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REPORT
ON THE
BRITISH AIRBORNE EFFORT
IN
OPERATION "NEPTUNE"
BY
38 AND 46 GROUPS, R. A. F.

H.Q., NO. 38 GROUP, R.A.F.

THE PURPOSE of this Report is to give a general outline of the preparation for, execution of, and lessons learned from the British airborne effort in Operation "NEPTUNE".

For more detailed information, reference should be made to the following documents, which are also quoted at the relevant points in the text;-

"38 Group Standard Operating Procedure for Airborne Operations and Exercises".
(38G/MS.10/46/AIR.28 MAR.44)

"British Airborne Forces Standing Operating Procedure".
(H.Q. Airborne Troops).

38 Group Operation Orders :

No. 500	Operation	"NEPTUNE".	25 May 44.
" 501	"	"TONGA"	"
" 502	"	"MALLARD"	"
" 503	"	"ROBROY"	"

"An Analysis of British Airborne Operations on the night 5/6th June 1944. Operation "TONGA"."
(H.Q. 38 Group).

"An Analysis of British Airborne Operations on the evening 6th June, 1944. Operation "MALLARD"."
(H.Q. 38 Group).

"Glider Pilot Organisation, Training and Operations".
(Commander Glider Pilots. June 1944).

"Air Signals Report on Operation "NEPTUNE".
(AEAF/S.25024/ASO-in-C. July 1944).

MAP REFERENCES:

FRANCE : 1:100,000 Sheet 7F

: 1:50,000 Sheet 7F/2

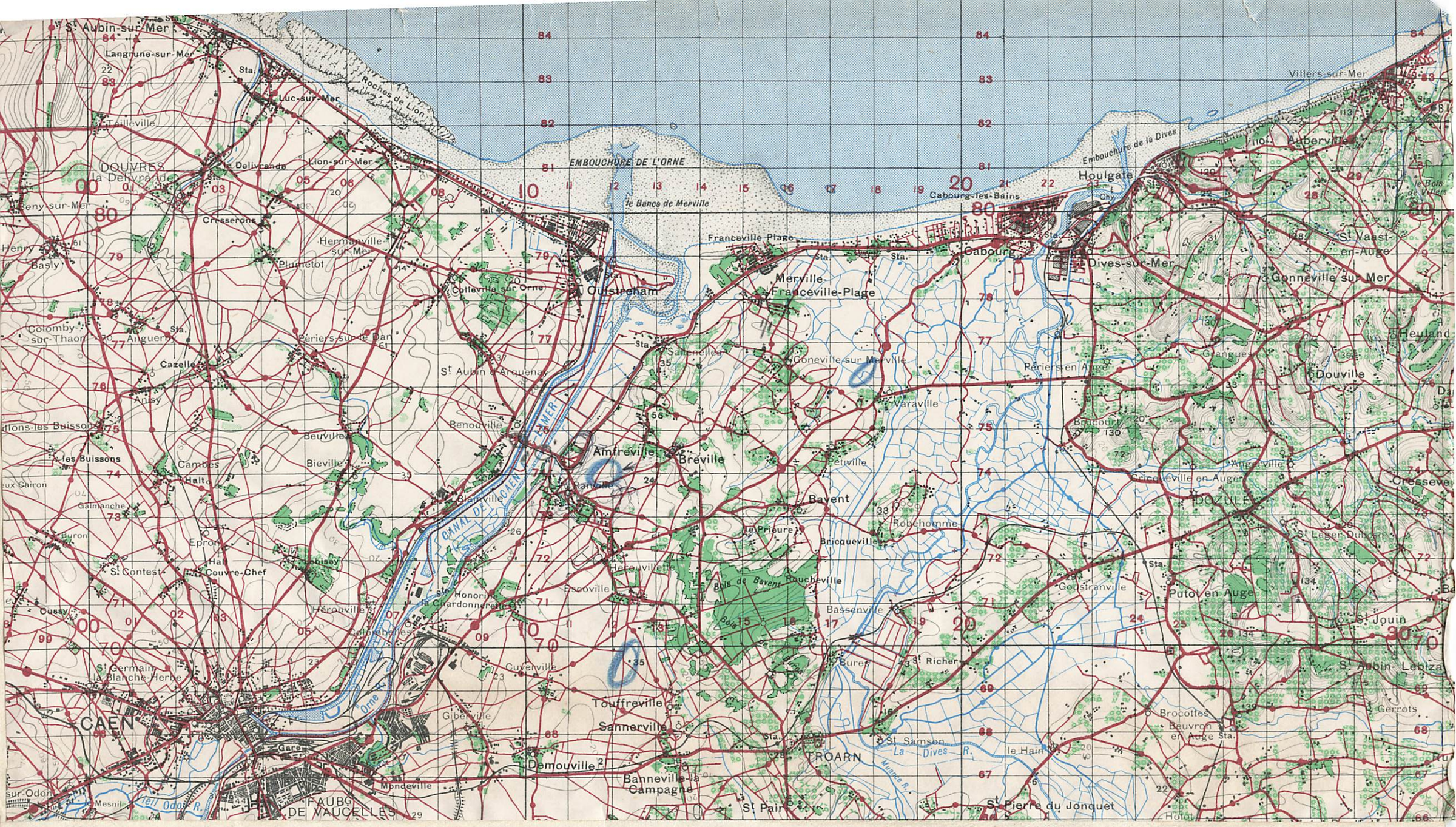
: 1:25,000 Sheets 40/16, NE, NW, SE, SW.
" 40/18, SE, SW.

H.Q. 38 GROUP, R.A.F.

REPORT ON THE BRITISH AIRBORNE EFFORT IN OPERATION "NEPTUNE" BY 38 AND 46 GROUPS, R.A.F.

C O N T E N T S.

I L L U S T R A T I O N S.


St Aubin-sur-Mer
Langrune-sur-Mer
Luc-sur-Mer
Tailleville
DOUVRES la Delivrande
Lion-sur-Mer
Beny-sur-Mer
Cresserons
Hermanville sur-Mer
Plumetot
Basly
Colleville sur Orne
Colomby sur-Thaon
Anguerny
Périers-sur-le Dan
Cazelle
Anisy
St Aubin d'Arquenay
Benouville
Beuville
Bieville
les Buissons
Cambes
Galmanche
Buron
Eprow
Couvre-Chef
St Contest
Cussy
Hérouville
St Germain la Blanche-Herbe
CAEN
Gare
FAUBG DE VAUCELLES
Mondeville
Mesnil
Vieil Odon R.
Giberville
Cuverville
Colombelles
Escoville
Hérouvillette
Ste Honorine la Chardonnerette
Blainville
Amfreville
Bréville
Ranville
Le Marais
CANAL DE CAEN A LA MER
Orne R.
EMBOUCHURE DE L'ORNE
le Bancs de Merville
Roches de Lion
Franceville Plage
Merville-Franceville-Plage
Outstreham
Sallenelles
Goneville-sur Merville
Varaville
Petiville
Bavent
Le Prieure
Bricqueville
Robehomme
Roucheville
Bois de Bavent
Bois de Bures
Bassenville
Bures
St Richer
Touffreville
Sannerville
Demouville
Banneville-la Campagne
St Pair
TROARN
St Samson
La Dives R.
Muance R.
le Hain
St Pierre du Jonquet
Cabourg
Cabourg-les-Bains
Houlgate
Villers-sur-Mer
Embouchure de la Dives
Dives-sur-Mer
Auberville
le Bois de Villers
St Vaast-en-Auge
Gonneville sur Mer
Heuland
Grangues
Périers en Auge
Douville
Bricqueville en Auge
Angerville
DOZULE
Cricqueville en Auge
St Leger Dubosq
Putot en Auge
Goustranville
St Jouin
St Aubin-Lebiza
Brocottes
Beuvron en Auge
Gerrots

REPORT ON THE BRITISH AIRBORNE EFFORT IN OPERATION "NEPTUNE".

I. PREPARATION.

The Military Plan.

1. "OVERLORD" was the code name for the operation designed to secure a lodgement on the Continent from which further offensive operations could be developed. Its opening phase, Operation "NEPTUNE", involved simultaneous seaborne assault, with air and airborne support, in the general areas CAEN and CHERBOURG PENINSULA, with a view to the early capture of airfields in the CAEN area, and the opening up of the port of CHERBOURG. The broad plan allotted the CHERBOURG PENINSULA sector to U.S. forces and the CAEN sector to British forces. The 2nd British Army was to assault between ASNELLES and OUISTREHAM.

2. 1 British Airborne Division, returning from Italy to refit, would stand by for later tasks. 6 British Airborne Division, formed in May 1943, was completing its training in the U.K. and was allotted to 1 (Assault) Corps to be used in a protecting rôle on the left flank of the British sector. The Commander 1 Corps called for the Commander 6 Airborne Division (Major General R.N. GALE, DSO, OBE, MC.) and explained to him the 1 Corps plan and the role of 6 Airborne Division.

3. The British left flank would rest on the CANAL DE CAEN and would be overlooked by high ground east of the river ORNE. If this high ground were left in enemy hands it would enable the enemy to bring down observed artillary fire over much of the British assault area, endangering the whole operation. The task given to 6 Airborne Division was to protect this left flank by denying to the enemy the use of the area between the rivers ORNE and DIVES, north of the road TROARN-SANNERVILLE-COLOMBELLES, and also to attack and delay enemy reserves and reinforcements moving towards CAEN from the east and south-east. (See 1:100,000 scale map, Fig.1.)

4. Within this main task were several minor tasks. The most important of these were: the capture, intact if possible, of the bridges over the CANAL DE CAEN and river ORNE near BENOUVILLE; the destruction of bridges over the river DIVES; the capture of a highly fortified coastal battery at MERVILLE, which commanded the landing beaches near OUISTREHAM.

5. 6 Airborne Division comprised two Parachute Brigades (3 and 5), the 6 Air Landing Brigade and supporting units. The Special Service Brigade, less one Commando, (Brig. the Lord LOVAT, DSO, MC.) after landing by sea, was to come under command of 6 Airborne Division. S.A.S. troops were to be allotted special reconnaissance and other supporting roles.

6. The air forces available to lift 6 Airborne Division were 38 Group, R.A.F. (Air Vice Marshal L.N. HOLLINGHURST, CB. OBE, DFC.), and 46 Group, R.A.F. (Air Commodore A.L. FIDDAMENT, DFC) with Glider Pilot Regiment (Col. G.J.S. CHATTERTON, DSO). The total aircraft being insufficient to lift the Division and its supporting arms at full strength, careful allotment of forces had to be made, but a formidable striking force could be put down in one lift, and the Divisional lift completed in two days.

Facing : Fig.I.
CAEN AREA. (From Sheet 7F. 1:100,000.)

/Joint Planning.

Joint Planning.

7. When planning had reached the stage where it could be completed at Division level, 6 Airborne Division transferred its planning staff to a specially "secure" H.Q. at MILSTON near NETHERAVON, where a room was allotted to 38 Group. There, a small 38 Group planning team was in close touch with army planning. By April 15th 1944 about six officers of 38 Group Air Staff had been briefed, and a War Room was opened at H.Q. 38 Group at NETHERAVON. There the air planning was completed.

8. Planning for an airborne operation is a reverse process: the dropping and landing zones (D.Z's and L.Z's.) are first agreed according to army and air requirements. The army plan dictates the allotment of troops to zones, whilst the navigation and glider landing problems decide the possibility of so delivering them. From this agreed basis, the flight plan is constructed, which in turn largely dictates the allotment of troops to airfields. A "spearhead" operation such as "NEPTUNE", where the ground situation is more or less static, fortunately allows ample time to dovetail together all these complex requirements.

9. From February 1944, detailed study of the terrain had been in progress. It was evident that the CAEN area offered first class terrain for airborne landings, with its great groups of verylarge, clear, almost level fields. Except for two special tasks (involving landings alongside the bridges at BENOUVILLE and on to the battery at MERVILLE) the terrain as such caused no difficulty in agreeing D.Z's and L.Z's to meet both army and air requirements. Map-reading features were plentiful and distinctive, except in respect of one D.Z/L.Z. which was uncomfortably close to the coastal entry point, and so left little margin to correct any error in landfall. This difficulty had to be accepted in deference to the military plan.

10. Flak and other ground defences in this area were comparatively light. Some opposition was expected from M.G. positions along the coastal belt, and there was a possibility of flak barges operating on the CANAL DE CAEN, but the flak picture generally was not disturbing.

11. The first detailed plan involved putting down 6 Air Landing Brigade in gliders on the night of D-1, together with one of the two Parachute Brigade Groups and some divisional troops. Unfortunately, terrain which is obviously suitable for air landings is equally obvious as such to the enemy, and on April 17th photo cover revealed extensive anti-air-landing obstacles in course of erection throughout the area. A trace outlining the obstructed fields corresponded almost exactly with that outlining the recommended L.Z's. The obstructions were too widespread to suggest that the enemy had anticipated the "NEPTUNE" airborne plan in particular, but they imposed a radical change. It was no longer considered feasible to land the main body of gliders by night, and the second of the two Parachute Brigades was substituted for 6 Air Landing Brigade, being given the additional task of clearing the A.A.L. obstructions (posts cut from local timber) to form landing lanes for the gliders, which would fly in by daylight on the evening of D day.

/12. Although this....

12. Although this change of plan did not suit the Divisional Commander, in that the Air Landing Brigade is the strongest fighting element of an airborne division and should be on the ground as soon as possible, it is arguable that the mass glider landing by night without obstructions, as originally planned, would have been more costly than the daylight landing among obstructions.

13. The D.Z's and L.Z's finally chosen are shown in Fig.2., and will be referred to hereafter by their distinguishing letters. Times will be referred to in relation to Civil Twilight (CT) as in the 38 Group Operation Order.

The Airborne Plan.

14. In the final plan the tasks of the various elements of the Division were as follows :-

(a) 5 Parachute Brigade Group.
Commander : Brigadier J.H.N. POETT.

To land on the night D-1/D on D.Z. "N" and to operate in the area BENOUVILLE-RANVILLE, carrying out the following special tasks :-

(i) Seize the crossings over the river ORNE and the CANAL DE CAEN at BENOUVILLE, using a special coup-de-main party carried in six gliders to land on L.Zs "X" and "Y" at CT-5 hours.
(ii) Secure and hold the area BENOUVILLE-RANVILLE-LE BAS DE RANVILLE.
(iii) Capture a battery at 107765.
(iv) Clear and protect L.Z. "N" for glider landings.

The main body of 5 Parachute Brigade was to start dropping at CT-4.30 hours.

(b) 3 Parachute Brigade Group.
Commander : Brigadier J.S.L. HILL, DSO, MC.

To land at the same time as 5 Parachute Brigade, on D.Z's "K" and "V", and to operate on the line TROARN-VARAVILLE and against an enemy battery at MERVILLE 155776, carrying out the following special tasks :-

(i) Capture and destroy an enemy battery at MERVILLE 155776 by CT-30 mins. with the assistance of a special coup-de-main party of three gliders.
(ii) Demolish bridges at TROARN, BURES, ROBEHOMME and VARAVILLE by CT+2 hours.
(iii) Deny to the enemy the use of the roads into the area from the south and east.

Each of these Brigade Groups was to be preceded by a detachment of 22 Independent Parachute Company which would set up ground aids, and by a small advance party of its own to be dropped at CT-5 hours. to provide cover. Each Brigade had also a very small glider element which was to be landed immediately before the main body, to provide a limited amount of transport and heavy equipment.

/(c) H.Q. 6 Airborne Division.


OUISTREHAM
H.W.L.
CABOURG
MERVILLE
155776
BTY
107765
BTY
W
V
PÉRIERS
EN
AUGE
VARAVILLE
BÉNOUVILLE
Y
X
N
RANVILLE
CANAL DE CAEN
LE BAS
DE RANVILLE
R. ORNE
ROBE-
HOMME
R. DIVES
BOIS DE
BAVENT
BURES
K
TROARN
CAEN
CAEN
Yards 1000 0 1000 2000 3000 4000 5000 Yards
Mile 1 ½ 0 1 2 3 Miles

FIG. 2.

(c) H.Q. 6 Airborne Division.
Commander : Major General R.N. GALE, DSO, OBE, MC.

This H.Q., together with elements of divisional troops including an anti-tank battery, was to land in gliders at CT-4.30 hours on L.Z. "N" on strips cleared and marked by 5 Parachute Brigade and 22 Independent Parachute Company. Divisional H.Q. was to take control of the battle from this point onwards.

(d) The "Battery Party".

Finally, three gliders were to land at CT-50 mins. on the actual coastal battery position at MERVILLE 155776 which was the objective of 5 Parachute Brigade, having signalled by means of the landing lights as soon as they were released, so that fire might be lifted.

This was the total lift planned for the night of D-1/D with the exception of a small number of S.A.S. troops who were to be dropped further inland. The code name "TONGA" described this total lift.

The landing of 6 Air Landing Brigade on the evening of D day was described by the code name "MALLARD", but its plan will be treated for the sake of clarity as part of the one continuous operation:

(e) 6 Air Landing Brigade and Airborne Armoured Reconnaissance Regiment.
Commander : Brigadier Hon. H.K.M. KINDERSLEY, MBE, MC.

At 21.00 hours on D day a force of 220 Horsa gliders was to deliver 6 Air Landing Brigade on L.Z's "N" and "W", and a force of 30 Hamilcar gliders to deliver the Airborne Armoured Reconnaissance Regiment on a specially reserved strip on L.Z. "N". Four additional Hamilcars were to carry extra equipment. Stirling tugs were to carry containers to be dropped after releasing gliders.

This would complete the landing of 6 Airborne Division, but after dark on D day, and subsequently as required, re-supply missions were to be flown under the code name "ROBROY", using D.Z. "N".

15. A synoptic picture of all the above phases of the operation is given in Figs. 4 to 8.

The Flight Plan.

16. The military requirements being firm and the allotment of aircraft and gliders to D.Z's and L.Z's being agreed, the flight plan was drawn up. The heights and positions of glider release points had first to be determined. The deciding factors were avoidance of flak and small arms fire, ease of map-reading, and the use of ground aids by the tugs for as long a period as possible. In nearly all cases a height of 1,500 feet A.G.L. was chosen. A considerable latitude was given to glider pilots as to the exact point of release, detailed briefing being given when the forecast winds were known. The technique was essentially that used in training.

17. Exceptions were made in respect of the coup-de-main glider party on the bridges at BENOUVILLE and the glider assault party on the battery at MERVILLE, both of which were to release at

/6,000 feet A.G.L.

6,000 feet A.G.L., the former to ensure surprise and the latter to allow a carefully planned glide approach to an exact spot landing on an extremely difficult target. Should cloud base be below 6,000 feet, tugs were to continue on the glider track at maximum height obtainable until gliders were within gliding range.

18. The main routing was then planned, taking into account the following requirements :-

(a) The minimum of turns and the maximum straight run in to drop or release.
(b) The best use of the radio aid GEE.
(c) Avoidance of flak (especially at LE HAVRE) and of friendly naval forces.
(d) Minimising the risk of enemy Radar detection,
(e) Use of ground aids in friendly territory.
(f) Co-ordination of forming up tracks, taking into account the simultaneous forming-up of large U.S. airborne forces in the U.K., and co-ordination of routes with other Commands operating.
(g) Simplicity, to allow quick but clear briefing.

The resulting route diagram is given as Fig. 3.

Navigational Aids.

19. All 38 and 46 Group aircraft were fitted with GEE as an aid to navigation to their approximate target area, and with REBECCA II. as a short-range homing device on to a pinpoint target. Normal aids such as occults and pundits were also available, and special coded lights (supplementing EUREKA beacons) at Group R/V's. Certain gliders detailed for special tasks were fitted with REBECCA.

20. Routes were planned where possible to give tracks along whole-number GEE lattice lines. New GEE frequencies were introduced on D-1 to reduce risk of jamming.

21. Except for the initial coup-de-main and advance parties, EUREKA beacons were to be set up on all D.Z./L.Z.'s by marker forces of 22 Independent Parachute Company. In addition, EUREKA beacons were allotted to Group R/V's and to each airfield for homing. Checks were to be made on the station homing beacon and again on the Group R/V beacon, to ensure proper working for the final run in to the D.Z./L.Z. To avoid saturation, REBECCA was not to be switched on until within 10 miles of the D.Z./L.Z. Coding was not used on the EUREKA beacons.

22. Standard ground-strip markings and smoke signals were to be set out on D.Z./L.Z's for the daylight operations.

Air Support and Diversions.

23. Air support and diversions were ordered broadly as follows :-

(a) Night D-1/D.

(i) A bombing attack by 100 Lancasters on the battery at MERVILLE, to last from 20 mins. until 10 mins. before the arrival of the main body. (This battery had been previously bombed, but with only partial success).

Cont'd /(ii) Intruders

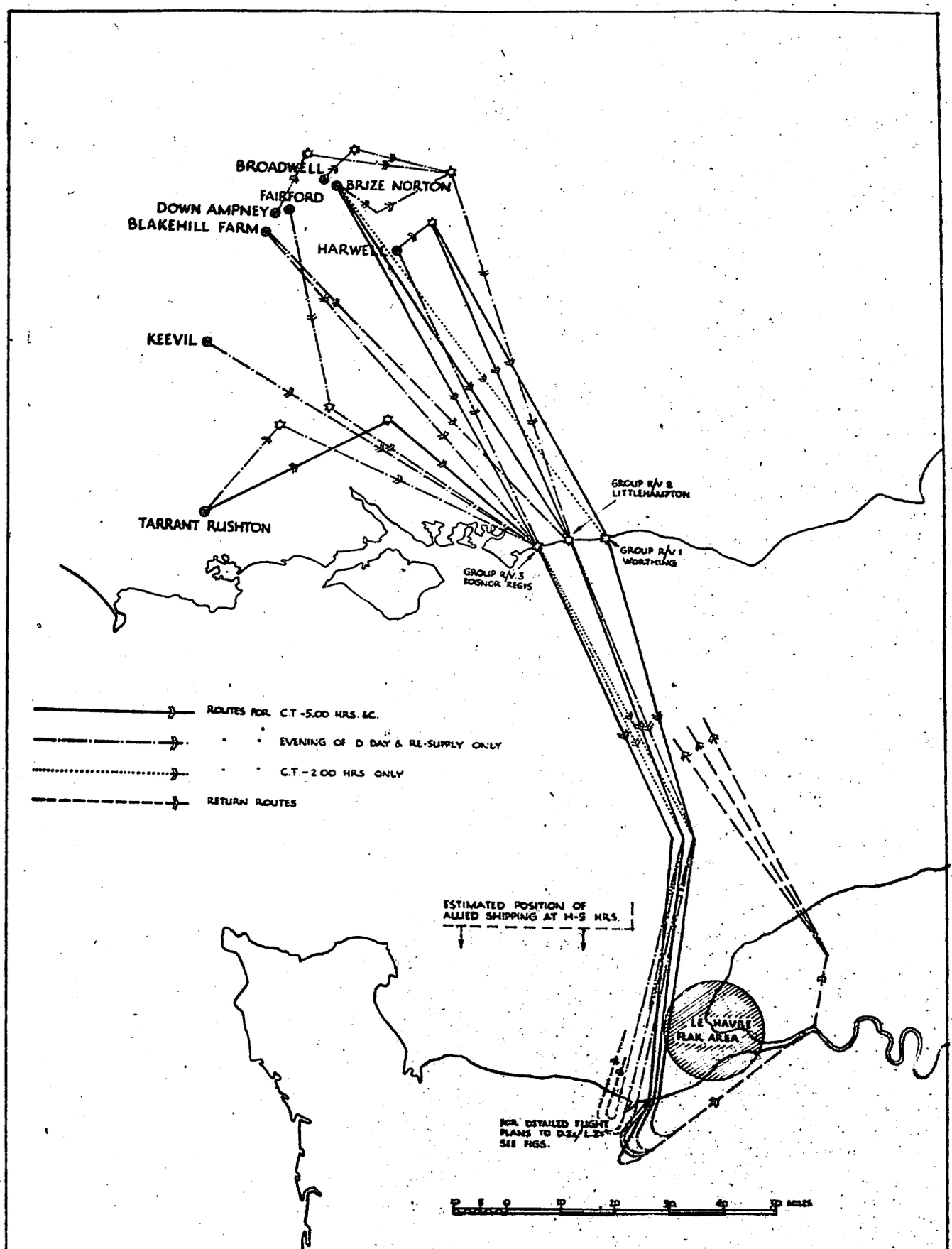


FIG. 3. OPERATION "NEPTUNE" ROUTE DIAGRAM

(ii) Intruders on enemy night fighter airfields inland, in the form of standing patrols from 2345 hrs. on D-1 to 0430 hours on D day.

(iii) Ground strafing by fighters patrolling the area to draw light flak and S/L and attack these, all these aircraft being clear of the area before the first landings.

(iv) To confuse the enemy Radar system until the last possible moment, ten WINDOW dropping aircraft to simulate an airborne attack in the direction of the SEINE estuary.

(v) The six tug aircraft concerned with the coup-de-main party on the bridges at BENOUVILLE each to carry 2 x 500-lb. G.P. bombs, to be dropped on a powder factory a short distance south-east of CAEN.

(vi) Dropping of dummy parachute troops and "noise simulators" by aircraft of No.3 (Bomber) Group, under the code name Operation "TITANIC".

(b) Evening of D day.

(i) Close fighter escort by 15 Squadrons of 11 Group.

(ii) Routine high and low level fighter cover over the beach head.

(iii) Escorted bomber operations and fighter sweeps to the south and south-east of the beach head area.

Operation Orders.

24. For full details of the foregoing plan, reference should be made to the following :-

38 Group Operation Order No.	500	Operation "NEPTUNE"
" " " " "	501	Operation "TONGA"
" " " " "	502	Operation "MALLARD"
" " " " "	503	Operation "ROBROY"
	38G/TS.62/31/AIR	Operation "TITANIC"

Order of Battle.

25. The air forces available to lift 6 Airborne Division were 38 and 46 Groups, R.A.F. The 46 Group Squadrons were under 38 Group control whilst used in airborne work. The eight operational bases were all occupied by March 1944. The final Order of Battle was as follows :-

Group.	Station.	Squadron.	Aircraft.
38	BRIZE NORTON	296	22 + 4 Albemarle
"	" "	297	" " "
"	HARWELL	295	" " "
"	"	570	" " "
"	KEEVIL	196	22 + 4 Stirling
"	"	299	" " " + 620 Sqn 22+4 Stirling
"	FAIRFORD	190	" " "
"	TARRANT RUSHTON	298	18 + 2 Halifax
"	" "	644	" " " A.2.1.
46	BROADWELL	512	30 + 0 Dakota
"	"	575	" " "
"	DOWN AMPNEY	48	" " "
"	" "	271	" "
"	BLAKEHILL FARM	233	" " "
	Reserves		25 "
	TOTAL (15 Squadrons)		362 + 61 aircraft.

26. The established glider force comprised 1040 Horsas (50 per Squadron) and 80 Hamilcars (allotted to Halifax Squadrons).

27. 6 Airborne Division would use about 350 gliders, 6,000 man-dropping ("X"-type) parachutes and 3,000 containers on the main operation, whilst for re-supply a further 10,000 containers or panniers were required.

Administration and Base Organisation.

28. A standardised procedure covering the planning and execution of airborne operations was agreed between U.S. and British air and airborne forces, and formed the basis for Standard Operating Procedures issued by H.Q. 38 Group and by H.Q. British Airborne Forces. The procedure, and in particular that for base organisation, had been fully tried out in large scale exercises, and although Operation "NEPTUNE" was the first operation on which the complete procedure was put into effect, it was not peculiar to the operation and will not be detailed in the present report. Reference should be made to :-

(a) 38G/MS.10/46/AIR. 28 March 44. H.Q. 38 Group Standard Operating Procedure for Airborne Operations and Exercises.

(b) British Airborne Forces : Standing Operating Procedure. (Issued by H.Q. Airborne Troops).

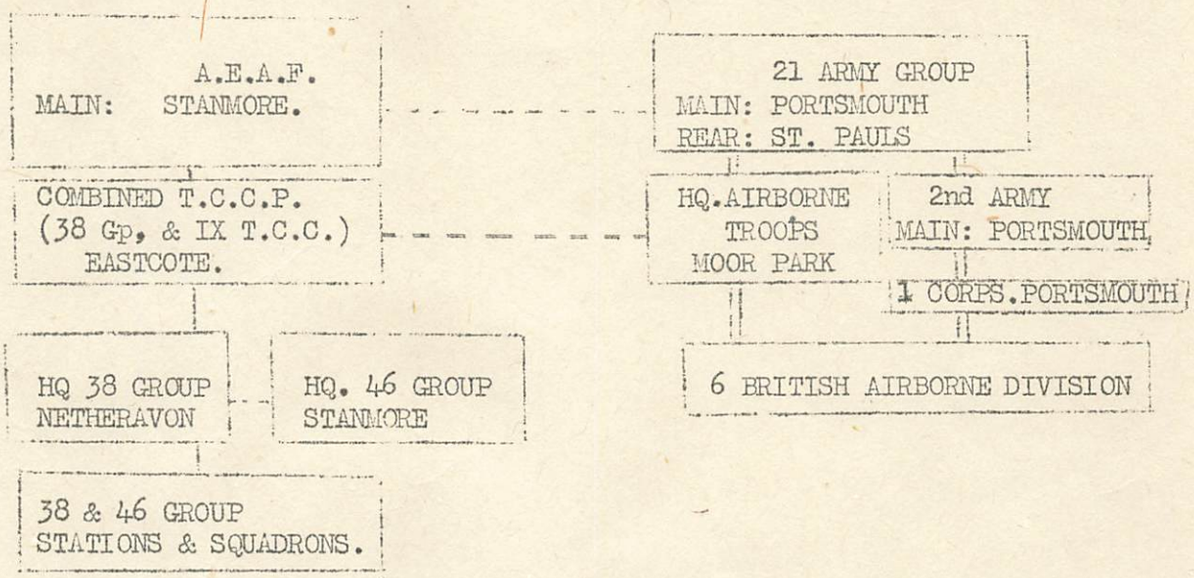
Command and Control.

29. The Supreme Commander, AEF., commanded all forces allotted to Operation "OVERLORD". Under his direction the Air Commander in Chief, AE.A.F., commanded the allied air forces allotted for direct participation.

/30. Some two

30. Some two months before D day a Combined Troop Carrier Command Post (U.S. and British) was set up at EASTCOTE, and the staff and communications organisation tried out on a full scale exercise. Although the British and U.S. operations were separate, both the A.O.C. 38 Group (Air Vice Marshal L.N. HOLLINGHURST, CB, OBE, DFC) and the Commanding General IX Troop Carrier Command (Brigadier General Paul L. WILLIAMS) exercised command of their respective operations from this Post, and the U.S. and British staffs co-ordinated their aircraft movements.

31. The chain of command and control was broadly as under :-



Air Command Channels ———————

Military Command Channels ═══════

Liaison Channels - - - - - - - - -

Special Training.

32. The aircrew and glider pilot training of the preceding months, and the combined exercises with 6 Airborne Division, had been designed with a view to the coming tasks. On April 24th a Corps Exercise (Exercise "MUSH") took place, in which one airborne division was dropped and landed, whilst the other acted the part of the enemy on the ground. In many ways the plan simulated that for Operation "NEPTUNE". This exercise, which was the final practice in co-ordination between British and U.S. forces, was controlled from T.C.C.P. at EASTCOTE.

33. Intensive training was given to the aircrews and glider crews detailed for the difficult glider landings near the bridges at BENOUVILLE, and on the battery at MERVILLE. Suitable areas on SALISBURY PLAIN were marked out in exact imitation of the L.Z's concerned; the flight plans (including the use of GEE) also conformed exactly. At the cost of several gliders, training was carried out in successive stages, culminating in simultaneous night landings. Ground training was also carried out in close simulation of the coming tasks.

Briefing.

34. An extremely accurate model of the "NEPTUNE" area to 1:5,000 scale was made by C.I.U., MEDMENHAM, and was set up at NETHERAVON for briefing. The unprecendented demand for models for Operation "OVERLORD" made the provision of duplicates for Stations impossible, but all aircrews had some (if limited) opportunity for studying this model.

35. A colour film was made byH.Q. 38 Group from this model and from larger scale models made by 6 Airborne Division. By moving the camera above the model at the appropriate height and speed, the actual runs in from the coast to the D.Z.'s/L.Z's were closely simulated. This film was shown repeatedly at all Stations concerned, with night simulation for the night operations.

36. In addition, successive still photographs were taken in the same manner, at points along each run-in, and were distributed to Stations.

37. Stations were provided with a wealth of vertical and oblique photographs, including one print for every aircrew and every glider crew taking part, showing the appropriate D.Z's/L.Z's.

38. A special target map of a type developed by H.Q. 38 Group for night airborne operations was also produced. A section of this map is given as a specimen (Fig.9).

39. Briefing at aircrew level began three days before the operation, from which time Stations and transit camps for airborne troops were "sealed" from the outside world.

40. "D" Day, after a postponement of 24 hours on account of weather, was finally set for 6th June, 1944.

/II. Execution.

FIG. 4.

PHASE 1. C.T. - 5.00 HRS.

COUP-DE-MAIN PARTY, PATHFINDERS AND ADVANCE PARACHUTE PARTIES.

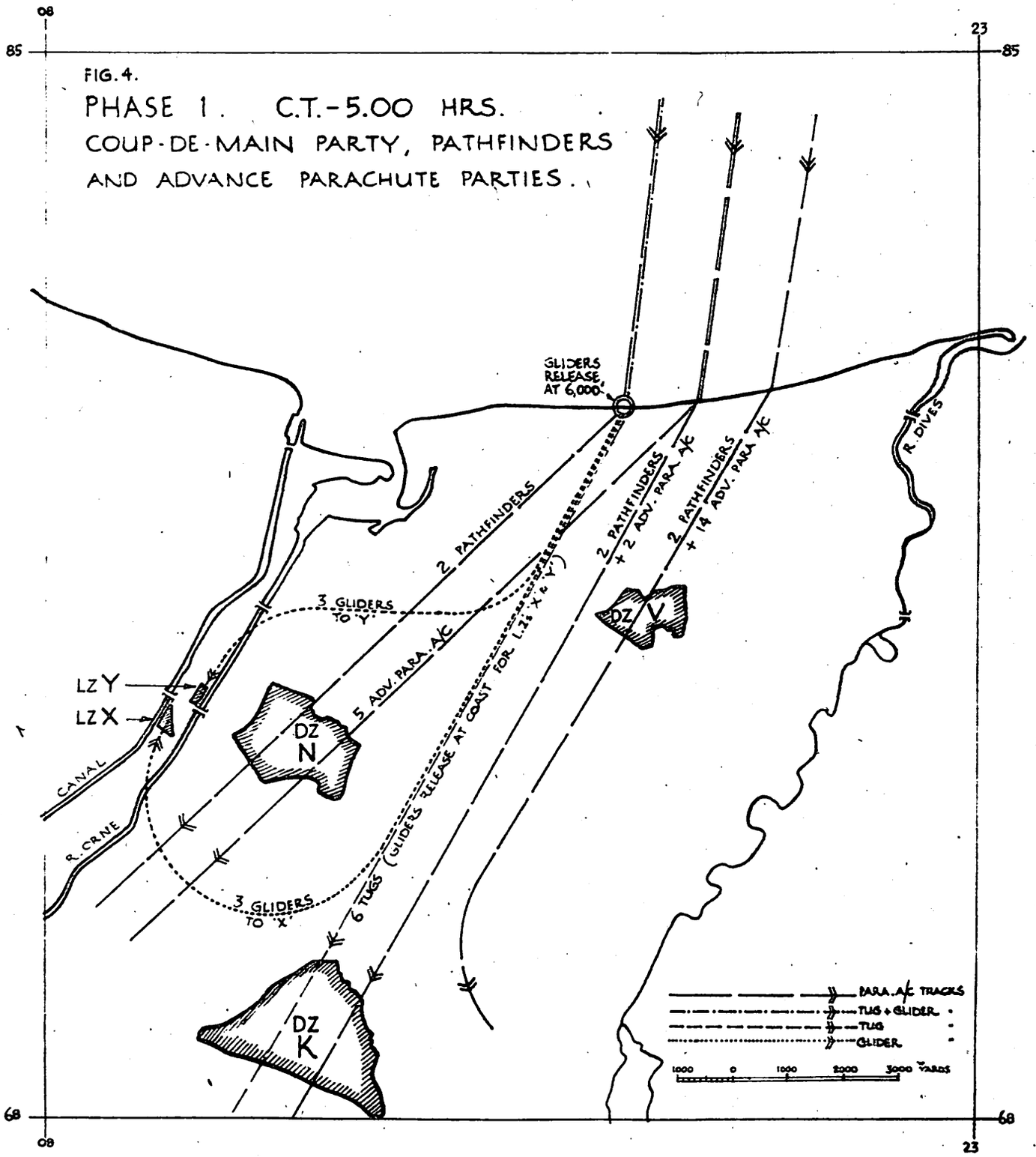


FIG. 5.

PHASE 2. C.T. - 4.35 HRS. & C.T. - 4.30 HRS.

MAIN PARACHUTE DROPS

AND GLIDER SUPPORT.

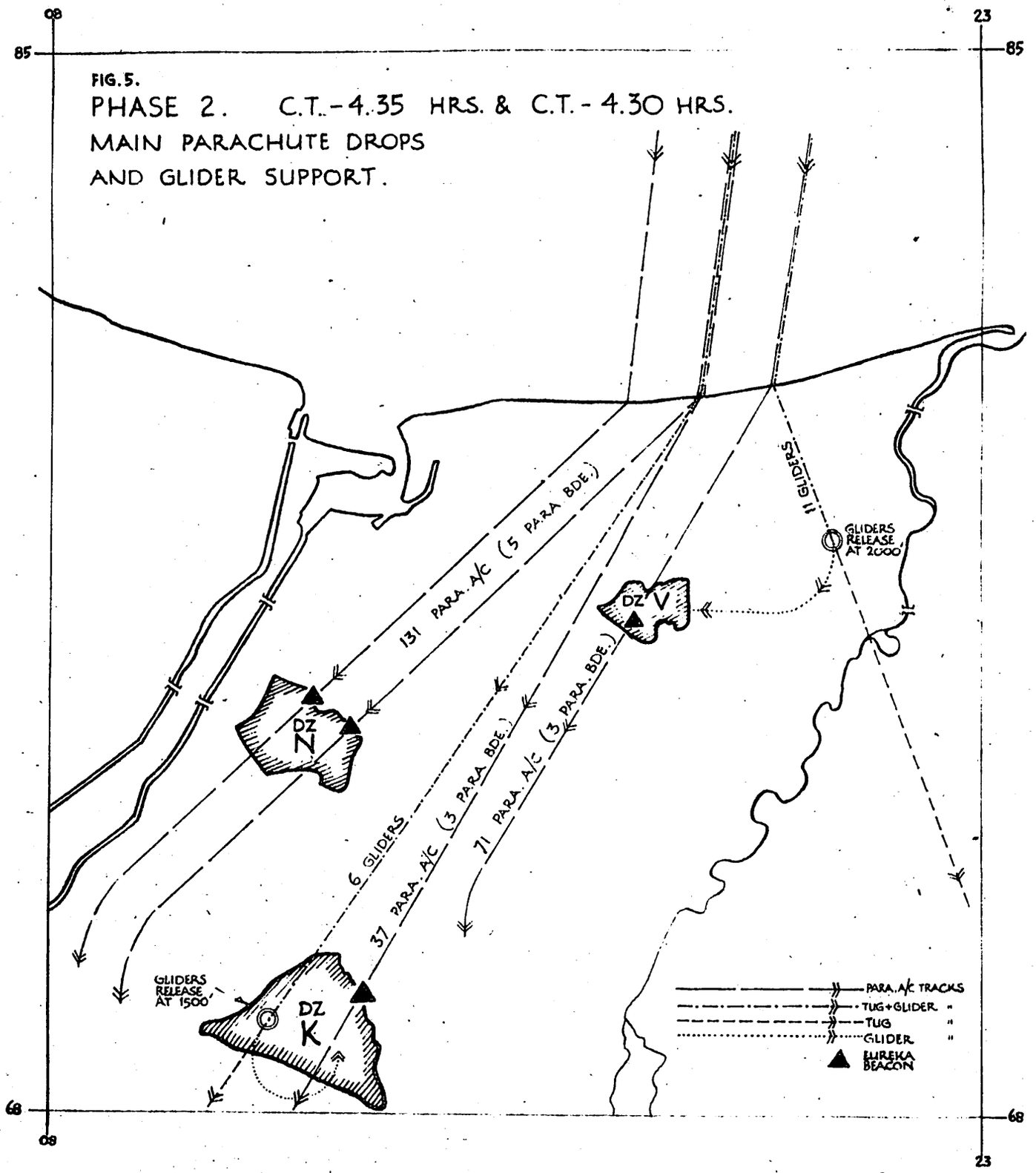
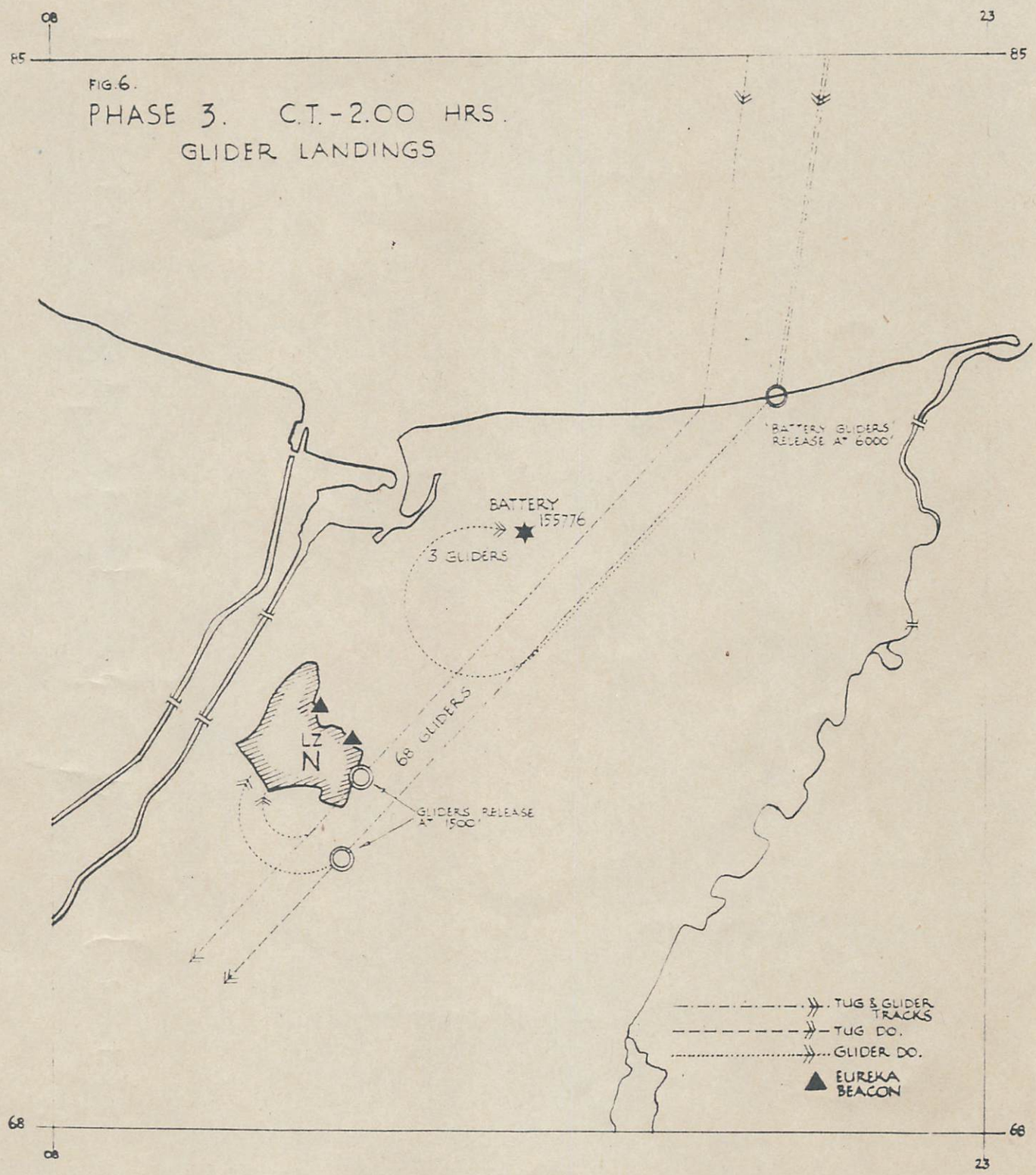
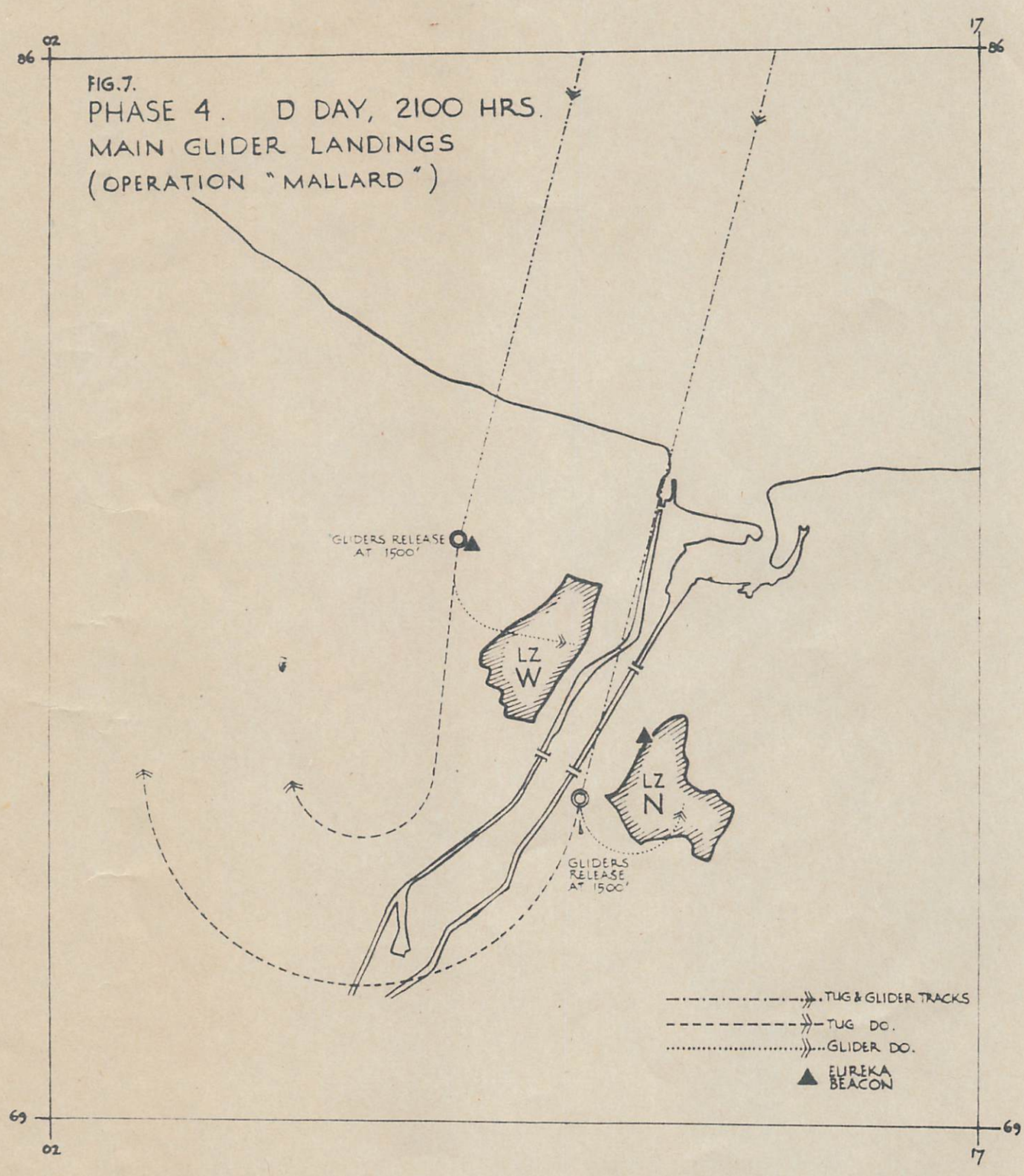


FIG.6.

PHASE 3. C.T. - 2.00 HRS.

GLIDER LANDINGS




02
17
86
86
FIG.7.
PHASE 4. D DAY, 2100 HRS.
MAIN GLIDER LANDINGS
(OPERATION "MALLARD")
GLIDERS RELEASE AT 1500'
LZ W
LZ N
GLIDERS RELEASE AT 1500'
TUG & GLIDER TRACKS
TUG DO.
GLIDER DO.
EUREKA BEACON
69
69
02
17

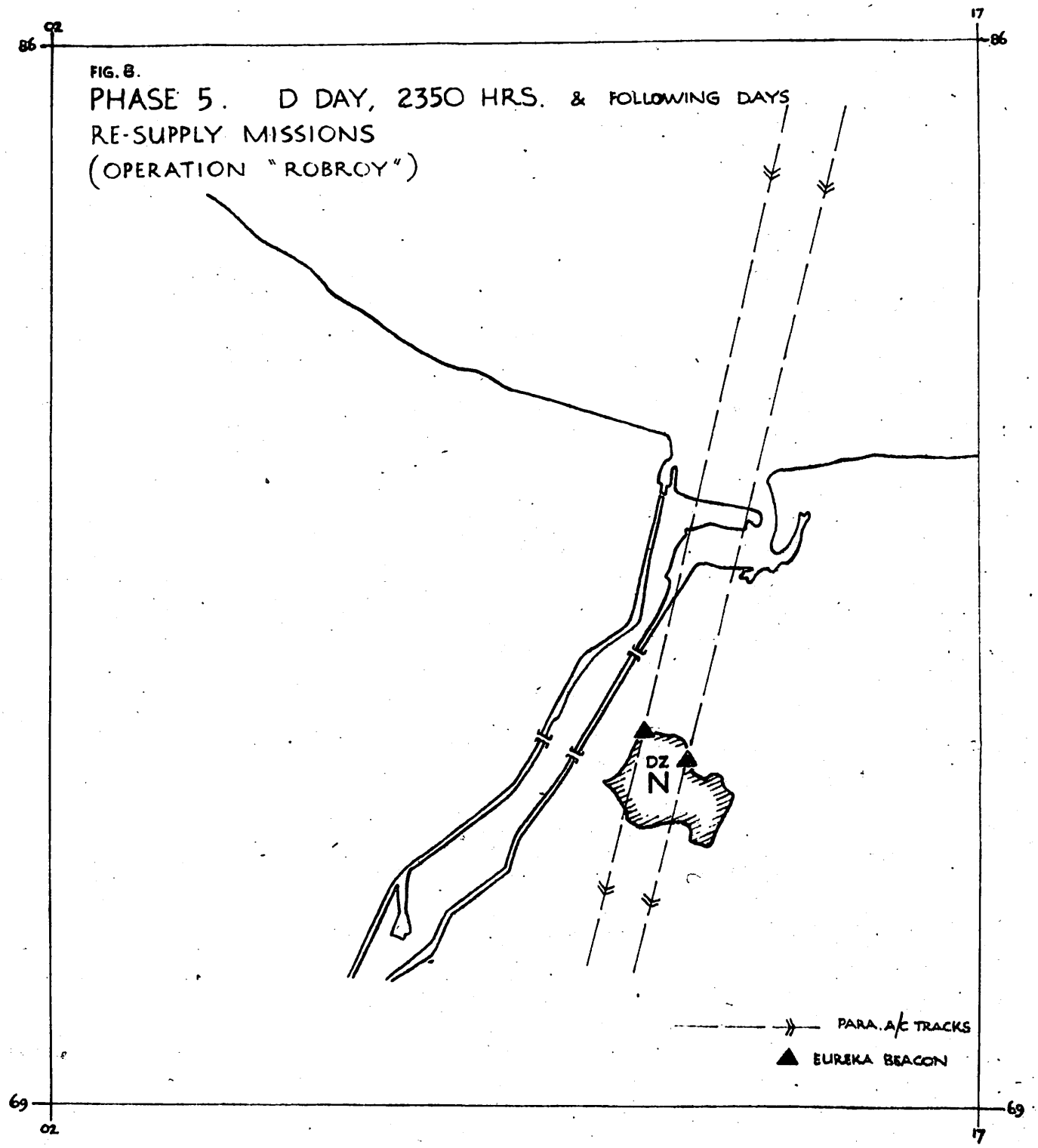


FIG. B.

PHASE 5. D DAY, 2350 HRS. & FOLLOWING DAYS
RE-SUPPLY MISSIONS
(OPERATION "ROBROY")

II. EXECUTION.

Assessment of Results.

41. The assessment of results in based on the following sources of information :-

(a) Routine reports from Station Operations.
(b) Interrogations of aircrews.
(c) Interrogations of glider crews.
(d) Photo cover made immediately after the operation.
(e) Plots of glider landings and parachute drops prepared by H.Q. 6 Airborne Division.

42. In the case of glider missions, aircrew and glider crew interrogations and air photographs provide good cross-checks, and the information is generally accurate, subject to very slight discrepancies between R.A.F. and glider pilot reports.

43. In the case of parachute missions, a less complete picture of the results can be obtained. Aircrew reports, though made in all good faith, tend to be over-optimistic. A crew which has dropped inaccurately would not have given the drop signal unless the drop was believed accurate, and their report will have been made accordingly. It is difficult to interrogate parachute troops during or even after a battle lasting several weeks and involving high casualties. Nevertheless the plots prepared by 6 Airborne Division give a good general indication of the degree of accuracy achieved. As regards the "sticks" of parachute troops from which no reports have been received : although these are more likely to be among those dropped wide, the absence of a report does not necessarily imply an inaccurate drop.

44. Certain detailed information as to serial numbers of gliders and parachute aircraft, direction of drop and length of stick, has been omitted from the present report and diagrams, but is available from H.Q. 6 Airborne Division.

Operation "TONGA". Night of 5/6 June, 1944.

PHASE I. (See Fig.4)

Drop of "Pathfinder Forces" on D.Z's "N", "K" and "V".

45. Two Albemarle aircraft were detailed to each of the three L.Z's, to drop at 0020 hrs. D.B.S.T.

46. Visibility was good; cloud 10/10 at 4,000 ft. in the D.Z. area; wind was between 295/28 and 230/10.

47. All aircraft reached the area. Exit difficulties were reported by four of the six aircraft, and in three cases, two or more runs were required, but all troops were dropped, with an average time error of about 2 minutes except for one aircraft which completed the drop on the third run, 14 minutes late.

48. Some indication of the success of the forces dropped is given by the reports from subsequent aircraft as to the ground aids found on the D.Z./L.Z's. Lights were reported to be on all three D.Z./L.Z'S, and EUREKA to be operating on "K" and "N". Although it is confirmed that both sticks were correctly dropped on D.Z. "V", both EUREKA beacons were damaged and unserviceable. One of the pathfinder aircraft for "K" dropped on the south-east corner of "N", where the EUREKA beacon and lights coded for "K" were put into operation.

/Although

(To face Fig. 9).

ANALYSIS FROM FIG. 9.

GLIDER LANDINGS ON NIGHT 5/6 JUNE 1944.

LZ.	"X"	"Y"	"N"	"V"	"K"	BTY.	TOTAL.
On L.Z.	3	1	46	0	2	0	52
Off L.Z. but within 1 mi. of centre	0	1	3	1	0	2	7
Over 1 mi. from centre of L.Z.	0	0	6	5	3	0	14
No information	0	0	3	2	1	0	6
Abortive	0	1	14	3	0	1	19
DETAILED	3	3	72	11	6	3	98
Percentage success	100%	66%	68%	9%	33%	66%	60%

Note: In estimating "percentage success", gliders landing within 1 mile of the centre of the L.Z. have been rated successful. No account has been taken of gliders landing at a greater distance, but it should be noted that many of these played a useful part in the battle.

FIG. 9A

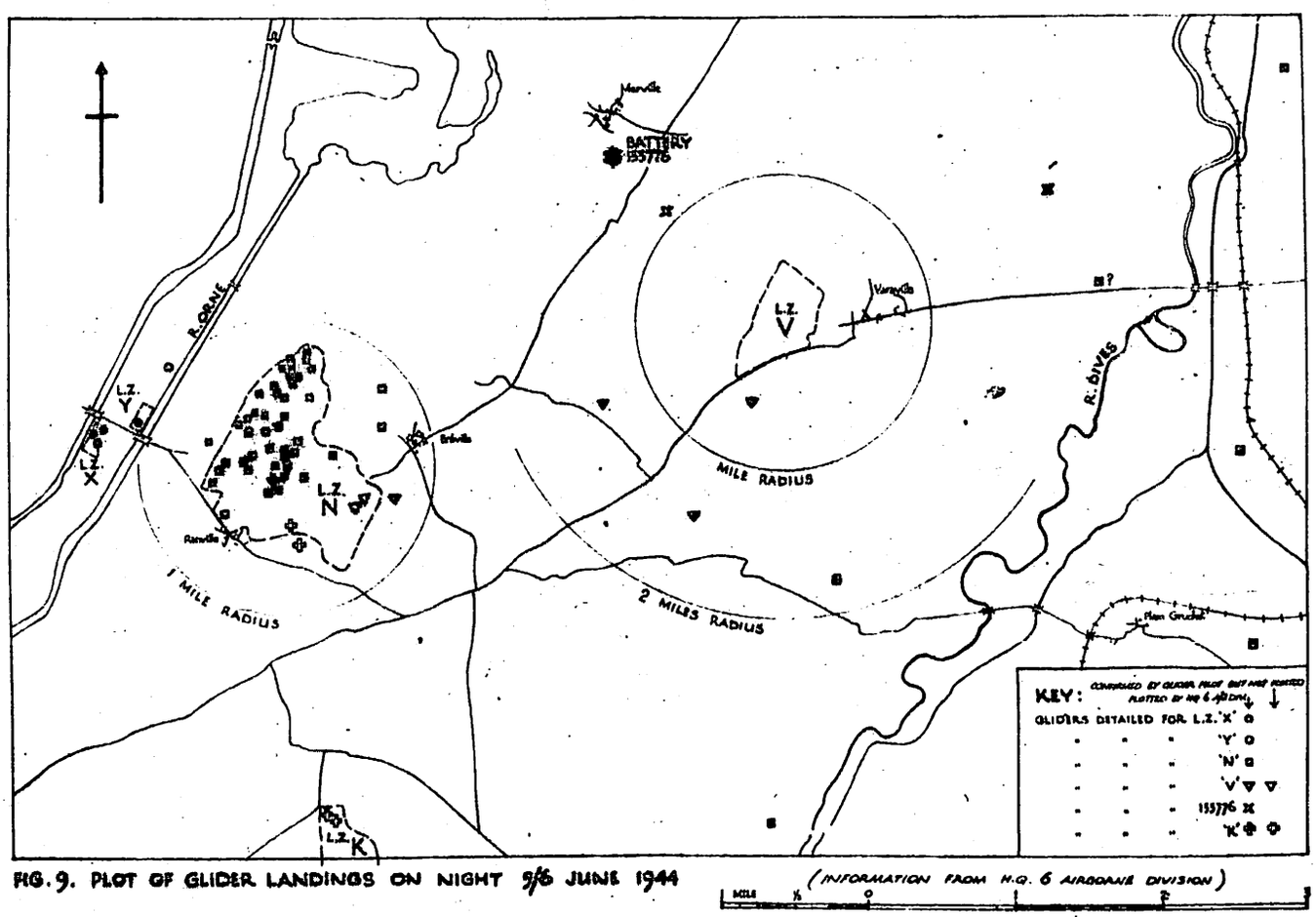


FIG. 9. PLOT OF GLIDER LANDINGS ON NIGHT 5/6 JUNE 1944

Although the error was soon realised on the ground and the beacon and lights were switched off, many aircraft had already dropped sticks intended for "K" on to "N".

'Coup-de-Main Party" on L.Z's "X" and "Y"

49. "Three Halifax/Horsa combinations (two from 298 squadron and one from 644 squadron) were detailed for LZ"X", and three (two from 644 squadron and one from 298 squadron) for LZ"Y" to release at 00.20 hours. Arrester parachute gear was fitted to these gliders".

50. In the L.Z. area visibility was good (10 miles or more), with 6-9/10 cloud at 5-6,000 feet; wind was from 290/40 to 312/18 at release heights.

51. All tug pilots reported releases between 4,500' and 5,500' at 5-6 miles distance from the L.Z's, but one glider pilot (for L.Z. "Y") reported that blind release was made on orders from the tug one mile east of HOULGATE; this glider landed 8 miles west of the L.Z. near two bridges at PERIERS-EN-AUGE which slightly resemble the bridges at the L.Z. Of the remaining five gliders the three allotted to L.Z. "X" all landed within a few yards of the bridge as briefed. (Figs. 9, 10). On L.Z. "Y" one glider landed about 150 yards from the bridge. One landed about 400 yards short of L.Z. "Y". No flak had been encountered, and it seems likely that the gliders were unseen until over the L.Z's.

52; It would appear that of the 170 troops carried, about 140 were in action against the bridges almost immediately. The bridges were seized intact and held as ordered.

53. The results of the diversionary bombing by the tug aircraft after release, on the powder factory near CAEN, could not be observed owing to cloud; all but one aircraft dropped their bombs.

Drop of Advance Party of 5 Parachute Brigade on D.Z. "N".

54. Five Albemarle aircraft were detailed : three from 297 Squadron and two from 296 Squadron, to drop with the pathfinders at 0020 hrs. and therefore without ground aids.

55. Weather conditions reported at the D.Z. ranged from 10/10 cloud at 4,000' to 10/10 cloud at 1,500'. Visibility was good; wind from 317/20 to 280/21.

56. Two aircraft reported exit difficulties, causing in one case an extra run, and in the other case the return of one man to base. Of 47 troops, 46 were dropped; of 13 containers all were dropped, but one of these jettisoned "near the D.Z.". Timing was accurate.

Drop of Advance Party of 3 Parachute Brigade on D.Z. "K".

57. Two Albemarle aircraft (295 and 570 Squadrons) were detailed, to drop with the pathfinders at 0200 hrs. and therefore without ground aids.

58. Visibility was good, with broken cloud at 1,500' increasing to 8/10 at 500'; wind 340/20 to 290/30.

59. Both aircraft reported accurate drops at $\frac{1}{2}$ and $3\frac{1}{2}$ mins. late, but on its second run, to drop containers, one aircraft failed to find the D.Z. and the containers were not dropped.

/Drop of Advance Party

Drop of Advance Party of 3 Parachute Brigade on D.Z. "Y".

60. Fourteen Albemarle aircraft were detailed : 7 from 295 Squadron and 7 from 570 Squadron, to drop at 0020 hrs. with the pathfinders, and so without ground aids.

61. , The visibility reported ranged from 1 to 6 miles; cloud from 10/10 at 1,500' to 7/10 at 2,000'; wind 260°-285°T. but varying from 12 to 41 m.p.h.

62. Exit troubles were reported by two aircraft, of which one dropped only 3 and the other only 9 troops. From another aircraft, 6 troops jumped over the coast "without warning" and only 4 were dropped on the D.Z. One aircraft, subjected to enemy M.G. fire over the D.Z., made a second run. Of two which reported GEE failure, one lost time flying along the enemy coast to find the entry point and dropped late; the other did not find the entry point and made seven unsuccessful runs to find the D.Z. It was then hit by flak and No.2 paratroop was knocked into the exit hole, jamming it; this aircraft then returned to base with full load.

63. Between 0021 and 0029, of 140 troops, 106 dropped correctly, 16 dropped incorrectly and 18 did not drop. Of 56 containers, 42 dropped correctly, 8 dropped incorrectly and 6 did not drop. (Aircrew reports).

PHASE II. (See Fig.5)

Landing of 6 Gliders on L.Z. "K".

64. Six Dakota tugs of 233 Squadron (46 Group) were detailed to tow six Horsa gliders; to release at 0045 hrs. at 1500 ft. A.G.L.

65. Weather over the L.Z. was: visibility 3-5 miles, cloud 10/10 at 4000'; wind westerly. Glider pilots report bumpy conditions en route, and heavy smoke clouds obscuring the approach.

66. All tug pilots reported correct releases (between 0045 and 0048 hrs. at heights between 500' and 1700') but of the 5 glider crews reporting, only two reached the correct L.Z. "K". Three landed on or near L.Z. "N";, of these, two had released on instructions from the tug, whilst in one case, both tug and glider pilots thought L.Z. "K" had been reached. The source of error was evidently the "K" beacon wrongly operating on "N", referred to in para. 48 above.

Landing of 11 Gliders on L.Z. "V".

67. Seven Dakota tugs of 46 Group and 4 Albemarle tugs of 38 Group were detailed to tow 11 Horsa gliders, to release at 0045 hrs. at 1500'.

68. Glider pilots report unfavourable weather en route, with patches of low cloud and bumpy conditions. Reports from tug pilots give the visibility at the L.Z. as good; cloud 10/10 at 3000' - 6000', lowering to 1000'; wind 310/25. The 5 glider pilots who reported stated that dust and smoke (from the battery bombed some minutes before) totally obscured the area.

/Para.69..These tugs..

69. Three tugs lost their gliders in cloud off the French coast. The remaining 8 tug pilots reported releases between 0044½ hrs. and 0105 hrs. between 1000' and 1700' mostly about one mile north-east to north-west of the L.Z. All tug pilots stated that they recognized the L.Z. and 4 that they saw the "T".

70. Reports are available from 4 glider pilots only. None of these reached L.Z. "V". Two landed about 2 miles west of the L.Z., near BREVILLE. Two, seeing the lights on L.Z. "N", landed there.

Drop of Main Body of 5 Parachute Brigade on D.Z. "N".

71. 131 aircraft were detailed : 110 from 38 Group and 21 from 46 Group. Two aircraft of 38 Group were unserviceable but the remaining 129 took off.

72. Visibility was good; cloud 7-10/10 at 2000'-4000'; wind westerly. Lights and EUREKA were available on the D.Z.

73. 123 aircraft reported reaching the D.Z. between 0048½ and 0112 hrs. (excluding one report of reaching the D.Z. at 0143½ hrs.). Of the 6 remaining aircraft, 5 (all Stirlings) are missing.

74. Of 2125 troops carried 2026 were dropped. Of 755 containers carried 702 were dropped. Reports from army sources indicate that the drop was generally accurate. (See plot Fig.11).

Drop of Main Body of 3 Parachute Brigade on D.Z. "K".

75. 37 Dakotas of 46 Group were detailed, to drop from 0050 hours.

76. Visibility was 3 to 5 miles; cloud 10/10 at 4000' - 6000'; wind 310/20 at 1500'-2000' over the D.Z. Lights and EUREKA were available on the D.Z.

77. Two aircraft (233 Squadron) are missing. The remaining 35 aircraft dropped between 0048 and 0100 hrs. Of 617 troops, 615 were dropped; one was killed before the drop and one refused. Of 163 containers, 151 were dropped. Owing to the error of one pathfinder crew (referred to in para. 48) the EUREKA beacon and lights coded for DZ "K" were actually operating on D.Z. "N", about three miles to the north, for a part of the dropping period. The formation leader dropped accordingly on "N", and although the error was realised on the ground, and the lights and beacon switched off, other aircraft had followed suit. Although the correct beacon and lights were operating from "K" before the end of the dropping period, the majority had dropped on "N". It is confirmed by 3 Parachute Brigade that 13 sticks were dropped on "N" and 8 on "K". (See plot, Fig. 12.)

Drop of Main Body of 3 Parachute Brigade on D.Z. "V".

78. 71 Dakotas of 46 Group were detailed, to drop from 0050 hrs.

79. Visibility was good; 7-10/10 cloud at 2000'; wind 290/25 at 2000'. No ground aids were operating on the D.Z.

80. All aircraft reported dropping, between 0049¾ and 0117 hrs., except for one report which is missing. Of 1294 troops carried, 1287 were dropped, 4 had exit difficulties, 2 were injured and one was sick. Of 235 containers 223 were dropped.

/Para. 81..Reports

(To face Fig. 11.)

ANALYSIS FROM FIG. 11.

DROP OF 5 PARACHUTE BRIGADE GROUP ON D.Z. "N".

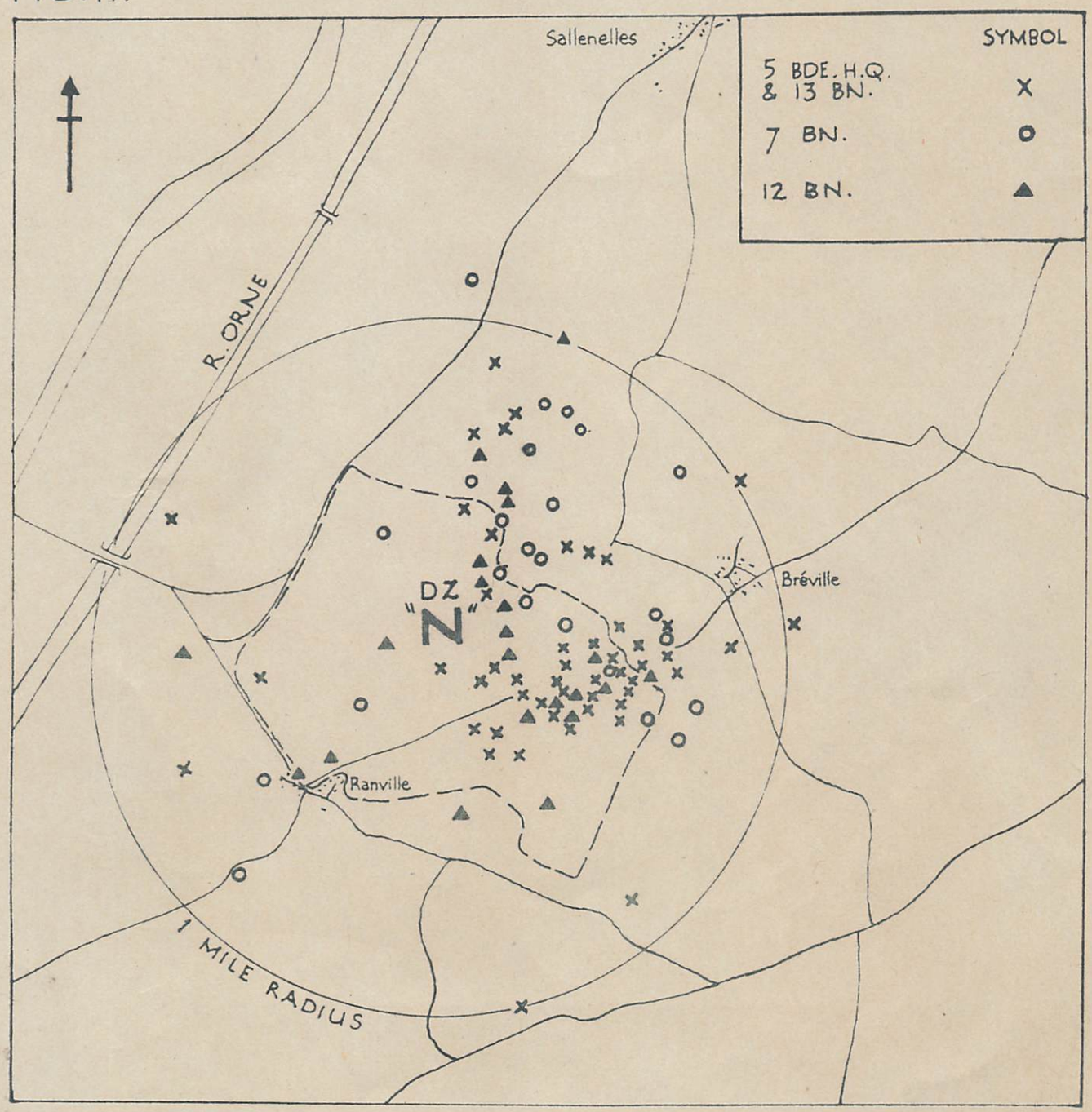
	5 Bde HQ & 13 Bn.	7 Para Bn.	12 Para Bn.	Total 5 Bde Gp.
On D.Z.	29	7	15	51
Off D.Z. but within 1 mi. of centre	18	15	7	40
Over 1 mi. from centre of D.Z.	4	0	0	4

Plotted	95
Missing	5
No information	28
Abortive	3
A/C DETAILED	131

Percentage success : 71%

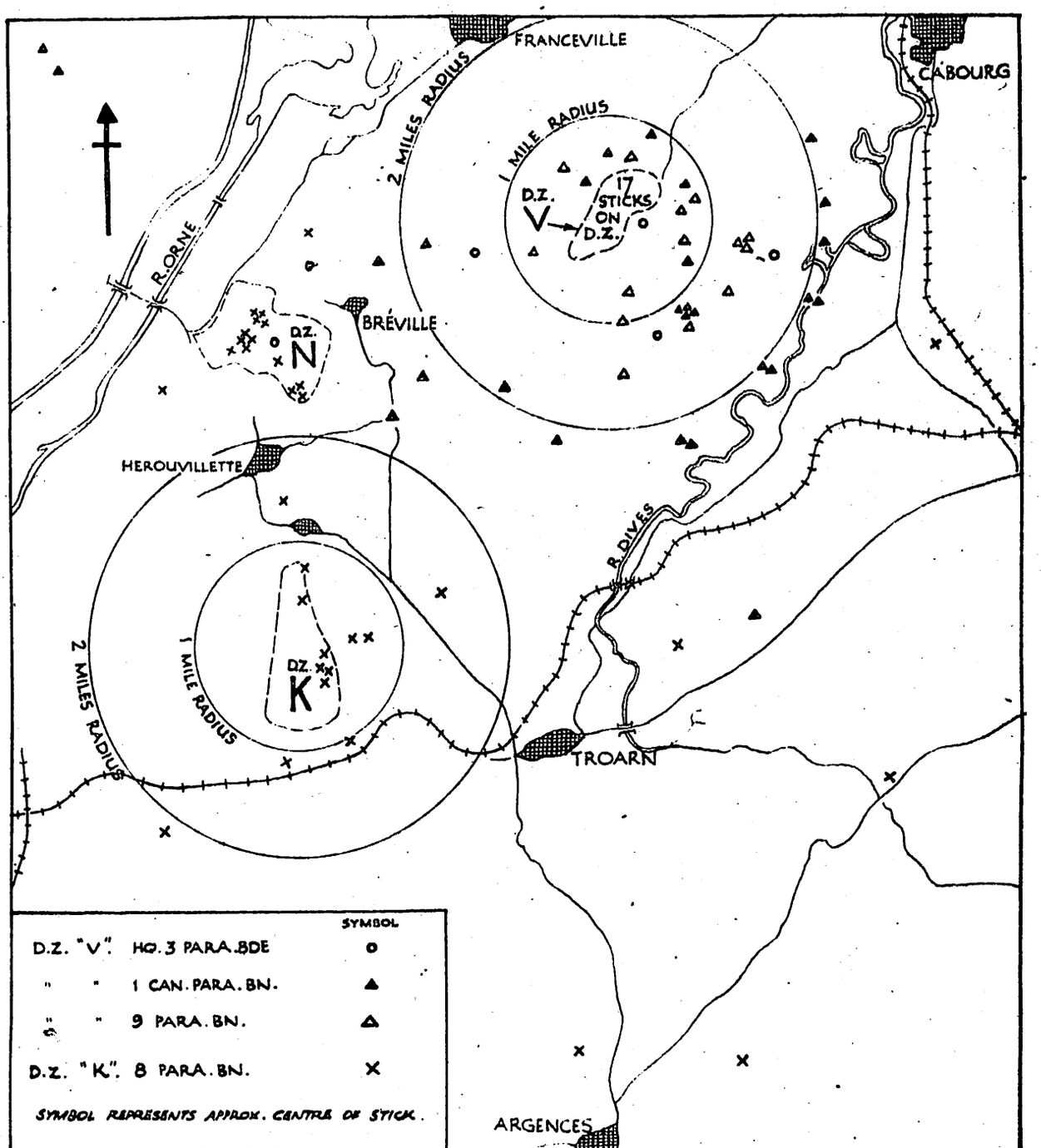
Note :- Figures given for "percentage success" are in all cases comparative, not absolute. In estimating "percentage success", sticks dropped within 1 mile of the centre of the D.Z. are rated wholly successful, and those dropped 1 to 2 miles from the centre are rated 50% successful. No account is taken of sticks dropped at greater distances, although many of these may have played a useful part in the battle. It is important to note that reports are incomplete, and that the absence of a report does not necessarily imply failure in dropping.

FIG. 11.



DROP OF 5 PARA. BDE. GROUP ON D.Z. "N"
NIGHT 5/6 JUNE 1944. (INFORMATION FROM H.Q. 6 AIRBORNE DIVISION)

FIG.12.



DROP OF 3 PARA. BDE. GROUP ON D.Z's V & K.
NIGHT 5/6 JUNE 1944.

FIG. 10

(To face Fig. 12)

ANALYSIS FROM FIG. 12

DROP OF 3 PARACHUTE BRIGADE GROUP ON D.Z's "K" AND "V".

	D.Z. "K"	D.Z. "V".			
	8 Para. Bn.	HQ 3 Para. Bde.	1 Can. P. Bn.	9 Para. Bn.	TOTAL DZ. "V"
On D.Z.	6	1	7	8	16
Off D.Z. but within 1 mile of centre	2	1	5	8	14
1 to 2 mi. from centre of D.Z.	4	3	6	6	15
Over 2 mi. from centre of D.Z.	21	1	16	0	17
Missing	2				0
No information	2				0
Abortive	0				0
DETAILED	37				62
Percentage success	27%				54%

Note:- Figures given for "percentage success" are in all cases comparative, not absolute. In estimating "percentage success", sticks dropped within 1 mile of the centre of the D.Z. are rated wholly successful, and those dropped 1 to 2 miles from the centre are rated 50% successful. No account is taken of sticks dropped at greater distances, although many of these may have played a useful part in the battle. It is important to note that reports are incomplete, and that the absence of a report does not necessarily imply failure in dropping.

* Total of 17 shown on plot (Fig. 12) includes one stick of 8 Para. Bn. for D.Z. "K", dropped on D.Z. "V".

81. Reports from 3 Parachute Brigade indicate that only about 30 of the 71 sticks were dropped on the D.Z. or within one mile of its centre. Most of the remainder were dropped in the low-lying country to the east and south-east of the D.Z., some of these as far as the east side of the river DIVES. (See plot, Fig.12).

PHASE III. (See Fig.6).

Landing of 3 Gliders on the Coastal Battery.

82. Three Albemarle/Horsa combinations of 297 Squadron were detailed; the gliders to land at 0430 hrs. For this very dangerous mission volunteer glider pilots were called for. The gliders were fitted with REBECCA and with arrester parachute gear. Star shells to light the target were to be fired by ground troops attacking the battery.

83. Weather was bad, demanding almost continuous cloud flying; at the target there was 10/10 cloud at 1000'; wind was 300/27 to 310/28.

84. One glider parted from its tug in cloud over England but force-landed successfully. On another glider, the arrester parachute gear streamed in mid-channel : the combination was stalled and lost considerable height, but the jettison gear was operated and control regained. The glider tail assembly had been strained, the controls becoming sloppy, and the starboard under-carriage had been carried away. Flak was encountered from the enemy coast to the L.Z., damaging both gliders and in one wounding four passengers. On arrival in the area, neither glider crew could distinguish the battery, and both made four circuits on tow. The gliders released at 0424½ hrs. and 0425½ hrs. at 1800' and 1200'.

85. Ground lights were seen by one glider crew, but no other ground aids or illuminations were reported. One glider crew mistook a heavily bombed village (MERVILLE?) for the heavily bombed battery, but at 500' realised their error, and turned away, landing successfully in a field 600-800 yards from the objective. The other glider crash landed in an orchard some 50 yards from the objective (See plot, Fig.9). During landing and unloading, M.G. and mortar fire was directed on the gliders, but the battery had been silenced by the 9 Parachute Battalion party by 0445 hrs., before the glider-borne party could get into action.

Landing of the Main Force of Gliders on L.Z. "N".

86. 68 Horsa combinations and 4 Hamilcar combinations of 38 Group were detailed, to land from 0320 hrs. on strips cleared of obstructions. All took off.

87. Weather conditions were not good. Although visibility was fair, a belt of low stratus cloud, with rain, lay over the French coast. At 2000' wind averaged 290/94. Lights and EUREKA were available on the L.Z.

88. Of the 68 Horsas which took off, 50 released over the L.Z. between 0324 and 0334 hrs. at between 1500' and 1600'. Of the unsuccessful gliders, 3 cast off in cloud, 4 cast off over England for other reasons, 7 cast off (or ropes broke) between the French coast and the L.Z. Of these 7, three were being engaged by flak, a total of 25 gliders being reported hit by flak with no injury to passengers or crews. One cast off 2 miles from the French coast; one was released by the tug pilot after assuming a dangerous attitude. Glider pilot reports confirm that 48 gliders landed on or close to the L.Z.

/Para. 89....The

89. The landings were appreciably cross-wind, and there were many collisions with obstacles or with other gliders.

90. Of the 4 Hamilcar gliders, one force-landed in England after breaking the towrope; another is believed to have landed safely after breaking the towrope one mile from the L.Z. The remaining two landed successfully on the L.Z.

Operation "TONGA" : Summary of Results.

91. Parachute Sorties :

266 aircraft were detailed.
264 aircraft, or 99.2%, took off.
255 aircraft, or 95.8%, report successful drops.
7 aircraft, or 2.6% are missing.

4512 troops were carried.
4310 troops, or 95.5% were dropped.

1315 containers were carried.
1214, or 92.3%, were dropped.

92. Glider Sorties.

98 combinations were detailed.
98 combinations, or 100%, took off.
74 gliders, or 75.5%, are reported successfully released.
57 gliders, or 58%, are confirmed by (incomplete) reports to have landed on or near their correct L.Z's.
22 gliders or 22.5% are missing. Of 196 glider pilots, 125 retuned to the U.K., 4 were killed, 14 wounded, and 53 missing.
Of 611 troops carried, 493 are reported successfully released.
Of 59 Jeeps " 44 " " " "
Of 69 M/C's " 55 " " " "
Of 17 6-pdrs. " 15 " " " "
Of 4 17-pdrs. " 2 " " " "
One bulldozer is reported successfully released.
One tank is NOT " " "

93. For a more detailed statement of the results of this operation, reference should be made to :-

"An Analysis of British Airborne Operations on night 5th/6th June 1944 - Operation "TONGA"." (38 Group).,

"Glider Pilot Organisation, Training and Operations" (C.G.P.), and to the detailed plots prepared by H.Q. 6 Airborne Division.

Operation "MALLARD". Evening of 6 June 1944.

PHASE IV. (See Fig. 7).

Landing Zone "N".

94. The total force detailed to land on this L.Z. consisted of 146 gliders : 116 Horsas and 30 Hamilcars. In all, 8 Squadrons were employed, four from each Group. All aircraft detailed took off.

/Para. 95...Weather

95. Weather conditions were good. Visibility was some 10-15 miles, with little or no cloud in the target area. Wind at release height was 320/10-15. Ground strips and EUREKA were available on the L.Z., but little mention of their use is made by tug or glider crews.

96. Of 146 gliders taking off, 142 are confirmed to have landed successfully, although one tug crashed near the L.Z. Of the remaining 4 gliders, one ditched (with its tug, of which the crew is safe), one crashed immediately after take-off, and one force-landed after towrope breakage over England. (See photograph, Fig.13). The total landing period was from 2051 to 2123 hrs., or 32 minutes.

Landing Zone "W".

97. The total force detailed to land on this L.Z. consisted of 112 Horsa gliders, towed by 6 Stirling and Albemarle Squadrons of 38 Group. Of 112 combinations, 110 took off, 2 being unserviceable.

98. Weather conditions were good. Visibility was some 10-15 miles, with little or no cloud in the target area. Wind at release height was 320/10-15. A few crews reported ground strips and smoke on the L.Z. but the great majority of reports contradict this. EUREKA was available.

99. Two gliders force-landed in England. Two cast off over the Channel, of which one ditched whilst one landed safely. Glider pilot reports state that 110 gliders landed on the L.Z.; there is a slight discrepancy in these figures. The total landing period was from 2052 to 2120 hrs., or 28 minutes. Considerable bunching at one stage of the landing was reported, six combinations arriving abreast.

100. Reports indicate some confusion as to the correct direction of landing, the leading gliders having landed in the wrong direction, and the majority having followed suit.

Operation "MALLARD" : Summary of Results.

101. 258 combinations were detailed.
256 combinations, or 99.2%, took off.
246 gliders, or 95.3%, are reported to have landed successfully.

102. For a more detailed statement of the results of this operation, reference should be made to :-

"Analysis of British Airborne Operations on the Evening of 6th June 1944 - Operation "MALLARD"." (38 Group).

"Glider Pilot Organisation, Training and Operations" (C.G.P.).

Use of Radio and Visual Aids on Operations "TONGA" and "MALLARD".

(For detailed information see "Air Signals Report on Operation "NEPTUNE"." H.Q., A.E.A.F. Ref. AEAF/S.25024/ASO-in-C. July 1944).

Use of GEE.

103. On Operation "TONGA", out of the 360 aircraft operating, reports on the performance of GEE have been received from 235.

/Of these.....

FIG. 13.

OPERATIONS "TONGA" & MALLARD".

PART OF L.Z. "N" ON THE EVENING OF JUNE 6TH, 1944.

97 Gliders are shown on this photograph, including most of the 48 gliders which landed on the night of 5/6th June.

The rear fuselages of most of the Horsa gliders have been removed for unloading.

Of these, 203 or 87.1% state that GEE fixes were possible in the target area, 19 that no fixes could be obtained, and 7 that equipment was unserviceable. 4 instances of faulty manipulation have been reported. The new frequencies used were very successful in avoiding jamming. The main reason for any failures to obtain a target fix was fading of the "C signal".

104. On Operation "MALLARD", out of the 256 aircraft operating, reports on the performance of GEE have been received from 197. Of these, 184 or 93.4% state that GEE fixes were possible all the way to the target area. Only 6 aircraft were unable to obtain fixes in the target area. The new frequencies were again satisfactory, but there were rather more reports of partial jamming than in Operation "TONGA". The "C signal", although still weak, was much improved.

105. On the basis of the reports submitted there is no doubt that navigation was considerably assisted by GEE.

Use of REBECCA/EUREKA.

106. On Operation "TONGA", out of the 360 aircraft operating, 235 reported on the use of REBECCA/EUREKA at the DZ/L.Z's. 68 used it successfully, 60 did not attempt to use it and 87 did not pick up the signal. Ranges of 8-9 miles at 1000'-1500' were obtained, but are not maximum as the REBECCA was only switched on 10 miles from the beacon. The EUREKA beacons at Group R/V's were used by a somewhat greater number of aircraft : 101, out of 268 reporting. Ranges were 15-20 miles at 2-3000'. Two of the beacons at Group R/V's were transposed in error, but most crews concerned realised this mistake, and no serious trouble resulted.

107. The percentage of success is comparatively small. Much of the lack of success occurred at D.Z./L.Z."V" where it is known that no beacon was functioning at the critical period. It should be remembered that visual aids were used with good results, which may explain the large number of aircraft which did not use the REBECCA/EUREKA system.

108. On Operation "MALLARD" the REBECCA/EUREKA system on the L.Z's was used by 61 (or 38.8%) of the 186 aircraft reporting. Of the remainder, 10% did not attempt to use the equipment, probably because the operation was in daylight and in good visibility. Ranges were 10-12 miles at 800'-1000', but are not maximum as REBECCA was switched on only when 10 miles from the beacon.

109. 120 (or 59.7%) of the 186 aircraft, which reported, used the EUREKA beacons at the Group R/V's.

110. The results obtained are satisfactory, but it appears that on this particular operation the REBECCA/EUREKA system did not prove necessary. It should however be stressed that in other operations, particularly those undertaken at night with no visual aids, the system might as well be essential to success.

Use of Visual Aids.

111. For the later phases of the night Operation "TONGA", visual aids were ordered on each D.Z./L.Z., consisting of a "T" of Holophane lights and a coded light flashing the letter of the D.Z./L.Z. The results are summarised :-

Cont'd /"T" and coded light....

	"N"	"K"	"V".
"T" and coded light seen	44	12	0
"T" only seen	30	5	3
Coded light only seen	0	5	0
Lights seen but not described	75	0	0
Absence of lights reported	9	7	10
Did not report	8	12	62

On "N" and "K", the lights appear to have been of value, but it seems that on "V" the lights were absent during some (if not all) of the critical period.

112. For the day operation "MALLARD", the visual aids ordered consisted of "T"s of ground strips supplemented by smoke generators. Few crews mention the "T" on L.Z. "N" and none mention the presence of smoke. On L.Z. "W", although 5 reports mention the presence of the "T" and 5 mention the presence of smoke, 30 state that no "T" could be seen. It is likely that in the conditions existing few pilots found these aids necessary, and that the majority paid no attention to them.

Retrieval of Gliders.

113. Although complete plans had been drawn up in advance for the retrieval of gliders after the operation, the ground situation did not permit more than a small percentage to be retrieved. The two main L.Z's had been a field of battle for several weeks. Ultimately, 40 Horsas were towed out from strips built on L.Z'S "N" and "W", using Dakota tugs and a ground party of H.G.S.U. Of these 40, one ditched but 39 landed safely in England. In addition, about 1200 tons of glider spares were salvaged.

III. LESSONS LEARNED.

114. The results of the airborne effort in Operation "NEPTUNE" have confirmed high hopes of what could be done with airborne forces rightly used. All the main military tasks were carried out, and at a lower cost than would have been paid in using any other arms of the service; most of the tasks were such that only airborne forces could have undertaken them.

115. Nevertheless there was a certain proportion of failure, or of only partial success, particularly in the night parachute dropping. When the causes have been examined, and the avoidable mistakes noted, some inevitable margin of error must remain. Whenever risks are to be accepted, this margin must be allowed. It has always been granted that the air commander cannot guarantee to the army commander the complete delivery of a given force on a given point. He can at best guarantee that most of the force will be delivered reasonably near that point, the balance depending upon two partly known factors - the weather and the enemy - and on the unknown factors commonly described as luck.

116. A lesson of the operation, or rather a confirmation of an old lesson learned, is therefore that the plan should not rely over much on precision in time or space; that if possible, no one airborne unit or task should be vital to the whole operation.

/Para. 117..Aircrews

117. Aircrews can promise a very high proportion of success if given two things : reasonable visibility, and reasonably good ground aids. Given only one of these, they can still promise a fair degree of success. Given neither, they can promise merely a cheerful attempt, and no amount of extra training, with the equipment at present available, will greatly improve the prospects.

118. Of the avoidable errors, two seem to be outstanding, and concern methods of navigation :-

(a) It has always been emphasised that radio aids are "aids" to D.R. navigation, and never substitutes for it. In most cases radio aids were wisely used, but it is clear from results that some crews leaned so heavily on these aids that when the aids failed their navigation broke down.

(b) Those crews who had been trained to fly in formation as such, relying more or less on a leader, were notably less successful than those trained to "individual navigation". It is no answer to say that had the leaders succeeded all would have succeeded. It is now agreed that individual navigation is essential.

119. It is only fair to add that the majority of the unsuccessful aircraft concerned were detailed to a very difficult D.Z. There was no radio aid on this D.Z., and probably no visual aids. The drop had to be made not more than 4000 yards from a coastal entry point which itself was not distinctive. This difficulty had been foreseen, but had been accepted in deference to the military plan.

120. The relative risk of day and night glider landings were carefully weighed in drawing up the plan, and it was appreciated that the risk from flak during a day landing might exceed the risk of crashes or inaccurate landings by night. Every case must of course be judged on its merits, but the comparative results of the day and night glider landings suggest that, all things being equal, the balance is rather more in favour of the day landing than was believed.

121. The use of four different types of aircraft, carrying different military loads at different speeds, complicates both the army load planning and the flight planning, the latter already complicated by the use of parachute and (slower) tug aircraft in the same mass formation. This use of miscellaneous types may also result in bunching on the route, which increases the risk of an aircraft entering another's wake, and may create gaps in the arrival flow. A reduction in the number of types would have many advantages, not the least being the opportunity to simplify army and air planning, and so to speed up the laying-on of opportunity operations.

122. The chief cause of abortive glider sorties continues to be the parting of tug and glider en route, usually through rope breakage. This is most commonly due, either to flying in the wake of other aircraft, or to getting badly out of position whilst in cloud. It is arguable that the former risk is one which must be accepted for the sake of compact formation, whilst cases of trouble in cloud have not been so numerous as to suggest that weather hazards have been under-estimated, and this also seems a reasonable risk. The desirability of strengthening the towropes is being considered, with due regard for the fact that the towrope is in the nature of a "weak link" : a situation may arise where it is preferable that the rope should break.

/Para. 123..The main

123. The main glider landing zones seem to have been ample in size, and there is no doubt that with thorough training glider pilots can achieve very close concentrations.

124. The enemy's obstruction poles seem to have been ineffective. Many of these poles were so short that the Horsa wing could clear them, and although some gliders collided with poles, little damage worse than broken wingtips, and few injuries, have been reported.

125. Of the visual aids, the lights (particularly the flashing beacons) seem to have been valuable, but the value of the daylight smoke signals seems doubtful.

126. No particular failures of equipment or manipulation were sufficiently common to deserve mention.

127. Briefing was probably a little too hurried. But for the postponement of the operation for 24 hours, only two clear days would have been available for briefing aircrews, most of whom were concerned with two successive tasks. Even the three days available were hardly adequate; for example, by no means full use could be made of the briefing film, and little direct use could be made of the one model.

128. Models are invaluable for airborne operations, but must be properly used. Aircrews should have repeated opportunities for visits to the model, but if more than a given number are admitted at one time, few will benefit. Wrong impressions are easily gained unless the proper viewpoints and lighting are demonstrated. One model per station therefore seems necessary. In spite of early demands, only one model (requiring considerable finishing work) was provided for eight stations, and this at so late a date that full use could not be made of it to produce photographic briefing material. To judge by the low priority given to 38 and 46 Groups, it would appear that the importance of models for airborne briefing is not fully appreciated.

129. In conclusion : the experience gained from Operation "NEPTUNE" does not necessarily produce a set method for the future. In a large-scale spearhead operation of this kind, where the ground situation is more or less static, ample time is given for detail planning, and there is unequalled opportunity for surprise. Such conditions are unlikely to recur, and the planning of the opportunity tasks to come may be to a different pattern, as technique develops. Meanwhile, the airborne arm has for the first time fully proved itself, and will undertake its future tasks with the confidence of experience.