The RAF beach squadron commander advises the beach brigade commander on all matters connected with the landing, handling and maintenance of RAF stores, equipment and vehicles landed over the beaches.

106. **RAF servicing commando**—A self-contained and fully mobile unit designed for servicing specified aircraft on a captured airfield until the arrival of squadron ground personnel.

107. **Wireless observer unit**—A mobile unit which reports by H/FWT the movements of aircraft as recognised by ground observers. A unit consists of 15 WOU posts, some or all of which may be used to provide a screen in the forward areas.

COMBINED OPERATIONS TRAINING

108. **Assault training**—Assault landing exercises are carried out by battalion or larger groups with live ammunition, explosives and all available special equipment.

109. **Basic training**—Basic training is carried out at combined training establishments and includes:—

- (a) Embarking and landing personnel and vehicles by day and by night with landing craft.
- (b) Assault landings carried out by day and by night as a drill on a platoon, company and battalion basis.
- (c) Passage of beach obstacles.

- (d) Ship's routine.
- (e) One or more exercises to enable the brigade and supporting arms to practise the assault landing and the establishment of the covering position.

Basic training also includes beach organisation training and specialist training for port operating companies, forward observer bombardment parties and Combined Operations engineer, signal and driver training.

110. **Cadre training**—Formations and units send on courses at combined training establishments a proportion of officers and NCOs who on qualifying are appointed unit combined operations instructors.

111. **Collective training (naval, military and air forces)**—Collective training is carried out whenever possible under joint force commanders, by formations specially detailed for the purpose, and includes landing exercises with one or more brigade groups with operational craft and crews. During collective training, communications, control and maintenance should be practised.

112. **Dryshod training**—Dryshod training is carried out under formation arrangements before basic training. It is designed to practise landing across a stretch of ground simulating a beach, making use of mock-ups or other expedients instead of assault craft.

113. **Elementary training (for army personnel)**—Elementary training is carried out under formation arrangements with mock-up craft, based on the principles laid down in Combined Operations publications, possibly under a Combined Operations training team.

OFFICERS (ROYAL NAVY)

114. **Assault force gunnery officer**—The naval gunnery officer is on the staff of the naval commander assault force and responsible to him for the efficiency of all seaborne support of the naval assault force. His assistant is called the assistant G.

115. **Assistant air commander (naval)**—A naval officer who will advise the air commander, when the latter is an RAF officer, on all aspects of the control of carrier aircraft.

116. **Assistant beachmaster**—An officer of the naval beach commando. He will land with the first waves and direct in the subsequent waves. There are normally two assistant beachmasters under each beachmaster.

117. **Beachmaster**—An officer of the naval beach commando. He is responsible for the control of naval personnel and craft on his beach. He will ensure the quick turn round of all landing ships and craft and barges.

118. Commander naval bombardment—A naval officer in command of the bombardment control headquarters. He is responsible to the naval commander assault force and, after his departure, to the appropriate senior naval officer, for the control of naval support to meet the needs of the army ashore.

119. Deputy naval officer in charge—Under the direction of the naval officer in charge, this officer is responsible for :—

- (a) *During the preparatory phase*—Assisting the naval officer in charge in the general administration of the naval port party.
- (b) *During the build-up phase*—Landing with the naval officer build-up to establish the communication and administrative services of the beach or port area.
- (c) *During the post build-up phase*—Assisting, as necessary, the naval officer in charge.

120. Deputy senior officer assault group—Under the direction of the senior officer assault group, he is responsible for :—

- (a) *During the preparatory phase*
 - (i) General administration of the group.
 - (ii) Co-ordinating the training of minor landing craft of the assault group and attached major landing craft, and other naval parties.
 - (iii) Acting as SOAG in the latter's absence.
- (b) *During the assault phase*
 - (i) Controlling inshore the naval responsibilities concerning the assault on a brigade front. When assaulting on a two battalion front he will delegate control on the front of one battalion to the SOFC.
 - (ii) Directing naval inshore operations until the ferry service is established.

121. Naval commander assault force—Commands a naval assault force. He will be embarked in the assault force headquarters ship, an LSH(L), together with the assault divisional commander and air commander or his representative. He will be responsible for :—

- (a) *During the preparatory phase*
 - (i) Commanding the ships, craft and naval parties allocated to the naval assault force and attached naval units.
 - (ii) Exercising general control over the training and organisation of the component groups of the naval assault force.
 - (iii) Planning the assault, including support of the assault with the assault divisional commander and air commander (in the case of an assault by one division).

- (iv) The general allocation within the assault force of ships and craft required to carry men, guns, vehicles and stores of the assault division, attached troops and RAF element and co-ordinating the loading of the naval assault force.
 - (v) Planning the sailing and passage of the naval assault force.
 - (vi) The safe arrival of the naval assault force at the assault area.
- (b) *During the assault phase*
- (i) Exercising general control of the assault through the SOAGs.
 - (ii) Exercising direct control over naval units taking part in the assault but not part of the assault groups.
 - (iii) Allocating bombarding ships and craft so as to fulfil the army's requirements for the assault.
- (c) *During the build-up phase*
- (i) The control and defence of the anchorage until he hands over to one of his group commanders; probably the SOBG. (The responsibility for the air defence rests with the air defence officer under the general direction of the joint force commanders).
 - (ii) Meeting, through SOBG, the army's build-up requirements.

122. Naval embarkation officer—An officer, detailed for duty at the loading point or hard, to supervise the embarkation of troops and vehicles into landing ships and craft, amphibians and barges. At a hard, this officer will be known as the hardmaster.

123. Naval liaison officer bombardment—A naval gunnery officer attached to the staff of the CRA of an assault division to advise on the employment of naval support fire.

124. Naval officer build-up—Under the direction of the senior officer build-up group he will be responsible for :—

- (a) *During the preparatory phase*
- (i) The planning of the build-up on a divisional level in conjunction with the beach brigade commander.
 - (ii) Advising the senior officer build-up group of the army's requirements for the build-up (on matters affecting the training and rehearsal of the build-up group).

- (b) *During the build-up phase*
- (i) Moving to the assault area in the same ship as the beach brigade commander and proceeding ashore with him.
 - (ii) Exercising operational control of the ferry service and naval beach organisations.

The NOBU will have no duties within the port organisation, which will be developing during the build-up stage, other than those particularly concerned with the build-up.

125. Naval officer in charge—This officer is responsible for :—

- (a) *During the preparatory phase*—The planning, in conjunction with the port commandant or beach brigade commander, of all matters concerning the beach area or port outside the specialised build-up duties of NOBU.
- (b) *During the post-assault phase*—Assuming the full responsibility for his area as a discharging point for military and RAF needs and/or a naval base when his organisation has been established ashore.

126. Principal beachmaster—This officer is responsible for :—

- (a) *During the preparatory phase*—The training and administration of naval beach parties in one assault group, working in close co-operation with the beach group commander serving one assault brigade.
- (b) *During the assault phase*—Representing the SOAG on shore until the NOBU assumes operational control of the naval beach organisation. He will be responsible to SOAG for marking, reconnoitring and clearing the beaches to receive landing craft, in accordance with the operational orders, working in close co-operation with the beach group commander.
- (c) *During the build-up phase*—Commanding and co-ordinating naval parties working on his beach group front. He will be responsible to NOBU for the beach control of craft to meet army needs.

127. Sea transport officer—The sea transport officer will :—

- (a) *During the preparatory phase*—Be associated with the NOBU during planning.
- (b) *During the build-up phase*—
 - (i) Land with the NOBU and represent sea transport interests from the earliest stage of build-up.
 - (ii) Work in close contact with the deputy NOIC with a view to carrying his subsequent functions as laid down in CAFO 1944/43.

128. Senior officer assault group—Commands the assault group under the naval commander assault force. He is responsible for :—

(a) *During the preparatory phase*

- (i) Commanding the ships, craft and naval parties allotted to the naval assault group and attached naval parties.
- (ii) The detailed training and organisation of his group.
- (iii) Planning the assault on the assault brigade commander's level.
- (iv) Co-ordinating the loading of the men, guns, vehicles and stores of the assault brigade into the ships and craft of his group.

(b) *During the assault phase*—Exercising direct operational control of his group and attached support craft under the general direction of the naval commander assault force. On his withdrawal some of his group may remain in the assault area and will then come under the command of the SOBG and on his withdrawal under the NOIC.

129. Senior officer build-up group—This officer is responsible for :—

(a) *During the preparatory phase*

- (i) Commanding all ships and craft of the build-up group.
- (ii) Being the administrative authority for all landing craft and ships of the build-up group. He will retain this responsibility when they are attached to other groups.
- (iii) Meeting the army build-up requirements in planning and training. As regards the former, the NOBU will act for him.

(b) *During the assault phase and build-up*

- (i) Commanding all ships and craft employed in the build-up in the assault area.
- (ii) Meeting the army and air force build-up requirements, his responsibilities on shore being exercised through the NOBU.
- (iii) Accommodation, maintenance, repair and salvage of landing ships and craft in the ferry service, and craft left in the assault area after the withdrawal of the SOAGs.
- (iv) The general control, through NOBU, of naval beach organisations and SOFCs.
- (v) When the naval force commander directs, the control and defence of the anchorage until the responsibility is taken over by the NOIC.
- (vi) Handing over his area as a discharging point for military and RAF requirements and/or a naval base to the NOIC when the latter's shore organisation is established.

130. **Senior officer ferry craft**—This officer is responsible for :—

(a) *During the preparatory phase*

(i) Planning, under the direction of SOAG, on brigade level, the naval aspect of the loading of ships and craft taking part in the assault.

(ii) Planning, under the direction of NOBU, the ferry service to meet the needs of the build-up planning, normally on a beach group front.

(b) *During the assault phase*—When assaulting on a two battalion front, controlling inshore the naval responsibilities concerning the assault on a battalion front as delegated by D/SOAG *vide* paragraph 120 (b) (i) above.

(c) *During the post-assault and build-up phase*—Exercising operational control afloat of the ferry service under the direction of SOBG, normally on a beach group front, so as to implement the build-up requirements laid down by NOBU in conjunction with the beach brigade commander. In the event of the two beach groups being contiguous, one SOFC may control the ferry service afloat on a beach brigade front.

131. **Senior officer LST group**—Commands the LST group. During the assault his headquarters will be the stand-by assault force headquarters ship, an LSH(S) with the reserve brigade commander.

132. **Senior officer support squadron**—Commands the support squadron, which comprises the flotillas of major support craft of a naval assault force.

133. **Squadron gunnery officer**—A naval gunnery officer attached to the staff of the naval force commander and responsible to him for the efficiency of all seaborne support of the naval force.

OFFICERS (ARMY)

134. **Assistant military landing officer**—The assistant to the beach group military landing officer.

135. **Assistant military landing officer (ship)**—A movement control officer carried in certain ships of the assault and follow-up convoys. He is detailed by the senior force movements staff officer to whom he is responsible. He is responsible for :—

(a) *On LSI or transports*—Ensuring that personnel and their equipment are transferred to landing craft, amphibians and barges in accordance with the landing plan, also the preparation of a detailed landing table for personnel travelling in his ship.

(b) *On MT/stores ship*—Ensuring that the ship is loaded as far as possible in accordance with the pre-stowage plan, and that discharge conforms to operational requirements.

136. **Beach brigade commander**—A brigadier who commands a beach brigade. He will be responsible for :—

(a) *During the preparatory phase*

(i) Advising the military force commander (who may be either a corps or divisional commander), on all aspects of the landing of personnel, vehicles and stores.

(ii) All planning in connection with beach maintenance including detailed planning with the naval officer build-up for the build-up.

(b) *During the assault phase*—The maintenance of the division during the assault phase and the maintenance of any other forces ashore.

(c) *During the build-up phase*

(i) With the naval officer build-up, exercising joint command of all troops engaged in beach organisation in his area.

(ii) To the commander of the highest formation ashore, the landing of all personnel, vehicles and stores assigned to his area, and for the construction and maintenance of such port and base facilities required in his area.

137. **Beach commander**—A major of the beach wing who is responsible for the organisation of one beach.

138. **Beach group commander**—A colonel who commands a beach group and such of the beach brigade troops as may be placed under his command. He will be responsible for :—

(a) *During the preparatory phase*

(i) The training of his beach group under the direction of the beach brigade commander.

(ii) Advising the assault brigade commander on all aspects of beach maintenance.

(iii) The preparation of the detailed first key plan for his beach group area.

(b) *During the assault and build-up phase*

(i) The production of a second key plan.

(ii) The establishment of his beach group in order to meet the requirements of beach maintenance.

(iii) The carrying out of these responsibilities until the beach group is relieved by a base organisation.

139. **Beach maintenance area wing commander**—A major commanding the beach maintenance area wing of the beach group. He is responsible for the establishment and functioning of the dump area.

140. **Beach wing commander**—A lieutenant colonel commanding the beach wing of the beach group. He is responsible for organising the beaches for the landing of stores and vehicles from landing ships and craft, barges and amphibians in conjunction with the principal beachmaster, and for their passage to the beach transit areas, transshipment areas or dumps.

141. **Bombardment liaison officer**—A bombardment unit officer (captain RA) embarked in a major war vessel of a bombarding squadron as military adviser to the captain; a BLO is also embarked in each LCG(L) flotilla. His particular duty is to interpret calls for fire received from an FOB with whom his duties are interchangeable.

142. **Bombardment liaison officer to brigade commander**—A bombardment unit officer (captain RA) who acts as adviser and liaison officer on bombardment matters to the brigade commander.

143. **Casualty evacuation officer**—An army medical officer detailed to organise, in consultation with the principal beachmaster and the beach group commander, the evacuation of casualties from the beaches.

144. **Chief bombardment liaison officer**—A lieutenant colonel RA commanding a bombardment unit. He is on the staff of the naval task force commander as adviser on naval bombardment in support of troops ashore. He assists the senior officer with the military force and the squadron gunnery officer in co-ordinating the joint fire plan.

145. **Forward observer bombardment**—A bombardment unit officer (captain or lieutenant RA) who is specially trained to observe naval gunfire on shore targets. He asks BCHQ for the allocation of a bombarding ship, calls for fire to meet the needs of the army formation or unit to which he is attached, and observes the fall of shot. He also reports frequently the tactical situation ashore, particularly the positions of our own forward troops.

146. **Military landing officer**—A major graded as DAQMG(M) on the staff of the beach group. He is responsible for:—

- (a) *During the preparatory phase*—Assisting in the preparation of the brigade landing plan and the landing table.
- (b) *During the assault and build-up phase*—Advising on all matters concerning the movement of personnel, vehicles and stores from ship to shore. He will be assisted by assistant military landing officers of captain's rank.

147. **Principal military landing officer**—A lieutenant colonel graded as an AQMG(M) on the staff of the beach brigade commander. He is responsible for:—

- (a) *During the preparatory phase*
 - (i) The detailed planning of the movement aspects of embarkation and landing. For this purpose he will be attached as beach brigade commander's representative to the staff of the assault division.

- (ii) Co-ordinating the work of the military landing officers attached to the assault brigade.
 - (iii) The planning of the movement aspects of the build-up.
 - (iv) Working in co-operation with the staff of the naval assault force commander and with the senior officer ferry craft.
- (b) *During the assault and build-up phase*
- (i) The co-ordination of all movement aspects of beach maintenance.
 - (ii) Co-ordinating the work of the military landing officers with the beach brigades and of the movement staff attached to senior officer ferry craft's headquarters, for the operation of the ferry service.
 - (iii) Working in co-operation with the senior officer ferry craft.

148. Senior bombardment liaison officer—A major RA commanding a bombardment troop. He is attached to the staff of the naval commander assault force. He is responsible for :—

- (a) Commanding and administering his troop.
- (b) Organising initial attachment of forward observers bombardment to assaulting battalions and ensuring that bombardment liaison officers are embarked in their allotted ships.
- (c) Assisting the commander, Royal Artillery, while he is afloat, and the naval force gunnery officer, in co-ordinating the divisional fire plan.
- (d) Working in the combined support control room of the LSH(L) during the assault, and maintaining close liaison with divisional headquarters, after it has landed, through his second in command, the staff officer (bombardment).

149. Staff officer (bombardment)—A captain RA, second in command of the bombardment troop. In an operation he is embarked in the LSH(L) as assistant to the senior bombardment liaison officer. When the division goes ashore he is attached to the commander, Royal Artillery, as his adviser on the suitability of targets for the various types of ships available to give supporting fire. He also controls all forward officers bombardment on the divisional front by means of their spotting frequencies, issuing fresh orders for attachment or detachment according to the situation.

OFFICERS (RAF)

150. Air commander—Commands all air forces, RAF and naval, in the assault area. He is located, together with his staff, in the LSH(C) or LSH(L) with the naval and military force commanders and will be of equivalent rank to them.

151. **Air commander's representatives**—Group captains who act as liaison between the air commander and the divisional commanders. They will be located at divisional headquarters in the LSH(L).

152. **Air co-ordinator**—An experienced pilot who will operate over the beaches in a fighter aircraft. It is his duty to advise the air commander on the current tactical situation on the ground and he will direct support aircraft, as far as possible, to their targets, rebriefing the pilots if necessary. (It has not yet been finally decided whether it shall be standard practice to employ an air co-ordinator.)

153. **Air defence officer**—Controls all means of air defence in the assault force. Normally he will be located in the landing ship fighter direction. He is subordinate to the air commander.

154. **Chief signals officer (RAF)**—A group captain who will probably be a member of the staff of the air commander. He is primarily responsible for ensuring that the RAF signals facilities ashore are set up as soon after H hour as possible in order to enable the air commander to transfer his headquarters ashore.

155. **Deputy air commander**—Deputises for the air commander in the latter's absence. His main function is to proceed ashore as soon as possible in order to supervise the establishment of the air forces ashore.

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STORES DISTINGUISHING MARKS

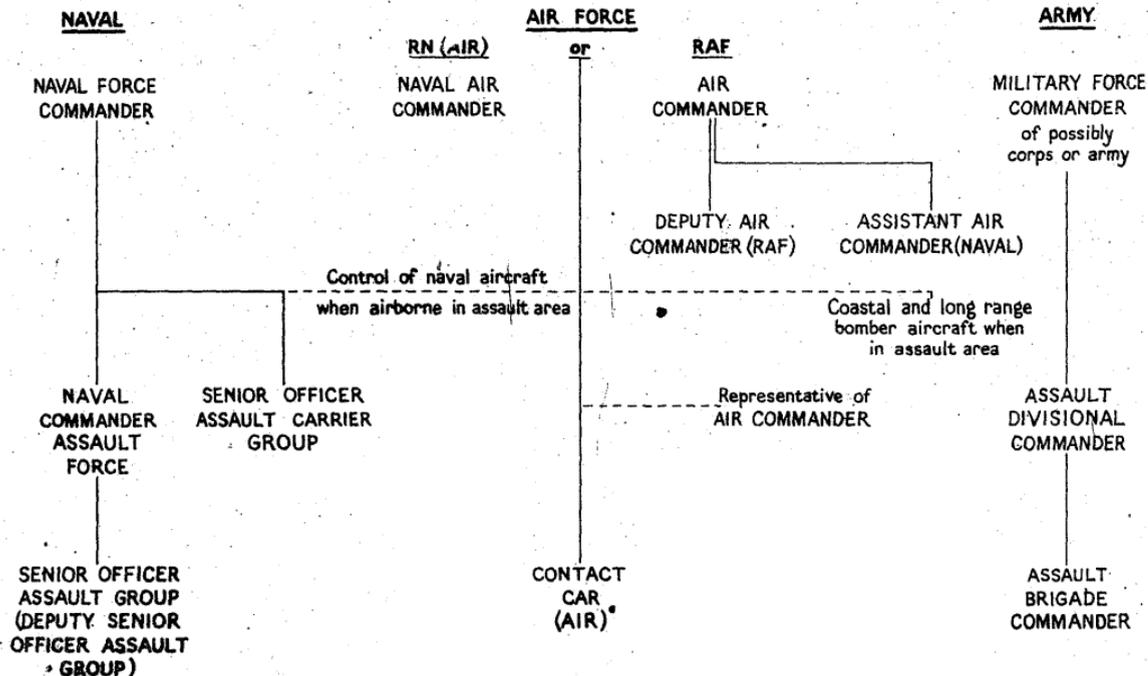
ABBREVIATIONS, DEFINITIONS AND SYMBOLS. PART I F I

RASC	RAOC	RE	MISC	MISC
 SUP	 MT STORES	 WORKS STORES	 VET STORES	 R N STORES
 POL	 TECH STORES	 TN & RY STORES	 STATIONERY AND PRINTING	 R A F STORES
 RASC STORES RAOC	 CLOTHING	 IWT STORES	 MED STORES	 WELFARE STORES
 ORD GEN	 ADV ORD DEPOT	 DOCKS STORES	 OR  N A A F I OR E F I	 CIVIL AFFAIRS STORES

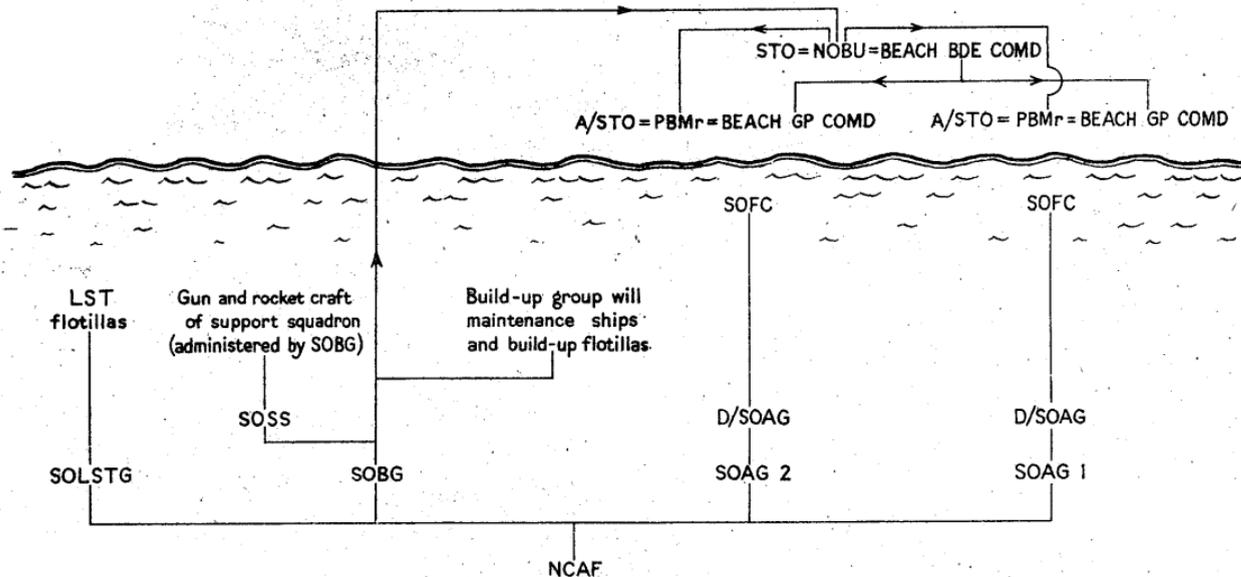
**DIAGRAMMATIC LAYOUT SHOWING RELATIONSHIP BETWEEN
NAVAL, ARMY AND AIR FORCE COMMANDERS IN THE ASSAULT**

CHANNELS OF COMMAND

PART II a 1

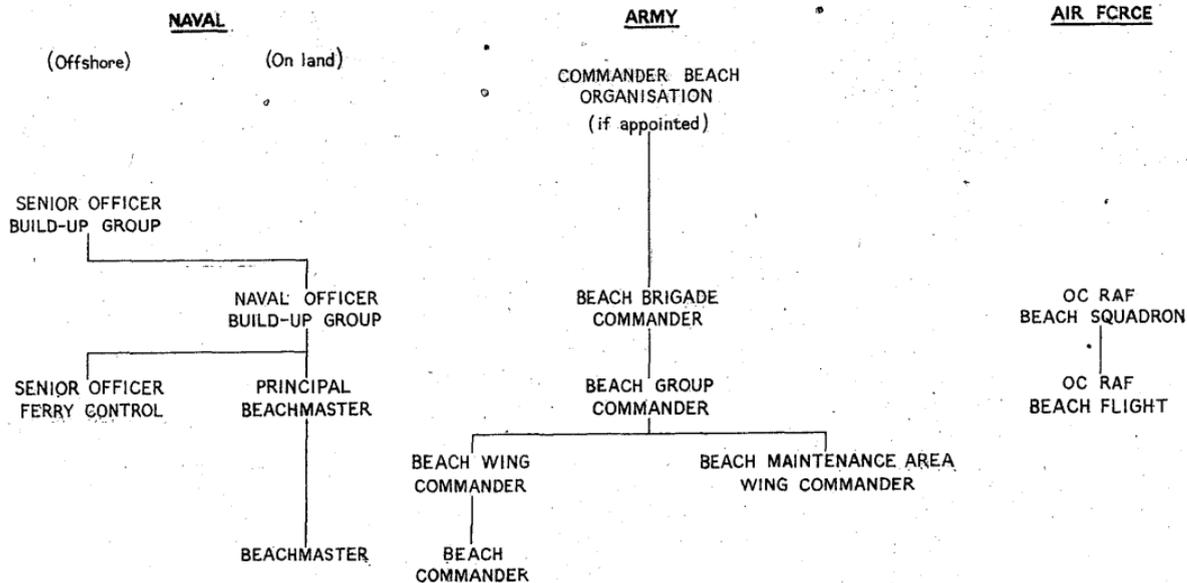


**DIAGRAMMATIC LAYOUT SHOWING RELATIONSHIP BETWEEN
NAVAL ASSAULT FORCE , NOBU AND BEACH BRIGADE IN THE ASSAULT AREA**

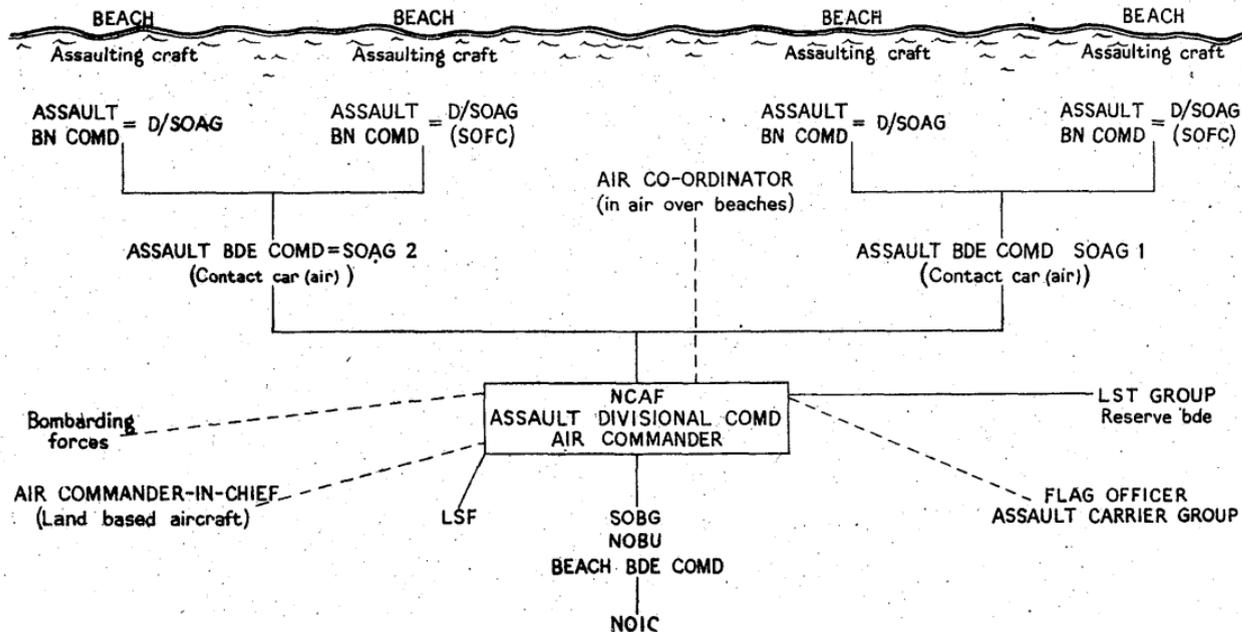


*NOTE :- NOIC replaces NOBU when the beach maintenance area is established as a port.
The NOIC is not under command of the NCAF.*

**DIAGRAMMATIC LAYOUT SHOWING RELATIONSHIP BETWEEN
NAVAL, ARMY AND AIR FORCE COMMANDERS IN BEACH ORGANISATION**



INTERSERVICE COMMAND ON A DIVISIONAL FRONT
 (in a one divisional assault)
STAGE I - THE ASSAULT



CHANNELS OF COMMAND

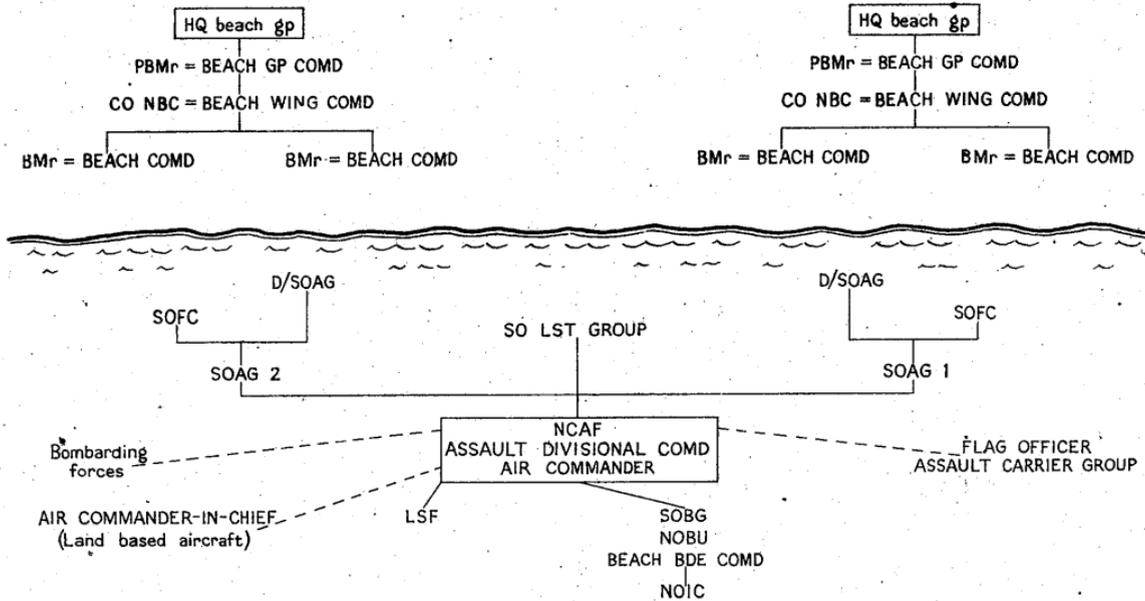
PART II D 1

INTERSERVICE COMMAND ON A DIVISIONAL FRONT

(in a one divisional assault)

STAGE II

SITUATION: Assault brigades ashore. Beach group HQ established on each assaulting brigade front.
PBMrs landed. D/SOAGs controlling craft until ferry service established.



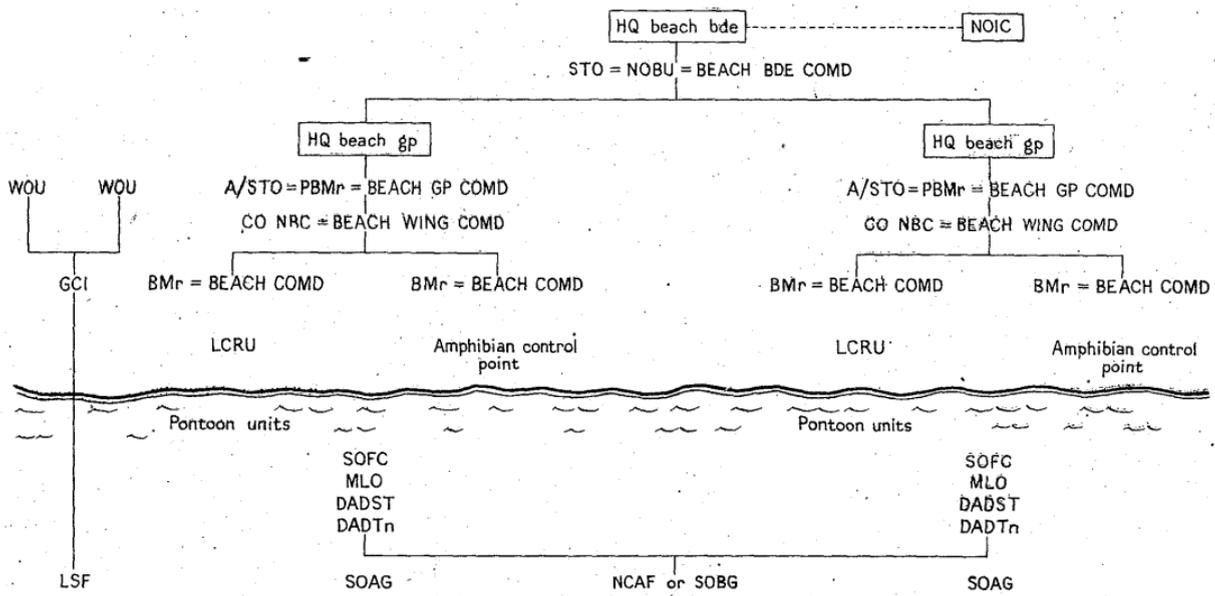
NOTE :- The assault divisional commander and the air commander will land as the operation requires

INTERSERVICE COMMAND ON A DIVISIONAL FRONT

(in a one divisional assault)

STAGE III

SITUATION: Build-up group with ferry craft arrived. SOFC established off each beach group front for control of ferry craft.
 Beach brigade HQ set up.. NOBU established ashore.. NOIC ashore establishing RN area facilities.

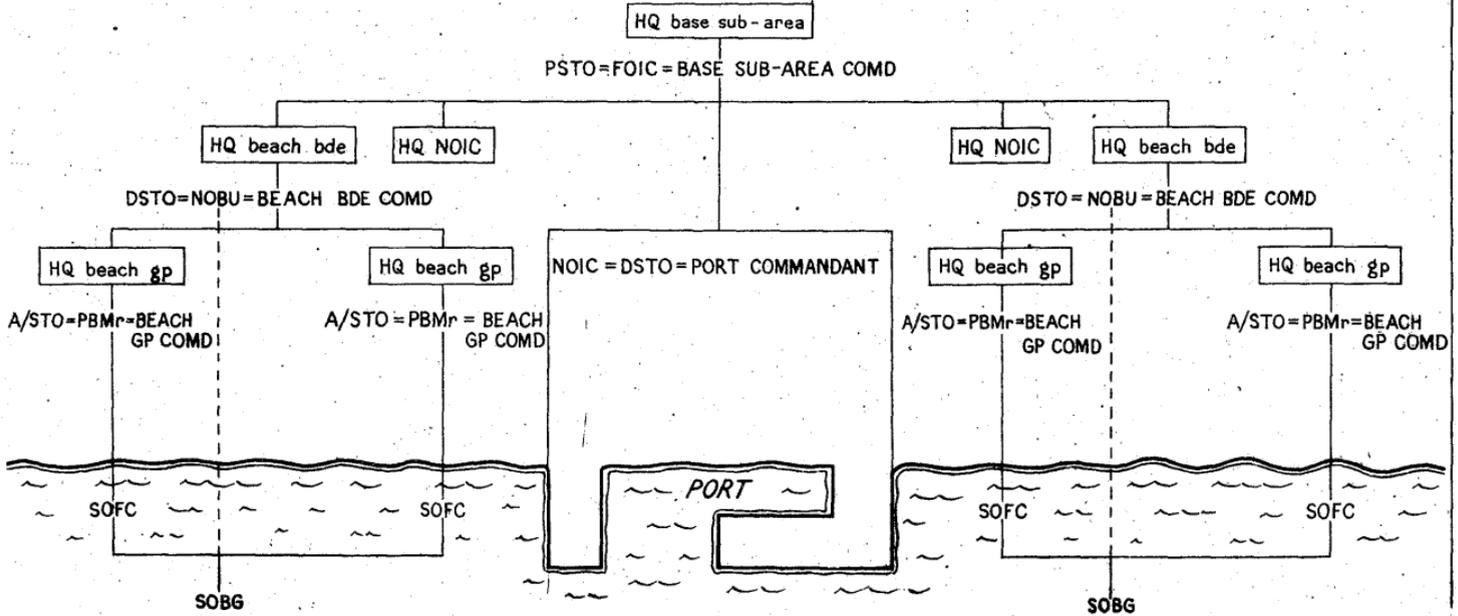


NOTE:- At discretion of NCAF, he and his SOAGs will withdraw, SOBG taking over control of seaward area.

INTERSERVICE COMMAND ON A TWO DIVISIONAL FRONT

STAGE IV

SITUATION: HQ base sub-area established ashore. Build-up phase developing into normal port working.
 Later when agreed by naval force commander and FOIC, the SOBG, NOBU, PBMr and SOFC will withdraw.



DIVISIONAL OPERATION ORDER PROFORMA

(To be classified)

TOP SECRET

..... **DIVISION OPERATION ORDER No.**

Copy No.

Date

GO/

Ref Maps :—(Country, scale, sheet numbers)

Air Photographs :—(Country, series, numbers)

INFORMATION

1. **Enemy**

See Divisional Intelligence Summaries Nos. and Defence Overprints.

2. **Topography**

- (a) Sector and beaches .. See Trace P attached.
(b) Beach exits { See Divisional Intelligence
(c) Hinterland { Summary No.....

3. **Own Troops**

.... Corps is to secure a bridgehead in the area of
.....from inclusiveto inclusive
with :—

RIGHT

CENTRE

LEFT

4. **Objectives**

See Trace P attached.

5. **Boundaries**

See Trace P attached.

6. **Additional troops**

See Appendix A attached.

7. **Allotment of ships, craft and amphibians**

See Appendix B attached.

8. **Naval support**

See Appendix C attached.

9. **Air support**

See Appendix D attached.

10. **Commandos**

(Brief plan if not under comd for ops.)

11. **Airborne troops**

(Brief plan.)

Divisional Operation Order Proforma—(contd.)**12. Other forces co-operating****INTENTION**

13.

METHOD**14. Outline plan**

The operation will be carried out in phases.

Phase 1—Seizure of by Commandos.

Phase 2—Assault by and Infantry Brigades.

Reserve Infantry Brigade will be prepared to
land at hrs.

Phase 3—Exploitation to by Infantry Brigade, etc etc.

15. Phase I

Seizure of by Commandos.

Codeword

For detailed plan *see* Appendix E.**16. Phase II**

Assault by and Infantry Brigades, etc.

Codeword

(a) Grouping**RIGHT**

Infantry Brigade Group.

Commander Infantry Brigade.

Under command

In support

LEFT

Infantry Brigade Group.

Commander Infantry Brigade.

Under command

In support

(b) Tasks.**(c) Objectives, report lines, boundaries, routes, junction points, *see* Trace Q.****(d) Co-ordination H- to H- Bombardment.**

H- Leading elements touch-down.

H Leading companies touch-down.

H+ Res coys touch-down.

H+ SP artillery land.

etc.

Divisional Operation Order Proforma—(contd.)

(e) Support :—

- (i) Naval. See Appendix C.
- (ii) Air. See Appendix D.
- (iii) Fire plan. See Appendix F.

(f) Success signals.

17. Phase III

18. **Fire plan.** See Appendix F.

19. RAC

- (a) (Sub/) Units not included in phase paragraphs.
- (b) Times of landing and assembly areas.
- (c) Tasks.
- (d) Recce regiment—Sub units not included in phase paragraphs.
- (e) Times of landing and assembly areas.
- (f) Tasks.
- (g) Contact detachments.
- (h) Flails.
- (i) Crocodiles.

20. Artillery

- (a) (Sub/) Units not included in phase paragraphs and times of landing.
- (b) Allotment of FOOs, FOBs, LOs and Commander's representatives.
- (c) Gun and OP areas at H+.

21. Amphibious support regiment

- (a) Allotment of (Sub/) Units not included in phase paragraphs.
- (b) Approximate times of landing.
- (c) Tasks.

22. Anti-tank

- (a) (Sub/) Units not included in phase paragraphs.
- (b) Approximate times of landing and assembly areas.
- (c) Tasks :—
 - (i) Initial.
 - (ii) Subsequent.
- (d) Battery will revert to command CRA on code word

23. Anti-aircraft

- (a) (Sub/) Units not included in phase paragraphs.
- (b) Approximate times of landing of various units.
- (c) Tasks :—
 - (i) Initial.
 - (ii) Subsequent.
- (d) Deployment of positions.
- (e) Orders for engaging aircraft after landing :—
 - (i) HAA and LAA regiments RA.
 - (ii) Engagement of aircraft by units other than (i) above.

Divisional Operation Order Proforma—(contd.)**24. Assault RE**

- (a) (Sub/) Units not included in phase paragraphs.
- (b) Allotment of AVRE.
- (c) Tasks :—
 - (i) Initial.
 - (ii) Subsequent.
- (d) Fd coy/platoons will revert to command CRE on code word

25. RE

Tasks—division of responsibility :—

- (a) CRE—
 - (i) (Sub/) Units not included in phase paragraphs and times of landing.
 - (ii) Support of assaulting brigades.
 - (iii) Initial clearance of beach obstacles during assault.
 - (iv) Construction of tracked vehicle gaps.
 - (v) Repair and clearance of inland roads.
 - (vi) Landing ground.
(NOT listed in order of priority.)
- (b) CRE beach brigade—
 - (i) (Sub/) Units not included in phase paragraphs and times of landing.
 - (ii) Clearance of beaches.
 - (iii) Development of tracked and wheeled beach exits.
 - (iv) Development of beach area and BMA.
 - (v) Landing ground.
(NOT listed in order of priority.)
- (c) Bridging.
- (d) RE stores and bridging. (Appendix G.)

26. Airfield construction

- (a) Recce parties.
- (b) Areas reserved for airfield construction. See Trace R.
- (c) Unit responsible.

27. Machine gun battalion

- (a) (Sub/) Units not included in phase paragraphs.
- (b) Approximate times of landing and assembly areas.
- (c) Areas of deployment.
- (d) Tasks :—
 - (i) MMG.
 - (ii) Mortars.

Divisional Operation Order Proforma—(contd.)

28. Air

- (a) Allotment of tentacles.
- (b) Allotment of FCPs and contact cars.
- (c) Time lag for support.
- (d) Bomblines.
- (e) Recognition signals.
- (f) Tac R broadcasts.

29. Mines

- (a) Allotment, giving types and quantity.
- (b) Minefield policy in bridgehead, *eg* priority—
 - (i) Protective minefields.
 - (ii) Defensive minefields.
 - (iii) Tactical minefields.

30. Smoke

- (a) Policy.
- (b) Tasks of smoke units.

31. Traffic control

- (a) Speed and density.
- (b) Vehicle lighting.
- (c) Recovery on forward areas.
- (d) For further details *see* Divisional Administrative Order No....., paragraph 23.

32. Control of beaches

- (a) Allotment of provost.
- (b) Marking of gaps through obstacles during assault.
- (c) Marking of minefields.

33. Security

- (a) Formation signs.
- (b) Documents not to be taken ashore.

34. Chemical warfare

35. Waterproofing—Policy.

36. Preservation of vulnerable points

- | | | | | |
|-----------------------|----|----|----|-------------------|
| (a) Responsibility :— | | | | } See Appendix H. |
| (i) Initial | .. | .. | .. | |
| (ii) Subsequent | .. | .. | .. | |
| (b) Bridges | .. | .. | .. | |
| (c) Installations | .. | .. | .. | |
| (d) Water points | .. | .. | .. | |

ADMINISTRATION

- 37. *See* Administrative Order No.

Divisional Operation Order Proforma—(contd.)**INTERCOMMUNICATION****38. Location of headquarters**

(a) Corps :—

- (i) Afloat.
- (ii) Ashore.
- (iii) Approximate time of landing.

(b) Division :—

- (i) Afloat.
- (ii) Ashore.
- (iii) Approximate time of landing.

(c) Brigades :—

- (i) Afloat.
- (ii) Ashore.
- (iii) Approximate time of landing.

39. Wireless restrictions

- (a) Wireless silence will be maintained up to H
- (b) Listening watch.
- (c) Communication prior to wireless silence being relaxed.
- (d) Code word for breaking of wireless silence, and originating HQ/authority.

40. Liaison—Exchange of liaison officers between formations.**41. Codes**

- (a) Place code name issued. *See* Appendix I.
- (b) Code names for formations and units. *See* Appendix J.
- (c) Code names for use from shore to ship only.

42. Success signals—Consolidated list. *See* Appendix K.**43. Time**—Time signals will be taken from BBC broadcasts.**44. Passwords**(a) *See* Appendix L.

These will be changed daily at hours.

45. Acknowledge

Lt.-Col.

G.S.O.I.

Time of signature.

Time issued to signals.

Delivery instructions.

Divisional Operation Order Proforma—(contd.)

		Copy No.	Appx. A etc.	Trace P etc.
DISTRIBUTION				
Brigades. Recce regiment.	}	Own subordinate units.		
RA.				
RE.				
Signals.				
Machine gun battalion.				
Formations and units under command.	}	Other formations and units co-operating.		
Formations and units in support.				
Naval commander assault force.				
Air commander's repre- sentative.				
Commandos.				
Airborne troops. Beach brigade.				
Flank formations.				
Corps. Army for " J " service.		Superior HQ.		
Commander. G. A/Q. AQMGM(M)—PMLO. SBLO.	}	Staff.		
ST.				
Medical.				
Ordnance.				
REME.				
Provost.	}	Own services.		
Postal.				
Camp.				
File.				
War diary.				
Spare.				

Divisional Operation Order Proforma—(contd.)

(To be classified)

TOP SECRET

APPENDIX A to Division
Operation Order No.

ORDER OF BATTLE

1. Division Order of Battle.
2. Under command
3. Coming under command at
4. In support and under command for landing.
5. Reverting to command of on landing.

Divisional Operation Order Proforma—(contd.)

(To be classified)

TOP SECRET

APPENDIX B to . . . Division
Operation Order No

ALLOTMENT OF NAVAL CRAFT

This Appendix must show clearly the allotment of landing craft, assault and load carrying, by types to each subordinate formation and unit under command. This information will be taken from the Naval Operation Order.

SPECIMEN

Type of craft	X Brigade Group	Y Brigade Group	Artillery	etc.
LCA ..	56	50	—	—
LST ..	—	—	20	30

Divisional Operation Order Proforma—(contd.)

(To be classified)

TOP SECRET

APPENDIX C to Division
Operation Order No.

NAVAL SUPPORT

Information for this Appendix should be taken from the Naval Operation Order, and may include the following details :—

1. Composition of naval assault force by types, giving armament and ammunition carried.
2. Details of pre-arranged bombardment plan.
3. No. of HM Ships on call to each brigade, giving armament and ammunition carried.
4. Target table.
5. Allotment of FOB parties.

Divisional Operation Order Proforma—(contd.)

(To be classified)

TOP SECRET

APPENDIX D to Division
Operation Order No.

AIR SUPPORT

This Appendix will be taken from Air Operation Order and should include :—

1. Pre-arranged bombing plan for heavy and medium bomber squadrons.
2. Number and type of squadrons available at call for close support.
3. Number of aircraft available for Strat R, Tac R and Arty R.

Divisional Operation Order Proforma—(contd.)

(To be classified)

TOP SECRETAPPENDIX F to Division
Operation Order No.**FIRE PLAN**

This Appendix should include :—

1. Policy for fire support.
2. CB fire.
3. Harassing fire.
4. Target table.
5. Annexures showing for each phase
 - (a) Grouping.
 - (b) Fire plan.

DIVISIONAL ADMINISTRATIVE ORDER PROFORMA

(To be classified)

TOP SECRET

Copy No.

Date

AQ/

..... **DIVISION ADMINISTRATIVE ORDER No.**

(Issued in conjunction with Div OO No.)

Ref Maps :—(Country, scale, sheet numbers)

Air Photographs :—

1. Troops to be maintained

Personnel

Vehicles

(a) Navy.

(b) Army.

(c) RAF.

Total numbers

2. Allocation and command of beach brigade or beach group

(a) Allocation of beach brigade or beach group.

(b) Divisional first key plan. *See* Appendix A.

(c) Time at which command of beach brigade or beach group will pass to division.

(d) Time at which command of beach brigade or beach group will pass to corps or L of C.

3. Organisation of beaches

(a) Beaches to be worked.

(b) If only one BMA in beach brigade, area includes installations in each beach group area and those in beach brigade area.

4. Maintenance policy

5. Maintenance requirements

(a) Breakdown of commodities on daily basis. *See* Appendix B.

(b) "XX" priority stores.

(c) Preloaded amphibians and vehicles of general transport companies.

6. Initial dump areas

Details of initial dumps in each beach group area.

7. Ferry control

(a) Policy of control.

(b) Beach brigade conference.

(c) Authority for change in priorities.

8. Documentation of stores

Separate instruction by PMLO of beach brigade

Divisional Administrative Order Proforma—(contd.)

9. **Transit areas**
 - (a) Responsibility.
 - (b) Procedure.
 - (c) Dumping of Mae Wests.
10. **Assembly area**
 - (a) Responsibility.
 - (b) Reporting of unit representatives.
 - (c) Procedure. See Appendix C.
 - (d) System for calling units forward.
11. **Ammunition**
 - (a) Unit holdings.
 - (b) Formation second line.
 - (c) Preloaded.
 - (d) Establishment of ammunition points (location and approximate time of opening in terms of H hour).
 - (e) Replenishment.
12. **Petrol, oil and lubricants**
 - (a) Unit vehicles.
 - (b) Unit reserve.
 - (c) Establishment of petrol points.
 - (d) Replenishment.
 - (e) RN requirements on shore.
13. **Supplies**
 - (a) Initial maintenance.
 - (b) Unit reserve.
 - (c) Establishment of supply points.
 - (d) Replenishment.
 - (e) Civil affairs requirements.
 - (f) Prisoner of war requirements.
14. **Transport**
 - (a) Unit first line policy.
 - (b) Command of transport on landing.
 - (c) Preloading.
15. **Waterproofing**
 - (a) Policy. See Division Operation Order No. para. 35.
 - (b) Unit vehicles will report to
 - (c) Units, etc to carry out work.
16. **Medical**
 - (a) Policy.
 - (b) Estimate of casualties.
 - (c) Evacuation shore to ship.
 - (d) Air evacuation.
 - (e) Allotment of medical resources.
 - (f) Medical stores.
 - (g) Hygiene.
 - (h) Anti-malarial precautions.

Divisional Administrative Order Proforma—(contd.)

17. Ordnance

- (a) Landing reserves.
- (b) Beach maintenance packs.
- (c) Channel of supply.
- (d) Indents.
- (e) Control of issue.
- (f) Unaccompanied G1098.
- (g) Packs for shipwrecked personnel.

18. Clothing and equipment

- (a) Personnel and unit anti-gas clothing and equipment.
- (b) Reserve of anti-gas clothing and equipment.
- (c) Camouflage clothing and equipment.
- (d) Lifebelts.

19. Repair and recovery

- (a) Landing of recovery sections.
- (b) Establishment of and recovery to drowned vehicle parks.
- (c) Establishment of forward recovery posts.
- (d) Responsibility for recovery.
- (e) Responsibility for repair.
- (f) First line repair.
- (g) Infantry brigade workshops.
- (h) Specialised workshops such as tank troops workshops.
- (i) Repair to RE plant and equipment.

20. RE services and stores

- (a) Priorities of development and administration works.
- (b) Indents for stores.

21. Labour

- (a) Allocation of additional troops.
- (b) Requirements other than normal beach brigade tasks.
- (c) Civilian labour.

22. Civil affairs

- (a) Provost.
- (b) Counter intelligence and security.
- (c) Medical.
- (d) Local purchase.
- (e) Hiring, requisitioning and claims.
- (f) Supplies.

Divisional Administrative Order Proforma—(contd.)**23. Traffic control**

- (a) Routes.
- (b) Marking of routes.
- (c) Responsibility between division and beach brigade.
- (d) Establishment of control posts.
- (e) Lighting of routes.
- (f) Speed and density.
- (g) Breakdowns.
- (h) Vehicle lighting.

24. Salvage**25. Prisoners of war**

- (a) Responsibility.
- (b) Evacuation.
- (c) Escaped Allied prisoners of war.

26. Water

- (a) Water points.
- (b) Ration scales, if any.
- (c) Medical precautions.

27. Burial

- (a) Burial of own dead.
- (b) Burial of enemy dead.
- (c) Registration and identification
- (d) Personal effects.

28. Pay

- (a) Issue and exchange into local currency.
- (b) Imprest accounts.
- (c) Local payments.

29. Welfare**30. Returns**

See Appendix D.

31. Acknowledge

Lt Colonel
AA and QMG
..... Division

Time of signature
Method of issue
Time issued to signals

Divisional Administrative Order Proforma—(contd.)

	<i>Copy No.</i>	<i>Appx. A.</i>	<i>Etc.</i>
DISTRIBUTION			
Brigades Recce regiment RA RE Signals Machine gun battalion			
} Own subor- dinate units.			
Formations and units under command Formations and units in support Naval assault force Group RAF Commandos Airborne troops Beach brigade Flank formations			
} Other forma- tions and units co- operating.			
Corps Line of communications area			
} Superior HQ.			
Commander G A/Q AQMG(M)—PMLO SBLO			
} Staff.			
ST Medical Ordnance REME Provost Postal Camp Civil affairs military government			
} Own services.			
File War Diary Spare			

Divisional Administrative Order Proforma—(contd.)

SHEET No.

TOTAL No. OF SHEETS

* UNIT detailing OC TROOPS

" X " INFANTRY BRIGADE LANDING TABLE

Issued as Appendix " " to " X " INFANTRY
BRIGADE OPERATION ORDER No.

DATED

(To be classified)
TOP SECRET

Copy No.

Date

Landing Table Serial No.	Approx time of landing	Unit	Men	No. of vehicles	Stores long tons	Ship	Craft				Beach	Remarks
							(h)	(i)	(j)	(k)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)

OPERATION ORDER, LANDING TABLE AND
AIR SUPPORT PROFORMA

PART III c 1

**INSTRUCTIONS FOR THE PREPARATION OF AN INFANTRY
BRIGADE LANDING TABLE**

Serial	Reference column	Instructions for completion
(a)	(b)	(c)
1	(a)	Landing table serial numbers refer only to craft loads (LCT, LCA, LVT etc.) and LST loads (and NOT to LSI carrying minor landing craft). Block landing table serial numbers are received by brigade from division and are sub-allotted by brigade to craft and ship loads in the order of beaching. When craft beach in flights, block landing table serial numbers are normally allotted to craft from right to left across the brigade front. Landing table serial numbers run consecutively through the landing table.
2	(b)	Time of landing is given for the first flights only, namely H hour; for all other flights, the time required in this column is the time at which subsequent flights are scheduled to touch-down, the actual time depending on the situation. These subsequent flights are normally called in to beach by personnel of the naval beach commando.
3	(c)	Unit finding the officer commanding troops must be indicated by a mark " * ".
4	(d)	Personnel travelling with bicycles or handcarts will be included in this column and not in column (e).
5	(e)	Vehicles should appear in the columns in the order of discharge, <i>ie</i> usually reverse order to loading.
6	(f)	Self explanatory.
7	(g)	Self explanatory.
8	(h) (i)	The headings of these columns will be filled in when the appropriate craft and amphibians to be used on the operation are known.
	(j) (k)	
9	(l)	Sector and beach should always be mentioned together.
10	(m)	In this column are put such details as are necessary for the information of users of the table and which have not already become apparent in previous columns. Details of personnel transferring from LSI or other ships to amphibians can be shown in this column.

Note. (a) An officer commanding troops must be detailed for every ship or craft load. Formations will normally prepare a list detailing these officers commanding troops by name and unit. Substitute officers commanding troops should also be detailed in case of necessity.

(b) A stowage plan should be attached to the brigade landing table in respect of each LST for which a serial is allotted. A copy of the stowage plan should be given to OC troops.

PART III d 2

OPERATION ORDER, LANDING TABLE AND
AIR SUPPORT PROFORMA

Army Form C 2138

AIR SUPPORT DEMAND FORM

Call		Transmission Instructions	
ABOVE THIS LINE FOR SIGNALS USE ONLY			
FROM		Date— Time of Origin	
TO		Demand No.	
TARGET (To include any special purpose not obvious in description of target.)	A.		
TIME OVER TARGET	B.		
POSITION OF FORWARD TROOPS	C.		
SPECIAL INSTRUCTIONS (If any.)	D.		
SIGNATURE	Inside this space for Signals use only		
		Operator.	
	THI or TOR		
	Time Cleared		

Note. (a) The air support demand form is filled in by forward army formations requiring air support on specific targets. Contents are transmitted by W/T to brigade headquarters over army channels. From brigade headquarters to corps headquarters LSH(C) or in the case of one divisional assault, to the LSH(L). It is transmitted over the ASSU net.

(b) Special instruction in Far Eastern theatres will probably give details of coloured mortar smoke target indicators.

BEAUFORT SCALE OF WINDFORCE

<i>Beaufort (a)</i>	<i>For use inland (b)</i>			<i>For use at sea (c)</i>		
	<i>General description</i>	<i>Velocity in m.p.h. at 30 feet above ground level</i>	<i>General description</i>	<i>Velocity in nautical m.p.h. at sea level</i>		
0	Calm	Smoke rises vertically	Less than 1	Calm	Sea like a mirror	
1	Light air	Wind direction shown by smoke drift but not by wind vanes	1-3	Light air	Ripples with the appearance of scales are formed, but without foam crests	
2	Slight breeze	Wind felt in face. Leaves rustle. Ordinary vane moved by wind	4-7	Light breeze	Small wavelets, still short but more pronounced, crests have a glassy appearance and do not break	6
3	Gentle breeze	Leaves and small twigs in constant motion. Wind extends light flag	8-12	Gentle breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses	7-10
4	Moderate breeze	Raises dust and small paper. Small branches are moved	13-18	Moderate breeze	Small waves becoming longer; fairly frequent white horses	11-15

METEOROLOGICAL DATA

PART IV a 1

Beaufort Scale of Windforce—*continued*

Beaufort (a)	For use inland (b)			For use at sea (c)		
	General description	Velocity in m.p.h. at 30 feet above ground level		General description	Velocity in nautical m.p.h. at sea level	
5	Fresh breeze	Small trees in leaf begin to sway	19-24	Fresh breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. (Chance of some spray)	16-20
6	Strong breeze	Large branches in motion. Whistling in telegraph poles	25-31	Strong breeze	Large waves begin to form, white foam crests are more extensive elsewhere (probably some spray)	21-26
7	High wind	Whole trees in motion	32-38	Moderate gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind. (Spindrift begins to be seen)	27-33
8	Gale*	Twigs break off trees. Generally impedes progress	39-46	Fresh gale	Moderately high waves of greater length; edges of crests break into spindrift. The foam is blown in well marked streaks along the direction of the wind	34-40

* The gale warning signal in the British Isles is hoisted for winds which may reach force 8 or above

Beaufort Scale of Windforce—continued

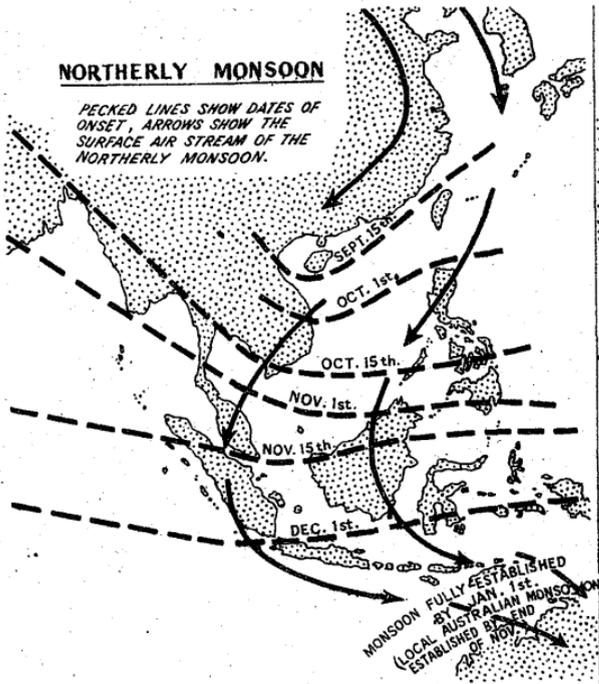
<i>Beaufort (a)</i>	<i>For use inland (b)</i>		<i>For use at sea (c)</i>			
	<i>General description</i>	<i>Velocity in m.p.h. at 30 feet above ground level</i>	<i>General description</i>	<i>Velocity in nautical m.p.h. at sea level</i>		
9	Strong gale	Slight structural damage occurs. Chimney pots removed	47-54	Strong gale	High waves. Dense streaks of foam along the direction of the wind. Sea begins to roll. Spray may affect visibility	41-47
10	Whole gale	Trees uprooted, considerable structural damage	55-63	Whole gale	Very high waves with overhanging crests. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes a white appearance. The rolling of the sea becomes heavy and shocklike. Visibility is affected	48-55

Beaufort Scale of Windforce—continued

Beaufort (a)	For use inland (b)		For use at sea (c)		
	General description	Velocity in m.p.h. at 30 feet above ground level	General description	Velocity in nautical m.p.h. at sea level	
11	Storm	Very rarely experienced. Widespread damage	64-75	Storm Exceptionally high waves. (Small and medium sized ships might be for a long time lost to view behind the waves.) The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected	56-65
12	Hurricane		Above 75	Hurricane Air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected	Above 65

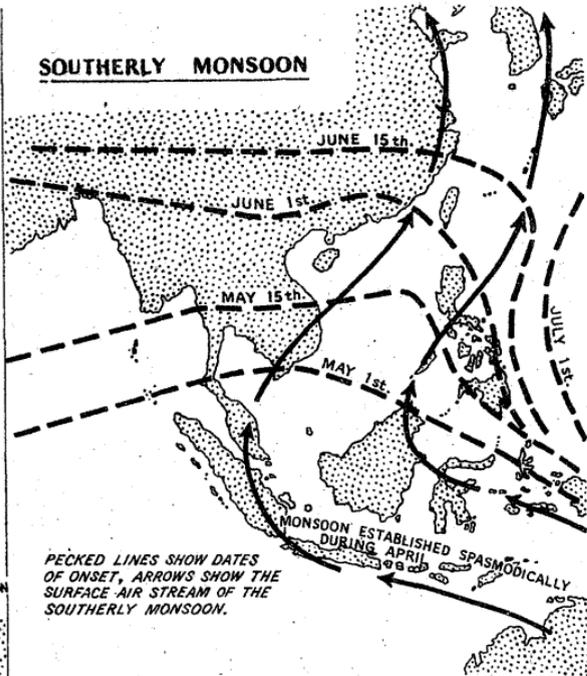
NORTHERLY MONSOON

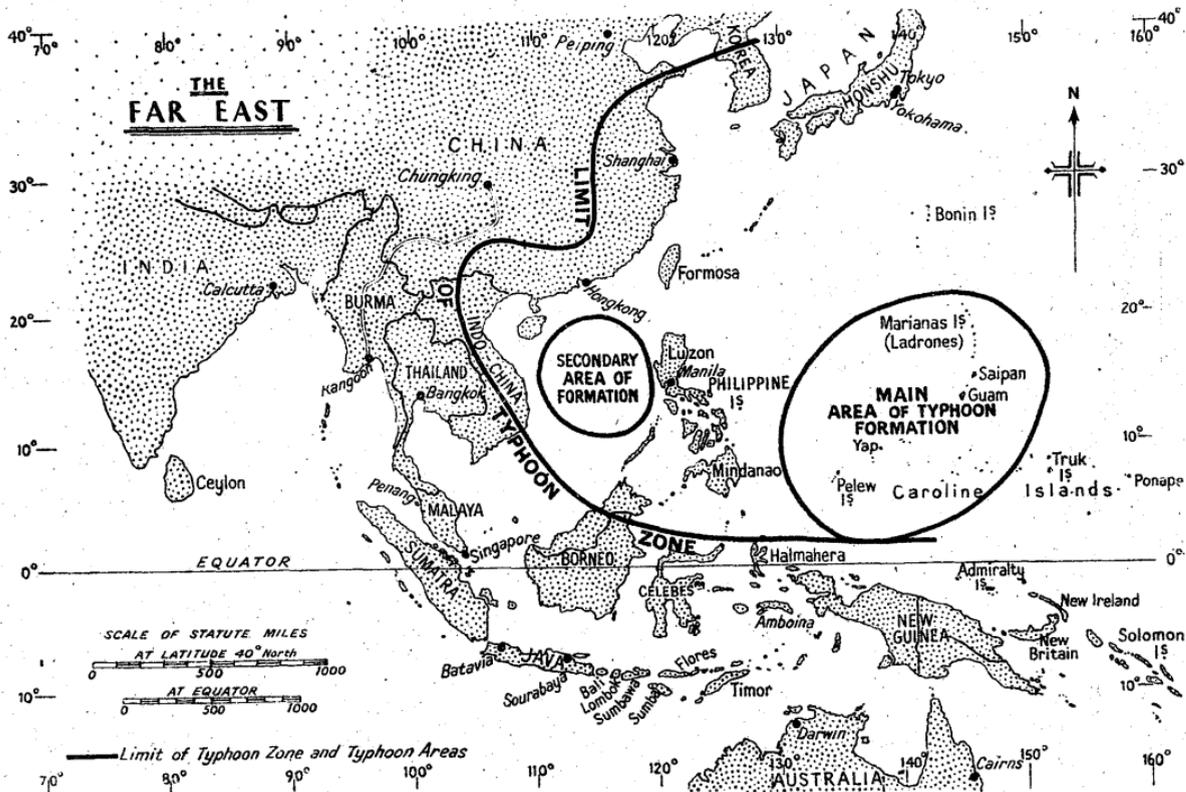
PECKED LINES SHOW DATES OF ONSET, ARROWS SHOW THE SURFACE AIR STREAM OF THE NORTHERLY MONSOON.



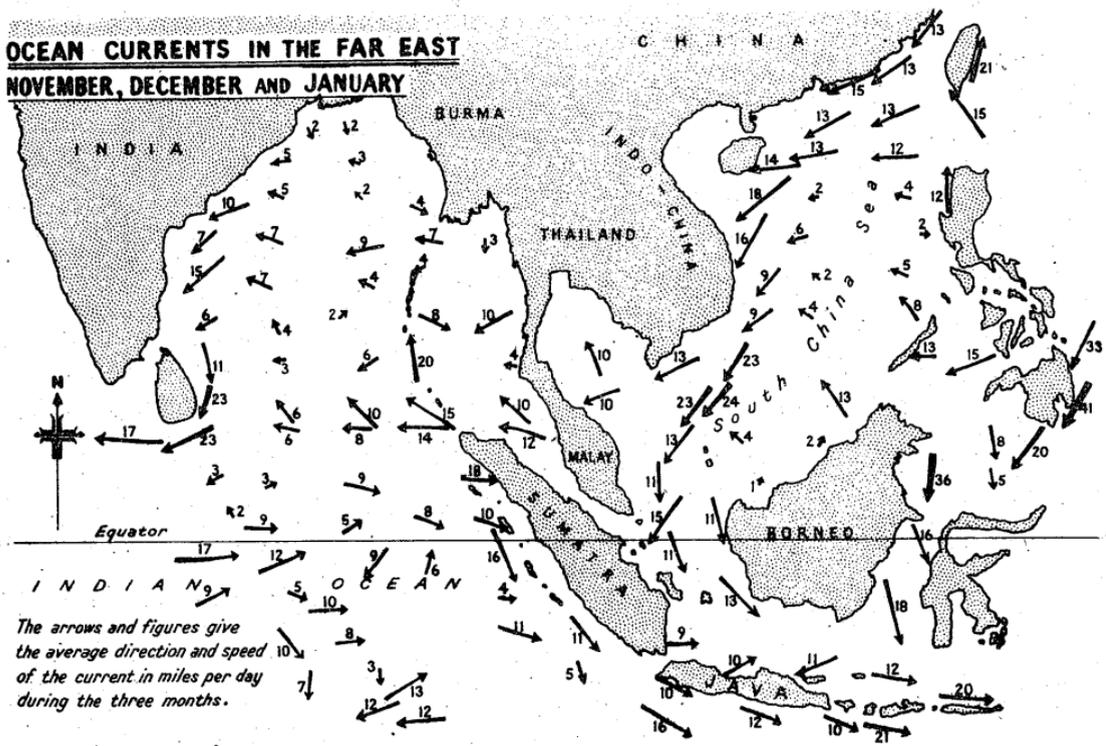
SOUTHERLY MONSOON

PECKED LINES SHOW DATES OF ONSET, ARROWS SHOW THE SURFACE AIR STREAM OF THE SOUTHERLY MONSOON.





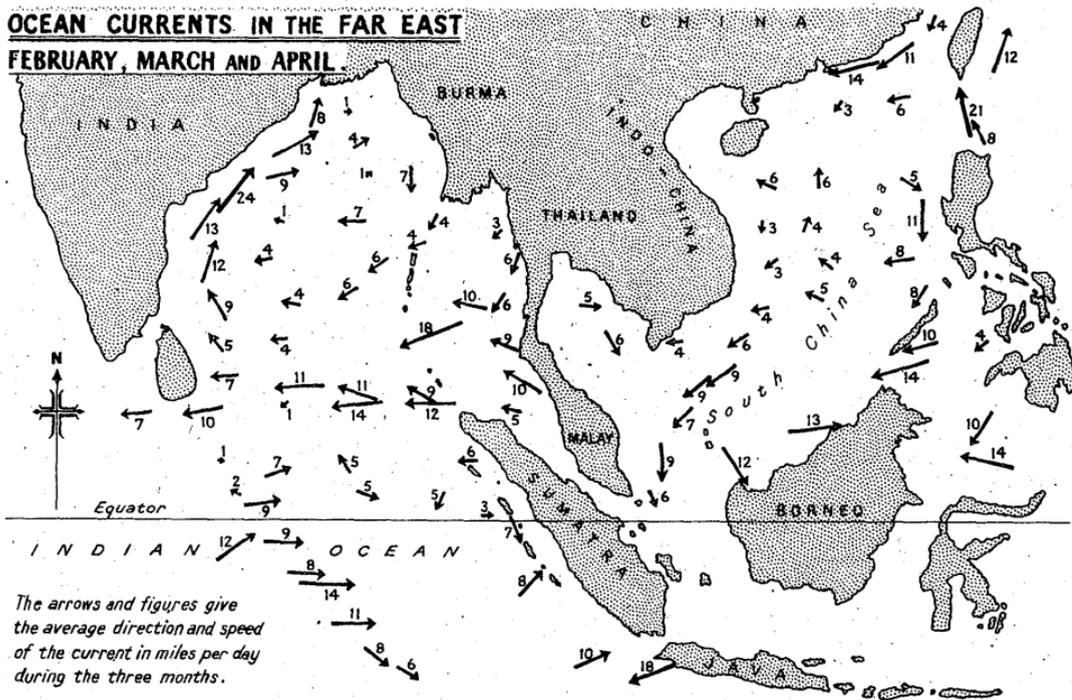
OCEAN CURRENTS IN THE FAR EAST
NOVEMBER, DECEMBER AND JANUARY



The arrows and figures give the average direction and speed of the current in miles per day during the three months.

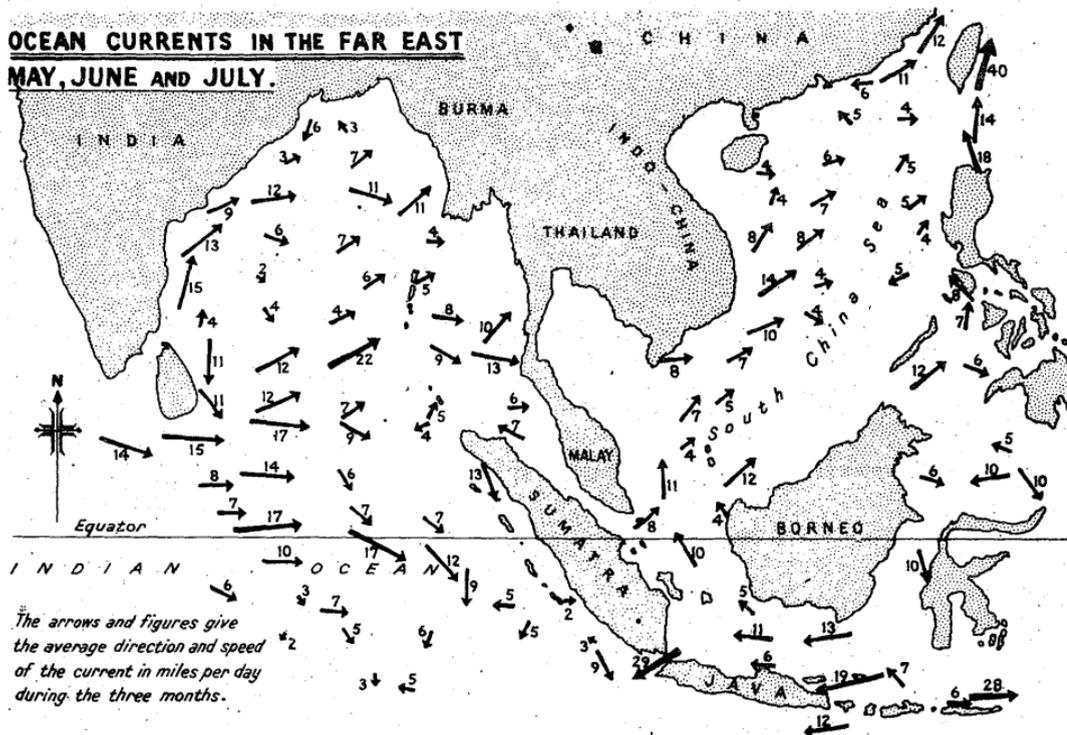
OCEAN CURRENTS IN THE FAR EAST

FEBRUARY, MARCH AND APRIL.



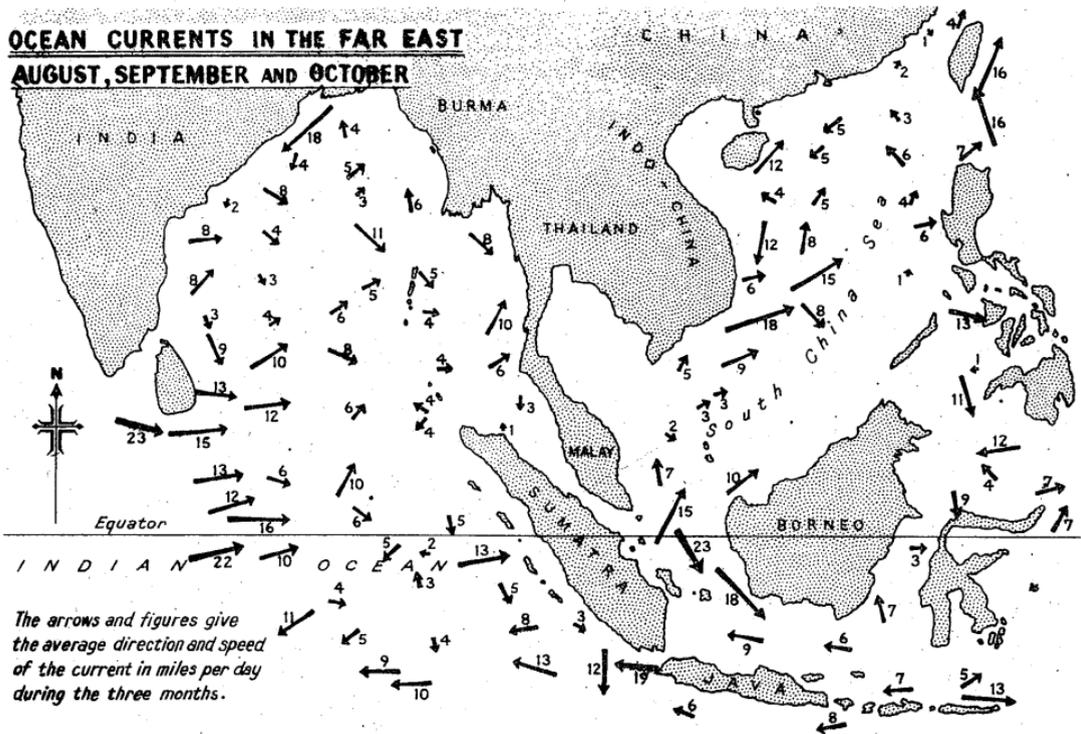
The arrows and figures give the average direction and speed of the current in miles per day during the three months.

OCEAN CURRENTS IN THE FAR EAST
MAY, JUNE AND JULY.



The arrows and figures give the average direction and speed of the current in miles per day during the three months.

OCEAN CURRENTS IN THE FAR EAST AUGUST, SEPTEMBER AND OCTOBER



GENERAL NOTES ON DATA OF LANDING SHIPS AND CRAFT

1. Certain details of the speed, endurance and capacity of landing ships and craft have been omitted from these tables as the security grading of this data is higher than Restricted. When this security restriction is removed, the details should be entered into the columns provided. Full details of landing ships and craft are given in Admiralty CB 04304 and CB 04305.

2. Caution should be exercised in the use of the tables giving the data of the landing ships and craft, as it has only been possible to give approximate figures in many cases owing to the fact that technical details are governed by the variety of types involved in each case, together with local conditions. Particular caution should be used when referring to the cruising speed and endurance of landing ships and craft. Cruising speeds will vary according to the different conditions of weather and climate under which they are recorded. Endurance will be affected by the cruising speed, the amount and type of fuel carried and the make of the engine. A range of these speeds and endurances can be obtained from the Admiralty CBs mentioned above.

3. The information given on the LST(3) and LCM(7) is based on specification and drawing board investigations and not upon actual trial figures.

4. All references to tons are " British " or " long " tons of 2,240 lbs.

General Notes on Data of Landing Ships and Craft—(contd.)

DETAILS OF HEADQUARTERS SHIPS

**THE STANDARD NOMENCLATURE OF HEADQUARTERS
SHIPS WITH NAVAL AND ARMY COMMANDERS
ACCOMMODATED ON BOARD**

<i>Serial</i>	<i>HQ ship or craft</i>	<i>Naval commander</i>	<i>Military commander</i>	<i>RAF or RN (air) representative</i>
(a)	(b)	(c)	(d)	(e)
1	Naval force HQ ship (LSH(C))	Naval force commander	Corps or army commander	The air commander
2	Naval assault force HQ ship (LSH(L))	Naval commander assault force (flag officer or commodore)	Assault divisional commander	An air staff officer
3	Stand-by assault force HQ ship (LST HQ ship)	Senior officer LST group	Reserve brigade commander	An air staff officer possibly
4	Naval assault group HQ ship (LSH(S) or LSI)	Senior officer assault group	Assault brigade commander	—
5	Senior officer build-up group HQ ship. (SOBG HQ ship)	Senior officer build-up group	Beach brigade commander	—
6	Landing craft HQ LCH (in initial stages)	Deputy senior officer assault group	Battalion commander (in initial stages)	—

PART V b 2 LANDING SHIPS AND CRAFT AND AMPHIBIANS

Details of Headquarters Ships—(contd.)

<i>Serial</i> (a)	<i>HQ ship or craft</i> (b)	<i>Naval commander</i> (c)	<i>Military commander</i> (d)	<i>RAF or RN (air) representative</i> (e)

LANDING SHIPS AND CRAFT

General Details, Speed, Endurance and Capacity

Serial (a)	Type (b)	Speed		Domestic fresh water capacity (in tons) (e)	Complement (f)	Troop carrying capacity (g)	Capacity						Remarks	
		Cruising speed in knots (c)	Endurance in miles at cruising range (straight course) (d)				Maximum homogeneous load— tons (h)	Number of—						
								Churchills (j)	Shermans (k)	3-ton GS (l)	DUKW (m)	LVT 2 and 4 (n)		LVT 3 (o)
1	LCA.. ..	7	90-140	2.5	4	35	—	—	—	—	—	—	—	Plus 1 officer per 3 craft making 5 in third craft. Spread of slings of davits and derricks—27' 3" Davits, 22' 8" Derricks.
2	LCF(3) ..	—	—	21	68	—	—	—	—	—	—	—	—	Serial Nos 3-6 complement of 68.
3	LCF(4) ..	—	—	—	76	—	—	—	—	—	—	—	—	Serial Nos 7-18 complement of 76.
4	LCG(L)(3) ..	9	900	14.3	45	—	—	—	—	—	—	—	—	This craft has extra fuel stowage for the Far East
5	LCG(L)(4) ..	8.5	900	60	45	—	—	—	—	—	—	—	—	Plus one Stoker and two Marines in Far East if fitted with 4.7 BL guns. 2 4.7-QF or BL and 2 Oerlikons.
6	LCG(M)(1) ..	10.75	3,320	10	31	—	—	—	—	—	—	—	—	Plus one Stoker and two Marines in Far East if fitted with 4.7 BL guns. Extra fuel stowage for Far East. 24.7-BL and 7 Oerlikons.
7	LCH ..	—	—	22.3	35 approx.	—	—	—	—	—	—	—	—	2 17-pr and 2 25-pr plus 2 twin Oerlikons.
8	LCI(L)1-350	12.5	1,800	22.3	19	200	—	—	—	—	—	—	—	On upper deck another 46 troops can be seated.
9	LCI(L)351 on-wards	12.5	1,800	37.5	29	186	—	—	—	—	—	—	—	Troops carried in bunks.

LANDING SHIPS AND CRAFT

General Details, Speed, Endurance and Capacity—*continued*

Serial (a)	Type (b)	Speed		Domestic fresh water capacity (in tons) (e)	Complement (f)	Troop carrying capacity (g)	Maximum homo- geneous load— tons (h)	Capacity						Remarks
		Cruising speed in knots (c)	Endurance in miles at cruising range (straight course) (d)					Number of—						
								Churchills (j)	Shermans (k)	3-ton GS (l)	DUKW (m)	LVT 2 and 4 (n)	LVT 3 (o)	
10	LCI(S) ..	—	—	2	17	102	—	—	—	—	—	—	—	Troops carried on seats. Plus 1 officer per 3 craft. Tanks and armoured cars up to 16 tons. MT loaded up to 10 tons. Gray engine (Diesel) plus 1 officer per 3 craft. Hudson Invader. Plus 1 officer per 3 craft. Fresh water carried at expense of load. 1 officer per 3 craft. Converted LCP(L)1-303—Stripped Lewis gun 2 officers and 7 ratings. } +1 officer per 3 craft for com- plement. Converted from LCI(L) "351" class. One 2-pr, one twin .5-MG, 1 4-in smoke 1 6-pr, 2 Oerlikons plus 1 4-in smoke mortar. 2 .5-MG, 1 4-in smoke. 2 .5-in, 1 4-in smoke.
11	LCM(1) ..	6.5	80	9.5	6	100	—	—	—	—	—	—	—	
12 (a)	LCM(3) ..	7	360	10	6	60	—	—	1	—	—	—	—	
12 (b)	LCM(3) ..	8.25	275	10	6	60	—	—	1	—	—	—	—	
13	LCM(7) ..	—	—	15	6	—	—	—	1	—	—	—	—	
14 (a)	LCN ..	7.5	150	—	9	—	—	—	—	—	—	—	—	
14 (b)	LCN ..	9.25	320	—	9	—	—	—	—	—	—	—	—	
15 (a)	LCP(L) ..	7.5	150	—	—	25	—	—	—	—	—	—	—	
15 (b)	LCP(L) ..	9.25	320	—	3	25	—	—	—	—	—	—	—	
16	LCQ ..	—	—	2	70 (inc. tps.)	—	—	—	—	—	—	—	—	
17	LCS(L)(1) ..	10	63	—	13	—	—	—	—	—	—	—	—	
18	LCS(L)(2) ..	—	—	2	25	—	—	—	—	—	—	—	—	
19	LCS(M)(1) ..	7	90-140	—	11	—	—	—	—	—	—	—	—	
20	LCS(M)(3) ..	7	90-140	—	11	—	—	—	—	—	—	—	—	

LANDING SHIPS AND CRAFT
General Details, Speed, Endurance and Capacity—(continued)

Serial (a)	Type (b)	Speed		Domestic fresh water capacity (in tons) (e)	Complement (f)	Troop car ying capacity (g)	Capacity						Remarks	
		Cruising speed in knots (c)	Endurance in miles at cruising range (straight course) (d)				Maximum homo- geneous load— tons (h)	Number of—						
								Churchills (j)	Shermans (k)	3-ton GS (l)	DUKW (m)	LVT 2 and 4 (n)		LVT 3 (o)
21 (a)	LCT(3)	9	1,110	2.5	12	—	300	5	8	10	—	—	—	Paxman engine. Sterling Admiral engine. Nos 423 on- wards extra 12 tons. Water can be carried at expense of maximum load. Extra fuel tanks fitted for Far East. Some with 31 tons extra fresh water stowage at expense of maximum load.
21 (b)	LCT(3)	9.5	700	2.5	12	—	300	5	8	10	—	—	—	
22	LCT(4)	7	3,100	2.5	12	—	240	6	9	12	—	—	—	792 5-in rockets. 1 radio mechanic with every two craft making total complement of 18 in alternative craft. 1,044 5-in rockets. 1 radio mechanic with every two craft. 1 officer per 3 craft. Distilling capacity 60 tons per day Total number of LVT and DUKW carried with two temporary decks— 92 LVT, 108 DUKW. 15 LCM(1) can be carried, each loaded with 10 tons. 3-tonners—Tank deck 31, Upper deck 21. 3-tonners.—Tank deck 29, Upper deck 21. Distilling capacity 65tons per day.
23	LCT(5)	7	760	2.25	12	—	160	4	5	9	—	—	—	
24	LCT(8)	—	—	—	—	—	—	—	—	—	—	—	—	
25	LCT(R)(2)	—	—	2.5	17	—	—	—	—	—	—	—	—	
26	LCT(R)(3)	9	1,660	2.5	17	—	—	—	—	—	—	—	—	
27	LCV(P)	9.25	205	5 gals	3	25	2.7	—	—	—	—	—	—	
28	LSD..	16	8,000	126	141	244	—	—	—	46	41	44	—	
29	LSG	11.7	13,000	221	92	266	—	—	—	—	—	—	—	
30	LST(2)	10	19,600	446	69	177	2,100	18	20	52	22	17	19	
31	LST(3)	—	8,000	110	129	168	2,200	15	19	50	30	14	16	

LANDING SHIPS AND CRAFT

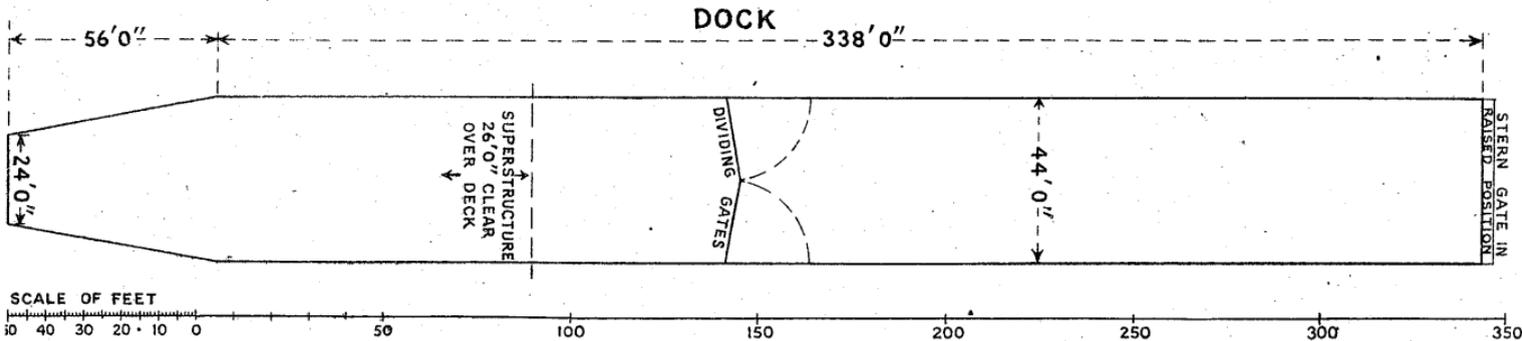
Dimensions, Beaching Draughts and Ramp Angles

Serial	Type	DIMENSIONS		Beaching draught		Ramp entrance width	Angle of ramp when beached with full beaching load, with no run up on following gradients: (a) with ramp extension (b) without ramp extension			
		Length overall	Beam, extreme	Forward	Aft		1 : 50	1 : 100	1 : 150	1 : 200
							(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
		ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.				
1	LCA	41 1½	10 6	1 10	2 3					
2	LCF(3)									
3	LCF(4)									
4	LCG(L)(3)	192 0	31 0	3 6	6 0					
5	LCG(L)(4)	186 4	38 9	2 6	4 0					
6	LCG(M)(1)	154 6	22 4	4 11	5 7					
7	LCH	158 6	23 8	3 1	5 0					
8	LCI(L) 1-350	158 6	23 8	3 1	5 0					
9	LCI(L) 351 onwards	158 6	23 8	3 1	5 0					
10	LCI(S)					9 8	(b) 19°	(b) 22°	(b) 22°	(b) 23°
11	LCM(1)	44 8	14 1	2 6	3 6	10 0	(b) 17°	(b) 18°	(b) 19°	(b) 20°
12	LCM(3)	50 0	14 1	3 3	4 0	12 0				
13	LCM(7)									
14	LCN	36 8	10 10	2 6	3 6					
15	LCP(L)	36 8	10 10	2 6	3 6					
16	LCQ									
17	LCS(L)(1)									
18	LCS(L)(2)									
19	LCS(M)(1)	41 2	10 6	1 8	1 10					
20	LCS(M)(3)	40 8	10 6	1 10	2 3					

LANDING SHIPS AND CRAFT

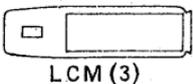
Dimensions, Beaching Draughts and Ramp Angles—continued

Serial	Type	DIMENSIONS		Beaching draught		Ramp entrance width	Angle of ramp when beached with full beaching load, with no run up on following gradients: (a) with ramp extension (b) without ramp extension			
		Length overall	Beam, extreme	Forward	Aft		1:50	1:100	1:150	1:200
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
21	LCT(3)	ft. ins. 192 0	ft. ins. 31 0	ft. ins. 3 5	ft. ins. 6 8	ft. ins. 11 10	(a) 9° (b) 18°	(a) 16° (b) 24°	(a) 18° (b) 25°	(a) 20° (b) 26°
22	LCT(4)	187 3	38 9	2 9	4 11	12 4	(a) 6° (b) 15°	(a) 11° (b) 20°	(a) 11° (b) 20°	(a) 11° (b) 20°
23	LCT(5)	112 4	32 8	2 11	4 7	12 6	(a) 10° (b) 14°	(a) 15° (b) 20°	(a) 17° (b) 21°	(a) 18° (b) 23°
24	LCT(8)	227 0	39 0							
25	LCT(R)(2)									
26	LCT(R)(3)	192 0	31 0							
27	LCV(P)	36 2	10 10	2 9	3 6	6 6	(b) 24°	(b) 28°	(b) 28°	(b) 28°
28	LSD	458 0	72 0	15 6	(mean)	43 0				
29	LSG	483 1	59 3	27 6 (mean)						
30	LST(2)	327 9	50 1½	3 0	9 6	13 0	(b) 22°	(b) 26°	(b) 26°	(b) 26°
31	LST(3)	345 10	54 0	4 6	11 6	15 0	(b) 18°	(b) 26°	(b) 26°	(b) 26°



**LANDING SHIPS & CRAFT
AND AMPHIBIANS. PART V e 1**

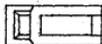
CARGO SPACE LSD



LCM (3)



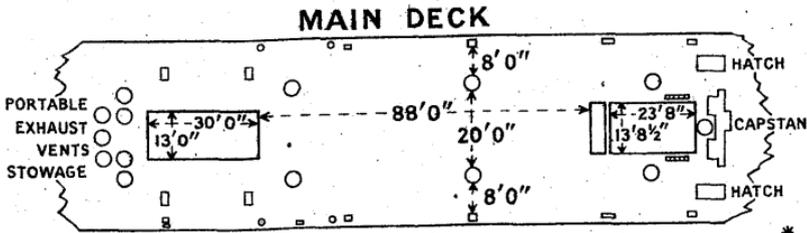
DUKW



LVT

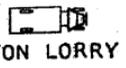
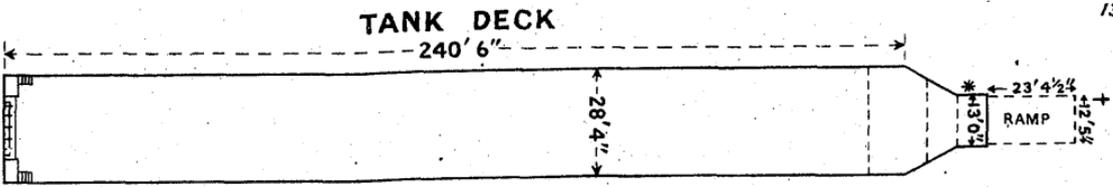
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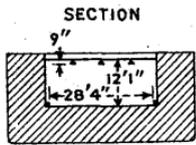


† RESTRICTING WIDTH OF RAMP :- 12' 5"

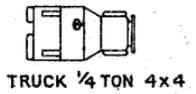
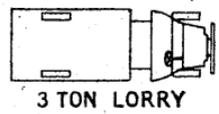
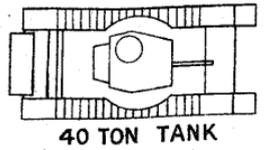
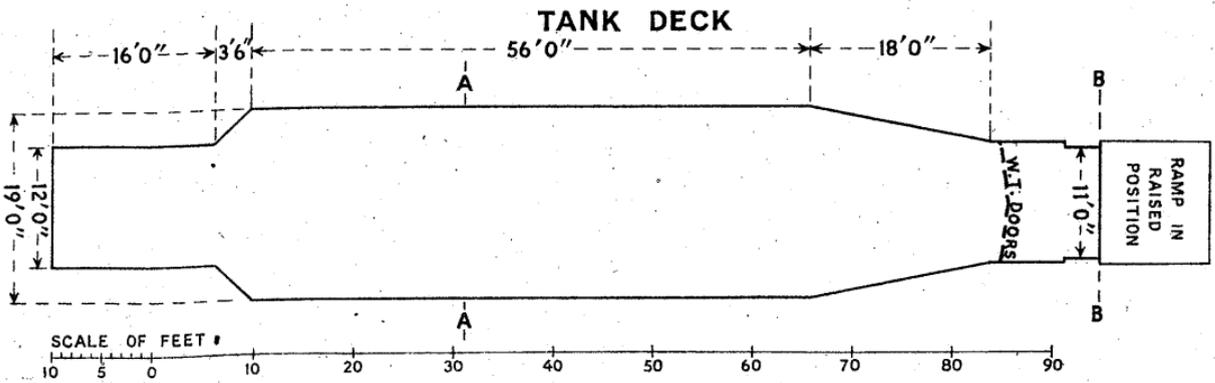
* RESTRICTING WIDTH OF ENTRANCE TO TANK DECK :- 13' 0"



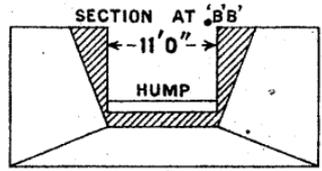
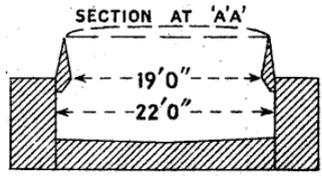
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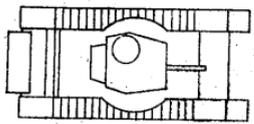
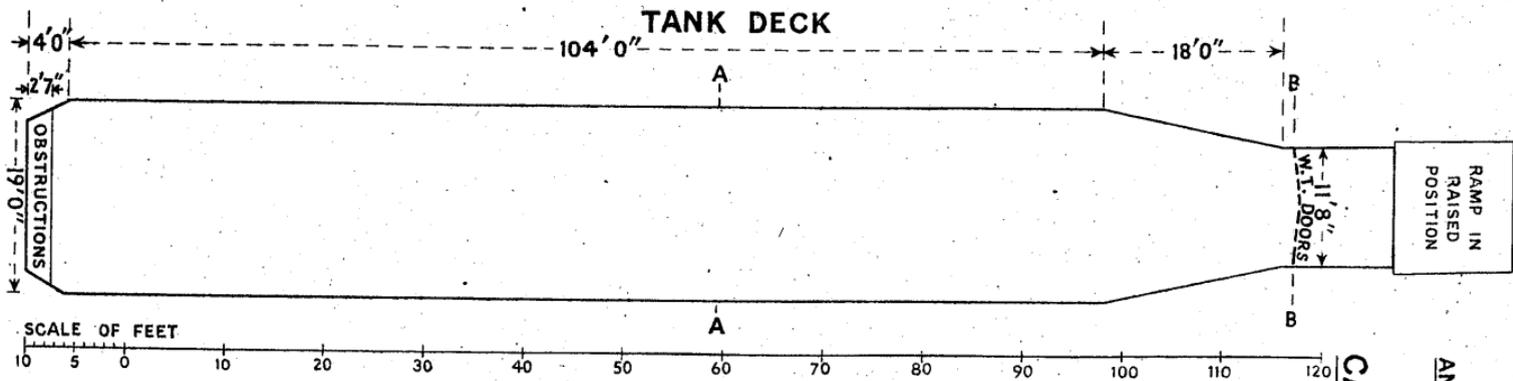


CARGO SPACE LCT (2)

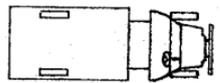


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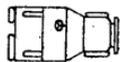




40 TON TANK

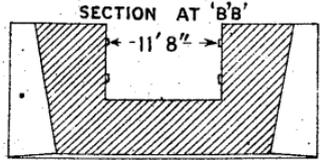
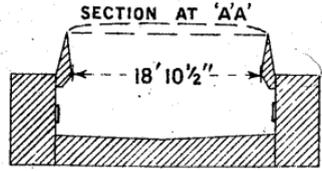


3 TON LORRY

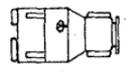
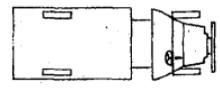
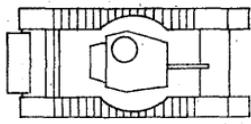
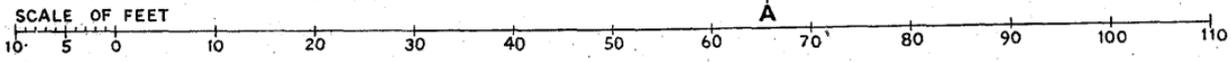
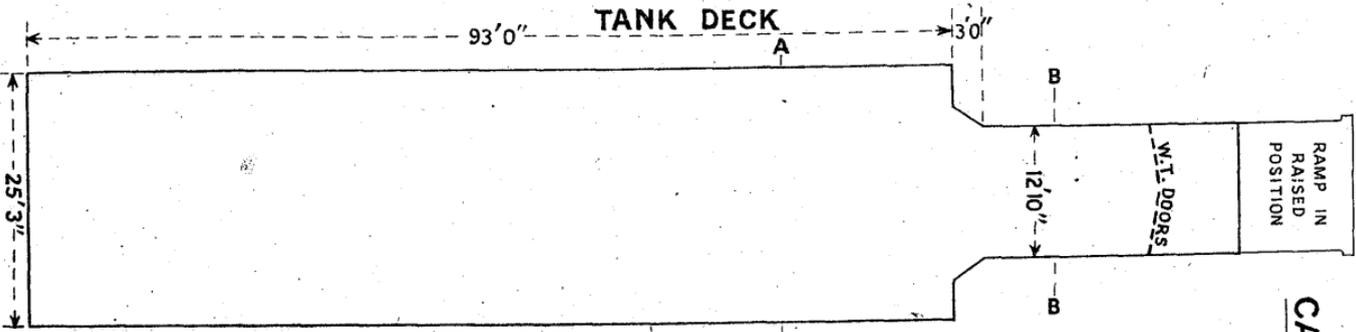


TRUCK 1/4 TON 4x4

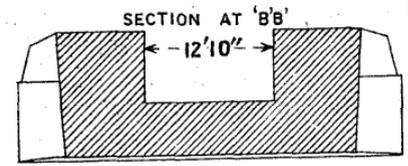
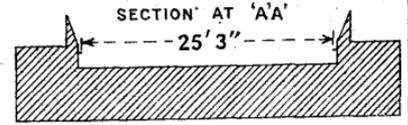
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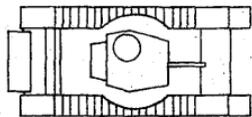
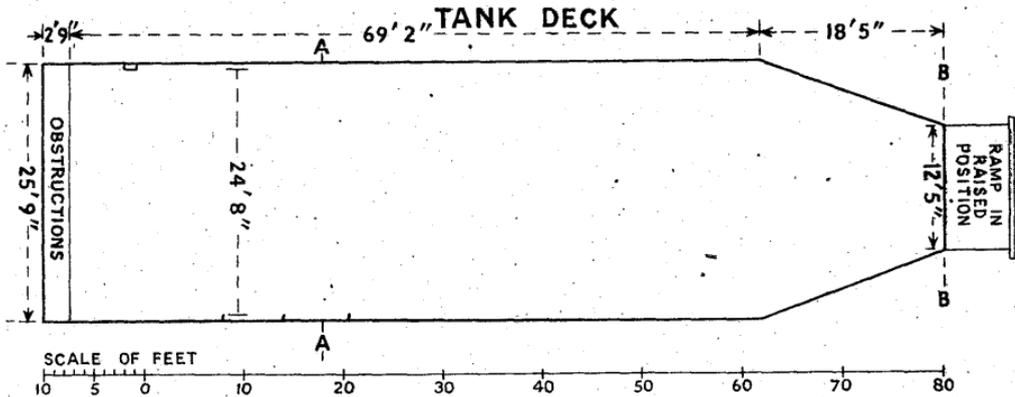


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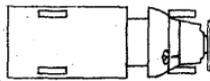


CARGO SPACE LCT (4)

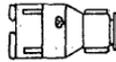
CARGO SPACE LCT(5)



40 TON TANK

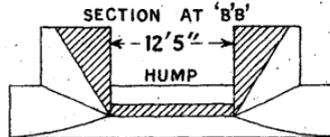
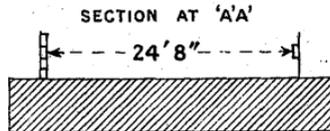


3 TON LORRY

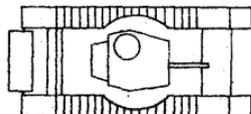
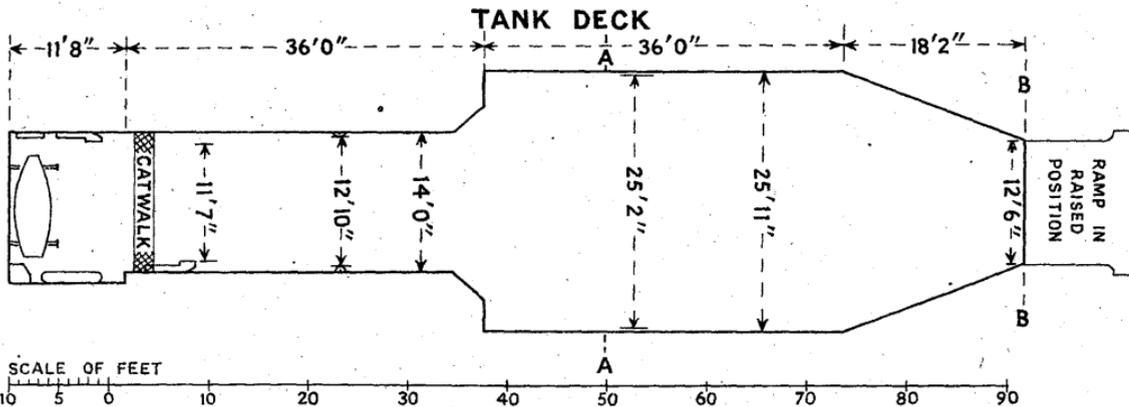


TRUCK 1/4 TON 4x4

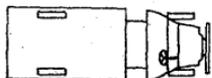
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CARGO SPACE LCT(6)



40 TON TANK

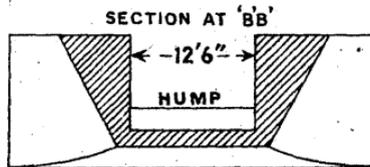
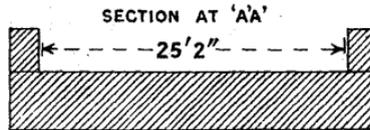


3 TON LORRY



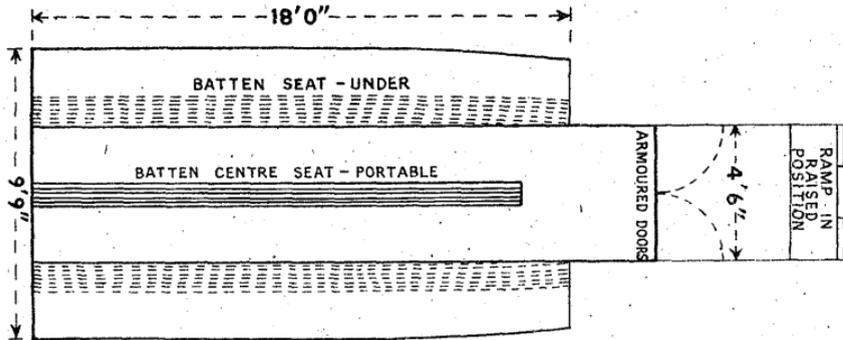
TRUCK 1/4 TON 4x4

On the same scale as LCT.



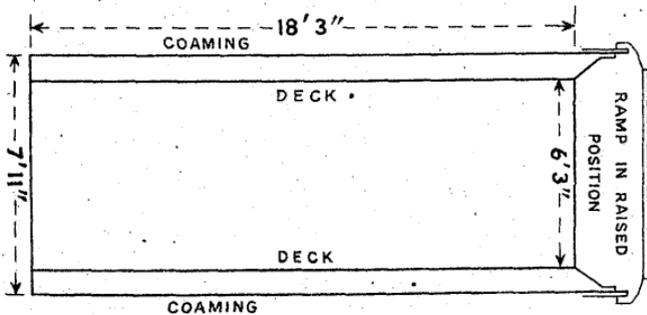
TROOPS SPACE

LCA

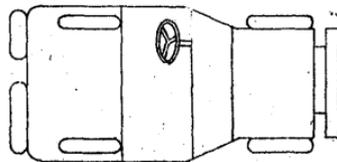


CARGO SPACE

LCV (P)



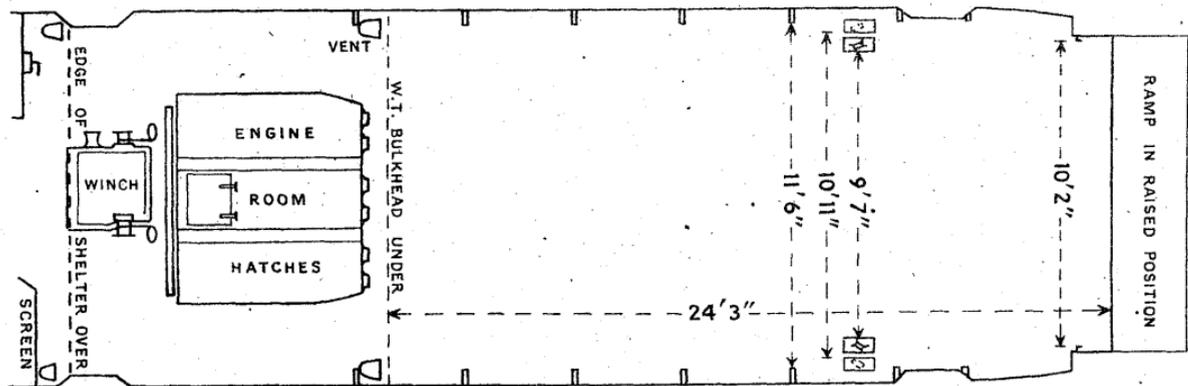
SCALE OF FEET



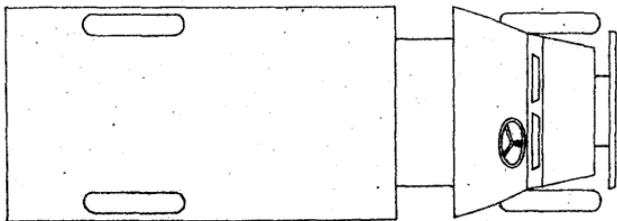
TRUCK 1/4 TON 4x4

On the same scale as LCA & LCV (P)

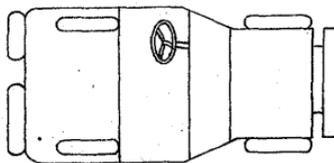
CARGO SPACE LCM(1)



SCALE OF FEET



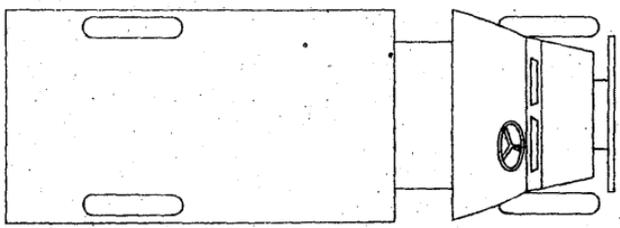
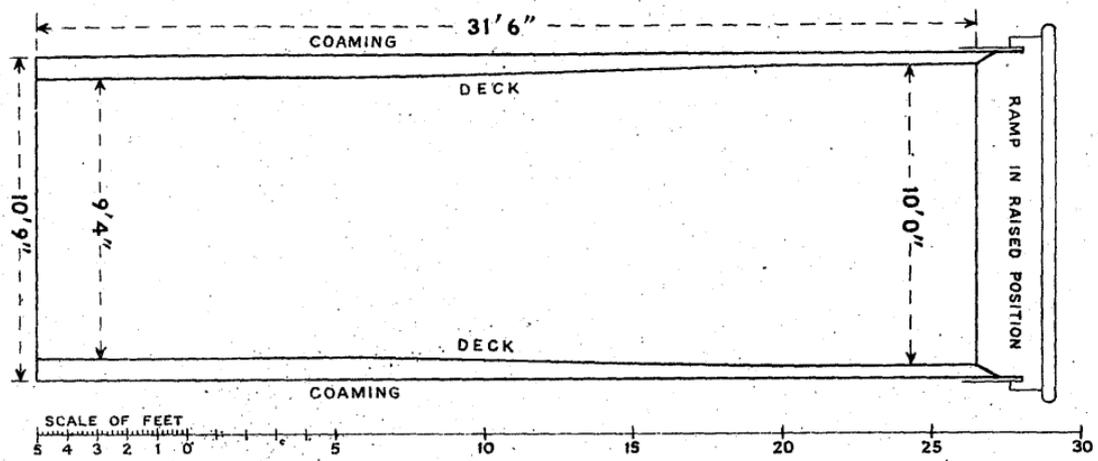
3 TON LORRY



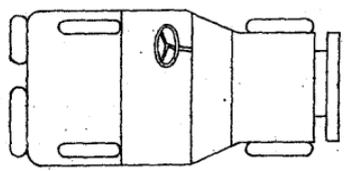
TRUCK 1/4 TON 4x4

On the same scale as LCM

CARGO SPACE LCM(3)



3 TON LORRY

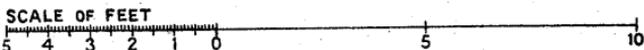
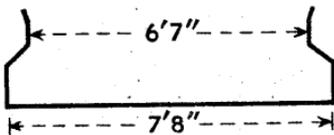


TRUCK 1/4 TON 4x4

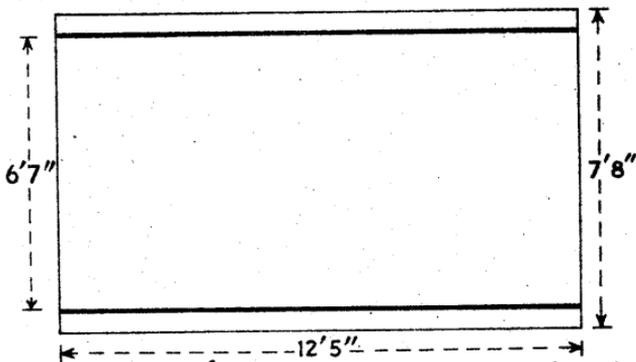
On the same scale as LCM

CARGO SPACE DUKW

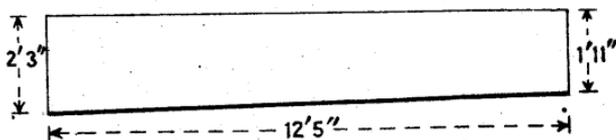
SECTION



PLAN

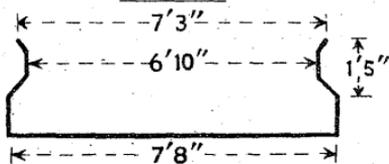


ELEVATION



CARGO SPACE DUKW (AFTER NOS.2505)

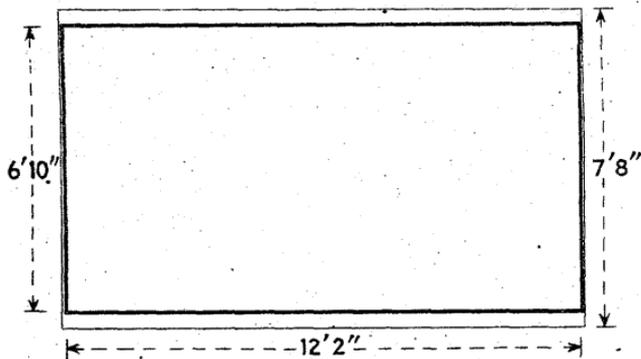
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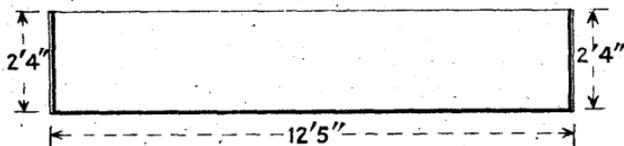
SCALE OF FEET



PLAN

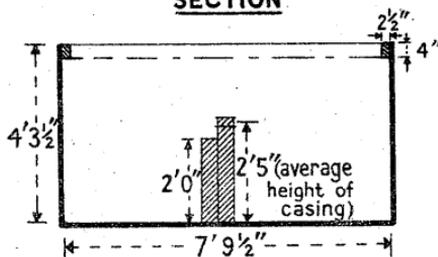


ELEVATION



CARGO SPACE LVT (2)

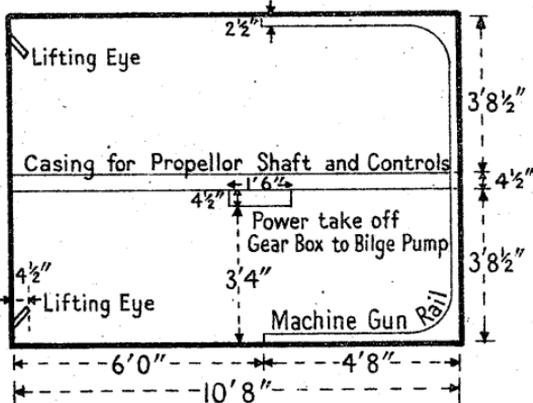
SECTION



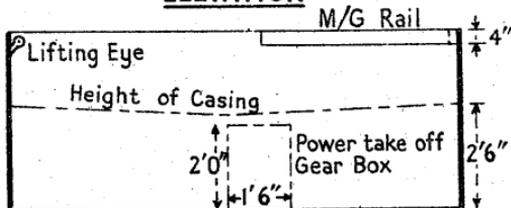
SCALE OF FEET



PLAN

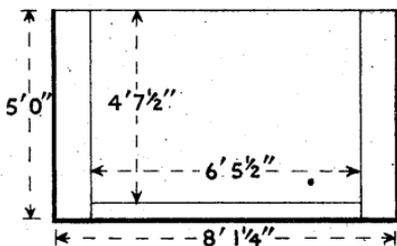


ELEVATION

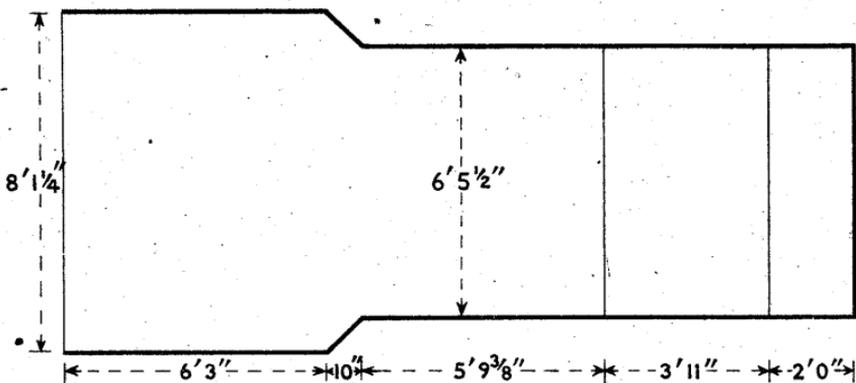


CARGO SPACE LVT (3)

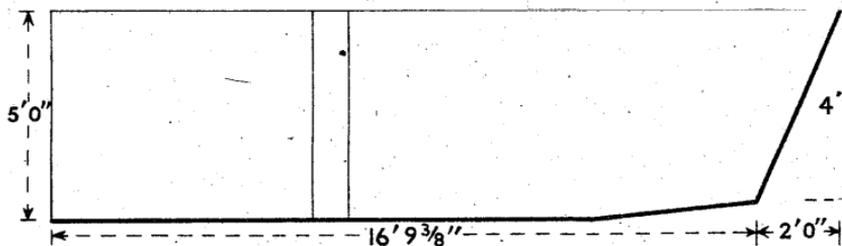
SECTION



PLAN

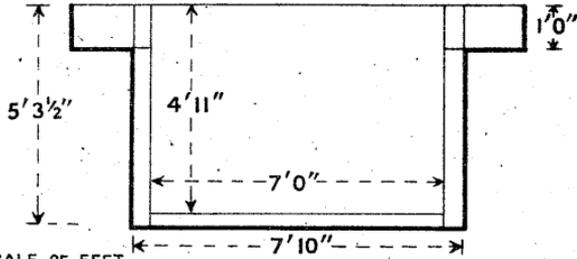


ELEVATION



CARGO SPACE LVT (4)

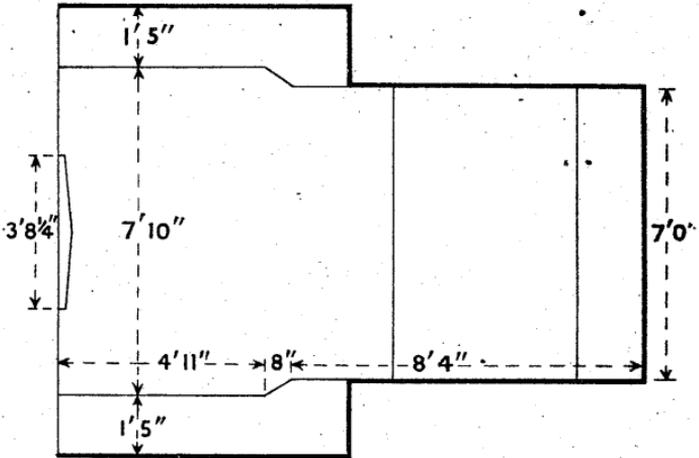
SECTION



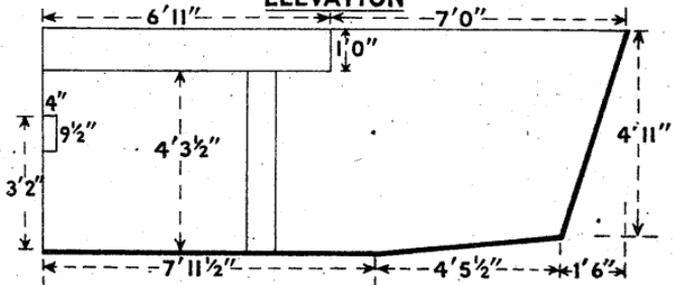
SCALE OF FEET



PLAN

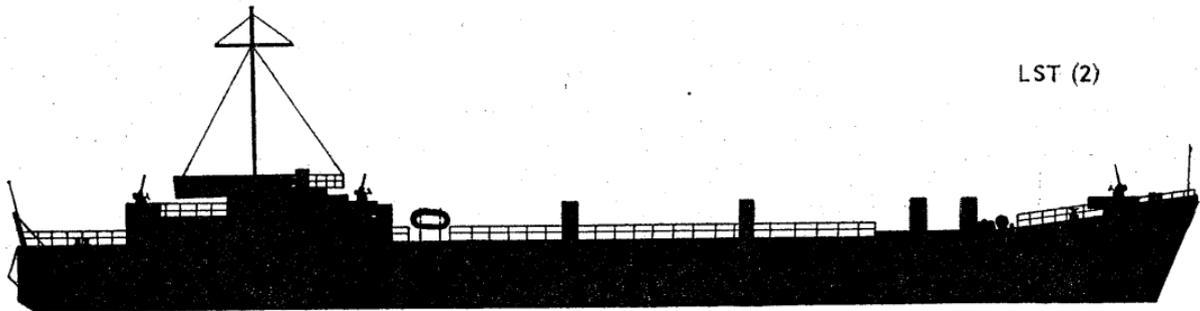


ELEVATION

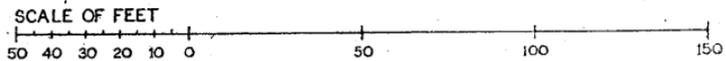
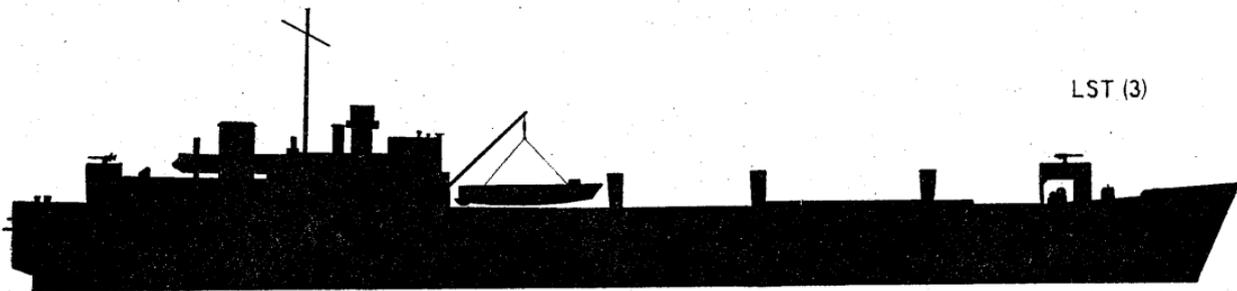


LANDING SHIPS AND CRAFT AND AMPHIBIANS PART VI
SILHOUETTES OF LANDING SHIPS AND CRAFT AND
AMPHIBIANS

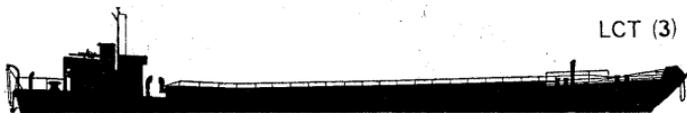
LST (2)



LST (3)



PART V f 2 LANDING SHIPS AND CRAFT AND AMPHIBIANS
Silhouettes of Landing Ships and Craft and Amphibians—(contd.)



LCT (3)



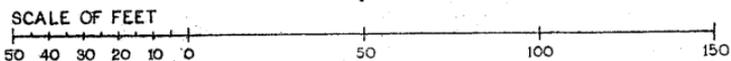
LCT (4)



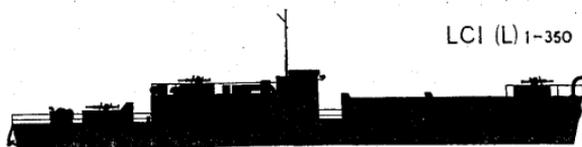
LCT (5)



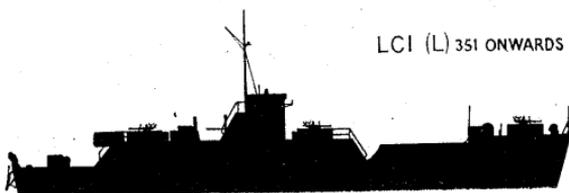
LCT (6)



Silhouettes of Landing Ships and Craft and Amphibians—(contd.)



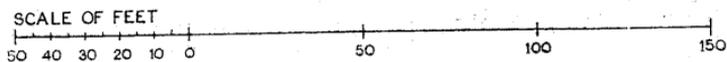
LCI (L) 1-350



LCI (L) 351 ONWARDS



LCI (S)



Silhouettes of Landing Ships and Craft and Amphibians—(contd.)



LCT (R)(2)



LCG (M)(1)



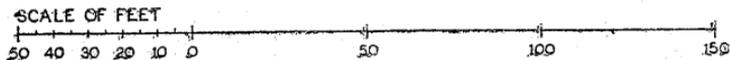
LCG (L)(3)



LCG (L)(4)



LCS (L)(3)



Silhouettes of Landing Ships and Craft and Amphibians—(contd.)



PART V f 6 LANDING SHIPS AND CRAFT AND AMPHIBIANS

Silhouettes of Landing Ships and Craft and Amphibians—(contd.)

LVT (2)



LVT (3)



LVT (4)



Silhouettes of Landing Ships and Craft and Amphibians—(contd.)

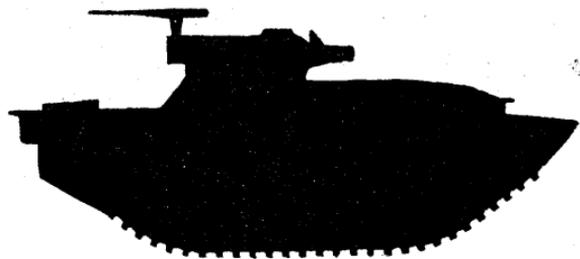
LVT (A) (1)



LVT (A) (2)



LVT (A) (4)



PART V f 8 LANDING SHIPS AND CRAFT AND AMPHIBIANS

Silhouettes of Landing Ships and Craft and Amphibians—(contd.)

DETAILS OF AUSTRALIAN LANDING CRAFT

Maximum draught and ramp angles

Serial	Type	Maximum draught		Ramp angles when beached with full beaching load on following gradients			
		Unladen (i)	Loaded (ii)	1:50 (d)	1:100 (e)	1:150 (f)	1:200 (g)
(a)	(b)	(c)		(d)	(e)	(f)	(g)
1	ALC3	ft 2 0	ins 3 0	32°	35°	35½°	35¾°
2	ALC5	2 0	3 6	32°	35°	35½°	35¾°
3	ALC15	2 3	3 9	14°	15°	15¾	16°
4	ALC20	2 3	3 9	14°	15°	15¾°	16°
5	ALC40	2 6	3 6	11°	11¾°	12°	12¼°
6	ALC120	3 3	4 6	23°	25°	26°	26¼°

Speed, endurance and capacity

Serial	Speed				Naval complement	Troop carrying capacity	Capacity				
	Type	Cruising speed in knots	Endurance in miles at cruising range (straight course)	Domestic fresh water capacity in gallons			Maximum homogeneous load in tons	Churchills	3-ton GS	DUKW's	LVT 2, 3 and 4
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)
1	ALC3 ..	7.5	132	450	4	30	3	—	—	—	—
2	ALC5 ..	7.5	132	450	4	45	5	—	—	—	—
3	ALC15 ..	8	120	2,500	4	90	15	—	—	—	—
4	ALC20 ..	6	96	3,600	4	120	20	—	1	1	—
5	ALC40 ..	8	100	1,800	6	200(x)	40	1	4	1	—
6	ALC120 ..	6	100	1,800	13	350(x)	120	2	8	3	3

Note. (x) For very short trips.

PART V g 2 LANDING SHIPS AND CRAFT AND AMPHIBIANS

**AIRCRAFT TYPES LIKELY TO BE USED IN THE EAST
COMBINED OPERATIONS**

<i>Types</i> (a)	<i>Max. combat range*</i> (nautical miles) (b)	<i>Max. weight of bombs with full tanks (lbs)</i> (c)
Heavy bombers		
Lancaster	2,330	7,000
Liberator	2,170	4,000
Lincoln	Greater than Lancaster	?
Medium and light bombers		
Avenger	800	2,000
Beaufighter	1,300	1,000
Hurricane	410	1,000
Mitchell	1,400	3,200
Mosquito	Over 1,300	4,000
Mustang	740	1,000
Seafire	450	500
Fighters		
Spitfire	750	
Photo reconnaissance		
Spitfire	1,040	
General reconnaissance		
Catalina	2,090	1,500
Sunderland	1,710	2,000
Wellington	1,500	3,300
Transport		
Dakota	1,660	
Air/sea rescue		
Catalina	2,950	
Air OP		
Auster	250	

Notes. *(i) This range can be increased considerably with the addition of long range fuel tanks, but, in the case of fighters especially, the operational efficiency of the aircraft will thereby be seriously reduced.

(ii) Certain of the above aircraft have a maximum range greater than the combat range shown above, but these figures cannot be published for security reasons.

(iii) See Part XII d 1 for factor to convert nautical miles to statute miles.

PART V h 2

LANDING SHIPS AND CRAFT,
AMPHIBIANS AND AIRCRAFT

AMPHIBIANS

Serial	Type	Length	Width	Height	Cargo capacity in lbs	Weight in long tons (laden)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	Truck amphibian $\frac{1}{4}$ -ton 4 x 4	ft ins 15 2	ft ins 5 4	ft ins 3 6	800	1.89
2	DUKW Nos. 353-2004	31 0	8 3	8 10	6,720	9.41
3	DUKW Nos. 2005-2505	31 0	8 3	8 10	6,720	9.57
4	DUKW after 2505	31 0	8 3	8 10	6,720	9.73
5	LVT(1)	21 0	9 10	7 8	4,500	9.55
6	LVT(2)	26 1	10 8	8 0	8,900 (w)	15.27
7	LVT(3)	24 3 $\frac{1}{2}$	11 0	8 5 $\frac{1}{2}$	8,000 (x)	17.63
8	LVT(4)	26 1	10 8	8 3 $\frac{1}{2}$	8,960 (x)	16.50
9	LVT(A)(1)	26 1	10 8	10 1	nil	14.64
10	LVT(A)(2)	26 1	10 8	8 1	7,600	14.64
11	LVT(A)(4)	26 1	10 8	10 2 $\frac{1}{2}$	nil	17.41
12	LVT(A)(5)	26 1	10 8	10 2 $\frac{1}{2}$	nil	17.41
13	Terrapin I	23 1	8 8 $\frac{1}{2}$	7 6	9,000	11.90
14	M29c 20 inch track	15 8 $\frac{1}{2}$	5 7	9 9(y) 5 10 $\frac{1}{2}$	1,120	2.71

Notes. (w) With integral and pin-on armour incorporated, payload is reduced to 5,300 lbs.
(x) With integral and pin-on armour incorporated, payload is reduced to 6,000 lbs.
(y) With canopy.

Amphibians—(contd.)

<i>Serial</i>	<i>Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Cargo capacity in lbs</i>	<i>Weight in long tons (laden)</i>
(a)	(b)	(c)	(d)	(e)	(f)	(g)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>		

ARMoured CARS AND SCOUT CARS (BRITISH)

<i>Serial</i>	<i>Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Weight in tons</i>
(a)	(b)	(c)	(d)	(e)	(f)
	Scout cars	<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	Daimler I, II and III	10 10	5 7	4 11	3.10
2	Humber I and II	12 7	6 2	5 1 $\frac{1}{2}$	3.50
3	Ford I and II	11 9	6 1	5 8 $\frac{1}{2}$	4.17
4	Morris II	13 8	6 9	6 8	4.20
5	Humber III and IIIA	14 1 $\frac{1}{2}$	6 0 $\frac{1}{2}$	6 10	3.40
	Armoured cars				
6	Humber IV	15 2	7 2	7 11 $\frac{1}{2}$	7.17
7	Daimler I and II	13 2 $\frac{1}{2}$	8 10	7 4	7.50
8	AEC III	18 8	8 11	8 10	12.75
9	Coventry I	15 6 $\frac{1}{2}$	8 10	7 9	11.52

ARMoured CARS AND SCOUT CARS (US)

<i>Serial</i>	<i>Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Weight in tons</i>
(a)	(b)	(c)	(d)	(e)	(f)
	Scout cars	<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	White scout car	18 5½	6 5½	6 11½	5.25
	Armoured cars				
2	Staghound I	17 9½	8 10	7 9	13.60
3	Staghound III	17 9½	8 10	8 4	14.05
4	Staghound AA	17 9½	8 10	8 0	12.50
5	Greyhound M8	16 5	8 4	7 4½	7.76

ARTILLERY (BRITISH)

Serial	Gun	Length	Width	Weight in tons	Towing vehicle	Overall measurements in travelling position		Weight laden in tons	Trailer	Total length in tra- velling position	Length closed up	Total weight in tons
						Length	Width					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)
		ft. ins	ft. ins			ft. ins	ft. ins			ft. ins	ft. ins	
1	6-pr A tk mk IV service spade	17 3	6 0	·34	Loyd Carrier No. 1 mk I	13 11	7 0	4·35	—	30 4	29 0	4·69
2	6-pr A tk mk IV shallow spade	17 3	6 0	·34	Loyd Carrier mk I	13 11	7 0	4·35	—	30 4	27 3	4·69
3	17-pr A tk	24 1½	7 4	2·90	Truck 15-cwt half track w/winch	20 10	7 0	—	—	44 11½	35 9	—
4	25-pr gun/how	25 10	7 0	1·76	Guy FAT (Quad)	13 9	7 3	5·25	No. 27 Length 10' 9" Weight 29 cwt	50 4	33 6	8·46
5	Short 25-pr (Australian)	11 0	6 0	1·25	Jeep or other vehicle	11 0	5 4	1·5	—	22 0		2·75(x)
6	3·7" pack how	11 1½	7 3½	·80	Jeep (possibly Dodge 15 cwt)	11 0	5 4	1·5	—	21 9	18 10(y)	2·30(z)

(x) Gun breaks down into 14 loads, heaviest of which is 400 lbs.
2-3 cwt each.

(y) Mk IV only—Mk II cannot close up.

(z) Gun breaks down into 8 loads of

Artillery (British)—(contd.)

Serial	Gun	Length	Width	Weight in tons	Towing vehicle	Overall measurements in travelling position		Weight laden in tons	Trailer	Total length in travelling position	Length closed up	Total weight in tons
						Length	Width					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)
7	5.5" gun/how	ft ins 24 8	ft ins 8 4	5.70	Matador	ft ins 20 9	ft ins 7 10½	11.75	—	ft ins 45 5	ft ins 34 9(v) 36 0(w) 39 9(x)	17.45
8	7.2" how	25 4½	9 0	10.25	Tractor 6-ton 6 × 6 Hy (MACK)	24 0	8 6	15.23	—	49 4½		25.48
9	40-mm AA Bofors mkII platform	21 4	6 3	2.50	Morris Bedford	17 2½ 18 8	7 4 7 6	5.28 6.60	— —	38 6½ 40 0	(y) 35 6 36 3	9.00 7.68
10	3.7" AA mk III	28 6	8 0	9.15	Matador	20 9	7 10½	11.75	—	49 3	(z) 43 0	20.90
Alternative tractors—Chevrolet FAT						14 8	7 4	5.50				
Ford FAT						14 9	8 7	5.30				
FWD MAT						22 1	7 9	11.20				

(v) Spade removed. (w) Locking lever "down." (x) Locking lever "up"—Some equipment lock in the "up" and some in the "down" position. (y) The space occupied may be further reduced by 1' 3" length by elevating the gun to 30°: if this is done the piece must be lashed transversely. The height of the muzzle will be 9' 9". The length is reduced to 37 feet. Gun to be elevated to 48°. Height of muzzle 17' 9". The elevation of the piece must be done before the gun is stowed in place as the gun leg must be lowered to allow access to the elevation handwheel. (z) Exclusive of oil motors but inclusive of layers' shields and sight correctional mark V.

ARTILLERY (US)

Serial	Type	Overall measurements in travelling position			Weight in tons	Prime mover
		Length	Width	Height		
(a)	(b)	(c)	(d)	(e)	(f)	(g)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>		
1	37-mm gun M3 and M3A1 carriages M4 and M4A1	10 10½	5 3½	3 1½	.41	Truck ¾-ton 4 × 4. Truck ¼-ton 4 × 4
2	57-mm gun M1 carriage M1A3	16 8½	6 3	4 2	1.21	Truck 1½-ton 6 × 6 cargo
3	75-mm pack how M1 and M1A1. Pack carriage M1	12 0	3 1¼	2 10	.57	Pack animals; breaks down into 6 animal loads
4	75-mm pack how M1A1 carriage M8 (x)	12 0	3 11	2 10	.60	Truck ¼-ton 4 × 4. Airborne model; breaks down into 9 paracrate loads including ammunition
5	75-mm pack how M1 and M1A1 carriage M3A3	12 8½	5 7½	3 2	1.00	6 horses with light limber M4
6	76-mm gun T3 carriage T4	22 2	6 5	4 4	1.70	Carrier, personnel, ½-track, M3
7	76-mm gun T3 carriage T5	23 2	6 8	3 11½	1.87	Carrier, personnel, ½-track, M3
8	3" gun M5 carriage M1	23 2	6 10	5 0	2.28	Carrier, personnel, ½-track, M3
9	105-mm how M2A1 carriage M2A1	19 8	6 8	5 5	2.00	Truck cargo 2½-ton 6 × 6 or Tractor high speed 13 tons M5
10	105-mm how M2A1 carriage M2A2	19 8	6 8	5 5	2.22	Truck cargo 2½-ton 6 × 6 or Tractor high speed 13 tons M5
11	105-mm how M3 carriages M3 and M3A1	12 11	5 7 ⁵ / ₁₆	4 1½	1.19	Truck cargo 1½-ton 4 × 4 or two trucks ¼-ton 4 × 4 in tandem

(x) Figures are for firing position.

Artillery (US)—(contd.)

Serial (a)	Type (b)	Overall measurements in travelling position			Weight in tons (f)	Prime mover (g)
		Length (c)	Width (d)	Height (e)		
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>		
12	4.5" gun M1 carriage M1A1	26 6	7 11½	6 11½	6.00	Truck cargo 4-ton 6 × 6 or tractor high speed 13-ton M5
13	155-mm how M1 carriage M1A1	24 0	7 11½	6 9¼	5.71	Truck cargo 4-ton 6 × 6 or tractor high speed 13-ton M5
14	155-mm gun M1 and M1A1 carriage M1	34 4½	8 2⅞	8 6½	13.66	Truck 7½-ton 6 × 6 or tractor high speed 18-ton M4
15	37-mm AA M1A2 carriage M3A1	20 1	5 9½	6 0	2.73	Truck 2½-ton 6 × 6 cargo
16	40-mm AA M1 carriages M2 and M2A1	18 9½	6 0	6 7½	2.48	Truck 2½-ton 6 × 6 cargo
17	90-mm AA M1 and M1A1 Mount M1	20 10	8 4⅞	9 4	7.90	Truck 7½-ton 6 × 6 or tractor high speed 18-ton M4
18	90-mm AA M1 and M1A1 Mount M1A1	20 10	8 4⅞	9 4	8.48	Truck 7½-ton 6 × 6 or tractor high speed 18-ton M4
19	90-mm AA M2 AA Mount M2	29 8	8 7	10 1	14.42	Tractor high speed 18-ton M4
20	120-mm (4.7") gun M1 Mount M1	30 9	10 3½	10 4	27.45	Tractor high speed 38-ton M6

CARRIERS

Serial	Type	Length	Width	Height	Weight (laden) in tons
(a)	(b)	(c)	(d)	(e)	(f)
1	Carrier Universal I	ft ins	ft ins	ft ins	4.01
		12 8 (p)	7 0	5 4	
2	Carrier MMG	12 2½ (q)	7 0	5 4	4.12
		11 10½ (q)			
3	Carrier Universal II	12 8 (p)	7 0	5 4	4.24
		11 10½ (q)			
4	Armoured OP	11 10½ (q)	7 2½	5 4	4.22
		11 10½ (q)			
5	Carrier 3-inch mortar	11 10½ (q)	7 0	5 4	4.24
		11 10½ (q)			
6	Carrier Loyd TPC	13 11 (p)	6 9½ (s)	6 11½ (w)	4.35
		13 2 (q)(r)			
7	Carrier Loyd towing	13 11 (p)	7 0 (s)	6 11½ (w)	4.35(t)
		13 2 (q)(r)			
8	Carrier Loyd TS and C	13 11 (p)	6 9½ (s)	6 11½ (w)	4.65
		13 2 (q)(r)			
9	M29 (ex T24) 20-inch track	10 5½	5 5	6 10½	2.20
		10 5½			
10	M29 (ex T24) 15-inch track	10 5½	5 0	6 10½	2.20
		10 5½			

Note. (p) With towing attachment
 (q) Without towing attachment
 (r) 13' 6" with sandshields
 (s) 7' 4½" with sandshields
 (t) When towing 6-pr A tk gun
 (v) Heaviest role (ammunition carrier)
 (w) Over hood

ARMoured COMMAND VEHICLES

<i>Serial</i>	<i>Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Weight (laden) in tons</i>
(a)	(b)	(c)	(d)	(e)	(f)
1	ACVHP (AEC) 4 × 4 mk I	22 2	7 9	9 6	12·15
2	ACVLP (AEC) 4 × 4 mks I and II	22 2	7 9	9 6	12·00
3	ACVHP (AEC) 6 × 6 mk I	26 1	7 11	8 10	17·02
4	ACVLP (AEC) 6 × 6 mk I	26 1	7 11	8 10	16·70

HALF TRACKS

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
		ft ins	ft ins	ft ins	
1	Car half track M2, M2A1, M3	20 5	7 3½	7 5	8.07
2	Carrier personnel half track M3A1, M5, M5A1	20 10	7 3½	7 7	8.78
3	Car half track M9A1	20 3	7 3	7 6½	8.50
4	Carriage motor multiple gun M13	21 4	6 5¼	7 2½	8.84
5	Carriage motor multiple gun M14	21 3½	7 1	7 2½	8.80
6	Carriage motor multiple gun M15	20 2½	8 2	8 8	8.93
7	Carriage motor multiple gun M15A1	20 3½	7 4½	7 8¾	8.97
8	Carriage motor multiple gun M16	21 4	6 5¼	7 8½	9.84
9	Carriage motor multiple gun M17	20 3	7 3	6 5¼ (x)	8.79
10	Carriage motor 57-mm gun T48	19 8¾	7 2½	7 4¾	8.84
11	Carriage motor 75-mm gun M3, M3A1	20 4¾	6 5¼	7 10	8.93
12	Carriage motor 75-mm how. T30	19 8¾	7 2½	8 0¾	8.71
13	Carrier 81-mm mortar M4, M4A1	20 2	7 3½	7 5	8.04
14	Carrier 81-mm mortar M21	19 8¾	6 5¼	6 0½	8.26
15	Carriage motor 105-mm how. T19	19 8¾	7 2½	6 3 (x)	8.93

(x) Less gun

Half Tracks--(contd.)



RAF VEHICLES

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
		ft ins	ft ins	ft ins	
1	AFV	14 6	6 8	7 0	3.70
2	Ambulance heavy	22 9	7 6	9 10	4.70
3	Ambulance light	15 0	5 3	7 3	2.15
4	Cars 4-cwt 4 × 4	11 3	5 4	6 2	1.35
5	Cars AOC	16 5	6 1	6 3	2.20
6	Cars passenger utility	15 0	6 6	7 0	2.90
7	Cars 2-seater	12 10	5 0	6 4	1.50
8	Cars 4-seater	14 1	6 2	6 5	3.00
9	5-cwt 4 × 4 (Jeep)	11 0	5 4	6 2	1.35
10	Trucks 15-cwt GS	14 9	6 7	6 6	2.75
11	Trucks 15-cwt water 200-gal	15 4	6 10	7 0	3.85
12	Crane salvage heavy	30 6	7 9	14 2	14.00
13	Crane salvage light	26 5	7 6	13 3	10.55
14	Tender extra heavy	30 0	7 6	11 0	12.75 (x)
15	Tender 3-ton	21 8	7 6	11 4	8.75 (x)
16	Tender 30-cwt	19 0	7 6	9 9	4.60 (x)
17	Tender fire crash	21 6	7 6	7 9	6.35
18	Tender fire domestic	21 6	7 0	7 10	7.65
19	Tender generator tank	21 6	6 7	8 6	7.45
20	Tender petrol 2,500-gal	25 9	7 9	10 10	20.10
21	Tender petrol 1,000-gal	19 6	7 8	8 6	7.50
22	Tender power 7-KW	23 0	7 3	10 11	7.75
23	Tender photographic	23 10	7 10	11 3	7.10
24	Tender photo processing	40 0	8 0	13 1	12.60
25	Tender photo multi-printing	36 4	8 0	11 0	12.60
26	Tender photo copying	36 4	8 0	11 0	12.60
27	Tender photo servicing	36 4	8 0	11 0	12.60
28	Tender photo power and water	21 6	7 7	8 6	7.25
29	Tender photo office	33 6	8 1	13 3	10.00
30	Tender photo enlarging	33 6	8 1	13 6	12.00
31	Tender photo multi	33 6	8 1	13 7	12.00
32	Tender photo cam maintenance	19 0	7 4	10 0	5.50
33	Tender photo 15-cwt	15 0	7 0	7 6	3.50
34	Tender photo generators	22 6	7 9	8 6	5.00
35	Tender photo 3-ton	21 6	7 3	9 9	5.50
36	Tender trailer J type	16 0	7 9	11 0	5.50
37	Tender photo J type	24 0	7 6	11 2	6.00
38	Tender photo C climax generator	22 0	7 0	9 0	8.50
39	Tender bomb	22 8	7 8	9 6	7.60
40	Tender dental surgery	24 0	7 8	9 11	4.75
41	Tender dental laboratory	23 3	7 8	9 11	4.80
42	Tender water 350-gal	23 0	7 0	7 6	7.25
43	Tender MT breakdown	24 0	8 4	10 10	9.90
44	Tender workshop	23 4	7 10	12 6	7.05
45	Tender floodlight	24 2	7 7	12 5	5.25
46	Tender oxygen plant	26 3	8 3	12 0	14.75
47	Tender office	22 8	7 6	10 0	7.75
48	Tender staff AA CSS	21 0	7 2	9 6	7.75
49	Tender parachute	24 0	8 3	10 0	5.95
50	Tender chute drying	24 9	7 4	9 9	6.80
51	Tender flying control	24 8	7 4	10 3	7.45
52	Tender ops room	19 11	7 9	10 3	4.85
53	Tractor articulator	14 7	6 7	7 6	2.50
54	Tractor light	10 0	6 4	5 0	3.90
55	Tractor light w/winch	10 0	6 3	5 0	3.85

Note. (x) The laden weight of load carriers assumes that the full authorised weight is loaded

RAF Vehicles—(contd.)

Serial	Type	Length		Width		Height		Weight in tons
		(a)	(b)	(c)	(d)	(e)	(f)	
		ft	ins	ft	ins	ft	ins	
56	Tractor heavy	10	0	7	2	7	6	4.15
57	Van pre-heater	16	0	6	6	8	2	2.95
58	Van 15-cwt	15	9	6	7	7	9	3.50 (a)
59	Trailer l/beacon	23	9	7	8	12	8	3.65
60	Trailer MT servicing	14	6	6	9	7	2	1.90
61	Trailer artic L HL	33	6	7	6	4	8	5.10
62	Trailer artic L LL	43	0	9	0	12	3	6.55
		43	0	9	0	7	3 (b)	6.55
63	Trailer artic LLL with tractor	50	0	8	7	12	3	9.05
		50	0	8	7	7	3 (b)	9.05
64	Trailer artic SHL	21	7	8	1	4	8	5.05
65	Trailer artic SHL with tractor	31	6	8	1	7	3	7.55
66	Trailer artic air compressor	12	4	6	0	7	0	1.50
67	Trailer artic air bottle	20	0	7	5	9	6	6.75
68	Trailer artic torpedo	25	1	9	1	7	1	9.85
69	Trailer artic oxygen	21	6	7	8	12	4	5.50
70	Trailer flat 8 wheels	21	0	7	6	3	3	10.00
71	Trailer 150-gal. water	11	10	5	8	6	3	1.65
72	Trailer 6.3-KVA	12	6	5	10	7	4	2.00
73	Trailer 1-ton 2-wheel	11	8	6	8	5	6	1.65
74	Trailer 3-ton 2-wheel	15	0	7	6	5	6	2.50
75	Trailer 15-cwt pole carrying	20	6	6	6	6	6	3.00
76	Trailer 15-cwt water 180-gal	11	8	6	6	6	2	1.80
77	Trailer 10-cwt 2-wheel	9	7	5	5	3	10	1.00
78	Dozer D4 caterpillar	14	5	8	11	6	8	6.40
79	Tractor LAA 4 × 4	18	8	7	6	9	0	6.35
80	Guns Bofors	21	4	6	2	6	6	2.40
	Radio types							
81	100	24	0	7	8	11	4	8.40
82	101	20	3	7	6	11	0	8.40
83	102	19	8	7	6	9	10	5.25
84	103	19	8	7	6	9	10	5.25
85	104	21	8	7	6	12	3	4.05
86	105	18	0	7	0	10	8	3.80
87	106	19	8	7	6	9	10	5.25
88	107	15	4	6	4	9	6	2.50
89	108	15	4	6	4	9	6	2.75
90	109	20	3	7	6	11	0	8.40
91	110	20	3	7	6	11	0	8.40
92	111	20	3	7	6	11	0	8.40
93	113	15	4	6	4	9	6	2.75
94	115	16	0	7	0	9	7	4.00
95	116	16	6	7	0	10	0	2.95
96	117	16	6	7	0	10	0	2.95
97	118	16	8	7	0	9	7	3.70
98	119							
99	122							
100	123	16	8	7	0	10	8	3.75
101	130	20	4	8	0	10	4	7.75
102	131	20	3	7	9	10	0	7.75
103	140	20	3	7	9	10	0	8.00
104	145	20	2	8	1	11	0	7.75
105	150	23	0	7	6	10	0	8.40

Note. (a) The laden weight of load carriers assumes that the full authorised weight is loaded

(b) Without superstructure

RAF Vehicles—(contd.)

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
	Radio types—continued	<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
106	151	23 0	7 9	12 6	5.90
107	152	23 3	7 6	11 4	6.75
108	153	23 0	7 8	11 0	8.40
109	154	23 6	7 10	11 4	4.00
110	155	23 6	7 10	11 4	4.00
111	156	15 6	7 6	10 9	4.00
112	157	15 9	6 7	9 6	3.50
113	158	15 9	6 7	8 9	3.35
114	159	20 3	7 9	10 0	8.40
115	160				
116	161	20 3	7 6	11 10	8.40
117	163	24 0	7 6	10 3	7.75
118	166				
119	170	23 6	7 6	11 4	4.00
120	171				
121	180	20 6	7 9	12 2	7.80
122	200	31 3	7 6	9 8	7.50
123	201	31 3	7 6	9 8	7.50
124	203	24 2	7 6	9 8	6.00
125	250	17 5	7 6	11 3	5.90
126	251	17 5	7 6	11 3	5.90
127	252	17 5	7 6	11 3	5.90
128	253	17 5	7 6	11 3	5.90
129	254	17 5	7 6	11 3	5.90
130	255				
131	257				
132	258				
133	259				
134	260				
135	261				
136	300	30 0	8 6	8 10	5.50
137	301				
138	302	30 0	8 6	8 10	5.50
139	303	32 3	8 0	12 3	7.50
140	304	32 5	7 10	11 10	7.50
141	305	32 5	7 10	11 10	7.50
142	306	22 6	8 1	12 2	8.55
143	309	30 0	8 6	8 10	5.50
144	310	30 0	8 6	8 10	5.50
145	311	30 0	8 6	8 10	5.50
146	312	30 0	8 6	8 10	5.50
147	313	15 6	7 0	10 2	3.60
148	314	16 6	6 9	9 9	3.75
149	315	16 9	6 9	9 9	3.50
150	316	15 9	6 8	9 6	3.30
151	317	30 0	8 6	8 10	5.50
152	318	30 0	8 6	8 10	5.50
153	319	30 0	8 6	8 10	5.50
154	320	30 0	8 6	8 10	5.50
155	321	30 0	8 6	8 10	5.50
156	322	21 0	7 2	10 3	7.75
157	323	31 3	7 6	9 8	7.50
158	328	23 0	7 6	10 0	4.45
159	329	23 0	7 6	10 0	4.45
160	330	14 2	7 9	11 0	4.45
161	331				
162	340	20 10	7 9	10 0	5.00
163	341	12 0	6 4	6 2	1.45
164	344				

RAF Vehicles—(contd.)

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
		ft ins	ft ins	ft ins	
	Radio types—continued				
165	345				
166	346	19 0	7 8	9 6	5.00
167	347	19 0	7 6	9 6	4.60
168	348	21 2	7 10	11 0	8.00
169	357	21 8	7 6	10 2	7.00
170	358	22 6	7 10	11 0	8.00
171	359	9 0	5 6	7 0	1.50
172	362	23 0	7 9	11 0	7.20
173	363				
174	364				
175	365	15 6	7 9	11 0	4.00
176	367	23 0	7 9	11 6	7.75
177	368	24 0	7 6	11 9	7.75
178	369				
179	370	20 3	7 9	10 0	8.40
180	372	20 5	7 9	10 0	8.40
181	373	21 0	7 2	10 3	8.40
182	378				
183	379				
184	382	20 3	8 0	10 3	5.75
185	383	16 9	7 6	9 7	3.70
186	384	23 0	7 6	10 0	6.75
187	385	20 3	7 9	10 0	6.75
188	386	20 3	7 9	10 0	6.75
189	387				
190	388				
191	389	23 0	7 6	10 0	7.00
192	390				
193	391				
194	392				
195	393	23 0	7 6	10 0	7.80
196	394	23 0	7 9	10 5	7.20
197	395	23 1	8 0	12 6	6.70
198	396	23 0	7 6	10 0	6.70
199	397	23 0	7 6	10 0	6.30
200	398	23 0	7 6	10 0	6.55
201	399				
202	400	20 1	7 6	12 0	7.80
203	401	20 1	7 6	12 0	7.80
204	402	20 1	7 6	12 0	7.80
205	403	20 1	7 6	12 0	7.80
206	404	20 1	7 6	12 0	7.80
207	405	21 6	7 8	13 0	7.80
208	409	21 8	7 8	13 0	7.80
209	411	22 5	7 6	11 0	8.40
210	412	22 5	7 6	11 0	8.40
211	413				
212	414				
213	415	22 9	7 6	10 3	7.75
214	416	22 7	7 7	7 2	7.75
215	417	22 0	7 6	12 0	8.40
216	418	22 0	7 6	12 8	8.40
217	420	23 0	7 6	11 3	4.00
218	421	23 0	7 6	11 3	4.00
219	422	16 9	6 8	9 0	3.50
220	423	16 9	6 8	9 0	3.50
221	424	16 9	6 8	9 0	3.50
222	425				
223	426				

RAF Vehicles—(contd.)

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
		ft ins	ft ins	ft ins	
224	Radio types—continued				
225	427				
226	428				
227	429				
228	430	15 9	6 10	9 6	3.50
229	431	27 3	9 6	14 6	7.15
230	432	24 4	7 6	12 6	5.55
231	433	25 3	8 6	14 0	5.70
232	434	21 7	9 3	12 9	9.00
233	435				
234	436	21 8	7 6	11 4	8.75
235	437	21 8	7 6	11 4	8.75
236	439	22 6	7 8	10 10	6.80
237	440	15 9	6 10	9 6	3.50
238	441	15 9	6 10	9 6	3.50
239	442	15 0	6 10	8 7	1.80
240	444				
241	445				
242	446				
243	450	21 9	7 9	11 3	4.00
244	451	23 6	10 0	12 6	7.80
245	456	21 8	7 6	9 9	6.50
246	457	23 3	7 7	13 6	7.00
247	458	22 9	7 3	13 2	7.00
248	459	20 1	7 6	12 0	7.80
249	460	22 0	7 6	12 0	7.15
250	461	30 0	9 6	10 6	6.50
251	462	27 0	9 6	10 6	6.50
252	463	16 3	6 9	9 0	4.00
253	464	21 0	7 9	11 9	7.00
254	465	15 6	7 4	10 6	4.00
255	466	22 9	7 3	13 2	7.00
256	467	24 4	7 6	12 6	5.55
257	468	24 2	8 0	12 6	6.35
258	469	22 9	7 6	10 3	7.75
259	471	22 3	7 4	10 9	7.50
260	472	22 3	7 4	10 9	7.00
261	473	22 0	7 6	10 9	7.50
262	474	15 9	6 6	8 8	3.00
263	475				
264	476				
265	477				
266	478				
267	479				
268	480				
	481				

RAF Vehicles—(contd.)

<i>Serial</i> (a)	<i>Type</i> (b)	<i>Length</i> (c)	<i>Width</i> (d)	<i>Height</i> (e)	<i>Weight in tons</i> (f)

RAF AIRFIELD CONSTRUCTION WING EQUIPMENT

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
		ft ins	ft ins	ft ins	
	Earth moving plant				
1	Dumper 2-cubic yard (Muirhill)	10 5	6 7	5 10	2.35
2	Power grader (caterpillar 12 std)	25 0	7 10	7 5	10.75
3	Excavator $\frac{3}{4}$ -cubic yard (Smith 2/10)	11 0	7 6	9 7	7.30
4	Ditto with face shovel attached..	26 6	7 6	9 7	8.55
5	Ditto with drag shovel attached..	26 6	7 6	9 7	8.50
6	Ditto with drag line attached ..	40 8	7 6	9 7	7.90
7	Excavator $\frac{3}{8}$ -cubic yard (Smith 5/10)	13 9	8 10	11 3	16.00
8	Ditto with face shovel attached ..	32 1	8 10	11 3	19.10
9	Ditto with drag shovel attached..	33 0	8 10	11 3	18.40
10	Ditto with drag line attached ..	55 9	8 10	11 3	17.90
11	Excavator $\frac{1}{4}$ -cubic yard lorry mounted (Michigan)	23 6	8 0	10 2	19.05
12	Tractor class I with angledozer and winch (D8)	20 4	12 11	7 6	21.60
13	Tractor class II with angledozer and winch (D7)	18 5	12 3	6 9	15.15
14	Tractor class III with angledozer and winch (D6)	16 8	10 5	6 1	11.15
15	Tractor class IV with angledozer and winch (D4)	13 8	9 8	5 1	6.85
16	Scraper 12-cubic yard (Le Tourneau)	32 2	10 2	10 11	8.80
17	Scraper 9-cubic yard (Le Tourneau)	29 7	9 10	9 11	6.30
18	Scraper 6-cubic yard (Le Tourneau)	23 4	8 1	8 7	4.95
19	Scraper 4-cubic yard (Blaw Knox)	21 1	7 5	8 5	2.70
20	Scraper 12-cubic yard motorised (Tornapull)	35 9	10 2	11 0	13.60
	Consolidation plant				
21	Roller 8-10-ton (Marshall)	16 5	6 8	9 7	8.05
22	Roller Sheepsfoot (Le Tourneau) ..	14 7	9 7	4 10	2.70(x)
23	Roller Sheepsfoot (Le Tourneau) ..	14 7	9 7	4 10	4.60(y)
24	Roller Sheepsfoot (Le Tourneau) ..	14 7	9 7	4 10	6.00(z)
25	Roller pneumatic-tyred (Pullen) ..	15 2	7 3	5 9	1.30
	Pumping plant				
26	Pump centrifugal 3-inch (Millars)	5 0	4 6	3 6	.20
27	Pump diaphragm 4-inch (Millars)	5 2	3 2	3 6	.35
	Lifting plant				
28	Crane tractor operated 40,000 lb (Le Tourneau)	27 0	9 6	22 0	3.60
	Scarifying equipment				
29	Rooter heavy (Le Tourneau) ..	20 0	8 0	8 6	6.50
30	Rooter light (Le Tourneau) ..	17 0	8 4	5 7	3.35

Note. (x) Empty.
 (y) Loaded with water.
 (z) Loaded with saturated sand.

RAF Airfield Construction Wing Equipment—(contd.)

<i>Serial</i> (a)	<i>Type</i> (b)	<i>Length</i> (c)	<i>Width</i> (d)	<i>Height</i> (e)	<i>Weight in tons</i> (f)

SP EQUIPMENT (BRITISH)

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	SP 25-pr Sexton	19 3	8 11	8 0	25.45
2	SP 17-pr M10	21 8	10 0	8 2	26.78
3	SP 17-pr Valentine	20 11	8 9½	6 8	15.25
4	SP 17-pr A30 (x)	27 11	10 1	7 0	30.00

Note. (x) Provisional figures only.

SP EQUIPMENT (US)

<i>Serial</i>	<i>Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Weight in tons</i>
(a)	(b)	(c)	(d)	(e)	(f)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	Carriage motor 75-mm how M8 ..	14 6	7 4½	7 7½	15.44
2	Carriage motor 76-mm gun M18 ..	22 1(x)	9 2	8 6	16.74
		20 11(y)			
3	Carriage motor 3-inch gun M10 ..	19 8	10 0	8 2	29.46
4	Carriage motor 3-inch gun M10A1 ..	19 8	10 0	8 2	28.17
5	Carriage motor 105-mm how M7 ..	18 7	9 6	8 4	23.21
6	Carriage motor 155-mm gun M12 ..	22 1	8 9	8 10(z)	25.44

Note. (x) Gun forward.
(y) Gun to rear.
(z) Reducible to 8' 0"

SPECIAL DEVICES

Serial	Type	Length	Width	Height	Heights above ground of greatest width of device	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)	(g)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>		
1	Baron	31 0	13 0	12 6	3-5 feet	29·00
2	Scorpion	27 3	12 0	8 9(p)	4' 4"- 9' 0"	21·00
3	Crab II	27 5½	11 6	9 4(p)	4' 3"- 13' 6"	34·00(g)
4	AVRE carrying fascine 8 feet	25 0	11 6(v)	13 6	5' 0"- 13' 6"	4·00(s)
5	Sledge	12 7½	6 9	1 5	—	·70(t)
6	Porpoise—mk I ..	14 1	3 7	11	—	·41(t)
7	Porpoise—mk II ..	14 7	4 10	11	—	·84(v)
8	AVRE with SBG ..	34 0(w)	11 0	22 0	3-22 feet	·50(t)
9	Goat—mk III ..	11 0(y)	11 0	7 0	6' 4"	1·14(v)
10	AVRE (Churchill IV)	25 2	10 8	8 2	—	42·00(x)
11	AVRE (Ram II)	19 0	9 5	8 9	—	39·00
12	Churchill bridge layer	37 6	10 8	11 1	—	38·00
13	Valentine bridge layer (Scissors).	23 7	9 8½	11 3	—	30·00
14	Churchill crocodile ..	40 6(z)	10 11	9 1½	—	40·40
15	Cavalier ARV mk I	21 5	9 5	6 2½	—	19·25
16	Cromwell I-III or IV ARV mk I	21 5	9 6	6 6½	—	23·00
17	Sherman III ARV mk I	20 6	9 4	6 11	—	28·00
18	Sherman V ARV mk I	21 3½	9 2	7 0	—	28·50
19	Churchill IV ARV mk I	25 1	10 8	6 8	—	33·00
20	Sherman III ARV mk I	22 8	9 9	9 11	—	33·00
21	Sherman V ARV mk II	23 4	9 8½	9 10½	—	33·00
22	Churchill IV ARV mk II	27 1½	10 11½	9 10½	—	35·00
23	Ram ARV mk II ..	22 8½	9 9½	10 2½	—	40·10
24	Sherman III ARV mk III.	19 5½	8 7	8 11½	—	31·00
25	Ark I	Tank plus 12 0	10 8	—	—	34·00
26	Ark II	Tank plus 12 0	10 8	—	—	27·54

Note. (p) Less lights.
 (q) Unstowed.
 (r) Normally.
 (s) Plus tank weight.
 (t) Unloaded.
 (v) Loaded.
 (w) Bridge at 32°.
 (x) With AVRE.
 (y) Projection in front of horns of AVRE.
 (z) Complete with trailer.

TANKDOZERS

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)	Remarks (g)
1	Sherman	ft ins 24 1	ft ins 10 4	ft ins 9 8 $\frac{3}{4}$	34.60	(a) Tank fully stowed (b) This is the only firm pattern for tankdozers
2	Centaur	23 10	11 4	8 4	26.25	

ARMoured DOZERS

1	D6	(a)	18 2	9 1	8 8	12.8
		(b)	16 0	10 5	8 8	12.8
2	D7	(a)	19 4	9 1	9 3 $\frac{1}{2}$	17.6
		(b)	17 2	10 4	9 3 $\frac{1}{2}$	17.6

Note. (a) blade angled. (b) blade square.

BULLDOZERS

1	D4	12 7	6 5	6 8	5.90	Less exhaust and air cleaner 5'1"
2	D6	14 9	8 1 $\frac{1}{2}$	7 0	9.40	Less exhaust and air cleaner 4'8"
3	D7	17 4	11 11	9 0	14.00	Less exhaust and air cleaner 6'8"
4	D8	19 3	12 11	9 2	19.90	Less exhaust and air cleaner 6'10"
5	Clarkair tractor bulldozer	9 2	4 11	4 11	1.9	

EXCAVATORS

1	Excavator RB10 28' jib	37 7	7 9	11 0	8.75	
2	Excavator RB19 40' jib	52 8	8 9	14 7	17.50	
3	Smith excavator model 210 $\frac{3}{4}$ -cubic yard	36 7	7 4	9 8	8.75	
4	Bucyrus Erie excavator 20B	46 10	8 4	10 6	16.40	
5	Bucyrus Erie excavator 10B	36 8	7 8	9 9	8.50	
6	Lovain excavator L40 ..	46 3	8 6	10 2		

ANGLEDZERS

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)	Remarks (g)	
1	Baker & Allis-Chalmers Wide HD7 ..	(x) 15 6	9 5	8 0	7.75	Note. Overall height of Baker dozers includes the superstructure	
		(y) 13 3	10 4	8 0	7.75		
2	Wide HD10 ..	(x) 18 0	11 0	8 8	12.25		
		(y) 15 7	12 2	8 8	12.25		
3	HD14 ..	(x) 19 6	11 3	9 6	16.25		
		(y) 16 10	12 4	9 6	16.25		
La Plant Choate and Caterpillar							
4	Std D4 ..	(x) 13 9 $\frac{1}{2}$	7 2	6 8	6.00		
		(y) 12 6 $\frac{1}{2}$	7 8 $\frac{1}{2}$	6 8	6.00		
5	Wide D4 ..	(x) 14 1 $\frac{1}{2}$	8 6 $\frac{1}{2}$	6 8	6.25		
		(y) 12 6 $\frac{1}{2}$	9 6 $\frac{1}{2}$	6 8	6.25		
6	Std D6 ..	(x) 18 0	9 3	7 9	9.75		
		(y) 15 7	10 4	7 9	9.75		
7	Wide D6 ..	(x) 18 0	9 3	7 9	10.00		
		(y) 15 7	10 4	7. 9	10.00		
8	D7 ..	(x) 19 4	10 10	9 0	14.00		
		(y) 17 3 $\frac{1}{2}$	12 1 $\frac{1}{2}$	9 0	14.00		
9	D8 ..	(x) 22 6	11 9 $\frac{1}{2}$	9 2	19.75		
		(y) 19 2 $\frac{1}{2}$	12 9 $\frac{1}{2}$	9 2	19.75		
Le Tourneau and Caterpillar							
10	Std D4 ..	(x) 15 11	8 5 $\frac{1}{2}$	8 3	6.00	Note. Overall height of Le Tourneau dozers includes the super-structure	
		(y) 13 8 $\frac{1}{2}$	9 9	8 3	6.00		
11	Wide D4 ..	(x) 16 3	9 7	8 3	6.13		
		(y) 13 8 $\frac{1}{2}$	11 1	8 3	6.13		
12	Std 6 ..	(x) 15 5	7 10	9 4	9.00		
		(y) 13 0	9 2	9 4	9.00		
13	Wide D6 ..	(x) 15 5	10 2	9 4	9.25		
		(y) 13 0	11 1	9 4	9.25		
14	D7 ..	(x) 20 6	11 9	9 5	13.25		
		(y) 17 3	13 7	9 5	13.25		
15	D8 ..	(x) 22 9	12 8	9 8	18.00		
		(y) 20 7	13 7	9 8	18.00		
Ruston-Bucyrus and International							
16	Wide TD6 ..	(x) 13 4	7 9	6 3	4.50		
		(y) 11 7	8 5	6 3	4.50		
17	Wide TD9 ..	(x) 15 3	9 1	6 9	6.25		
		(y) 13 0	10 1	6 9	6.25		
18	Wide TD14 ..	(x) 17 3	10 10	7 0	9.75		
		(y) 15 4	11 11	7 0	9.75		
19	Wide TD18 ..	(x) 19 6 $\frac{1}{2}$	11 4	7 8	13.75		
		(y) 17 5	12 7	7 8	13.75		

(x) angled (y) square

TANKS (BRITISH)

Serial	Type	Length	Width	Height	Weight
(a)	(b)	(c)	(d)	(e)	(f)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	Tetrarch	16 8½	7 7	6 11½	7.60
2	Centaur IV	20 9	10 0½	8 1	27.75
3	Cromwell IV, V, VI	20 9	10 0½	8 1	27.50
4	Cromwell VII, VIII	20 9	10 0½	8 1	28.00
5	Challenger	23 6	9 6½	9 1½	32.50
6	Comet	21 1	10 1	8 9½	32.70
7	Valentine IX, X, XI	18 9¾	9 1	6 11½	17.20
8	Churchill III	24 1½	10 8	8 11½	38.50
9	Churchill IV, V, VI	24 1½	10 8	9 1½	38.50
10	Churchill VII, VIII	24 2	10 11	9 1½	39.50

SHERMANS MODIFIED FOR BRITISH USE

Serial	Type	Length	Width	Height	Weight
(a)	(b)	(c)	(d)	(e)	(f)
		<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
1	Sherman I	19 9	8 9	9 4½	30.80
2	Sherman IB	20 1	8 9	9 8½	30.97
3	Sherman IC	19 9(x)	8 9	9 4½	32.75
4	Sherman II	19 9	8 9	9 4½	30.80
5	Sherman IIA	20 1(y)	8 9½	9 8½	31.20
6	Sherman III	20 1	8 9	9 4½	31.20
7	Sherman IV	20 6½	8 9	9 3¾	31.50
8	Sherman V	21 4	8 9	9 4½	31.75
9	Sherman VC	21 4	8 9	9 4½	34.75

(x) Over gun 24' 4".

(y) Over gun 24' 3½".

TANKS (US)

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
		ft ins	ft ins	ft ins	
1	Locust (T9E1)	12 10 $\frac{3}{4}$	7 3 $\frac{3}{4}$	6 5 $\frac{1}{2}$	7.60
2	Stuart III, IV	15 3 $\frac{1}{4}$	8 3 $\frac{1}{2}$	8 3 $\frac{3}{4}$	12.50
3	Stuart V	16 6	8 3 $\frac{3}{4}$	8 1 $\frac{3}{8}$	14.70
4	Stuart VI	14 6 $\frac{3}{4}$	7 4	7 6 $\frac{3}{8}$	15.10
5	Chaffee—light tank M24	16 3	9 9	8 1 $\frac{3}{8}$	17.60
6	General Grant M3	18 7	9 0	9 11	29.00
7	Lee	18 7	9 0	10 2 $\frac{1}{2}$	29.00
8	Sherman I	19 4	8 7	9 8	30.50
9	Sherman IB	19 4	8 7	9 8	30.97
10	Sherman IC	19 4	8 7	9 8	30.55
11	Sherman II	19 2	8 7	9 8	30.50
12	Sherman IIA	19 2	8 9 $\frac{1}{2}$	9 9	31.20
13	Sherman III	19 5	8 7	9 8	31.20
14	Sherman IV	19 4 $\frac{1}{2}$	8 7	9 8	30.50
15	Sherman IV (up-armoured)	19 4 $\frac{1}{2}$	8 7	9 3 $\frac{3}{4}$	37.70
16	Sherman V	19 10 $\frac{1}{2}$	8 7	9 4	32.00
17	Sherman VC	19 10 $\frac{1}{2}$	8 7	9 4	34.75
18	Ram I	19 0	9 5	8 9	28.90
19	Ram II	19 0	9 5	8 9	29.70
20	M26 General Pershing	20 9	11 6	9 1	41.00

VEHICLES (BRITISH)

"B" Vehicles

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
		ft ins	ft ins	ft ins	
1	Car 2-str 4 × 2 utility	12 4	4 7	5 2	.85
2	Car 4-str 4 × 2	14 0	6 4	6 4	1.90
3	Car 6-str 4 × 2 pullman	16 5	6 1	6 2½	2.18
4	Car 4-str 4 × 4 heavy utility	14 1	6 2	6 5	2.70
5	Ambulance 2-stretcher 4 × 4 light	13 9	6 0	7 5	2.74
6	Ambulance 4-stretcher 4 × 2 heavy	19 0	7 3	9 3	3.90
7	Ambulance 4-stretcher 4 × 4 light	16 3	6 2	7 10	2.95
8	Truck 8-cwt 4 × 2 GS	14 10½	6 4	6 2½	2.30(q)
9	Truck 15-cwt 4 × 2 or 4 × 4 GS	14 9	6 6½	7 6	3.45(q)
10	Truck 15-cwt 4 × 2 office	14 8	6 10	7 4	3.25
11	Truck 15-cwt 4 × 2 water—200 gals	15 3½	6 6½	6 4	3.88
12	Lorry 30-cwt 4 × 2 GS (Note—All 30-cwts obsolescent)	19 0	7 2½	9 11	4.60(p)
13	Lorry 3-ton 4 × 2 GS	21 1	7 6	9 11	6.50
14	Lorry 3-ton 4 × 4 GS	19 8	7 5	9 9	6.86
15	Lorry 3-ton 4 × 2 (Special purpose vehicles of varying sizes, eg battery slave, petrol 800-gallons etc)	21 7½	7 6	11 6	7.75(q)
16	Lorry 3-ton 4 × 4 (Special purpose vehicles of varying sizes, eg machinery, mobile ops room, troop carrying)	21 10	7 6	9 8	6.55(r)
17	Lorry 3-ton 6 × 4 GS	21 1	7 6	10 4½	7.75
	Minimum	22 6	7 6	10 4½	9.05
18	Lorry 3-ton 6 × 4 (Special purpose vehicles of varying sizes, eg machinery, wireless, SL, etc)	22 5½	7 5	11 6	8.45
	Maximum	26 0	7 6	11 8	10.50(s)
19	Lorry 5-ton 6 × 4 GS	20 6	7 4	8 10	8.76
20	Lorry 6-ton 4 × 2 GS	21 10½	7 8	10 6	11.44
21	Lorry 10-ton 6 × 4 GS	26 4	7 6	10 2½	17.45
	Minimum	28 3	8 3½	11 6½	19.00
	Maximum	30 6	7 6	10 8	10.90
22	Lorry 6-ton 4 × 4—2 Tractor & semi-trailers, GS	17 8	7 6	10 8	
	Semi-trailer	17 8	7 6	10 8	
23	Lorry 7-ton 4 × 2—2 low loading	18 0	7 6	—	11.50
24	Lorry 7-ton 6 × 4—2 With tractor semi-trailer, GS	29 6	7 6	8 1½	} 12.85
	Semi-trailer	17 2	7 6	8 1½	
25	Lorry 10-ton 4 × 2—semi-trailer, GS	15 0	8 0	2 0	14.35
26	Transporter (Albion) With tractor	43 9½	9 5	8 6	34.28
	20-ton 6 × 4—4 Semi-trailer	27 6	9 5	6 2	34.28
27	Transporter (Scammell) With tractor	49 3	9 2	9 5	} 35.90
	20-ton 6 × 4—8 Semi-trailer	35 7	9 2	9 4	
	semi-trailer, recovery	49 8	9 5½	10 11	49.80
28	Transporter (Scammell) With tractor	36 6	9 5½	10 11	49.80
	30-ton 6 × 4—8 Semi-trailer	36 6	9 5½	10 11	49.80
	semi-trailer, recovery	49 8	9 5½	10 11	49.80
29	Transporter (Diamond T) 40-ton 6 × 4 transporter and recovery. Pulls trailers in serial 50	22 7	8 4	8 3	18.93

Note. (p) These are largest of 30-cwt types.

(q) Maximum consolidated dimensions given. Height of all except one type never exceeds 10' 6".

(r) Representative figures. Max. height found is 10' 6" and weight 8 ton 8 cwt.

(s) Maximum sizes.

Vehicles (British)—continued

"B" Vehicles

Serial	Type	Length	Width	Height	Weight in tons
(a)	(b)	(c)	(d)	(e)	(f)
30	Tractor 4 × 4 light AA	ft ins 18 8	ft ins 7 6	ft ins 9 0	6.60
31	Tractor (AEC Matador) 4 × 4 heavy AA	20 9	7 10½	10 2	10.85
32	Tractor (AEC Matador) 4 × 4 medium AA	20 9	7 10½	10 2	10.85
33	Tractor (Scammell) 6 × 4 heavy artillery	20 3	8 6	9 9	12.14
34	Tractor 4 × 4 A tk 6-pr	19 3	8 4½	10 2½	7.90
35	Tractor (Scammell) 6 × 4 breakdown heavy	20 3	8 6	9 5	13.60
36	Tractor 4 × 4 FA	14 9	7 3	7 5	4.80
37	Tractor 4 × 2 for 6-ton semi-trailer	15 5½ (p)	7 3	7 5	4.80
38	Trailer 10-cwt 2-wheeled GS	30 6	7 6	10 8	10.90
39	Trailer, 4.2-in. mortar and 4.2-in. mortar ammunition.	17 8	7 6	10 8	10.90
40	Trailer 15-cwt 2-wheeled special purpose trailers of varying sizes.	9 7½	5 2	3 9	.75
41	Trailer 1-ton 2-wheeled GS and special purposes	9 5	5 4½	5 3	.80
42	Trailer 2-ton 4-wheeled FBE With load	11 6	6 6	5 5	1.46(g)
43	Trailer 2-ton 2-wheeled generator 15 KVA and radar varying sizes	11 5	6 6	4 10¾	—
44	Trailer 4/5-ton 4-wheeled GS	22 1	6 5½	7 8½	22.20
45	Trailer 7½-ton 6-wheeled light recovery	28 0	7 5	9 0	3.30
46	Trailer (Rogers) 10-ton 6-wheeled low loading or printing press.	14 4	7 6	10 8	7.78
47	Trailer (RB) 18-ton 4-wheeled	20 0	7 8½	4 5	10.13
48	Trailer (Carrimore) 18-ton 8-wheeled low loading.	30 2	8 0	6 3	13-15(r)
49	Trailer (crane) 20-ton 8-wheeled low loading	25 4	9 0	2 11	20.75
50	Trailer (Rogers) 20-ton 12-wheeled low loading	28 8	8 6	4 10	24.85
51	Trailer (multi-wheeler—SMT) 20-ton 16-wheeled low loading.	36 5	9 1	5 2½	31.55
52	Trailer 40-ton 24-wheeled transporter and transporter recovery.	31 9	10 0	5 9½	—
	British mk I	27 5	9 5½	4 5	27.20
	British mk II	30 2	9 6	4 9	50.35
		31 11	10 0	5 10	52.70
		32 4½	10 0	5 8½	50.90

Note. (p) With gun platform
 (q) Sizes given are usual type.
 (r) Unladen.
 (s) When carrying Churchill.

VEHICLES (US)

Serial (a)	Type (b)	Length (c)		Width (d)		Height (e)		Weight in tons (f)
		ft	ins	ft	ins	ft	ins	
1	Truck artillery repair	19	0	7	11	9	0	5.92
2	Truck instrument repair	19	0	7	11	9	0	5.92
3	Truck machine shop	19	0	7	11	9	0	5.92
4	Truck small arms repair	19	0	7	11	9	0	5.92
5	Truck welding	19	0	7	11	9	0	5.92
6	Truck automotive repair	19	0	7	11	9	0	5.92
7	Truck 1/4-ton 4 × 4 jeep	11	0 $\frac{1}{2}$	5	2	4	4	1.45
8	Truck 3/4-ton 4 × 4 C & R	14	7 $\frac{5}{8}$	6	6 $\frac{5}{8}$	6	9 $\frac{1}{2}$ (r)	3.07(p)
		14	7 $\frac{5}{8}$	6	6 $\frac{5}{8}$			3.20(q)
9	Truck, WC, 3/4-ton 4 × 4	13	10 $\frac{7}{8}$	6	10 $\frac{3}{4}$	6	9 $\frac{3}{8}$	3.01(p)
		13	10 $\frac{7}{8}$	6	10 $\frac{3}{4}$	6	9 $\frac{3}{8}$	3.12(q)
10	Truck, Carryall, 3/4-ton	15	4 $\frac{5}{8}$	6	6 $\frac{5}{8}$	6	10	3.37(p)
11	Truck 1 $\frac{1}{2}$ -ton 6 × 6, cargo and personnel	18	8 $\frac{1}{2}$	6	10 $\frac{1}{2}$	7	1 $\frac{1}{2}$	4.43(p)
		18	8 $\frac{1}{2}$	6	10 $\frac{1}{2}$	7	1 $\frac{1}{2}$	4.63(q)
12	Truck 1 $\frac{1}{2}$ -ton 4 × 4 cargo, steel body	18	8	7	2	8	8 $\frac{1}{2}$	4.71(p)
		18	8	7	2	8	8 $\frac{1}{2}$	5.01(q)
13	Truck 1 $\frac{1}{2}$ -ton 4 × 4 cargo, wood body	18	8	5	9 $\frac{3}{4}$	8	8 $\frac{1}{2}$	4.7(p)
		18	8	5	9 $\frac{3}{4}$	8	8 $\frac{1}{2}$	5.01(q)
14	Truck 1 $\frac{1}{2}$ -ton 4 × 4 dump	19	3	7	2 $\frac{3}{8}$	8	10 $\frac{1}{2}$	5.04(p)
		19	3	7	2 $\frac{3}{8}$	8	10 $\frac{1}{2}$	5.42(q)
15	Truck tractor 1 $\frac{1}{2}$ -ton 4 × 2	14	10	7	2	7	4 $\frac{1}{2}$	4.34
16	Truck 2 $\frac{1}{2}$ -ton cargo LWB 6 × 6	22	0 $\frac{1}{2}$	7	4	7	7 $\frac{3}{8}$	6.72
		22	0 $\frac{1}{2}$	7	4	7	7 $\frac{3}{8}$	7.14
17	Truck 2 $\frac{1}{2}$ -ton cargo SWB 6 × 6	20	4 $\frac{5}{8}$	7	4	9	2	6.74
		20	4 $\frac{5}{8}$	7	4	9	2	7.14
18	Truck 2 $\frac{1}{2}$ -ton 6 × 6 700-gallon water tank	21	1 $\frac{1}{2}$	7	6	7	7 $\frac{3}{8}$	6.78
19	Truck 2 $\frac{1}{2}$ -ton 6 × 6 750-gallon gas tank	21	1 $\frac{1}{2}$	7	7	8	0	7.19
20	Truck 2 $\frac{1}{2}$ -ton 6 × 6 dump	22	8 $\frac{3}{4}$	7	4	8	3 $\frac{5}{8}$	7.52
21	Truck 2 $\frac{1}{2}$ -ton 6 × 6 15-foot body COE	22	2 $\frac{1}{2}$	7	4	9	0 $\frac{1}{2}$	6.44
22	Truck 4-ton 6 × 6 cargo LWB	24	8 $\frac{5}{8}$	8	0	9	8 $\frac{1}{2}$	11.83
23	Truck 4-ton 6 × 6 cargo SWB	22	4	8	0	9	6	11.78
24	Truck 4-ton 6 × 6 dump	21	2 $\frac{1}{2}$	7	10	8	11 $\frac{3}{8}$	11.78
25	Truck 4-ton 6 × 6 wrecker	24	3 $\frac{5}{8}$	8	5	9	3	9.69
26	Truck tractor 4-5-ton 4 × 4	16	10	7	11	8	11 $\frac{1}{2}$	9.46
27	Truck tractor 5-6-ton 4 × 4	24	8 $\frac{3}{4}$	8	2 $\frac{3}{8}$	10	10 $\frac{1}{2}$	12.19
28	Truck 6-ton 6 × 6 prime mover	24	0 $\frac{1}{2}$	8	0	9	5 $\frac{3}{8}$	15.24
29	Truck 7 $\frac{1}{2}$ -ton 6 × 6 prime mover	24	8 $\frac{5}{8}$	8	6 $\frac{1}{2}$	10	2(s)	19.92
30	Tank transporter M19	23	3 $\frac{3}{8}$	8	5 $\frac{1}{2}$	8	4	20.09
	Truck	29	8	9	6	4	8 $\frac{1}{2}$	50.00
	Trailer	25	4	8	1	11	8(t)	21.43
31	Tank transporter M25	38	5 $\frac{1}{8}$	12	6(v)	6	6 $\frac{5}{8}$	51.78

Note. (p) Without winch.
 (q) With winch.
 (r) Reducible to 5' 2 $\frac{1}{2}$ ".
 (s) Reducible to 7' 10".
 (t) Reducible to 10' 0".
 (v) Reducible to 10' 4".

RE EQUIPMENT

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
	Scrapers	<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
	12 cubic yard				
1	Le Tourneau model F	35 2	11 5	11 9	9.80
2	Le Tourneau model LP	32 2	10 2	11 11	8.90
3	Digma 12 S	29 0	11 6	11 6	9.00
4	Empire model H	30 10	11 0	12 8	10.30
5	Bucyrus-Erie or Ruston Bucyrus S146	29 5	11 8	9 6	9.40
	8 cubic yard				
6	Le Tourneau LS	29 1	9 11	9 10	6.00
7	Le Tourneau L	23 4	9 4	9 7	5.20
8	Digma 8 SW	23 0	10 0	9 3	6.00
9	Empire G	27 6	9 5	10 9	6.60
10	Empire K	26 3	9 5	10 2	6.00
11	Bucyrus-Erie or Ruston-Bucyrus S112	26 4	10 4	8 8	7.10
12	Bucyrus-Erie or Ruston-Bucyrus S90	25 9	9 6	8 0	5.80
	6 cubic yard				
13	Le Tourneau G	20 10	8 11	9 7	4.00
14	Le Tourneau M	23 4	8 1	8 7	5.00
15	Digma 6 SX	23 0	8 6	9 3	5.35
16	Empire L	24 9	8 6	9 0	5.50
17	Empire BL	24 6	8 3	9 0	—
18	Bucyrus-Erie or Ruston-Bucyrus S67	23 3	8 9	7 4	4.50
	4 cubic yard				
19	Le Tourneau X	19 0	6 11	7 0	2.70
20	Digma 4 SY	21 0	7 6	8 0	2.70
21	Empire J	18 0	7 3	8 0	2.70
22	Bucyrus-Erie or Ruston-Bucyrus S45	21 8	7 6	6 10	3.50

RE Equipment—continued

Serial (a)	Type (b)		Length (c)	Width (d)	Height (e)	Weight in tons (f)
			ft ins	ft ins	ft ins	
Graders						
23	No. 66	(m)	21 0	9 8	7 5	4.80 (P)
		(n)		12 0		4.60 (Q)
24	No. 44	(m)	18 0	8 10	7 0	3.60 (P)
		(n)		10 0		3.40 (Q)
25	No. 33	(m)	16 4	7 9	6 9	2.70 (Q)
		(n)		8 0		
26	No. 22	(m)	14 2	7 0	5 5	1.62 (P)
		(n)		8 0		1.60 (Q)
27	No. 4 Hi-way	(m)	11 8	5 11	5 2	.74 (Q)
		(n)		8 0		
28	Caterpillar 48 elevating grader (with pole).		24 8	10 2	9 5	8.80
29	Caterpillar No. 12 motor grader	(m)	25 0	7 10	7 5	9.30
		(n)		12 0		
30	Caterpillar No. 112 motor grader— Tandem drive	(m)	24 10	7 10	9 9 (X)	8.10
		(n)		12 0	7 4 (Y)	
31	Single drive	(m)	24 0	7 10	9 9 (X)	6.60
		(n)		12 0	7 4 (Y)	
32	Caterpillar No. 212 motor grader— Tandem drive	(m)	21 11	6 10	9 6 (X)	5.70
		(n)		10 0	7 0 (Y)	
33	Single drive	(m)	21 0	6 5	9 6 (X)	4.70
		(n)	21 0	10 0	7 0 (Y)	
34	Galion No. 101D motor grader	(m)	25 2	7 7	10 0 (X)	9.67
		(n)	25 2	12 0	7 2 (Y)	
35	Austin western 99 motor grader	(m)	22 10	7 10	9 8 (X)	7.70
		(n)	22 10	13 0	8 2 (Y)	
36	Adams grader No. 104	(m)	30 0	8 7	7 7	3.40
		(n)	30 0	10 0	7 7	3.40
37	Adams grader No. 124	(m)	32 6½	9 8	8 3	4.47
		(n)	32 6½	12 0	8 3	4.47
Tractors						
38	Fordson tractor		8 10½	5 2½	6 0½	1.50
39	Cletrac Model DD		10 5	5 8½	5 6	6.13
40	Cletrac Model BD		9 8	5 0½	4 9½	4.00
41	Cletrac Model HG		7 7	4 4½	4 2	1.33
42	Case tractor Model "LAI"		12 0	8 0	5 11	4.60
Rollers						
43	Wallis-Stevens 10-ton diesel		16 10	6 4	8 6	10.50
44	Wallis-Stevens 6-ton diesel		15 3	6 2	8 2½	6.55
45	Wallis-Stevens 8-ton diesel		15 3	6 2	8 2½	8.75

Note. (m) angled (n) square (P) power control (Q) hand control (X) with cab (Y) without cab.

RE Equipment—continued

Serial (a)	Type (b)	Length (c)	Width (d)	Height (e)	Weight in tons (f)
	Rollers—continued	<i>ft ins</i>	<i>ft ins</i>	<i>ft ins</i>	
46	Aveling Barford 12-ton diesel ..	18 9	6 10 $\frac{3}{4}$	9 3	12.60
47	Aveling Barford 14-ton diesel ..	18 9	6 10 $\frac{3}{4}$	9 3	14.60
48	Aveling Barford 6-ton diesel ..	15 3	5 6	8 8	6.35
49	Aveling Barford 8-ton diesel ..	15 3	5 6	8 8	8.35
50	Aveling Barford 10-ton diesel ..	17 6 $\frac{1}{2}$	5 10	9 8	10.25
51	Marshall motor roller utility 10-ton	16 6	6 7	9 0	10.00
52	Huber road roller 10-ton diesel ..	18 3	6 5	6 8 $\frac{1}{2}$	9.68
53	Huber road roller 10-ton petrol ..	18 3	6 5	6 8 $\frac{1}{2}$	9.88
54	9-wheeled wobble wheel roller ..	15 3(x)	7 4	5 2	11.60
55	La Plante Choate or Le Tourneau rollers (tamperers)—vary in size according to number of rollers—				
	Minimum	11 6	4 8 $\frac{1}{2}$	—	1.25
	Maximum	14 7	23 3	—	9.00
	Miscellaneous equipment				
56	Killifer plough No. 350	17 6	10 0	8 0	1.90
57	Le Tourneau roter	20 5	8 3	7 9	5.50
58	Digma ripper	13 6	6 3	7 0	2.54
59	Le Tourneau crane—				
	AD2 steel wheels	41 6	10 6	12 6	2.50
	AD2 single pneumatic	41 6	9 6	12 6	2.25
	AD2 double pneumatic	41 6	11 10	12 6	2.75
60	Le Tourneau crane—				
	AD3 steel wheels	51 5	10 6	12 6	3.00
	AD3 single pneumatic	51 5	9 6	12 6	2.50
	AD3 double pneumatic	51 5	11 10	12 6	3.00
61	Le Tourneau crane—				
	AD4 steel wheels	61 9	12 6	12 6	3.25
	AD4 single pneumatic	61 9	11 6	12 6	3.00
	AD4 double pneumatic	61 9	13 10	12 6	3.25

Note. (x) Including drawbar.

ROADWAYS

The time and labour constants given in this part are by no means firm as they lack confirmation in operational reports.

These planning figures should only be used by an engineer trained staff officer as circumstances can change the data enormously. No account has been taken for the time required in the preparation of the sites for work which is always a major commitment.

BEACH ROADWAYS

1. Beach roadways average requirement per assault brigade for the BMA is 5,000/6,000 yards.

2. The following types are typical roadways for normal beaches :—

Serial (a)	Description (b)	Suitable for tracked vehicles (c)	Suitability					Weight in tons per 100 yards (h)	Laying data per 100 yards run			Bulk in cu. ft. per 100 yards (l)	Remarks. (m)
			On sand		On shingle (up to 1-inch diameter) (e)	On mud (f)	Between high and low water (g)		Party (j)	Time (mins)			
			Hard (d)	Soft						Day (k)	Night		
1	Track square mesh (BRC)	Limited	Yes	Yes	Yes	No	Yes	2.1	18	30	—	177	Width 12' 3"
2	BRC Monkton pack	Limited	Yes	Yes	Yes	No	Yes	2.4	18	15	76	293	Weight includes coir
3	Sommerfeld track in rolls	No	Yes	No	Yes	No	Yes	2.0	22	30	—	113	Fair in surf
4	Sommerfeld track Monkton pack	No	Yes	No	Yes	No	Yes	2.0	25	20	—	113	
5	Sommerfeld track laid on coir	No	Yes	Yes	Yes	No	No	2.3	28	30	—	193	Matting will need renewal earlier than track

3. The number of yards of Sommerfeld (Monkton Pack or rolled, plus tools and accessories) which can be carried by different trailers or sleighs are given in the table below :—

Serial (a)	Type of trailer or sleigh (b)	Rolled yards (c)	BRC panels or Monkton Pack yards (d)
1	Rogers 10/15-ton trailer	500	300-400
2	Jahn 6/8	250	200
3	Eagle 5-ton trailer	250	200
4	Inverkip sleigh	100	—

Roadways—continued

MUD ROADWAYS

1. Roadways can be improvised out of timber, BRC fabric and coir matting which will carry traffic over mud beaches up to but excluding mud of such liquid consistency as to require bridging to cross it.

2. The principles for the construction of these roadways are :—

- (a) A mattress of BRC fabric laid on coir 22 ft. 0 in. wide for the heavy duty type, 12 ft. 3 in. wide for the light duty type. This mattress is laid on the mud and distributes the load.
- (b) A superstructure built on the mattress, consisting of longitudinal round or square timbers with Bailey or other decking spiked on top, the superstructure taking the traffic load.

3. Two types of mud roadway have been evolved. The general data for the two types is given in the table below :—

Serial	Description	Overall width	Width of vehicle road	Weight per 100 yards	Bulk per 100 yards in cubic feet	Transport per 100 yards (3-ton lorries)	Time to lay 100 yards		Remarks
							Working Time		
							Party (Hours)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)		(j)
1	Mud roadways for all types of vehicles	ft ins 22 0	ft ins 10 0	(tons) 18	1,350	6	24	1½	Roadways will withstand 3,000 trips by 3-ton lorries overloaded 50%
2	Mud roadways for jeeps	12 3	6 0	7	535	3	12	1¼ to 1½	Roadway will withstand passages of 3,000 loaded jeeps. The mattress alone can take up to 50 jeeps

AIRFIELD CONSTRUCTION

1. (a) As a guide for the Far East, it is unwise to allow for the completion of a fair weather (unsurfaced) landing strip for Dakotas before D plus 6.

(b) The following table shows the general data of the labour and surfacing materials required for the construction of surface landing strips for Dakotas :—

Serial (a)	Description (b)	Pre-fabricated bituminised surfacing (PBS) (c)		Square mesh track (SMT) (d)		Pierced steel blank (PSP) (e)		Channel track (f)	
		Weight in tons	Time to lay in man hours	Weight in tons	Time to lay in man hours	Weight in tons	Time to lay in man hours	Weight in tons	Time to lay in man hours
		(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
1	3,500 feet × 150 feet runway, fully surfaced	200	2,600	294	5,300	1,260	5,250	705	1,461
2	3,600 feet × 150 feet advanced landing ground (ALG) fully surfaced	600	7,800	882	15,900	3,780	15,750	2,115	4,380

AIR OP LANDING STRIPS

Size :—200–250 yards × 20–30 yards.

There should be no obstacle subtending an angle greater than 15° from either end of the runway. In view of the great differences of terrain no safe time of preparation can be given.

WATER SUPPLY

1. The following tables show the amount of stores required for a brigade water point when drawn from :—

(a) *Surface water* :—

Serial	Type of equipment	Numbers required
(a)	(b)	(c)
1	Mobile water purification trailers	1
2	Hose, water, canvas 2-inch, 30-foot lengths	20
3	Hose, armoured or suction, 2-inch, 12-foot lengths	10
4	Petrol engines, 8 BHP (complete with tools)	1
5	Pumps, flexed driven 1½-inches	4
6	Flexible drive, ft	60
7	"S" tanks 1,500 gallons (if storage required)	3
8	Valves	3
9	Nozzles	3
10	Footvalves	4
11	Connectors—4-way (1 female, 3 male)	5
12	2-inch, 1 pipe, 1' 6" lengths	12(a)
13	T-5 2-inch to ½-inch	10(a)
14	Plugs 2-inch	1(a)
15	Bibcocks ½-inch	10(a)
16	"S" tanks 500 gallons capacity	1(a)
17	Tape insulating 10lb.	5

Note. (a) If not supplied with mobile water purification trailer

(b) *Subterranean water up to 20 feet below the surface* :—

Serial	Type of equipment	Amount required	Weight in lbs
(a)	(b)	(c)	(d)
1	Standard Miller Wellhead equipment	1	1,447
2	Water purification trailer complete, capacity 3,000 gallons per hour	1	4,480(b)
3	No. 4 pumping set complete with 3 pumps, 4 flex drives and clips	1	280(b)
4	8-hp Petter petrol engine, complete with spares	1	310(b)
5	Armoured suction hose 2" diameter × 12' long	3	96(b)
6	"S" tanks	2	160(b)
7	Stillson wrenches 24-inch	2	20(b)
8	Pair of chain tongs to take 3-inch diameter tube	2	25
9	Beaver chaser die stock 1½-3-inch BSPI	1	20
10	Pipe vice portable	1	15
11	Oil M.220	2 gallons	20(b)
12	Saline test box	1	4
13	1½-inch lashing × 30 feet	—	7(b)
14	One jar of distilled water, 2 gallons	1	25
15	Shovels, RE	2	8(b)
16	9-inch earth auger	1	7(b)
17	Tow	—	1(b)
18	Red lead powder	—	5(b)
Total weight			6,910

Note. (b) Items so marked are usually carried by the Fd coys or Fd Pk coy—thus making the additional weight entailed by the set 1,491 lbs.

Water Supply—*continued*

2. **Sea water**—The following table gives the general data for mobile distillation plants :—

<i>Serial</i>	<i>Description</i>	<i>VOCAB No.</i>	<i>Output in gallons</i>	<i>Approximate total weight in tons</i>
(a)	(b)	(c)	(d)	(e)
1	Distillation plant, skid or trailer mounted	EO 640 (C9)	1,500 (per day)	3
2	Distillation plant for carrying 3-ton lorry, skid mounted	NIV	60 (per hour)	2½
3	Distillation plant, trailer mounted	EO 640	140-180 (per hour)	10

MAJOR ITEMS OF EQUIPMENT CARRIED IN MECHANICAL EQUIPMENT PLATOON

1. (a) The following table contains the major items of equipment which are carried in the Mechanical Equipment Platoon Type D (alternative role). This platoon can work 16 pieces of this type of equipment 24 hours a day.

Serial (a)	Type of equipment (b)	Number of pieces (c)
1	Angledozer class I	4
2	Angledozer class II	3
3	Angledozer class III	3
4	Excavators $\frac{3}{4}$ -yard	1
5	Excavators $\frac{3}{8}$ -yard	1
6	Rollers road 6-ton	2
7	Graders blade 12 feet mould board	4
8	Graders motor 12 feet mould board	2
9	Rooters heavy	1
10	Scrapers 8-yard	2
11	Scrapers 6-yard	2
12	Dumpers 2-yard	4

(b) Angledozer (unarmoured) :—

Serial (a)	Class (b)	D4 (c)	D6 (d)	D7 (e)	D8 (f)	HD7 (g)	HD10 (h)	HD14 (j)	TD9 (k)	TD14 (l)	TD18 (m)
<i>Ground pressure in lbs per square inch</i>											
1	I	—	—	—	10·27	—	—	7·39	—	—	—
2	II	—	—	8·98	—	—	7·46	—	—	—	10
3	III	—	9·5	—	—	6·06	—	—	—	8·6	—
4	IV	9·4	—	—	—	—	—	—	9	—	—

**Major Items of Equipment carried in Mechanical
Equipment Platoon—*continued.***

CLIFF SCALING EQUIPMENT

RIGID LADDERS

Note. In assessing the length of ladder required for scaling a particular height, the slope of the ladder should be taken into consideration as this may decrease the effective height of the ladder by as much as 20 per cent.

1. **40-foot extension ladder**—Standard portable extending ladder which can be carried in LCA and is useful for scaling low cliffs.

2. **60-foot hand-operated ladder**—Mounted on two large wheels with operational limit of 40 feet, can be carried in LCM. Six to eight men needed to handle.

3. **100-foot power-operated ladder mounted in DUKW**—

(a) Details :—

(i) Weight of ladder (standard 100-foot Merry-weather).	22 cwt.
(ii) Weight of frame and mechanism (frames duralumin).	33 cwt.
Total weight ..	55 cwt.
(iii) Power drive to ladder—taken from winch drive on DUKW.	
(iv) Time to elevate from horizontal to 75° (maximum elevation).	50 seconds
(v) Time to extend to 100 feet	90 seconds
(vi) Time for man to climb	45 seconds
(vii) Maximum length of ladder	100 feet
(viii) Height of bottom of ladder from ground ..	5 feet
(ix) Overhang of ladder fulcrum from bow of DUKW.	20.5 feet
(x) Overhang of ladder when horizontal ..	7 feet
(xi) Maximum elevation of the 100-foot power controlled ladder.	75°

(b) Performance against a vertical cliff :—

Serial	Angle of elevation	Loss of height for full extension in feet	Height of ladder above ground in feet	Distance of DUKW's bow from cliff bottom in feet
(a)	(b)	(c)	(d)	(e)
1	75°	3.5	101.5	7
2	70°	6.0	99.0	16
3	65°	9.5	95.5	25
4	60°	13.5	91.5	34

Note. Column (e) above has taken into account the sag of the ladder due to the weight at the top and these distances are therefore a minimum.

Cliff Scaling Equipment—continued

Rigid Ladders—continued

(c)

Alteration in elevation	Will move ladder top :—	
	Up vertically in feet (approximately) (i)	Out horizontally in feet (approximately) (ii)
From 60° to 65°	4	7.5
From 65° to 70°	3.5	8
From 70° to 75°	3	8.25

FLEXIBLE LADDERS AND ROPES

4. Rocket projected grapnel with 2½-inch rope

(a) Description of parts and weights :—

Serial (a)	Description (b)	Weight in lbs (c)	Remarks (d)
1	Projector	38	Modified PAC type J length 4' 3"
2	Rocket	9	Standard 2-inch type J
3	Rope box with pin base	49 (no rope)	Size 2' 5½" square by 1' 3½" deep
4	Rope box without pin base	34	
5	Rope 2½ inches in diameter	58	45 fathoms in each box
6	Grapnel	9	15 inches overall diameter
7	Wire strop	—	8-inch flexible wire (1 ton) with brass thimble each end
8	Flame protector	—	Connects strop to tail of rocket
9	Firing battery and key	—	4-volt dry battery in water- tight container containing firing key and socket to take firing load plus

(b) Performance :—

Serial (a)	Description (b)	Rope size and type (c)	Approximate vertical height in feet (d)	Elevation (e)
1	Standard 2-inch rocket grapnel	1-inch plain	600	80°
2	Standard 2-inch rocket grapnel	2½-inch plain	300	80°

Cliff Scaling Equipment—continued**Flexible Ladders and Ropes—continued****5. Schermuly mortar (light weight grapnel equipment)**

(a) Description of parts and weights :—

<i>Serial</i> (a)	<i>Description</i> (b)	<i>Weight in lbs</i> (c)
1	Schermuly rocket 27 inches by 3 inches diameter	5½
2	Grapple head	4
3	Projector 27 inches by 3 inches diameter	4½
4	Rope box 23 inches by 6 inches deep	10
5	Approximately 200 feet of 1-inch rope	25

(b) Performance :—

<i>Serial</i> (a)	<i>Description</i> (b)	<i>Rope size and type in inches</i> (c)	<i>Approximate vertical height in feet</i> (d)	<i>Elevation</i> (e)
1	Light Schermuly equipment	1	200	80°
2	Light Schermuly equipment	1½	150	80°

6. Rope ladders

(a) Description of parts and weights :—

<i>Serial</i> (a)	<i>Description</i> (b)	<i>Weight in lbs</i> (c)
1	2-inch manilla ropes with wooden rungs 1 inch diameter by 9 inches long spaced 18 inches apart	
2	200 feet length of ladder	48
3	Box to hold ladder 50 inches by 10½ inches by 19 inches high	30
4	30 feet of 2½-inch rope between rocket and ladder	5

(b) Performance :—

<i>Serial</i> (a)	<i>Description</i> (b)	<i>Rope size and type</i> (c)	<i>Approximate vertical height in feet</i> (d)	<i>Elevation</i> (e)
1	Standard 2-inch rocket grapnel	Rope ladder (light)	250	80°
2	Standard 2-inch rocket grapnel	Rope ladder (heavy)	200	80°

Cliff Scaling Equipment—continued**Flexible Ladders and Ropes—continued****7. Toggle rope**

(a) Description of parts and weights:—

Serial (a)	Description (b)	Weight in lbs (c)
1	5-inch wooden toggles spaced every 3 feet 220-foot length	45
2	Box as for plain rope (without pin base)	35

(b) Performance:—

Serial (a)	Description (b)	Rope size and type (c)	Approximate vertical height in feet (d)	Elevation (e)
1	Standard 2-inch rocket grapnel	2½-inch toggle 3 feet spacing	275	80°

Note. Six PAC rocket projectors can be fitted and fired from LCA in an assault. They are arranged three on each side of the craft, which carries its full complement of troops. The projectors can be arranged to fire any combination of rope ladders, toggle ropes or ropes that are required.

8. Light tubular steel ladders—Manufactured in 4-foot sections. Ladder is built up at bottom and hauled to top of the cliff by men already at the top. Warp hooks in top section secure ladder to cliff; sections are connected with S hooks and ladder is kept away from cliff by steel supports. Line with grip fast is necessary. Useful up to about 90 feet and is good for overhangs.

9. Rollers—Special roller placed at the cliff top over which bight of rope is dropped to the foot. Man runs up the cliff assisted by haulers pulling on the bight, which has been placed under his armpits.

MISCELLANEOUS EQUIPMENT

10. Climbing irons and pitons—On chalk cliffs special pitons 15 inches long are required in place of those of the normal length of 8½ inches.

11. Balloons—Naval kite balloons can be flown offshore at a suitably operational height (500 feet); the leader is attached to the cable by a parachute harness at a height slightly greater than height of cliff. One to three balloons are used to give necessary lift depending on wind force. Balloons are flown ashore attached to power

Cliff Scaling Equipment—*continued***Miscellaneous Equipment**—*continued*

winch in boat or amphibious vehicle. Leader drops off on to cliff top and balloons are then used to lift remainder. This method is completely dependent on a steady onshore breeze and should only be considered as a last resort.

12. **Block tackle and sheer legs**—Placed on top of cliff for hoisting heavy stores and equipment. They consist of a pair of 10-foot tubes shackled together at one end and fitted with spikes and plates at the other. Total weight is 60 lbs. Sheer legs are supported by a wire backstay on to a screw picket.

Cliff Scaling Equipment—*continued*

FLAIL DEVICE

1. This device consists of a number of chain flails attached to a rotating drum which is fixed to and extends over the whole width of the tank. The strike of the flail as the tank advances detonates the mines in its path. Fitted on the ends of the rotating drum are wire cutters. These cut the barbed wire strands should they be drawn in by the flails. Only narrow belts of wire entanglements can be dealt with.

<i>Serial</i>	<i>Description</i>	<i>Performance</i>
(a)	(b)	(c)
1	Maximum speed when travelling across country	10 mph
2	Maximum speed when travelling on roads with rotor raised	20 mph
3	Maximum speed when flailing	1.25 mph
4	Maximum width of path which can be cleared through mines. (This includes all known anti-tank and anti-personnel mines except "S" mines with 3-prong igniters)	9 feet
5	Effectiveness of flail when mines submerged under water:—	
	(i) 6 inches	100%
	(ii) 12 inches	75%

Note. Flails suffer from detonation of mines and wear. A least 50% spares should be carried.

EQUIPMENT WHICH CANNOT BE LOADED IN LST

1. For one, or a combination of the following reasons, the vehicles and equipments listed below cannot be loaded and disembarked from LST(2) : overall height, low ground clearance, large overhang at rear or poor articulation.

(a) Guns

(i) 8-in how.

(ii) 6-pr and 17-pr A/T guns when towed by DUKW.

(b) Tanks

(i) Churchill bridgelayer.

(c) Trailers

(i) Trailers, 5-ton, wheeled.

(ii) Trailers (smoke coy).

(iii) 30-ton 16-wheeled gun shaft.

(iv) 18-ton 8-wheeled gun shaft.

(v) 20-ton 16-wheeled gun shaft.

(vi) Carrimore.

(vii) John low loader.

(viii) 30-ton 8-wheeled low loading.

(ix) Athey wagon.

(d) Semi-trailers

(i) 7½-ton 6 × 2 low loader.

(e) Cranes—A few of the smaller cranes can be loaded into LST(2) but the length of the jib is always liable to cause difficulties.

(f) Tractors, road making equipments—Extra heavy tractors with trailers, scrapers, excavators, rooters, rippers, sheep-foot rollers, blade graders, Killyer plough, trenchers, rollers, crushing plant, caravans and sleeping coaches.

(g) Miscellaneous

(i) Tractor heavy high speed M6.

(ii) Truck mounted crane.

(iii) Carriage wagon transporters.

(iv) Wagon gun transporter.

2. In addition, for similar reasons to those stated in para 1 above, the following vehicles and equipments, although capable of being loaded into LST(2) are liable to present certain difficulties, the seriousness of which will depend on gradient of hard or beach. Care in loading will, in any case, be necessary.

(a) Guns

(i) 3·7-in AA Mobile.

(ii) 4·5-in gun.

(iii) 5·5-in medium gun.

(iv) 7·2-in howitzer.

(v) 240-mm gun.

Equipment which cannot be loaded in LST—continued*(b) Tanks*

- (i) Churchill crocodile.

(c) Trailers and transporters

- (i) Trailers with Esso.

- (ii) All types of tank transporters, semi-articulated trailers and low loading trailers. Modifications as those described in Part VIII b 1, for disembarkation from LCT, will also be needed in most cases.

MODIFICATIONS REQUIRED FOR DISEMBARKATION OF MISCELLANEOUS EQUIPMENTS FROM LANDING CRAFT

<i>Serial</i> (a)	<i>Type</i> (b)	<i>Remarks</i> (c)
1	Carriage 6-pr A tk	Fitting of eye bracket to breech block for use with No. 14 pulling back apparatus. Welding of guide plates to traillegs to position No. 3 travelling clamp. Fitting of shallow spades. (EMER Armt D.207 Modn. Inst. No. 33)
2	Carriage 17-pr A tk	Fitting of shield skids and trail pan.
3	Carriage 155-mm	Fitting attachment to limit movement of leading wheels of rear axle bogie.
4	Mounting triple 20-mm Oerlikon	Raising of platform on rear axle by fitting distance pieces.
5	Radar AA No. 3 mk III (early equipments)	Removal of rear jack bracket
6	Radar AA No. 3 mk III	Removal of foot step and rear jack bracket
7	Searchlight 150-cm	Removal of underside flange of RH central jack securing plate
8	Trailers generator 15 KVA, 17 KVA, 27.5 KVA and 22 KW (2 types)	Fitting of skids to rear underside of frame
9	Trailer REME servicing	Fitting of skids to rear underside of frame
10	Trailer 20-ton Albion	Fitting attachment to limit movement of leading wheels of rear trailer bogie
11	Trailer 40-ton crane	Fitting attachment to limit movement of leading wheels of rear trailer bogie.
12	Trailer 40-ton Rogers	Fitting attachment to limit movement of leading wheels of rear trailer bogie
13	Trailer 40-ton Dyson	Fitting attachment to limit movement of leading wheels of rear trailer bogie
14	Trailer 20-ton low loading (R13) Carrimore	Re-positioning of air pipe

STAGES OF WATERPROOFING

" B " VEHICLES

Serial	Type of vehicles	Stage	Description	Maximum subsequent distance	Time taken	Where done	By whom	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	
1	" B " vehicles for all formations	Before embarkation	A	Major preparation	200 miles	3 days	Concentration area	Unit drivers under formation REME supervision except RASC units under their own technical supervision
2			B(i)	Semi-final preparation	20 miles	6 hours	Marshalling area	Unit drivers under static REME supervision
3			B(ii)	Fitting of waterproof ground sheet, sealing engine and distributor breathers	½ mile	15 mins	Vicinity of point of embarkation	
4			C	Preliminary de-waterproofing	200 miles	—	Beach transit area	Unit drivers. Maximum distance from beach to Stage C is 2 miles, but groundsheets will be removed immediately on landing.
5			D	Final de-waterproofing: general inspection and complete lubrication	—	—	As soon as conditions permit	Unit drivers and formation REME

Stages of Waterproofing—continued

“A” VEHICLES (HEAVY) (OVER 12½ TONS)

Serial	Type of vehicles	Stage	Description	Maximum subsequent distance	Time taken	Where done	By whom	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	
1	“A” vehicles (heavy). Tanks and SPs for all formations	Preliminary work	Fitting weldware	No restriction	—	By REME or manufacturers before issue		
2		Before embarkation	1	Maintenance and inspection. Sealing hull, turret etc., fitting hardware, cowls etc, greasing internal parts and testing in fresh water pit etc	100 miles	70-84 daylight working hours	Concentration area	Crews, fitters and electricians
3			2	Final adjustments, fitting extensions to air intake and exhaust etc	20 miles	6-8 hours	Marshalling area	Crews, and for some vehicles, fitters and electricians
4		During voyage	3	General attention to details (<i>vide</i> Wading Instruction Book)	—	—	On craft	Crews
5		After landing	4, 5 & 6	Removal of waterproofing	<i>Externals</i> blown off—as tactical situation demands. <i>Internals</i> removed—beach transit area or where possible (Does not affect performance.)			

Stages of Waterproofing—*continued*

“A” VEHICLES (LIGHT)

Serial	Type of vehicles	Stage	Description	Maximum subsequent distance	Time taken	Where done	By whom		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)		
1	“A” vehicles (light). Carriers, armoured cars, scout cars for all formations	Before embarkation	1	Inspection and maintenance, cleaning waterproofing engine, sealing hull etc. Testing in fresh-water pit	150 miles	49-70 daylight working hours	Concentration area	Crew, fitters and electricians	
2			2(a)	Semi-final preparation <i>eg</i> stowage bins, sealing visors, lamps, etc	20 miles	4 hours	Marshalling area	Crew, and for some vehicles, fitters and electricians	
3			2(b)	Final preparations, sealing breathers, etc	$\frac{1}{2}$ mile	15 mins	Vicinity of point of embarkation or on craft	Crew	
4		During voyage	3	General attention to details (<i>vide</i> Wading Instruction Book)	—	According to duration of voyage	On craft	Crew	
5		After landing	4 5 & 6	4	Removal of stage 2 (<i>vide</i> Instruction Book)	150 miles	—	Beach transit area	Crew
6				In accordance with Instruction Book	No restriction	—	As soon as conditions permit	Crew	

MARKING OF VEHICLES TO SHOW COMPLETION OF WATERPROOFING STAGES

<i>Serial</i> (a)	<i>Colour</i> (b)	<i>Meaning</i> (c)	<i>Where affixed</i> (d)	<i>By whom affixed</i> (e)
1	Blue	That STAGE "A" has been carried out.	Unit lines or concentration area	Formation REME or RASC officer or NCO supervising unit waterproofing
2	Yellow	That STAGE "A" has been checked and STAGE "B" (i) carried out by the unit	Marshalling area	Static REME officer or NCO checking unit waterproofing
3	Red	That STAGE "B" (ii) has been carried out by unit and that vehicle has been passed for embarkation	Port of embarkation	Static REME officer or NCO checking unit waterproofing
4	White	That the vehicle cannot be waterproofed	Unit lines or concentration area	Formation REME or RASC officer or NCO supervising unit waterproofing

Note. Nature of pigment = Oil paint
 Size of mark = 3" x 1" (horizontally)
 Location of mark = Off side front mudguard (behind wing lamp where fitted)

WATERPROOFING OF " B " VEHICLES

With few exceptions all " B " vehicles can be waterproofed. Below is a list of " B " vehicles for which no waterproofing schemes are being developed.

Serial	Type of vehicle	Reasons
(a)	(b)	(c)
1	Any vehicle manufactured before January, 1940	Obsolete
2	Albion BY1 3-ton 6 × 4	Obsolete
3	Austin 8-hp 4 × 2	Floats
4	Austin 10-hp 4 × 2	Floats
5	Commer 15-cwt 4 × 4	Obsolete
6	ERF 2C14 6-ton 4 × 2	Engine fills with water
7	Ford WOA1 2-str 4 × 2	Floats
8	Ford WOA2 4 × 2 hy utility	Floats
9	Guy FBAX 3-ton 6 × 4	Obsolete
10	Morris Com GPO van 30-cwt 4 × 2	Obsolete
11	Thornycroft XS/TC4 3-ton 4 × 2	Engine sump fills with water
12	Tilling Stevens TS 20/2 3-ton 4 × 2	Obsolete
13	AEC Marshall 3-ton 6 × 4 GS FBE SGBG	Magneto ignition cannot be proofed effectively
14	Leyland Lynx 3-ton 6 × 2	Useless with open clutch-housing
15	Thornycroft 3-ton 6 × 4 (Petrol engine)	Engine fills with water
16	Carriers TS and C	Generator cannot be sealed
17	Roller 8-ton	(a)
18	Roller 6-ton	(a)
19	Crane 2-ton	(a)
20	Crane 3½/5-ton	(a)
21	Excavator RB 10	(a)
22	Excavator RB 19	(a)
23	Humber Utility 4 × 2	Floats
24	Humber 4 × 2 telecommunication equipment car	Floats
25	Hillman 2 str 4 × 2	Floats
26	Morris 2-str 4 × 2	Floats
27	Standard 2-str 4 × 2	Floats
28	Ford 4-str 4 × 2	Floats
29	Humber 4-str 4 × 2	Floats
30	Humber 6-str 4 × 2	Floats
31	Humber 8-cwt 4 × 2 W/T	Floats
32	Morris 8-cwt 4 × 2 W/T	Floats
33	Albion 3-ton 4 × 2 machinery	Open type clutch
34	Albion 3-ton 4 × 2 X-ray	Open type clutch
35	Bedford tractor 4 × 2 for Scammell 6-ton semi-trailer	Fouls ramp
36	Bedford tractor and trailer 6-ton 4 × 2-2 (RAF type 103-104)	Fouls ramp
37	Lorry 3-ton, teleprinter	Obsolete
38	Lorry 3-ton CW laboratory	Obsolete
39	Lorry 3-ton 6-wheel, TEV Army	Obsolete
40	Lorry 3-ton 6-wheel, TEV Corps	Obsolete
41	Lorry 3-ton 6-wheel, Mob Pet Lab	Obsolete
42	Chevrolet, 4-str 4 × 2	Lack of traction
43	Plymouth	Floats
44	Buick, 4-str 4 × 2	Floats
45	All motor cycles	Floats

Note. (a) Cannot be waded owing to difficulties in disembarking. Will have to be landed on trailers or transporters but will require partial waterproofing

Waterproofing of "B" Vehicles—*continued*

<i>Serial</i>	<i>Type of vehicle</i>	<i>Reasons</i>
<i>(a)</i>	<i>(b)</i>	<i>(c)</i>
46	Trailer lightweight 10-cwt 2-wheeled type "Z" (wireless repair)	Must be lorry borne
47	Trailer 1-ton 4-wheeled Pigeon loft	Floats and overturns
48	4/5 Aveling Barford roller	Will not negotiate ramp
49	66 blade grader	Can only be disembarked on steep beaches when ramp is hori- zontal. Recommend trailer borne

**LIST OF "A" VEHICLES FOR WHICH WATERPROOFING
MANUALS ARE AVAILABLE FOR ALL THEATRES**

<i>Serial</i>	<i>Title</i>	<i>Wading depth in feet</i>	<i>Chilwell catalogue No.</i>	<i>Date published</i>
(a)	(b)	(c)	(d)	(e)
1	Churchill III—XI OP AVRE and Crocodile	6	62/787	12/44
2	Sherman I, I (Hybrid), Ia, Ib, Ic, Ic (Hybrid) II and IIa	6	72/650	12/44
3	Sherman V (Med M4 A4) OP and Crab	6	72/721	12/44
4	Stuart III (Light M3A1)	6	72/724	11/44
5	Stuart V (Light M3A3)	6	72/725	11/44
6	Stuart V (Light M3A3) (Supplement to 72/725)	6	Supple- ment (1)	2/45
7	Stuart VI (Light M5A1)	6	72/642	3/45
8	M7 105-mm SP (Long Immersion)	6	72/719	12/44
9	M10 3-inch SP and M10 17 pr SP (Long Immersion)	6	72/653	1/45
10	SP 25-pr Sexton and Ram OPO (Long Immersion)	6	73/56	12/44
11	ACV (HP and LP) (AEC) 6 × 6 I	4	60/121	12/44
12	ACV (HP and LP) (AEC) 4 × 4	4	60/131	11/44
13	Ford I (Lynx) Scout car	3	73/58	11/44
14	Carrier Universal—all marks: 3" mortar I, II, MMG, AOP, III, FT transportable No. 2 II and IIc (Wasp)	4	63/108	12/44
15	Carrier T16	4	72/656	11/44
16	Churchill Bridgelayer	3	62/796	1/45
17	Churchill Ark II (Long Immersion)	6	62/797	1/45
18	Valentine bridgelayer	3	62/815	3/45
19	Self sealing materials—"A" vehicles	—	62/786	11/44
20	Freshwater river—crossing—"A" vehicles	—	62/841	3/45
21	Porpoise No. 2 Mk I	—	63/107	11/44

Note. For Flotation instructions for:—Carrier Univ.—all marks—3" mortar I, II: MMG and AOP III fitted with attachments, Kapok II—see Chilwell Catalogue No. 63/109 (all theatres).

**APPROXIMATE AVERAGE WATERPROOFING TIMES
FOR AFVs**

Serial	Class of AFV	Make	Mark	Waterproofing man hours			
				Stage 1	Stage 2	Stage 3	Total man hours
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1	Tank heavy	*Churchill	III to XI	238	44	4	286
2	Tank	Sherman	I and II	157	21	8	186
3	medium	*Sherman	III	221	33	8	262
4		*Sherman	V	244	30	12	286
5		Cromwell	I-III-IV	216	10	2	228
6		Centaur	I-III-IV	216	10	2	228
7		Ram	II	177	28	1	206
8	Tank light	*Stuart	III and V	142	4	4	150
9		*Stuart	VI	145	12	10	167
10	SP	*M7		200	27	2	229
11		M10		234	13	8	255
12		*Sexton 25-pr		188	32	1	221
13	Gun tractor	Crusader		181	8	4	193
14	AA III	Crusader	III	180	26	4	210
15	ARV	Churchill	ARV I	98	63	4	165
16		Churchill	ARV II				
17		Sherman	V ARV I	250	32	10	292
18		Sherman	V ARV II				
19		Ram	ARV II				
20	AVRE	*Churchill		238	44	4	286
21		*Ark II		207	10	—	217
22	Bridgelayer	Churchill		61	6	4	71
23		Valentine		171	6	6	183
24	Flail	*Sherman Crab		252	30	12	294
25	Armoured car	Humber	II, III and IV	178	11	1	190
26		*Daimler	I	178	14	2	194
27		*Daimler	II	136	10	10	156
28		Staghound	I	156	10	3	169
29		*Greyhound		176	6	4	186
30		*ACV (6 x 6)		106	28	1	135
31		*ACV (4 x 4)		137	26	1	164
32		AEC	III	204	21	3	228
33	Scout car	Humber	I and II	83	4	—	87
34		Daimler	I and II	137	1	2	140
35		*Lynx	I	100	25	1	126
36	Carriers	*Universal		80	3	1	84
37		*T16		67	3	1	71
38		Loyd		87	6	1	94

Note. These figures are based on the average times taken by British other ranks during the mounting of operations by different crews having but little experience. With practice and by careful organisation these times could in most cases be reduced.

In the case of vehicles marked with a "*" the times refer to equipment for all theatres and packflat hardware.

**LIST OF AFVs WITH PACKFLAT DESIGN OF HARDWARE FOR
USE IN ALL THEATRES**

<i>Serial</i>	<i>Type</i>	<i>Wading depth in feet</i>
(a)	(b)	(c)
1	Churchill III to XI (OP AVRE and ARK II)	6
2	Sherman I and II	6
3	Sherman III and OP	6
4	Sherman V OP and Crab	6
5	Stuart III	6
6	Stuart V	6
7	Stuart VI	6
8	M7 I and II	6
9	M10 I and II (and 17-pr)	6
10	SP 25-pr Sexton and GPO	6
11	Centaur bulldozer	6
12	Black Prince I	6
13	Comet	6
14	Chaffee	6
15	Sherman V ARV II	6
16	Special Lee/Grant	6
17	Daimler armoured car I and II	5
18	Greyhound	4

CARRIAGE OF CASUALTIES

Serial	Type	Stretcher	Total No. of stretcher and walking wounded		Remarks
(a)	(b)	(c)	(d)	(e)	(f)
1	AKA	15	65		
2	APA	150	475		
3	LSI(L)	150	475		
4	LST(2)	144	244		
<p>In an emergency up to 130 additional stretcher cases can be embarked which, together with 165 walking wounded gives a casualty lift of 439. The numbers embarked, however, must depend on climatic conditions and on the length of the voyage. If serious cases requiring nursing are carried, then the stretcher cases should not exceed 50.</p>					<p>All British LST for the Far East are equipped for carrying casualties for periods up to 36 hours A LST can be speedily adapted for casualty carrying, particularly for a short sea voyage when the demands for surgical procedure and nursing do not require the use of a hospital ship</p>
5	LCT(2)	60	110		
6	LCT(3)	80	140		
7	LCT(4)	100	150		
8	LCT(5)	50	80		
9	LCI(L)	—	100		
10	LCI(S)	—	70		
11	LCA	6	21		
12	LCM	12	42		If fitted with wooden frame, will take 21 stretchers
13	LCP(L)	4	8		Canopy off when using six stretchers
14	LCP(R)	6	11		
15	LCP(S)	6	13		Angle iron runners are fitted port and starboard. A small piece is cut from the coaming each side to permit the carriage of stretchers with extension bars
16	LCV(P)	6	18		
17	LVT(2)	13	13		Cross beams are necessary for the stowage of this number of stretchers
18	LVT(3)				
19	LVT(4)	3	—		Absence of springing makes it unsuitable as a casualty carrier
20	M29C	2	2 or 3		Can take either 2 stretcher or 3 walking wounded
21	DUKW	7	14		
22	Terrapin	3	3		Absence of springing makes it unsuitable as a casualty carrier
Stretchers		British mk I	US		
Length		7' 9"	7' 6"		Runners are same height off
Width		1' 11"	1' 9½"		ground, 2 6 inches, but differ in
Canvas		6' 0"	6' 0"		width
Weight		30 lbs	24 lbs		

Carriage of Casualties—*continued*

<i>Serial</i> (a)	<i>Type</i> (b)	<i>Stretcher</i> (c)	<i>Total No. of stretcher and walking wounded</i> (d)	 (e)	<i>Remarks</i> (f)

EVACUATION OF CASUALTIES BY AIR

1. Evacuation of casualties by air is a responsibility of the RAF, from the time of admission of casualties to the RAF medical receiving station or sick quarters until the time of disembarking and discharge from the airfield of arrival. Casualties are cared for by RAF medical personnel.

2. If the patients are properly prepared beforehand, the loading of a complement of 18 stretcher cases or 12 stretcher and 8 walking wounded cases should normally be completed within 20 minutes.

3. With a few exceptions, any multi-engined aircraft can be used for carrying casualties. The more common ones are :—

Commando	.. ..	33 longitudinal stretchers ; <i>or</i> 24 inclined stretchers ; <i>or</i> 36 sitting.
Dakota C.47	.. ..	18 stretchers.
Skymaster	.. ..	24 stretchers (with fuselage tanks) ; <i>or</i> 36 stretchers (without fuselage tanks) ; <i>or</i> 24 sitting.
York	.. ..	24 stretchers.

Evacuation of Casualties by Air—*continued*

TYPICAL RN COMMUNICATION CHANNELS IN COMBINED OPERATIONS

Serial (a)	Wave (b)	Manned by (c)	Purpose (d)
1	Admirals wave	Assault force HQ Assault group HQ All major war vessels Flag officers afloat	Used for main naval enemy reporting wave for ships outside the assault area
2	Area broadcast	Admiralty or main base Assault force HQ Assault group HQ White ensign LSI Major war vessels	A broadcast service covering the whole area for promulgation of information on orders by the admiral or commander-in-chief to all ships in the area
3	Army liaison officer's briefing wave	Assault force HQ Fighter direction ships (reception only) Assault carrier flagships Assault carriers Advanced landing grounds	Intercommunication between assault force HQs, assault carriers and, later, ALGs
4	Artillery reconnaissance	Assault force HQ Spotting aircraft Shore battery	For observing the fire of land artillery
5	Assault carrier air plot control	Carrier flagships and assault carriers	To co-ordinate the action of the various ships controlling and directing of aircraft
6	Assault carrier cover wave high	Carrier flagships (or by a carrier detailed by carrier flagship to control high carrier cover aircraft) Carriers providing high cover aircraft	For the control of high carrier cover aircraft
7	Assault carrier cover wave low	Carrier flagship (or by a carrier detailed by carrier flagship to control low cover aircraft) Carriers providing low cover aircraft	For the control of low carrier cover aircraft
8	Assault group wave (1)	Assault group HQ All W/T fitted ships and craft in assault group concerned Advanced beach signal stations	Used for main communication channels between assault group commander and his group. Channels can be worked duplex, SOAG, deputy SOAG and MBSS transmitting on (1) and remainder on (2) or ships, craft and authorities can be divided as appropriate between the two channels as required by the assault group commander
9	Assault group wave (2)		
10	Beach cover wave high	LSF Stand-by LSF Carrier flagships Carriers providing high cover aircraft	Control of high beach cover aircraft
11	Beach cover wave low	LSF LSH(L) Stand-by LSF Command HQ ship Carrier flagships Carriers providing low cover aircraft	Control of low beach cover aircraft

Typical RN Communication Channels in Combined Operations—
continued

<i>Serial</i>	<i>Wave</i>	<i>Manned by</i>	<i>Purpose</i>
(a)	(b)	(c)	(d)
12	Bombardment calling wave	BCHQ FOBs and sections with brigade HQs Assault force HQ Assault group HQ Bombarding ships	Primarily for unallocated FOBs to communicate with SBLO for the passing of situation reports and for calls for support
13	Bombardment liaison wave	Assault force HQ Assault group HQ Bombarding ships BCHQ	Inter-officer channel for control bombardment
14	Carriers support bombardment wave	HQ ships, carrier flagships, carriers (listening only)	Passing of requests for air support from HQ ships to carrier flagships
15	Fire command wave VH/F	Assault group HQ Heavy support craft	Inter-officer speech channel for control of support craft One frequency per assault
16	FOB waves	FOB and bombarding ship to which FOB is allocated	Control of ships gunfire and passages of tactical messages
17	Force auxiliary wave	Assault force HQ Assault group HQ W/T fitted ships and craft in the assault area as ordered by the force commander	These two channels may be used for intercommunication between all bombarding ships and craft, major war vessels other than A/S patrol, senior officers of groups, assault group commanders, deputy assault group commanders. Channels can be worked duplex, or ships, craft and authorities can be divided up as appropriate between the two channels as required by the force commander.
18	Ground attack and Tac R wave	ASSU (CC Air) Assault force HQ Command HQ ship Corps/Air HQ ashore	For final briefing and control of ground attack and Tac R a/c
19	Homing	Fighter direction ships Carrier flagships Assault carriers Headquarters ships	For emergency guard and homing
20	Inshore air plot control wave	LSF, stand-by LSF, LSH (L), command HQ ship, RAF control organisation ashore	For co-ordination of control of aircraft in the inshore area
21	Inshore radar reporting wave	LSF, stand-by LSF, LSH (L), command HQ ship, major war vessels in the inshore area	Radar reporting in the inshore area
22	Inter force inter FDO wave	LSF, stand-by LSF, LSH (L), command HQ ship, assault carrier flagships, covering, force flagship	Co-ordination of control of aircraft between forces

Typical RN Communication Channels in Combined Operations—
continued

<i>Serial</i>	<i>Wave</i>	<i>Manned by</i>	<i>Purpose</i>
(a)	(b)	(c)	(d)
23	Joint force broadcast	Assault force HQ (controlling) All ships and major landing craft (reception only)	Primary use is for promulgation of situation reports and raid reports during the assault Common to all three services routine periods being allocated to each service Assault force commander controlling
24	Landing wave	Assault group HQ MT ships Transport etc Certain landing craft Beach signal stations	Administrative wave for ship-shore traffic, landing craft etc Primarily for control of the landing Usually one wave per brigade front
25	Naval beach wave	Assault force HQ Assault group HQ Deputy senior officer assault group Main beach signal stations office Naval officer in charge	Operational wave for ship-shore traffic of all services Primarily W/T One wave per division
26	Patrol wave	All "E" boat and AS patrols Certain shore W/T stations	The control of anti "E" boat and AS patrol
27	Rear link HF	Main and advanced bases ashore Assault force HQ	A direct channel for communication between assault force commander, assault group commander and shore authorities
28	Senior officers broadcast	Assault force HQ Flag officers afloat Cruisers and above not attached to a particular assault force	Broadcast from shore base to flag officers concerned
29	Spotting aircraft guard	Certain carrierborne aircraft Assault force HQ	VH/F communications between spotting aircraft and LSH(L) concerned
30	Spotting wave	Certain carrierborne aircraft, bombarding ships	Control of naval bombardment
31	Support wave	ASSU tentacle Assault force HQ Corps/Air HQ ashore Command HQ ship Carrier flagships Carriers (reception only)	Requests for air support
32	Tac R and sitrep wave	Any HQ ship and carrier flagship	For passing tactical reconnaissance and operational situation information obtained as a result of tactical reconnaissance and close support missions by carrierborne aircraft

Typical RN Communication Channels in Combined Operations—
continued

<i>Serial</i>	<i>Wave</i>	<i>Manned by</i>	<i>Purpose</i>
(a)	(b)	(c)	(d)
33	Tac R and op sit broadcast	Assault force HQ Assault carrier flagship Fighter direction ships (reception only) Assault group HQ (reception only) Assault carriers (reception only)	A broadcast from the command headquarters ship on the ground and air situation
34	Task force auxiliary wave	Assault force HQ Flag officers afloat All major war vessels not attached to a particular assault force	Main naval command channel
35	Unloading wave	Main beach signal station Assault group HQ Senior officer ferry craft MT ships } while Landing } unloading ships }	Administration of all vessels concerned during the unloading stage. This may be one of the assault group waves

TYPICAL ARMY COMMUNICATION CHANNELS IN COMBINED OPERATIONS

Serial	Wave	Manned by	Purpose
(a)	(b)	(c)	(d)
1	Army A or B waves	Divisional HQs (afloat and ashore) Corps HQ Army command	Direct communication from assault divisions and corps to army
2	Brigade A wave Brigade B wave	Brigade to battalions (intercepted for early information by divisional HQ ship)	Brigade command waves
3	Corps A and B waves	Assault divisional HQs Corps HQ	Corps command wave
4	CRA	CRA's wave to RA groups and regiments Commanders in SOAG and deputy/SOAG ships and later ashore	May be replaced on board divisional HQ ships by CCRA if corps uses the ship as its HQ
5	Divisional A wave	Divisional HQ (afloat and ashore) Tactical divisional HQ (afloat and ashore) Brigade HQs (afloat and ashore)	R/T divisional command wave
6	Divisional B wave	Assault signal offices Divisional HQ (afloat and ashore) Tactical divisional HQ (afloat and ashore) Brigade HQs (afloat and ashore)	W/T wave may not be opened until divisional tactical HQ ashore can take control
7	Lateral wave	Assault signal offices Divisional HQ (afloat and ashore) to flanking formations	—
8	RA regimental wave	Field regiment or RA group (afloat and ashore) to regimental batteries plus close support craft	Close support fire during approach Normal RA communications after landing
9	Reconnaissance wave	Divisional HQ (afloat and ashore) to contact patrols with battalions	Direct communication from forward areas to divisional commander
10	Support wave	Divisional HQ ship and ASSU tentacles at brigade ashore. Carrier flagships (listening only) Carriers (listening only)	Calls for air support

Forward of battalions, communications in the assault differ very little from normal land communications. In addition to the main nets mentioned above, several channels are provided for internal communications in the beach area, such as:—

Beach brigade A wave	}	Beach brigades to beach groups
Beach brigade B wave		
Beach group wave	}	Beach group to beachmaster at beach HQ SOFC to craft on ferry service
Ferry control etc		

Typical Army Communication Channels in Combined Operations—
continued.

<i>Serial</i> (a)	<i>Wave</i> (b)	<i>Manned by</i> (c)	<i>Purpose</i> (d)

TYPICAL AIR COMMUNICATION CHANNELS IN COMBINED OPERATIONS

Serial (a)	Wave (b)	Manned by (c)	Purpose (d)
1	Air command wave.	Air commander Air commander's representative. Air force units on captured shore.	For the air commander to pass orders to his representatives in ships and on captured shore.
2	Beach cover wave high (also shown in Part XI a 1).	LSF, stand-by LSF, carrier flagships, carriers providing high cover aircraft.	Control of high beach cover aircraft.
3	Beach cover wave low (also shown in Part XI a 1).	LSF, stand-by LSF, LSH(L), command HQ ship, carrier flagships, carriers providing low cover aircraft.	Control of low beach cover aircraft.
4	Assault carrier cover wave high (also shown in Part XI a 1).	Carrier flagships (or by a carrier detailed by carrier flagship to control high carrier cover aircraft); carriers providing high cover aircraft.	For the control of high carrier cover aircraft.
5	Assault carrier cover wave low (also shown in Part XI a 1).	Carrier flagships (or a carrier detailed by carrier flagship to control low carrier cover aircraft); carriers providing low cover aircraft.	For the control of low carrier cover aircraft.
6	Ground attack and Tac R wave (also shown in Part XI a 1).	ASSU(CC(Air)), LSH(L), command HQ ship, corps/air HQ ashore.	For final briefing and control of ground attack and Tac R aircraft.
7	Guard and homing (also shown in Part XI a 1).	Fighter direction ships, carrier flagships, carriers HQ ships.	For emergency homing and lifesaving.
8	Assault carriers air plot control wave (also shown in Part XI a 1).	Assault carrier flagships, assault carriers.	For co-ordination of control of aircraft within the assault carrier force.
9	Inshore air pilot control wave.	LSF, stand-by LSF, LSH(L), LSH(C), RAF control organisation ashore.	For co-ordination of control of aircraft in the inshore area.
10	Inter force inter FDO wave (also shown in Part XI a 1).	LSF, stand-by LSF, LSH(L), command HQ ship, assault carrier flagships, covering force flagship.	Co-ordination of control of aircraft between forces.

Typical Air Communication Channels in Combined Operations—
continued

<i>Serial</i>	<i>Wave</i>	<i>Manned by</i>	<i>Purpose</i>
(a)	(b)	(c)	(d)
11	Inshore air plot control wave (also shown in Part XI a 1).	Shore GCI stations, LSF, stand-by LSF.	Co-ordination of control of aircraft on shore.
12	Air commander's liaison wave.	Air commander, LSF, LSH(L).	Liaison between air commander and air defence officer.
13	Assault carriers radar reporting wave.	Carrier flagships, assault carriers, major war vessels escorting assault carrier force.	Radar reporting within the assault carrier force.
14	Inshore radar reporting wave (also shown in Part XI a 1).	LSF, stand-by LSF, LSH(L), command HQ ship, major war vessels in the assault area.	Radar reporting in the inshore area.
15	Inter force radar reporting wave.	LSF, stand-by LSF, assault carrier flagships, covering force flagship.	Radar reporting between forces
16	Shore plot reporting wave.	Shore radar stations, WOU posts, master LSF.	Reporting by shore units.
17	Filtered track broadcast.	Made by master LSF. Stand-by LSF, LSH(L), command HQ ship, major war vessels in the assault area, GCI stations and AAOR ashore (reception only).	Broadcast of filtered track information by LSF.
18	Homeshore friendly aircraft movements broadcast	Made by Air HQ on the friendly shore LSF, stand-by LSF, LSH(L), command HQ ship, flagship of assault carrier force and covering forces (reception only).	Broadcast of movements of land-based friendly aircraft.
19	AA control wave	LSF, stand-by LSF, LSH(L), major war vessels in the assault area, AAOR ashore.	For control (of employment of AA guns and searchlights) by the air defence officer.
20	Air base wave	Air HQ on friendly shore Command HQ ship, LSH(L), master LSF.	RAF rear link.

ORGANISATION OF SIGNAL PARTIES LANDED EARLY IN THE ASSAULT

Serial	Name	Strength		Main equipment	Lands	Function
		Officers	Other ranks			
(a)	(b)	(c)		(d)	(e)	(f)
1	RN Beach signal section RN	2	30	6-46 sets 2-22 sets 1 Jeep VS eqpt	With advance parties (6 each) with BMrs. With main party (2 plus 18) with PBMr	One section per beach sector includes:— 1—advanced station per beach 1—main station per sector Provides RN shore-ship communications.
2	FOB parties	1	3	1-18 set 1-22 set 2 Jeeps	With assault battalion HQ	Observation of naval bombardment
3	ARMY Assault signal sections Royal Signals (x)	3	48	15-46 sets 12-22 sets	Prior to brigade command on each sector	1 section per assault division sub-divided into 3 parties (1 per assault brigade plus 1 in reserve) Sets up assault signal office on beach for use of successive formation HQs on landing
4	Contact car (air)	1	4	1-TR 1143 1-No. 22 1-No. 12	Ditto	1 CCA per brigade headquarters for direction of support aircraft
5	Air support signals unit tentacle	0	4	1-No. 12	Ditto	1 tentacle per brigade headquarters to provide an independent signals network for transmission of air support messages
6	Beach brigade signal company (less beach group signal sections)	8	148	(y)	Approximately divisional level	To provide communications for the beach brigade to higher formations and laterally to adjacent beach brigades
7	Beach group signal sections	4	136	(y)	Approximately brigade level	To provide all communications within the beach group
8	RAF RAF beach signals section	1	10	Pack sets, eg Collins 18Q	Approximately divisional level	To provide communications between RAF beach squadrons and airfields or airstrips captured or constructed

Note. (x) Special signal units eg contact car air and ASSU tentacles (for general direction of ground attack aircraft), and reconnaissance detachments are attached to assaulting brigades. In general, these land just after tactical brigade headquarters.

(y) Refer G.1098 for the Section. (A.F.G. 1098, 1747/1 unamended).

WIRELESS SETS FITTED IN HQ SHIPS OR USED IN COMBINED OPERATIONS

NAVAL EQUIPMENT

Serial	Type	Frequency	Power in watts	
			R/T	C/W
(a)	(b)	(c)	(d)	
1	86M	100-156 Mcs	5	—
2	87M	100-147 Mcs	50	—
3	89P	1.5-20 Mcs	100	350
4	HSL2	{ 100-750 Kcs 2.5-20 Mcs	100	450
5	HS2	2.5-20 Mcs	100	450
6	60EQR	{ 100 Kcs 12.5 Mcs	7	20-30
7	TCS	1.5-12 Mcs	20	40
8	TBS	60-80 Mcs	40	—
9	CNY1	1.5-9 Mcs	5	8

ARMY EQUIPMENT

1. General details of the more common sets used ashore are given briefly below. (It is pointed out that certain sets may be replaced by American equipment of the SCR 510-610 series.)

2. On board LSH(L) the majority of the wireless equipment is Naval or RAF, the only Army sets used being No. 12 LP. On board LSH(S), however, No. 22 sets are also sometimes included.

Serial	Set	Frequency range in mcs	Output in watts	Weight in lbs (complete station)	Use
(a)	(b)	(c)	(d)	(e)	(f)
1	12	1.2-17.5 mcs	6 R/T 25 C/W	134	Rear link from div up- ward HQ ships set
2	18	6.0-9.0	0.25	34	Battalion—company HQ R/T or C/W
3	19	2.0-8.0 229-241	8 R/T 10 C/W	70 (a)	Vehicle or ground station gives R/T, MC/W, C/W, VH/F
4	21	4.2-7.5 19.0-31.0	1.5 0.4	48 (a)	Vehicles or ground station R/T, C/W, MC/W
5	22	2.0-8.0	8 R/T 15 C/W	57 (a)	General purpose R/T, C/W
6	38	7.3-8.9	0.125	12	Infantry pack set for R/T
7	46	3.6-9.1	1.5	24	Xtal controlled R/T MC/W
8	68	1.6-10.0	3.5 R/T 70 C/W	27	Replacing W/S 22
9	68(T and R) 68P	3.0-5.2 1.7-2.9	0.25	34	R/T or C/W for battalion to company HQ FOB comms

Note. (a) Does not include batteries or aerial equipment

Wireless Sets Fitted in HQ Ships or Used in Combined Operations—
continued

RAF EQUIPMENT

Serial	Set	Equivalent		Frequency range	Power in watts	Remarks
		Naval	Army			
(a)	(b)	(c)		(d)	(e)	(f)
	Transmitters					
1	T 1131	Type 87	—	100-124 Mcs	50	Used with R1132 (or R5032)
2	T 5031 (US BC640)	Type 87M	—	99-156 Mcs	50	Used with R 5032 (or R 1132)
3	T 1190	Type 88	—	1.5-15 Mcs	350	—
4	T 1179	Type 89M	—	2.2-20 Mcs	350	—
5	T 1154	—	—	200-500 Kcs 3-10 Mcs	40	—
	Receivers					
6	R 1132	Type 87	—	100-124 Mcs		Used with T 1131 (or T 5031)
7	R 5032 (US BC639)	Type 87M	—	99-156 Mcs		Used with T 5031 (or T 1131)
8	R 1297	B28 & CDC	CR100	60 Kcs- 30 Mcs		Used with all HF Trs
	Trans-receivers					
9	TR 1143	Type 86	—	100-124 Mcs		—
10	TR 5043	Type 86M	—	—		Forms part of SCR 522 installation (battery operated) and SCR 624 (mains operated)

GENERAL PLANNING DATA

1. Petrol, oil and lubricants

(a) Maintenance rates

“ B ” vehicles—5 gallons per carburetter per day.
 Carriers—25 gallons per carrier per day.
 Tanks—50 gallons per tank per day.
 Tanks and mechanical equipment (or derv in proportion).
 Cooking—5 gallons per 100 men per day (petrol).
 Lighting—600 gallons per 1,000 men per month (kerosine).

(b) Calculation rates

MT spirit to be calculated at 230 gallons per dead weight ton.
 Derv to be calculated at 210 gallons per dead weight ton.
 Lubricants to be calculated at 210 gallons per dead weight ton.

(c) Carriage

3-ton lorry will take—156 jerricans (4½-gallon); or 150 4-gallon returnable cylinders; or 175 4-gallon non-returnable cans.

2. Supplies

14-man compo pack 480 rations per ton.
 6-man Pacific compo pack 360 rations per ton.
 24-hour ration (Pacific type), 9 rations per case. 500 rations per ton.
 Emergency ration (Pacific type), 27 rations per case. 1,560 rations per ton.
 Field service scale ration 400 rations per ton.
 Prisoner of war (transit rations) .. 1,000 rations per ton.

3. Ammunition

Serial	Type	Rounds per dead weight ton	Normal 3-ton lorry load (Rds)	DUKW or 2½-ton truck load (Rds)
(a)	(b)	(c)	(d)	(e)
1	303 BDR	30,000	89,000	74,000
2	303 CTN	33,000	99,840	81,500
3	303 TRACE	33,000	99,840	81,500
4	303 Mk VIII Z	26,000	79,000	66,000
5	303 BELT	26,800	80,400	67,000
6	50 BELT	6,500	18,500	16,200
7	7·92 MM	18,780	56,250	46,700
8	9 MM PARA	66,000	197,500	164,600
9	2 MOR HE	590	1,764	1,470
10	2 MOR SMOK	680	2,050	1,710
11	3 MOR HE	144	432	760
12	3 MOR SMOK	160	480	400
13	4·2 MOR HE/SMOK	82	246	205

General Planning Data—continued

Serial (a)	Type (b)	Rounds per dead weight ton (c)	Normal 3-ton lorry load (Rds) (d)	DUKW or 2½-ton truck load (Rds) (e)
14	PIAT HE	250	744	620
15	8 SMOK GREN	330	1,000	834
16	36M GREN	1,070	3,216	2,680
17	69 GREN	1,670	5,000	4,160
18	74 GREN	400	1,200	1,000
19	75 GREN	700	2,100	1,650
20	77 GREN	1,730	5,200	4,320
21	79 GREN	960	2,880	2,200
22	MINE ATK Mk IV	150	440	365
23	15-MM	2,700	8,150	7,025
24	37-MM HE/SMOK	450	1,340	1,117
25	2-PR	320	960	800
26	6-PR HE	120	360	300
27	6-PR AP	104	312	262
28	17-PR AP	42	126	103
29	79-MM HE/SMOK	96	288	240
30	95-MM HE/SMOK	56	168	140
31	3-INCH M10	59	176	147
32	40-MM	320	960	800
33	3-7" AA	30	90	75
34	25-PR HE	66	184	150
35	25-PR SMOK	66	200	167
36	25-PR CART SU- PER (CART only)	261	784	650
37	4-5" BL HE	30	90	75
38	3-7" HOW HE/ SMOK	76	228	190
39	5-5" HOW HE	20	58	49
40	7-2" HOW HE	8	26	21
41	155-MM HE/SMOK	15	45	38
42	20-MM INC	3,060	9,180	7,650
43	20 TRACE	3,240	9,720	8,100

POUNDS/TONS—CONVERSION TABLE

Serial (a)	Lbs (b)	Tons (c)	Serial (a)	Lbs (b)	Tons (c)
1	10	·004	19	1,000	·446
2	20	·009	20	1,100	·491
3	30	·014	21	1,200	·535
4	40	·018	22	1,300	·580
5	50	·022	23	1,400	·625
6	60	·027	24	1,500	·670
7	70	·031	25	1,600	·714
8	80	·036	26	1,700	·759
9	90	·040	27	1,800	·805
10	100	·045	28	1,900	·848
11	200	·090	29	2,000	·892
12	300	·134	30	3,000	1·339
13	400	·183	31	4,000	1·786
14	500	·223	32	5,000	2·232
15	600	·269	33	6,000	2·678
16	700	·312	34	7,000	3·125
17	800	·357	35	8,000	3·571
18	900	·402	36	9,000	4·018
			37	10,000	4·464

BEACH ORGANISATION STATISTICAL DATA

These approximate figures are given as a guide for beach organisation regimental officers and should not be used for long-term planning purposes. All the weights given are in deadweight tons.

STORES DISCHARGE EX SHIPPING**1. Port operating company discharging stores**

Hatch gangs in company ..	About 16.
Men in gang	8 working in hold. 3/5 on deck (depending on rig). 1 checker. 2/6 working craft alongside.
Capacity of gang per hour ..	6/8 tons.
Effective working day per gang	8 hours.
Average output per company per day.	800 tons.

2. Discharge of craft**(a) Loose stores by crane**

Capacity of crane	8/10 tons per hour.
Gang per crane	4 making up sets. 4 stowing vehicles. 1 crane driver.

(b) Netted, unitized or skid loads by crane

Capacity of crane	10/12 tons per hour.
Gang per crane	2 hooking on. 2 unhooking. 1 crane driver.

(c) Manhandling

Gang of about 16 men ..	6 tons per hour.
(Using roller runway or hand-carts as necessary.)	
Maximum effective shift ..	8 hours.

Note. Hours of work may be determined by tidal conditions.

3. Discharge of amphibians or vehicles at dump**(a) Loose unnetted stores by hand or hogtrough**

Men required per vehicle ..	10 men.
Tonnage of gang per hour ..	4 tons.
(Allowing average rate of arrival of vehicles at dump.)	

(b) Netted or unitized loads by crane

Capacity of crane per hour ..	6/8 tons.
Gang per crane	2 unhooking. 4 stacking/1 crane driver.

4. Discharge of amphibians by crane at transfer point

Capacity of crane per hour ..	10/12 tons.
Gang per bay	3 transferring. 1 crane driver.

Beach Organisation Statistical Data—*continued*

5. Serviceabilities and capacities of craft

Serial	Type	Serviceability in %	Capacity in tons
(a)	(b)	(c)	(d)
1	LCM(1)	50	10
2	LCM(3)	50	15
3	LCM(7)	50	15
4	LCT(3)	70	180
5	LCT(4)	70	200
6	LCT(5)	70	100
7	LCT(6)	70	100

Capacity and serviceability of amphibians discharging stores

1	DUKW	75	2½
2	LVT(2)	60	3
3	LVT(3)	60	3
4	LVT(4)	60	3

- (a) LVT(2), (3) and (4) are capable of a continued period of running of between 72–80 hours. They require major overhaul after 300 hours. This takes 72 hours to complete.
- (b) DUKWs require a minimum of 6 hours maintenance for every 18 hours running time.

6. Average turn-round of landing craft

Type	Load Pers Vehs or Stores	Loading time	Time to cover 1 mile	Unloading time and unbeach- ing	Return trip	Turn- round at 1 mile	Turn- round at 7 miles
LCA	Pers	10 m	10 m	5 m	8 m	33 m	2 h 20 m
LCV(P)	"	7 m	7 m	3 m	6 m	23 m	1 h 41 m
LVT	"	7 m	12 m	3 m	10 m	—	—
LCI	"	20 m	5 m	10 m	5 m	40 m lands	1 h 40 m
LCM(1)	Vehs	15 m	10 m	7 m	8 m	40 m	2 h 38 m
LCM(3)	"	15 m	8 m	7 m	6 m	36 m	2 h 06 m
LCM(7)	"	15 m	10 m	7 m	8 m	40 m	2 h 38 m
LCT(3)	"	2 h 0 m	10 m	30 m	10 m	2 h 50 m	4 h 50 m
LCT(4)	"	2 h 20 m	10 m	40 m	10 m	3 h 20 m	5 h 20 m
LCT(5)	"	1 h 30 m	12 m	20 m	10 m	2 h 12 m	4 h 24 m
LCT(6)	"	1 h 00 m	12 m	15 m	10 m	1 h 37 m	3 h 49 m
LCM(1)	Stores	1 h 30 m	10 m	1 h 30 m	8 m	3 h 18 m	5 h 06 m
LCM(3)	"	3 h 00 m	10 m	3 h 00 m	8 m	6 h 18 m	7 h 06 m
LCT(5)	"	8 h 0 m	10 m	8 h 0 m	8 m	16 h 18 m	18 h 06 m
LCT(6)	"	7 h 0 m	10 m	7 h 0 m	8 m	14 h 18 m	16 h 06 m

Beach Organisation Statistical Data—continued

7. Turn-round of amphibians

(a) Time loading at ship (includes waiting)	30 mins.
(b) Time unloading including waiting :—	
(i) At dump	1 hour.
(ii) At transfer point	15 mins.
(c) Water gap. To cover 1 mile	12 mins.
(d) Land journey. To cover 1 mile ..	5 mins.

8. Lorries loading at craft

(a) Loose store (with roller runway and/or handcarts).	1 hour.
(b) By crane with netted or unitised stores	45 mins.

9. Serviceability figure for cranes working a 16-hour day
75 per cent.

VEHICLE DISCHARGE EX SHIPPING

10. Port operating company discharging vehicles

Hatch gangs in company	About 20.
(Depends on distribution.)	
Men in gang	4 men in hold. 4 men in craft. 4 winch drivers. 1 hatchwayman.
Capacity of gang per hour	4 vehicles.
Maximum effective working day per gang.	8 hours.
Output per company per day	640 vehicles.

11. Average capacity of craft when operating ferry service in number of vehicles

	<i>No. of 3-tonners or equivalent</i>
LCM (all marks)	1
LCT(5) and (6)	9
LCT(3) and (4)	11
LST with ramp from upper deck ..	25
LST with lift	50
Rhino ferry	33

12. Average turn-round of craft loaded with vehicles on the ferry service

LCM (all marks)	3 trips per day.
LCT (all marks)	2 trips per day.
LST (all marks)	1 trip per day.
LST with ramp from upper deck ..	1½ trips per day.
Naval pontoon	1 trip per day.

**WEIGHT AND MEASUREMENT EQUIVALENTS—
BRITISH AND FOREIGN**

Linear

Statute mile (land)	.. =	5,280 feet.
	=	1,760 yards.
	=	0.868 nautical miles.
Nautical mile (US C and G Survey).	6,080.27 feet =	1.15 statute miles.
Fathom	=	6 feet.
1 acre	=	43,560 square feet.

METRIC—ENGLISH UNITS

English—Metric		Metric—English	
1 inch	= 2.540 centimetres.	1 cm.	= 0.394 in.
1 foot	= 0.305 metres.	1 m.	= 3.281 feet.
1 yard	= 0.914 metres.	1 m.	= 1.094 yards.
1 mile	= 1.609 kilometres.	1 km.	= 0.621 mile.

Area

1 sq. inch	= 6.452 sq. cm.	1 sq. cm.	= 0.115 sq. inch.
1 sq. foot	= 0.093 sq. m.	1 sq. m.	= 10.76 sq. feet.
1 sq. yard	= 0.836 sq. m.	1 sq. m.	= 1.196 sq. yards.
1 sq. mile	= 2.950 sq. km.	1 sq. km.	= 0.386 sq. mile.
1 acre	= 0.405 hectares	1 hectare	= 2.47 acres.

(Ha.).

100 hectares = 1 sq. km.

Volume

1 cu. inch	= 16.39 cu.cm.(c.c.).	1 cu. cm.	= .0610 cu. in.
1 cu. foot	= 0.028 cu. m.	1 cu. m.	= 35.31 cu. foot.
1 cu. yard	= 0.7646 cu. m.	1 cu. m.	= 1.308 cu. yards
1 gallon (US).	= 3.785 litres	1 litre	= 0.2642 gallon
1 gallon (Br. Imp.).	= 4.545 litres		(US).
		1 litre	= .220 gallon
1 litre	= 1,000 cu.cm.(c.c.).		(Br. Imp.).
1 shp or measurement ton	= 40 cu. feet.		

Weight

1 lb. (Avoir)	= .4536 kgm. = .0714 stone.
1 stone	= 14 lbs.
1 cwt.	= 112 lbs.
1 ton (long—2,240 lbs.)	= 1,016.0 kgms.

Liquid measure

1 gallon (US)	= 231 cu. inch.
	= 0.134 cu. foot.
	= 0.832 gallon (Br Imp.).
1 gallon (Br. Imp.)	= 1.201 gallon (US).
1 cu. foot	= 7.481 gallon (US).
	= 6.223 gallon (Br. Imp.).
1 cu. foot fresh water at 4° Cent.	weighs 62.5 lbs.

Water pressure (static) = .434 lbs per sq. inch for 1 foot height of column (ie pressure in lbs per square inch at bottom of tank (or container) = .434 × depth of water in tank, in feet).

UNITS OF LENGTH—BRITISH AND METRICAL

The following tables are for converting geographical and sea or nautical miles into British and metrical units of length :—

Serial No.	Geo-graphical mile	Statute mile	Kilo-metre	Fur-longs	Chains	Fathoms	Metres	Yards	Feet	Links	Inches	Centi-metres
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)
1	1	1.1529	1.8554	9.223	92.23	1,014.5	1,855.4	2,029.1	6,087.2	9,223	73,046	185,537
2	—	1	1.6093	8	80	880	1,609.3	1,760	5,280	8,000	63,360	160,934
3	—	—	1	4.97	49.71	546.8	1,000	1,093.6	3,280.8	4,971	39,370	100,000
4	—	—	—	1	10	110	201.2	220	660	1,000	7,920	20,117
5	—	—	—	—	1	11	20.12	22	66	100	792	2,012
6	—	—	—	—	—	1	1.829	2	6	9.091	72	183
7	—	—	—	—	—	—	1	1.0936	3.281	4.971	39.37	100
8	—	—	—	—	—	—	—	1	3	4.545	36	91.44
9	—	—	—	—	—	—	—	—	1	1.515	12	30.48
10	—	—	—	—	—	—	—	—	—	1	7.92	20.12
11	—	—	—	—	—	—	—	—	—	—	1	2.54

Serial No.	1 Sea or nautical mile at latitudes	Statute miles	Cables	Metres	Feet
(a)	(b)	(c)	(d)	(e)	(f)
1	0°	1.1451	10	1,842.86	6,046.13
2	30°	1.1480	10	1,847.53	6,061.45
3	60°	1.1538	10	1,856.93	6,092.30
4	90°	1.1568	10	1,861.66	6,107.82
5	*M	1.1509	10	1,852.24	6,076.91

* M is the mean value of a sea or nautical mile. The lengths of this mile as given here are not precisely the same as those adopted by the Admiralty, but the differences are negligible for map purposes.

**WEIGHT AND MEASUREMENT EQUIVALENTS—
INDIAN AND BRITISH**

Weights and measures in India vary not only from district to district, but also for different commodities.

Linear

Normal inches, feet, yards and miles.

Area

Normal square inches, square feet, etc, up to acre, but in some districts the bigha is used. This varies in places but is generally about one-third of an acre, especially in Calcutta, Bengal and Assam.

A guntha of 121 square yards is very rarely used and an anna (one-sixth of a guntha) rarely ever.

Weights

1 tola = 180 grains (weight of new silver rupee).

80 tolas = 1 seer (2·057 lbs).

40 seers = 1 maund (82·28 lbs).

Maund of 40 seers is the Standard (or Railway) maund.

The maund varies in some cities and provinces viz :—

Cawnpore ..	48½ seers	}	Local contractors may use these weights.
Muttra ..	72½ seers		
Bombay ..	28 lbs.		
Madras ..	25 lbs.		

**CONVERSION FACTORS
PETROL—SPECIFIC GRAVITY ·730**

<i>Cubic feet</i>	<i>Imperial gallons</i>	<i>Weight in tons</i>	<i>American gallons</i>	<i>Litres</i>	<i>Barrels</i>
·1337	·8327		1	3·785	·02381
·16054	1		1·2009	4·5460	·02859
5·62	35	·114	42	159·1	1
48	300	1	360	1365	8·77
1	6·229		7·48	28·32	·1784

To obtain the factor for converting imperial gallons to barrels, find the line under "imperial gallons" which reads "1". On that line, under "barrels", appears the figure ·02859. This is the required conversion factor. Thus 1,000 imperial gallons is 28·59 barrels.

CARRYING CAPACITY OF AIRCRAFT FOR SUPPLY AND MAINTENANCE BY AIR

Serial	Type	Free dropping (lbs)	Air landing (lbs)	Parachute dropping		Remarks
				Containers CLE Mk III	Panniers	
(a)	(b)	(c)	(d)	(e)		(f)
1	Dakota C47	5,500	—	—	—	These are planning figures and may be adjusted to meet operational requirements
2	Dakota C47	—	5,500	—	—	
3	Dakota C47	—	—	—	16	Panniers packed to 350 lbs gross
4	Dakota C47	—	—	6	10	Panniers and containers packed 350 lbs gross
5	Halifax II, III, V	—	—	15	2	Panniers and containers packed 350 lbs gross
6	Halifax II	—	3,000	—	—	These weights to be packed in 15 panniers and 3 containers maximum
7	Halifax II	—	3,000	—	—	
8	Halifax III	—	6,000	—	—	
9	Halifax III	—	4,650	—	—	
10	Halifax V	—	3,500	—	—	
11	Halifax V	—	3,500	—	—	
12	Lancaster I, II, III	—	—	14	—	Containers packed to 350 lbs gross
13	Lancaster III	6,250	—	—	—	Stores in SBC and resting on bomb doors
14	Lancaster III	—	5,304	—	—	Packed in 22 panniers and 6 containers maximum
15	Stirling I, III, IV	—	—	24	4	Panniers and containers packed to 350 lbs gross
16	Stirling I, III, IV	—	5,000	—	—	May be packed in 19 panniers and 3 containers maximum
17	Halifax "A" conversion	—	12,000	—	—	
18	Halifax "B" conversion	—	12,000	—	—	
19	Halifax "C" conversion	—	10,000	—	—	
20	Stirling conversion	—	9,500	—	—	
21	Liberator B24	—	—	12	2	Panniers and containers packed to 350 lbs gross
22	Commando C46	—	10,000	—	—	

**Carrying Capacity of Aircraft for Supply and Maintenance
by Air—continued.**

Serial	Type	Free dropping (lbs)	Air landing (lbs)	Parachute dropping		Remarks
				Con- tainers CLE Mk III	Panniers	
(a)	(b)	(c)	(d)	(e)		(f)

AIR PHOTOGRAPHS—GENERAL

1. The data given in parts b, c, d and e will assist staff officers in using and ordering of air photographs. It is not intended that this data should eliminate the necessity for expert advice for detailed work.

2. In hilly country, where the hill tops are nearer the camera than the valleys, the scale on prints will have proportionate variations. Only in perfectly flat country will the scale of a vertical photograph be constant.

3. Tilting of an aircraft can also produce variations in scale. These photographs can, however, be rectified for tilt.

4. The normal size of contact print (no enlargement) from F52 camera is either 5" × 5" or 7" × 7". The normal American cameras produce 9" × 9" and 9" × 18" photographs.

5. The number of exposures required to provide cover of a given area can be calculated by the RF shown at the bottom of the graph read in conjunction with the measurements taken from the scale of miles shown at the bottom of part e. Adjustment must, however, be made to allow for the normal overlap allowed for each exposure. This is :—

- | | |
|--|--------------|
| (a) Overlap of individual prints in any run .. | 60 per cent. |
| (b) Overlap of consecutive runs | 30 per cent. |

INTERPRETATION AND ORDERING OF AIR PHOTOGRAPHS— GENERAL GUIDE TO SCALES

The following table is to be used as a general guide for interpretation purposes.

Serial	Type	Minimum suitable scale	Scale above which no satisfactory interpretation is possible
(a)	(b)	(c)	(d)
1	Shipping (a) Units above 200 feet (b) Smaller units, 100–200 feet	1/20,000 1/15,000 (x)	1/45,000 1/25,000
2	Aerodromes (a) Location of known aerodromes (b) Distinguishing early stages of a landing ground	1/50,000 1/20,000	1/80,000 1/30,000
	Identification of aircraft (a) Large a/c (b) Small a/c	1/18,000 1/10,000	1/40,000 1/18,000
4	Wireless equipment (a) Locating (b) Identification of type	1/10,000 1/5,000	1/20,000 1/10,000
	Railways (a) Distinguishing passenger from goods trains (b) Counting and identifying types of trucks	1/20,000 1/10,000	1/25,000 1/20,000
6	Damage (a) Large buildings, oil tanks, hangers etc (b) Shipping (c) Cities and built-up areas (d) Fighter attacks by cannon (e) Location of craters	1/12,000 1/5,000 1/10,000 1/5,000 (x) 1/20,000	1/25,000 1/10,000 1/15,000 — 1/30,000
	MT and AFVs (a) Distinguishing and counting (b) Differentiation between MT and AFVs (c) Identification of AFVs	1/15,000 1/5,000 1/2,000 (x)	1/20,000 1/12,000 1/3,000
8	Defence details	1/8,000	1/15,000
9	Dumps	1/30,000	1/60,000
10	Anti-aircraft	1/12,000	1/20,000
11	Camouflage (a) Location (b) Identification of details	1/10,000 1/5,000 (x)	1/20,000 1/7,000
12	Decoys	1/15,000	1/25,000
13	Industrial objects (a) Location of known works (b) Identification of unknown works and detailed description of plant (c) Full descriptions of oil installations and synthetic oil plants (d) Transformer stations	1/15,000 1/12,000 1/10,000 1/10,000	1/40,000 1/20,000 1/30,000 1/15,000

(x) And low flown obliques.

**Interpretation and Ordering of Air Photographs—
General Guide to Scales—*continued.***

**METHODS FOR CALCULATING APPROXIMATE SCALE
OF VERTICAL AIR PHOTOGRAPHS**

1. Comparison of measurement on the photographs between two points and measurement on the ground (or map) between the same two points.

Example :—

Representative fraction of the map .. .. .	..	$\frac{1}{12,500}$
Measurement on map .. .. .	..	41 mm.
Measurement on the photograph .. .. .	..	31 mm.

Therefore :—

$$\begin{aligned} \text{Scale of photograph} &= \frac{12,500 \times 41}{31} \\ &= \frac{1}{16,532} \end{aligned}$$

Scale should be deduced from the average of as many measurements as possible.

2. Comparison of measurement on the photograph with objects of known size.

Example :—

Actual length of ship .. .. .	..	840 feet
Measurement of ship on photograph	7 mm.	(1 foot = 304.8 mm.)
Scale	$\frac{7}{840}$	$\times 305 = \frac{1}{36,600}$

Scale from photographic data :—

The representative fraction of the scale may be deduced from the focal length of the lens and height of aircraft, both in inches.

Example :—

Focal length .. .. .	..	8 inch
Height .. .. .	..	20,000 feet
Scale	$\frac{8}{20,000}$	$\times 12 = \frac{1}{30,000}$

**Methods for Calculating Approximate Scale of
Vertical Air Photographs—*continued.***

**PHOTOGRAPH/GROUND MEASUREMENT
CONVERSION TABLE**

1. The following table is used for converting measurements on a vertical photograph (when the scale is known) into distance on the ground or vice versa.

2. Used with Part e, a rapid calculation can be made of the size of any object or feature.

Serial	<i>Scale of map or vertical photograph</i>	<i>1/50 inch on map represents feet on ground</i>	<i>1 inch on map represents yards on ground</i>	<i>1 mm on map represents metres on ground</i>	<i>1 mm on map represents feet on ground</i>	<i>1 mile on ground is represented by inches on map</i>
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	1/1,000	1.6	28	1	3.28	63.36
2	2,000	3.4	55	2	6.6	31.6
3	3,000	5.0	83	3	9.8	21.1
4	4,000	6.6	111	4	13.1	15.8
5	5,000	8.4	139	5	16.4	12.7
6	6,000	10.0	167	6	19.7	10.5
7	7,000	11.6	194	7	23.0	9.9
8	8,000	13.4	222	8	26.3	7.9
9	9,000	15.0	250	9	29.5	7.05
10	10,000	16.6	278	10	32.8	6.34
11	11,000	18.4	306	11	36.1	5.75
12	12,000	20.0	333	12	39.4	5.28
13	13,000	21.6	361	13	42.7	4.87
14	14,000	23.4	389	14	46.0	4.52
15	15,000	25.0	417	15	49.3	4.22
16	16,000	26.6	444	16	52.5	3.96
17	17,000	28.4	472	17	55.8	3.72
18	18,000	30.0	500	18	59.0	3.52
19	19,000	31.6	528	19	62.4	3.33
20	20,000	33.4	556	20	65.6	3.17
21	21,000	35.0	583	21	68.9	3.01
22	22,000	36.6	611	22	72.2	2.88
23	23,000	38.4	639	23	75.5	2.75
24	24,000	40.0	667	24	78.8	2.64
25	25,000	41.6	694	25	82.0	2.53
26	26,000	43.4	722	26	85.3	2.44
27	27,000	45.0	750	27	88.6	2.34
28	28,000	46.6	778	28	92.0	2.26
29	29,000	48.4	805	29	95.2	2.18
30	30,000	50.0	833	30	98.4	2.11
31	31,000	51.6	861	31	101.7	2.02
32	32,000	53.4	889	32	105.0	1.98
33	33,000	55.0	917	33	108.2	1.92
34	34,000	56.6	944	34	112	1.86
35	35,000	58.4	972	35	115	1.81
36	36,000	60.0	1000	36	118	1.76
37	37,000	61.6	1028	37	121	1.71
38	38,000	63.4	1056	38	125	1.67
39	39,000	65.0	1083	39	128	1.62
40	40,000	66.6	1111	40	131	1.58
41	41,000	68.4	1139	41	135	1.54
42	42,000	70.0	1167	42	138	1.51
43	43,000	71.6	1194	43	141	1.47
44	44,000	73.4	1222	44	144	1.44
45	45,000	75.0	1250	45	148	1.41

Photograph/Ground Measurement Conversion Table—*continued*

Serial	Scale of map or vertical photograph	1/50 inch on map represents feet on ground	1 inch on map represents yards on ground	1 mm. on map represents metres on ground	1 mm. on map represents feet on ground	1 mile on ground is represented by inches on map
(a)	(b)	(c)	(d)	(e)	(f)	(g)
46	46,000	76.6	1278	46	151	1.38
47	47,000	78.4	1306	47	154	1.35
48	48,000	80.0	1333	48	157	1.32
49	49,000	81.6	1361	49	161	1.29
50	50,000	83.4	1388	50	164	1.27
51	51,000	85.0	1417	51	167	1.24
52	52,000	86.6	1444	52	171	1.22
53	53,000	88.4	1472	53	174	1.19
54	54,000	90.0	1505	54	177	1.17
55	55,000	91.6	1528	55	181	1.15
56	56,000	93.4	1555	56	184	1.13
57	57,000	95.0	1583	57	187	1.11
58	58,000	96.6	1611	58	191	1.09
59	59,000	98.4	1639	59	194	1.07
60	60,000	100.0	1667	60	197	1.05
61	61,000	101.6	1694	61	200	1.04
62	62,000	103.4	1722	62	204	1.02
63	63,000	105.0	1750	63	207	1.005

DATA FOR AIR PHOTOGRAPHS PART XIIIe 1

HEIGHT OF AIRCRAFT, FOCAL LENGTH OF CAMERA AND REPRESENTATIVE FRACTION OF SCALE, GIVING LINEAR COVERAGE OF A 5" x 5" OR 7" x 7" VERTICAL PHOTOGRAPHIC PRINT.

