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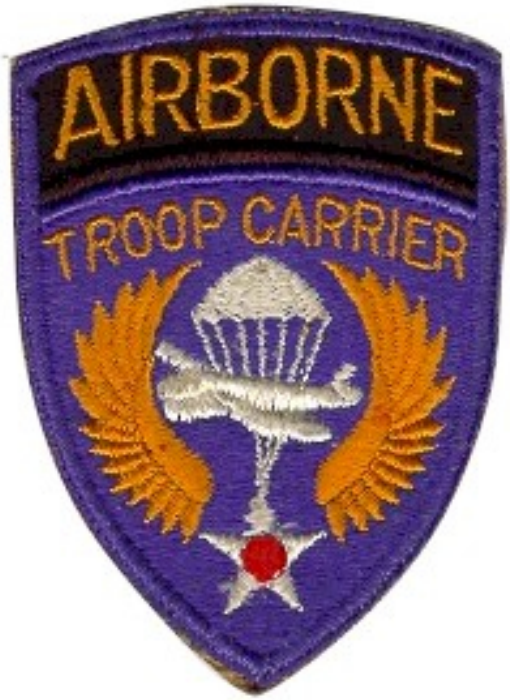

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OPERATIONAL RESEARCH SECTION A-3 NAAF.

REPORT NO. N.4.

REPORT ON THE PARATROOP OPERATIONS OF THE N.A. TROOP CARRIER COMMAND AND THE 82ND (AMERICAN) AIRBORNE DIVISION ON THE NIGHTS OF 13th-14th AND 14th-15th SEPTEMBER, 1943, WITH PARTICULAR REFERENCE TO THE NAVIGATIONAL AIDS USED IN THESE OPERATIONS.

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The report is in the following sections -

SECTION 1. A short account of the tactical situation making necessary airborne operations under review.

SECTION 2 & 3. An account of the plans of the two operations ('Giant III' for the reinforcement of 5th Army on two nights, and 'Avalanche' for an attack on Avellino.)

SECTION 4. A review of the navigational aids available for the operations.

SECTION 5. An account of the navigational aids used.

SECTION 6. A description of the rehearsals and practices carried out before the operations.

SECTION 7. A narrative of the two operations comprised in 'Giant III'.

SECTION 8. A narrative of the paratroop operation 'Avalanche'.

SECTION 9. Description of the state of the navigational beacons after being dropped and returned.

SECTION 10. Conclusions regarding the Navigational Aids used.

SECTION 11. Recommendations concerning navigational aids to Paratroop Dropping.

APPENDIX A. S.O.I. giving communications and navigation aids to be used in operation 'Giant.'

APPENDIX B. Details of use of Radar by 52nd T.C. Wing in operation 'Giant III.'

APPENDIX C. Note on the condition of the Eurekas returned to Sicily after operation 'Giant III.'

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SECTION 1. TACTICAL SITUATION.

1.1. The operations of the 82nd Airborne Division on the nights of 13th-14th and 14-15th September were made necessary by the serious situation which had developed on the Salerno sector of the Allies' attack on Italy. A beachhead stretching from Campenella to Agropoli had been seized by the 5th Army and initially the landed troops held the high ground which surrounds the beachhead in an arc some 7 miles inland. The Germans counter-attacked, however, drove the Allied troops from the hills and advanced down the Sele river between the two halves of the Army, the 10th British Corps and the 6th American Corps. By the 13th of September it had penetrated beyond Battipaglia and was threatening to cut the Army in two.

1.2. To prevent this all available forces of the 6th Corp had to be drawn northwards into the Sele river - Battipaglia area. Only a few companies of beach engineers and other non-combatant troops were left holding the various passes through the mountains on the South flank of the 6th Corps. An attack by the Germans on this flank could have penetrated without difficulty to the coast and caught the 6th Corps in a pincer movement. Reconnaissance reported German troop movements which might indicate such an intention.

1.3. In these circumstances reinforcements were imperative and it was accordingly decided to drop by parachute behind our own lines the Units of the 82nd Airborne Division which had been standing by in Sicily for some days. It was also decided to carry out at the same time a previously planned attack on Avellino, the communications centre of the German Army operating in the Salerno area, with the intention of preventing reinforcements reaching the Germans.

SECTION 2. PLAN OF OPERATION 'GIANT III'. (Reinforcement of 5th Army.)

2.1. It was decided that in the Salerno sector half of the 504th Airborne Regiment (800 troops) should be dropped on the 1st night (13th - 14th September,) and, if the drop was successful, the whole of the 505th Airborne Regiment (2100 troops) should be dropped on the same Drop Zone the following night. The troops would be carried on both occasions in the C-47's and C-53's of 52nd T.C. Wing.

2.2. A D.Z. was chosen some 5 miles behind our front line between the main road and the sea. (Coordinates 15° 1' E, 40° 23' N,) and since it was in friendly territory arrangements were made to place lights on the D.Z. in the shape of a large T, the vertical stroke of the T pointing up wind. Despite the considerable aid which these lights alone could provide, it was decided that on each night a pathfinder force of 3 a/c should be sent in 15 minutes before the main force, carrying with it all available aids which could be set up on the D.Z. to assist the oncoming a/c in finding it. The pathfinder force itself would have to find the D.Z. by D.R. navigation. Since the a/c were routed along the West coast of Italy a number of check points would be visible in the bright moonlight, thus making D.R. navigation simple.

SECTION 3. PLAN OF THE OPERATION 'AVALANCHE'. (Attack on Avellino.)

3.1. The plans of the operation 'Avelanche' were changed several times immediately prior to its execution, but as finally adopted they consisted in dropping 598 troops of the 509th Airborne Regiment on a D.Z. 2.5 miles South of Avellino (coordinates 14° 50' E, 40° 53' N.) The troops were to be carried in the C-47's and C-53's of 64 Group, 51st Wing, T.C.C. and an advance marker force was to be dropped from a single pathfinder aircraft 15 minutes before the main force. The route to the D.Z. lay along the West coast of Italy on a similar path to that used by the a/c of 52nd Wing in their operation of the same night. From Agropoli in the South of the Salerno plain the route lay parallel to the

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road and rail joining Agropoli and Battipaglia, then in the same direction over Montecorvino, through the gap between M. Garofano and M. Terminio, over S. Lucia di Serino and then parallel to the river, road and rail to the D.Z. The D.Z. itself was fixed by a crossroads and a triangular shaped grove of trees. The troops were to occupy Avellino, destroy the bridge there or deny its use to the enemy and to hold the town until the 5th Army moved in from the Giffoni direction. The troops understood that this would be between 2 and 5 days after the drop. Through some unexplained breakdown in intelligence the force was totally unaware of the true situation on the Salerno front.

SECTION 4. NAVIGATIONAL AIDS AVAILABLE FOR PARATROOP DROPPING.

EUREKA MARK 11.

4.1. Eureka is an R.D.F. responser beacon weighing 50 - 55 lbs. when packed. It can be packed in an ordinary sized kitbag and the British Independent Parachute Company has found that the best way to drop it is to strap it to the leg of a paratrooper. After the paratrooper's chute opens a quick release device enables him to release the bag from his leg so that it can be lowered on 20 feet of rope. By this method the kitbag prevents the paratrooper from oscillating, while its weight does not make him hit the ground harder than usual. The bag can be readily recovered by following the rope from which it was suspended.

4.2. A choice of frequencies in the beacon both for interrogation and reply can be selected by knobs on the top of the set. The beacon can be keyed to give out an agreed call sign. There are detonators fitted in the beacon which give complete destruction. Even if the beacon falls into enemy hands without being destroyed, the fact that the frequencies and the call sign are not known to the enemy would prevent him using it as a decoy.

4.3. The beacon has 3 units, a Nife battery of 6 hours life, a power unit and the combined receiver-transmitter. The aerial is an end-fed dipole attached to the top of a 6 foot aluminium tripod. Other Marks of Eureka have been designed, including a light weight set which can be carried by a paratrooper in a special belt. The best beacons available, however, in North Africa during September, 1943 were the British-made Mark 11.

4.4. The interrogator equipment in the a/c which works with the Eureka is known as Rebecca. Its cathode ray tube display unit gives the distance of the a/c from the beacon and the heading of the a/c in relation to the beacon. Troop Carrier Command in the Italian theatre of war had only 16 aircraft fitted with Rebecca and these were all in 52 Wing. The equipment, moreover, was only a hurriedly made "mock-up" prepared in America by modifying units of other types of R.D.F. gear. Its range was poor owing to lack of power in the transmitter. In the weeks immediately prior to the mission 28 personnel of 52 Wing were trained as Rebecca operators by sergeants of 38 Wing, R.A.F. For the mission itself it was decided to use the B-D frequency channels since the Rebecca transmitter worked best on the B frequency.

5G C.W. TRANSMITTER.

4.5 All C-47's and C-53's in Troop Carrier Command NAAF are fitted with radio compasses SCR 380 or SCR 269. SCR 280 requires ICW for its operation but SCR 269 will operate on CW. Both sets are tunable from 250 - 1,750 kc and indicate whether the a/c is heading directly towards the transmitter of the signal to which the compass is tuned. SCR 269 also gives for any position of the a/c its heading off the transmitter. These radio compasses are used extensively by all pilots in the United States and are also used in North Africa and Sicily by the pilots of T.C.C. to provide homing facilities to its airfields, an SCR 188 transmitter being used as the homing beacon. Recent reports indicate that the radio compasses in the a/c of T.C.C. are very uneven in their performance.

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4.6. The SCR 128 transmitter weighs c.1500 lbs (with batteries) and is, therefore, too heavy for this pathfinder work. Various alternatives have been tried and the modified 5½ Admiralty transmitter which is used by the British Airborne Division for rear link working has proved the most satisfactory so far. It weighs 33 lbs, consisting of transmitter, aerial coupling unit and telescope mast antenna, with 34 lbs of battery and can be packed in a kitbag in the same manner as the Eureka beacon. Its output is 4 - 6 watts, crystal controlled and as modified by Capt. Pike of the 1st O.R.G., XV Army Group, it will operate on frequencies within the range of the radio compass and will put out an ICW signal. Test flights have indicated that the average maximum range for operating the radio compass at 500' altitude is 40 miles. The equipment requires, however, careful adjustment on setting up in order to get maximum power output. The beacon can be keyed for recognition purposes but this is the only security measure against enemy capture and use as a decoy.

LIGHTS AND FLARES.

4.7. A variety of coloured lights and flares for lighting D.Z's has been tried, the 12 volt recognition lights off a/c being found very effective. In the 'Giant 111' operation, however, reliance was placed on iron troughs 3' x 1' in surface area filled with a mixture of sand and petrol. They could be lit on the approach of each Group of a/c by throwing in a match and extinguishing by a cardboard or metal sheet when the a/c had dropped their loads. Krypton lights which give a single flash visible for 30 miles on each depression of the button switch were also available, but were not used on the D.Z. for signalling to the a/c.

4.8. A/c can also be guided into a D.Z. by flashing a narrow beamed light at them from the D.Z. The lamps which are used for daylight signalling have proved to be effective for this purpose, such as the British Aldis lamp, the American Navy Aldis lamp and the American E E & 4 Signal Corps lamp. These lamps have, however, a narrow beam which makes it difficult for the operator to be sure that he is directing the beam correctly. One lamp, moreover, can only handle one a/c at a time.

SECTION 5. NAVIGATIONAL AIDS ACTUALLY USED IN THE TWO OPERATIONS.

5.1. For operation 'Giant 111' it was decided to have on the D.Z. as well as the petrol flares a Eureka operating on B-D frequency and a 5G transmitter on 1690 kcs and a blue Krypton light. Each beacon was allocated a call sign. The pathfinder force was also to take in several handie-talkies (SCR 536) for inter-communications between themselves. Attached in Appendix A is a copy of the SOI issued by 52nd T.C. Wing for the original 'Giant' operation (Rome) involving gliders. When the D.Z. was altered the seaborne aids and the radio range had to be dispensed with but all other arrangements stood.

5.2. For operation 'Avalanche' a 5G transmitter on 1690 kcs and Aldis lamps were to be used on the D.Z. The transmitter had a call sign and the Aldis lamps were to flash an 'N' at the oncoming a/c and then to t throw a steady beam vertically upwards as the a/c passed overhead.

SECTION 6. REHEARSAL MISSIONS PRIOR TO OPERATIONS 'GIANT 111' AND 'AVALANCHE.'

6.1. In order to familiarize the pilots of T.C.C. NAAF with the problems involved in such operations as these and to test out the proposed Navigation Aids, a series of rehearsals were carried out in the Sousse-Kairouan area during 25 - 31st August. The rehearsals actually had in mind another operation which was subsequently cancelled, but the experience gained was still of great value. The most significant of the rehearsals are described below.

6.2. Full scale rehearsal of 28th August. This rehearsal involved all available a/c in both Wings of T.C.C. NAAF. A full scale model of the D.Z's and L.Z's proposed for the intended operations (gliders were also

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to be used) was laid out at the same distances inland from the coast. The only difference from the intended operation was the difference in magnetic bearings of the route to be flown in approaching the coast. 2 destroyers, a submarine and a launch were arranged in a straight line pointing towards the correct landfall. These craft flashed agreed light signals at the approaching a/c and also gave out an ICW signal from their radios for use on the a/c radio compasses. The submarine was to flash a red light. The launch marked the point on the coast at which the a/c should turn to make their final run over the D.Z. or L.Z. The L.Z. for 51 Wing were marked by a 5G transmitter and coloured lights while 52 Wing's D.Z. were marked with a British Mark II Eureka and coloured lights.

Most pilots saw the lights on the destroyers and some claim to have seen the light on the submarine but no one saw the launch's light. Many pilots reported finding the ships out of position by as much as 4 miles. Many a/c failed to pick up the radio signals from the ships while some of those that did found the signals off frequency with an effective range less than that of the lights.

The 5G transmitter on the L.Z. of 51 Wing gave wrong indications because there was in the same vicinity a point-to-point HF station working on the same frequency. It may have been due to this fact that of the 150 a/c of the 51 Wing which took part only 2 passed over the L.Z. and 17 passed within visual range of it. Another 40 passed near enough for their gliders to have reached the L.Z. if cast off at the right moment. The lights on the L.Z. were useless because there were innumerable other lights in the vicinity, mainly car lights on the various roads.

52 Wing at this time consisted of 5 Groups of approximately 30 a/c each. The plan was that the whole Wing should fly in to D.Z. in mass line-astern formation, reliance being placed entirely on the navigation of the leading a/c. Actually, however, the Groups became separated. The 3 Groups which were led by Rebecca-fitted a/c found the D.Z. by its use. They picked up the D.Z's Eureka at 15, 18 and 19 miles and two of the Groups passed directly over the beacon, the third being 60 yards to the left. The two Groups not having Rebecca-fitted a/c had to rely on straight navigation. One passed in the vicinity of the D.Z., while the other was 1 mile south of it.

6.3. Resupply Rehearsal of 29th August. On this occasion 10 a/c of 52 Wing, two from each Group, practised a resupply mission. A Eureka beacon was assumed set up by the paratroopers requiring resupply and the a/c were to drop down to an altitude of 50' above the Eureka and to push out their bundles, without parachutes, immediately after passing over it. There was a high wind gusting at 35 m.p.h. on this particular night, yet 3 a/c succeeded in making a perfect run up, losing height correctly by the aid of the ranges indicated on their Rebeccas and passing directly above the beacon. 4 a/c were blown 300 yds to the leeward of the beacon but were otherwise correct, while 2 a/c not using Rebecca were 500 yds away. 1 a/c lost its lead ship and failed entirely to find the D.Z. Average range of pick up of the Eureka was 10 miles which was hardly sufficient in the high wind to permit proper course corrections to be made. No lights were shown on the D.Z.

6.4. 52nd Wing's rehearsal of 31st August. This was a full scale rehearsal for all the a/c of 52 Wing but in this case the destroyers were not available. Their presence was simulated by an SCR 188 transmitter on the coast. Navigating by means of their radio compasses to this transmitter gave the a/c their correct landfall. A pathfinder force flew in 15 minutes ahead of the main formation to drop marker troops carrying a Eureka beacon. This was done, the pathfinder force being dropped accurately in the centre of the D.Z. Within 5 minutes the Eureka was working and being triggered by the oncoming a/c. All a/c picked up the SCR 188 transmitter on the coast without difficulty, while the Eureka was picked up by the Rebecca-fitted a/c which led 4 of the Groups

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at 6, 6, 8, and 11 miles. Some a/c actually dropped troops while others flashed their recognition lamps at the moment when, if they had had paratroopers on board, they would have given the signal to drop. The distances from the D.Z. at which paratroopers would have been put down were as follows :-

314th Group	0-200 yards.
313th Group	1/2 mile to 1 mile left of beacon.
61st Group	Group leader 300 yards away, rest of the Group ragged, overshooting the D.Z. by distances up to 1 mile.
316th Group	0 for lead ship, others undershot up to 1/2 mile.
Provisional Group.	This Group had no Rebecca-fitted a/c and overshot the D.Z. by 1/2 mile and 200 yards to left.

If paratroopers had actually been dropped it was estimated that over 90% would have landed in a rectangle of dimensions 1.5 by 2 miles.

SECTION 7. OPERATION 'GIANT 111.'

7.1. Shortly after dusk on 13th September, the 3 pathfinder a/c carrying 50 paratroopers took off from Agrigento airfield in Sicily. The leading a/c of this element was piloted by Lt. Col. Crouch, A-3 of 52 Wing, and contained the leader of the advance troops Lt. Col. Freeman with paratroopers ready to take down a Eureka beacon, a 5G transmitter and a Krypton lamp. The second a/c carried a further Eureka and Krypton lamp, the third a/c contained local security personnel to protect the D.Z. if attacked while the main force was landing. Each a/c also carried a handie-talkie (SCR 536) for intercommunication between the 3 sticks when they had landed. A proportion of the force had been trained to set up and operate the Eureka and the 5G in the darkness. The force was briefed that no matter what happened it had to get a Eureka beacon set up and if possible, the 5G transmitter as well.

7.2. Under the skilful leadership of Lt. Col. Crouch, the 3 a/c flew up the west coast of Italy and crossed over the peninsula between the Golfo di Salerno and the Golfo di Policasto along the valley of the Alento river. Just as the pilot remarked that they should be over the D.Z. a flash lamp was seen signalling immediately below and a few seconds later a Verey pistol was fired. As the 1st troops jumped the petrol flares were lit, finally removing any doubt as to whether the correct D.Z. had been found. The 1st stick landed right among the petrol flares and had its Eureka operating in 3 minutes. The second Eureka landed on the far side of a ditch and by the time it reached the D.Z. the other was going strong. It was treated, therefore, as a standby. The straps by which the kitbag containing the 5G transmitter was attached to the paratrooper's leg tore loose from the bag itself when the paratrooper's chute opened with a violent jerk. The paratrooper was unable to prevent the transmitter crashing to the ground and smashing beyond repair. The attempts made by the main force to tune their radio compasses to a beacon on 1690 kc were, therefore, doomed to failure.

7.3. The Eureka beacon was being triggered immediately by the oncoming a/c of the main force and it continued in uninterrupted operation for the next 3 hours. The a/c came in from all directions and it seemed to the ground observers evident that they were homing on to the Eureka. No enemy opposition by flak or fighters was met during the mission but enemy a/c were heard in the vicinity, necessitating the extinguishing of the petrol flares after each Group had passed over in order not to give too much away. Lt. Col. Freeman stated that 1 enemy a/c circled overhead for upwards of 1/2 hour and seemed to be trying to find the frequency of the Eureka-Rebecca. Every so often it appeared to tune a transmitter to the Eureka receiver frequency, thus triggering the set. The odds against the frequencies of Rebecca-Eureka being found by this method are, however, enormous. The detailed reports of each Rebecca fitted ship which flew on this mission are given in Appendix B. It will be seen that 9 Rebeccas out of 11 gave satisfactory

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results with ranges from 7 to 13 miles.

7.4. The bulk of the troops were dropped within 200 yards of the Eureka and all dropped within 1 mile except B company of the 1st Battalion which was dropped 8 - 10 miles southeast of the D.Z. This company succeeded in rejoining the main force the following day. One man only was injured in the drop. In 60 minutes the paratroopers (800 in all) had collected round the Krypton light which was used as a rallying point and the D.Z. had been cleared. The same night the troops were packed on lorries and taken to a position near Albanello. In 24 hours they had a strongly fortified position prepared and confidently awaited any attempt of the Germans to break through. 4 days later the Regiment made a night attack on Altavilla. After a hard fight in which 2 of the staff officers were killed and Lt. Col. Freeman wounded it succeeded in capturing and holding this town.

14th - 15th September.

7.5. The departure of the pathfinder force of the 505th Regiment was as uneventful as that of the 504th. Lt. Col. Crouch was again the lead pilot and Lt. Col. Billingsly led the advance marker force of 29 men. The same number of navigational aids were carried as on the previous night and were distributed in the same way between the two leading a/c. The same D.Z. was again found without difficulty, the petrol flares being lit as the 1st a/c came over. Troops of the 504th also set up one of their Eureka beacons on the D.Z. to assist the pathfinder force but it was not used because none of the pathfinder a/c was fitted with Rebecca.

7.6. The pathfinder force with the 2 Eurekas and the 5G transmitter all landed safely on the D.Z. and one Eureka was in operation within 5 minutes of arrival. Lt. Col. Billingsly then instructed the other Eureka teams by means of the haplie-talkies (SCR 536) with which the force was also equipped, not to operate. Although the 5G transmitter landed intact it was not set up because its frequency was the same as that taken in by the 509th on the same night. The Krypton lights were also not used. Details of the performance of the Rebecca-fitted a/c in the main force which homed on the Eureka are given in Appendix B, from which it will be seen that 9 out of the 11 Rebecca-fitted a/c picked up the beacon successfully with ranges from 6 - 17 miles.

7.7. The bulk of the troops were again dropped within 200 yards of the beacon, the furthest troops being less than a mile and a half away, except for 2 a/c which dropped their troops 20 miles to the north of the D.Z. Within 45 minutes of the last a/c passing over the D.Z. the 2100 troops were loaded into the 60 trucks which had been made available and were on their way to protect the southern flank of the 6th Corps, one battalion being stationed in front of Agropoli, one by Oglianto and one by Capaccio.

7.8. The following day motor patrols of the Regiment moved south as far as Sapri where they met forward units of the 8th Army which had advanced up the coast. The relieved beach engineers were able to return to their unloading, which had fallen 3 days behind schedule, while the hard pressed 45th Division was withdrawn from the front line to reform.

SECTION 8. OPERATION 'AVALANCHE.'

8.1. The advance marker force which preceeded the units of the 509th Regiment in their attack on Avellino carried with it one 5G transmitter on 1690 kcs. and several Aldis lamps and EE 84s with batteries. The equipment was packed in an A-5 container and was dropped separately, but was easily found because one paratrooper landed immediately beside it. The marker force was dropped 1 - 1.5 miles South of the D.Z. but

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not having time to move to the proper D.Z. the marker force decided to set up the 5G where they were. The only damage sustained by the 5G in the drop was a smashed morse key. In 10 minutes it was working though the 1st a/c of the main force did not come over for another 25 minutes. The beacon was operated from 10.40 until 1.10, after which it was smashed up and hidden. Parts were subsequently found by Italian peasants and returned to our troops.

8.2. 2 a/c only reported picking up the 5G transmitter on their radio compasses when the a/c were 5 miles from the D.Z. and the indications were not reliable. This may have been due to the high hills surrounding the D.Z. or to the inexperience of the operators of the transmitter. However, in the light of this experience and of previous trials the C.O. of the 64th Group recommended that the 5G beacon should not be used since it was not reliable and only led to confusion.

8.3. 8 pilots reported picking up the Aldis lamp on the D.Z. and being successfully guided by it. The EE 84 proved to be the most useful of the lamps available. Many pilots found difficulty in choosing the right gap in the mountains above Salerno. One Squadron (9 a/c) went several miles up a wrong valley before its leader realised his mistake and returned to the Salerno plain to start again.

8.4. By the 8th October information had been accumulated of the fate of the troops from 38 out of the 40 a/c which took part. 15 a/c only dropped their loads in the vicinity of the D.Z., the remainder dropping from 8 to 25 miles away. The average distance from the D.Z. was approximately 7 miles. 11 a/c dropped their troops E. and S.E. of Cassano - 10 miles from the D.Z. (coordinates 15° 3' E., 40° 51' N.) These a/c would appear to have taken the wrong gap in the mountains, passing to the right instead of the left of M. Terminio and then dropping their troops in an area with physical characteristics somewhat similar to the correct D.Z.

8.5. Owing to the mountains the troops had to be dropped from 3,000 - 5,000', i.e. 1,500 - 3,500' above the ground. There was, however, very little wind so that the sticks were not scattered unduly while the long drop gave the troops time to loosen their harness in preparation for a quick release of their chute when they hit the ground. Most of the troops which were not dropped on the D.Z. itself landed in woodland or vineyards in which the vines were growing 8 - 10' high. They had, therefore, great difficulty in finding each other and in most cases failed entirely to find their equipment bundles. One supply section which had tied all its bundles together (this is standard practice) searched the terrain exhaustively all night and then took refuge in the hills in the morning. From there they eventually spotted their bundles resting in the top of some tall trees where they dare not venture to retrieve them. The attacking force was, therefore, split up into small groups, some a long way from their objective, and all very lightly armed. Several days after the drop the largest force which had collected together was 80 men. None of the mortars and bazookas which had been dropped were retrieved and only a very limited supply of dynamite.

8.6. Nevertheless, a small force did penetrate into Avellino, where it moved across the main road a conveniently placed road-block, and blew a hole in the bridge with the 25 lbs. of dynamite which it had. The force was, however, too weak to hold the town, so like the rest of the scattered force, they took to the hills, whither the Germans made no attempt to follow them. Since they hourly expected the arrival of the 5th Army they did not attempt to move Southwest to rejoin our own troops, but remained in hiding in the hills, being fed by the Italians and doing such damage as they could to isolated trucks, telephone wires, etc. When at first only a few officers and men returned to our lines it looked as if the bulk of the force had been wiped out, but when the 5 days were up and the 5th Army still failed to materialise round Avellino they began to attempt to cross over to our lines. By 8th October only 118 out of the total of 598 in the force were listed as missing, captured or killed.

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8.7. The widely scattered troops gave the Germans the idea that 3,000 troops had been dropped and they strengthened their guards accordingly. Since, however, they made no concerted effort to round up the para-troopers they can not have regarded even 3,000 scattered troops as a serious menace. This was, therefore, very small consolation for the failure to achieve the main objects of the mission, a failure which must be laid principally at the door of the airforce which failed to drop the troops as a united force on the D.Z.

SECTION 9. STATE OF EQUIPMENT AFTER THE DROP.

9.1. The 4 Eurekas dropped in the 'Giant 111' operation on the nights of 13 - 14th and 14 - 15th September were returned to Sicily. Appendix C is a note on the state of the Eurekas on their return. An assurance was received from the troops concerned that all the damage was done during the drop. It will be noted that the Eurekas packed in the small kitbags suffered more damage than those packed in the large ones. The lace-up type of kitbag is by far the easiest to pack and unpack. Switches and switch knobs appear to be the most vulnerable parts of the Eurekas. The cast lug on the aerial tripod and the Nife accumulator boxes also suffered much damage.

9.2. Only one 5G transmitter was returned to Sicily after the operations, the one taken in but not used by the 505th Airborne Regiment. This proved to be in excellent condition. Of the other two transmitters one was smashed during the drop and the other had to be smashed up after use on the Avellino D.Z.

SECTION 10. CONCLUSIONS REGARDING THE NAVIGATIONAL AIDS USED.

10.1. 'GIANT 111'.

1. The dropping of advance marker troops by a pathfinder force was a success.
2. The route chosen for the formations made navigation easy in the bright moonlight.
3. The D.Z. being in friendly hands could be so brightly lit that no one should have had any difficulty in navigating to the D.Z. without other aids.
4. Rebecca-Eureka was not really, under these excellent conditions, necessary, but it was welcomed by the pilots flying with it because it gave them confidence that the correct D.Z. had been found and aided in correct tactical approach by giving accurate ranges.
5. The average range of pick-up of the Eureka was 9 miles. This is poor compared with ranges obtained on test but is probably due to the low power of the transmitter in the a/c Rebecca equipment.
6. Some parts of the Eureka are not sturdy enough to withstand the shock of landing even when carefully packed.
7. The 5G transmitter can be dropped successfully but has not yet been given an adequate operational trial as a radio compass beacon.

10.2. 'AVALANCHE.'

1. The advance marker troops helped navigation to the D.Z. appreciably.
2. The 5G transmitter did not operate successfully but in view of the inexperience of the operators and the terrain the test cannot be regarded as conclusive.
3. Some success was obtained with the Aldis lamp.
4. Aircrews must be capable of navigating to within range of the aids provided on the D.Z. by the pathfinder force and not get

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lost on the other side of high mountains.

SECTION 11. RECOMMENDATIONS ON NAVIGATIONAL AIDS TO PARATROOP DROPPING.

11.1. The technique of a pathfinder force in Airborne operations to take in the optimum number of navigational aids well before the main force should invariably be adopted. The advance troops should be highly trained to operate the navigational aids in darkness and the pathfinder aircraft should be led by the most expert pilot in D.R. navigation. Any aids to navigation which can be operated in the pathfinder aircraft, such as H2S, should be used if available. Such a pathfinder force might well go in a night or two before the main operation.

11.2. Rebecca-Eureka should be used on all operations. It is indispensable when there is an overcast or bad visibility - adverse conditions which might arise at any time - while even under the most favourable conditions of a brightly lit D.Z. its accurate range indications give assistance in making the best tactical approach.

11.3. All Troop Carrier aircraft should, therefore, be fitted with Rebecca. The British Mark II version should preferably be used owing to its great transmitter power and push button method of changing frequencies.

11.4. The British Mark II Eureka should be used until a better model becomes available. Steps should be taken to have the battery box and the aerial tripod strengthened in subsequent models and the switches protected.

11.5. The leg pack method of dropping the beacon should be used, but very careful attention should be paid to the method of packing. Lace-up kitbags should be provided.

11.6. Bright lights or flares are the best means of identifying a D.Z. and when this aid can be used other aids merely provide confirmation. They should be used whenever possible, but not if there is any danger of molestation by the enemy before the paratroopers have had time to collect together.

11.7. The use of the Aldis lamp and other methods of lighting the D.Z. in ways which are visible from the air but not from the ground should be given detailed examination.

11.8. A light weight beacon transmitting MCW to operate the aircrafts' radio compasses should be developed. It should have a range of better than 30 miles and should be readily set up in the dark. The modified 5G transmitter appears to have a good enough range but it is not readily set up in the dark and is of heavy weight for its power output. It has the advantage of being the normal rear link radio set of the British Airborne Divisions.

11.9. All radio compasses should be checked to ensure good average performance, particularly in the higher frequency ranges.

11.10. The tactical value of using an SCR 536 (handie-talkie) for communication between the D.Z. and the troop carrying a/c while over it should be examined.

11.11. The navigational aids taken in should depend upon the location of the D.Z. and the probable difficulty in approach. A D.Z. which is easily found by the coastline shape needs fewer aids than one which is right inland.

11.12. At least 2 sets of each type of equipment should be taken by the pathfinder force and should be carried in separate ships.

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11.13. T.C.C. pilots are not given enough practice in dealing with the navigational problems involved in night paratroop dropping. Rehearsals on the lines of those described above should, therefore, be constantly carried out. Various combinations of navigational aids on the D.Z. and for marking the way to it should be tried and on the results of the rehearsals the pilots most suitable for leading Groups and Squadrons should be chosen.

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APPENDIX A TO REPORT NO. N.4.

S.O.I. FOR OPERATION 'GIANT'

COMMUNICATIONS AND NAVIGATION AIDS.

1. Visual and Radio aids en route to the Target Area will be as follows :-

a. Standard A and N radio range, located between RAISI POINT and CAPE GALLO. Position 38 degrees, 11 minutes North - 13 degrees, 8 minutes East. The North leg will be directed on a course of 345 degrees MAGNETIC. The frequency of the range will be 201 kcs. on D-1/D, 298 on D/D plus 1, 201 on D plus 1, 201 on D plus 1/plus 2, 298 on D plus 2/plus 3, etc., and will use the letter "Q" for identification. Range will operate 1700 hrs to 0630 hrs on D-1/D. A WHITE beacon will also operate from this location. The light will be directed 345 degrees. It will operate from 2100 hours to 0630 hours on D-1/D.

b. Beacon light on USTICA ISLAND will use a white light flashing the letters: (From 1st to 15th September inclusive as follows:-) AD, IK, AG, NR, AO, MU, ND, IU, MR, AU, ND, NK, IS, NG, IW.

c. Air Sea Rescue ship on course 342 degrees MAGNETIC from USTICA ISLAND and approximately 68 statute miles from USTICA ISLAND. This ship will be equipped with a radio homing beacon transmitting on 435 kcs. and will send signal "EM" (-.-.. --) in the following manner: 10 second dash - 5 second interval - call letters twice - 5 second interval - 10 second dash, etc. This ship will also have a light beacon flashing the signal "EM" every 10 seconds. The light beacon will be directed 162 degrees MAGNETIC and will have a spread of 60 degrees. Position of ship will be 39 degrees, 38 minutes North — 12 degrees, 43 minutes East, Radio Beacon and light beacon will be on 1943 hrs to 2210 hrs on D/1/D.

d. Destroyer on course 342 degrees MAGNETIC from USTICA ISLAND and approximately 68 statute miles from Air Sea Rescue boat. This ship will be equipped with a radio homing beacon transmitting on 472 kcs. and will send the signal "GK" (--. -.-) in the following manner: 10 second dash - 5 second interval - call letters twice 5 second interval - 10 second dash, etc. This ship will also have a WHITE light beacon flashing the signal "GK" every 10 seconds. The light beacon will be directed 162 degrees MAGNETIC and will have a spread of 60 degrees. Position of ship will be 40 degrees, 33 minutes North - 12 degrees, 13.5 minutes East, Radio beacon and light beacon will be on 2010 hrs to 2240 hrs.

e. Submarine on course 342 degrees MAGNETIC from USTICA ISLAND and approximately 68 statute miles from Destroyer. This ship will be equipped with a radio homing beacon transmitting on 1565 kcs. and will send the signal "OI" (--- ..) in the following manner: 10 second dash - 5 second interval, etc. This ship will also have a RED light beacon flashing the signal "OI" every 10 seconds. The light beacon will be directed 162 degrees MAGNETIC and will have a spread of 60 degrees. Position of Submarine will be 41 degrees, 27.5 minutes North - 11 degrees, 44 minutes East. Radio beacon and light will be on 2040 hrs to 2310 hrs on D-1/D.

NOTE: The Navy cannot guarantee the Submarine to be any more accurate than within a seven (7) mile radius, (Maximum error.) However, an average error of 3 miles is expected. NOTE: All aids in C, D, E, above will operate for 2.5 hours each night and 15 minutes later each succeeding night.

2. The following Navigational Aids will be available at the Target Area :-

1. Radio homing beacon operating on _____ kcs: sending the identification _____.

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2. Two British type 5-G radio homing beacons will be parachuted to the airdrome 15 minutes prior to lead paratroop aircraft. One of these will be placed into operation, the other will be held as a spare. This beacon will operate on a frequency of 1690 kcs. and will transmit the signal "AD" (.-..) in the following manner: 10 second dash - 5 second interval - call letters twice - 5 second interval - 10 second dash, etc. In addition to the above two (2) EUREKAS will be parachuted to the airdrome. One of these will be placed in operation, the other will be held as a spare.

NOTE: The British type 5-G radio is normally reliable up to 20 miles.

3. Wind Tee lighted with Green lights.

4. Runways lighted with White lights.

5. Obstacles marked with Red lights.

6. Airdrome outlined with Amber lights.

NOTE: The pathfinder crew from the 82nd Airborne Division who are dropping the Radio Homing Beacons will duplicate, as nearly as possible, 3, 4, 5 and 6 above if the original lights are not operating. If conditions are encountered by the pathfinder party or paratroopers which would jeopardise the landing aircraft, RED flares will be fired in the air to warn aircraft to turn back.

3. AIR SEA RESCUE.

The following channels will be available for requesting Air Sea Rescue: Channel "C" VHF and 6440 kcs. The information centres will maintain continuous watch on the above channels. It is preferable to use "C" channel if possible.

Procedure for requesting Air Sea Rescue will be as follows :-

a. (A/c call sign) calling MAYDAY MAYDAY MAYDAY (then give all the information possible, such as height, speed, direction of flight, possible landmarks, number of crew, etc.

Aircraft equipped with Mark 111 IFF switch to position No. 6.

4. REQUESTING A RADIO FIX AND HOMING.

The following facilities will be available for obtaining a "Radio Fix" and "Homing": .....

5. Radio Silence will be observed. In the event inter-plane communications is necessary, channel "B" of VHF Radio will be used. This will be done only in cases of emergency or if pathfinder a/c encounter condition that would jeopardise landing a/c.

6. It will be the responsibility of the 51st and 52nd T.C. Wings to establish facilities adquate for "homing" and local Airdrome Control on their respective fields.

7. Colours of the day will be those normally used for that particular period.

8. Amber lights will be used for recognition. The downward recognition light (Amber) will be on en route until the lights of the Submarine are seen or the pilot is sure he is within thirty miles of the target.

9. The Command will establish an Air Ground station. Aircraft of each Wing will have their liaison transmitting pre-set to the A/G frequency. A continuous watch will be maintained by the Radio Operator in each aircraft on this channel.

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APPENDIX B TO REPORT NO. N.4.

REPORT ON USE OF RADAR IN GLANT III OPERATIONS OF 13-14th & 14th-15th SEPTEMBER BY THE GROUPS OF THE 52ND TROOP CARRIER WING.

13th-14th September.

61st Group.

41 a/c of this Group took part in the mission and all a/c claim to have dropped their troops on the D.Z. except one a/c from which the troops dropped 1 minute after the green light was given.

5 Rebecca-fitted ships flew on this mission, the Group and each of the 4 Squadrons being led by one such ship. 53rd Squadron made no attempt to use its Rebecca, while the 59th Squadron had no trained operator on board. Of the other three Rebecca-fitted ships the Group lead ship picked up the signal at 7 miles and the two Squadron lead ships at 8 miles. The lights on the D.Z. were switched on just before the lead ship arrived and all aircraft gave the signal to drop when over the lights, the Rebecca signals being used to give range from the D.Z. and confirmation that the D.Z. had been reached. Those Squadrons which had no Rebecca guidance had no difficulty in finding the D.Z., since they knew their position along the coast line and saw the lights on the D.Z. when a considerable distance away.

313th Group.

36 a/c took part in the mission from this Group and 35 a/c claim to have dropped their troops on the D.Z., the tyre of the remaining a/c burst just before take-off. The whole Group dropped as a formation.

All 4 Squadrons of the Group were led by Rebecca-fitted ships. The lead ship of the Group picked up the Eureka on the D.Z. when 18 miles away but could not get a definite bearing from the blips until 7 miles away because of violent squittering. This may have been due to the beacon responding to the transmitter of another Rebecca and the transmitter on this aircraft only succeeding in triggering the beacon at 7 miles. The other three Rebecca-fitted ships obtained ranges of 7, 11, 13 miles at 1000 feet. In all cases the signal was of a good shape and easily read.

314th Group.

6 a/c of this Group took part in the mission but the Rebecca-fitted a/c was not one of them because it was grounded on the departure airdrome by an electrical failure. The lead ship thought it dropped the troops over the D.Z. but the other 4 ships which dropped at the same time thought they were 2 - 5 miles to the SSE of the D.Z. One ship which lost the formation saw the T lights on the D.Z. and dropped its troops on them.

316th Group.

Did not partake in this mission.

14th-15th September.

61st Group.

35 a/c of this Group took part in the mission of 14-15th September. 5 Rebecca-fitted ships flew with the Group, one was the Group lead ship and the other 4 being the Squadron lead ships. The ship in 15 Squadron failed to get any response on its Rebecca. The fault has not yet been traced. 53rd Squadron again made no attempt to use its Rebecca, while the other two Squadrons and the Group lead ship had ranges of 8, 9, and 10 miles respectively. The lights on the D.Z. were again very easily seen and the troops were dropped on them, the Rebecca signals used for confirmation.

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313th Group.

18 a/c of this Group took part, 9 of which (47th Sqdn) flew with the 314th Group. Both Squadrons claim to have dropped their troops on the D.Z.

The lead ship of both Squadrons was fitted with Rebecca. The 49th Squadron picked up the D.Z. Eureka at 11 miles, 1000 feet, and came in on it until it saw the lights on which it dropped its troops. The 47th Squadron followed the 314th Group out but realised by the contours of the coastline that the ships it was following had missed the D.Z. The Squadron leader, therefore, made a right hand turn and approached the D.Z. At 6 miles his Rebecca picked up the D.Z. Eureka but the corrections to course given by the operator was contrary to those which the pilot thought right. The lights on the D.Z. when picked up proved the pilot to be correct. The operator of the Rebecca may have become confused and called for a right turn corrections when he should have called for a left or the receiving aerial of the Rebecca in the a/c may have become crossed.

314th Group.

35 a/c of this Group took part in the mission and 32 a/c claim to have dropped their troops on the D.Z. although some a/c missed the D.Z. on their first pass. The troops in another a/c did not jump until 1 mile after the green light. The remaining two a/c - the leader of the 61st Sqdn and one of his wing ships - failed entirely to find the D.Z. and brought their troops back to Sicily.

The Group lead ship and the lead ship of two other Squadrons were fitted with Rebecca, the remaining Squadron had no such aid. The lead Squadron picked up the Eureka on the D.Z. at 17 miles and the 62nd Squadron at 13 miles, height 800'. The signal picked up by the 62nd Squadron equittered badly. The lights on the D.Z. were bright, in one case being picked up 17 miles away and all Squadrons had no difficulty in identifying the D.Z. and dropped their troops in the correct place, the Rebecca signals were, however, welcomed when available to improve the tactical approach and give confirmation that the correct D.Z. had been found. The Rebecca on the leadship of 61st Squadron did not pick up the Eureka at all. It seems that there was a mistake in navigation and the aircraft did not come within range.

316th Group.

36 a/c of this Group took part in this mission. 32 a/c claim to have followed the Group leader in and to have dropped their troops over the D.Z. 1 a/c which lost the main formation claims to have dropped in the close vicinity of the D.Z., but 4 or 5 minutes late. Remaining 3 a/c brought their troops back. Of these latter 3 a/c, 2 failed to find the D.Z. entirely while the 3rd depressed the wrong switch over the D.Z. so that the green light was not given and on the 2nd pass over the D.Z. an attempt at aural signals also failed.

2 Rebecca ships only flew on this mission, one being the Group leader's ship and the other in the lead of one of the Squadrons. The lead ship picked up the Eureka on the D.Z. at 7 miles while the other picked it up at 8 miles at heights of 6 to 8 hundred feet. The pilot of the lead ship corrected his course on the instruction of the Rebecca operator and also used the ranges read out by the operator to adjust his height for the correct tactical approach.

The lights on the D.Z. were very bright and parachutes were also seen on the ground. The Rebecca operator gave the signal to drop 200 yds short of the centre of the lighted D.Z., but the signal to the troops to drop was given by the pilot when actually over the D.Z. lights.

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APPENDIX C TO REPORT NO. N.4.

NOTE ON THE CONDITION OF THE EUREKAS RETURNED TO SICILY AFTER OPERATION 'GIANT 111.'

1. EUREKA Beacons used on the 13th and 14th of September, 1943, in the Salerno landings were returned in the following condition:-

Beacons Used on the 13th September.

Serial No. 3664.

a. Main switch on power pack broken.
b. T/R case dented and buckled.
c. TX frequency on C, D, E from 1 to 2 Mcs off tune, due to distortion of top plate unit.
d. Aerial damaged.
e. Cast lug on aerial tripod broken.
f. Anode lead to Rx diode (B3) disconnected.
g. Earpiece missing.

Serial No. 3673.

a. Tx frequency selector knob broken.
b. Main switch on power unit broken.
c. Squitter on all frequencies.
d. Aerial bent and buckled.
e. Tripod lug broken.
f. Earpiece and power lead missing.

These two beacons were packed in small kitbags, originally intended for use with Krypton lights, which did not allow much space for shock absorbing packing material.

Beacons Used on the 14th September.

Serial No. 3679.

Receiver frequency selector switch knob broken.

Serial No. 3658.

Main switch on power unit broken.

In this case two larger kitbags were used, one of them a lace-up type. More packing material was used, with consequent prevention of damage.

All Eurekas were packed personally by Lt. Konar, 505th Bat. 82nd Airborne Division, U.S. Army who also dropped with, and set up one Beacon during the operation.

The "NIFE" accumulators also suffered damage, one of them being rendered completely unserviceable, the bottom of one wooden box became detached, and another box was split open on impact.

(S) J. D. BAGGS F/O
Signals R.D.F. Officer,
32 Wing, R.A.F.