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R.A.F. MONOGRAPH

(FIRST DRAFT)

DECOY

AND

DECEPTION

AIR HISTORICAL BRANCH (I)
AIR MINISTRY.

COPY NO. 49

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R.A.F. MONOGRAPH

(First Draft)

DECOY

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DECEPTION

Air Historical Branch(1)

Air Ministry

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F O R E W O R D.

Before the war the study of Visual Deception was neglected except to a minor degree in relation to camouflage. During the war it was developed by branches of the three Services with inadequate direction from operational Staffs. Owing to the secrecy enforced, few staffs other than those in immediate contact with the deception branches knew anything of the measures and practice of Visual Deception. At the end of the war the branches are being disestablished and the technicians, who were temporary officers, are rapidly returning to civil life. The risk of this form of deception returning to its former state of oblivion is obvious.

This War Book has been written with two objects in view, Primarily it provides a detailed history of R.A.F. Visual Deception during the war. Information is also included on similar work by the other services, together with suggestions for the formulation of doctrine and for a co-ordinated policy for the future.

The war has shown the necessity for all staff officers to have sufficient knowledge of the principles of Visual Deception to make use of it in war, and for policy and development to be directed by specially trained operational officers. This War Book has been written to meet the needs of both; the first six chapters provide the basic information necessary for the ordinary staff officer; the remaining chapters record the details required by the specialist and technician. Some repetition in these other chapters has been unavoidable, but, it is hoped, not unreasonable.

As certain terms and initials constantly recur in the text, it has been considered advisable to group them with their explanations immediately after the index of chapters.

CONTENTS

/Chapter 11

/Chapter 21

M A P S and D I A G R A M S

P H O T O G R A P H S

/Air

INITIALS AND DEFINITIONS

Attacks.

An "Attack" in this War Book means enemy activity over a definite period of time, and includes all forms of bombing and machine gun action whether carried out by single or by large numbers of aircraft.

Camouflage.

"Camouflage" includes all methods of artificial concealment and disguise, by which targets, materials or equipment, can be hidden or made inconspicuous.

Display.

"Display" includes all types of false construction or dummy equipment, deliberately exposed to the enemy to deceive him. When the purpose is to protect a target or to draw attack, it is known as a "protective display" or decoy. When the purpose is to deceive the enemy with regard to our dispositions, movements, or intentions, it is known as "misleading display".

C.T.D.

Colonel Turner's Department. As soon as the Air Staff decided to develop displays for the protection of R.A.F. stations, a branch of the Air Staff was formed and for reasons of secrecy was given the name of the officer placed in charge. For the same reason the department and its personnel were excluded from the official Air Ministry list.

C. and D.

Originally represented Camouflage and Decoy. Later changed to Camouflage and Display to fit in with Army nomenclature and to include misleading displays which were not true decoys.

K. Site.

A day dummy airfield, with cleared area, dummy aircraft, dumps, tracks, etc.

/K. Areas.

K. areas.

The areas into which Great Britain was divided for the purpose of local supervision of the display sites of various kinds in each area. The K. Area staff was part of the C.T.D. organisation.

Q. Site, M.Q., A.S.Q.

A Q. site is a night display site with lights simulating a true airfield, but with certain differences recognisable to friendly pilots, but not likely to be detected by an enemy. Some static Q. sites were provided with fixed equipment, others were set up with mobile equipment.

M.Q. Mobile Q. Set, the term used to describe the mobile equipment for a non-static Q. site. It is packed in boxes for easy transport.

A.S.Q. Assault Q. designates a much lighter set of mobile equipment for a somewhat smaller Q. site. It is packed in boxes and bags to enable it to be manhandled across country.

Note:- The M.Q. is heavier and more lasting. The A.S.Q. is designed for maximum mobility.

QL. Site, M.Q.L., A.S.Q.L., B.Q.L.

A QL. site is a night display with lights simulating any other form of lighting, civil or military, that may be visible in war at night. QL's naturally vary considerably according to the type of lighting they simulate. As in the case of Q sites the equipment may be fixed (static sites) or mobile.

M.Q.L. (Mobile QL) designates a form of mobile equipment used for non-static civil or military QL. sites. It is transported in boxes and when set up covers a considerable area of ground.

A.S.Q.L. (Assault QL) designates a very light QL. set which can be used to represent a small military camp or convoy.

/B.Q.L.

B.Q.L. (Battery Q.L.), designates a set of equipment with battery lighting representing side lights of 40-50 vehicles.

Two or more A.S.Q.L's and B.Q.L's can be disposed to simulate a large military camp with activity at night.

Q.F. Site.

A site on which combustible material is arranged in groups to represent patches of fire over a medium area. All groups are fired electrically. A Q.F. site normally protects an individual isolated target such as a factory or R.A.F. station.

S.F. Site. Special Fire or more commonly Starfish.

A large fire site covering a considerable area, with various types of combustible material in groups. One or more Starfish are normally provided to protect towns, especially those of importance to the war effort.

Note:-

Q.L's are often combined with Starfish on one site or with Q.F.'s. A large town may be covered by a series of Starfish with or without Q.L's and a number of QF's and QL's, all under single control.

The Importance of the Scheme.

5. The degree of importance attached to any scheme must be decided and specified by directing staffs, as it dictates the amount of effort to be expended. In modern war a nation is involved as a whole, and to produce the maximum effect, labour, raw material and factory output must be allocated on a basic of balanced economy. Over-elaboration or extravagance in meeting one requirement will be detrimental to the adequate output of others. In visual deception the degree of importance may vary from a standard of vital necessity to one of mild desirability. For instance, in a protective scheme the importance of the target, (which may be a single source of supply), its location and the degree of air attack expected may demand the best possible camouflage and the construction of a dummy installation; whereas another possible target may be one of a number of similar factories or supply centres, and its location or importance may render it less likely to attack; in such a case simple camouflage may be all that is reasonably necessary. Similarly a misleading scheme may be of such importance as to justify in a Commander's opinion the use of considerable equipment and personnel to make certain of deceiving the enemy on a strategic scale; on the other hand difficulties in communications, transport or shortage of men, may reduce or even preclude the mounting of a desirable but not vital misleading scheme.

/6.

The Day or Night Factor

6. Conditions for visual deception by day differ considerably from those experienced at night.

By day, visual deception must be good enough to contend with clear weather visibility, when the enemy pilot will not only be able to identify his exact position at any time, but will also be able to observe any suspicious lack of "life" in displays. His observations will be backed by photographic reconnaissance, which is carried out constantly in modern war, both on special areas to which priority attention is for a period directed, and over wide areas to pick up new developments for general intelligence purposes. Successive photographs are examined by specially trained experts, and all indifferent or elaborate camouflage, (which takes a long time to produce and which is difficult to maintain in good order), and any mistakes in displays, particularly lack of movement and of personnel, will be detected. Visual deception by day therefore must expect to have its position exactly identified, and its measures closely scrutinised. The longer it remains in being, the greater the chances of detection.

By night, although modern aids, developed in the later stages of the war, almost guarantee crews reaching the targets they are detailed to attack, generally speaking, a pilot cannot be certain of his exact position at any time, unless he can recognize landmarks either visually or by radio. Night photography may provide a check on his observations, but will not produce the detail for close scrutiny provided by the camera by day. Concealment by night relies mainly on disciplined black out, though certain camouflage measures may be undertaken to make large targets inconspicuous; display is provided by lights or fires. The position of lights is usually unidentifiable by day photography, but fire sites may be picked up. As these

/forms

forms of displays are economical in men and material, considerable numbers can be provided in any particular area, and, if varying sites are operated, a pilot is unlikely to identify exactly either their position or his own, even if some of them have been detected by previous reconnaissance. By night therefore, concealment is easier than by day, and a display cannot normally be pinpointed or recognized.

These day and night conditions affect protective and misleading displays and their control differently.

By day, it is improbable that men, transport, and materials will ever be available in sufficiently large numbers to render realistic an isolated protective display which has generally to be operated for a considerable period of time. In terms of airfields, protective displays should only be mounted on a partially occupied airfield, or for a very short time on one that has been temporarily abandoned by aircraft, but on which ground crews and transport are still located. In similar circumstances, the Army may consider it desirable to display dummy tanks, guns and transport to draw air attack away from true equipment which has been partially concealed. Protective day displays therefore are domestic and limited. On the other hand, an Army Commander, wishing to deceive the enemy, may decide to mount a misleading display by day on a large scale <u>for a short time,</u> and he may think it well worth while to allot a large number of true units and transport to back up dummy equipment to produce the required effect. Many brilliant misleading schemes were carried out on these lines by the Army during the war. In some of them the R.A.F. co-operated by displaying dummy and true aircraft.

Domestic misleading displays of aircraft were also mounted by the R.A.F. for special purposes during the war, but always on partially occupied airfields.

By night, protective displays of lights and fires form one of the defences against air attack, and were used in large numbers by the R.A.F. during the war. The Navy and Army also made use of this form of protection in the United Kingdom under Air Staff direction and co-ordination.

Misleading displays by night are only carried out to confirm day displays and are dependent on the same cover plan.

Summing up we find that

(a) Day protective displays are domestic and limited.

(b) Day misleading displays may be on a very large scale and may need the co-ordination of all three Services.

(c) Night protective displays can be used in large numbers and form one of the defences against air attack.

(d) Night misleading displays are only required to confirm day displays.

Air Superiority or Inferiority.

7. Air superiority or inferiority may vary between belligerents in any theatre and at any time during the progress of a war. Our air superiority or inferiority will considerably affect the measures we take to provide visual deception, protective or misleading.

With marked air superiority by day, there is less need for protection. Camouflage may be reduced considerably, and nets, which tend to impede operations, may be discarded, especially in back areas. No degree of air superiority can guarantee complete immunity from air attack at night. and lighting displays may still be necessary to draw attack off vital points, particularly in forward areas. When we suffer from air inferiority or even from equality, good

/concealment

concealment and camouflage is necessary by day, and disciplined black out by night. In certain areas liable to sudden attack domestic displays will probably be required by day to draw attack, and an extensive system of decoy lights and fires will be needed at night. Air Inferiority is especially likely to occur in the early days of a campaign in theatres of war abroad. It is, unfortunately precisely at this period when all efforts, shipping and transport are allocated to the concentration of troops, and supplies, that deception requirements are liable to be neglected.

In misleading schemes, if our air superiority is overwhelming, the enemy may not be able to carry out daylight reconnaissance and the deception must then fail. It is important in all misleading schemes to institute fake wireless messages to attract enemy attention, and if we have marked air superiority it may be necessary to instruct our fighter screen to permit some reconnaissance by day, as it is his reconnaissance by day which results in his being misled. His night reconnaissance may draw his attention to a possible concentration or confirm what he sees by day, but it is insufficient alone to induce him to react as we wish. If enemy superiority is considerable, we may get overmuch reconnaissance of our misleading schemes, and our chief concern will be to prevent their detection as fakes, especially by low flying aircraft.

Direction

8. Three of these basic factors, the object of the scheme, its importance, and the degree of our air inferiority or superiority are matters on which only operational staffs can give advice and information. Visual Deception must therefore always be directed by operational staffs.

leaving the wide open space which was the most marked

/feature

feature of airfields in England. In addition, suitable types of dummy aircraft were provided, and also accessories in the form of dummy roads and dumps, dummy tracks on the airfield, real and dummy machine gun posts, and a shelter and trenches for the operating crew.

The first K site was in operation at the end of January 1940, 34 were ready by the end of July, and two more were added later. Attacks on K sites commenced in July 1940 when 6 attacks were recorded. By the end of 1940 thirty attacks had been delivered. Six more were made in 1941, the last in June of that year.

By May 1941, enemy air attack had fallen to occasional tip and run raids on those airfields situated near the south and east coasts. To save man power 12 inland K sites were closed down in June and two more in July, leaving 22 in operation. Meanwhile the satellites which had been simulated, were being rapidly transformed into full-size operational airfields, with clusters of hutting on the perimeters, and often with concrete runways and taxi tracks. It was evident that deception of the enemy by K sites would not last much longer. This was confirmed first by the gradual reduction of attacks on K's, and secondly by the recovery of a map from an enemy reconnaissance aircraft which was shot down in October 1941, which showed 50% of the remaining K's marked clearly as decoys. The Air Staff agreed to the closing down of 19 sites, but retained 3 near the coast until May 1942, when these last K's were also abolished.

In the winter of 1940/41, the enemy delivered a number of strong attacks on our most exposed airfields in the East Kent, and this led to the withdrawal of the squadrons occupying these airfields to safer ones further inland.

/Dummy

Dummy aircraft were installed on some of these vacant airfields, which were then known as K.L.G's; there were 6 attacks on the dummies at Lympne, 2 attacks at Eastchurch and three at Manston. When, in May 1941, the scale of enemy attack fell off, these stations were again reoccupied and the dummies were packed up.

The eventual recognition by the enemy of our K sites as decoys was a certainty. It is surprising they managed to deceive him as long as they did. Protective displays of this kind lack reality in the form of movement of men, transport, and aircraft and they can only be expected to be successful in special circumstances such as were provided by the existence of satellite airfields, and in the early stages of a war before photographic cover has been sufficiently developed. On the other hand the location of dummy aircraft in suitable concentrations on partially occupied or temporarily unoccupied airfields is a method of protection that can be adopted with success at any time. There will usually be sufficient men and movement for realism even on airfields from which squadrons have been temporarily withdrawn, as ground personnel and transport will normally be present and at work, and the defences will be manned.

Dummy night airfields, Q sites.

3. The night dummy airfield offered a simpler problem, as it was only necessary to simulate the forms of lighting normally used on a R.A.F. airfield. Sites were selected in the same way as for K decoys, but were more easily found as flat ground was not necessary, and hedges and crops offered no difficulties as the lights could be carried on poles. To minimise interference

/with

with agriculture, the cables were laid along hedges or buried below turf or below ploughing depth. The forms of lighting on these sites varied during the course of the war to suit similar alterations of lighting on true airfields. It was, however, always necessary in the design of Q sites to ensure that there was no risk of our own pilots mistaking them for true airfields and landing on them in error. Certain lights were omitted and others deliberately introduced which identified a Q distinctly to our own pilots but which would not be likely to be noticed by an enemy: constant briefing of our own pilots in these differences was arranged. The first Q site was in operation at the end of January 1940. Twenty were working by May, forty-two by June, and seventy-nine by the end of 1940. Owing to the collapse of France, airfields throughout the country had now to be protected by these decoys and during 1941 and 1942, the numbers of Q sites were increased as new airfields were completed and required protection. A limit was eventually reached at a maximum figure of 170 in March 1943, as the country by then was so crowded with airfields, factories, depots, and training grounds that further sites were unobtainable. By the end of 1943 enemy air attack became negligible in the North-West of the country and Q sites were progressively closed down first in Ireland, then in Scotland and North-West England, later in the Midlands and South-West England, until only 93 remained in East and South-East England. These were made non-operational in September 1944 and cleared as conditions permitted.

Of all decoys the Q sites were the most fruitful in drawing enemy attack. The first attempt occurred on June 6th/7th 1940 and in that month 36 attacks in all were recorded. The following figures are of interest; they represent recorded attacks; others certainly occurred which were not recorded.

/Date

Date	Night attacks on R.A.F. Stations.	Night attacks on Q's.
In 1940	90	174
Up to end of June 1941 (end of main blitz)	304	322
Up to end of 1941	360	359
To end of May 1944 (end of night attacks)	434	443

It will be seen that the attacks on the 170 Q sites and those on something over 500 R.A.F. airfields were almost identically the same in number. It cannot be considered however, that the Q's drew off 50% of the attacks on R.A.F. airfields, as it is fairly certain that many aicraft attacking Q sites had been originally detailed for attacks on towns and other civil targets. The bulk of the Q's were located in the east and south of England, and any aircraft crews that were temporarily lost or not anxious to attack a well defended objective, might well have considered an apparent airfield a reasonable target. In this way the Q's contributed to the defence of the whole country, and the large number of attacks on them compared with those on other decoys is due to the fact that many Q's, but comparatively few other decoys, were in operation during the main blitz in the winter of 1940/1 and the Spring of 1941.

R.A.F. Q.F's. 4. To protect important and vulnerable R.A.F. stations, other than airfields, dummy fires were provided some 3 to 4 miles away which could be lit under the orders of the Station Commander, if and when his station or its vicinity were bombed. Some 19 of these Q.F's were constructed. Only 5 were ever lit, and of these two drew attack. The difference between dummy lighting and dummy fire operation should be understood. Dummy lights were operated frequently - on the average some 20 hours per week - to draw attack at any time. Dummy

/fires

fires were not operated unless there was a definite attack on the particular target they protected, as it was considered undesirable to draw attention to the vicinity of any target. Whereas lights often drew attacks from single aircraft, fires when lit tended to draw considerable attack..

Dummy buildings

5. Demands came in from two R.A.F. sources for dummy buildings to protect important installations. In June, 1940, the Signals branch at the Air Ministry asked for maximum protection to be provided for their very vital communication centres at Leighton Buzzard and Dagenham. Camouflage, in the form of a complete cover by netting of all buildings and roads, was undertaken and very satisfactorily carried out by the R.A.F. Works Services. It was not possible to conceal the large group of wireless masts at each place and the decoy buildings had to be constructed by the Department alongside these masts with the object of drawing off any attack from the true target. The work was started early in July and completed by the end of September 1940. An abortive attack was made while the work was in progress, but none were subsequently delivered, though both camouflage and dummy were maintained until the end of the war.

Later, similar camouflage and decoy protection was undertaken by the Department for the civil wireless station at Leafield. The work was completed in September 1941. Neither the station nor decoy were ever attacked.

A proposal was put forward in March 1940 to provide dummy factories to protect the then very few aircraft factories. In April authority was given to construct dummies for six factories, but dummy airfields, an essential adjunct, could only be found in the neighbourhood of four of them, viz. for Bolton and Paul (Wolverhampton), Armstrong Whitworth (Baginton), De Havillands (Hatfield),

/and

and for Short Brothers (Rochester). The work was considerable, each decoy costing about £30,000. In addition to the buildings and airfield, dummy aircraft, roads and shelters had to be provided. To give some sign of life, broken down cars, bicycle stands and other accessories were added including smoke from chimneys during an alarm. Lights and small fires were also arranged to attract attention by night. The four decoys were completed by the end of September 1940. Considerable success was not anticipated as, like the K sites, it is impracticable to provide men, transport, and movement generally to achieve realism by day. Nevertheless, in these early years, when aircraft factories were so few and so important, the draw off of any attack would have made these dummies worth while. The results far exceeded expectations as the four factories drew 23 attacks, 9 by day and 14 by night. When the scale of attack was considerably reduced, the expense of maintenance in manpower and material did not justify the retention of these decoys, and three of them were closed down in June 1942, and the fourth near Rochester, which was in the most vulnerable area, in April 1943.

Oil decoys.

6. In May 1940 the then Petroleum Board approached the Department for advice in connection with decoy sites for oil installations. Some experiments were then in progress on dummy fires to protect R.A.F. stations, but it was obvious that a decoy representing an oil tank on fire necessitated a quite different design. After discussions with the head of the Oil Refinery at Llandarcy in South Wales, the company had dug out on the Welsh moors a test trench about 2 feet wide in a circle the diameter of which was about $\frac{3}{4}$ of a full size oil tank.

/This

This was tested on the 2nd of August and considered satisfactory but capable of improvement. The Department undertook the responsibility of finding suitable decoy sites near the most important installations and the Petroleum Board guaranteed that the Oil Companies would carry out all work and arrange for the manning of the sites. Very little enthusiasm was shown by the Oil Companies. It is fairly certain that some managers erroneously thought that the decoys might attract enemy attention to the installations, and difficulties were raised in regard to personnel for the work, and for manning. Further difficulties arose when it was found that concrete lined trenches cracked under the heat of the fire and fire brick linings had had to be constructed. Nine oil decoys were reported to be ready for operation between the 24th April and the 1st of June 1941. It is fairly certain however that few of these decoys were ever satisfactory. At a later period two of them were taken over by the Department, and tests showed that considerable improvements were necessary. At the end of the war the Oil Companies raised similar difficulties in regard to the dismantling of their decoys prior to derequisition of the sites.

One decoy successfully drew attack when it was fired in 1944 while enemy aircraft were operating close to an oil installation near the mouth of the Thames.

The Petroleum Board and the Oil Companies were lucky: oil storage before the war had been concentrated into packed areas of large tanks which were particularly vulnerable. No attempt was made at dispersal even on a small scale. When it is remembered that our air attack on German oil supplies and synthetic oil factories was one of the main factors contributing to victory, it is

/astonishing

astonishing that the Germans made no systematic attack on our vulnerable installations at a time when the U boat campaign was causing such serious losses in tankers. It is hoped that in a future war decoy protection will be ready at the outset for oil installations as well as for all other civil vital points; in addition reasonable dispersal and a modicum of underground storage in peace should be ensured.

Civil Decoys, Q.L.'s, Q.F.'s and Starfish. 7. In May, 1940, the Civil Defence Committee investigated the various systems of lighting adopted throughout the country, and, after experiments, issued instructions which allowed certain "permitted" lighting for essential purposes. They also started experiments on decoy lighting, but these progressed very slowly, and in July 1940, the Deputy Chief of Staffs Committee reviewed the matter and decided that all decoys at night should be co-ordinated to prevent clashes and mutual interference between schemes. They considered the Air Ministry was the best authority not only for co-ordination but also for the development and control of all decoys for civil as well as R.A.F. protection. Naval and Army night decoys were to be developed by the appropriate Service, subject to co-ordination by the Air Ministry.

As a result of this decision C.T.D. took over the experiments being made at Sheffield and most of the staff employed. Contact was immediately made with the Air Staff Branch responsible for checking industrial lighting and experiments were started on decoys to simulate several types of "permitted" lighting in use in different parts of the country. The Ministry of Home Security supplied a list of the most important towns and other vital points and a search for decoy sites was commenced in the neighbourhood of some of them.

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A considerable number of night reconnaissances were undertaken in varying visibilities to view the true "permitted" lighting and to check the decoy simulations, now designated QL to distinguish these types from the Q types of airfield lighting. Generators, cable, and other material were collected, and work on a few Q.L. sites was in progress when the concentrated attack on Coventry occurred on the night of the 14th/15th October, 1940.

The Coventry blitz and Hitler's threat to "rub out" our cities in successive attacks, entirely altered the situation. It was clear that decoy lights, however well designed, would be of little value if enemy pilots could see their target town in flames. Only large decoy fires, lasting several hours, could expect to draw off this new form of attack. The R.A.F. Q.F. type of fire was too small and burned out too quickly. Political pressure was strong for instant action and the Air Staff ordered trenches to be dug on suitable sites, to be filled with oil and set alight by hand until something better could be evolved. A few sites were selected and prepared in this way, but they proved of little value and were a source of much trouble both at the time and later. Ordinary soil cracks under the heat of an oil fire, and the oil on these sites seeped through the cracks and gradually found its way into ponds and streams, polluting them in varying degrees. A chorus of protest at once arose from farmers and others, which continued long after this hasty type had been abandoned.

Meanwhile experiments on new types of fires were rushed through, in which the Sound City Film Company showed much ingenuity. Three different types were produced, one burning diesel, another parrafin, and a

/third

third scrap wood and sawdust. A combination of these three types provided realistic variations in flame and smoke and enabled a new large decoy to be constructed which, known first as the Special Fire or S.F. became famous under the code word of "Starfish". On each Starfish site two quite spearate groups of these three types were located to provide two large fires each of some 30 tons of inflammable materials, for lighting on two successive nights. Later reserves for a third night were stacked on the site. Each 30 ton fire burned for 4 hours and was electrically lit from a shelter some 800 yards away.

Construction was rapid; four Starfish were installed in November, 18 by December 1940, 108 by March, 1941, and 155 by the end of July 1941. Others were added later to protect new targets, the maximum figure in operation at any one time being 209.

As soon as sufficient Starfish protection had been constructed to meet heavy concentrated attacks, attention was again turned to the development of Q.L's and Q.F.'s to draw off attack by single or small groups of aircraft. Various types of lighting were used on Q.L.'s e.g. marshalling yard, ship yard, factory, and coke oven to suit each locality so that ample variety was obtained. Many Q.L.'s were laid out on Starfish sites, the remainder were located in the vicinity of large towns or isolated vital points. Frequently Q.F.'s were also coupled with Q.L.'s but in some cases, where lights were undesirable, Q.F.'s were sited alone. Progress was good. By August 1941, 47 Q.L.'s and 23 Q.F.'s were operating; by December 1941, 170 Q.L.'s and 73 Q.F.'s. Maximum figures amounted to 212 Q.L.'s and 82 Q.F.'s in November, 1942. In this month the total number of night decoys operated by the Air Ministry amounted to

/171

171 Q's., 22 R.A.F. Q.F.'s 82 civil Q.F.'s, 212 Q.L.'s and 208 Starfish, a total of 695 decoys on some 500 sites.

Starfish drew attacks at once. In December 1940 although only 18 Starfish were completed by the end of the month, 10 had been lit, and 5 of these had been heavily attacked. Many other attacks were drawn during the rest of the 1940/41 blitz, the crowning achievement occurring at Sinah Common, the decoy protecting Portsmouth, on the 27th/28th April, 1941. Details of attacks on all types of decoys may be found in Chapters IX and X, where they are fully discussed.

It must be pointed out, at the risk of some repetition, that the main air attacks on this country occurred between August 1940 and July 1941. Subsequent attacks occurred in later periods but on a much smaller scale. When the main attacks commenced, there were a considerable number of Q sites in operation, a few R.A.F. Q.F.'s but no decoys to protect towns or civil vital points. Starfish were hurriedly constructed during this period and from December onwards achieved increasing successes. The civil Q.L.'s and Q.F.'s were nearly all constructed after July 1941, as were nearly all the naval and army decoys. Consequently the full development of decoys coincided with the reduced scale of air attacks.

As in the case of Q sites, when the risk of enemy air attack diminished, other decoys in the less vulnerable areas were successively closed down, first in Northern Ireland in early 1944, then in North West England and Scotland in August 1944, and in South West England in September, 1944. Further reductions in the South of England were made in November 1944, leaving only certain decoys in the East and South East of the country. All sites except those protecting London were closed in March, 1945, and the few remaining London sites in May

/of

of that year.

Camouflage. 8. The static camouflage of R.A.F. stations received no policy direction until September, 1941. Before the war the Works Services, on their own initiative, carried out certain experiments in netting hangars and painting hedges on airfields to break up "the open space". When the Munich crisis occurred, orders were issued to adopt these methods of camouflage on certain airfields near London. German civil pilots flying the regular services to London took much interest in the work, and were seen to circle these airfields on several occasions. Similar measures were adopted after war broke out. It cannot be said that R.A.F. Commands and Units took much interest in camouflage in the early days of the war, and in fact opposition was encountered, if the methods adopted caused any inconvenience to the operation of aircraft on stations. Later, when attacks developed, buildings were hastily painted and some station commanders did their best to get their stations rendered as inconspicuous as possible. In September 1941 some Commands approached the Air Staff with the request for a considerable improvement in camouflage on their stations, and Colonel Turner's Department was instructed to direct and inspect all R.A.F. camouflage, the execution of which still remained the responsibility of the Works Services.

C H A P T E R III.

HISTORICAL SUMMARY PART II BRITAIN.

1. During the last half of 1941 and early 1942, it became increasingly evident that the department's activities were extending beyond the provision and operation of static decoys in Britain. Q equipment similar to the static sets used at home were sent abroad in July 1941, 3 sets to Malta and 10 to Egypt. This was followed by another consignment of 12 sets to North Africa in December 1942. In September 1941 the improvement of camouflage for which the department was made responsible necessitated investigation into the best methods of concealing aircraft. In April 1942 the enemy switched his air attacks on to very lightly defended towns, of no military, but of much historic value (Baedeker raids). Decoys were hurriedly organized to meet these attacks and were reasonably successful. It became clear that the provision of mobile equipment was a growing requirement both for home and abroad, including various types of decoy lighting, dummy aircraft, and hides or nets for concealing aircraft.

Hides and Nets. 2. Although previous attempts to construct hides on dispersal points had not been successful, new experiments were carried out. It was found that unless hides were very strongly constructed, they rapidly disintegrated in wind and rain; snow was fatal. If strongly constructed, concealment was most difficult owing to constant seasonal changes in tone and colour of the surroundings. Even a twin-engined aircraft required a hide of considerable size to conceal it from side as well as overhead view. It was confirmed that hides were not worth the labour and material to achieve such indifferent concealment. Nets could provide good concealment, but were troublesome to put on and take off. Two new types of nets were produced, one for single-engined aircraft providing

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really good concealment and another for twin-engined aircraft, not quite so efficient. Attempts were made to use nets and other accessories to conceal large aircraft; these gave reasonable concealment but still more work. It must be recognized that if enemy air attack is scanty, it is very difficult to get ground crews to make use of nets; on the other hand whenever attacks develop, demands are immediately made for nets to be provided at once (see Basic Factors Chapter I). Full details of hides and nets are recorded in Chapter XIV.

Dummy aircraft. 3. The original dummy aircraft, constructed for K. sites were made of wood, and, though reliable, were cumbersome and difficult to transport: light canvas dummy Spitfires and Mustangs were designed, which could be rolled up into bags, whose total weight was under 3 cwts. These stood up well to all but heavy gales, when if necessary they could be dismantled very quickly. For larger aircraft, twin engined and over, canvas dummies were unpracticable. At a demonstration in August 1942, attended by senior officers of Commands and the Air Staff, the new nets and dummies were approved and production ordered. Details of dummy aircraft of various types and accessories in the form of of dummy transport, etc., can be found in Chapter XXVI.

Mobile Q's 4. To provide protection for airfields in theatres of war abroad, a mobile Q. set (MQ) was designed, which was packed in boxes that could be manhandled and weighed rather less than 30 cwts. Later a much lighter set was produced, known as the Assault Q or ASQ weighing about 6 cwts. Details of this equipment can be found in Chapter XXII.

Mobile QL's 5. A general purpose mobile QL set was designed which could be used to provide any normal type of lighting used in ports, on railways, or in large camps and dumps. This set when laid out covered an area of approximately half a square mile. It was known as the M.Q.L. and was packed in boxes and weighed about 30 cwts. Later an Assault Q.L. was also produced which

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when laid out covered an area of about ½ square mile as a camp or could be used to represent a convoy; it weighed rather over 5 cwts. A Battery QL. set, (B.Q.L.) was also produced to provide quantities of vehicle side lights. A combination of A.S.Q.L. and B.Q.L. sets provided a very efficient decoy for use in the field to represent military activity. Details of these sets are available in Chapter XXIII.

Mobile Airfield Lighting

6. An early result of the provision abroad of decoy airfield lighting equipment was the immediate use made of it for the lighting of true airfields. At that time the official airfield lighting consisted of Glim lamps and flares, all of which had to be lit independently. Lacking lighting that could be switched on and off as required, the Q sets though not designed for the purpose were allocated for true airfields and the department was faced with having to provide an unpredictable quantity of sets for both purposes, one of which was not its concern. Reference to proper authority produced no result, as this authority did not take action till it received a "demand" through the official channels. In the end the department designed all the mobile airfield lighting used in the Middle East, N. Africa and Europe during the war, and produced most of it. The story is told in Chapter XXI, and the department, in filling the gap, made an invaluable contribution to the success of night operations in these theatres.

Provision of Equipment.

7. In the early days of the war, it was not difficult for a special department, untrammelled by precedent, to find contractors to produce comparatively small quantities of equipment quickly. As time went on, the two great Supply Ministries acquired by degrees more and more control not only over contractors and their output but also over basic materials. The department was then faced either with

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having to apply to one or other of these Ministries for work to be carried out, or of obtaining through them the necessary material for C.T.D. contractors. The first alternative was avoided if possible. The organisation of the Supply Ministries was designed to produce bulk orders over a long period of time. Neither Ministry apparently possessed a section allocated to the turning out of small quantities of a requirement quickly. All demands, however small, had to go through the regular procedure, which, even if priority had been obtained, always entailed 3 to 4 months delay before production even commenced. Less, but still considerable, difficulty was met when application was made for basic materials for the use of the department's contractors, and it was often necessary to obtain special priority on a high level before the material in question was released. Wherever possible, in designing new types of equipment, every use was made of items of normal R.A.F., Army or civil supply.

By these methods, the department managed, throughout the war, to obtain all the equipment it required with reasonable speed; production in all its stages had, however, to be carefully watched, and all incipient delays dealt with immediately.

Exercises and Cover Plans.

8. The Air Staff took early advantage of the introduction of mobile equipment for visual deception to make use of it in Cover Plans and Exercises. Details of these are given in Chapters XIV and XV and it will be noticed that some of them aimed at protective, and others at misleading deception. Valuable lessons were learned from these cover plans and from the experiences gained in visual deception in the Middle East and North Africa, of which full advantage was taken.

The Spartan manoeuvres of February 1943, clearly showed the necessity of training airfield personnel not only in the handling of nets to hide their aircraft, but also in practical camouflage in the field to conceal personnel and transport. IInd T.A.F. issued orders for instruction and demonstrations to be given

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directly under the Chief of Staff. Consequently there was no direct contact between similar officers of IInd T.A.F. and 21 Army Group. Here again the Army Group's decision was quite correct, as all army deception work was of the misleading type and it was obviously desirable to direct this from the highest level. Colonel Strangeways who took over the duties of deception staff officer at 21 Army Group, had gained experience of the direction of misleading displays in Italy but had no knowledge of protective measures. It was some little time before he was convinced of the necessity for the latter, and of the desirability of its being treated as a part of the defence against air attack, and therefore a R.A.F. responsibility. He was much interested in the equipment, (A.S.Q.L. and B.Q.L. sets), used by C. and D. units and was surprised to hear that similar sets had been available but were not used in Italy, where he had long wanted lighting equipment for misleading displays. He reiterated the request for C. and D. units for misleading displays only, but after some discussion agreed to the following arrangement, which is quoted in full, not only because, with one slight deviation, it was adhered to in the Europe campaign, but also because it should be the accepted policy for the future.

The agreement ran

"(a) All protective lighting displays for both Army and R.A.F. are to be the responsibility of the R.A.F. Displays are to be carried out by C. and D. units under the instructions of R.A.F. Group Staffs, who will decide on their best employment after consultation with the staffs of their respective Armies."

"(b) All misleading army lighting displays are to be carried out by the R.E. units at the disposal of

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Colonel Strangeways, the deception staff officer at 21 Army Group. Colonel Turner's Department will provide the necessary equipment and train a sufficient number of R.E. Officers and O.R.'s in its use".

"(c) In the event of a very large misleading display at night being required, Colonel Strangeways will call on the R.A.F. Groups to help him out with C. and D. units or detachments, but normally he will have no concern with these units, whose main function will be protective work."

Note. In addition it was arranged for each R.A.F. airfield to be provided with one Q set for its own protection, and to be operated by its own C. and D. personnel, thus reducing R.A.F. demands on C. and D. units, which will then become available almost entirely for general and army protection.

There were three main reasons for this division of responsibilities. The R.A.F. were in the best position to know the strength and direction of enemy air attack, and decoy protection was a part of the defence against air attack. Secondly, considerable knowledge and training is required to devise and operate decoys which will induce an enemy aircraft to attack, especially if large displays are used. Simple training only is necessary to lay out light sets for misleading displays which, in fact, merely confirm to reconnoitring aircraft day displays developed for the same object. Thirdly whereas misleading night displays are simple and employ only certain types of lights, protective displays may be complicated and require many varieties. It is important that the responsibility for these should be with units who have full knowledge of R.A.F. airfield lighting, to ensure that our own pilots are not confused by any form of night decoy.

Training of U.S.A. personnel.

10. Early in 1943 Staff Officers of the American Air Force showed considerable interest in the department's activities

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and soon after the mobile Q sets had been put into production, demands were made for the supply of H.Q. and A.S.Q. sets and for the training of American Engineer Officers and men in their use. Similar demands came from American Army Engineers in relation to the H.Q.L. and A.S.Q.L. Sets. All demands were met, and a number of sets supplied and courses were arranged in Richmond Park. No information is available as to whether the equipment was successfully used in Europe.

Bomber Command Exercises.

11. In September 1943 Bomber Command approached the department for assistance in the training of bomber crews. They asked that certain Starfish should be lit when required so that Pathfinders could drop Target Indicators of various colours round them and provide for crews under training the conditions similar to the large fires that occurred in enemy targets when we attacked. A number of exercises were carried out in this way on two rather isolated sites near Swindon, but it was found that there was considerable risk to neighbouring farms and haystacks when the flares were dropped. It was then decided that the department should produce pyrotechnics simulating the red marker flares and that these should be set off in selected towns to train aircraft crews in picking them up under difficult conditions, which included concentrations of searchlights on the aircraft as they circled the target area. Satisfactory pyrotechnics were decoloped, and C. and D. personnel were employed in setting off these flares in London, Newcastle and Bristol. These exercics known as Bulls Eye were held once or twice every week for the training of O.T.U. Crews, and usually 200 to 300 aircraft took part in each exercise.

In London the Green Park was used, and the practices had to be of short duration to prevent the collection of crowds. By wiring the display area, and with police assistance this trouble was avoided. One could not help thinking of the

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shock this enterprise must have given to the Victorian and Edwardian ghosts haunting the Hall.

Inter-Service Co-ordination.

12. The lack of inter-service co-ordination, the Air Ministry attempts to obtain it, and the eventual formation of the Tactical Deception Committee, whose function was limited to the collection and distribution of information, are discussed in detail in Chapter V.

CHAPTER IV

HISTORICAL SUMMARY PART III, ABROAD.

1. R.A.F. Visual Deception was employed in varying degrees in theatres of war abroad, but it was only in Europe that it was accepted as a general form of defence against air attack to be used to protect vital points as necessary. In other theatres, in spite of the Department's efforts to give full information of the trend of events at home, it was limited, with a few minor exceptions, to airfield protection.

Malta

2. In July 1941, three static Q sets were sent to Malta as some protection against the heavy air attacks then in process of development. Very little information is available of the use to which these sets were put. Malta is a small island and large areas were taken up for airfields, for aircraft dispersal, and for taxi tracks. It is known that at least one Q site was found and operated, and that it drew attack. It is also believed that at least one and perhaps both the other sets were used to light underground operation rooms.

Middle East.

3. Static Q sets were also sent to the Middle East in July 1941, followed by other sets static and mobile at later dates. Samples of dummy aircraft and nets were forwarded as they were developed. A C.T.D. officer was sent out with the original sets, together with a few O.R.'s to demonstrate them; three other officers followed at a later date. The full story of R.A.F. deception in the Middle East, as far as it is known in this country, is told in Chapter XVI. Its failure to develop along lines parallel to practice at home was due to several causes.

Prior to the arrival of the C.T.D. officer and equipment, a very excellent camouflage establishment had been developed by the Army. This organisation was chiefly concerned, as is normal in the Army, with misleading deception, though it did some protective work as well, e.g. dummy fires for protection of vital points, and some dummy aircraft for the R.A.F.: at no time were lighting

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displays developed either for misleading or protective deception, probably owing to the difficulty of obtaining the necessary equipment through army sources, and the lack of any contact, except at a very late date, with C.T.D. This lack of contact was due to the action of the R.A.F. Defence Officer who, for reasons unknown, gave strict orders that no information should be given to C.T.D. of deception in the Middle East. As a result the Department was unable to help either by giving advice based on its own experience at home, or more directly when difficulties arose in the provision of personnel.

R.A.F. visual deception for these and other reasons was therefore limited to Q displays for airfield protection. Three Q sites drew attacks, one of them no less than twenty thus achieving the record for the war.

Enemy air attack in the Middle East was spasmodic and comparatively light, and it so happened that more elaborate decoy protection was not required. Had the Germans developed a major offensive against Egypt instead of embarking on a war with Russia, enemy air attack on all vital points would have been most serious; the few fires provided by the army would have been quite inadequate, and no decoy lighting could have been improvised at short notice, as all equipment would have had to be sent round the Cape.

N. Africa and Italy.

4. By the time the North African campaign opened, contact had been established with the Army camouflage school at Farnham and with the American Air Force Engineers, but except by technicians, little was known of the Department's activities or capabilities. Owing to the secrecy imposed on all preparations for this campaign, C.T.D. only learned of it when the landings commenced. It was too late then to contact the A.O.C.-in-C. and his Air Staff to discuss deception requirements, as they had left the country. Once the landing had been made, shipping space was at a premium, and food, ammunition and

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vital stores somewhat naturally received priority over deception equipment. So it happened that when deception was most wanted, i.e. when we suffered from air inferiority, neither nets, dummies nor lighting sets were available. Out of 128 Spitfires sent out in the opening days of the campaign, 118 were destroyed or seriously damaged in the first three weeks, nearly all being shot up on the ground. Chapter XVII gives the history of deception in N. Africa and Italy as far as is known in this country, and it will be noticed that the call for equipment came from the combined Headquarters and not from the A.O.C.-in-C. In sending it out one error was avoided and another made. Men were sent out to operate the dummies and lighting sets, but they were not formed into units or provided with transport. It was wrongly considered at the time that they would be attached in small parties to existing formations, and that as they would not have to move frequently, transport would be provided locally. The lack of transport was particularly unfortunate and considerably hampered all forms of C. and D. work. Some men with their equipment arrived on the forward airfields very late, and provided useful protection until our air superiority reduced enemy attacks to such an extent that C. and D. requirements became negligible.

Another factor which militated against the introduction of a satisfactory scheme of decoy protection at night, was the early and continuous use made of the Q sets for true airfield lighting. This was not unexpected as Middle East experience had shown, and the Q equipment sent to North Africa had been purposely made dual purpose. It led however to the Department becoming more and more involved in the provision of mobile lighting equipment, and to cater for advanced airfields, the controllable Glim flarepath and A.S.Q. sets were designed and produced. All types

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were used later in Sicily and Italy, and some of the A.S.Q.'s were used to light Balkan airfields.

Chapter XVII records the hurried use made of C. and D. personnel in the Sicily landings, and the demand later for decoy protection for Italian airfields by the Americans. No attempt was made in Italy to introduce decoys for general purposes, e.g. ports, and eventually nearly all C. and D. personnel were transferred to mobile airfield lighting or general duties, leaving one small unit of about 50 men in case C. and D. work was required at a future date.

Generally speaking R.A.F. visual deception failed to be used fully in N. Africa first because the equipment arrived too late, and secondly because Commanders and Staffs had little or no knowledge of what could be achieved. This was due to the secrecy imposed on C. and D. work at home, and the lack of inter-service decisions as to the respective responsibilities of Army and R.A.F. in regard to deception generally.

Western Europe. 5. R.A.F. visual deception in France and Belgium, as recorded in Chapter XIX provides a very different story. Before the campaign, both 2nd T.A.F. and 21 Army Group staffs had full knowledge of C. and D. work and capabilities, and an arrangement had been made between the two, defining respective Army and R.A.F. responsibilities in regard to deception; all protective deception was definitely allotted to the R.A.F. as part of the defence against air attack. The Department had profited from past mistakes, and provided small C. and D. units, fully equipped for mobile work and provided with transport, cooks, etc., as self contained units which could look after themselves, and drop detachments wherever required. In spite of the very small air attack, full use was made of these units, who were intelligently controlled by Group and T.A.F. Staffs. The record of the work done, though not dramatic, provides a clear example for the future organisation

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of visual deception in a theatre of war. In addition airfield ground personnel were taught to conceal themselves and their aircraft and a C. and D. crew was attached to each airfield to help in concealment and to operate a Q site, if required.

C. and D. detachments landed on the Normandy beaches on D and subsequent days and a decoy constructed in the evening drew attack on D night. After a few days 2 C. and D. units operated decoys which had considerable success in protecting the beaches against the small scale air attacks that developed. Later these units helped to install hooded lighting for the Mulberry at Arromanches. The story of the ingenious attempt to draw off supplies dropped by the enemy at Dunkirk, the account of the installation of the large decoy at Antwerp, and the provision of dummy aircraft and Q sites to protect airfields in Belgium are fully recorded in Chapter XIX and need not be repeated here.

It was of course easier to ensure good deception in Western Europe. Apart from improvements in organization due to lessons learned in other theatres, and the full briefing of staffs, the proximity of the war theatre to Britain enabled calls for equipment and personnel to be rapidly met by air and ship transport. This does not detract from the fact that the arrangement between 2nd T.A.F. and 21 Army Group and the fixing of respective responsibilities was the chief factor in ensuring correct direction and the smooth working of R.A.F. visual deception in Europe.

Although the Department had hoped to be freed from further responsibilities for the provision of mobile airfield lighting equipment, it was called on in June 1944 to provide improved and new types of sets at short notice. These were used with success throughout the campaign in West Europe. It so happened therefore that C.T.D. as a side-line to its official activities designed all and produced most of the mobile

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lighting equipment used by the R.A.F. throughout the war.

India and S.E.A.C.

6. R.A.F. visual deception in India never developed. Early in the war a C. and D. officer was sent to India about the time of the fall of Singapore and it is believed he was eventually sent as an instructor to an Army Camouflage school. A second officer was sent out later to advise on the concealment of airfields in Assam. He appears to have shocked the Higher Authorities by getting work done without financial approval. After a short period as instructor in a Camouflage School, this officer returned to England. Sample decoy lighting sets, collapsible dummy aircraft and aircraft nets were sent to India and later on a demand for 200 X nets was met. Occasional contacts were made with Army Camouflage and Deception Officers on Staffs in India, but it was limited on the whole to exchange of information. The only equipment asked for from the Department were the provision of two types of booby missile, which could be dropped from aircraft to frighten the Japanese. One type consisted of a delay action Very light which was dropped in forest areas held by the enemy; the other type was similar and provided a sudden burst of rifle fire. Samples and specifications were sent from India, and the Department arranged the necessary production and received warm thanks for their help. Later, in 1944 S.E.A.C. were again asked if they required C. and D. equipment, but by then Japanese air attack was negligible and S.E.A.C. and the Air Staffs in India had no further decoy requirements. In June 1945 some A.S.Q. sets and mobile funnels were sent out to India by air as described in Chapter XXI.

CHAPTER V.

DIRECTION AND CO-ORDINATION.

1. Although considerable use was made by the Army of both camouflage and display during the war of 1914-18 in France, no records were made of the experience gained, and in the period between the two wars training and development in Visual Deception was largely neglected by all the Services. Some work was carried out by the R.A.F. on measures to conceal airfields, and a Camouflage Centre was established at Farnborough in 1938 to investigate methods of static camouflage applicable to military and civil vital points in this country.

Early days.

2. Thus, at the outbreak of the war in 1939, each Service had to develop Visual Deception to suit its particular needs, with little or no experience to guide it. The Navy's attention was chiefly directed towards the camouflage of ships and the construction of dummy warships; the Army concentrated on camouflage in the field, and the R.A.F. continued with their airfield camouflage and developed decoy protection. In these early days, when needs were somehwat divergent, contacts, co-ordination, and common direction were not so necessary, but in 1940 when the Navy and Army also begain to develop decoy protection, co-ordination was essential and achieved as far as static decoys in the United Kingdom were concerned, as described in Chapter IX. In 1941 co-ordination was also achieved between the Services and the Home Office in relation to static camouflage in the United Kingdom. In both cases the Air Staff provided the necessary direction. Later, however, during the further developments of Visual Deception, no further co-ordination or common direction was arranged on a /Ministerial

Ministerial level, and in consequence many difficulties were encountered.

It will be recognised that some forms of Visual Deception were peculiar to an individual service, e.g. camouflage of ships, or the provision of dummy tanks or of dummy aircraft. Responsibilities for other forms were uncertain, e.g. dummy landing craft, night decoy protection in war areas. Without a co-ordinated policy decided at Ministerial level, technicians could not arrange for the training of personnel or the provision of adequate equipment to meet probable requirements; planning staffs, responsible for one campaign, had to base their deception schemes and cover plans on what was likely to be available, and not on what was really required. In addition, Commanders and Staffs were not informed of the forms of deception developed in the various services of the branch from which men and equipment could be obtained. This led to one great difficulty, which persisted in varying degrees throughout the war. As little or no information was issued through higher official channels technicians were forced to "sell their wares" to Commanders and Staffs, some of whom were immediately interested, whereas others were not.

Direction Anomalies.

3. One of the factors which militated against co-ordination was the different source in each Ministry from which direction was provided. In the Admiralty direction in regard to static decoys was vested in the Local Defence Division, and, in regard to static camouflage, in their Chief Engineers Branch (Works). The source of direction in regard to dummy landing craft is not known, but it is believed they were originally developed by Combined Operations. In the War Office, direction in regard to decoy protection originated with A.A.2.C. (an artillery branch), it was later transferred to S.A.V.8, and finally ended with R.E.8.

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(an ordnance depot branch), which seems odd. Any Camouflage, it is believed, was directed partly by S.W.V.8. and partly by one of the Training Branches. It was only in the Air Ministry that all Visual Deception was directed by the Air Staff, i.e. an operational branch. It was recognized by the R.A.F. that whereas camouflage considered separately might be a Training concern when applied by R.A.F. units under mobile conditions, and a Works matter when static concealment was required, direction had to be entirely an operational concern when camouflage was combined with displays to provide Visual Deception. Protective displays formed part of the defences against air attack, and misleading displays had to conform to an operational plan. When the Army developed misleading displays, direction was invariably provided on a high level by operational staffs, but it appears that it was never recognized in the War Office, that similar direction was also necessary to frame the general policy of Visual Deception, both to guide its development by technicians in the right channel, and also to ensure its readiness to meet requirements as they arose.

The London Controlling Section.

4. Yet, in spite of this, co-ordination could have been achieved if the London Controlling Section had been strengthened and its authority increased to provide requisite direction for all the Services. This branch worked directly under the Chiefs of Staff, and was responsible for certain highly specialised forms of deception, which were kept intensely secret. It was the only source during the war of specialist deception officers, the need for whom is discussed in Chapter VI.

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The London Controlling Section, through these specialist officers kept in reasonably good touch with Army Visual Deception, especially in relation to large misleading displays, but knew little of the protective display work carried out by the R.A.F. Towards the end of the war, continued attempts by the Air Staff to obtain co-ordination in deception resulted in the establishment of the "Tactical Defence Committee", of which the head of the London Controlling Section was appointed chairman. The functions of this Committee were strictly limited to the collection and dissemination of information on deception developments; all direction and policy matters were expressly excluded from its terms of reference. Though it was established far too late in the war to be of any great value, this Committee did bring technicians together to learn something of each others work, and did provide Commanders in war areas with information they had never before received.

5. To sum up, Visual Deception suffered not only from the lack of attention paid to it before the war, but also, except in the Air Ministry, from lack of operational direction during the war. This in turn rendered co-ordination between the three Services unsatisfactory except in relation to static work in the United Kingdom.

C H A P T E R VI.

RECOMMENDATIONS FOR THE FUTURE

1. It is proposed in this chapter to make certain suggestions for the improvement of Visual Deception in the future, based on the lessons learned during the war. It is also proposed to discuss some of the effects that may be expected from the development of radar in the form of H_2S. No attempt will be made to introduce speculations in regard to the atomic bomb. The two most obvious points to consider in Visual Deception, both of which must be decided between the three Services, are the individual responsibilities of each Service and the best organization to be adopted in the future.

Border-line responsibilities.

2. A decision as to the responsibilities of each Service in regard to particular forms of Visual Deception is long overdue. During the war several cases occurred when doubts arose to which Service should undertake a particular scheme. Each case was decided on its own merits by the Planning or other operational staffs concerned, but it is obvious that until clean cut decisions are made by the Service Ministries, no training or development programme can possibly be planned. Three of these border line cases may be considered.

(a) Responsibility for protective displays at night, (static or mobile).

Lighting displays installed to confirm misleading displays by day are obviously the concern of the authority controlling the day display. Protective displays come under a different category. During the war the R.A.F. were made responsible for decoy protection by

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night of civil in addition to R.A.F. targets, but in the United Kingdom both the other Services installed displays to cover their domestic targets. In Egypt decoy lighting was limited to the protection of R.A.F. airfields, but decoy fires were installed by the Army to protect other targets. In North Africa night decoys, so far as they existed, were a R.A.F. responsibility, chiefly because the other Services were not particularly interested in providing them. In Western Europe it was definitely agreed that all night decoys should be installed by the R.A.F. The reasons for allocating the responsibility for night decoys to the R.A.F. in all theatres of war may be briefly stated.

(i) The Air Staff are in the best position to know the probable direction and strength of enemy air attack.

(ii) Protective night displays constitute one form of the defences against air attack, for which the R.A.F. are responsible.

(iii) Protective displays to be effective require considerable experience in night flying.

(iv) It is important to prevent any form of lighting being installed which might confuse pilots of aircraft.

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(v) Responsibility for the provision of night displays in no way compromises their control. In the Fortitude cover plan and at Antwerp, the control of R.A.F. night displays was allocated to the local Naval authorities, and the Arromanches decoys were controlled by the local Army Base. Control must always be placed with the most suitable local authority.

If this suggestion is accepted as a principle for the future, the R.A.F. will not only have to arrange for staff and personnel to provide static decoys, but also trained mobile units to install mobile decoys in any theatre of war.

(b) Responsibility for displays of dummy landing craft.

Theoretically the provision of dummy displays should be entrusted to the authority responsible for the provision of the true equipment. Cases will however occur when another Service is far more interested operationally in the provision of a particular type of display. In the Fortitude cover plan it was the Army who were chiefly concerned in misleading the enemy as to their point of attack, and who therefore arranged for the provision of the necessary dummy landing craft. It is suggested that in such cases the Service principally interested should be made responsible for mounting the required display.

(c) Misleading Displays.

The same argument applies to large scale misleading displays. Domestic displays are

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naturally the concern of the Service concerned, but large scale misleading displays are normally of chief interest to the Army, even if considerable contribution is required from the other Services to render them effective. If this is accepted, inter-Service misleading displays should normally be directed by Army operational staffs.

Suggested organization

3. The organization for any form of deception must permit of operational direction and technical implementation.

To ensure co-ordination between the Services, it is suggested that direction should be organized on similar lines, and an inter-Service Committee established to fix individual responsibilities and to decide all policy and programmes for development. In addition, training should be arranged in Staff Colleges to ensure that future Commanders and Staffs have sufficient knowledge of deception measures to be able to make use of them.

A distinction should be drawn between the type of officer required for the direction of deception on a high level and the ordinary Staff Officer. Both are operational officers, but the latter has merely to use a ready-made weapon, while the former has to forge the weapon, and must therefore be a specialist. He should have considerable technical knowledge of all forms of deception for which his Service is responsible and also of similar forms used in the other Services. He would normally work directly under the Chiefs of Staffs of his Ministry or of one of the Commands, but he would not be required in lower formations.

Technical officers presumably will be responsible

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for implementing one type of deception only.
For visual deception, they should preferably be engineers, as considerable knowledge of strengths and qualities of materials is required in camouflage and display design. They must also have military knowledge and should therefore be trained officers and not civilians.

Personnel for deception is a matter of Service organization. Presumably no specialised deception units will be kept up in peace, and deception will have to be included in the training of the most suitable permanent unit. It is suggested that R.A.F. Visual Deception should be kept alive in the Airfield Construction Squadrons of the Works Services.

Inter-service contact and co-ordination is as necessary between technicians as it is amongst directing staffs. This could most easily be arranged in visual deception by an inter-service school and development unit.

H_2S. 4. The form of radar development known as H_2S will undobutedly affect the practise of Visual Deception in the future. It must also be recognised that H_2S is in its early stages of development and may achieve considerably greater results. In the past the undoubted successes of German and British night decoys has been largely but not entirely due to the fact that in a blackout a pilot could not be certain of his exact position, and could therefore be led astray by an apparent target. Thhoretically this should not occur in the future, because H_2S provides a map which shows the main features of the ground in spite of darkness or fog. On the other hand it is easy to overestimate the value of H_2S in war conditions. Pilots of aircraft subjected to attack by night-fighters and A/A cannot maintain a steady course

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and have to take avoiding action. Under such circumstances accurate navigation is difficult; even by day when the ground is directly visible it is not easy to regain exact knowledge of location if sudden diversions have to be made. It is also noteworthy that the decoys which achieved the greatest successes in the United Kingdom were those guarding ports and estuaries, even when attacks were carried out on nights when the coast line should have been easily located. Moreover history shows that up till now no weapon of war has ever been produced which has not been countered at least in some degree, and the more scientific and complicated the weapon, the easier is the opportunity for deception. Even now, if the wave length of H_2S is known, counter radar measures can make it non-effective, and up to the present no experiments have been carried out to discover whether some form of structural camouflage cannot also be designed to defeat it.

As far as can be foreseen at present, it seem improbable that H_2S will be of much assistance in discovering the presence of troops in the field, but it will certainly affect static camouflage of large buildings. Unless counter radar or structural measures can be provided to defeat it, static camouflage will be limited to the darkening down of buildings to make them comparatively inconspicuous against day raids. All the elaborate painting schemes of the past will be useless in the future, and it is highly probable that the cost in labour, equipment and money to provide radar or structural counters to H_2S will limit static camouflage to a few supremely vital targets, whose protection can probably be better provided by underground construction.

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It is obviously vitally important that the future development of Visual Deception should include the investigation of every possible method of countering H_2S, both by structural and by counter-radar measures. This provides an added reason for the close co-ordination of all forms of deception, and for an adequate inter Service organization to direct them.

CHAPTER VII.

VISIBILITY BY DAY AND NIGHT

1. In all forms of visual deception, by day or night, knowledge of visibility from the air is essential, both for design and for operation. Sun, moon and weather conditions obviously affect visibility, but the extent to which they do so is only known to those who have had considerable flying experience in all weathers. This chapter has been written to pass on some of the main facts observed.

Day Visibility.

2. With little or no cloud, visibility by day depends on the presence or absence of haze, mist, dust, and, near industrial areas, smoke. The presence of any of these will reduce visibility according to the density of the medium concerned, but generally speaking they interfere to a greater extent with view from the air than from the ground. Frequently from the ground the sun may be clearly visible through a slight haze, when in the same conditions the surface of the ground is invisible to a pilot in the air unless he is flying at a very low level.

In this country, especially during the summer, heavy cumulus clouds are frequently experienced, casting deep shadows. In between the clouds, shafts of bright sunlight render patches of the earth's surface clearly visible from a long distance, whereas nearby features in deep shadow are not recognised except at very close range. A pilot, under the cloud layer might have to hunt for some time to find a particular target. In bright sunlight visibility is greatest down sun, but it is precisely under these conditions that camouflage is most effective, as few shadows are to be seen. The best direction to detect a camouflaged target is to

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view it up sun, when all shadows are most marked, and when smooth surfaces "shine", especially if they are wet. Detection is easiest when the sun is low, i.e. early morning or late evening. Shadows are then at their longest, and "shine" most conspicuous.

Most camouflage will be detected by the camera, but when attacking, however much he has been previously briefed, the pilot or bomb-aimer has to rely on his own eyesight.

Night Visibility of the Earth's Surface.

3. Visibility at night is even more affected by natural conditions, e.g. clear sky, cloud, mist or dust, and moon or its absence.

(a) Moonlight.

Variations occur in the phase and altitude of the moon. A full moon gives 10 times the light of a half moon. A high moon gives the most light. The more light, the greater the distance and height from which objects can be identified. Moonlight can be considered under two aspects, normal reflection and "shine" or glint from smooth surfaces. In normal reflection from the ground, colour is indistinguishable but differences of tone are conspicuous. At one end of the scale white roads, white or light coloured buildings, and light coloured fields, can be readily identified. At the other end of the scale, woods which contain much shadow show up dark. Medium tones tend to merge into each other. Some features are picked up by their form, e.g., roads and railways which generally have long straight stretches, embankments and cuttings, etc. Isolated plumes of smoke are clearly seen in moonlight. Normal reflection is more visible at angles greater than 45° to the horizontal. Below this angle only the greatest contrasts in tone are picked up and "shine".

Shadows

Shadows are only really conspicious from a steep angle. "Shine" refers to the specially strong reflection from smooth surfaces when viewed up moon. Examples are all forms of water, smooth roofs, roads, tarmacs, runways, etc., particularly if wet. A low moon is most effective in providing "shine". Any ground mist or industrial haze rapidly reduces the visibility of ground features in moonlight, particularly when viewed down moon. Diffused moonlight with light cloud shows up water strongly.

Summing up, therefore, in moonlight in varying degrees according to the phase and height of moon, the most conspicuous landmarks will be coast lines with their white surf edging and "shine" from the sea, all forms of water of any size, all smooth surfaces reflecting shine, white roads, runways, buildings and fields, straight railways, and dark woods. The best visibility for normal reflection is from nearly overhead, for "shine" from a flatter angle looking up moon.

(b) Starlight and a Clear Night.

On a bright starlit night, light-toned fields are picked up at 3,000 feet from a nearly vertical view. Water is identified by its very even tone covering a considerable area. The coast line again is the easiest object to pick up, especially the surf line.

(c) Cloud, Mist, and Haze without Moon.

Very little mist or cloud will reduce visibility to practically nothing.

Visibility of lights at Night.

4. It is even more difficult to specify the extent to which lights are visible at night for in addition to the natural factors, e.g., moon, cloud, mist, etc.,

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concerned, the strength and conditions in which the light is exhibited bring in many variations in individual cases. Some generalizations can be made and some examples of lights observed at night may be given.

Dealing with natural factors, first, lights are most visible during dark nights with a clear atmosphere. A strong moon reduces visibility of lights very considerably and if there is slight mist may obliterate all but the very brightest. Slight mist on a dark night considerably reduces visibility of all types of lights. These factors make it desirable to vary the strength of display lighting to counter natural conditions. Medium strength should be used in moonlight, less strength on a dark clear night. The object is always to make the lights sufficiently visible to attract attention, but to avoid the over-brightness which might cause suspicion.

When we consider light variations, it is obvious that the more powerful light will be seen at a greater distance. The main factor in visibility of lights depends on whether the observer from his position can see the actual source of light, e.g. the filament in an electric lamp, or whether he only sees a reflection either from the glass of the lamp, the ground or even from the dust or water molecules in the air. If a filament can be seen a light even of low wattage is conspicuous. There is much variation in the reflecting properties of various surfaces, the smoother the surface, or the whiter, the more the light is reflected and the less it is absorbed. Some lights are provided with metal reflectors which intensify the light shown in a limited direction and cut it off from other directions. The ordinary car sidelight of 4 watts is equivalent <u>in its beam</u> to a lamp of 25 watts

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without a reflector backing. The variations, therefore, are endless. Some visibility figures may be given. It may be assumed that the natural conditions are a dark night with reasonably clear atmosphere.

(a) Fires, e.g. naked flames.
Visible at great distances according to their size, 30-40 miles for a fire of 30 tons inflammable material.

(b) Torches flashed at an Aircraft.
Visible 10,000 feet 3 or 4 miles away.

(c) Aircraft Headlamp.
Visible in its beam 20-30 miles.

(d) Pre-War Railway Signals.
Visible 8 miles away. Green less visible than red.

(e) Hurricane Lamps.
Visible up to 6 miles away at low heights or 3 3 miles at 10,000 feet.

(f) Lamps of Various Wattages.

(i) If the actual filament can be seen, 60 and 40 watt lamps visible 10-12 miles, 25 and 15 watt lamps 6-8 miles, 6, 4 and 2 watt lamps almost as far as the 25 watt.

(ii) If only the reflection can be seen. Much depends on the reflective properties of the surface. With maximum reflection, e.g. from water and wet smooth surfaces distances approximate those of the bare filament. With normal reflection from the ground, 60 and 40 watt lamps up to 5-6 miles, 25 and 15 watt lamps 2-3 miles, smaller lamps practically nil. The pool of light from a 6 watt lamp is not normally visible from overhead at 1,000 feet.

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(g) Firebox of Railway Engine.
Very bright at 8 miles.

(h) Gooseneck Flarepath.
Visible 2,000 - 1,000 feet, 10 miles away.

(i) Average of Car Spills from Headlamps.
Easily visible at 8,000 feet 4 miles away. The most conspicuous and frequently seen light in a blackout is the motor cyclist's headlamp. After this and still more frequent are the road reflections of hooded car and lorry headlamps. As traffic increases near towns, the lines of roads are easily seen. In LONDON, large areas, particularly in the West End, are readily identifiable, street by street, from altitude below 5,000 feet. Whitehall, Piccadilly, Oxford Street, Edgware Road, can be picked out from end to end owing to the spill from car and bus headlamps.

True lighting varies considerably in colour, from bluish-white to yellow, and in strength. There is also a very noticeable tendency for lights apparently to flicker, due to objects or smoke intervening between the moving aircraft and the source of light and which momentarily reduce or extinguish its visibility. Both these features must be artificially arranged in display lighting.

The above visibilities apply only to dark and clear nights with no moon and no mist. In moonlight the distances at which lights are visible fall off rapidly according to the phase and height of the moon. At maximum moonlight only bare lights are visible and reflected light is very difficult to pick up. Mist or haze also reduce visibility. In thick mist even bare lights are not seen, except from almost immediately above and at very low altitudes.

CHAPTER VIII.

THE ORGANIZATION OF PROTECTIVE DISPLAYS IN BRITAIN

1. Until August 1940 C.T.D. responsibilities were limited to the provision of decoy protection by day and by night for the then comparatively few airfields in the east and south-east of Britain. During this period the general war effort, including output of all types of equipment, munitions and other supplies, the intensification of agriculture, etc., had only begun to develop, and clashes with other war interests were negligible. Working only within R.A.F. limits, contacts and decisions were easy and help was readily available from Station Commanders, the Works Services, etc., which enabled staff and administration to be reduced to a minimum. Organization was then a comparatively simple matter. The Department's headquarter staff arranged for the siting and construction of decoys, and the establishment and training of officers and men. Control was allocated to Station Commanders who were provided with operational instructions, and with whom direct contact was maintained. Officers of the Department were appointed to each of the four areas, known as K Areas, which covered all decoy sites, to ensure local supervision of their operation and maintenance, and to look after the comfort and discipline of crews on K sites. Nevertheless this initial period was of great value in providing many lessons in the use of what was in fact an entirely new form of defence against air attack. It was shown that it was not necessary and indeed undesirable for the Department to control directly the day to day or night to night operation of decoys, which was affected by local weather conditions and the activities of R.A.F.

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squadrons on the nearby stations. It also demonstrated the vital need for close contact between Headquarters and "individual" decoy sites, so that experience could be gained quickly from successes and failures. This in turn proved the necessity for organizing any decoy system in minimum depth, no matter how much it might expand laterally. To do so every opportunity should be taken to make use of existing organization especially for administrative work so as to minimise staffs. It was proved also that first-class intelligence was an essential for any decoy organization.

When in the autumn of 1940 the Chief of Staffs and Civil Defence Committees placed on the Air Ministry the responsibility for the decoy defence of all civil vital points and built up areas, the basic system or organization was not changed, though many complications and difficulties were encountered. Many new direct contacts had to be made, the competition for land for all kinds of war requirements made the finding of decoy sites increasingly difficult, and supply difficulties delayed new work, especially in relation to the provision of equipment.

Headquarters Staff.

2. The Headquarters Staff consisted of R.A.F. Officers, certain civilian specialists and the usual clerical personnel. The head of the Department was responsible for all matters of policy, and the Headquarters was divided into the following Sections.

Section I. Operations and Control arrangements for Displays, including initial training.

Section II. Administration, including all matters relating to R.A.F. personnel, equipment and transport.

Section III. Experiments and Works, including site finding, designs, initiation and production of display and camouflage equipment.

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Construction and maintenance of static decoys and of all kinds of field camouflage and display equipment.

Section IV. Secretariat, finance and clerical.

Section V. Camouflage direction. This section was only developed when camouflage became a departmental responsibility. It was abolished when camouflage became less important and its reduced duties were taken over by Section I.

Section VI. Intelligence, and Operational Records.

Section VII. Training in camouflage and in field equipment, particularly in relation to the C. and D. Units, and in the training of British Army, American Army and American Air Force personnel. This section was also formed later.

The duties of the above sections are obvious but special reference must be made to Section VI Intelligence. First class intelligence is as necessary for visual deception as for ordinary operations. It must include immediate information of scale, method, and direction of enemy air attack, a general knowledge of the progress of the war, and exact information on successes and failures of decoys. The earliest information is essential as conditions are never stable and policy must learn lessons all the time, hot only to correct inefficiencies but also to look ahead to enable new methods of attack to be foreseen and measures arranged to meet them as soon as they develop. Success is absolutely dependent on

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first class intelligence.

Another essential was an adequate staff of surveyors, land officers, and draughtsmen, to enable sites to be quickly found and requisitioned, and large numbers of plans to be produced.

Air Staff. 3. The expansion of decoy protection in the autumn of 1940, necessitated additions to the K Areas mentioned in paragraph 1 above, until they covered the whole of the United Kingdom. Two to four officers were provided for each Area, according to local circumstances; these officers were not encumbered with the usual office routine, as all R.A.F. personnel were attached for administration to the nearest R.A.F. Station. Consequently their staff was limited to one Warrant Officer, one Flight Sergeant, (A.C.H./G.D.), one Sergeant, (Clerk G.D.) and one W.A.A.F. clerk for office duties, one electrician for inspection, and D.M.T.'s as necessary for the pooled K Area Transport. The K Officers were responsible for ensuring the efficiency of all decoys in their area. They gave detailed instructions to all crews for operation and minor maintenance, maintained good contact with all local controls and A.A., checked telephonic communications, and reported attacks, difficulties and pertinent matters to the Headquarters of the Department. When heavy maintenance, repairs, or new equipment were required, they called in the area contractor.

The numbers and boundaries of areas varied during the war according to the numbers of decoys in operation. The general principle was to arrange manageable areas, and to locate the K Headquarters so as to minimise distances to and petrol consumption in the supervision of decoy sites.

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When camouflage was added to the Department's responsibilities, for a time a separate organization of C. and D. Officers was established with Commands and Groups, (as described in Chapter XI), to carry out the necessary inspections. These officers also took over the supervision of R.A.F. decoys from the K Area Officers; this resulted in the Department losing some of the direct contacts with Station Commanders and in delays and failure in reporting attacks. Later, when the Air Staff decided that the war situation permitted a considerable reduction in camouflage, the C. and D. organization was merged into the K Area staff which again took charge of the R.A.F. decoys, and of the supervision and inspection of camouflage intthe areas where this was required.

K Area Officers were also employed in charge of sections of the mobile displays mounted in the later years of the war. For mobile work especially, the necessity for combining camouflage and display in one organization became obvious, and a repetition of separate responsibilities should be avoided in the future.

Manning and Minor Maintenance of Displays.

4. With the static sites, manning and minor maintenance varied according to the type of display. From early days economy in overheads and personnel was exercised, and as manpower difficulties increased, rigorous cutting down of possible surplus personnel was enforced.

(a) R.A.F. K. Sites. These were manned by R.A.F. personnel of the department who were specially trained in the work and sufficiently in rifle and machine guns to use them against low-flying aircraft. They also carried out a

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small amount of maintenance, the area contractor taking it up when heavy repairs were required.

(b) R.A.F. Q. and Q.F. Sites. These were manned by R.A.F. (or civilian depot personnel in some Q.F.s) posted to the target station. Only sufficient men for a night's crew were added to the station establishment. They were trained by the Department and passed on their knowledge to other personnel on the station with whom they alternated duties. Minor maintenance was undertaken by the local Works Services, major by the area contractor.

(c) Starfish. These were manned by R.A.F. personnel of the Department. As construction and equipment improved the numbers on each site were reduced from an original figure of about 20 or more to 10. On many Starfish sites QL lighting was also provided on the site or nearby. It was manned by the same crew with some additions if the QL was distant. The crew undertook general maintenance and rebuilt fires. The area contractor provided all material except oil, for quick supply of which arrangements were made with the Petroleum Board.

(d) Civil QFs and QLs. These were used in two ways, i.e. either to guard a specific vital point, e.g. a railway junction or isolated factory, or as one of a group of sites protecting a large built up area with many vital points. In both cases civilian crews were employed. The Department made a contract with the railway company or factory concerned, which undertook

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not only to supply and pay the personnel but also to carry out all minor maintenance. In the case of groups of QLs or QFs the Department approached the largest firms in the area and induced one or more of them to take on similar contracts for a number of sites round a large built up area, thus reducing the number of contractors to be dealt with. Some firms proved dificult, others extravagant, but on the whole the system worked well under the supervision of the area officers and was reasonably economical.

Policy. 5. Directives were issued from time to time by the Air Staff, which dealt with the probable weight and direction of enemy air attack. The Department's general policy was based on these directives and on information obtained from the Air Ministry Intelligence branches, from the Ministry of Home Security and from Station Commanders and decoy crews. The "Local Defences" branch of the Admiralty and S.W.V.8, of the War Office, respectively in charge of naval and military decoys, followed the Department's general policy. Detailed policy was settled between the Department and R.A.F. Commands and Groups in relation to R.A.F. decoys and with the Ministry of Home Security in relation to civil decoys.

The Key Points Intelligence Department (K.P.I.D.) of the Ministry of Home Security was an invaluable contact throughout the war. It provided full information of all existing vital points, and by arranging for all Ministries to report to them all contemplated factories, dumps, camps, etc., before they were constructed, they were able to warn the Department of their future locations. This enabled the Department not only to plan a comprehensive decoy scheme for the protection of civil targets throughout the country, but also to avoid locating decoys where clashes might later

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occur with one or other extension of the war effort.

Sites. 6. Given a detailed policy, preliminary action in site selection was undertaken by a study of one inch and six inch maps. Site finders were then sent out into the areas provisionally selected to record on the maps any new buildings, etc., built or building which might interfere with the authorised safety distances.

These safety distances were proposed by the Department and agreed and promulgated by the Civil Defence Committee. They consisted of the following provisos -

(a) Sites were to be selected in open country at least 800 yds. clear of any occupied houses and at least 1 mile clear of a large village or town.

(b) If a house was within 400 yards, the occupants were to be evicted or the site abandoned.

(c) If any house was located between 400 yards and 800 yards a shelter had to be provided for the occupants.

Although never officially approved, a practice also grew up which prevented the location of any site less than $1\frac{1}{2}$ miles from any large camp, dump or very important vital point. Certain exceptions were made to this unofficial rule by mutual agreement when circumstances demanded, but efforts were normally made to adhere to it.

It may be admitted that these safety distances could never guarantee that bombs would not fall outside them in the event of an attack, especially by night. In heavy attacks on decoy sites bombs often fell as much as $1\frac{1}{2}$ - 2 miles away; in such cases the factor

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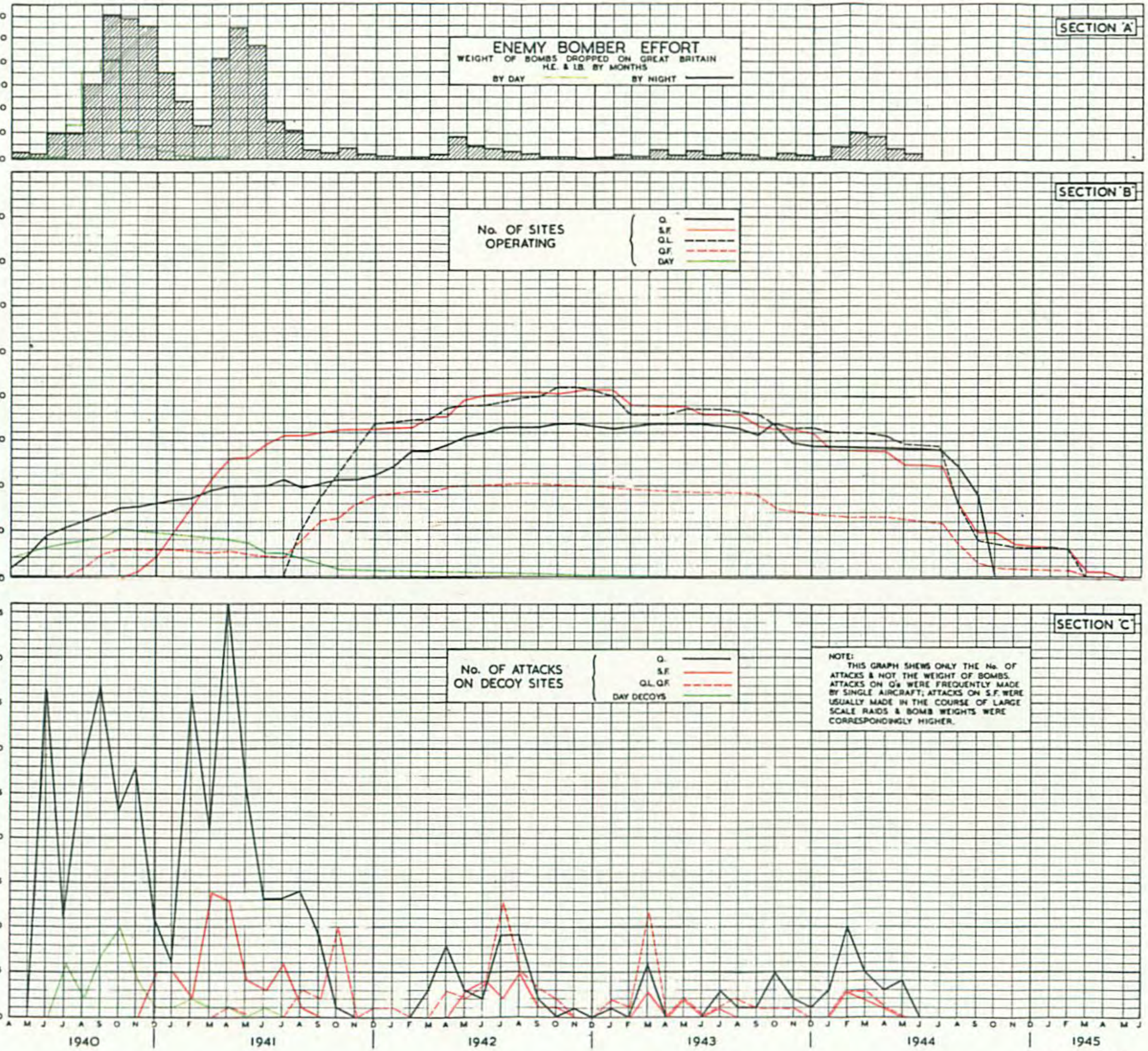

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of "open country" proved important, and the theory of probabilities operated. Mathematically and in practice, the chance of a few individual houses being hit in open country was very small, even during a heavy attack. Actually in many hundred attacks only four cases were recorded when houses near a decoy site were hit and casualties caused, though damage often occurred to barns, cattle and fields.

In addition to checking safety distances, consideration had to be given to possible interference with agriculture and contact was always made with the local representative of the War Agricultural Committee. To avoid delays it was agreed, after some wrangling, that when a proposal was brought to the local agricultural officer, he had to suggest another suitable site within 24 hours, or approve the proposal. In practice, friction grew less as time went on. Site finders learned to pick the less suitable fields, and arrangements were made to restrict requisition to fire sites only. When "lights" decoys were used without fires, the lights were erected on poles and the wires buried. When cropping or ploughing took place, lights and wires were temporarily lifted. It may be said that, with a few exceptions, farmers co-operated thoroughly. To help them, special arrangements were made for immediate compensation for loss of cattle or other livestock.

Co-ordination and procedure.

7. Only four departments were engaged in carrying out decoy protection, i.e. Local Defences at the Admiralty, A.A.2.C. at the War Office (afterwards S.W.V.8), the Petroleum Board and Colonel Turner's Department at the Air Ministry.

The Admiralty was concerned with the protection of certain specified naval ports; the Army constructed a

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few decoys for army vital points, chiefly ordnance factories. The Petroleum Board constructed and arranged for the manning of a small number of decoys for oil installations, but the sites for these were found and cleared by Colonel Turner's Department. All other decoys, R.A.F. and Civil, were initiated and carried out by the Department which was also made responsible for co-ordinating all decoys. The procedure adopted was as follows.

When any of the three Service departments proposed to construct a new decoy, the responsible officer cleared the proposal with his own Ministry and forwarded a plan with a brief description to Colonel Turner's Department. Copies of the plan were forwarded to the Other Service Ministries AND to K.P.I.D. of the Ministry of Home Security, and Colonel Turner's Department also cleared the proposal with the Director of Organization, Air Ministry. The most important reference was that to K.P.I.D., as this branch (see above) was not only able to clear the site for existing, but also for future war commitments. If the four Ministries approved the proposal the site was considered acceptable and work on it proceeded. Certain additional checks were, however, added. All Ministries were permitted to send a representative from time to time to check the decoy maps at Colonel Turner's Headquarters and raise objections if they saw fit. All Commands of the three Services were provided fortnightly with a list of all new decoys showing their positions. This was found necessary as, especially in the Army, Commands were authorised to take up land independently of their Ministries. The same lists were sent to all Regional Commissioners as far as it affected their areas, and to R.A.F. Groups. The latter were interested, as lights

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at night might affect their operational activities. Lists of decoys were particularly not sent to R.A.F. Stations to avoid any risk of pilots making notes and taking them into the air, thus giving the enemy much information if the aircraft was shot down. Pilots were, for their own safety, instructed in the difference between Q sites and true flarepaths but were not concerned with other types of displays.

If a serious objection was raised to any decoy it was made non-operational until the matter was cleared. Some clashes occurred and some decoys had to be abandoned; generally speaking however, the initial co-ordination between the Service Ministries and the Ministry of Home Security was effective in preventing clashes. Success depended on a thorough search round the site by site-finders, and on the accuracy and completeness of the information supplied by all Ministries to the Ministry of Home Security. In addition to clearing sites against all other activities, Colonel Turner's Department also checked sites with other displays to prevent mutual interference.

Construction of Displays.

8. The design of displays is dealt with in the next chapter, but their construction was a matter of organization, and was carried out by civilian contractors. These were specially chosen from engineering firms of good standing, who took on the rather unattractive work as a contribution to the war effort. The country was divided into areas and one contractor appointed to each area; he was responsible for carrying out the rapid construction of any new decoy in his area and also for all major maintenance that might be necessary. To enable him to meet sudden demands, he collected equipment required for

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the various types of decoys, the non-inflammable in his own stores,, and the inflammable in special compounds (generally alongside Starfish sites) allotted to him for the purpose. Small contractors would have proved unsatisfactory for even if they had been given charge of smaller areas, lack of labour and shortage of materials would have prevented them meeting requirements immediately, which was an essential for the effeciency of the decoy scheme.

CHAPTER II.

DESIGN, OPERATION AND CONTROL OF DISPLAYS

1. Design, operation and control are closely interconnected and are all affected by the basic factors described in Chapter I. Every display must have a meaning, i.e. it must simulate something which an enemy pilot may expect to see in the vicinity. In both types of displays, protective or misleading, knowledge of what is visible from the air (Chapter VII) in different conditions of weather by day and by night is a first essential. There is, however, one important difference between protective and misleading displays; the latter are not as stereotyped as the former as they represent forces in the field, whose layout and distribution is always variable; they are also not intended to draw attack. Protective displays or decoys must be sufficiently faithful to induce an enemy pilot to risk his aircraft in attacking what might be a well defended target. Hence much fuller knowledge of visibility and of methods of simulation are required for protective than for deceptive displays.

General principles of day displays.

2. The first principle of a day display is that it must be reasonably proof against high level photography; risk must be taken against low level oblique views, as simulation to defeat these is impracticable. It must be remembered that except during phases of moving warfare, photographs are examined by experts with special equipment and that they will certainly pick up any mistake. In addition, photographic cover, as it is called, is repeated at intervals, and comparisons are made between view taken at different dates; these comparisons often bring to light mistakes which may be overlooked in a single photograph.

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Departments responsible for displays should therefore have good contacts with a photographic intelligence unit.

One of the most common mistakes is lack of "life". To produce life, tracks, scars, dumps and heaps of tins, scrap, etc., must be provided, together with men and vehicles; some real units must be available ready to move about when an alarm is given. Similarly if dummy A.A. are displayed, some real A.A. must be on hand to open fire. It is the difficulty of producing sufficient "life" that militates against the use of day displays for protective purposes except under certain conditions, as sufficient numbers of men and vehicles can never be spared for any length of time to provide the necessary movement. Dummy airfields made in open country, and dummy factories will not deceive for long. On the other hand some dummy buildings may be satisfactory, if the targets they simulate do not normally show signs of life, e.g. wireless stations. Dummy aircraft can be used effectively on true airfields that are not fully occupied or are temporarily abandoned, the dummies being displayed attractively at one end and the true aircraft dispersed and concealed under nets elsewhere on the airfield: it is desirable to have one or two aircraft ready to move about if a warning is received. The conditions for misleading displays are different, especially in army displays, as troops are normally hidden in woods and hedges for their own security and full display is consequently not necessary. Moreover, a Commander may consider his deception scheme so important that he will arrange for a short time to provide labour for making tracks, dumps etc., and men and vehicles to give "life". Similarly an A.O.C. may think it worth while

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to mislead the enemy as to the strength of aircraft on a group of airfields, by adding to a few squadrons, located on them, a larger number of dummy aircraft. Normally, however, the long range of modern aircraft renders this form of deception unlikely unless it is carried out on a large scale for strategic rather than tactical reasons.

Generally speaking, therefore, protective day displays which normally have to last a long time are only worth while under conditions in which life and movement can be easily provided, while misleading displays which only have a comparatively short life may be of sufficient importance to be supplied with men, vehicles, and movement on a large scale to ensure success.

Day displays should normally be confirmed by suitable night displays, and also by radio messages or silences planned on the same lines.

General Principles of displays at night.

3. On the other hand night displays in the form of lights and fires are not affected by normal photography. They are economical in men and material, whether used to protect or to mislead. In a war area, the general blackout renders it difficult for a pilot to be certain of his exact position and this adds to the chances of success of protective displays.

The first main principle of lighting displays is that lights must be in action before the enemy aircraft arrive in the vicinity; the sudden switching of lights in view of the enemy is fatal. If lights are not on when an alarm is sounded, they must be switched on with full dimmer and very gradually brightened over a period of at least a minute.

The second principle is the necessity for providing equipment which will permit the strength

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of lighting to be varied to cater for differences of visibility due to moon or weather variations. Too little lighting will not be seen, too much may be suspected.

In the case of fires, it is essential that no dummy fire should be lit before an attack is developed on or near the area of the target. Success will then largely depend on whether fires started by the attack in the target area can be extinguished sufficiently quickly, and whether the decoy fire is lit without delay. To ensure the former, every effort should be made to convince the local N.F.S. of the vital importance of concentrating every reasonable effort on the first fires of an attack, as was done during the war. To ensure the latter, efficiently in the operation and control of the dummy fires, and reliable communications are necessary. Fires can be seen from a long distance, and in thick weather their glow illuminates the clouds above them. A fire is a great attraction to any pilot, and even an experienced one will be deceived by a good dummy properly operated.

From time to time army officers and civilians, who have little or no air experience, put forward objections to decoy lighting on the grounds that it will draw attack on to the true target. Decoy history during the war proves this to be a complete fallacy. In some cases Station Commanders readily accepted decoys, which had to be located only a mile from their airfields. Two of such decoys drew attack without harm to the stations, and no instance was recorded of any decoy leading an enemy to its target. This is not to say that an isolated decoy, always lit at the same time and for the same number of hours, would not eventually be pin-pointed and used as a guide by an enemy, but a

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proper decoy system that has to be effective over a long period must consist of a large number of decoys of various types operated in varying ways at different times. It is known that except in one unimportant corner the enemy never located any of our decoys during the war with any accuracy. It should be realized however that conditions are sometimes met when it is undesirable in certain localities to show any lights at all, either permanently or during a particular period; in such cases during the war decoy fires only were built.

Design of displays.

4. Day displays are dealt with in Chapters II, III and XIV and dummy equipment in Chapter XXVI. Some details of construction of accessories may be mentioned.

(a) Airfields.

If hedges are cut down in open country and ditches well covered with the brushwood so obtained, the resulting view from the air resembles the painted hedges on true airfields.

(b) Buildings.

Horizontal dimensions of dummy buildings must be the same as those of the true ones simulated, as they can be measured on photographs. Vertical dimensions must be at least $\frac{3}{4}$ of the true dimensions, as cast shadows will always be checked up by enemy intelligence officers. Normally the main frame work of dummy buildings, constructed during the war, consisted of well braced tubular scaffolding which supported the walls and the roof. The walls consisted of canvas sandwiched

/between

between two layers of chicken wire which was firmly fastened to the tubular scaffolding. Doors and windows were painted a dull black on the walls as necessary. Some windows were cut out of the canvas and replaced by windowlite. This gave shine by day, and when lights were lit inside, bad blackout at night. The roof consisted of plaster slats spread on a single thickness of chicken wire; each slat was 6 inches wide and the gap between slats was 3 inches. This gave the appearance from the air of a corrugated roof, and rain and snow fell through the gaps between slats.

(c) Roads.

Dummy roads were made by clearing the turf and laying a thin layer of white lime stone or clinker which was then lightly rolled.

(d) Tracks.

Tracks were made in several ways. In some cases turf was lifted and turned upside down. Where available, sand and saw dust were used; straw was sometimes used but it does not last long as it is carried away by wind. For rapid work, chloride of lime powder was used to bleach the grass. The result was satisfactory from the air, but gloves have to be used and this method is not very durable. Other tracks were made by towing barrows behind lorries.

Operation of day displays

5. The operation of R.A.F. day displays by the crews allotted to them is laborious but simple. Dummy aircraft must be assembled by night or under cover by day. Their

/positions

positions and numbers must be frequently changed, and this applies also to accessories in the form of dummy tankers, transport and litter. Tracks must be renewed, and new tracks made; care must be taken to continue tracks across hedges. Movement must be visible and it is desirable to have true aircraft and transport standing by to move about when there is an alarm. If a display is mounted on a partially occupied airfield and is properly operated, it is unlikely that its bogus character will be detected.

The operation of building displays, e.g. aircraft factories, consists chiefly in the movement of aircraft as described above, and in the maintenance of the dummy building which needs constant repair in bad weather.

Control of day displays.

6. During the war the control of most protective days displays, e.g. K's and dummy factories was vested in the Area Officers concerned. K.L.G.'s were controlled by the Station Commander, to whom policy and operational instructions were issued. Area Officers inspected all day displays.

All misleading displays during the war, except Tindall and Fortitude were controlled by the Headquarters of the department who contacted Groups and Station Commanders as necessary. Tindall and Fortitude were inter-service displays and controlled by inter-service Staff Officers. The Department provided all supervision.

Design of Night Lighting displays.

7. In the design of protective lighting displays for static targets, full knowledge is necessary of the various forms of "permitted" lighting and of measures taken during an alarm. In Britain, during the war, railways, factories, etc., who used "permitted" lighting, received first a "purple" warning and then, if necessary a "red" warning when the attack approached their area. Some lights were extinguished on the "purple" warning and most or all the remainder on the "red". It often happened that the warning centre was further away from the line of enemy attack than some of the factories it warned. Hence there was a tendency for certain factories

/to

to turn out their lights either too late or at any rate within view of the first aircraft of the attack. Moreover, discipline was often bad and some lights were frequently not extinguished. Blackout also was often imperfect.

As a result of frequent reconnaissance of "permitted" lighting, it was discovered that there was considerable variation in the apparent strength and visibility of similar lights due to several causes. It was also found that many lights appeared to flicker, i.e. to disappear for short periods as if some obstruction intervened between them and the aircraft.

All these factors were taken into account in the design of night displays. In addition to the simulation of the target, nearly every display had the following features - bright lights to attract the enemy from a considerable distance, less bright lights visible only as he approached, two circuits main and subsidiary, the main circuit being turned off when he was close and the subsidiary in the form of bad blackout, etc. being left on for him to attack. Lights of different visibilities and colour, some of them flickering at intervals were also provided.

Operation of lighting displays.

8. Moonlight and weather conditions were considerable factors in the operation of lighting displays. Moonlight affected different types of displays in different ways, if, for instance, the display represented factory lighting, it could not hope to be effective and consequently was not operated, if the enemy pilot could see the ground features sufficiently to detect the adsence of buildings and roads. On the other hand, a Q site represented an airfield in open country and many true airfields had hedges painted on them. Unless therefore the layout crossed large ditches with water in them Q lighting could be displayed in certain moonlight conditions.

The presence of cloud and mist affected visibility of the ground and of lights to such a degree that exact instructions could not be laid down. Generally speaking variations

/of

of strengths of lights were necessary according to these weather conditions and to the strength of moonlight. To effect this all display equipment was fitted with a dimmer which regulated strengths as necessary. To avoid switching on lights in view of the enemy, the local control gave instructions for operating them over a period of X hours each night, as suited local conditions, though conforming to the general policy, operated in different ways. This gave rise to variations which are vitally necessary for efficiency. If lights were extinguished, when an attack was in progress and the controller wished them to be operated, the crew turned them on with full dimmer and very gradually increased the lighting to the required standard.

Details of designs of various forms of lighting displays are recorded in Chapters XXII and XXIII.

Design and operation of fire displays Q and Q.F.

9. A static decoy fire has to be lit after an attack commences, to draw off further attack from the target area. Its essential features are immediate ignition, rapid enlargement, and endurance for a considerable time. This entails electric firing and a considerable amount of inflammable material. To render them more realistic different types of material are used to give redder or yellower flames. In the field where dispersal is practised, a fire started by air attack may be comparatively small. A decoy fire in the field may be effective without being very large, and this is fortunate as transport of material is limited and timber from damaged houses or woods can only be collected with difficulty. The Germans for some time built walls round their fires to simulate burning houses; this is not necessary, as however much the fire may show up the vicinity to an observer on the ground, the surroundings are rarely visible to a pilot at any height.

As in the case of decoy lighting, bright moonlight may render it undesirable to operate a decoy fire if the enemy can recognise the ground features. Here again weather

/conditions

conditions may cancel out moonlight effects. Fires light up clouds to a considerable extent and their glow can be seen from above the cloud unless it is very thick.

Types of fires and their layouts are shown in detail in Chapter XXIV.

Control of Night displays.

10. The salient factor in the choice of a local control to operate night displays is that it should have an all-night operations or A.R.P. watch with a plotting table on which enemy attack is promptly recorded. R.A.F. Operational Stations can control their own Q sites but are unsatisfactory for controlling a large number of decoys, as their own operations at night absorb the attentions of the flying control staff and their telephones. At an early date Balloon Centres were chosen for local control of many civil decoys. Later, police obtained plotting tables and staff and were also used as controls. Normally speaking controls were allotted as follows:-

(a) R.A.F. Qs and QFs.

These were controlled by the stations which the decoys were protecting. The Q lighting was lit to suit the operations in progress on the parent airfield. QFs were not lit unless the parent station or its vicinity was attacked. A direct telephone line connected the parent station to its display site.

(b) QLs and QFs protecting individual civil targets.

These were controlled by the night A.R.P. watch of the parent target. Few QLs were used for individual targets but the lighting of QFs was based on the same principles as for R.A.F. QFs.

(c) Groups of QLs and QFs near large towns, etc.

These were controlled by the local Balloon Centres in or near the towns. When no considerable attack was imminent QLs were lit for certain hours on most nights to attract the odd raider. Generally groups of QLs were lit on one side or the other of the

/protected

protected area to avoid encircling the target. All lighting and the QFs were subject to immediate change of operation if a considerable attack was imminent and it was decided to operate a Starfish. Direct telephone lines connected these local controls with all their sites.

(d) Starfish.

These large fires were the backbone of civil decoy protection. They were controlled by 80 Wing at Radlett, a special signals headquarters which operated all radar and radio countermeasures. This wing had early information of all movements of enemy aircraft, and were in the closest contact with Fighter Command. 80 Wing was connected to all local Starfish controls by the main trunk telephone lines, but first priority was ensured for Starfish operation. When an attack was imminent 80 Wing communicated with the local controls in the area liable to attack and discovered weather and other conditions locally. As the attack approached a particular area, the most suitable Starfish sites were picked for operation. The sites were warned, but the actual order for lighting was delayed until attack had started. Once 80 Wing had given the order the sites concerned operated and fires were started within two minutes at a maximum. If there was any further delay a special enquiry was afterwards made. Most fires were lit within two minutes. The above represented the normal procedure, but special arrangements were made in particular cases. If the telephone system broke down, which was rare, the local control after 15 minutes acted on his own authority.

The preliminary discussion and selection of the Starfish to operate gave the local control time to

/change

change the operation of QLs to suit, again to avoid any encirclement of the target.

(e) Temporary Starfish.

These were operated by 80 Wing in a similar way to Starfish sites for the protection of smaller towns against Baedeker raids. Local Controls were generally chosen from County or Urban Police Headquarters.

(f) Special QLs and QFs for Cover Plans.

Both protective and deceptive displays were constructed and manned by the Department to meet the requirements of Cover Plans initiated by Combined Planning Staffs, Cossac and S.H.A.E.F. As these were situated on or near the coast, control was vested in the local naval authorities, to whose headquarters the necessary telephonic communications were laid.

Policy and Supervision.

11. Although the control of displays was handed over to local authorities or to 80 Wing, the Department still maintained the direction of the decoy defence of the country, and also its general supervision and inspection to ensure efficiency in operation and control. Decoy defence is never static; new methods or directions of attack have to be constantly countered, and, if possible, foreseen. There were therefore frequent changes in policy and in methods of operation of decoys. Good contact with controls and with operating crews was essential to ensure that these changes were quickly understood and applied. A decoy organization can have unlimited breadth, but its depth should be minimised.

CHAPTER X.

ENEMY ATTACKS ON PROTECTIVE DISPLAYS IN BRITAIN.

1. During the war, and particularly in the winter of 1940/41 when enemy air attacks were at their heaviest, the department's attention was concentrated on the rapid expansion of decoy protection and the improvement and development of the various types of displays. Attacks were recorded for operational reasons, to check successes and failures so that the latter could be remedied. Crews, who were responsible for the initial reports, were fully employed on rebuilding fires and general maintenance, and though they were able to provide a rough calculation of the number of bombs drawn, they had not the time nor the knowledge to make an exhaustive search and provide an exact estimate of the type and tonnage of bombs dropped.

Now, at the end of the war, for historical purposes more information is desirable and other sources have been examined to arrive at a reasonable estimate of the total draw off of enemy attack by decoys and the consequent saving of life and property.

This chapter is divided into two parts; the first deals with the operational picture and discusses attacks which are listed as "certainties"; the second part gives reasons for the addition of "probables", and attempts a conservative assessment of the value of decoy protection during the war.

PART I.

"CERTAINTIES" AND THE OPERATIONAL ASPECT.

2. The enemy effort wasted on Air Ministry decoys is best illustrated by the two diagrams A and B.

3. Diagram A shows in the top half the Enemy Bomber

/Effort

Effort, and in the lower half the number of decoys in operation month by month throughout the war. Q's, QL's, QF's, and Starfish are shown separately but all decoys, K's, KLG's and dummy buildings are shown together.

The maximum enemy effort known as the big "blitz" occurred between August 1940 and June 1941. There was a reduction in January and February 1941 due to bad weather. Subsequently the scale of enemy attack fell off considerably, largely owing to the diversion of the Luftwaffe to the Russian campaign, but partly also to the development of our night fighters and A.A. which caused him increasing losses as time went on. Two peaks subsequent to the "blitz" may be recorded. The first in April 1942 was due to the Baedeker raids on undefended towns of historical, but no military, value. The second in February 1944 represented his last effort with a complicated path-finder technique on London prior to the introduction of the flying bomb.

The diagram shows an unmistakable fact. Only the K. sites, (day decoys), some Q sites, and in the latter period an increasing number of Starfish, were in operation during the big blitz. Civil QL's and QF's were not constructed until after the blitz. The K sites served their purpose, but their use was very limited. Q sites were sufficient for the protection of the airfields then in existence and were increased as airfield construction progressed. Civil protection was started much too late. As mentioned in the history, civil QL's and QF's were actually commenced in October, 1940 but had to be dropped in November 1940 to permit of all efforts being concentrated on Starfish, the best type of decoy for heavy raids.

The moral is obvious.

/All

All decoy sites must be chosen and constructed before the war and put into operation at the earliest moment.

4. In diagram B the top half again shows the enemy attack effort and the lower half illustrates the number of attacks on the various types of decoys. (See also Appendices I and II at the end of the chapter). All day decoys are again shown together and in this diagram QL's and QF's have also been grouped. Most QF's were located with QL's on the same sites and the few that were separate were never operated unless the individual target they protdcted was attacked. Very few of these were lit and a separate record is unnecessary.

The following points are brought out in this diagram:-

(a) Although the upper and lower halves are obviously on very different scales, if the peak points on the decoy lines are studied in conjunction with the peak points of the same month in the enemy attack effort, it will be seen that the former are comparatively higher in later years than in 1940-41, indicating an increase in draw off in the later periods per unit of enemy attack. This increase was chiefly due to the continuous additions in decoy numbers up to the end of 1942. It is important to realise that decoy lighting, if too bright, is liable to be suspected. On many nights with poor visibility an enemy may pass within a few miles of a lighting display and never see it. If there are large numbers of displays, he will probably see some and may be attracted to one. If there are only

/a

a few displays, he may see none. Fires are more visible but to ensure they are in the best position to draw attack from any approach to the target, their numbers must be considerable. Hence for success in protective displays, large numbers are essential.

Improvement in decoy technique and the reduction in Luftwaffe efficiency were also factors in obtaining greater success as time went on.

(b) Peaks on the attack lines generally coincide with peaks in the enemy attack effort which is to be expected; those that don't probably indicate periods of weather most suitable for deception.

(c) The very large proportion of Q successes is due chiefly to the fact that they were the first decoys constructed and were in operation in considerable numbers during the main blitz of 1940/41. Most Q's were located in the South and East, i.e. on the lines of enemy approach to inland targets. It is quite certain that they not only drew attacks off airfields but also off other targets including built-up areas.

(d) The diagram records only the numbers and not the extent of attacks on different decoy types. Attacks on decoy lighting were normally delivered by single aircraft or at most two or three at a time; those on Starfish were often carried out by considerable numbers of aircraft.

Some Starfish attacks.

5. Some of the attacks on Starfish are interesting, especially when an A.W.A.S. (Air Warfare Analysis Section) estimate of bombs dropped is also available.

(a) BRISTOL AREA.

Date.	Decoy	Department's Estimate.	A.W.A.S. Estimate.
2/3.12.40.	STOCKWOOD	59 H.E.	
6/7.12.40.	STOCKWOOD	56 H.E.	
16/17.3.41.	DOWNSIDE	50 H.E.	150 H.E.
			/3/4.4.41.

Date.	Decoy.	Department's Estimate.	A.W.A.S. Estimate.
3/4.4.41.	DOWNSIDE	25 H.E.	
4/5.4.41.	DOWNSIDE	16.H.E.	
9/10.4.41.	DOWNSIDE	12 H.E.	
11/12.4.41.	CHEW MAGNA	34 H.E.	
(b) CARDIFF AREA.			
4/5.3.41.	LAVERNOCK	67 H.E.	102 H.E.
(c) LONDON AREA.			
16/17.3.41.	FARLEIGH	26 H.E.	27 H.E.
19/20.3.41.	RAINHAM MARSH MARSHES	28 H.E.	
(d) BIRMINGHAM AREA.			
16/17.5.41.	BALSALL	20 H.E.	
(e) GLASGOW AREA.			
5/6.5.41.	AUCHENREOCH	25 H.E.	
(f) PORTSMOUTH AREA.			
17/18.4.41.	SINAH COMMON	170 H.E. 14 parachute mines 20 oil bombs.	

Note: In all attacks large quantities of incendiaries were also dropped.

Comments on the above:-

(a) A.W.A.S. estimates of bombs dropped average at least double the amounts claimed by the Department's rough estimates.

(b) Bristol casualties and damage would have been much worse if its protective decoys had not drawn off so much.

(c) The attack on Portsmouth on 17/18th April 1941 ((f) above) was the star success of the war and the draw off was much greater than the department's figure recorded above. The decoy was located on the tip of the peninsula in the mouth of Langstone

/Harbour,

Harbour, which is very similar in shape to Portsmouth harbour. Weather conditions were ideal. A wireless message from the enemy attacking aircraft was picked up and translated - "Portsmouth obscured by mist, but can see fires". 144 aircraft attacked that night; only 8 bombs fell on Portsmouth, the remainder fell on the decoy, in its neighbourhood, in the sea or in Langstone Harbour. Allowing 4 bombs average per aircraft, of 576 bombs 568 must have been drawn off; some 200 odd fell on land, the remainder in the sea or Langstone Harbour, or on its edges. One small ship entering Langstone Harbour 2 days later was sunk by a magnetic mine, and the harbour had to be swept. This was one of the four known occasions when casualties occurred as the result of decoy success. Eight people, chiefly A.A. personnel, were killed and some 30 injured, including civilians. The A.A. hutted camp, 800 yards from the decoy, was almost destroyed, and many houses on Hayling Island received damage varying from "considerable" to "light". The attack was extremely accurate, many of the boiler fires suffering severe damage.

(d) A most interesting success was achieved during an attack on Nottingham on 8/9.5.41. This was a heavy attack, of which the first half was aimed at Derby, and the second half at Nottingham. The direction of the enemy's radio beams and other information collected by 80 Wing provide the full story. The first half of the attack was diverted by radio counter measures and the enemy aircraft

/instead

instead of reaching Derby spent their effort in the moors to the north-east. The first aircraft of the second half of the attack found Nottingham and started a fire. Cropwell Butler, a Starfish south-east of Nottingham was hit at once. Attack ceased in Nottingham and none was delivered on the decoy. The Regional Commissioner's staff in Nottingham, always troublesome, wrote and complained bitterly that the decoy had not been successful. While a suitable, but not too lurid, reply was being framed, information was received from 80 Wing which enabled an answer to be sent which had so salutary an effect that no further trouble was experienced from this sector in the future. The remainder of the second half of the attack was switched to about 12 miles east of Nottingham and some 40 tons of bombs fell harmlessly in the Belvoir valley. It is quite certain that this portion of the attack, seeing the decoy, mistook it for Derby burning and registering their position as too much to the west turned to the east and bombed what they thought was the Nottingham area in the Belvoir valley.

(e) The attack on Glasgow on 5/6.5.41 ((c) above) was also very interesting. After dropping 25 H.E. on the Auchenreoch site on which a large Starfish had been lit, the attack was switched 2 miles to the west and another 60 H.E. dropped on the hills in open country, without causing damage or casualties. It is assumed that two targets in the Clyde area had been selected, one of which was probably the Naval Oil Depot. The decoy was mistaken for one target and,bombed. Other aircraft, judging the first target well alight, transferred theirattack to the second target 2 miles to the west. The decoy was therefore

/responsible

responsible for drawing off this second attack, although the bombs fell a long way from it.

Both (d) and (e) prove that decoys may draw attacks off targets without necessarily drawing it on themselves.

Moorland country often provided automatic decoys and drew a number of considerable attacks. When some enemy aircraft, lost or desperate, dropped bombs on a moor, fires started on the heather or peat which attracted other aircraft, often to a considerable extent. One attack on Ipswich was delivered on its eastern edge and started fires in heather. A decoy east of Ipswich was lit and the bulk of the attack shifted still further east and fell in open country between the town and the decoy.

Additional general information

6. Generally speaking the greatest successes in the protection of civil vital points were achieved by Starfish and QL's guarding Portsmouth, Plymouth, Bristol, the Humber, and Middlesbrough. This is interesting as ports or coastal targets should have been the easiest targets to pick up and the most difficult for decoys. The star success at Langstone Harbour has already been described; several small raids on Portsmouth occurred in June 1944, shortly before D day. 80% of these raids was drawn off by decoys round Portsmouth. It is harder to understand the success of the Plymouth and Humber decoys, but these and the Portsmouth decoys were particularly well controlled and operated by the Navy. It was the QL's north of Middlesbrough that continually drew attacks north of the town. They also were very well operated by Imperial Chemicals staff.

Least success was obtained at Liverpool. Apart from the very conspicuous estuary and port, the worst attacks were all made in bright moonlight when decoys could not be operated successfully. In addition dumps and camps were

/constructed

constructed all round Liverpool and Birkenhead and the siting of decoys was most difficult. All had to be located at a considerable distance from the target area. After the heavy attacks further decoys were added along the Dee estuary to be used in thick weather in the hope that the enemy would mistake the Dee for the Liverpool estuary. No further attacks developed so that no test could be made. Similar difficult conditions of siting prevented much decoy success near Birmingham. This centre, large in itself, is surrounded by other towns and suburbs. Manchester too was poorly protected but not often attacked.

The Leeds, Bradford, Halifax area, nearly always under industrial haze, was rarely attacked though a number of decoys were sited for its protection.

Glasgow protection was made more difficult by bad blackout discipline generally, by continuous tram flashes due to the refusal of tram-drivers to make an attempt to prevent them, and by the reflection of searchlights on clouds nearly always present above the city. This reflection shining on the Clyde marked it unmistakably, and after a time searchlights were not operated in the Glasgow area. It is interesting to record that most attacks on Glasgow came from the North. The enemy appeared to use Loch Lomond as a recognisable landmark to guide them to the city.

PART II.

"PROBABLES" AND AN ESTIMATE OF THE TOTAL EFFECT OF DECOYS.

Incompleteness of records.

7. The records of decoy successes discussed in Part I, though reliable as far as they go, are incomplete as a total figure, both in regard to numbers of attacks, and still more so in relation to their extent; some reasons may be given:-

/(a)

(a) Attacks were only logged as such if bombs fell within three quarters of a mile of a Starfish, or within half a mile of any other type of decoy. A few exceptions were made, when, after careful investigation, it was proved beyond any doubt that no other light or feature could have drawn the attack. This restriction was adhered to in spite of A.W.A.S. researches, which showed that when an isolated target was attacked bombs fell anywhere within a circle of two miles radius from the centre of the target. The reason was an operational one; we could not afford to deceive ourselves by logging as an attack on a decoy one that might have been aimed elsewhere. Similarly in gauging the extent of an attack crews did not search for craters outside the above limits. As a result therefore for historical purposes the department's records do not include attacks on decoys when bombs fell between ½ or ¾ mile and 2 miles from the target, and in regard to the extent of recorded attacks they do not include bombs which fell within the same distances.

(b) A second factor which varied with the type of site was the reliability of the crew operating the decoy in spotting an attack. Even the best crews might fail to note an attack in certain types of country. Each night only 2 or 3 men were on duty and they were located in a shelter half a mile on one side of the decoy. Bombs falling half a mile on the other side might escape notice. With slack crews, particularly those in charge of some civil decoys, many attacks
/may

may have been missed. A.W.A.S. record thirteen of these of which the department has no record, and as A.W.A.S. records are incomplete it is certain that other attacks occurred which were not noticed.

(c) Reliability in reporting attacks varied considerably. Although every effort was made to ensure reports reaching the department, many cases occurred of attacks being discovered long after they occurred, and it must be assumed that some were missed altogether. Reporting became less reliable in the later years of the war. Sometimes the crews were to blame, at other times the reports remained dormant in some part of the chain of communication. This certainly happened when U.S.A. Groups took over airfields with Q. sites. Many saw no need of reporting successful draw-offs to an Air Ministry Department until they were found out and given the reason for doing so. Constant changes in the occupation of airfields necessitated repeated prompting to report.

Summing up, the department's records are incomplete owing to three factors:-

(a) The restriction of attacks to the half or three-quarter mile limit.

(b) Failures of crews to notice attacks.

(c) Failures in reporting attacks.

These factors operated in varying degrees according to the type of decoy.

Other Sources

8. A.W.A.S. (Air Warfare Analysis Section) and K.P.I.D. (Key Points Intelligence Department), both branches of the Ministry of Home Security, are the only other sources

/from

from which information is available. Their recorded figures of attacks are shown in Appendices I and II at the end of this chapter.

A.W.A.S. unfortunately did not come into being until after the Coventry blitz. Their main duty was to analyse attacks, and the decoy draw-off was only one item in this analysis, which could not be accurately assessed until their organization had been fully developed, and until their staff had learned a great deal about the positions, types, and operation of decoys. As will be seen in the Appendices they did not come into the picture properly until October 1941 and they missed assessing most of the attacks on decoys previous to that date, including nearly all the heavy ones that occurred in the main blitz. They soon discovered that the limits imposed by C.T.D. for attack distances was far too small, and they extended the ring first to one and later to two miles. This had the immediate effect of increasing the figures of bombs dropped in each attack. A.W.A.S.' chief value to the department was in this accurate assessment of the extent of each attack they investigated; in fact they were the only reliable authority in this respect, as their staff was trained for the purpose. In addition they were helpful in discovering a number of unreported attacks.

K.P.I.D. records are based on the location of the fall of bombs. If these fall within 1½ miles from a decoy site, unless warned to the contrary, K.P.I.D. logged a possible attack. They could not know, without reference to C.T.D. whether the decoy was in operation, i.e. if the lights or fires were lit. Bombs might have fallen near a decoy not in operation at the time, which therefore could not be credited with an attack. K.P.I.D.'s information as to the fall of bombs near built-up areas or other targets was very

/reliable

reliable, but not so in the case of some attacks in open country. The very great secrecy imposed on decoy work during the war was largely responsible for this. Local wardens were not informed of decoys in their area, and therefore did not specially check up the vicinity of decoy sites. Many bombs falling in remote districts were not reported even to wardens and information of some attacks, especially those on Q sites, did not reach K.P.I.D. For historical purposes, therefore, K.P.I.D's records are not sufficiently accurate for an estimate of decoy successes. For operational purposes, during the war, in reporting to C.T.D. possible attacks, K.P.I.D's work was of the greatest value to the department; it provided a check on our own information, and often drew attention to attacks that had not been reported.

Reference to the Appendices provides the following points of interest:-

(i) For day attacks K.P.I.D. records show few and A.W.A.S. no attacks. Up till September 1940, C.T.D. was employed on R.A.F. decoys only and had no contact with K.P.I.D.; as previously stated A.W.A.S. was not functioning during the day attack period.

(ii) For night attacks, though contact with K.P.I.D. for decoy requirements was established in September 1940, exchange of information on attacks was not arranged till February 1941.

(iii) K.P.I.D. figures of attacks exceed C.T.D. figures in September 1941, in 6 of the 12 months of 1942, in all months except September 1943, and in all months to May 1944. This is due partly to their using the 1½

/mile

mile limit and partly to their logging possible attacks when decoys were not operating. A.W.A.S. figures exceed those of C.T.D. in October 1941, in January and February 1942, and in May 1943. These figures are "certainties" and the difference is due to the increased limit of 2 miles against the C.T.D. restricted. Generally speaking the figures of K.P.I.D. and A.W.A.S. show that C.T.D. records based on their restricted limit are short of the true total.

Assessment of attacks.

9. It is clear that the only reasonable method of arriving at the full total of attacks is to take C.T.D. "certainties" as a basis and to add a figure of "probables" to each type of decoy according to the extent to which the three factors, (a) restricted limit, (b) failure of crews to notice, (c) failure in reporting, operated.

In Table I below the assessments are based on the following circumstances:-

(i) Day decoys of all kinds should have been fully noticed and reported; no probables should be added.

(ii) For Q sites all three factors operated. The certainty figure is taken as 85% of the real total.

(iii) For QL. AF sites all three factors operated but (a) and (b) to a much greater degree. Certainty figure is taken as 75%.

(iv) For SF. sites the distance factor alone operated but it is known that several possible attacks were ruled out owing to this factor. Certainty figure is taken as 85%.

/TABLE I.

TABLE I

ASSESSMENT OF TOTAL ATTACKS.

	Type of decoy.	C.T.D. & Naval Certainties.	Certainty % of total	Probables	Total
Day Attacks	K, K.L.G.	47	100%	Nil	47
	Dummy factories	9	100%	Nil	9
	Q	443	85%	78	521
	QL, QF.	130	75%	43	173
	SF.	101	85%	18	119
	TOTAL	730		139	869

Assessment of tonnes dropped.

10. A.W.A.S. figures being the most accurate are taken in Table II below for Q, QL, and Starfish (plus an addition for this last type). C.T.D. figures, the only ones available, are taken for day decoys.

The addition of 300 tonnes in Table II for Starfish is due to the inadequate A.W.A.S. figure which provides an average for the later attacks, but missed all the heavy early attacks in 1940/41, six of which drew 297 tonnes.

TABLE II.

ASSESSMENT OF TONNES DROPPED ON DECOYS.

	Type.	No. of Attacks.	Average in tonnes	Total tonnes	Source of figures.
Day decoys	K,K.L.G.	47	2.5	117.50	C.T.D.
	Dummy factories	9	1.3	11.70	C.T.D.
	Q	521	1.65	859.65	A.W.A.S.
	QL, QF.	173	1.53	264.69	A.W.A.S.
	Starfish	119	5.61	667.59	A.W.A.S.
	ADD for A.W.A.S. short estimate on Starfish			300.00	
	Total in tonnes.			2221.13	

/11.

Percentage of draw-off.

11. The total tonnage of bombs dropped by aircraft on the United Kingdom during the war was 68,500 tonnes. This figure includes incendiaries and mining by aircraft in estuaries and on the coast. 12,500 tonnes were dropped by day and 56,000 by night. The percentage of draw-off by decoys according to the above assessment is 1.03 by day and 3.73 by night.

At first sight these percentages appear small; in any case the day draw could not expect to be very successful; our decoy effort was small and conditions unsuitable. In considering the night draw-off, it must be remembered that a large proportion of bombs dropped at night fell in open country and that the tonnage dropped on towns and other targets was a good deal less than 56,000. Decoys were sited close to towns and targets, and it is considered that, taking this into account, the real night draw-off for the whole war from vital points and inhabited areas was at least 5.

More accurate A.W.A.S. figures are available for the year 1942. In this year the total tonnage dropped amounted to 2,761 tonnes by night, of which 176 tonnes was drawn off by the decoys which were checked by A.W.A.S. Even this gives a draw-off of 6.37 but the figures of "certainty" attacks are as follows:-

	C.T.D. Certainties	Checked by A.W.A.S.
Q's	37	19
QL.QF.	35	28
SF.	21	21

Thus 18 Q's and 7 QL's were not checked by A.W.A.S. If we give average A.W.A.S. figures for these we must add:-

/18 Q's

18 Q's	@	1.65 tonnes	=	29.7
7 QL's	@	1.53 tonnes	=	10.71
		total	=	40.41 tonnes

This brings the total draw-off by certainties up to 216.41 tonnes or 7.84%.

Working on the "probables" percentages allowed above for attacks which were unseen, unreported, or at greater distances we must add again:-

7 Q's	@	1.65 tonnes	=	11.55
12 QL,QF's	@	1.53 tonnes	=	15.36
4 SF,	@	5.61 tonnes	=	22.44
		Total		49.35 tonnes

This brings the total draw-off of certainties and probables to 265.76 or 9.95%, and even this does not take into account the bombs which in any case fell in open country and the consequent less tonnage dropped on targets and towns.

For reasons already given the draw off in later years is known to be proportionately greater than in the early years and consequently 1942 figures will average a greater draw-off than those for the whole war. They do however confirm that the assessment of 5% for the whole war is a very conservative one, and that the value of night decoys in the defence of the country was very considerable.

This however does not give the whole picture. A considerable proportion of enemy attack was delivered on towns which were not covered by decoys, e.g. Brighton, Eastbourne, etc. Decoys could only be provided for the more important towns and targets. When this is considered, the value of decoy protection appears very considerable. In some cases the decoys were attacked

/on

on more than one occasion and the target area escaped altogether. In other cases it is known that the decoys drew amounts varying between 25% to 80%.

Life and Property.

12. The published figures of civilian casualties from bombs dropped by aircraft amount to 51,923 killed and 63,208 injured. On the basic figure of 5% draw-off by decoys, the saving in killed and wounded works out at 2,596 and 3,160 respectively.

The saving in damage to property, taking all factors into consideration, was probably in the neighbourhood of a hundred million pounds.

CHAPTER X
APPENDIX I

ATTACKS ON DECOYS BY DAY.

1940	TYPE	R.A.F.	NAVAL	R.A.F. & NAVAL	K.P.I.D. ALL TYPES	A.[illegible].A.S.
APRIL	K					
	KLG					
	DF					
MAY	K					
	KLG					
	DF					
JUNE	K					
	KLG					
	DF					
JULY	K	6		6		
	KLG					
	DF					
AUGUST	K	2		2		
	KLG					
	DF	1		1		
SEPTEMBER	K	7		7		
	KLG					
	DF	4		4		
OCTOBER	K	10		10		
	KLG					
	DF	3		3		
NOVEMBER	K	4		4		
	KLG					
	DF	1		1		
DECEMBER	K	1		1		
	KLG					
	DF					
1941 JANUARY	K	1		1		
	KLG	1				
	DF					
FEBRUARY	K	2		2		
	KLG	3		2	5	
	DF					
MARCH	K	1		1		
	KLG	4		4	2	
	DF					
APRIL	K	1		1		
	KLG					
	DF					
MAY	K					
	KLG	3		3	1	
	DF					
JUNE	K	1		1		
	KLG					
	DF					
TOTALS	K	36		36		
	KLG	11		9	9	
	DF	9		9		
GRAND TOTAL	ALL TYPES	56		54	9	

K. Dummy airfield with dummy aircraft.
KLG. Dummies on temporarily abandoned true airfield.
DF. Dummy Factories (aircraft).

CHAPTER X.

APPENDIX II

ATTACKS ON NIGHT DECOYS

1940.

1940	TYPES	R.A.F.	NAVAL	R.A.F.& NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
APRIL	Q					
	QF QL				1	
	SF					
MAY	Q					
	QF QL					
	SF					
JUNE	Q	36		36		
	QF QL					
	SF					
JULY	Q	11		11		
	QF QL					
	SF					
AUGUST	Q	28		28		
	QF QL					
	SF					
SEPTEMBER	Q	37		37		
	QF QL	7		7		
	SF					
OCTOBER	Q	23		23		
	QF QL	5		5	1	
	SF					
NOVEMBER	Q	28		28		
	QF QL	2		2		
	SF					
DECEMBER	Q	11		11		
	QF QL	1		1		
	SF	5		5		
TOTALS	Q	174		174		
	QF QL	15		15	2	
	SF	5		5		
GRAND TOTAL	ALL TYPES	194		194	2	

N.B. Attacks on dummy factories by night included as QL.

APPENDIX II

ATTACKS ON NIGHT DECOYS
1941

1940	TYPES	R.A.F.	NAVAL	R.A.F.& NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
	Q	6		6		
JANUARY	QF QL	1		1	1	
	SF	5		5		1
	Q	36		36		
FEBRUARY	QF QL		3	3	40	
	SF	2		2		1
	Q	21		21		
MARCH	QF QL		1	1	35	
	SF	14	2	16		5
	Q	46		46		
APRIL	QF QL	1		1	61	
	SF	13		13		11
	Q	26		26		
MAY	QF QL				25	
	SF	4		4		1
	Q	13		13		
JUNE	QF QL		4	4	14	
	SF	3		3		
	Q	13		13		
JULY	QF QL				8	
	SF	6		6		3
	Q	14		14		5
AUGUST	QF QL	3		3	8	1
	SF	1		1		1
	Q	9		9		4
SEPTEMBER	QF QL	2		2	15	3
	SF					
	Q	1		1		1
OCTOBER	QF QL	10	1	11	5	16
	SF					
	Q					
NOVEMBER	QF QL		1	1	1	1
	SF					
	Q					1
DECEMBER	QF QL	1	1	2	1	9
	SF					
	Q	185		185		11
TOTALS	QF QL	18	11	29	214	30
	SF	48	2	50		23
GRAND TOTALS	ALL TYPES	251	13	264	214	64

C H A P T E R X

APPENDIX II
ATTACKS ON NIGHT DECOYS
1942

1942	TYPES	R.A.F.	NAVAL	R.A.F.& NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
JANUARY	Q					1
	QF QL	1		1		1
	SF					
FEBRUARY	Q					1
	QF QL					
	SF					
MARCH	Q	3		3		3
	QF QL					
	SF				1	
APRIL	Q	8		8		8
	QF QL	3	1	4	26	3
	SF		1	1		1
MAY	Q	3		3		3
	QF QL	2	1	3	17	3
	SF	3	2	5		[illegible]
JUNE	Q	2		2		1
	QF QL	3	1	4	20	2
	SF	4		4		6
JULY	Q	9		9		
	QF QL	13		13	21	10
	SF	2	2	4		1
AUGUST	Q	9		9		1
	QF QL	5		5	32	4
	SF	5		5		5
SEPTEMBER	Q	2		2		1
	QF QL	3		3	20	2
	SF	1		1		1
OCTOBER	Q					
	QF QL	2		2	10	2
	SF	1		1		2
NOVEMBER	Q	1		1		
	QF QL				1	
	SF					
DECEMBER	Q					
	QF QL				12	1
	SF					
TOTALS	Q	37		37		19
	QF QL	32	3	35	160	28
	SF	16	5	21		21
GRAND TOTAL	ALL TYPES	85	8	93	160	68

C H A P T E R X.

APPENDIX II

ATTACKS ON NIGHT DECOYS
1943.

1943	TYPES	R.A.F.	NAVAL	R.A.F. & NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
JANUARY	Q	1		1		1
	QF QL	2	2	4	15	3
	SF					
FEBRUARY	Q					
	QF QL	1		1	9	1
	SF					
MARCH	Q	6		6		2
	QF QL	12	2	14	34	15
	SF	3		3		2
APRIL	Q					
	QF QL				2	
	SF					
MAY	Q	2		2		1
	QF QL	2		2	21	6
	SF					
JUNE	Q					2
	QF QL				18	
	SF		1	1		
JULY	Q	3		3		1
	QF QL	1	1	2	11	1
	SF	1		1		2
AUGUST	Q	1		1		
	QF QL	2	1	3	13	2
	SF		2	2		1
SEPTEMBER	Q	1		1		
	QF QL	1		1	2	1
	SF					
OCTOBER	Q	5		5		5
	QF QL	1	3	4	30	2
	SF		1	1		
NOVEMBER	Q	2		2		2
	QF QL	1	1	2	9	
	SF		1	1		
DECEMBER	Q	1		1		
	QF QL				2	
	SF					
TOTALS	Q	22		22		12
	QF QL	23	10	33	166	33
	SF	4	5	9		5
GRAND TOTAL	ALL TYPES	49	15	64	166	50

CHAPTER X.
APPENDIX II.

ATTACKS ON NIGHT DECOYS
1944.

1944	TYPE	R.A.F.	NAVAL	R.A.F. & NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
JANUARY	Q	3		3		2
	QF QL		1	1	20	
	SF					1
FEBRUARY	Q	10		10		7
	QF QL	3	3	6	38	3
	SF	3		3		4
MARCH	Q	5		5		3
	QF QL	3	1	4	23	3
	SF	2	1	3		3
APRIL	Q	3		3		2
	QF QL	1	3	4	16	3
	SF	1	5	6		7
MAY	Q	4		4		4
	QF QL	1	1	2	18	1
	SF		4	4		3
JUNE	Q					
	QF QL	1		1		
	SF					
TOTALS	Q	25		25		18
	QF QL	9	9	18	115	10
	SF	6	10	16		18

ANNUAL TOTALS	TYPE	R.A.F.	NAVAL	R.A.F. & NAVAL TOTAL	K.P.I.D. ALL TYPES	A.W.A.S.
1940	Q	174		174		
	QF QL	15		15	2	
	SF	5		5		
1941	Q	185		185		11
	QF QL	18	11	29	214	30
	SF	48	2	50		23
1942	Q	37		37		19
	QF QL	32	3	35	160	28
	SF	16	5	21		21
1943	Q	22		22		12
	QF QL	23	10	33	166	33
	SF	4	5	9		5
1944	Q	25		25		18
	QF QL	9	9	18	115	10
	SF	6	10	16		18
TOTALS	Q	443		443		60
	QF QL	97	33	130	657	101
	SF	79	22	101		67
GRAND TOTAL	ALL TYPES	619	55	674	657	228

CHAPTER XI.

R.A.F. CAMOUFLAGE

Camouflage means teamwork.

1. The dictionary's definition of camouflage may be paraphrased as "the disguising of an object by artificial means to reduce its visibility or to conceal its actual nature or location from the enemy". Obviously there are many different degrees of concealment ranging from total concealment from the camera or radar to inconspicuousness from an air view in thick weather or at night. The degree to which camouflage is made effective depends partly on the object camouflaged and partly on the effort expended on the work; this effort must be defined by policy decisions emanating from the appropriate operational staff. In other words camouflage must have "direction".

It must be recognized that good camouflage can only be obtained by team work; no single individual can be an expert in all the requisite knowledge and experience. In the past the team should have included well informed policy direction (i.e. the specialist staff officer), experienced observation from the air (the pilot's eye), the artist for design, and most important of all the engineer with knowledge of materials and of artificial means to carry out the work. In the future radar in the form of H_2S or in other ways will be a prominent factor in all camouflage, and a radar expert will have to join the team. It is essential for all who have to deal with camouflage in any form to understand this necessity for team work in order to debunk the self-styled camouflage experts who are met in many forms; they include the scientist who thinks that Nature has provided the full answer, and who discourses on insects and small animals but does not explain why Nature failed to camouflage the elephant; the artist who shoots a line better than he draws it; and the inventor who has one universal pattern of

/material......

material which meets all requirements but which unfortunately will not change colour with the seasons nor stand up to wind and rain, let alone snow. They are camouflage experts in one sense only, i.e. their ability to disguise their own limitations of knowledge and to put this disguise across.

R.A.F. Camouflage.

2. It is convenient to discuss R.A.F. camouflage under the following heads:-

(a) Static camouflage of airfields and buildings.

(b) Camouflage painting of aircraft and camouflage of transport and other equipment.

(c) Camouflage in the field.

It must be understood that no hard and fast lines exist betwe between these types; for instance, aircraft and transport netting designed for concealment in the field may also be used for the same purpose on static aerodromes, and camouflage painting of aircraft may be based on the need for rendering it less conspicuous on the ground or in the air.

Records of Static Camouflage.

3. It has been found impracticable to record the experience and development of R.A.F. static camouflage during the war in a single publication. Its execution, even before the war, had been the responsibility of the Works Services who continued to implement it throughout the war. Design and execution of static R.A.F. camouflage are both intimately connected with the layout and design of R.A.F. airfields and stations. Hence the record of static camouflage implementation is contained in the War Book of the Works Services.

Previous to September 1941 the Air Staff had not directed the policy of camouflage. In that month Colonel Turner's Department was made responsible for obtaining direction from the Air Staff and for laying down the detailed policy to be followed. Hence the record of R.A.F. camouflage policy is contained in this War Book of the Department.

All three Services and a number of civilian Ministries

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were engaged in camouflage work for their own installations. Co-ordination, the pooling of experience, some experiments, and supply problems were dealt with by a Camouflage Committee, to which representatives of all Ministries concerned were appointed. The general principles of static camouflage practice have been recorded by this Committee in a paper edited by Colonel Wyatt R.E. entitled "Principles and Organization of static Camouflage". This paper has been accepted by all the Ministries concerned as a basic representation of the art, covering all common ground, but avoiding detailed description of specialist work undertaken by individual Ministries.

Information regarding R.A.F. static camouflage during the war is therefore contained in the following publications:-

(a) R.A.F. VISUAL DECEPTION, the War Book of Colonel Turner's Department, for policy and organization.

(b) "Principles and Organization of Static Camouflage", issued by the Camouflage Committee, which deals with general principles common to all forms of static work.

(c) "Execution of R.A.F. Camouflage", a chapter in the War Book of the Works Services.

Note:- (b) is attached as an appendix to (c).

R.A.F. Static Camouflage Problems.

4. Although the principles of concealment and camouflage are generally applicable to all work of this type, during the war each Ministry had its special problems. In the case of the Air Ministry the greatest difficulties were met in the application of camouflage to airfields. The wide open space of the landing ground always catches a pilot's eye in country where hedges or woods are prevalent. Runways, taxi-tracks, and dispersal points immediately identify an airfield. Large buildings, e.g. hangars, with attendant built up areas, sited on the edge of the open space, are particularly conspicuous.

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Had it been possible to lay out airfields in peace with a view to their easy concealment in war, camouflage would have been rendered much easier to effect. It would have entailed minimising buildings alongside the airfield to absolute essentials and dispersing them suitably, all other buildings being located a mile or so away; the landing ground would have been laid out in strips instead of occupying a large open area. The extra cost in roads and in water and electrical services, and the resulting difficulties in administration ruled out this form of layout in peace, but it is interesting to note that war airfields with hutted accommodation were largely constructed on these lines.

R.A.F. airfield concealment measures have always to take second place to "operational efficiency", and some station commanders before and in the early days of the war tended to confuse "operational efficiency" with "operational convenience". It is a British characteristic to avoid inconvenience until the costs of doing so are exemplified in heavy losses of men and equipment. The Works Services therefore, who before the war and up to September 1941, received no direction and little support, were faced with a most difficult task in their attempts to render airfields less conspicuous.

R.A.F. stations and depots without airfields could be dealt with more easily. Maintenance depots were built in convenient sections separated by distances of half to one mile. Some petrol and bomb depots were constructed underground in bomb proof storage; in other petrol depots the tanks were given a four foot covering of earth on which grass was planted to conceal them.

R.A.F. Static Camouflage up to September 1941.

5. In spite of the above difficulties the Works Services, largely on their own initiative, paid considerable attention to camouflage generally, particularly in relation to airfields. Painted hedges were devised to break up the wide open space, runways and taxi-tracks were darkened down and

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to reduce the inevitable shine from these smooth surfaces, and various forms of texturing were introduced. Granite chips had to be abandoned as they increased tyre damage, but rubber chips, and later, when rubber supplies fell off, wood chips were successfully used to diminish "shine". Attempts were made to reduce hangar visibility by attaching sloping nets, and one type of hangar was produced which enabled nets to be easily fixed. The great height of hangars and the need for keeping the entrances clear prevented this method becoming really successful. Trees were planted alongside hangars, but the war did not wait for them to grow sufficiently to be of any real value. On storage stations hangars were built in the shape of a half eclipse and covered with earth and grass.

When enemy attacks on airfields became heavy in 1940, Groups and Commands pressed for improved camouflage, and buildings on all stations were hurriedly painted to make them less conspicuous.

It is not generally understood that whether the initial application of camouflage is easy or difficult, its upkeep in changing seasons necessitates constant attention, much labour, and the expenditure of large quantities of materials, especially paint. Normal paints produce "shine", and matt paints which reflect less light, deteriorate quickly. During a war the supply of labour and materials rapidly falls off and camouflage upkeep becomes more and more difficult. German camouflage, much of which was very elaborate, suffered the same troubles, and rapidly became inefficient.

Static Camouflage policy and organization.

6. In September 1941, Commands and Groups complained of the unsatisfactory state of camouflage on R.A.F. Stations and the Air Staff made the Department responsible for its direction and supervision.

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It did not take long to discover that there was nothing wrong with the methods used by the Works Services from a technical point of view, and that the deterioration complained of was due to the following factors. First the absence of two members of the team, referred to above, i.e. direction and the pilot's eye; secondly the rapidly growing shortage of labour and of materials, especially paint, and thirdly the constant increases in size of airfields and in length of runways, which resulted in large areas of scarred ground which immediately attracted air observation.

From a technical point of view, it was only necessary to press for substitutes for material in short supply, to increase the application of texture to runways which had already been started, and to introduce measures for reducing and covering up scarred areas. Painted hedges were becoming impracticable and several measures were undertaken in lieu; attempts were made to get Commands to agree to the building of brushwood hedges over parts of the airfields leaving the runways and a space 200 feet on each side clear. Fighter Command objected for operational reasons, as their squadrons had to take off in any direction at short notice. Bomber Command also did not like the proposal, but many of their Station Commanders adopted it to a certain extent. Other dummy hedges were devised over which an aircraft could run without risk or damage to types, but not many were introduced. A third method of breaking up the open space was more universally adopted; this consisted of selective mowing and seeding of airfields to provide areas resembling fields of different colour and tone. When well carried out this method was extremely effective.

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The provision of policy and supervision was a matter for organization. Directives were obtained from time to time from the Air Staff to suit the changing war situation, and policy was laid down by the Department as necessary. It was important to bring Commands, etc., into the picture and supervision was therefore provided by the appointment of a C. and D. Officer to each Command and to most Groups, whose duty it was to make constant inspections to bring all stations in their formation up to the requisite camouflage standard. They were also made responsible for the supervision of R.A.F. Q and other decoys. The officers were picked mostly from ex-pilots of the last war, who had experience in observation from the air, and some of whom had requalified as pilots of communication aircraft. They were all sent in batches to courses at the Army School of Camouflage at Farnham, and then to the Air Ministry to learn at first hand from the Works Camouflage branch, the methods and material used. They were also given instruction in R.A.F. decoy work by C.T.D. Area Officers. From the organization point of view they were responsible to their own formations, but they had direct contact with their local Works camouflage officers and with Colonel Turner's Department. A standardised system of reporting camouflage defects were introduced. Monthly reports by these C. and D. Officers were sent to local Camouflage Officers direct to enable them to effect improvements, and to the Department to permit of a full record of the situation being kept up to date. Differences of opinion were settled by the Department in conjunction with Commands and W.War (b) at the Air Ministry.

Aircraft could generally be obtained by C. and D. Officers for observation by day, but few were available for night inspection which was equally important. Fortunately one

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of the Department's officers was in touch with the optical trade, who, at his request, carried out a considerable number of experiments in the design of suitable goggles, which, worn by day, simulated moonlight conditions at night. The goggles were provided with two pairs of filters, one pair to be worn in sunlight with no cloud, and the other in dull and cloudy weather; the latter transmitted five times as much lightas the former. They had to be worn for at least a quarter of an hour before the eyes got sufficiently used to them to carry out an inspection. These goggles proved so successful that demands for them were received from many theatres of war and for many purposes in addition to inspection of camouflage.

Static Camouflage policy changes.

7. The initial policy laid down by the Air Staff in September 1941 recognised the impossibility of full concealment by day and laid down the following standard to be attained throughout the country - viz. by day effective concealment in conditions of bad visibility and by night in bright moonlight.

First change.

The first change in policy occurred in January 1943, when the Air Staff considered that the reduction in enemy attack and the necessity for economy in manpower and material warranted a reduction of camouflage standards in the North and West and the country was divided into 3 Priority Areas.

No. 1 Priority Area included all the country south and east of a line from ST. DAVID'S HEAD to BLETCHLEY, and BLETCHLEY to GOOLE on the HUMBER.

No. 2 Priority Area included the north east coast, east of a line GOOLE - FALKIRK - DINGWALL - STRATHY POINT.

No. 3 Priority Area included the rest of England, Wales, Scotland and Northern Ireland, (i.e. excluding areas 1 and 2).

The new policy aimed at the existing standard in No.1 Priority Area, efficient night concealment only in No. 2 Priority Area, and no special concealment measures in No. 3 Priority Area. It may be mentioned that where buildings, etc., had to be painted for preservation purposes, and runways, roads

/and ...

and taxi tracks sealed to make them water-tight, dark colours were used even in No.3 Priority Area, but no special camouflage painting or dressing was permitted.

The reduction in work due to this change permitted considerable reduction in C. and D. officers with Groups.

Second Change

The second change in policy was discussed in January 1944 and introduced on the 1st April, 1944. This effected a further reduction in camouflage standards in Priority 1 and Priority 2 Areas. Only darkening down of buildings was permitted, either when newly constructed or when they became conspicuous due to deterioration of previous camouflage. Selective seeding and mowing was permitted to break up the wide open space of airfields, but all painted hedges were stopped. Preservative painting and sealing was accepted if dark colours were used.

The introduction of this change so reduced the work of inspection that all C. and D. officers with Commands and Groups were abolished, their remaining work being carried out by the K Area Staff whose numbers were slightly increased.

Third Change.

In August 1944 Camouflage was practically discontinued. As a general rule only preservative painting in dark colours was permitted, and no painting for special camouflage purposes allowed. Commands and Departments were allowed to put forward certain exceptions in the case of super-vital specialist targets, if they considered it worth while to do so. Even in those few cases renewals of camouflage were postponed to the maximum extent.

Static Camouflage reports and records.

8. As a result of the reorganisation of September 1941, the camouflage of R.A.F. airfields and stations was very greatly improved and in a few months reached and retained a very considerable standard consistent with economy. A very complete watch and control was obtained by a careful standardised system of reporting and by a method of

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recording the reports on a board which showed at a glance the camouflage situation on each and every one of many hundreds of R.A.F. Stations.

Static Camouflage by other Ministries.

9. The Air Staff policy, and its changes, set the standard for all camouflage in the country in addition to that carried out for the R.A.F. Heads of camouflage departments did, however, interpret the policy in somewhat different ways. The Admiralty and War Office generally followed Air Ministry practice. Home Security and some of the Civil Ministries tended to set a somewhat higher standard. There were two reasons for this. Home Security made out most of the camouflage schemes for the other Ministries and having a large staff of artists tended to produce more elaborate types. Secondly the Service Ministries were responsible for offence as well as defence and tended to economise as much as possible on defence, and to make reductions in camouflage at a somewhat earlier period owing to their closer contact with the war situation. The other Ministries were not concerned with offence and tended to over-estimate the necessity for defence measures.

Static Camouflage Committees.

10. There were three inter-departmental Camouflage Committees. The main committee known as the Camouflage Committee has already been mentioned. This committee threw off a Technical Sub-Committee to deal with matters of detail. In addition there was an Assessment Committee to classify the camouflage standard considered necessary for each vital point or possible target of all the civilian Ministries. These committees are dealt with more fully in Col. Wyatt's paper.

Detection of Static Camouflage.

11. Civilian camouflage experts are very liable to over-estimate the effect of their schemes in concealing structures. In the first place many of them have insufficient experience in viewing ground features from the air, and this is one of the causes of the over-emphasis they place on model work. Even those

/who.......

who have been taken up on many reconnaissances identify far less than the trained pilot, whose constant air experience provides the "pilot's eye", which has already been mentioned as one of the necessary factors in camouflage. In addition the camouflage expert normally views his work shortly after its completion and before it has time to deteriorate. Basically all camouflage is an attempt to merge the target into its surroundings, and it ceases to be effective if the camouflage deteriorates or the surroundings change with the chan ing seasons of the year. The more elaborate the camouflage, the longer it takes to construct, and the greater the risk of its execution being spotted by enemy air reconnaissance. Normally photographic cover is always carried out before an attack on a target, and, after careful examination, crews are briefed as to the targets aspect from the air, particularly in regard to neighbouring landmarks or other features in the neighbourhood which can be identified. Photographic cover, if renewed from time to time, will detect all static camouflage if the position of the target is known. Good cover, good briefing and the pilot's eye will generally find the target, but if the camouflage is particularly good, there may be some delay in picking it up, and this delay is the real value of camouflage in that it provides a short period for the attack to be intercepted.

If, however, a pilot has not been briefed and is searching for a target which is believed to be camouflaged, attention to the following points will assist him to detect it.

(a) Accurate pin-pointing of its position on the map, if possible.

(b) Approach by recognisable ground features.

/(c).......

(c) If there is sunlight, the approach to the target should be up sun. Shadow will then be visible. Some are certain to exist.

(d) Check of disappearance of roads, movements of traffic, car parks, smoke from chimneys, etc.

(e) If the target has been newly constructed or added to there will certainly be spoil or ground scars which are readily picked up. Unless these are covered by special netting they will be visible for many months until the grass grows long enough to hide them.

(f) A look out for deterioration and incomplete merging into surroundings.

Aircraft and transport camouflage.

12. The Ministry of Aircraft Production working with D.G.E. at the Air Ministry and also with Commands were responsible for camouflage painting of aircraft, and presumably have left records describing their work. Generally speaking this painting was carried out to enable the aircraft to tone into the ground, and therefore varied in each theatre of war; it was never really efficient owing to the "shine" from perspex and painted surfaces, and the Ministry produced the first nets for covering aircraft entirely. These could not be put on or removed quickly, and, as recorded elsewhere, they were later considerably improved by the Department. Some aircraft were painted white to reduce their conspicuousness while over the sea and their concealment on the ground was impossible.

Concealment in the field.

13. Camouflage in the field is not discussed in Colonel Wyatt's paper. The best source of information on the subject is the Army School of Camouflage or in the pamphlets published by it from time to time. R.A.F. units were not trained in field camouflage until 2nd T.A.F. began to form for the invasion of France. At home squadrons worked from static airfields, and in Egypt and North Africa, the little camouflage practised was carried out under the advice of local Army Camouflage Officers.

/The

The instruction of 2nd T.A.F. was carried out by C. and D. Officers of the Department, who had themselves been trained in the Army School of Camouflage at Farnham.

Although R.A.F. field camouflage is normally designed against air observation and attack, the defences of an airfield manned by the R.A.F. regiment should also be well concealed against ground attack. Hence there is little different between R.A.F. and Army concealment in the field, and as the Army are experts in the art, all R.A.F. training should be based on the example set by them.

Field concealment is based on the minimum apparent disturbance of the existing scenery as viewed from air or ground. Training is especially required in siting camps, tents, and dumps, in the use of available materials, in strict track discipline and in the hiding of transport and personnel.

CHAPTER XII

GERMAN REACTIONS AND GERMAN VISUAL DECEPTION

Intelligence requirements.

1. Every department engaged in deception must contain an Intelligence Section; an important duty of this Section is to maintain a constant watch on enemy reactions to our own methods and on enemy measures to deceive us.

In time, no doubt, the Intelligence Services will be able to collect more information of German reactions to our methods of Visual Deception. A good deal, however, has already been picked up from various sources, chiefly captured documents and maps, and prisoners' statements, confirmed or unconfirmed. It is necessary to remember that although the enemy did employ aircraft for reconnaissance purposes throughout the war, they never achieved the continuous photographic cover attained by the R.A.F. It is only by constant and systematic photography, repeated at intervals, that static visual deception in fully laid bare.

German reactions to our camouflage.

2. A captured document purporting to be a minor treatise on camouflage contained references, with photographs, to our own attempts to make R.A.F. Stations inconspicuous. Some of our work, generally airfields, very recently camouflaged, was highly praised. Other airfields, generally those whose camouflage had faded, were criticized. One main fault exemplified was the crowding together of hangars and buildings in one corner of the airfield. Dispersal of permanent station buildings was fully considered before the war and decided against on the grounds of economy and the difficulty of administration. During the war hutted buildings were dispersed and considerable inconvenience thereby caused. It is impracticable in peace time to disperse buildings: in war, if liable to constant attack, they must be evacuated and buildings nearby requisitioned as necessary. No information

/has

has reached this Department in regard to German reactions to our civil camouflage of vital factories, etc. It is improbable that much evidence will ever be obtained. Civil camouflage took a long time to get going, and by the time it was appreciable day raiding on any scale had ceased. Enemy attacks by night were directed almost entirely on large towns or built-up areas which were not camouflaged.

German reactions to day displays.

3. In the early days of the war our K sites (dummy airfields) were not very unlike R.A.F. satellite airfields and they drew 36 attacks. When the satellites were extended, provided with buildings and large numbers of men and transport, all resemblance ceased and attacks on the dummies rapidly fell off. The Germans had evidently started to recognise the K sites as dummies, and this was confirmed when an enemy reconnaissance aircraft was shot down and a map found, marking correctly 50% of the K sites as dummies. K sites were then packed up. The K.L.G.'s, dummy aircraft on temporarily abandoned airfields, were only in use for a short period and drew 11 attacks. As a number of men and transport were left in the station there is no reason to suppose that the enemy recognized the dummies before the stations were reoccupied.

The four dummy factories drew 9 day attacks. These also suffered from lack of life and movement and would certainly have been spotted in time, but there is no evidence that they were recognized before all day attacks everywhere ceased.

German reactions to out night decoys.

4. The successes of our decoy lights and fires throughout the war show that the Germans never managed to locate them correctly. This is confirmed by a map found in France in late 1944 which attemtped to pin-point the decoy system in Britain. (Historical Folder H.7.) Except in one area in East Anglia, none of the positions marked were in any way accurate. It is possible that the correctness in East Anglia was due to an aircraft crew taking up a map of Q sites, (strictly against orders) and the map being

/recovered

recovered by the Germans when the aircraft was shot down. Compared with our own discovery of their decoys this is remarkable. It is true that decoy lighting is not too easy to detect by day, but our decoy fires, especially Starfish, should have been unmistakable. The Germans certainly knew we used decoys, and were considerably concerned at their success in drawing attack. Enemy prisoners of war frequently referred to them, and often boasted that they recognized their types and location and that they used them to fix their own position. In all cases where their information was sufficiently definite to check, it was conclusively proved that they did not recognize them. In fact they often deceived themselves, by classifying as decoys fires started by the attacks of their own bombers. The immunity of our night decoys from discovery was due first to insufficient photographic cover by day and secondly to their considerable numbers. Even if he knew the position of some decoys, an enemy could not know which was lit of a large number. Consequently any attempt to fix his position by a decoy was certain to fail. Emphasis must be laid on the necessity for large numbers of night decoys. Isolated decoys may in time be pinpointed and could then provide a fix.

German reactions to misleading displays.

5. Cover plans and misleading displays are fully described in Chapters XIV and XV. Their success was undoubted.

German Camouflage.

6. The Germans were fully aware of the value of concealment and camouflage. Before the war many of their airfields were specially constructed to provide dispersal and concealment. Where possible hangars were recessed into woods and barracks and other buildings were also sited well back inside them.

They did not, however, develop any large scale static camouflage of vital points until after the Battle of Britain, when it became probable that retaliatory attacks would be launched against their industrial areas, their communications,

/and

and the occupied French airfields. As in this country, airfields in Germany and France had to be extended to cope with the larger and faster aircraft that were constantly being introduced. The resultant constructional activity, with its scarred surfaces, conspicuous dispersal areas and runways, as we found in our own case, rendered the airfields very conspicuous. Considerable camouflage work was carried out, consisting of the painting of aerodromes to resemble agricultural fields, and of runways and taxi tracks; structural work supporting nets was also used to conceal hangars, buildings and dispersal bays.

Oil tank camouflage was introduced at an early stage. In some cases nets were spread over groups of tanks, in others tanks were given a square shape to hide their identity. An example of this latter form of camouflage is shown in the photographs at the end of this chapter which show the oil tanks at Misburg (near Hanover) after camouflage. A nearby canal is also netted over.

As time went on German camouflage spread to all types of factories and vital points. It was also extended to landmarks in or near certain large towns or ports. Familiar examples are the camouflage of the Bennen Alster and other landmarks near Hamburg, and similar work in Bremen, Hanover and Berlin. Later (1943/44) this type of camouflage was particularly developed in S.W. Germany at Stuttgart, Strasbourg, Munich and Augsburg.

Although the Germans followed methods similar to our own, their camouflage design was much more thorough and painstaking, and often very elaborate. As a result the work, especially the structural features, was spread over a long period. Our photographic cover soon picked up many of the schemes while under construction and enabled progress to be watched and our crews warned what to expect. In some cases elaborate schemes were carried out on targets so pin-pointed by their surroundings, that the work was quite useless. An example of this if the Fokker factory at Amsterdam: the photographs at the end of this

/chapter

chapter show the camouflage at this factory in various stages. Attention is drawn to the dummy houses and netting on the factory roofs simulating a housing estate, the covering of the small basin east of the factory, dummy rows of houses along the roads in the neighbourhood, dummy roads, gardens and trees. This is a magnificent example of camouflage and had the factory not been photographed before and during the work, it might never have been picked up if the surroundings had been different, but the port and main channel are so unmistakable that crews could find the target without difficulty, however camouflaged.

One of the difficulties of camouflage is the necessity for constant maintenance and frequent renewal, not only to keep pace with the inevitable deterioration, but also to cope with the seasonal change in the surroundings into which the camouflaged target should fade. Our experience showed that the batter the material used and the simpler the camouflage, the easier was the maintenance. The Germans on the other hand developed very elaborate camouflage but used indifferent materials, and as a result deterioration was considerable and rapid, and this led to the early detection of even the best schemes. The photographs at the end of this chapter show some of the standard types of German netting used. None were as good as the types used by us: many of their nets were inflammable. In cost the German nets appear to have been unusually expensive.

Later, towards the end of the war, when our bombing became much heavier, the enemy used smoke screens to a considerable extent. On many targets, particularly airfields, camouflage was allowed to lapse. On others, however, further elaboration was introduced. Its most extreme application was the complete covering of waterways, lakes or pools that might be used as navigational aids to target location. There also

/appeared

appeared "dummy damage" on undamaged vital points in blitzed towns, the purpose being obvious. Similarly, when in the preparation for the Second Front, airfields in France and Belgium were heavily attacked, many dummy craters were painted on runways after repairs had been completed.

German Protective Displays.

7. Although our photographic reconnaissance in the early days of the war was limited and not too good, there is little doubt that the Germans did not develop protective displays until after the Battle of Britain.

They then controlled all the airfields in Belgium and France and some of the less important ones, not required for war use, were provided with dummy craft and used as decoys. These decoys, similar to our K sites, had the same defect, i.e. lack of life; but they were more easily detected, as, contrary to our operational procedure, the dummy aircraft were rarely moved or even swung round to face another direction. Successive photographs showed them in identically the same position, confirming them as dummies without any doubt whatever. Other decoy airfields were laid out on agricultural land, often with dummy runways in replica of those at the target airfield nearby. Some of these dummy airfields were provided with dummy lighting at night, and on a few a form of runway was developed fitted with rails and a trolley, no doubt intended to simulate the take off or landing of aircraft at night. Generally speaking, German dummy airfields were not as good as ours by day or by night, and although little is known of the extent to which they drew attack, it is unlikely that they were as successful as our own.

To protect civil vital points and built-up areas, the Germans adopted a practice similar to our own, i.e. particular decoys to protect individual targets and groups of decoys, usually fire sites round important towns.

The earlier decoys of this kind were constructed in 1940/41 and simulated nearby oil targets. Most were designed against

/night

night observation, but some were elaborated to withstand day photography. Later dummy factories, very similar to the original target were also constructed, and some were very good (see photographs at end of Chapter).

Decoy lighting at night varied considerably in different districts. In some cases powerful hooded lights were used throwing a strong circular patch on the ground, in other cases parallel lines were lit at night to resemble buildings.

Early decoy fires were on a comparatively small scale, groups being enclosed in some form of wall or fencing. Some of these fences about 6 feet high were composed of reed mats. It is not known whether the object was to simulate walls of buildings when the fire was lit, or whether they were erected merely to keep out the inquisitive. Later in many cases scattered fires were laid out over a considerable area either in a single large block, or in groups, spaced a considerable distance apart (see photographs at end of Chapter).

Contrary to their elaborate camouflage and day decoys, German night decoys were comparatively simple and not very imaginative. We have no records of lights being laid out to simulate a definite target, nor of variation in colours and strengths which we found necessary to obtain fidelity. Their fires were of brushwood or oil. Brushwood fires consisted of heaps about 20 feet long, 6 - 8 feet wide and some 2 feet high, loosely packed and supplemented with wood shavings, pitch, etc. These heaps were spread irregularly on a site, sometimes only a few yards apart. Lighting appears to have generally been carried out by hand. These heaps must have burned out fairly quickly, and presumably if the attack was a long one, other heaps would be lit later. Normally our attacks were concentrated over a short period in contradistinction to theirs which lasted many hours. Hence their decoys were not required to burn as long as ours. There appear to have been several

/methods

methods of using oil for fires. Sometimes the oil was poured on to the ground over an area of about 20 x 8 feet. At other times a 250 Kg. incendiary oil bomb was used as a container for a fire about 10 feet in diameter, the bomb being tipped to spread the oil inside the circle. Ignition appears to have been by hand.

Neither of these types of fires could have been very efficient although they were undoubtedly simple. Much of the oil must have soaked into the ground and crews must have been on hand to keep the fires going during an attack. This is borne out by the discovery of shelters right alongside many of the fires instead of 800 yards away as was our practice.

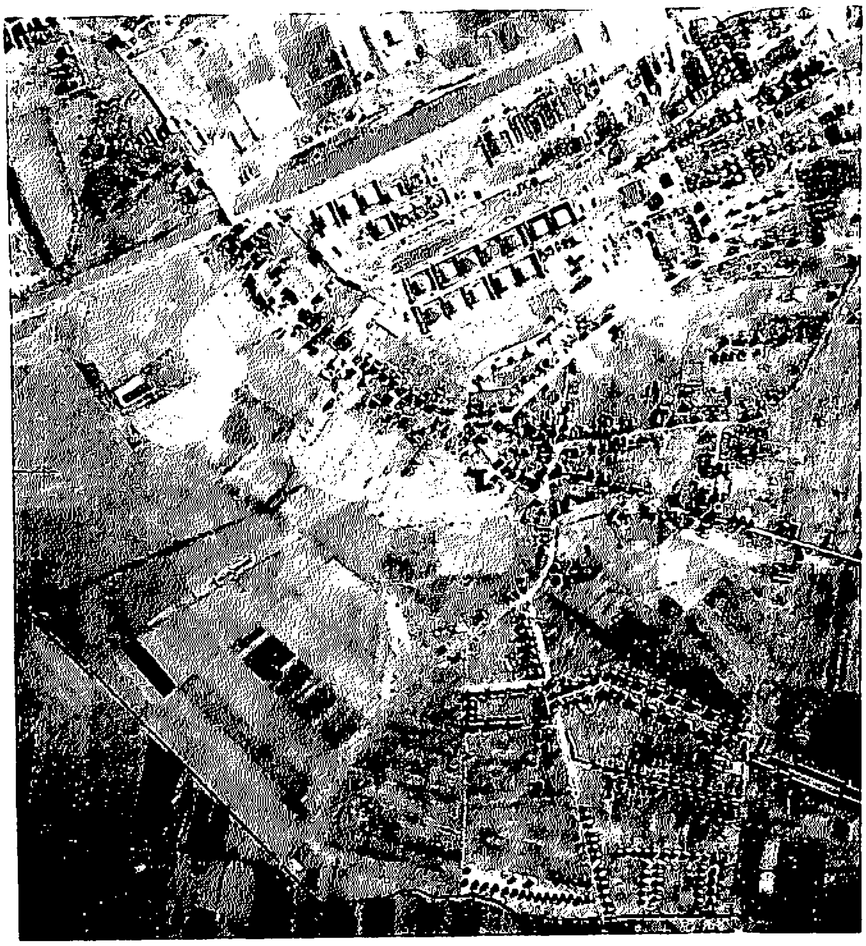
Nevertheless these decoys, particularly the fires, were undoubtedly successful in drawing off a considerable proportion of our bomber attacks especially in the early years. The methods by which our bombing was rendered more and more accurate in spite of decoys, flak, and other difficulties will be fully recorded in the history of Bomber Command. One feature is relevant here. Special aircraft dropped target indicators (T.I's) to enable crews to bomb accurately. The Germans countered by producing a form of rocket which carried on its forward end a cartridge of incendiary candles. These candles took fire at the top of the trajectory and cascaded down in a manner very similar to the contents of our T.I. bombs. Rockets with different coloured candles were kept on many decoy sites and used as necessary when the colour for the night was discovered. Even when the wrong colour was used, our crews were sometimes led astray. There were several types of rockets used and they were fired in different ways. What appeared to be the latest type was a rocket which was fired from the crate in which it was packed for transit; The crate was provided with guide rails for firing and was set up at an angle of approximately 20° from the vertical.

This account shows that the art of deception is an

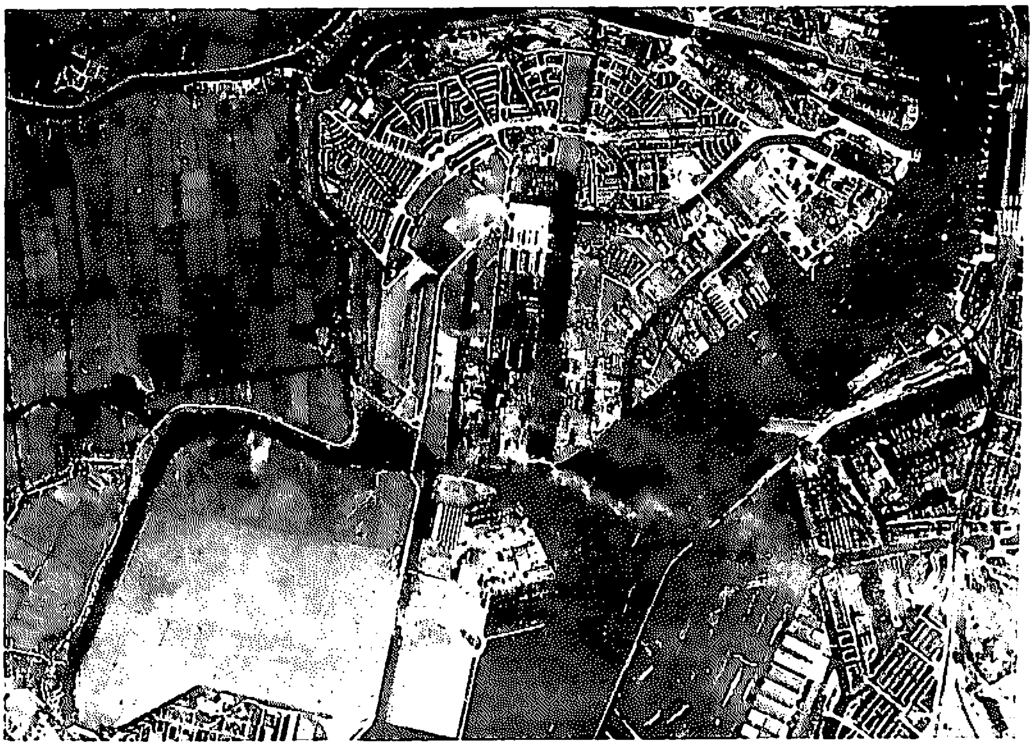
/operational

operational one, constantly changing to meet new conditions. As soon as one measure ceases to deceive another must be adopted. Measure, countermeasure and new development follow each other in a continuous deception battle throughout a war. First class intelligence both of the enemy's and our own developments is essential.

Further information on enemy visual deception can be obtained from historical folder H.7.



German Camouflage. MISBURG Oil Refinery near HANOVER showing oil tanks with dummy rectangular roofs. Note also the netting over the canal.

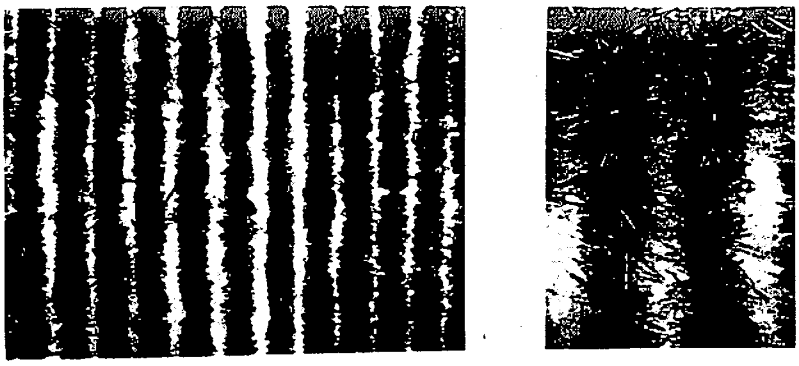


FOKKER FACTORY, AMSTERDAM (2.10.40). This photograph shows the buildings before camouflage has been commenced. The Flak position alongside is clearly seen.

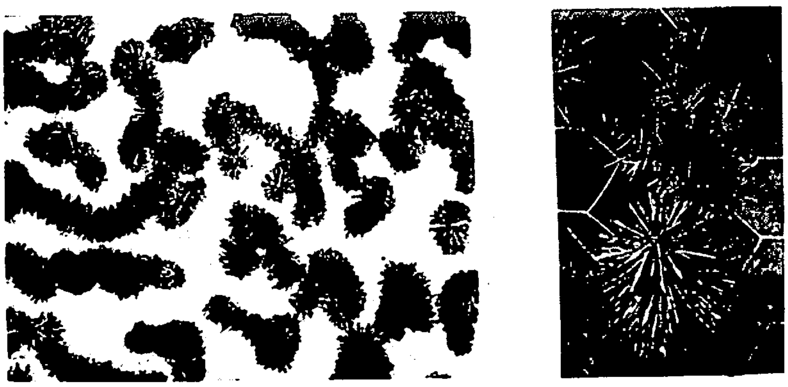
FOKKER FACTORY, AMSTERDAM (10.2.41). Extensive camouflage has now been undertaken. The shadows of the main factory buildings have been obliterated by netting on a framework except for the broad lane down the centre of the works. Small dummy houses have been built on the factory roofs. The small basin East of the factory has been filled in and also the head of the canal immediately North of the factory. The Flak position has been cleverly disguised.

FOKKER FACTORY, AMSTERDAM. (18.4.41.). The camouflage completed. It hides the factory buildings but if the factory is known, the position is unmistakeable - by the surrounding features.

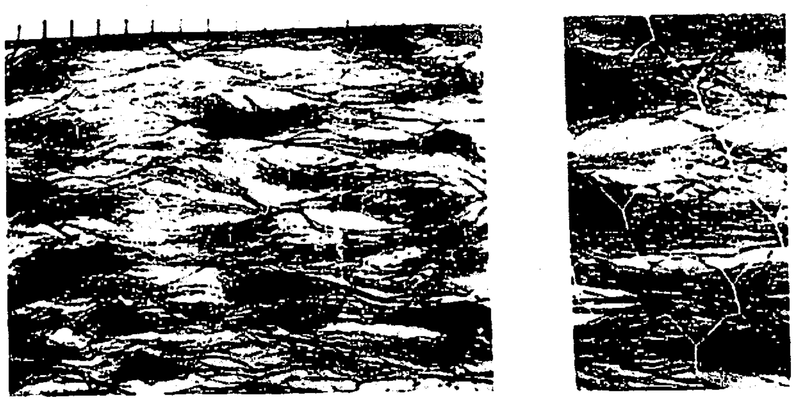
GROUP "B" INFLAMMABLE CAMOUFLAGE NETTING



Grass camouflage netting (Type B.1.)



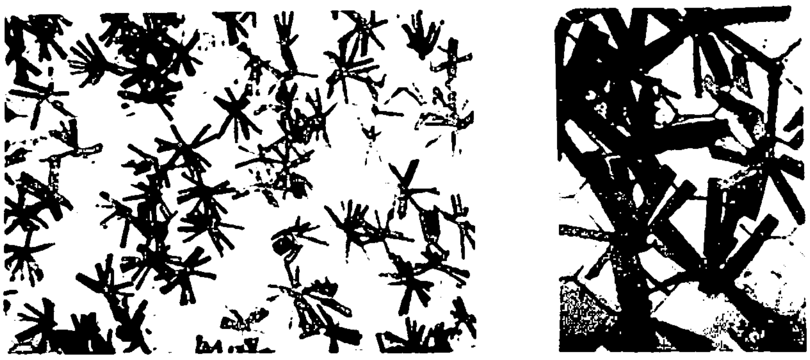
Grass camouflage netting (type B.2.)



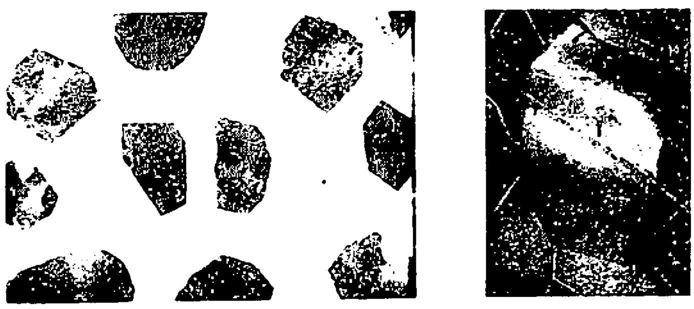
Heather camouflage netting (type B.3.)

Paper fabric camouflage netting (type B.8.)

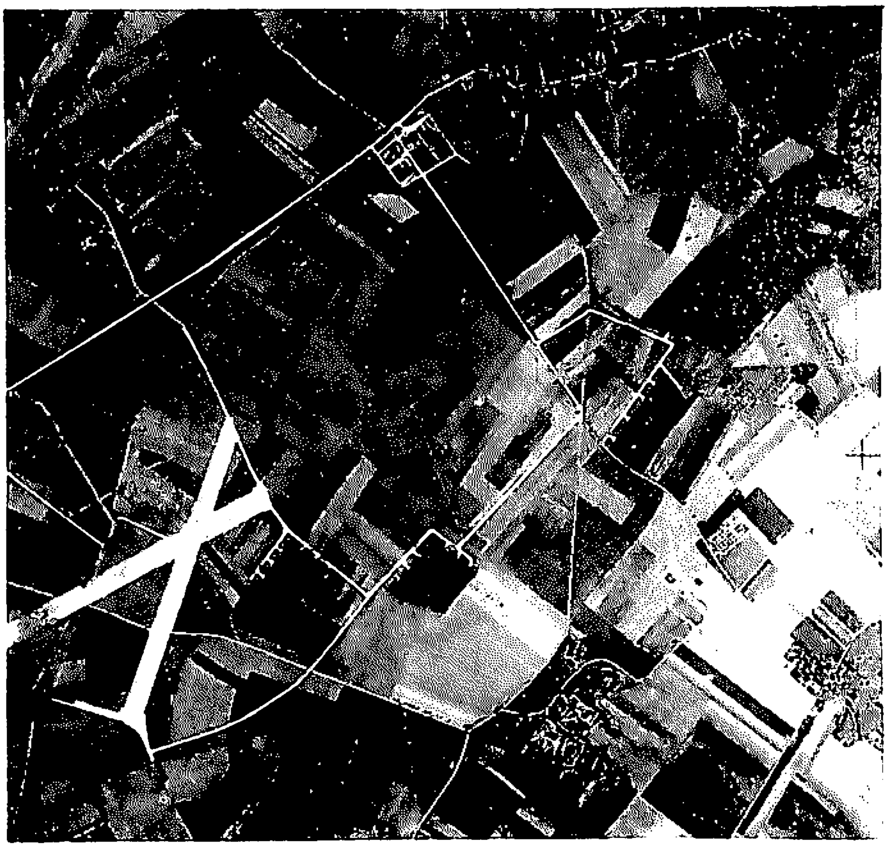
NON-INFLAMMABLE CAMOUFLAGE NETTING



Artificial camouflage netting, tufted (type N.1.)

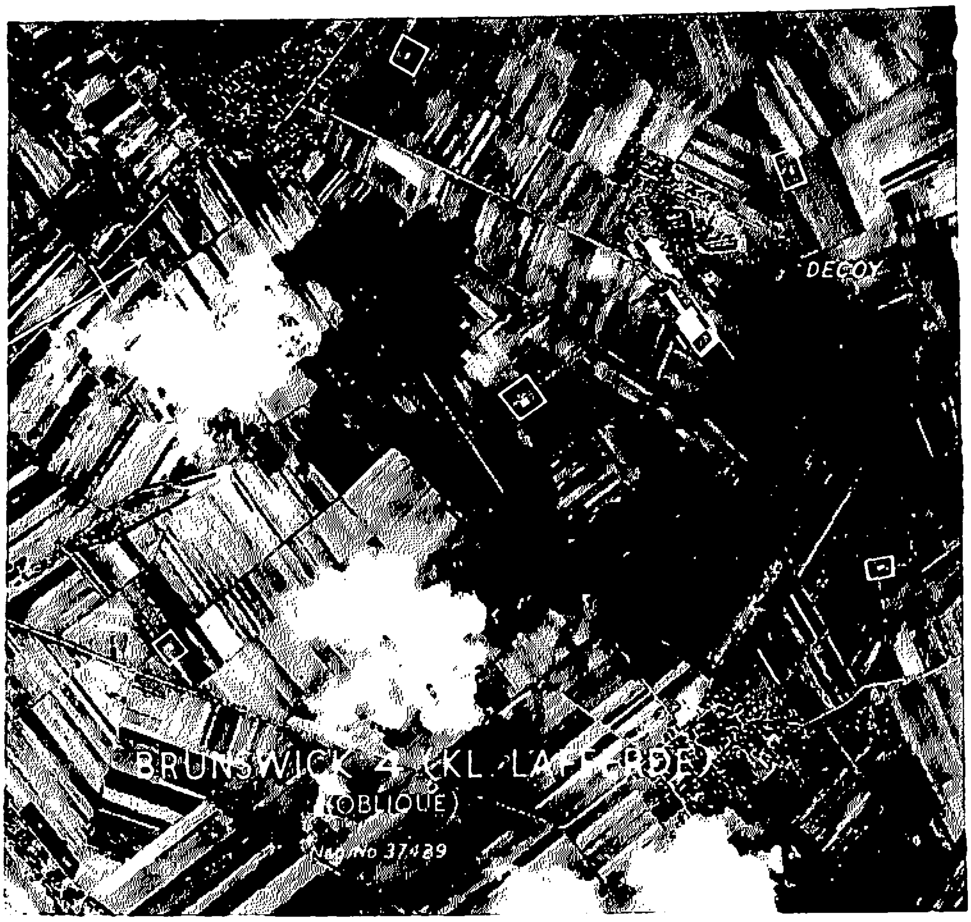


Artificial camouflage netting, flat (type N.2.)



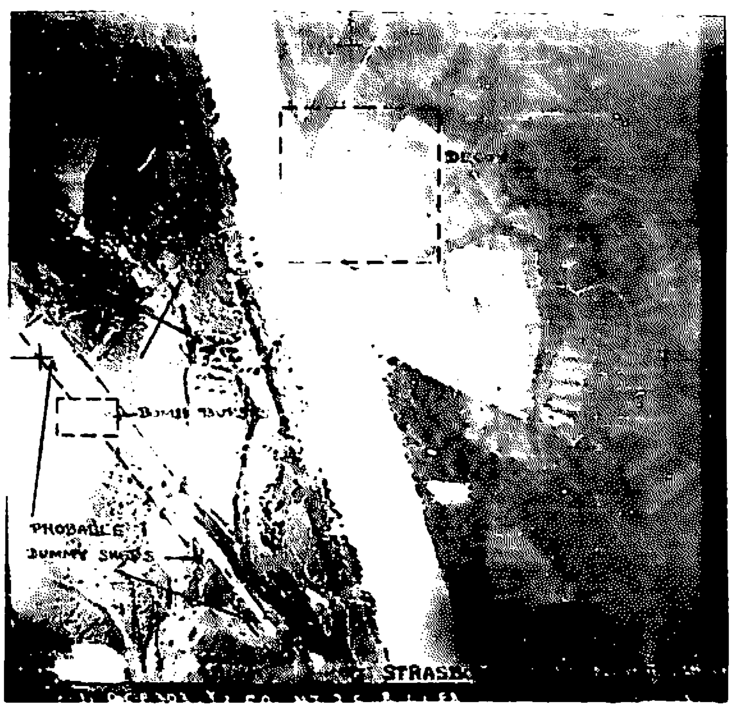
A typical decoy for a big air base in France. Note painted runways and dummy dispersal bays, with dummy aircraft.

An elaborate decoy protecting the Politz Synthetic oil refinery. Note - This was not a close copy of the target.

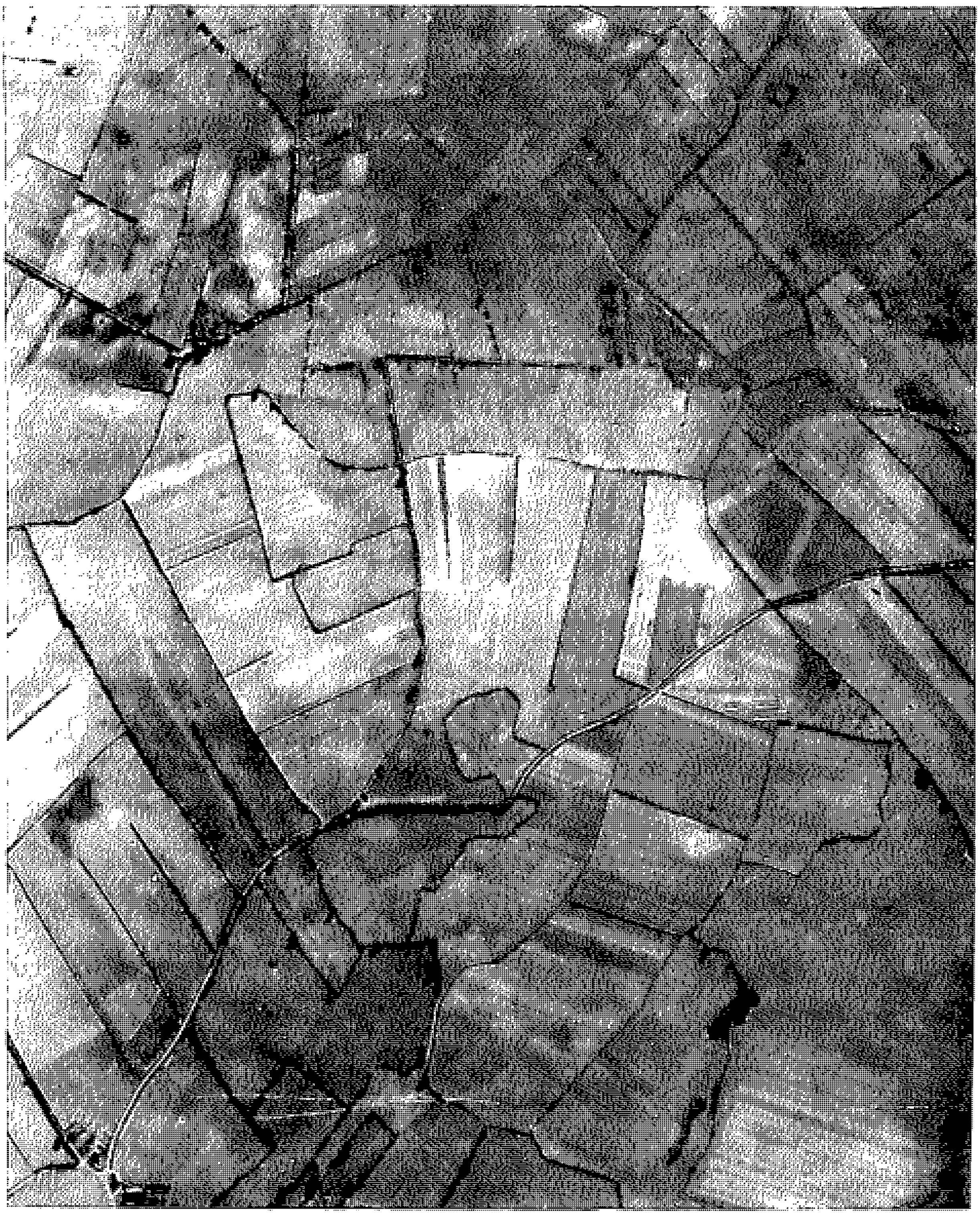


This decoy is an exact replica of the Hermann Goering Steelworks at HALLENDORF. Note smoke issuing from the dummy chimneys. The emplacements outlined in white are for the firing of decoy T.1.

A Fire site at Saarlouis (Neuforweiler) covering approximately 50 acres. The Fire groups can be seen in the bottom right corner.



A night photograph of one of the decoys on the Rhine near STRASBOURG.



A lighting decoy near KIEL. The parallel white lines simulated buildings when illuminated at night.

A fire site at HANOVER, covering a large area of ground. This site was constructed late in the war. Note the irregular layout and absence of walls.

CHAPTER XIII

TRAINING OF OFFICERS AND OTHER RANKS

1. When Colonel Turner's Department was initiated, it was faced with the task of developing a new technique with no past experience to guide it. Although camouflage had been used in the war of 1914-1918, no records existed of its operation and of the equipment used. Between the wars army camouflage training was limited to individual concealment from ground observation in battle. Meanwhile developments in aircraft and air photography had completely altered the picture and rendered visual deception of the air view equally important. The department was established with officers drawn from civil life, some of whom had served in the previous war, and newly enlisted men whose training was limited to the ordinary recruits course. Consequently all training for visual deception had to be based on an initial guess of requirements, followed by alterations and additions instituted as experience was gained or responsibilities increased.

In all types of training emphasis was laid on security and on the taking of responsibility when necessary. All ranks were given full information as to the object of their particular job, and were put on their honour not to discuss it with anyone outside the department. It is to the outstanding credit of many thousands of these men, that in over 5 years only case occurred of a talkative individual, and the secrecy observed was so complete that very few outside those officially concerned knew that decoys even existed. Taking responsibility was also necessary to ensure that isolated detachments would act on their own in the absence of orders or when communications broke down. In addition, all ranks were taken up into the air, whenever possible to look at their own decoys, to learn from their own mistakes, and to take a real interest in their work.

Roughly speaking the training carried out fell into three categories - Training in Static Decoys, Training in Camouflage, and Training in Mobile Visual Deception which included camouflage and displays of both kinds in the field. Every main course was followed by an examination, oral and written, which each individual had to pass. When courses were started for mobile work, failure in passing the subsequent examinations debarred the individual from receiving his 6d. a day C. and D. pay. Only 3-4 per cent failed.

Static Decoys K's and Q's.

2. The first training aimed at the efficient operation of day and night decoys for airfields (K's and Q'S). The men were taught to erect, site and handle several types of dummy aircraft and to operate dummy airfield lighting correctly. Between the 20th January and the 31st March 1940, four officers and 864 airmen were put through this initial course to enable them to man the decoys as they became operable. Later, as Q sites increased in number many other men were trained in the use of Q lighting and established on parent stations to man the new sites under the orders of the Station Commanders.

As soon as the K sites were working satisfactorily, individuals were withdrawn to form small parties to go through ground gunnery courses at armament training centres. On their return K sites were issued with machine guns to fire at attacking aircraft and so improve the realism of the decoy. Subsequent refresher courses in gunnery and new courses in Browning automatic rifle training were instituted as men could be spared.

Static Decoys Starfish, QF's and QL's.

3. The rush to instal decoys in the form of lights and fires, (which were all electrically controlled), to protect the civil population and vital points prevented experiments in equipment and prior training being carried out. Sites were manned as soon as contractors could build them and crews had to buy their experience and get over teething difficulties as best they could. Later, as the rush subsided, attention was paid to improving

/equipment

equipment to reduce maintenance trouble and to train men in electrical work. Electricians and sergeants were put through a special linesman's course at the G.P.O. Research Station and Training School, Dollis Hill, London N.W. This included circuit testing, jointing and soldering and fault finding. Non-electricians, including civilian crews manning "QL" sites were trained on their sites in the operation of decoy lighting, engine and circuit testing, and minor maintenance. Instruction was given by area and other officers who visited each site to train the crews. Considerable drive was necessary to induce the civilian crews of "QL's" to try and learn something about their equipment. As a result of these two types of training, breakdowns and bad maintenance were largely eliminated. When the non-electricians became more relaible, the establishment of electricians was largely reduced and many men of this vital trade were released for service with R.A.F. squadrons. Improvement in maintenance and improvement in equipment led to the reduction of work on sites and of the numbers of men in crews, thus assisting the manpower problem which steadily became more acute.

C. and D. Officers.

4. In November 1941 the department was given the responsibility of directing all static camouflage on R.A.F. stations. This led to the establishment of C. and D. Officers in all Commands and Groups who had to be trained in both camouflage and decoy work. The main camouflage course was arranged at the Army School of Camouflage at Farnham, and was supplemented with visits to the static camouflage branch at the Air Ministry where plans and practical measures of large scale camouflage were explained. The theoretical part of the decoy course was arranged at Shepperton and the practical side demonstrated on various decoy sites. After instruction these officers returned to their Commands and Groups.

/Later

Later, when the risk of air attack gradually became less, the responsibility for the supervision of the reduced scale of camouflage was taken over by the Area Officers of the Department and the Command and Group Officers were posted to other duties. This necessitated all Area Officers going through similar courses of camouflage instruction at Farnham and in the Air Ministry.

Mobile deception.

5. Training in mobile deception took the form of courses in camouflage and display. The first ones aimed at requirements at home and abroad in the early days when equipment, though not static, was comparatively heavy, and not intended to be frequently moved. The later ones were designed to compete with the general tendency towards increased mobility, lighter equipment, and work in forward areas. These courses were accompanied by battle courses to enable men to look after themselves in the field.

Early mobile courses.

6. The first series of courses included instruction in -

(a) the use of M.Q. sets.

(b) the use of various types of aircraft netting.

(c) the use of portable dummy aircraft.

(d) Motor cycling.

(e) Anti-gas.

(f) Camouflage.

(g) the use of M.Q.L. sets and field camouflage.

Between September 1942 and April 1943, 28 officers and 396 men were put through a series of M courses at Shepperton, each of which lasted 10 days and included instruction in M.Q. sets, aircraft netting and portable dummy aircraft. Other courses were held later, either as refresher courses to keep the men up to the mark and in touch with improvements in sets, or to train additional personnel as the first trainees were sent abroad.

Motor cycle courses of three weeks each were arranged at the R.A.S.C. School at Bournemouth which included instruction in road riding, rough riding in bad country, map reading and

/combination

combination riding. 29 Officers, 9 Warrant Officers and 11 Sergeants were put through these courses between June 1942 and January 1943.

Anti-gas courses were of ten days duration and were arranged at the R.A.F. Gas School, Rollestone Camp, Salisbury at which 16 officers and 15 O.R.'s were trained as instructors between December 1942 and March 1943. These instructors in turn trained R.A.F. personnel in the K. Areas in anti-gas drill.

To ensure adequate training of all officers in camouflage, all those who had not had previous instruction at Farnham were put through courses at the Army schools at Farnham, Tunbridge Wells, and Norwich according to available vacancies on courses at various periods in 1942 and 1943.

During May, June and July 1943, 38 officers and 270 O.R.'s were put through a course at Lower Hope Point, Gravesend, to instruct them in the M.Q.L. set and its various uses. This course included topographical study, site planning, and the handling and operation of sets. Each crew of six laid out a set on their own initiative to represent a selected form of lighting. All officers and N.C.O.'s were given a night flight to observe the results of their work. It should be realized that whereas a Q set is laid out to represent one single type of lighting, i.e. a flarepath, M.Q.L. sets can be used to simulate many types. Study of the ground and considerable initiative is necessary for success. The trainees were accommodated in tents to add to the flavour of mobility. At the end of their course at Lower Hope Point, officers and men returned to Shepperton to go through a course of concealment in the field, which included camps, avoidance of tracks, etc.

The early mobile courses gradually established throughout the K. Areas a considerable proportion of C. and D. personnel who could be called on for mobile work at home and abroad at

/short

short notice. The younger and medically fit men were chosen for this training. As noted in the history chapters many were sent to N. Africa during the winter of 1942 and spring of 1943.

Later C. and D. courses.

7. In 1943 several factors pointed to the necessity for a revision of the training programme and for making C. and D. personnel more fit for employment on mobile work in war areas. New light equipment in the form of A.S.Q., A.S.Q.L., and B.Q.L. sets had been designed and produced. Experience in cover plans and exercises showed that men were insufficiently trained in looking after equipment and in locating faults. There was too much of a tendency to call for specialist help to remedy minor defects. As the department became more involved in the design and production of mobile equipment for true airfield lighting, it became the only source of supply of trained personnel to operate these sets. Two schools were opened at Shepperton and Richmond Park. Men worked in crews of six, one corporal and five O.R.'s; the course lasted four weeks, two weeks being spent at each school. At Shepperton up-to-date instruction was given in the following subjects:-

(a) Engine maintenance.

(b) Map reading.

(c) Reconnaissance of sites.

(d) Aircraft nets and dummy aircraft (day and night).

(e) Concealment in the field, including camouflage (personnel, transport and camps).

(f) Site planning for display work.

At Richmond comprehensive training on equipment was arranged; it included:-

(g) layout and operation of ASQ, MQL, ASQL (camps and convoys) and BQL sets.

(h) layout and operation of mobile airfield lighting equipment in the Flying Control Van.

(i) Fault finding in all equipment.

/(j)

(j) Construction of fires out of any available material in the field.

N.C.O.'s were also specially trained in finding sites and planning layouts.

Daily oral tests and a written examination at the end of the course for each individual were arranged to ensure proficiency. Of the 869 officers and men who attended these courses 840 passed a 65% qualification and 29 failed.

Battle Course.

8. Concurrently with the new courses at Shepperton and Richmond batches of men required for C. and D. units and reserves were put through a series of Battle courses in an Army school near Birmingham. This course included :-

(a) Marches and P.T. drill to promote physical and mental fitness.

(b) Mustketry training.

(c) Grenade training.

(d) Booby traps.

(e) Bayonet fighting.

5 officers and 337 men went through this course.

Training of other units and personnel.

9. The training section at the Headquarters of the department also took on the responsibility for training personnel of other units. These included -

(a) The training of Flying Control Officers in mobile airfield lighting.

(b) The training of Army (R.E.) personnel in the use of A.S.Q.L. and B.Q.L. sets for misleading displays.

(d) The training of American Army and Army Air Force Officers and N.C.O.'s in mobile decoy sets, A.S.Q., M.Q.L., A.S.Q.L., and B.Q.L.

83 Flying Control Officers and 11 airfield engineer officers were trained to the Flying Control Van and all mobile airfield lighting sets. Requests were made for the

/training

training of additional numbers, but it was impossible to meet this extra responsibility at the time.

All airfields in 83, 84, 2 and 85 Groups were visited as they formed in 2nd T.A.F., and the personnel trained as follows:-

(1) C. and D. crews of 1 Corporal and 5 O.R.'s allotted to each airfield, fully trained at Shepperton were established with each wing and gave demonstrations and instructions to all ground crews in camouflage methods generally and in aircraft netting in particular.

(2) Instruction by touring officers by lectures, films, and practical work.

(3) Posters and notes produced by the Department.

The results of this training were remarkable. Except for the netting of aircraft which they found a nuisance, all ranks throughout 2nd T.A.F. took a great interest in concealment, and squadrons, when located on advanced airfields, hid themselves extremely well. Visits by C. and D. officers up to D day kept the interest going and the standard of concealment up to the mark.

21 Army Group Headquarters took considerable interest in the work of the department, asked for and were supplied with a number of A.S.Q.L. and B.Q.L. sets for misleading displays, and arranged for parties of R.E. to be trained in laying them out.

Similarly interest was shown first by the American Army Air Force and later by the American Army. Parties from each were trained in the use of A.S.Q. (Air Force) and A.S.Q.L., B.Q.L. (Army), and a considerable number of sets were supplied to both by the department.

Conclusions.

10. Generally speaking the training given to C. and D. personnel was found adequate with one exception. The training they had at the Battle Course in detecting and moving mines

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CHAPTER XIV

EXERCISES AND MISLEADING DISPLAYS IN BRITAIN.

1. October 1942 saw the introduction of a new form of R.A.F. Visual Deception; in that month and later, under the direction of the Air Staff, several cover plans and exercises were carried out by the department, which necessitated the use of mobile equipment for concealment and display.

First Cover Plan.

2. The first of these was a cover plan which aimed at preventing the enemy discovering the preparations for the transfer of aircraft from England for the opening of the North African campaign. Instructions were received from the Air Staff on the 20th October 1942 to arrange for the concealment of U.S.A. aircraft as they concentrated in Devon and Cornwall prior to their departure for N. Africa; in addition a misleading display of dummy aircraft was to be mounted from Hampshire eastwards to Kent, to deceive the enemy, if he became suspicious, as to the direction of our attack.

U.S.A. aircraft, Airacobras and Lightnings, were due to arrive at St. Eval, Chivenor, and Portreath early in November; most were earmarked for Portreath. The department already had contacts with the U.S.A. Air Force with whom the problem was at once discussed. Time was short and several difficulties had to be met. St. Eval was occupied by Coastal Command, whose aircraft, engaged on submarine hunting, were painted white. As a result St. Eval airfield was a most attractive target, visible for many miles. It was decided to locate as few U.S.A. aircraft as possible on St. Eval and not to net them. Major Ackley of the U.S.A. Engineers undertook to provide American personnel to net aircraft arriving at Chivenor, and the department concentrated 100 O.R's to deal with Portreath. The Airacobras could be concealed under the new X type nets and offered no difficulty. The Lightnings,

/on

on the other hand, required a much larger net, and the only type then available consisted of the official R.A.F. C Type which had not been designed for quick covering up and removal. These nets were stored in various Maintenance Units, whose staffs could not be convinced of the necessity for urgent dispatch. Nets were sent off in consignments by slow goods train, pickets often arriving later. Fortunately a delay in the move of the American units enabled practically all the equipment to be received and laid out in time. The American aircraft eventually arrived at Portreath late one afternoon with very short intervals between squadrons. The comparatively few American officers on the airfield were confronted with a difficult job in directing them to the proper dispersal points where nets had been laid out in readiness, and the R.A.F. personnel had to work most of the night to get all aircraft under cover before daylight. On the whole the American units accepted the situation calmly, although they had not been warned previously, and indeed had never seen aircraft nets before. All senior officers were most helpful and except for a few pilots who didn't much like this interference with their "ships", and a few ground crews who occasionally cut the nets loose rather than unlace them, there was little trouble. The weather however was abominable, strong gales persisting throughout the cover plan. The heavy C Type nets required constant attention including re-pegging by crews of 10 men, as the wind tended to draw the nets against and across the aircraft. Some late arrivals landed the following day, and not seeing of their aircraft thought at first they had arrived at the wrong airfield; then, when they were told that they had reached Portreath, they showed considerable concern at the departure of their units previous to their arrival. When directed to their dispersal points and nets, they were agreeably surprised to find that they had not been left behind. The Americans stayed at Portreath much longer than was originally

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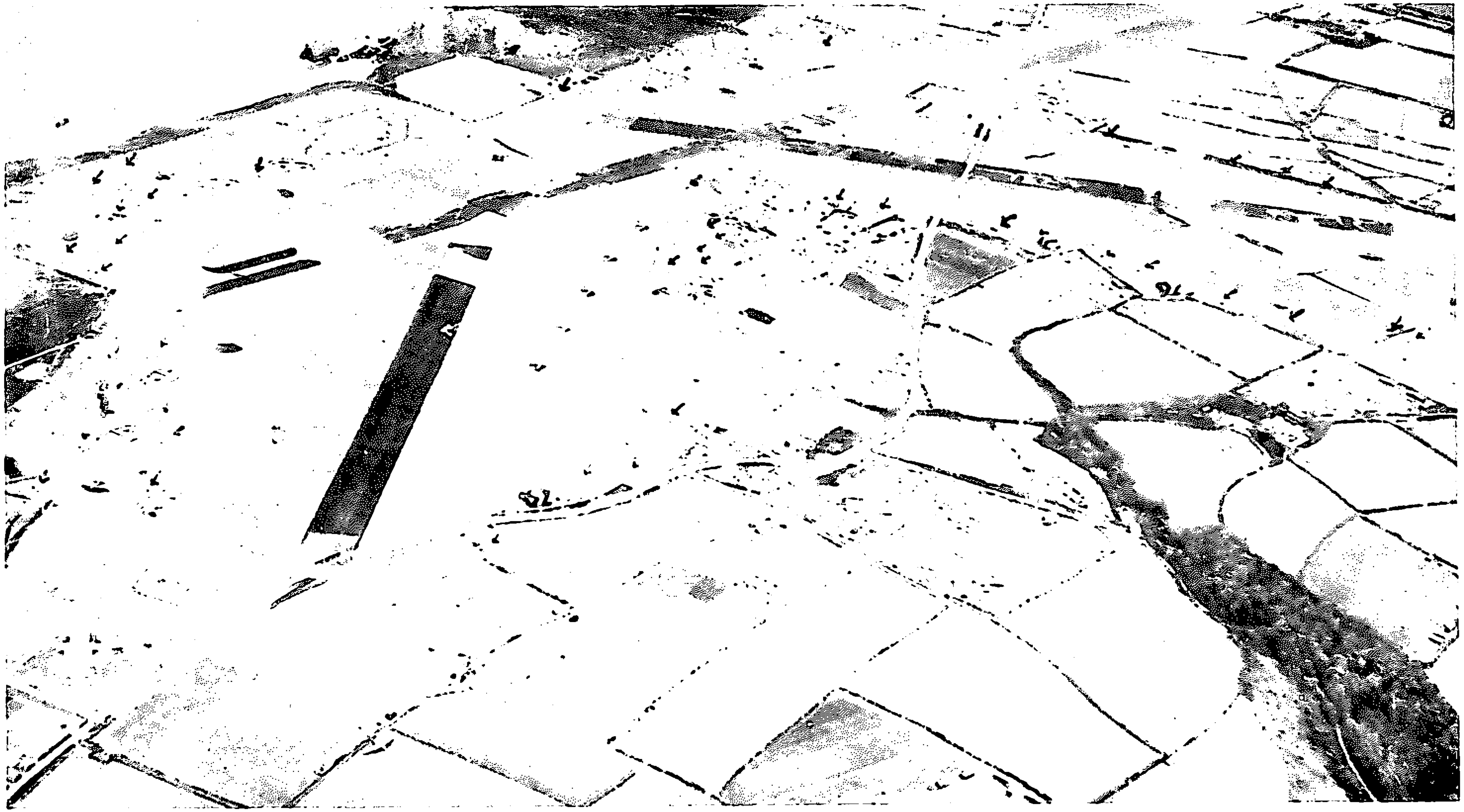

A view of Portreath airfield showing the large concentration of U.S.A. aircraft immediately prior to the North African operations. Some of the concealed aircraft are indicated by arrows.

anticipated, but the net concealment was a complete success. There was no additional enemy reconnaissance over Devon and Cornwall, and their presence there must have been unnoticed.

The experience gained in this use of C Type nets resulted in their conversion by the department into the more easily handled Z type, although it was always recognized that no nets of this size could usefully be used in the field. Later the Twin Engine type nets were developed.

Concurrently with the concealment in the west, a misleading display, the first one attempted by the department, was mounted in Hampshire and further east. Two squadrons of Hurricanes were displayed at each of four airfields under construction, i.e. Dunkerswell, Stoney Cross, Holmesley South and Dunsfold. Two more squadrons were displayed on a large open area south-east of Dunsfold airfield, which had in the past been used as a temporary landing ground. Light canvas dummies had not up to this time been produced in sufficient quantities and the old wooden types had to be used. At the three airfields construction was well advanced, and runways and some hangars had been constructed. The hangars were used for the concealed storage of dummy aircraft parts as they arrived, and later for their assembly under cover. Contractors' personnel and transport on two of the airfields, and a Canadian Engineer unit on the third provided ample movement and personnel for realism. Litter of all kinds was lying about and there were many rutted tracks due to construction work. These displays were considered satisfactory. Thr fourth display on the open ground near Dunsfold was not so good: lacking cover, aircraft parts were dumped in heaps and covered with nets and the erection of the aircraft was carried out by night. Although the numbers and positions of aircraft were continually changed, the lack of movement, personnel, transport, tracks and litter would have given away the deception, if there had been continuous

/reconnaissance

reconnaissance. The prolongation of this cover plan beyond the two weeks originally intended added to the risk of discovery, but fortunately enemy reconnaissance remained normal and of small extent. Weather was consistently bad, and heavy gales necessitated constant work on the maintenance of the dummy aircraft.

This display provided useful experience and showed the need for "life", tracks and litter. There is no information as to whether German reconnaissance reported these apparent concentrations, but it is certain thatthe main object was achieved and that the transfer of American units to Devon and Cornwall passed unnoticed, or at any rate caused the enemy no concern.

Spartan Exercise.

3. In February 1943, large scale Army manouvres were held over a considerable area in south and south-west England. The Air Staff instructed the department to provide nets and dummies for the protection of the tactical aircraft on one side, without the knowledge of the air contingent on the other side.

By this time light canvas dummies were available and 5 squadrons of 18 dummies were displayed as follows:- one squadron of Spitfires at each of the airfields at Middle Wallop, Chilbolton and Lasham, and one squadron of Mustangs at Stoney Cross and at Hurn.

Nets for the concealment of true aircraft were provided as follows:-

Middle Wallop	18 X Nets 36 Y Nets
Chilbolton	54 X Nets
Stoney Cross	54 X Nets
Hurn	18 X Nets 120 Tree Nets.

These tree nets were supplied by D.G.E. for general camouflage purposes and could be used to conceal camps, transport and temporary accommodation in the field. They were tried out on this exercise as concealment for Boston aircraft at Hurn.

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The dispersal points on this airfield were fringed with gorse and scrub of which full advantage was taken. Nets were looped over the aircraft and scrub spread round the dispersal points, completely obliterating shape and shadow. The Bostons were invisible at 2000 feet, and the experience gained led directly to the development of the Twin Engine type netting.

Airfield Commanders, during this exercise, were on the whole most helpful. Considerable interest was shown in the dummies and nets, but as ground crews had not been trained to manipulate the latter, and the C. and D. detachments were too small to cover all the dispersal areas on large airfields, full use could not be made of these forms of protection. Nevertheless when netting was carried out, even on open grass land, the opposing Air Force consistently attacked the dummies which were attractively grouped at one end of the airfield.

The Spartan Exercise made it clear that ground crews would have to learn to manipulate all nets for their own aircraft, and instruction and demonstrations were arranged lated to effect this.

Cover Plan Tindall.

4. The first really inter-service cover plan was mounted in July 1943 in Scotland. Its object was to deliver a deceptive threat aimed primarily at Stavanger to pin down German forces in Norway during our attack in the Mediterranean on Italy. The cover plan, known as Tindall, was originated by COSSAC who issued instructions for the scheme to be co-ordinated by F.O.I.C. Rosyth, G.O.C. Scottish Command and No. 18 Group, R.A.F., whose headquarters were near Inverkeithing. It was not necessary to assemble large bodies of troops, as these would naturally embark at points in S.W. Scotland. The cover plan was therefore limited to the simulation of invasion preparations in the East of Scotland by a considerable glider-borne force. Heavy gliders were to be assembled at

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certain airfields, where camps were also to be pitched and troops moved to obtain realism. The department was made responsible for displaying 40 dummy Bostons on three airfields, 20 at Peterhead, 10 at Fordoun and 10 at Fraserburgh. Originally Dyce was also chosen for a display, but this part of the scheme was cancelled when it was pointed out that this airfield was used by Swedish air-liners.

Cover Plan Tindall received a severe setback when it was discovered that though the requisite number of gliders was available, aircraft for towing them were unprocurable. The department was then asked to construct hides large enough to conceal the gliders that should have been displayed. This was quite impossible to carry out under three months even if material and labour had been readily available as many acres of hides would have had to be built. As a result only two gliders instead of 30 or more were provided at each airfield, and the enemy were left to guess that the remainder would arrive the day before the invasion!

The dummy Bostons were assembled in hangars and towed to their positions at night. At that time dummy transport, tankers, and litter had not been produced, but sufficient true transport etc. was borrowed from the stations to render the displays effective. Dummy Ack-Ack with dummy crews were also borrowed from the Army, but a mistake was made in not providing a few true guns. This was particularly evident when an enemy aircraft flew over to reconnoitre at 1000 feet. The dummy aircraft would not have been spotted, but it must have surprised the crew when the Ack-Ack with crews in their firing position took no notice. The display was ready by the required date, August 15th, and continued till August 25th when the aircraft were dismantled by night and the parts covered by nets. A second display of Bostons was ordered between the 19th September and the 5th November, but no gliders, camps, or troops were used during this period. In

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spite of the sketchiness of this cover plan, and the failure to concentrate gliders, it drew the enemy's attention and his reconnaissances were considerably increased; it probably prevented any considerable withdrawal of aircraft from Norway to Italy.

Cover Plan Starkey.

5. While Tindall was in operation in the north, a second cover plan was developed on the south coast. This was also originated as an inter-service scheme with the objects of deceiving the enemy into thinking an invasion imminent, of drawing enemy aircraft from Italy, and of provoking an air battle so that a serious blow could be struck at the enemy Air Force before winter. The scheme included the concentration of dummy landing craft in ports and estuaries on the south coast, the movement of a force of army strength to embarkation points, and the concentration of aircraft, supplemented by dummies in the south and east of England.

Unfortunately very few dummy landing craft had been produced at that time. About a year previously, several types had been developed by Combined Operations, but these had been found insufficiently robust to withstand heavy winds. The Admiralty, as far as is known, made no further attempt to solve the problem. C.T.D. constructed one large type on the Queen Mary reservoir, which broke loose during a gale and careered all over the reservoir, eventually stranding itself on one of the stone banks. The dummy was undamaged structurally but much of the canvas covering was badly rent. It was however a far too cumbersome type of construction for transport and rapid assembly. It proved however that a dummy was a practical proposition and after inspections by Naval and R.E. Officers, the Army undertook further experiments and soon developed a satisfactory prototype which went into production. The Army and Navy came to an arrangement that the former should produce and build the craft, and the latter should be responsible for

/moving

and mooring them.

The absence of dummy landing craft knocked the bottom out of the invasion scheme and the Army treated Starkey as an army exercise in large scale movement followed by embarkation practices from hards and ports.

The R.A.F. still hoped to provoke an air battle and continued with their part of the original plan. C.T.D.'s share consisted in the display of 12 squadrons each of 18 dummy aircraft on certain R.A.F. stations and the provision of decoy lighting protection to army concentrations near the coast in case the enemy saw fit to deliver attacks.

The dummy aircraft were all of the light portable type and were located as follows. At Biggin Hill, Hawkinge, Hornchurch, Southend, Shoreham and Friston one squadron of Spitfires, and at Ibsley 2 squadrons of Spitfires: in addition one squadron of Mustangs was displayed at Gravesend and West Malling, and two squadrons of Mustangs at Martlesham. By this time C. and D. personnel were well trained and each squadron of 18 aircraft plus accessories in the form of dummy transport, tank lorries and litter was successfully installed in a single night by a crew of 6 men.

From the department's point of view the most interesting feature of the cover plan was the provision of decoy lighting for army protection. Few of the Army Headquarters Staff had heard of protective deception, but even though no great enthusiasm was shown, no serious objections were raised. Plans were provided showing the location of troop concentrations near the coast, and the department was able to select 34 decoy sites, which would afford protection but bring no risk on the various camps. 21 of these were inland and 13 on the coast; A.S.Q.L. sets were provided to simulate army camps and convoys. Some of the permanent decoys had to be rendered non-operational temporarily where they interfered with the army's movements.

The next problem was the question of control of decoys, i.e. when and for how long light should be displayed. Theoretically this should have been made the responsibility of some R.A.F. formation but as home Commands were operating and 2nd T.A.F. had not come into the picture, this was impracticable. Control could not be allocated to army formations, partly because they were on the move and partly because they knew nothing about decoy lighting. Finally the F.O.I.C. Portsmouth was selected as chief controller, as his staff were well experienced in decoy work. Naval Headquarters Portsmouth controlled the main concentration area near Southampton and decentralized the control of other areas to local N.O.I.C.'s.

A satisfactory communication system provided a third problem. Experiments had been carried out with Walkie-Talkie sets but it was found that their range was too limited in certain types of country for a decoy scheme spread over a large area. Medium distance radio communication entailed the provision of R.T. equipment and technical operators which was impracticable. The use of Beetle and similar type sets necessitated a permanent watch; one man would always have to be sitting alongside the receiver. Moreover, Beetle sets cannot answer back without a transmitter and conversation is one-way. In the end motor cyclists were provided at the control for each group of sites. Normally they were sent out about mid-day to tour the sites and deliver instructions for the following night. They then returned to the control and were available to communicate any changes in orders at any time if necessary. Actually no changes were made, chiefly because the enemy made no attacks. This problem, has, however, always to be faced. In static decoy work, priority over main telephone systems and special lines between controls and decoys ensure immediate contact and action. To secure adequate control of decoys in

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the field without telephone lines is a very different matter. It is interesting to note that it was solved in France by the simple practice of operating lights all the night and fires if the decoy was attacked; no other orders were issued. Little information is available as to the effect of this cover plan. It is known that the enemy made a number of reconnaissances, but most of his aircraft were shot down, which, as the scheme was intended to be a real attempt to mislead the enemy, seems to render Fighter Command liable to an accusation of undue officiousness. Certainly no air battle developed, but it is known that a considerable number of enemy aircraft were transferred at this period from Italy to France and Belgium, so that one aim of the cover plan seems to have been attained, and our task in Italy lightened.

Value of Cover Plans.

6. All the above cover plans and exercises provided valuable experience and showed up faults in the direction and operation of deception schemes and in the equipment used. As a result of the Cornwall cover plan and the Spartan exercise, T.E. nets were developed. Spartan also showed the need for training R.A.F. Squadrons in concealing not only their aircraft but also their camps and transport. Tindall provided lessons especially in regard to the necessity for the provision of true Ack-Ack if dummies were installed. From the deception point of view Starkey was invaluable. It introduced to the Army the practicability of decoy lighting protection in the field and of the use of the same equipment in misleading schemes at night. As a result, when the invasion of Normandy took place, R.A.F. visual deception was used smoothly and efficiently. The production of dummy landing craft by the Army was expedited for use in "Fortitude". Various faults in mobile lighting equipment were discovered and remedied, and C. and D. personnel were given further training in rectifying normal faults instead

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of appealing for technical help as soon as they developed. The two outstanding deficiencies which received no attention were the necessity for training specialist staff officers to direct deception schemes and the need for a clear inter-service policy as to individual responsibilities in regard to visual and other deception.

CHAPTER XV.

COVER PLAN "FORTITUDE".

1. In the Middle East several excellent cover plans were carried out by the Army, under the direction of the Chief of Staff, who had an expert "deception" staff officer as his adviser; they had considerable success in misleading the enemy at important periods in the war. R.A.F. contribution was small, and consisted of the provision of a liaison officer and some true aircraft to provide "life" on airfields occupied by dummies. Owing to the lack of any inter-service decision on respective service responsibilities, the Army in the Middle East undertook all the work, some of which (i.e. dummy aircraft) should have been carried out by the R.A.F.; on the other hand, lacking the necessary equipment in sufficient quantity, less attention was paid to confirming day displays by lights at night than would appear to have been advisable. In England the only major inter-service Cover Plan developed was, after many changes of name, designated "Fortitude"; it was mounted to mislead the enemy as to the direction of our attack in France. The responsibility for its planning varied at different times between COSSAC, who had no "deception" staff officer to advise them, and 21 Army Group, who were chiefly interested in developments across the Channel. The distribution of tasks amongst the three services was based on their existing capacity for producing what was required, and not on any defined principles. This chapter records only the visual deception part of the Cover Plan, and more particularly the Air Ministry contribution. There was, in addition, a very successful tactical radio-deception scheme carried out during the crossing of the Channel, and a "sonic" deception scheme, which owing to weather and unsuitable equipment proved unsuccessful.

2. The visual deception cover plan "Fortitude" was divided into two parts, "Northern" and "Southern".

Northern Fortitude Intention.

3. The intention of "Northern Fortitude" was to mislead the enemy to expect an invasion of Southern Norway. It was hoped that this would induce him to retain his aircraft in Norway and not move them south

/south

in the early and most dangerous days of our invasion of France.

Northern Fortitude Display.

4. It was decided to limit this cover plan to a display of aircraft on airfields in the East of Scotland, and it therefore became an Air Ministry responsibility only. The presence of troops and gliders on some of these airfields would have helped to make the display more realistic, but as all gliders were wanted for the true invasion, this was impracticable. In this particular case their absence was not serious, as in any invasion of Norway, nearly all troops would be embarked in the Clyde and other ports in the west of Scotland. As this area was always crowded with shipping, special deception measures were unnecessary.

The display consisted of the following aircraft:-

At Peterhead	2 squadrons of twin-engined dummies (Bostons). 8 Spitfires to thicken up the existing squadron.
At Fraserburgh	1 Squadron Bostons.
At Fordoun	1 Squadron Bostons.

In addition dummy petrol tankers and vans were supplied with other tins and litter, partly real and partly dummy to simulate the usual odds and ends always to be seen in the neighbourhood of aircraft dispersal areas. Two real Bostons were also located at Peterhead partly to show life and also to send from the air signals specially prepared beforehand to indicate reconnaissance reports, etc.

The dummy Bostons, a heavy wooden type, were erected by day in hangars and towed to their dispersal points at dusk. The dummy Spitfires, the collapsible canvas type, were erected by night. Fake wireless messages were sent of the arrival of the various units which appeared according to plan on their respective airfields in the morning. Numbers of aircraft and their positions were

/changed

changed daily.

Northern Fortitude Remarks.

5. This display was mounted with all the features necessary for success. The most important was the location of the dummies on already occupied airfields. The usual station transport and personnel therefore provided the "life", which dummy aircraft on dummy airfields lack. The attendant tankers and litter added to the realism. Wireless co-ordination of arrival and reconnaissance reports was well worked out. The dummies were good enough to defy recognition by any reconnaissance aircraft over 1,000 feet and stood up to searching air photography tests.

The degree of success of the display will not be known accurately till after the war. It did however attract a considerable increase of enemy reconnaissance and with the care taken to achieve realism, it must have had some influence on his dispositions.

Southern Fortitude Intention.

6. "Southern Fortitude" aimed at misleading the enemy as to the direction of our attack in France, and also at protecting with decoys our hards and ports of embarkation on the South Coast.

The configuration of our southern coastline rendered it necessary for any invasion of France, to concentrate shipping and craft from Chichester Harbour westwards, as Dover and Folkestone were under fire from enemy guns near Calais, and there are no large harbours between Folkestone and Chichester. Enemy observation of our concentrations would not, therefore, enable him to gain any reliable clue as to the probable point of attack. If landing craft were reported on the east coast, north of the Thames estuary he would be likely to anticipate attack much more to the east than the Normandy coast, and if he was misled completely, he

/would

would probably keep troops in the Pas de Calais area for a considerable time after the actual invasion took place. It was on this reasoning that a display of Big Bobs, reinforced by lights at night, was located on the east coast, mostly in Suffolk, where embarkation facilities in the form of hards and ports also existed.

As far back as early 1943, as already recorded in Chapter III, decoy sites to protect embarkation hards had been selected all along the south coast, and a form of lighting installed, to simulate the lighting which it was anticipated would be adopted for the true hards themselves. Although these lighting displays had to be modified considerably at a later date, their early initiation enabled the changes to be rapidly made without difficulty.

Southern Fortitude.

Development of Plan.

7. In the late summer of 1943, the planning staff of COSSAC initiated the first cover plan, based on the above principles, which remained unchanged, though details were revised from time to time to suit circumstances. These alterations, which are dealt with below, provide an example of the necessity for flexibility and mobility in all cover plans of this kind.

The original plan intended that protective lighting in the south should operate during periods of specially arranged wireless silence during February, March and April, 1944. The object was to accustom enemy reconnaissance to seeing frequent lighting, so that when D Day arrived he would not recognise attack as imminent. About Xmas 1943, 21 Army Group took over the direction of "Southern Fortitude", and immediately raised an objection to this early display of lights on the grounds that unless ample landing craft were visible nearbybefore, during and after these displays, they would be recognised as bogus. It was undesirable to use true landing craft for this purpose

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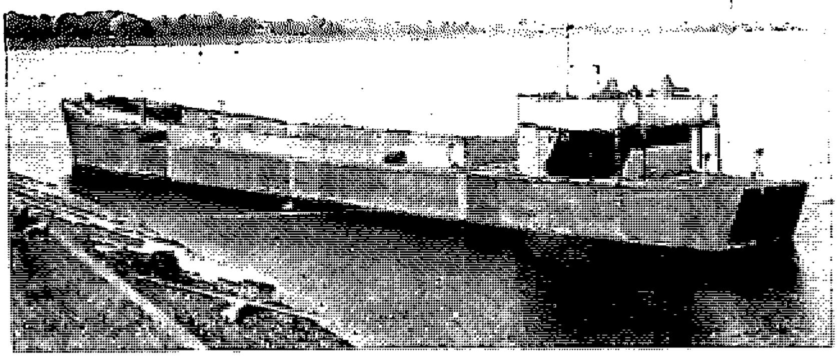
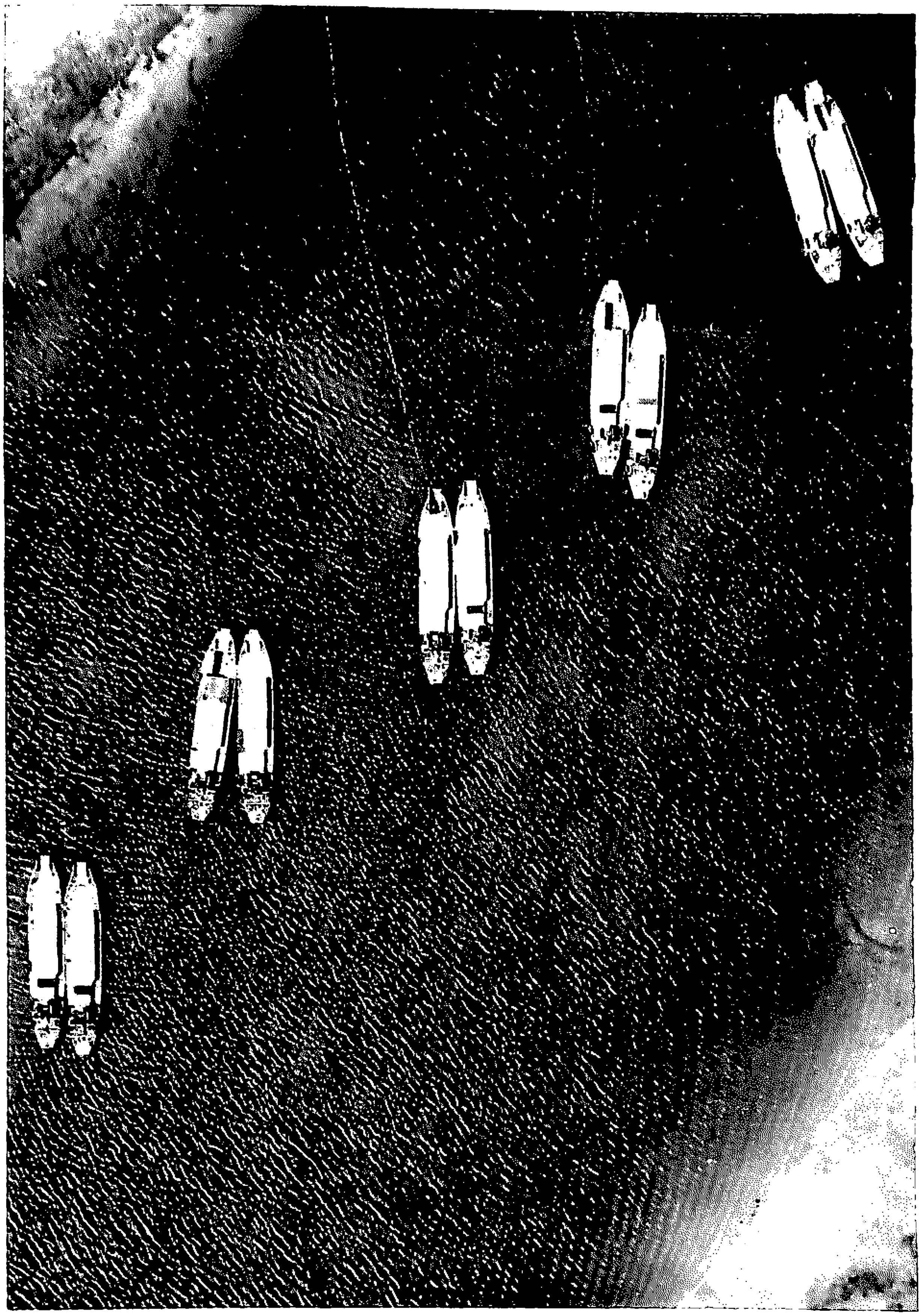


L.C.T. The prototype craft constructed on the Queen Mary Reservoir at Staines.

L.C.T. An air view of the L.C.T. trots displayed in the Deben river as part of the D Day cover plan. The craft were fitted with lights to provide confirmation for any night reconnaissance.



Air view of Big Bobs in the river Deben

and inconvenient to bring them to the hard areas so early. The production of dummy craft, i.e. Big Bobs, had started so late that they would not be available in sufficient numbers to produce any effect. This part of the original plan was therefore abandoned.

In February 1944, the Admiralty finally decided the system of lighting to be adopted on true hards. The lighting was so effectively screened that the only lights likely to be visible from the air during embarkation were the side lights of vehicles moving between the collection areas and the hards, and torches used on the hards to guide vehicles when backing into the landing craft. This necessitated a revision in both the design and the operation of the protective decoys to hards. With so little light visible on true hards, it became undesirable for the decoys to attract attention to the coast by showing lights in the normal way, i.e. previous to enemy attack or reconnaissance. It was decided therefore that decoys should simulate what might happen on a real hard if an attack took place. Some vehicle lights might be left carelessly on, and probably a few scattered fires would develop from stores or vehicles hit by bombs. These small fires, always visible from a long distance, thus became the main feature of the decoys, which were then only to operate (both fires and lights) if an attack took place on the neighbouring hard or in its vicinity. If there was no attack (as actually happened during D and subsequent days) the decoys were not to be operated at all.

On February 24th, 1944, at a meeting held at 21 Army Group, further details of the plan were developed. It had been decided that with the Big Bobs likely to be produced by D day, their display would have to be limited to Folkestone, Dover, the Deben and Orwell rivers in Suffolk, Lowestoft and Yarmouth. The lighting and fire

/displays,

displays, to conform, were divided into three Groups. No.1 Group from Falmouth to Hastings was purely protective on the lines already described. No.2 Group comprising the coast from Hastings to the Thames estuary was to be considered as protective at first, but capable of development as misleading later if required. This was due to the impracticability of establishing misleading displays to reinforce the Big Bobs in Folkestone and Dover. The vicinities of these ports are marked by high white cliffs likely to be visible from the air even at night. This precluded the location of displays near the ports, partly from the impossibility of producing reality, i.e. simulating port lighting, and partly due to the risk of attack causing civilian casualties in an area crowded with villages and houses. The nearest sites that could be found were west of Hythe and north of Deal, too far for misleading displays for the ports, but reasonable enough for protective displays for the hards at Hythe and Deal, which incidentally were never used. No.3 Group comprised the sites reinforcing the Big Bob displays north of the Thames. This group consisted entirely of misleading displays of lighting, which were quite different to the protective displays, as their main object was to attract attention. They consisted of a considerable amount of hooded lighting along the banks of the rivers and Broads, with lines of vehicle lights leading towards the water. At specified periods they were to be operated all night to simulate embarkation activity. The sites for these displays were close to true hards and to the anchorages of the trots of Big Bobs. Lights were also arranged on the Big Bobs to simulate activity at night. Control of all displays, misleading or protective was located with the local Naval authority so that the movements of shipping and craft should not be endangered. R.A.F. personnel of

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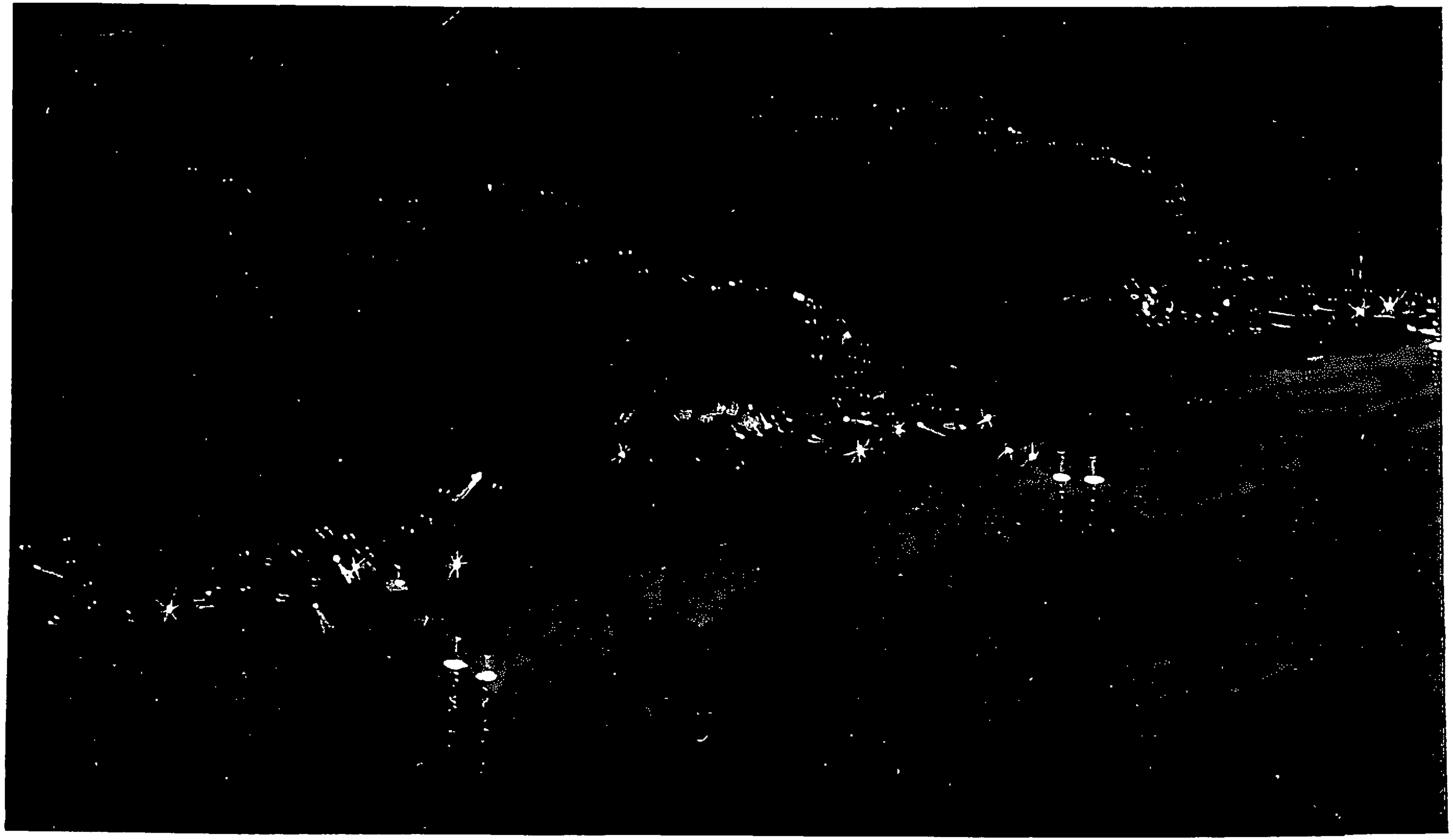


Lighting on the Hards. A typical decoy layout incorporating the jetty lights, accumulation of vehicles on the Hards, and other vehicles approaching along the access roads.

the department were to operate all night displays under the orders of these Naval controls.

Southern Fortitude

Some details

8. The map at the end of the chapter shows the locations of the display sites. The yellow circles represent the position of static decoys, part of the general defence of the country, constructed long before Fortitude was mounted, and still operated normally. The red circles mark the sites of decoy protection to hards, the blue circles similar protection or improvements in existing decoys for ports, craft and shipping, and the green circles the misleading displays reinforcing the Big Bobs.

It is worth recording that a large number of other suitable decoy sites were selected which would not have interfered with the civil population, but which had to be discarded owing to the concentration of troops, dumps, craft, etc., along and near the south coast of England. Cover Plans will always find this difficulty and the necessity for close touch with all Commands of the three Services is emphasized. Even though these precautions were taken, it was often found that A.A. and other units campedtoo close to decoys. The A.A. never objected to the risk and hoped that the decoy would attract targets for their guns. An American unit commander when he received the warning of his risk replied with the remark; "Suits me, we want our boys to get tough."

Turning to the map and working from West to East certain points of interest may be noted.

(a) Menabilly was sited in a valley close to the country house on which the story and play of "Rebecca" was based. Dams were placed across the valley to flood it, and a number of lights were sited to shine on the water. It was hoped that this might draw off attack from Fowey harbour which was crammed with craft.

/(b)

(b) Newtown Bay, East and West, and Bembridge on the Isle of Wight were designed to draw attack off concentration of shipping in the Solent. Bembridge was included at the last moment at the request of C. in C. Portsmouth.

(c) Cobnor Point, etc. Three sites were located in Chichester harbour east to protect craft on the western side, and as additional protection for Portsmouth.

(d) Cuckmere Haven lighting was an exact replica of Newhaven port and railway lighting.

(e) Owing to the concentration of shipping in the Thames, two large protective decoys were located at East Tilbury and Lower Hope Point to cover Tilbury and Gravesend.

(f) Of the misleading sites, the three northern ones Breydon Water, Oulton Broad and Benacre Ness were used in the first half of the display only, and the three sites East Mersea, Burham and Canewdon, in the second half only.

Southern Fortitude Operation

9. During the latter part of May, enemy aircraft attempted to attack Plymouth and Portsmouth on several occasions at night. 80% or more of these attacks were drawn off by the static decoys protecting these ports. It may be noted that the naval authorities were fully alive to the value of decoy protection, and that they had officers and men specially detailed for the operation of all static decoys in the vicinity of their main ports. On these pre-D day attacks the decoys were particularly well handled. By this time, however, ships and craft were gradually concentrating, and all local Naval authorities felt considerable uneasiness in regard to their safety, if these attacks developed and spread. 21 Army Group orders had laid down that none of the new protective decoys should be operated till D - 4 day, but in view of the circumstances the local Naval

/authorities

authorities were given full authority to operate any coastal decoy at their discretion to protect shipping in any port or estuary. This particularly referred to the Solent and Southampton Water, where the concentration of shipping became so great that it was evident that the risk to ships was much greater than that to hards. In addition all Southampton static decoys were placed under the control of the C. in C. Portsmouth. Although therefore the decoys had been originally designed to protect hards, in the end the safety of shipping and craft was made first priority, and that of hards relegated to second place. This constitutes a lesson for future schemes of this kind. Much to the astonishment of all concerned, enemy attacks suddenly ceased, and none of the protective decoys anywhere along the coast ever had to be operated at all.

Orders for operating the misleading displays on the east coast were issued shortly before D day, the date being dependent on that on which the dummy craft (Big Bobs) could be assembled, launched and anchored. They were operated for the first time on D + 2 night.

Another example of lack of inter-service fixing of responsibilities for displays was evident in relation to the construction, handling and mooring of the dummy craft. On the general principle that the Service which constructs the true equipment should also construct and man the dummy, Big Bobs should have been supplied and operated by the Navy. Unfortunately the Admiralty were not interested in these displays and in consequence they became an Army responsibility at a time when it was difficult to produce sufficient dummies in the time available. Although a

/number

number were produced, there is no doubt that at least double that number were required for really effective display and some true craft should have been available to give movment and life. Lacking these, the only life the army could provide was the movement of boats between the shore and the anchored dummies whenever there was an alarm of approaching enemy aircraft. It is suggested that this would have been insufficient if the enemy had made a thorough reconnaissance of the area; fortunately very few aircraft came over by day or by night. The next difficulties were the provision of craft for towing the dummies into position and moorings. At one meeting the Navy guaranteed providing both these, if the Army provided the dummy craft and the men to build, launch and man them. Owing to changes of personnel and the concentration by the Navy of everything they could lay hands on for the real invasion, this agreement was forgotten and the Army had considerable difficulty in getting the dummies moved into position, and in many cases could only use moorings when no longer required by the Navy for their own craft, some of which did not leave them till D day or after. So it happened, that although the display would have been more effective, if, like the true invasion fleet, it had started to build up well before D day, no display could be mounted in much of the area till after D day.

The Army display in the Orwell and Deben was well planned and well carried out; security was excellent. At Yarmouth, however, many of the dummies were constructed and launched within full view of the local populace. There were no restrictions at the time on the entry of outsiders into the town, and there was therefore plenty of opportunity for any enemy agent in the vicinity to recognise that the

/display

display was a fake. Security is of vital importance in all cover plans, because one mistake of this kind may not only compromise the whole scheme, but also by inference provide a pointer to our true plan.

The misleading display was operated from D + 2 until as late as the 15th September a period of over 3 months, far too long for reality. Here again it must be pointed out that COSSAC to whom control had reverted had no specially trained deception officers. Certain variations were however instituted in the display of lighting to indicate alterations in plans.

(a)	8th June	-	25th June	Normal lighting was displayed.
(b)	25th June	-	5th July	Specially increased lighting was displayed to indicate the embarkation of troops (too long a period as stores would have bden embarked in the first period).
(c)	6th July	-	30th July	Normal lighting, indicating troops embarking waiting for orders (again too long a period).
(d)	31st July	-	14th August	No lighting indicating troops had disembarked to be sent elsewhere.
(e)	15th August	-	12th September	Normal lighting, indicating embarkation by other troops, (again too long a period).

Fake wireless messages were issued to interpret these changes to the enemy In period (d) Yarmouth and Lowestoft areas were abandoned, dummy craft being dismantled and lighting displays packed up. In period (e) three new sites were lit up in Essex but no dummy craft displayed.

Southern Fortitude Effect.

10. Enemy reconnaissance certainly occurred on several occasions in the early part of the display, and an attack was made on one display site. We shall not know till

/after

after the war to what extent or how long the enemy was deceived. It is true that his troops in Belgium and near Calais were largely retained there until after the decision had been reached in the battle for Normandy. How much of this was due to the cover plan and to what extent the great activity in the Thames estuary also affected the issue is still unknown. Ships were loading day and night in the Tilbury area and were passed through the straits at night bound for Normandy. This activity must have greatly reinforced the effect of misleading displays on the east coast, at any rate for a time.

Summing up this cover plan, it must be admitted that it w it was mounted, for reasons given, on too small a scale, that a bad mistake was made at Yarmouth, and that the display was operated too long to carry conviction in the later stages, during which time no enemy reconnaissances were made. On the other hand the display together with the activity in the Thames probably had very considerable effect in its early stages, and should be undoubtedly credited with misleading the enemy to a large extent exactly as required, and caused him to retain troops in Belgium and the Pas de Calais when they might have made all the difference in Normandy.

SCHEDULE OF DECOY SITES - FORTITUDE

PROTECTION OF HARDS

Sites on South Coast (shown red on the Map).

SITE	PROTECTION OF	MANNING	CONTROL
1. HELFORD	POLGUIDDEN HARD	R.A.F.	F.O.I.C. FALMOUTH
2. ST. MAWES	FALMOUTH HARDS	"	" "
3. RUAN LANIHORNE	do.	"	" "
4. MENABILLY	FOWEY RIVER	"	R.N.O., FOWEY
6. EAST CORNWORTHY	DARTMOUTH HARDS	"	C.-in-C. PLYMOUTH
7. CHURSTON	BRIXHAM HARD	"	R.N.O. BRIXHAM
8. PENNINGTONMARSHES	LYMINGTON HARBOUR	"	H.M.S. MASTODON
9. SOWLEY POND	BEAULIEU RIVER	"	" "
12. CHILLING	STOKE BAY HARD	R.N.	C.-in-C. PORTSMOUTH
18. PETT LEVEL	HASTINGS HARDS	R.A.F.	R.N.O. RYE
20. WEST HYTHE	HYTHE HARDS	"	R.N.O. FOLKESTONE
21. WORTH	DEAL HARDS	"	R.N.O. SANDWICH AND RICHBOROUGH

SCHEDULE OF ADDITIONAL STATIC DECOY SITES - FORTITUDE

(shown in blue on map)

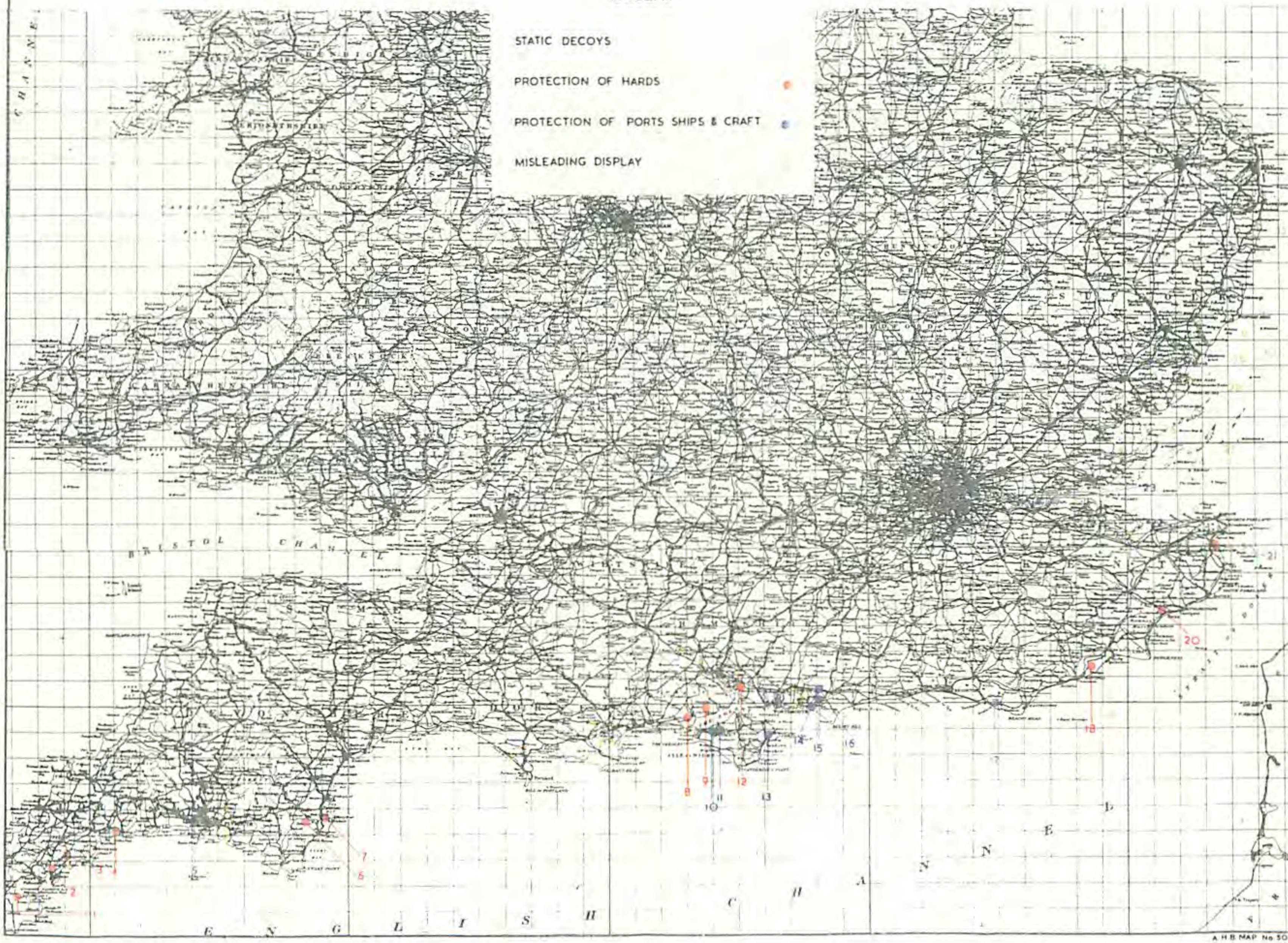
SITE	AREA PROTECTED	MANNING	CONTROL
5. EARTH	PLYMOUTH - DEVONPORT Hards	R.N.	C.-in-C. PLYMOUTH
10. NEWTOWN BAY WEST	SOLENT	R.A.F.	N.O.I.C. ISLE OF WIGHT
11. NEWTOWN BAY EAST	SOLENT and COWES	"	" "
13. BEMBRIDGE	SOUTHAMPTON WATER	"	" "
14. EAST HEAD	CHICHESTER HARBOUR and PORTSMOUTH	R.N.	C.-in-C. PORTSMOUTH
15. ITCHENOR	"	"	" "
16. COBNOR POINT	"	"	" "
17. CUCKMERE HAVEN	NEWHAVEN	R.A.F.	N.O.I.C. NEWHAVEN
19. CAMBER CASTLE	RYE	"	R.N.O. RYE
22. LOWER HOPE POINT	GRAVESEND	R.A.F.	C. in C. NORE
23. EAST TILBURY	TILBURY	"	Captain-in-Command, Tilbury, R.N. Base.

MISLEADING DISPLAYS - (FORTITUDE)

Coastal Sites in East Anglia (shown in green on the Map).

SITE	DECEPTIVE AREAS	MANNING	CONTROL
24. CANEWDON	CROUCH RIVER	R.A.F.	F.O.I.C. HARWICH
25. BURNHAM	CROUCH RIVER	R.A.F.	F.O.I.C. HARWICH
26. STEEPLE	BLACKWATER RIVER	R.A.F.	F.O.I.C. BRIGHTLINGSEA
27. EAST MERSEA	BRIGHTLINGSEA	R.N.	F.O.I.C. BRIGHTLINGSEA
28. LONG REACH	RIVER ORWELL	R.A.F.	C.O., H.M.S. WOLVERSTONE
29. TRIMLEY MARSHES	RIVER ORWELL	R.A.F.	C.O., H.M.S. WOLVERSTONE
30. FALKENHAM MARSHES	RIVER DEBEN	R.A.F.	C.O., H.M.S. WOLVERSTONE
31. KIRTON	RIVER DEBEN	R.A.F.	C.O., H.M.S. WOLVERSTONE
32. WHITEHALL FARM	RIVER DEBEN	R.A.F.	C.O., H.M.S. WOLVERSTONE
33. BENACRE NESS	COAST	R.A.F.	F.O.I.C. YARMOUTH
34. OULTON BROAD	LOWESTOFT	R.A.F.	F.O.I.C. YARMOUTH
35. BREYDON WATER	YARMOUTH	R.A.F.	F.O.I.C. YARMOUTH

DECOY SITES AND MISLEADING DISPLAYS — FORTITUDE



A.H.B. MAP No 501

CHAPTER XVI

R.A.F. VISUAL DECEPTION IN THE MIDDLE EAST.

1. The Middle East was the first war theatre abroad in which R.A.F. visual deception was used. Consequently teething troubles and difficulties were to be expected, but not to the extent which occurred. The history of the work in the Middle East is therefore interesting, but the picture given in this chapter cannot be considered quite complete, as full information of circumstances and the reasons for decisions is not available to the writer, and will perhaps never be known. Nevertheless some lessons can be learned.

Origin of decoy measures.

2. The origin of R.A.F. protective deception dates from October 1941, when equipment for ten static Q decoys was sent out from England by C.T.D. Full instructions regarding experience at home, siting, and operation of these sets were sent out at the same time to enable a local decoy organization to be started. Middle East, however, found themselves unable to spare officers for this work, and asked for a fully trained officer to be sent out. This request was met and Squadron Leader Burdock from the department was posted to Egypt. He was placed by the Air Staff under the orders of the Command Defence Officer, who was responsible for the defence arrangements of all R.A.F. airfields and stations, and a "Decoy and Deception" section was inaugurated. Unfortunately the Command Defence Officer, who had no knowledge of visual deception in any form, was determined to run the decoy system himself, without help or advice from the Air Ministry. He issued instructions that no communication whatever should be held with C.T.D., and he himself adhered rigorously to the same principles. Except for occasional demands for more equipment, no communications were received in the department, and letters and signals from C.T.D., to the Middle East were ignored and received no answer. This attitude had unfortunate results. The department not only could not help when difficulties arose,

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but also did not even hear of them till long afterwards and then only through roundabout channels. In addition it failed to gain experience from happenings in the Middle East which would have been most helpful in other war theatres. Another unavoidable local circumstance did not make things easier. The Army and R.A.F. Operational Staffs decided that central control of air defence was impracticable, and allotted the responsibility for its own defence to each of the subordinate Commands. This necessitated 3 more C.T.D. officers being provided to superintend decoy work in these Commands and reduced the control and co-ordination which should have been achieved by Squadron Leader Burdock. Coupled with the embargo on communication with C.T.D. the result was that the decoy protection in the Middle East depended on the extent to which four comparatively junior C.T.D. officers, out of touch with all new developments at home, could put visual deception across the staffs of these subordinate Commands.

Immediate personnel difficulty.

3. An immediate difficulty arose over the question of personnel. The Air Ministry was asked to establish and provide personnel for decoy work. The establishment staff at the Air Ministry asked Colonel Turner's Department whether adequate training could be arranged in the Middle East by the officers sent out. They did not raise the question of provision of personnel. Answering the query the department pointed out that the officers sent out could easily train local personnel in decoy work and that the Army Camouflage Staffs, who had already gained a great reputation could easily train the same personnel in concealment. The Air Ministry reply to Egypt advised them to allocate and train their own personnel. As few units were up to strength, this instruction very nearly killed visual deception at the outset. With true bureaucratic procedure, headquarters informed local Commands to find and train their own personnel, and the local Commands passed the same orders on to the airfield commanders. Some had the imagination to try and do something about it, others were put off altogether. As a result only six decoy Q's were established in early 1942

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at Abu Seweir, Amriya, Shallufa, Heliopolis, Fayoum and Kasfareet. No information reached C.T.D. of this trouble till many months had elapsed and then only through the passage of an ex C.T.D. officer through Egypt to India and China.

Decoy Sites.

4. In September 1942 the P.A.C. (Parachute air curtain) defence of airfields was abolished and some 300 R.A.F. personel became available for decoy work. This enabled a number of other decoy sites to be manned. The full list of decoy sites in Middle East is recorded in Appendix A at the end of the chapter. Most sites are shewn on the accompanying maps but Habbaniya, Abadan, Cyprus, Gambut, Berca, Misurata and Benina are outside the areas covered. The last four lie between Mersa Matruh and Tripoli.

Dummy fires and K's.

5. It will be noticed that a number of the sites had fires (QF) as well and that there were 4K. sites and one K.L.G. The types of fires used in England were impracticable in Egypt. The Army had previously experimented and developed one local type, but when C.T.D. officers arrived further experiments were carried out, using their knowledge of fires at home, at the Army Camouflage School at Helwan; an excellent fire was evolved consisting of 40 gallon drums heavily perforated to form a skeleton framework. Wire netting was then placed round each drum which was then filled with 10-12 lbs. raw cotton impregnated with oil. This became the very effective standard type for the Middle East and was used by the Army for their protective decoys as well as by the R.A.F. To attain the maximum co-operation and to prevent overlapping in the case of fire decoys, a directive was issued in 1942 which provided for the setting up of a Decoy Fire Committee in each subordinate Command. C.T.D. officers acted on these committees in an advisory capacity, ideas were interchanged, and control simplified. Neither the Army or Navy attempted any decoy lighting.

Four K sites were attempted in 1942 and were located on Q sites. Dummy aircraft for these were built by the

/Army

Army (Blenheims and Tomahawks) for the R.A.F. Conditions in the Middle East for K. sites were still more detrimental to success than they were at home. All true airfields were permanently covered with a cloud of dust, and on the bare desert large number of tents, vehicles, and personnel were always conspicuous. These could not be simulated in K. sites, and it is little wonder they drew no attack. Had advice been asked from C.T.D. at home, where K. sites were soon abandoned, the Middle East K's would never have been attempted. On the other hand the one K.L.G. was successful in drawing attack. This was located on a true airfield, which acted as a refuelling ground for aircraft passing through, and tents, life and movement could be seen. The K.L.G. drew three attacks before a lengthy day enemy reconnaissance occurred. Attacks then ceased, and it is possible that this reconnaissance discovered the deception.

Dummy aircraft were used in the Middle East at much later dates for the misleading displays Zeppelin and Turpitude. These displays were organised by the army who provided all dummies including Spitfires, Mosquitoes, Lightnings, and Waco Gliders. It is interesting to note that although C.T.D. sent out samples of very portable dummy aircraft and of aircraft nets to Egypt they were never copied locally by the Army. This is understandable in the case of the portable Spitfires as the deep desert sand, strong winds and frequent dust-storms demanded heavy cumbersome types to withstand local conditions. The nets could have been used even in these conditions and are believed to have been superior to those actually made by the army for the R.A.F. It is probable that the embargo on communication laid down by the Command Defence Officer was indirectly responsible for the failure to use the nets. C.T.D. Officers, cut off from new developments at home, get out of date, and may often fail to see the advantages of new equipment unless they are kept in the picture.

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Q set use on airfields.

6. In Chapter XII, which gives the history of airfield mobile lighting, it is explained how the department became involved in supplying a need that had nothing to do with its normal work. This was due to the use of decoy sets as true flarepath lighting originally in the Middle East, and later in N. Africa. In Egypt one set, and in Irak 4 sets, were constantly so used. It is also known that some sets were so used in the advance westwards to Tripoli but details are lacking.

Closing down of decoys.

7. The rapid advance after Alamein rendered the continuance of decoy protection unnecessary. Within three months a start was made in closing down sites in the Levant and in April 1943 all except the Abadan site were shut down and the personnel transferred for other purposes.

During the advance westwards the Bomber Wings still made use of decoy equipment and laid it out for their protection where-ever possible. The MQ sets were not used for this purpose, owing to the weight of the boxes. A.S.Q's had not then been invented. Instead, use was made of 4 core rubber signal cable left behind by the Germans in large quantities during their rapid retreat. This cable was wound in 300 metre lengths on metal drums and fitted with plug and socket connections at the ends. By wiring in two other connections at 100 yard intervals in each section, the cable for the decoy could be carried on 4 or 5 light drums in a lorry with the engine, bulkhead lamps and the crew. No attacks have been reported on the desert sites in this period.

Attacks.

8. Appendix B shows the list of attacks on decoy sites. The results are so extraordinary as to lead one to think that either attacks on other sites were not recorded or that the decoy lighting was not operated properly. It will be seen that the Daba site drew 20 attacks, the Alexandria/Cairo road site No. 2 drew 8, Heliopolis decoy one, and no other site drew any at all. The Daba site of course was well out to the west and near the coast, but it must have been operated

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by 231 Wing of 205 Group with great imagination and thoroughness. This Wing was so decoy-minded that it took a Q set and arranged sites to protect its airfields all the way to Tripoli. Site No. 2 Alexandria/Cairo road must also have been well run. No information is available about the other sites, there is certainly no evidence that they were operated indifferently. The probable reason for these odd results was the comparatively small scale and unsystematic direction of enemy attack.

There are no records at home of the enemy's air attacks in the Middle East. It is known that some attacks were delivered on or near Suez, but it is understood that at no time could the Germans have ever mounted attacks of more than 50-75 L.R. Bombers, mostly Ju.88's, against targets in Egypt. Most of the L.R. Bombers worked from Greece and Crete and their main effort was directed against our shipping or in protection of Rommel's lines of sea communication, for which L.R. Bombers were used. The success of the Daba decoy is therefore all the more remarkable. The day attacks on K.L.G. on L.G.172 have already been remarked on.

Lessons.

9. Although as it turned out the decoy effort in Egypt was reasonably sufficient, it is pertinent to consider what might have happened if the Germans had postponed their attack on Russia until they had over-run Egypt and Syria which they could easily have done after their capture of Crete. Neither the decoys nor their handling would have been adequate against a series of really heavy attacks. The fact is that decoy protection was never "sold" in the Middle East. Practically no attempt was made, as at home, to cover vital points, communication centres, etc., and whereas at home decoys for ports were the most successful of all, it was assumed in Egypt that ports could not be so protected. Nor in an emergency would there have been adequate equipment or trained personnel for protection. All stores had to be shipped round the Cape and sets could not have reached the Middle East sufficiently quickly. Although the ban on communication with this country prevented our knowing

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till long after, the real lessons of protective decoy work we have learned from the Middle East are that all staffs must know something about deception, that only specially trained staff officers can direct it properly, and that technicians and trained personnel are necessary to ensure efficient operation. No scheme of decoy defence can work if personnel are not established and trained for the purpose.

CHAPTER XVI - APPENDIX A.

LOCATIONS OF DECOY INSTALLATIONS IN THE MIDDLE EAST.

Type	Command or Group	Location	Map No.	Remarks
		Installed before the Battle of Alamein		
K.Q.QF.	AHQ Egypt	Abu Suweir	2.	
Q.	AHQ Egypt	Amiriya	2.	Set transferred later to AHQ Western Desert.
Q.	AHQ Eqypt	Shallufa	2.	
Q.QF.	AHQ Egypt	Heliopolis	2.	
K.Q.QF.	AHQ Egypt	Fayoum Road	2.	
Q.	AHQ Egypt	L.G. 224 (Cairo West)	2.	
QF.	AHQ Egypt	Kasfareet	2.	
K.Q.QF.	AHQ Levant	Aqir	1.	
K.Q.QF.	AHQ Levant	Cyprus	-.	
Q.	AHQ Levant	St. Jean	1.	
Q.	AHQ Levant	Lydda	1.	
Q.	AHQ Levant	Haifa	1.	
Q.	AHQ Levant	Ramat David and Megido	1.	
Q.	AHQ Levant	Wadi Sharia	1.	
Q.	AHQ Levant	Rayak	1.	
Q.QF.	AHQ Iraq	Habbaniya	-.	
Q.QF.	AHQ Iraq	Abadan	-.	
Q.	AHQ Western Desert	Alexandria/Cairo Road No. 1.	2.	Mobile.
Q.	AHQ Western Desert	Alexandria/Cairo Road No. 2.	2.	Mobile.
Q.	AHQ Western Desert	Gambut, 3 S.A.A.F.	-.	
Q.	AHQ Western	Maaten Bagush, 3 S.A.A.F.	3.	
K.L.G.	AHQ Western	L.G. 172	2.	
Q.	201 Group	Gianaclis	2.	Mobile.
Q.QF.	205 Group	Daba	3.	Mobile.
		Installed after the Battle of Alamein		
Q.	201 Group	Berca	-.	Mobile.
Q.QF.	205 Group	Ghazal	3.	Mobile.
Q.QF.	205 Group	Misurata	-.	Mobile.
Q.QF.	212 Group	Benina	-.	Mobile.

CHAPTER XVI - APPENDIX B.

ATTACKS ON DECOYS IN THE MIDDLE EAST.

Attacks on 'Q' Site DABA for L.G. 104 Western Desert.

Date.	No. of Bombs and Types.	Remarks.
9. 3.42.	8 250 lb. H.E.	
9. 4.42.	5 1000 lb. H.E.	Site machine-gunned.
20. 5.42.	8 40 lb. A.P.	Site machine-gunned.
22. 5.42.	1 250 lb. H.E.	Site machine-gunned.
26. 5.42.	5 250 lb. H.E.	
29. 5.42.	1 250 lb. H.E.	
31. 5.42.	1 1000 lb. H.E.	
31. 5.42.	24 Small A.P. Bombs.	Site machine-gunned.
30. 5.42.	10 250 lb. H.E.	Site machine-gunned.
3. 6.42.	2 250 lb. H.E.	
3. 6.42.	2 40 lb. A.P.	Site machine-gunned.
8. 6.42.	2 250 lb. H.E.	Site machine-gunned.
8. 6.42.	4 40 lb. A.P.	
9. 6.42.	4 40 lb. Flares.	
13. 6.42.	5 40 lb. A.P.	
24. 6.42.	3 250 lb. H.E.	
26. 6.42.	4 250 lb. H.E.	
26. 6.42.	16 40 lb. A.P.	
Date not recorded	11 1000 lb. H.E.	
26. 6.42.		JU.88 shot down by personnel of 'Q' Site.

Attacks on 'Q' Site Alexandria/Cairo Road No. 2.

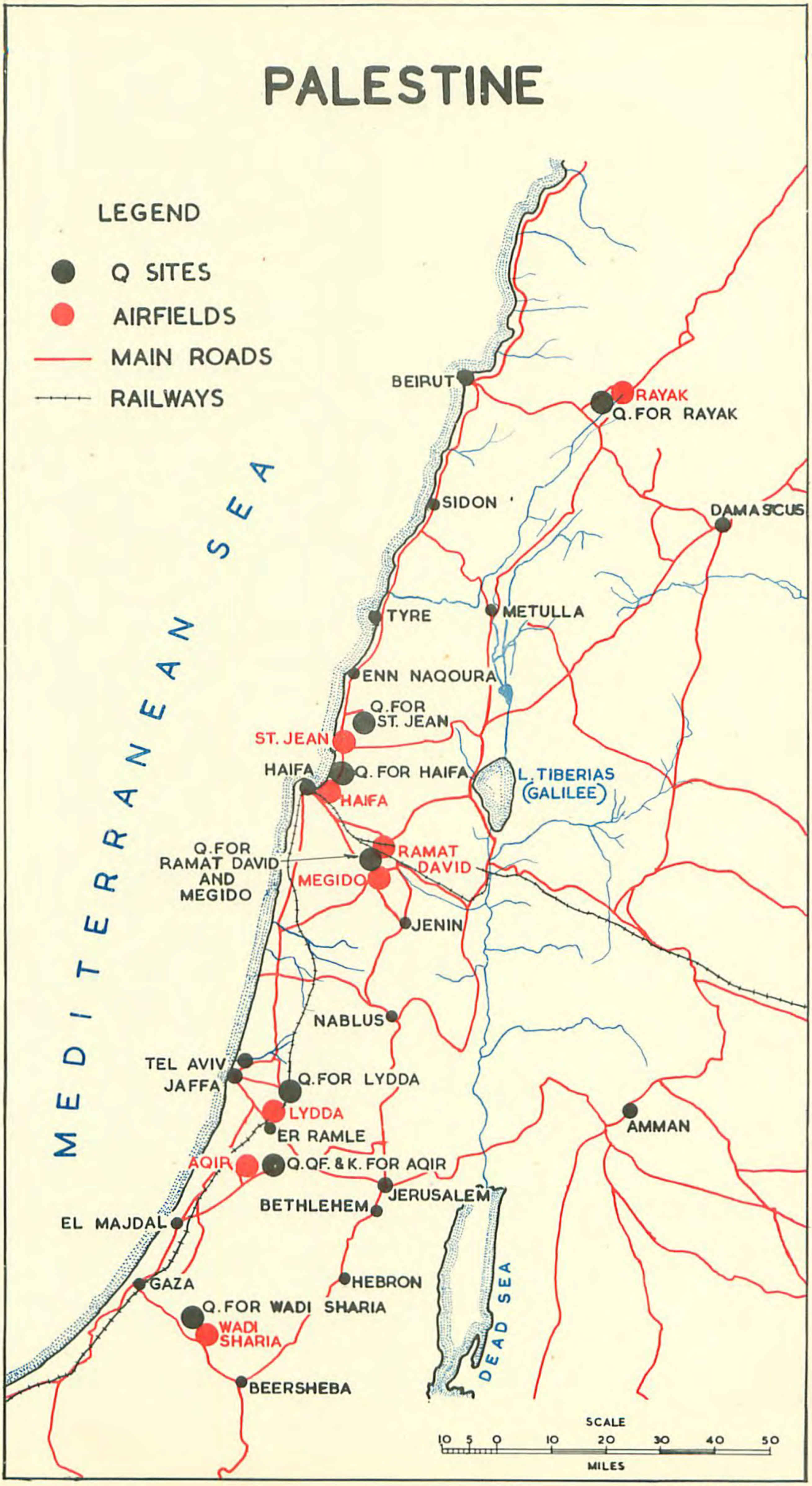
Date.	No. of Bombs and Type.	Remarks.
28. 8.42.	20 H.Es. and incendiaries.	A.A. Brigade consider that out of 71 bombs dropped during this period in the area, 64 were directed at the 'Q'. Attacks only appear to be made after the full moon. Figures given opposite are bombs actually accounted for.
29, 8,42.	3 H.Es.	
31. 8.42.	4 H.Es.	
31. 8.42.	12 A.Ps. and incendaries.	
2. 9.42.	4 H.Es.	
3. 9.42.	6 H.Es.	
3. 9.42.	3 A.Ps.	
5. 9.42.	4 H.Es.	

Attacks on 'Q' Site for Heliopolis.

Date.	No. of Bombs and Type.	Remarks.
15/16. 9.42.	4 250 lb. H.E.	'QF' also used.

Attacks on K.L.G. Location L.G. 172.

Date.	No. of Bombs and Type.	Remarks.
2. 8.42.	14 Light H.E.	7 ME. 109Fs attacked from 9000 ft. No damage to aircraft.
11. 8.42.	4 250 lb. H.E.	Also flares.
12. 8.42.	2 Macchi 200s machine-gunned at 150/200 ft. Slight damage to aircraft.	
14. 8.42.	Reconnaissance for 8 minutes. No other attack after this.	



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A.H.B.I DIAG. No.64

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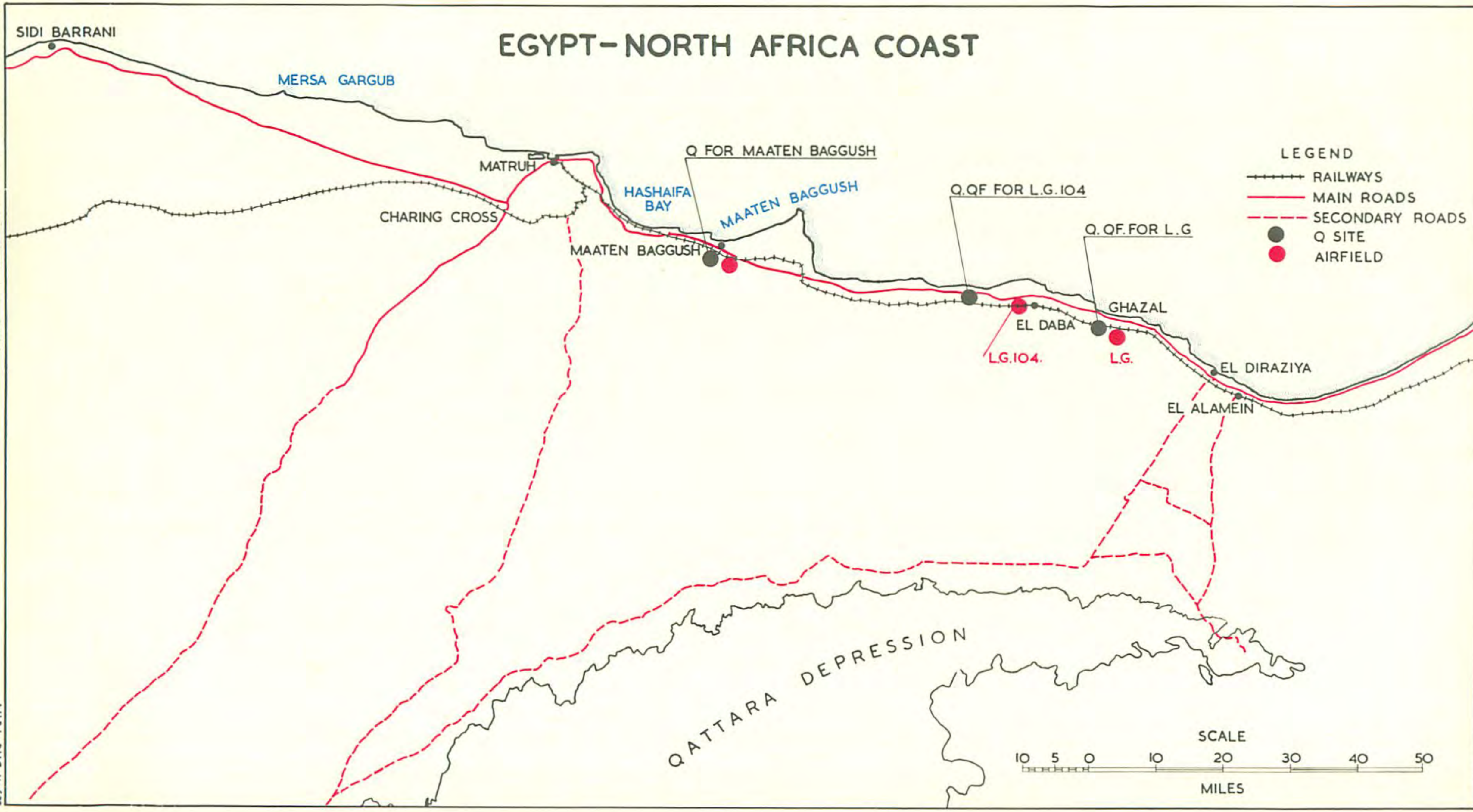

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CHAPTER XVII

R.A.F. VISUAL DECEPTION IN N. AFRICA, SICILY AND ITALY.

1. By the time the North African campaign opened, contact had been established at home between visual deception experts in the Army and R.A.F., and ideas and experience pooled. The Staffs of the two services still knew very little about the protective possibilities of visual deception, especially in the form of lights at night. American Engineers, however, who were responsible for camouflage in their army and air force had interested themselves considerably in the work of the Department. Unfortunately, apart from the lack of knowledge and interest of Staffs, visual deception suffered from a difficulty which was particularly prevalent in N. Africa, i.e. shortage of transport. This not only affected shipping availability, but more particularly road transport over the long and indifferent tracks towards Tripoli. For a long time our advanced forces only had one day's reserve rations, and the building up of stocks of food and ammunition became a priority which ousted all other competition. So it happened that at the time when visual deception was most needed, i.e. in the initial stages when we suffered from marked air inferiority, no equipment was in the war area, neither nets, dummies, nor mobile Qs or QLs. 118 out of 128 Spitfires were lost in the first three weeks of the campaign, nearly all shot up on the ground on crowded airfields. In addition ports, ships and dumps were bombed.

2. Hearing of some of these losses Colonel Turner sent out one of his senior officers, Lt. Colonel Bathe, to the A.O.C., R.A.F., with a letter stating the equipment and men available for mobile protective displays and camouflage. The A.O.C. was away on tour when Colonel Bathe arrived on the 25th December, 1942, but on his return approved of the provision of equipment and of the necessary C and D establishment. Meanwhile, however, a demand had arrived from Allied Force Headquarters (A.F.H.Q.) on Christmas day

/asking

asking for very large quantities of equipment and personnel to be sent out at once (special priority) and repeated monthly. The origin of this demand is unknown, but it is believed to have emanated from strong American backing to proposals put forward by Army camouflage officers for this protection. Believing that A.F.H.Q. represented Air Force Headquarters, the Department understood that the demand originated as the result of Colonel Bathe's visit, and forwarded the first installment of equipment and men requested. A mistake was made in not establishing the men in definite units with their own transport, but at the time, it was considered that they would be better established locally to suit local circumstances of which the Department had no knowledge, and the extent of the shortage of transport was then unknown. On Colonel Bathe's return, the position was clarified, A.O.C., E.A.C., informed of the despatch of the equipment so that it could be allocated under R.A.F. operational control, and Colonel Bathe was sent back to advise on its proper use.

3. On his return to N. Africa Colonel Bathe discovered that a complete reorganization had taken place, E.A.C. dissolved, and its staff dispersed. A fusion with the U.S.A.A.F. was in progress which caused some confusion and held up decisions. Eventually the C. and D. personnel were put at the disposal of N.A.A.F. Here another error was made, for C. and D. was placed under the orders of the A.O.A., and not the Air Staff. Deception is definitely an operational matter, as was recognised throughout the war in England. The A.O.A's staff, overworked in organization and supply matters, is not interested in deception.

Three other factors militated against the efficient employment of men and equipment. As explained in Chapter XX1, MQ sets had been made "dual purpose", i.e. they could be used as decoys or as true flarepaths. Lacking any form of switchable mobile flarepath lighting, R.A.F. Groups and airfield commanders immediately grabbed nearly all the

/'Q' sets

'Q' sets and installed them on airfields at Maison Blanche, Blida, Canrobert, Bone, Jemappes, Souk el Khemis and Souk el Arba. Six sets were later allotted to the Night Fighter Wing at Setif for use as required. It is also known that decoy equipment was later used for true flarepath lighting on the following airfields, Protville, Sidi Ahmed, Sidi Amor, Le Passet, Monastir, Phillipville and Lampedusa. Secondly, as we gained more and more air superiority, the need for decoy protection and camouflage was very greatly reduced. Lastly, the failure to provide established units with their transport, and the difficulty of obtaining any transport locally, rendered it impossible to move sets to their destinations in any reasonable time; it should be remembered that at this time only the heavier type of equipment MQ and MQL were available, each set weighing about 30 cwts.

4. Nevertheless, in spite of these difficulties, and largely because staffs at lower formations had had some experience of C. and D. work at home, and were anxious to use the equipment available, C. and D. men and equipment were used, although very late in the day, and were successful in drawing attack and concealing aircraft.

Nets were issued to advanced Fighter Squadrons, and most Squadron Commanders insisted for a period on their use by squadron personnel who were trained by C. and D. detachments. As time went on however the reduction in attack rendered this protection less necessary, and as it meant much extra work, netting was gradually abandoned and the equipment stored. Had the nets arrived early, they certainly would have been used and many aircraft losses avoided.

Dummy aircraft, (Spitfires), were erected on various airfields, chiefly those that had been used, but were not in use at the time. In spite of the lack of "life", they drew a good deal of attack at Bone, and also in the Feriana area where some had been allotted to the Americans.

The Coastal R.A.F. Group, with some difficulty, obtained

/the

the men and equipment for the protection of Djidjeli and Bougie ports by QL's. The Djidjeli decoy was effective and drew several attacks. The same group asked for other decoys, but owing to various reasons, continual changes and moves and the control of C. and D. not being in the hands of operational staffs, it is not known to what extent these demands were met or the success, if any, of other QL decoys. A Q site was established at Souk el Arba, but it drew no attack.

5. As time went on, our mounting air superiority rendered protective displays less and less necessary, and the Headquarters Staff were faced with the problem of trying to assess the extent to which they would be wanted in the future. With shortage of man power, always a bugbear in operational areas in war (other than on staffs), there was a strong case for transferring the men to other duties, instead of leaving them to kick their heels doing little or nothing. Gradually men were transferred in driblets to General Duties, but sufficient were retained for future requirements. Unfortunately, perhaps owing to the uncertainties of the value, and inexperience in the use of, this new weapon of war, the men and equipment were even then not established in units with transport, although many attempts were made by the Air Ministry to get this done. A few weeks before the Sicily landing, Colonel Turner wrote direct to Air Chief Marshal Tedder, explaining the C. and D. situation, and informing him of the availability, if he wanted it of lightweight equipment - ASQs and ASQLs - which could be manhandled across country for short distances. Four ASQLs were demanded and sent out for use on beaches in the Sicily landing.

6. A brief description of C. and D. work in Sicily is contained in Colonel Bathe's report, attached as an appendix to this chapter. The Planning Staffs only decided to use decoys at the last moment, and it is fairly evident that except for the Headquarters Staffs and Embarkation units, very few commanders in Sicily knew anything about them or what their functions

/were.

were. The operation of decoys on beaches is probably the most difficult task in Visual Deception. Sites for decoys can be picked on maps previous to an attack, but even so they are difficult to find as they must be within the perimeter occupied and yet sufficiently distant from the beaches not to endanger them if they (the decoys) draw attack. When landings are made, enemy resistance, minefields, etc., dictate the form of the occupied area and pre-selected sites may have to be abandoned. Later, as more troops disembark, beach occupation areas extend, and decoys have to give way to troops and dumps. Taking all the circumstances into consideration, it is understandable that the Sicily decoys were not more successful. It was the first time protective decoys had been used in this way, the decision to use them was late and information to commanders scanty or nil, and enemy air attack was negligible. The decision to use them however was quite right; they might have been invaluable had enemy air attack been developed in any strength, and in any case lessons were learned for future guidance.

7. After Sicily C. and D. personnel sent there were returned to North Africa and a decision was at last made as to their future employment. By this time the original C. and D. drafts from England had been scattered all over N. Africa. Many men were employed on operating and maintaining the dual purpose sets used on true flarepaths; these men were retained permanently on this work. Others had drifted off into General Duties. It was then decided to retain 50 men and to form them into a C. and D. unit, afterwards known as No.5, as four similar units had by then been formed at home. The remaining men were transferred permanently to General Duties. No decoys were operated in N. Africa after July 1st 1943. The C. and D. unit was however fully employed in collecting all the scattered equipment and in servicing it for future operations.

8. In December, 1943, Headquarters 12th Air Force Engineer Command, then in charge of all Italian airfield

/construction

construction, asked for the services of the unit and for ASQ and ASQL equipment, for decoys in the Foggia plain. Six additional ASQ sets were sent direct to Italy from England to assist in this work. Crews and equipment for a total of 16 decoys were sent to No.323 Wing at Foggia and in a short time all decoys were operational, but they drew no attack. No decoys were developed in Corsica, which was attacked by air, and no MQLs were provided for the protection of ports. It is interesting to speculate what might have happened if Bari had been well protected by decoys, and if port lighting there had been controlled, as it was later in Antwerp.

No. 5 C. and D. Unit was disbanded on August 20th 1944, equipment being handed to 214 Group, and all personnel posted to ACH/GD vacancies, mostly for Flying Control work.

9. During the Anzio beach-head operations, a small landing strip was constructed for the use of Spitfires by day. By night the beach-head was covered by Beaufighters of 600 Squadron operating from Marchanesi. At the request of the squadron commander, a C. and D. crew with an A.S.Q. set were flown to the Anzio strip and a flarepath constructed. This enabled a few Beaufighters to operate successfully from the Anzio strip, thus saving twenty minutes flying time in an emergency. Later other A.S.Q. sets were sent to the Balkans to provide flarepaths on partisan airfields. No information is available as to how they were used.

10. In this and the preceding chapter mistakes and shortcomings in C. and D. organization and operation have been fully recorded, in the hope that they will not be repeated in the future. Criticism of staffs and persons is not intended, and indeed under the circumstances not justified, for basically mistakes were inevitable. It must be remembered that in a global war, staffs are always pestered by individuals or branches with ideas and proposals often of little value, and sometimes put forward to advance the interests of the individual. In N. Africa the long straggling war area, with its

/indifferent

indifferent communications, shortage of transport, and mixture of staffs and troops of two nations, added to sales difficulties. Again, because visual deception was a war baby, wet nursed on a comparatively low level, inter-service co-ordination did not exist on a high level, with the result that staffs of formations obtained no direction or information except through the experts. In addition, the two Services' requirements in visual deception differed, the Army concentrating on misleading deception by day, and the R.A.F. on protective deception especially by night. Up to the N. African campaign protective displays had been almost entirely static. Mobile protective displays were first developed in the Middle East, and then only for R.A.F. airfields. In North Africa and Sicily, mobile and static protective displays at night were operated for the first time, (though on a small scale), by the R.A.F., as a measure of defence against air attack not only for their domestic airfields, but for ports, beaches and vital points generally. The experience of N. Africa led to the R.A.F. shouldering the same responsibility on the Western front, and, it is hoped, will lead to an accepted policy on these lines for the future.

On the other hand the equipment sent out for airfield decoy work was used most satisfactorily for flarepaths. In particular the light A.S.Q. sets must have been invaluable for rapid flarepath construction on advanced airfields for which no other provision existed. The link between decoy and mobile airfield lighting is unmistakable. They both should be operated by the same organization.

Appendix: Colonel Bathe's report on Sicily operations.

CHAPTER XVII - APPENDIX

C. & D. OPERATIONS IN SICILY.

Assault Sets and Parties were only included in the striking force at the last moment. Four parties were detailed, each of one N.C.O. and five men. They were detailed for landings as follows:-

No. 1 Party.	- Avola	Port of Embarkation - Suez.
No. 2 Party.	- Pachino	Port of Embarkation - Malta.
No. 3 Party.	- Scoglitti	Port of Embarkation - Tunis.
No. 4 Party.	- Licata	Port of Embarkation - Bizerta (U.S.A. landing).

Nos. 1 and 2 Parties left by air for their ports of embarkation where they arrived only just in time. All parties, however, arrived in Sicily on time.

No. 1 Party - Corporal Jenkins.

This Party embarked on an ordinary Transport at Suez. Corporal Jenkins immediately made contact with the Anti-Aircraft Commander who was luckily in the same ship. Between them, during the voyage, they selected five or six possible sites off the map. The Party landed at 1200 hours on D day near Cassibile. On landing they encountered a certain amount of machine gun fire. Owing to the extension of landing beaches, Corporal Jenkins found it necessary to abandon four out of the five previously selected sites. He was therefore not able to operate until the following night, when he set up on the sixth site. Enemy aircraft circled over the site during that night but made no attack. On the following morning he was compelled to move again as an airfield construction party arrived and began operations adjacent to the site. He found yet another site where he set up and operated that night. No attack was made but flares were dropped on the site which he had been occupying on the previous night. On completion of the airfield referred to above it was occupied by 244 Wing to whom Corporal Jenkins and his party were attached. They continued to operate until the Wing moved to Lentini. The party followed the Wing to Lentini but were eventually sent back to Cassibile. The Wing was badly bombed at night shortly after they had sent Corporal Jenkin's party back. After arriving back at Cassibile they continued to operate on the old site until evacuated from Sicily.

No. 2 Party - Corporal Wright.

This Party lost two men sick at Malta. They were taken to Sicily by L.S.T. and landed on D + 1 day. They were attached to 211 Group who would not allow them to operate. They attempted to run their Assault Set as a flarepath at the request of the Group, but were not successful. When 211 Group moved up their place was taken by 324 Wing who immediately put them into operation on the beach south of Pachino. They continued to operate there until evacuated but drew no attack.

No. 3 Party - Corporal Halyon.

This Party was landed from a L.S.T. on D + 1 day at Scoglitti. One man was found to be sick and was therefore not landed but returned in the L.S.T. After landing they were allotted an inconvenient site on a narrow beach west of the town and backed by minefields, through which only narrow roads were cleared. Moreover, during the day, there was traffic across the site from a beach further west, which was being used for off-loading. However, they drew one lot of bombs which unfortunately fell in the minefield, with the result that no one was anxious to locate the exact number or position of the bomb craters.

On D + 7 day the party moved to Comiso where they were attached to 324 Wing and operated a decoy site under their control. When the Wing moved to Pachino this party was left stranded, but they managed to get food and water from a local American Unit and continued to operate until evacuated.

/No. 4 Party.

No. 4 Party. - Corporal Rambridge.

This Party landed 4 miles West of Licata at 1700 hours on D day. This was only possible because I was with this party and persuaded the Captain of our L.S.T. to put us ashore in one of the ship's boats. Heavy surf and a sandbank parallel to the shore made it impossible to beach the L.S.T. The site was operated on the night D/D + 1, but no aircraft came over. On the night D + 1/D + 2 aircraft circled over the site but were scared off by Beaufighters before any attack developed. On the night D + 2/D + 3 the site was moved on to the beach and dummy jeeps and bivouacs erected, but no aircraft came over that night. On D + 4 day the ration and water dumps were moved 6 and 8 miles away and I protested to the 36th Engineer Regiment, U.S.A., who had been carrying out the duties of Beach Commandant. They at once sent transport to bring us in, attached the party to their Regiment and lent me transport in which I went forward to division and Brigade areas. Both Division and Brigades stated that they had had no night bombing and were therefore unwilling to have decoys in their areas, lest this should start night bombing. I therefore told them where we could be found, if needed, and returned to 36th Regiment Headquarters. As a number of ships were still off-loading on the beaches East of Licata, we set up the decoy on a beach in their neighbourhood and this was operated on the same site, with variations in layout, until the section was evacuated.

I would like to draw particular attention to the outstanding zeal and initiative displayed throughout our operations in Sicily by Corporal Jenkins and Corporal Rambridge.

NOTES.

(1) Even in this lightly opposed landing, beaches were very cramped and crowded for the first day or so, and as more beaches became available they were quickly occupied for landing purposes. It was therefore difficult to find sites.

(2) Throughout the initial landing operations there was bright moonlight from approximately 10 p.m. till 2 a.m.

(3) Light discipline was extremely strict: beach patrols were instructed to fire at any exposed light. In fact, although I had warned the Beach Commandant as to what we should be doing and where, we were still fired at on two occasions by these patrols. Hence, only a minimum amount of light can be shown by the Assault sets.

(4) The generator is difficult to land from a small boat into surf. It is also a good four man load over soft sand or up cliffs.

(5) A detachment of 6 was found to be the minimum for working the set and carrying out camp duties.

(6) Some form of transport, such as jeep, is essential for these detachments, both for drawing rations, water, petrol and oil, and also for following up Units during an advance.

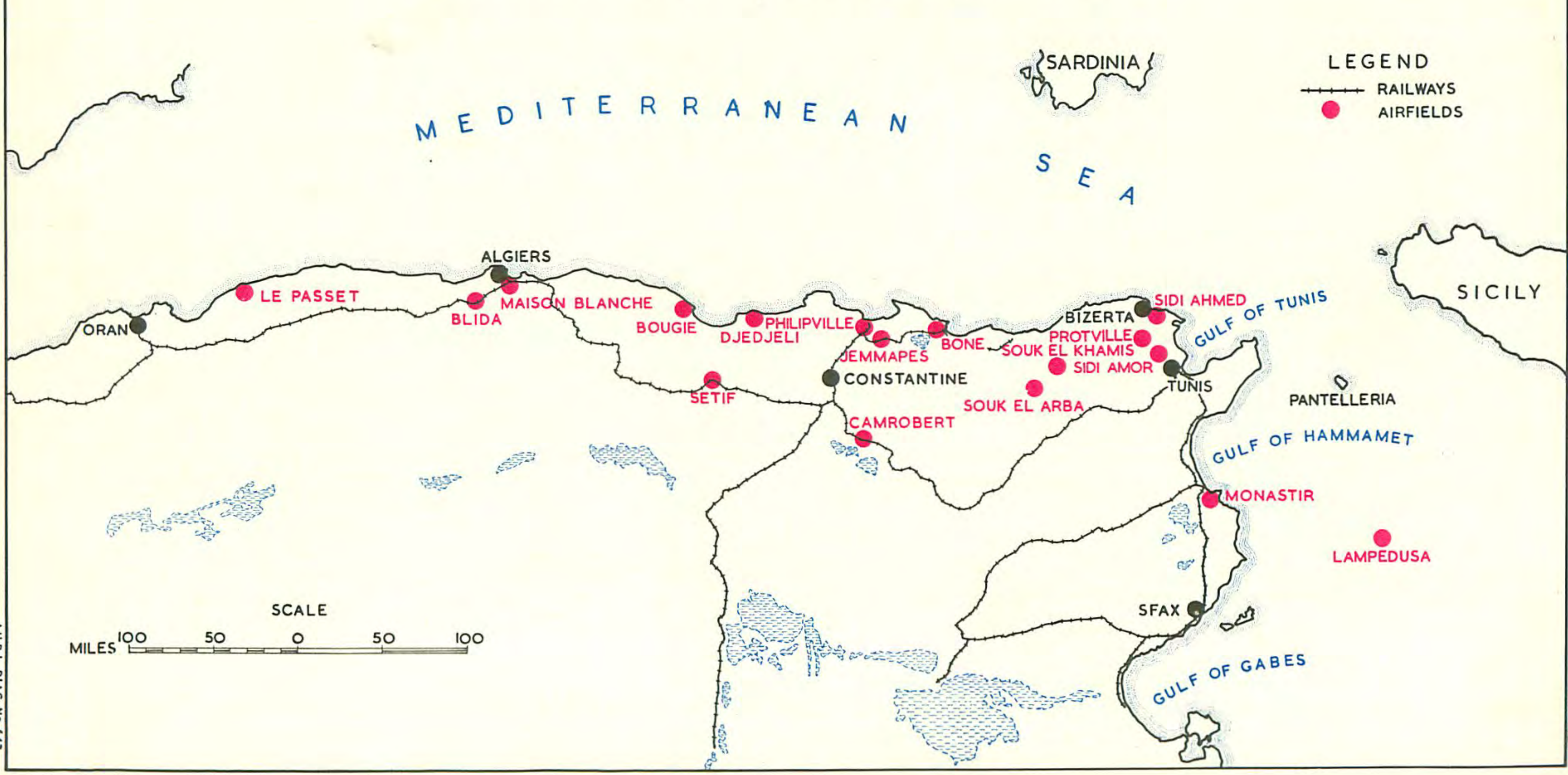
(7) There is no doubt that these sets could be of some value, especially as I understand that in their up-to-date form they can be used as emergency flarepaths, but they must have their own transport and be self-contained in such matters as cooking utensils, camp kit, etc. I would suggest that they be landed on D + 1 or D + 2 day and that space be allotted to them beforehand. In Sicily no one knew that we were coming till we boarded our ships. This was no one's fault, but certainly made things more difficult for us.

(Signed) D. BATHE.

Lt. Colonel.

25th November, 1943.

NORTH AFRICA — ALGERIA AND TUNISIA



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CHAPTER XVIII.

ORGANIZATION OF C. AND D. IN THE SECOND TACTICAL AIR FORCE

1. As the war progressed, it became evident that protective visual deception, as an integral part of the general defence against air attack, could be usefully employed in theatres of war in a mobile form, as well as statically to protect vital points behind the main forces. Although still not officially laid down, it began to be accepted that these protective displays were a R.A.F. responsibility under the direction of combined operational staffs of formations. Our experiences in the Middle East and North Africa taught us that it was useless only to provide trained personnel and equipment and expect local staffs, who knew little or nothing of decoy work, to organize them into suitable detachments. For successful operation of decoys it was necessary to establish and equip definite units with transport, which could be sent anywhere at short notice. In addition as far as the R.A.F. were concerned, it was necessary to train airfield ground personnel in the concealment of themselves, their camps, and their aircraft.

2. For the campaign in N.W. Europe therefore, the C. and D. organization consisted of a C. and D. airfield crew of 1 Corporal and 5 O.R.'s established on each airfield, and seven C. and D. Units specially established and equipped for mobile work.

C. and D. Airfield Crews.

3. Of the airfield crews, 10 were established with 83 Group. 10 with 84 Group, 6 with 85 Group, 4 with 2 Group, and one with 34 Wing, making 33 crews in all. Their main duties were as follows:-

(a) To assist and instruct airfield ground personnel in the netting of aircraft, and to look after and maintain the nets.

/(b)........

(b) To advise on general concealment including the siting of transport and camps and assisting in maintaining track discipline.

(c) To find sites for and to lay out and operate a Q decoy for the airfield when considered necessary. Each airfield was provided with an A.S.Q. set for this purpose.

(d) To help Flying Control on arrival at a new airfield to lay out the mobile airfield lighting sets.

These duties could not all be carried out at once by one small crew, it was arranged that if enemy air attack necessitated considerable concealment and decoy protection, one or more crews would be allotted from one of the C. and D. Units to any airfield requiring them, and this became necessary when dummy aircraft had to be installed. The dummy aircraft were mainly stored in England and were sent overseas when required. As explained in the history, enemy air attack was so slight, that the necessity for concealment and airfield decoys was small until the hold up in Belgium. Consequently these airfield C. and D. crews were almost entirely and incidentally very fully employed on maintaining and operating the mobile true airfield lighting under Flying Control, to whom they were later transferred.

A fully trained C. and D. Officer was attached to each Group to advise on all C. and D. matters and to control, under the combined Group and Army Staffs, the C. and D. Units. On each airfield a Flying Control Officer supervised the work of the C. and D. airfield crew.

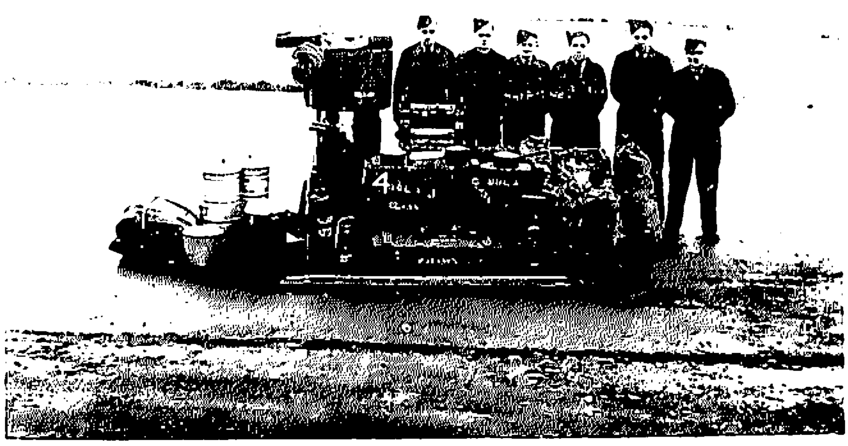
C. and D. Units.

4. The composition of each C. and D. Unit was as follows:- 1 Flight Lieutenant, 1 Flight Sergeant (ACH/GD), 1 Sergeant (ACH/GD), 6 Corporals (ACH/GD), 5 D.M.T.'s, 1 Cook (G.D.), 1 Clerk (G.D.) and 30 ACH/GD's - Total 46.

/Each.......

One complete C. and D. Unit.

One complete section (2 crews) of a D. and D. Uni+



One crew (6 men and their equipment) of a C. and D. Unit.

Each C. and D. Unit was divided into a Headquarters Section and three other Sections.

The Headquarters Section consisted of the Officer-in-Charge, the Flight Sergeant, the Sergeant, the Cook, Clerk (GD) and 2 D.M.T.'s. The Flight Sergeant was provided to take charge of the administration of the Unit, whilst the Sergeant was used for operational purposes.

Each Section was divided into 2 crews and one D.M.T., each crew consisting of 1 Corporal and 5 ACH/GD's.

Transport required for each C. and D. Unit consisted of 1 Utility Van and 2 - 15 cwt. covered trucks for the Headquarters Section, and 3 - 3 ton Bedford Vehicles, 3 Jeeps and 3 solo motor cycles for the three sections to which reference has already been made.

Equipment.

Operational.

Each C. and D. Unit carried the following technical equipment:-

12 ASQL Sets Complete
6 BQL Sets complete with Jinx Lights.
3 Boxes of Cordite
1 Spare Generator
3 - 1 gallon jars for distilled water
1 Hydrometer
1 Voltmeter

Each Corporal had on his charge 2 ASQL sets and 1 BQL set, and was repsonsible for their maintenance.

Arms and Ammunition.

The scale provided for each Unit was:-

4 Revolvers
28 Sten guns each with 150 rounds
13 Rifles each with 150 rounds.

Domestic and other Equipment.

The usual domestic equipment was carried with such additions that would make the unit fully self-supporting and able to operate independently of its parent formation. A schedule of

/such.........

such equipment is given in the Appendix. Special mention is, however, made of the cooking arrangements which enabled each crew to operate on its own when necessary.

Administration.

The C. and D. Units were administratively controlled by the R.A.F. Group to which they were allotted, but they kept their identity and were self-administrating as far as possible. During operations in the field they could be attached to any R.A.F. or Army Unit for pay, rations, equipment, etc.

Duties.

The main duties of the C. and D. Units were as follows:-

(1) Primarily, to set up and operate protective decoys (night lighting and fires) to cover beaches, ports, dumps, railway junctions and marshalling yards, camps, convoys, and other vulnerable R.A.F. or Army points.

(2) Occasionally and when required to assist airfield personnel on special schemes in erecting dummy aircraft, laying out A.S.Q. sites or netting concentrations of aircraft.

(3) If required, to assist No. 21 Army Group in special deceptive schemes.

Of the seven C. and D. Units formed, Nos. 1 and 2 were allotted originally to 83 Group, Nos. 3 and 4 to 84 Group, Nos. 6, 7 and 8 to 85 Group. No. 5 C. and D. Unit was formed in Italy of the men finally retained for C. and D. work. As matters turned out, onlys Nos. 1 and 2 went over with the invasion forces to France; No. 8 C. and D. Unit followed in December 1944 to Belgium and these Units remained in being till the end of the war in Europe. The other C. and D. Units were disbanded after the break through in Normandy.

C. and D. Reserve Pool.

5. Shortly before D Day, a reserve pool of approximately 40 fully trained men was formed at Richmond Park to replace all casualties of C. and D. personnel within the 2nd T.A.F.

/This......

This pool was kept under canvas in the Park and underwent exercises in different parts of the country so that the personnel would be thoroughly conversant with the organisation and work of the C. and D. Units if and when replacements were required. The pool was formed into crews and equipped as far as possible with the same scale of transport and equipment as that established with C. and D. Units.

CHAPTER XVIII - APPENDIX

DOMESTIC AND OTHER EQUIPMENT CARRIED BY C & D UNITS.

The scale for Domestic Equipment etc., was as follows:-

Description	Qty.	Description	Qty.
	DOMESTIC		
Twin Burner Primus	7	Egg Slicers	7
Camp Kettle (2 galls)	7	Cooks Spoons	7
Pots Cooking (2 qts)	21	Ladles	7
Baking Trays (9")	14	Thermos Flask (1 qt)	1
Cooks Knives	7		
	MOTOR CYCLE KIT		
Khaki Coats, Waterproof	3	Gloves (pairs)	3
Khaki Leggings "	3	Leather Jerkins.	3
Crash Helmets	3	Goggles (pairs).	3
Armlets, Drivers	3		
	GENERAL		
Rubber Gloves (pairs)	6	Chairs fold-flat	2
Compasses	7	Hair Clippers (hair)	1
Watches Leader	7	Torches	17
Tables P.F.S.	2	First Aid Haversacks	7
Hurricane Lamps	6	Bags Leather	7
Jars	3	Entrenching Tools	45
Ridge Tents	9	Entrenching Handles	45
Containers Water	14	Screens Latrine	3
Pails Iron	7	Map Cases	7
Axes, hand	2	Saws, hand	2
Ration Boxes	7	Suits Combination (Pairs)	12
Cans, petrol	7		

AIRMEN'S PERSONAL EQUIPMENT

Each airman was equipped to scale C. 53 D

C H A P T E R XIX

R.A.F. VISUAL DECEPTION IN EUROPE

1. The campaign in Western Europe in 1944-45 is of particular interest from the Deception angle in that it provides the first and only example of the correct organization and practice of Protective Visual Deception in the field.

Before D Day

2. The organization of the C. and D. units and staff, and the agreement in regard to responsibilities for protective and misleading displays has been dealt with in Chapter XVIII. Two incidents however occurred before D day which had repercussions later and which are best recorded here.

When it was decided that C. and D. units were to be employed in the early stages in France, contact was established with the Army to obtain information as to the types of lighting likely to be used on the beaches and in dumps nearby, as it might have been found necessary to alter the C. and D. equipment to enable these lights to be simulated. Officers of the department attended several exercises in October, 1943 and in February and March 1944, in which troops practised beach landings in Scotland and in England. They were startled to discover that unlimited lighting was being used. Chance and Lion floodlights illuminated long areas of beach, other floodlights were sited near barges to assist their unloading. Head lamps of vehicles were unhooded, and those used on the "Ducks" were visible for 20 miles. Many lamps lit up notices on roads and none were hooded. The matter was reported to 2nd T.A.F., and it was explained that if unlimited lighting of this kind was to be used, no form of decoy lighting could be of the least value in drawing attack. Considerable consternation was caused in the higher staffs. It appeared that several branches had been concerned in providing these lights and that no co-ordination or check had been secured to consider their visibility from the air or the assistance they would give to enemy air attack. Once the matter was brought to notice, immediate action was taken. Colonel Turner was asked to advise on the class of lighting that would be invisible outside a 10 mile radius, and steps were taken to organize a warning system under which the hooded lights would be switched off before enemy raiders could reach this distance from the beaches. The general tendency was to reduce all lighting to an absolute minimum; all flood lighting was abandoned, hooded lights were permitted in dumps and near important notice-boards, and the lighting for the unloading from ships or barges was limited to torches or carefully screened lamps. It was also agreed that the maximum advantage should be taken of the long days and unloading be shut down during the night. The repercussion of this incident occurred later when C. and D. Units, as experts on screened lighting, were called upon to provide hooded lighting for the Mulberry at Arromanches, and later for Antwerp Docks.

The second incident relates to the inception of the protective deception plan for the beaches in Normandy. It has been recorded in Chapter IV that responsibilities for misleading displays were allocated to 21 Army Group's Deception Staff Officer whilst those for protective displays were relegated to the R.A.F. Groups, acting in contact with each Army. The Deception Staff Officer with 21 Army Group, decided, without informing 2nd T.A.F., to take over the responsibility for the Normandy beach decoys and employ R.E. personnel to lay them out and operate them. The Army and Group Staffs concerned, understanding that this was a higher decision accepted the situation. The arrangement was not discovered until a few days before D day, when it was too late to make any serious alterations in the plans. As 2nd T.A.F. insisted that protective displays must be regarded as a R.A.F. responsibility, it was arranged that some R.A.F. should land with the R.E. on D day, others should on D + 2, and that C. and D. Units should take over entirely on D + 10.

The 21 Army Group's Deception Officer no doubt considered that R.E. personnel were required to clear paths through

/minefields.

minefields. He evidently did not understand the great differences between protective and misleading displays at night and the necessity for considerable experience and training in the former type. Misleading displays of lights at night are intended to confirm day displays to any reconnoitring aircraft. They are not intended to be attacked. To simulate army units, spread over an area, scattered lighting conforming to no particular plan is all that is required, and personnel need only be trained to lay out sets in easily taught ways. Protective displays are intended to draw attack off a nearby target. They must be laid out in forms which will provide an enemy pilot with what he thinks he recognises as a definite target and so attract him to risk his crew and aircraft to make an attack. Much knowledge of what is typical in different targets, of visibility from the air, and of many methods of night deception is necessary to ensure success. The R.E. personnel, officers and men, had only had the minimum training required for misleading displays, the R.A.F. personnel were fully trained. The right course to have taken would have been to have left the responsibility, as previously agreed on, with the Army and Group concerned, and for the Army to supply R.E. personnel for clearing mines to help the C. and D. units, or to have trained the C. and D. personnel to do this for themselves. The repercussion of this incident was the final allocation of responsibility for all protective displays to the R.A.F.

Normandy Beach Decoys.

3. 21 Army Group's decoy scheme for the Normandy beaches comprised 5 tasks; 4 of these were simulations of beach lighting at A, B, C and D on the attached map, and the fifth a simulation of a bridge crossing at E. For the initial landings each party for A,B,C and D consisted of 14 R.E. and 4 R.A.F. under R.E. command. The fifth site at E was manned entirely by the R.E. R.A.F. personnel for sites A and B were drawn from No.1 unit, and for sites C and D from No.2.

Party A landed on the afternoon of D day, enemy resistance in the area being then limited to sporadic sniping. The men had to carry their equipment in slings as the ground was unfit for transport. After clearing a passage through a thick belt of TELLER and SCHU mines, one A.S.Q.L. and one B.Q.L. set were laid out in the late evening of D day. The site collected one bomb and was machine gunned from the air that night.

Party B landed practically dry shod with a 3 ton lorry on the evening of D day. Mines were confined to the cliff edge but time was unavoidably wasted in probing for lanes across areas marked "ACHTUNG MINEN". It was later discovered that the signs on a yellow background were bogus, and on a white one genuine. Nevertheless a small decoy was laid that night and augmented considerably next day.

O.C. No. 1 Unit landed late on D plus 2 with two 15 cwt. trucks, a Sergeant and 4 men, and suggested some improvements. It was not until the remainder of the unit arrived on D + 8 that he took over control from the R.E. officer. He was then able to effect considerable improvements in the layouts and install dummy fires of brushwood and wreckage, liberally swilled with oil.

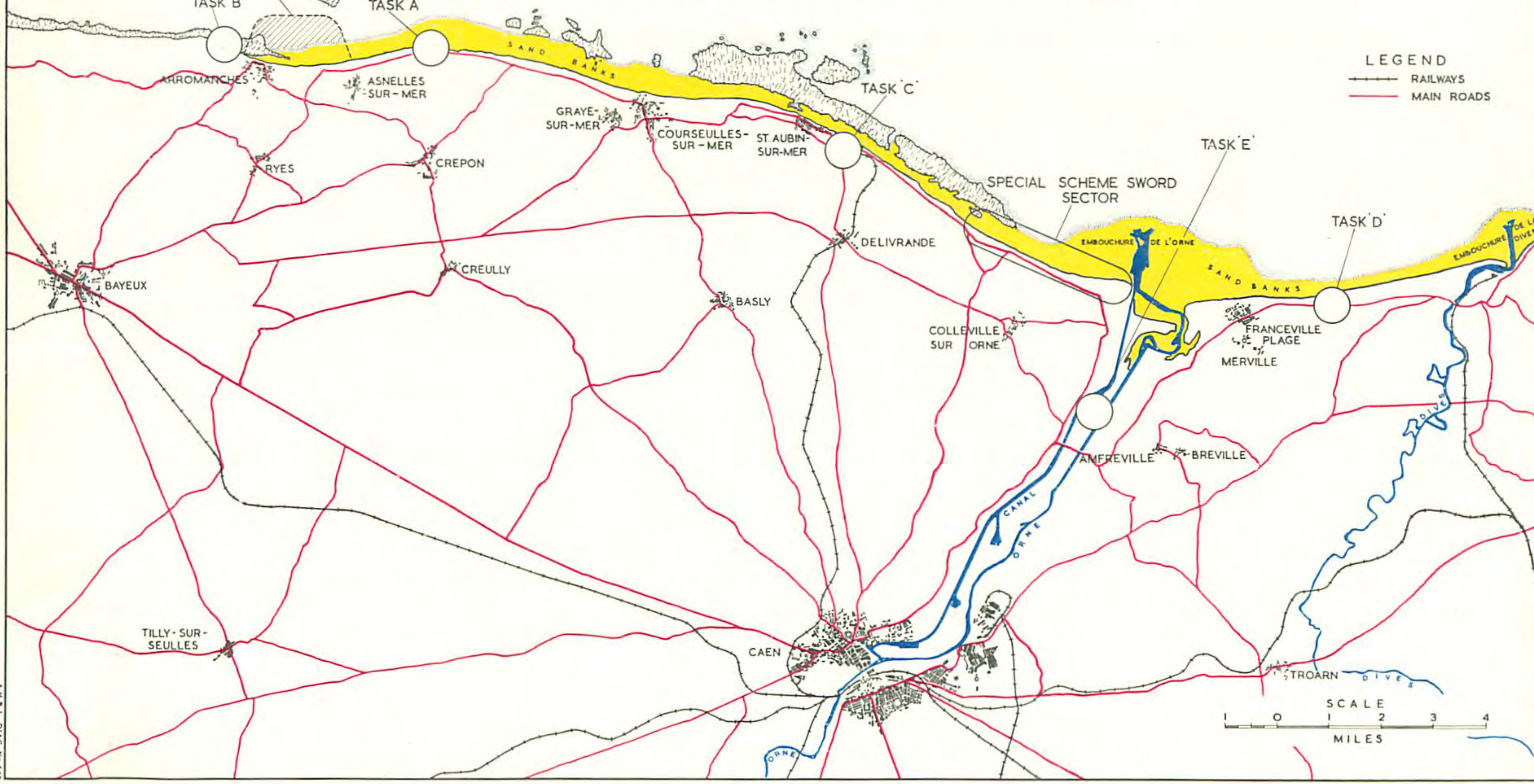
The sites were bombed on four occasions and were also machine-gunned. 9 H.E.'s were dropped on A site and 6 H.E.'s with 1000 incendaries and a mine at B. Though few, these attacks represented about half of the total bombing in that area. The nearest Ack-Ack were interested in the "B" site and moved some of their guns close to it. They shot down 3 enemy aircraft which came down low presumably to inspect it.

Party C landed early on D day and successfully manhandled their equipment ashore although the front of their craft had struck a mine and was blown up. Spasmodic shell and sniper fire were experienced, and the party was held up till D + 3 until the area of their task had been mopped up. They laid out a small decoy on arrival.

Party D landed without incident near OUISTREHAM but was then held up as their task site was still, and continued to

/remain

PROTECTIVE DISPLAYS FOR LANDINGS IN NORMANDY



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remain for some time, in enemy occupation.

The O.C. No.2 Unit landed with the second echelon on D + 5 day, on a dry beach, and reached site C with two trucks, on D + 6. The site up to that time had not been attacked. The R.E. officer agreed to suggestions for improving the decoy at C and a considerable amount of new and better lighting was introduced. On D + 10, the rear echelon of the unit arrived, and on D + 14, the R.A.F. with party D rejoined and made the unit complete. The D party had had a tough time with the forward troops, but had never been able to reach their objective, though they spent a week to the east of the river Orne. After the improvement of the lighting, the decoy at C started to draw attack. In all some 30 bombs fell on or close to this site, and it is estimated that this amounted to 60% of the attack in that area. As time went on enemy attacks were diverted more and more to shipping and as army units steadily crowded up to the site, it was closed down on June 25th.

Later No.2 Unit was employed on another deception scheme in the Sword Sector at the request of 2nd Army. The object was to conceal the fact that this sector had been abandoned as an unloading beach. A modicum of lighting was shown and was spasmodically shelled by the enemy until July 20th when this task was closed down.

On the whole the Normandy beach decoys achieved considerable success. Much of it was due to the very sound planning which minimised unloading and movement at night and so rendered the decoys the most conspicuous features to enemy aircraft. The comparative small scale of attack, which soon shifted seaward, owing probably to the terrific Ack-Ack defences, could not have been anticipated, and the decoys drew half of what actually fell. The scheme was not an easy one. Decoys close to the front line are difficult to site. The best positions were chosen by 21 Army Group and the only criticism has already been mentioned, i.e.

/the

the substitution of untrained R.E. for trained R.A.F. in the initial parties. The effect of this in the circumstances of small attack cannot be estimated, but judging from much experience in protective decoys, there is little doubt that had the attack been heavy they could not have drawn off as much as they should have done if properly laid out from the start.

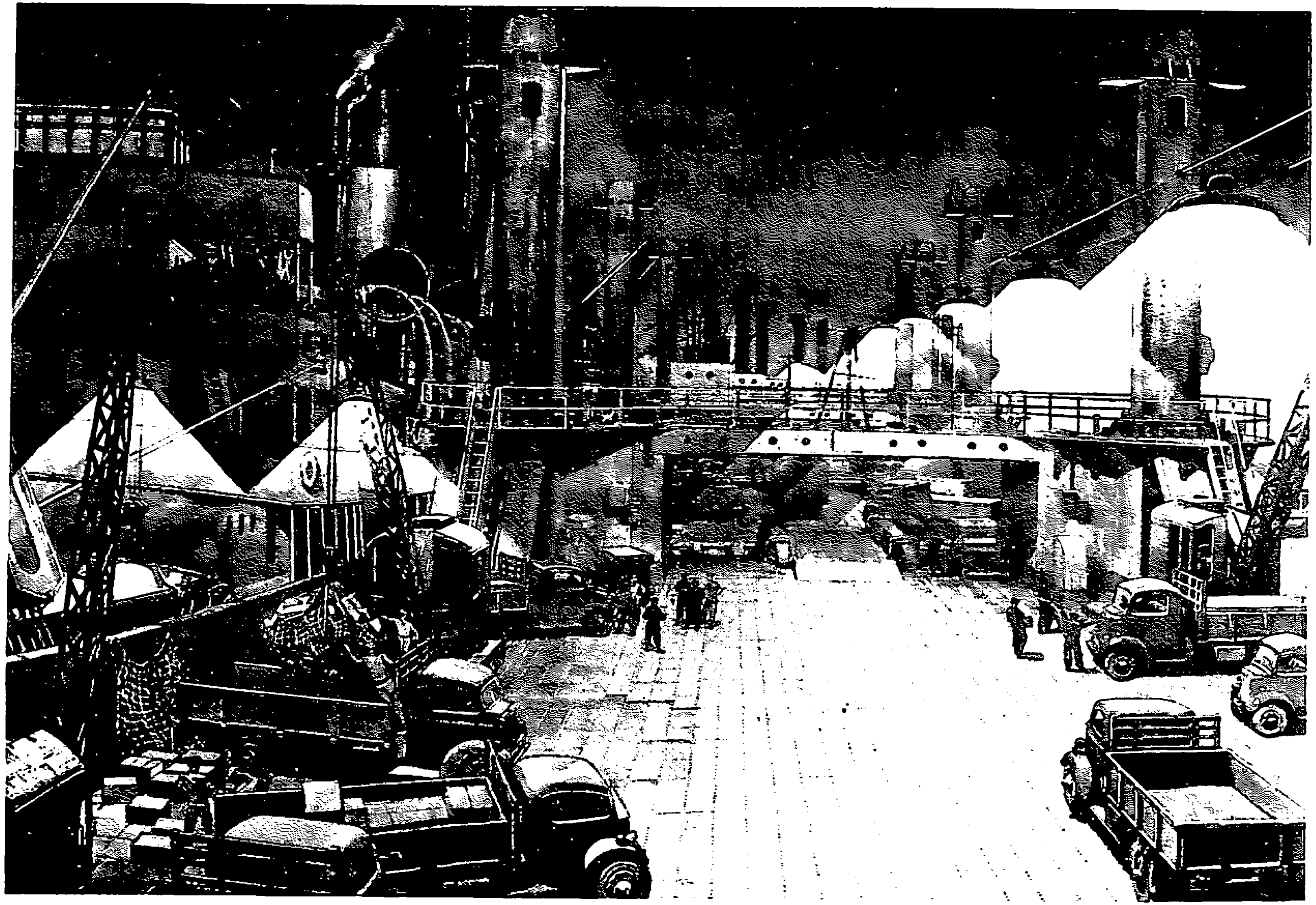
Arromanches lighting

4. As the nights lengthened the problem of unloading by day became more and more difficult and it became necessary to work at night to pass through the required tonnage. A call was made on Colonel Turner's Department to supply advice and equipment for hooded lighting. No.1 C. and D. Unit and part of No. 2 were allotted for the work, together with R.E. Port maintenance personnel. All the work had to be carried out by night. Ample power was available from the port plants, and C. and D. lighting equipment was sent over quickly from England. Between mid August and September 15th the work was completed to the complete satisfaction of the port authorities. This work actually saved the two units from being disbanded. The break through in Normandy raised hopes of an early end to the war, and as 2nd T.A.F. did not want to carry units they considered they no longer required, they informed the Air Ministry accordingly. Nos. 3, 4, 6 and 7 C. and D. Units at home were disbanded; No.8 was given a special task at home and Nos. 1 and 2 were scheduled for disbandment as soon as they had completed their task at Arromanches.

Antwerp Decoy.

5. The last ditch defence by the enemy in some of the French and Belgian ports, and their mining and destruction of facilities in others rendered Antwerp, when we captured it almost intact, not only our main port of supply but almost our only one. Even though only a reduced scale of aircraft attack was anticipated, its protection was vital. It was decided that a decoy scheme should form part of the defence, and 2nd T.A.F. asked Colonel Turner to visit Brussels to discuss the matter. Colonel Turner went over on the 19th October, reconnoitred the area round Antwerp on the 20th and attended a

/meeting



Mulberry Lighting - showing overhead hooded lighting on the Spud Piers.

meeting of naval, army and R.A.F. staffs on the 21st at which his proposals were generally approved, and arrangements made to provide all necessary contacts and to give him all assistance.

The scheme was a very large one and entailed a great deal of work. Antwerp port (see map) consists of two parts, the large northern section lying north of the town and the river section lying along the west edge. The whole area to the south of the town was set aside for supply depots of all kinds; north of the town similar depots were to be formed adjoining the marshalling yard area north of the port. The only possible site for a large decoy was 1½ miles to the north of these marshalling yards, and the basis of the scheme was to move the apparent position of the northern port some 5 miles northwards. Protection could not be confined to the port only. The main channel of the Western Scheldt was comparatively narrow and the naval authorities were more concerned with the danger of oyster mines being dropped by aircraft in this channel than damage to the port itself. A ship sunk in a narrow part of the channel might block the port for a long time. For this reason it was necessary to locate dummy buoys in the Eastern Scheldt lying to the north, both to attract mines and also to fit in with the northern location of the decoy port. No decoy can achieve success unless arrangements are made to screen the lighting on the target and ensure its being extinguished when a raid warning is received. Consequently the scheme included the following tasks :-

(a) Screening all lighting in both parts of the port so as to reduce their visibility to a maximum of 15 miles.

(b) Blackout arrangements in Antwerp itself.

(c) Screening buoys and navigational shore lighting in the Western Scheldt.

(d) A warning system to enable all working lights to be

/extinguished

extinguished prior to a raid (including the lights of ships unloading.)

(e) A large dummy port lighting layout 5 miles to the north.

(f) Dummy buoys in the Eastern Scheldt.

Two officers from the Department were sent over to Antwerp to superintend all the tasks, and No. 1 and later No. 2 C and D. Units were brought up from Normandy to build and operate the decoys. The tasks were dealt with as follows:-

(a) Port lights screening was carried out by the Belgian Railway and Port authorities, under the orders of C.R.E. Base and working to the instructions of a C.T.D. officer.

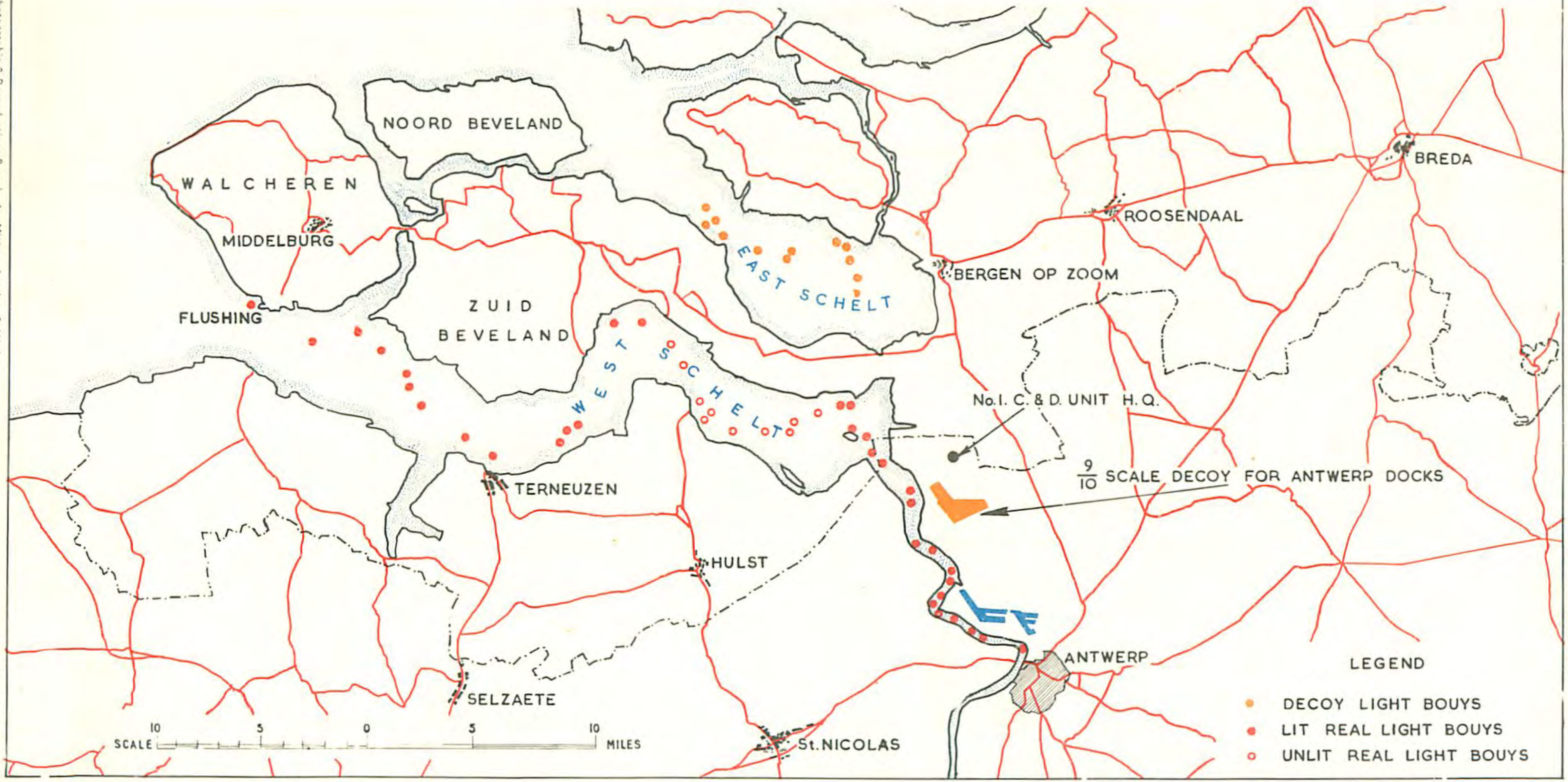
(b) Blackout of the Town of Antwerp was arranged through the Belgian police under the orders of the Brigadier No. 7 Base Area. Moderate blackout was obtained and under the orders of 21 Army Group all unhooded vehicles headlights were forbidden within 10 miles of the centre of Antwerp.

(c) Working through the Director of Navigation at the Admiralty and Trinity House all new buoys sent from England to the Scheldt were hooded. Local buoys were hooded by the port authorities under instructions of the C.T.D. officer. Navigation shore lights had already been screened by the Germans effectively. Repairs only were required.

(d) The warning system was worked out by the C.T.D. Officers and carried out by the Belgian state telephones. It covered 39 light control points and a distance of 15 miles. When enemy aircraft arrived within 60 miles watchers at these points were warned by telephone and all lights were flicked on and off as a preliminary warning, to give time to cranemen to lower any loads. Two minutes afterwards all lights were switched off from the control points.

(e) The main port decoy was built by No. 1 C. and D. Units and covered an area of $2\frac{1}{2}$ by $1\frac{1}{2}$ miles. 5 MQL and

ANTWERP DECOYS



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2 ASQL sets were used. The chief features of the decoy were the lines of hooded lights corresponding with the quay lighting, and bunches of lights representing ships lighting over holds. Fires were also arranged in tents to conceal them. To ensure communication with the Control at the N.O.I.C.'s office two telephone lines and a R.T. set were provided.

(f) The dummy buoys were built by Dutch contractors in the Eastern Scheldt, on a design initiated by the C.T.D. officer S/Ldr. Sugg. They were capped on top to be realistic and were made invisible up to 5 degrees above the horizon to avoid attention from the ground. Otherwise the light was fully exposed all round. The true buoys in the channel between OSSENISE headland on the South side of the Western Scheldt eastwards to the river mouth were not lit at night; shipping passed through this section by day. Consequently even if the buoys west of OSSENISE i.e. the western section of the Western Scheldt were picked up from the air, the apparent channel would run north-east from OSSENISE across the narrow neck into the Eastern Scheldt where the dummy buoys were located leading to the dummy port.

The port decoy and the hooding of the lights were completed sufficiently to provide real protection by the time the Scheldt was cleared and the first ships arrived. Additions to the port decoy were made in early December, and the dummy buoys in the Eastern Scheldt were operating by Xmas.

Security had to be considered as the area was close to the front line and many Belgians were friendly to the enemy. This was arranged in three ways. First all suspected collaborators were removed by the police and jailed for a few months; secondly unserviceable radar sets were located on the site to give an excuse for the presence of R.A.F. personnel;

/thirdly

thirdly it was arranged that the decoy would not be lit unless a possible attack by over 4 aircraft was expected. It was recognized that if the decoy was used frequently, the Germans might be informed of its position by collaborators. Hence a second site was chosen 2 miles further north as a decoy to a decoy; telephone communications to it were arranged, and equipment set aside for its construction in 12 hours if required.

Actually the lights were lit twice only; in neither case was Antwerp or the decoy the target, the attack being delivered in the mouth of the Scheldt and just north of it. Many V.1 and V.2 however dropped on the site necessitating considerable repairs. The installation of this decoy under the circumstances was undoubtedly a right decision, as no one could anticipate the failure of the enemy to attack so vital a target.

Dunkirk.

6. During the siege of Dunkirk the enemy garrison received certain supplies by air and it was thought that if their ground signals could be simulated in our area, the enemy aircraft might be induced to drop the supplies in our lines. 2nd T.A.F. therefore moved No.2 C and D Unit on the 28th October from Normandy to the Dunkirk area. Local front line units and intelligence were consulted as to the methods employed by the enemy, and various sites selected for simulating their signals. The first time a marker flare was imitated a supply aircraft crossed the coast at a low altitude and was shot down by A.A. No further success was met, as the enemy spotted the deception and altered their signals so frequently that no clear and definite type to imitate could be distinguished. Considerable confusion must have been caused amongst their own aircraft by these tactics and this may have resulted in loads going astray. The incident has been recorded not for its comparatively small success but to show how intelligently deception can be directed when operational staffs know of its possibilities.

/7.

Nets, Dummies, Q sets.

7. Before the invasion of Normandy 2nd T.A.F. decided that a full complement of nets, plus 50% reserve, should go over with each squadron in case the enemy attacked our advanced strips by day. Owing to the anticipated crowding of strips by true aircraft, dummy aircraft were left at home ready to be sent out by air if wanted. One A.S.Q. set was issued to each airfield to be laid out as a decoy to draw off any night attacks. When it was found that enemy air attack was negligible, nets were withdrawn and stored in depots. No room was available for setting out Q sets, even if there had been any considerable night attack, and these sets were used throughout the campaign to supplement the official flarepath lighting sets provided in the Flying Control Van. They were never used as decoys. The C. AND D. crews of one corporal and 5 O.R.'s allotted to each airfield for decoy work were employed solely on mobile airfield lighting and were eventually transferred to Flying Control.

In Belgium enemy day attacks by jet propelled aircraft gradually became sufficiently frequent to induce 2nd T.A.F. in December 1944 to re-introduce net and dummy protection. No. 8 C. and D. Unit was moved from England to Belgium just before Christmas, but though it reached Ghent before the end of the year, it was not allotted to any airfields before the 1st January when the enemy made their one and only large scale attack on a number of our airfields. After this incident the unit went to work, but conditions were not easy. Bad weather had converted a number of airfields into bogs with the result that squadrons were crowded on to a smaller number of the drier ones. There was little or no room for dummies and it was difficult to get ground crews to use nets. A few aircraft which were temporarily not in use were netted, and dummies were erected when and where room was temporarily available on occupied airfields, and occasionally on temporarily abandoned airfields. Airfield commanders welcomed the arrival of the dummies and gave all possible help. Generally speaking the equipment stood up to the bad weather very well,

/but

but trouble was experienced with the propellers which had to be changed and repaired after windy weather. No further German attacks developed on our airfields which was disappointing in view of the hard work carried out in very difficult conditions.

A few enemy night attacks on airfields in Nos. 2 and 85 Groups were responsible for the introduction of Q protection in January. No. 2 C. and D. Unit handed over their section of the Antwerp decoy to No. 1 and installed 7 Q sites. An interesting departure from the normal custom at home was introduced by the Group Staffs. Instead of a dummy flarepath without totem poles or funnel, the existing true flarepaths were copied as closely as possible. The flarepath was of the avenue type, a complete funnel was installed and totem poles provided in some cases. Additional lighting, simulating Flying Control was installed, ASQL sets being used. The Q's were only lit when an air raid warning was received. Very careful briefing of all aircraft crews was arranged to prevent any aircraft landing on a Q site by mistake. Information was also broadcast to other Groups for the same purpose. In spite of this one aircraft did land on a Q site but got off with little damage and no casualties. No attacks were made on Q's or on true airfields after the former came into operation.

The experience of C. and D. protective deception with dummies, nets and Q sites in Europe, though unfruitful, is not uninteresting. It brings out the all important factor of air superiority, when it is doubtful if protection is really required at all. Under such circumstances the inadvisability of having C. and D. units hanging about doing nothing and cluttering up accommodation renders it inevitable that they will be discarded or at any rate left in the background until sufficient enemy attack develops to make it worth while making use of them. This means that every time there is likely to be at least one attack with its losses to teach the need. No criticism is levelled at the action of 2nd T.A.F. in this respect. As soon as C. and D. Units were wanted, they were sent

/for

for and all staffs and airfield commanders made use of them properly. One other matter is worthy of mention. Under conditions of air superiority it is most difficult to get ground crews to use nets on their aircraft. They are a nuisance, especially when they have to be put on for a comparatively short period. This illustrates a second basic factor, i.e. the degree of importance. If commands and staffs consider net protection necessary, strict orders should be issued to ensure its being rendered effective. Meanwhile, however, it is important that experiments should be carried out to develop a type of net that is simple and gives the minimum trouble.

Note. Further details in regard to C. and D. work in France and Belgium can be obtained from Historical files nos. N.725, N.750 and Historical Folder N.5.

CHAPTER XX.

ABADAN SMOKE SCREEN

Initiation of the smoke screen

1. As the German advance in southern Russia continued, it became evident that the oil refinery at Abadan would soon be within range of long distance enemy air attack. The importance of this refinery at this period of the war could not be over-estimated. With the oil-fields in Burma and the East Indies in Japanese hands, the one source of supply available to the allies in the east was Persia and Iraq, and the crippling of Abadan would throw on America the responsibility for oil supplies in the east as well as in all the other war theatres. In October 1941 the Admiralty took up the question of the concealment of Abadan in the Oversea Defence Committee, and it was agreed that, as at that time the command in Iraq was under an A.O.C., the Air Ministry should be responsible for dealing with the situation. In December this unwanted "baby" was light-heartedly handed over to Colonel Turner's Department, who knew nothing of smoke screens, the only form of concealment practicable under the circumstances.

At that time although the Services had developed forms of chemical and oil smoke screens for tactical purposes, the only manipulator of long term smoke screens hiding large areas from the air was the Ministry of Home Security. This Ministry was responsible for covering certain towns and vital factories in England against air attack, and their methods were under a continuous fire of criticism from all the Services. The general criticism was lack of efficiency of the screens over the target area, but the Army who had to supply large numbers of men to man the generators objected to the wasteful use of the men, and the R.A.F. objected that the only areas where the smoke screen was really successful were those over their airfields

/miles...

miles away from the target. Discussion had been going on for some time as to which Service should take over smoke protection, but as no Service wished to allocate their restricted man-power to the task, a decision was not reached for a long time. Eventually the army took over responsibility for smoke screens on a reduced scale.

Experience shows that where a large area is concerned, such as at Abadan, smoke screen efficiency is dependent on certain weather conditions. With a steady gentle breeze from 3 to 6 m.p.h. a good smoke screen is practicable; in a near calm it takes too long to cover the target, in high winds the near side of the target is only covered in strips; if any form of turbulence exists, the smoke may go anywhere, and large uncovered patches are certain. Briefly, by using a great deal of equipment and man-power it is generally possible to cover an area sufficiently to make it difficult for a bombing attack to pick up specific small vital targets in an area, but it is only under special conditions that the whole target can be hidden and even then the smoke itself gives a clue to its position.

Action was taken at once to get into touch with the branch of the Ministry of Home Security concerned and it was discovered that the screens were organized and controlled by civil servants, most of them temporary ones, who had been through a brief course of instruction, that the equipment was manned by army units broken up into small groups responsible for sections of each screen and that the only technical knowledge available was confined to a retired engineer Vice-Admiral in the Admiralty, lent to the Ministry of Home Security to help them, and his assistants, some of whom were loaned by Oil Companies for the purpose. It was also discovered that the efforts of this small band of experts who designed the equipment and advised the Ministry of Supply

/in turning...

in turning it out were much handicapped by civil service procedure and othodox bureaucratic channels.

First Arrangements.

2. Contact was at once established with these experts and with the Headquarters at home of the Anglo-Iranian Oil Company. It may be here recorded that without the unstinted help given by the experts and by the Company, both at home and particularly at Abadan, the work could not possibly have been carried out either in reasonable time or efficiently. It was discovered that the best and latest type of mobile oil smoke generator, known as the Haslar, was in slow production by the Ministry of Supply for smoke screens at home. It was improbable that production, apart from home requirements, could be stepped up to provide sufficient for a twenty mile perimeter in reasonable time. In addition shipping space was most difficult to get and the Haslars were cumbersome. Moreover at the time ships were being constantly sunk by submarines. On the other hand it was known that ample supplies of piping were available at Abadan. It was therefore agreed that the scheme should be based on a complete ring of static generators, fed by oil and water pipe lines, and that a limited number of Haslars should be shipped out to be used to thicken up any portion of the screen as required to ensure that all the most vital points were adequately covered. A prototype static generator afterwards known as the "Abadite", was experimented with at the Company's headquarters at Sunbury and plans and specifications sent out by air to Abadan. With some difficulty, 50 Haslar generators and 50 sets of mechanical equipment to be used with mobile or fixed generators were obtained from the Ministry of Supply, special priority having to be obtained to overcome objections raised by Home Security. These were shipped out to Abadan and after a long passage via the Cape and Egypt arrived safely.

/Meanwhile.......

Meanwhile other experiments were carried out locally to get a temporary scheme going as soon as possible. Open smoke trenches were dug and provided with baffle walls to reduce flame visibility. A trial of 1½ miles of trench showed that a good screen could be obtained, but that there were many objections to this method. Even with the baffle wall the flame was visible ten miles away, the oil consumption ran into 100 tons per hour per mile of trench, the trenches cracked under heat (as was found at home) leading to seepage into the ground, and the nature of the smoke produced, full of sooty particles which were deposited over the area, was most unpleasant. It was therefore decided on the 26th March that the home proposals should be adopted and the trench system discarded.

To ensure success it was necessary to send out fully trained officers, experienced in home smoke screens to supervise the work in Abadan. One Major R.E. was borrowed from the Ministry of Fuel and Power and a first class oil specialist officer, with difficulty, from the Ministry of Home Security. These two left by air in March 1942.

The Problem.

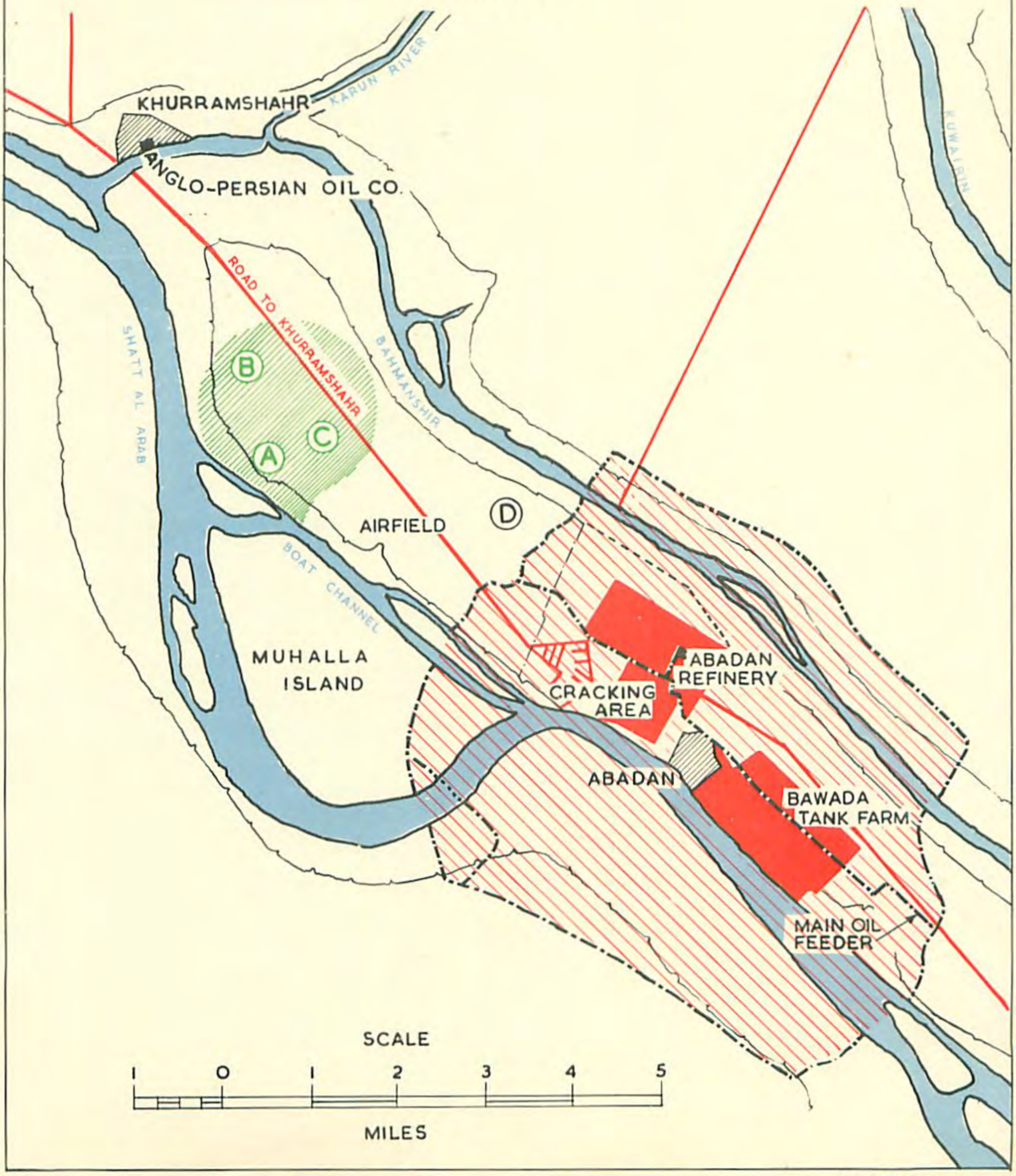
3. The problem teemed with difficulties. (See enclosed map). The area to be covered necessitated a perimeter of twenty miles for the pipe lines. The Shatt-el-Arab was an unmistakable guide to pilots by day or night and the particular area was pinpointed first by the junction of the Karun river 8 miles to the north, secondly by a branch river the Barmashir to the North-east which with the Shatt-el-Arab converted the area into an island, and thirdly by the large island of Muhalla, in the Shatt-el-Arab immediately adjoining the refinery area. In addition care had to be taken to avoid the American airfield on the north edge of the refinery which was essential for erection of aircraft being sent through Persia to Russia. The river itself running

/through....

AIR SURVEY
ANGLO-IRANIAN OIL CO. LTD.
ABADAN ISLAND

LEGEND

- (A) DUMMY GAS FLARE
- (B) DECOY FLARE PATH
- (C) AREA OF DECOY LIGHTS & FIRES
- (D) H.Q. SECTOR CONTROL
- DECOY AREA
- TARGET AREA
- OIL FEED PIPE
- MAIN ROADS



through the area left gaps in the screen which had to be dealt with. The refinery on the east of the river was in Persian territory, and the opposite bank in Iraq. The local Arab population on both sides of the river were expert thieves and invariably removed anything that was not securely guarded. Though blackout could be arranged at the refinery, considerable political difficulties had to be overcome to control to some extent the lighting in Mohamerah (Khorram Shah) which was located at the junction of the Karun and Shatt-el-Arab. Finally a gas flare (for getting rid of waste gases) lying east of the refinery constituted a landmark visible for 50 miles at night.

The vital points in the refinery consisted of the Power house with very high chimneys, the Cracking Plant, two large tank farms, one of which the Bawarda was located well down stream, and certain wharfs on the river front used for shipping oil. They were spread over a considerable area which accounts for the great length of the perimeter.

Meteorological Data.

4. During the summer the prevailing wind at Abadan is hot and dry from the north west. When not more than 25 m.p.h., visibility is good. If the wind is stronger, dust-storm conditions prevail. Maximum wind strength is generally at 4 p.m., rapidly decreasing till 8 p.m., after which calm conditions normally prevail till morning. In winter the wind is variable and frequently from the south west when wet weather conditions prevail. In the summer inversion conditions are common at night limiting the rise of smoke. By day turbulence is considerable and smoke tends to pillar upwards a short distance from the source. As a result of high winds, inversion and turbulence, the output of smoke has to be greater at Abadan than in England generators have to be closer together, i.e. 180 to 225 feet apart instead of 300-400 feet as in England.

The scheme. 5. The scheme consisted of the following parts:-

(a) Perimeter of 463 Abadite static smoke generators spaced 180-225 feet apart. Oil pipe line 25 miles long with pumps situated in the refinery area drawing from large storage tanks, pressure being maintained at 100 lbs. per square inch. Water pipe line also 25 miles long with individual pumps drawing from creeks, pressure being maintained at 40 lbs. per square inch.

(b) To close the gaps in the river six barges each carrying two generators anchored in the stream.

(c) Desert roads and paths along the whole perimeter to permit of access in wet weather.

(d) Control posts at intervals linked by telephone to the main control which in turn was linked to the R.A.F. Sector Operations room.

(e) Posts for 63 mobile Haslar generators, 32 on the North West side and 31 to the South East.

(f) Decoy site (situated west of the airfield) consisting of dummy lighting, a Starfish fire, decoy airfield lighting and some balloons to confuse the attack in relation to the exact area of the refinery.

(g) Dummy gas flare situated east of the Bahmashir river also to confuse the attack.

Thanks to the Anglo-Iranian Company who carried out the work, this great task was completed in 6 months between April and October, 1942, except for the barge generators and the roads. It was originally proposed to add a dummy smoke screen also but the task was too great and this additional deception had to be abandoned.

Personnel. 6. In March 1942 the question of personnel for operating the smoke screen was discussed. It was decided that local

/Arab....

Arab personnel could not be employed, partly because all in the neighbourhood were wanted for work in the refinery or for fire duties, partly because of their lack of discipline and unreliability and partly because the river split the screen and political difficulties would cause endless trouble if Persians crossed into Iraq and vice versa. The R.A.F. therefore provided the personnel, viz. 91 British and 365 local levies. In addition some 243 local coolies were temporarily engaged for cleaning generators after operation.

Test and attacks

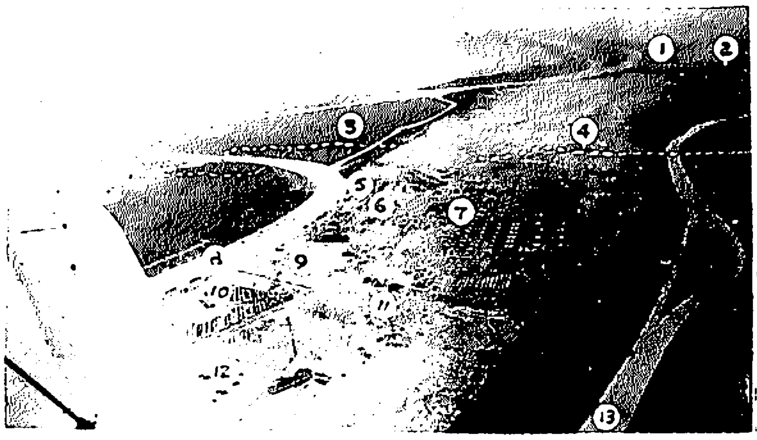
7. Minor tests were carried out as soon as work was sufficiently advanced in June and July. A full scale test was arranged on the 23rd September with air reconnaissance. The pilot's report considered that for heights above 3/4000 feet the screen would be sufficiently effective to prevent aimed bombing of vital points. At lower altitudes details could be seen but only from directly overhead, which also would prevent any aimed bombing.
The river bends were effectively obscured, largely due to the dispersal of smoke by the palm trees. The wind was only $3\frac{1}{2}$ miles an hour; a stronger wind would have improved the screen.

No attacks were made on the refinery and the smoke screen was dismantled in May 1944.

Photographs.

8. Photographs at the end of the chapter show details of some of the equipment. A very excellent and full report is available in historical file No. H.10.

ABADAN ISLAND (looking North-West)



(1) Khorramshahr

(2) Karun river

(3) Muhalla island

(4) Smoke H.Q.

(5) A.I.O.C. No.2 water pumphouse

(6) Power station

(7) Refinery area

(8) Shatt Al Arab river

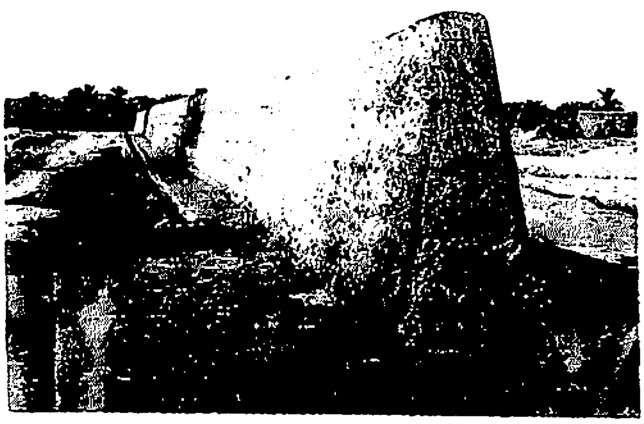
(9) Abadan Town

(10) Bawarda staff quarters

(11) Ahmadabad village

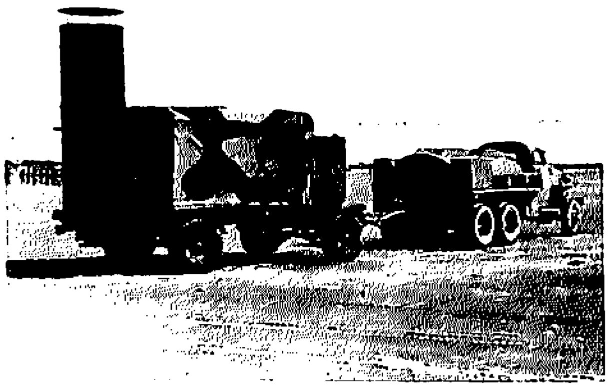
(12) Bawarda tank farm

(13) Bahmashir river



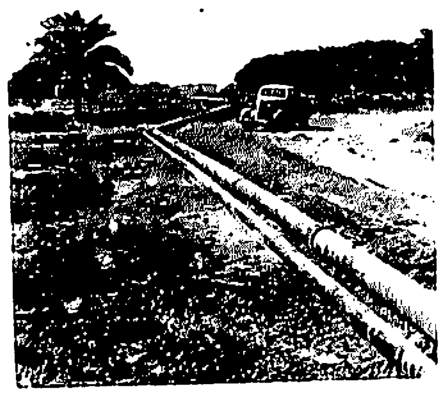
Smoke Trench with Baffle Wall

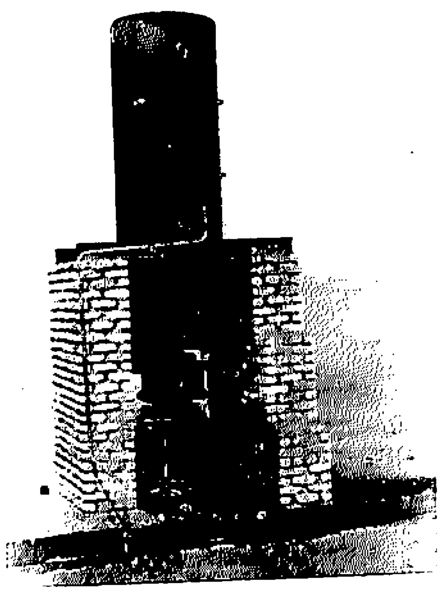
constructed of Brick and Mud.



The Haslar trailer
coupled to a
Studebaker Tank Lorry.

Oil and water pipe lines
showing offsets to allow
for expansion.





THE "ABADITE" SMOKE GENERATOR.

CHAPTER XXI.

MOBILE LIGHTING EQUIPMENT FOR AIRFIELDS.

1. A combination of circumstances led to the Department becoming involved in the design, and to a considerable extent in the production, of mobile equipment for lighting true airfields at night.

2. Before the war aircraft design necessitated landings being made almost directly into wind, and flarepaths had therefore to be laid out at any angle, and might have to be frequently changed from one direction to another during a single night. This precluded the installation of any form of lighting, static or mobile, in which power was provided by electrical circuits, and individual lights, easily moved, had to be used so that their layout could be rapidly changed as the wind veered. At that time, when the Works Services were a purely civilian organisation, all mobile equipment was made the respobsibility of the D. of E. and static equipment that of the D. of W. Consequently it was the D. of E. who supplied the Glim Lamps and Goose-neck Flares and it was the R.A.F. personnel of airfields who were responsible for the layout and control of airfield lighting.

3. The constant demand for aircraft of better performance led to increased wing-loadings which necessitated higher landing speeds and larger airfields; it did, however, also permit of landings being made well off the wind direction, and consequently the installation of electrically lit flarepaths along definite runways. Static equipment could now be installed on home airfields for which the responsibility devolved on Works. Later, as enemy attack developed, a hooded flarepath became necessary, which in turn necessitated funnels, leading in lights and eventually circles of lights round the airfield for use in bad weather. Each accident at night tended to favour some additional lighting to prevent a recurrence, and static lighting systems on home stations became more and more complicated and extensive, and requiring electrical circuits over 50 miles in length. No action was taken at the same

time to provide analagous mobile equipment for overseas, and as modern aircraft became available for war areas abroad such as the Middle East, their pilots, trained to the elaborate systems of home lighting had to do their best to land with the old flares and glim lamps laid out on long runways, each light having to be turned on or off separately.

4. In the summer of 1942, mobile decoy sets (MQ) were sent to the Middle East for airfield protection. Some of these sets were immediately used by airfield commanders for true flarepath lighting in preference to the glim lamps and flares. After Alamein when our air superiority became pronounced and decoys consequently less necessary, more and more of these MQ sets were relegated to flarepath use. This practice naturally upset all assessments of decoy requirements, and the Department contacted Flying Control to find a solution of the problem. It was immediately evident that no electrical mobile sets for airfield use were available or even contemplated, far less in production.

To meet North African needs, therefore, the Department had to cater for true flarepaths as well as for decoys, and the MQ was refitted as a dual purpose set to satisfy both requirements. When the set was required as a true flarepath, the lamps were hooded, an angle of glide indicator and a pair of totem poles were added to the flarepath, in some cases funnel lighting was improvised out of the same equipment. When required as a decoy the flarepath lamps were bare, no angle of glide, totem poles, or funnel were used but a red bar was located to leeward to warn off friendly pilots. The generator switchboard and main wiring were suitable for both purposes.

5. On their arrival in North Africa the refitted MQ sets were at once made use of on all night flying airfields near the main ports; owing however to their weight (1½ tons) and the unusual road and transport difficulties which were at that time a main feature in that war area, it was some

/time

time before these sets could be sent on to the forward airfields. These also required electrical sets, not so much for their normal work, but to be able to land night flying aircraft that were shot up, damaged, and forced to land at the nearest airfield. Without switchable sets the forward airfield commander had to choose between keeping his lights on and drawing attack at a time when we had not attained air superiority, or of trying to lay out his flarepath quickly when a lame duck arrived. Many of these aircraft could not wait long enough for these flarepaths and there were a number of crashes and casualties in consequence. The need for a very light electric set that could be transported by air was evident. At the request of A.C.A.S. (Ops.) the Department sent out to North Africa in March 1943, a very simple arrangement for switching on and off Glim Lamp flarepaths from a control point. By wiring a post office relay across the switch of each lamp and connecting the relays to a telephone cable laid along the flarepath, it was possible to activate the switches and turn on or off the flarepath from a distant control point. This equipment was afterwards standardised as one of the official mobile flarepath sets.

6. In the meantime the necessity for a much lighter decoy set which could be manhandled across country in mobile warfare, resulted in the production of the Assault Q (or A.S.Q.) set which was also made dual purpose. Some A.S.Q. sets were sent to North Africa shortly before the invasion of Sicily and others later to Italy on a demand for more decoys for Foggia. They were used as decoys in Sicily and Italy and also as advanced airfield flarepaths on many occasions in Italy. One for instance was in use on the Anzio beach-head. Many of the original M.Q. sets were also taken over to Italy. Full information is not available

but it is understood that on several occasions the A.S.Q. was the first set used until it was replaced by the M.Q. or American sets, which continued until static lighting could be put in.

7. In the spring of 1943 as the result of experience in North Africa, the then Fighter Command put forward to Flying Control a demand for mobile flarepath sets, similar to the M.Q. but of an improved pattern. The Department was asked to produce a prototype, and also to fit out a lorry as a Flying Control Van, which would serve as a mobile Watch Office and transport flarepath equipment and V.H.F. sets as necessary. Unfortunately disagreement occurred between Flying Control and Fighter Command as to the exact requirements of the main flarepath, which had repercussions in future events. Fighter Command, considering requirements only from the day fighter aircraft point of view, asked for a single line flarepath, totem poles, A.A. Indicator and one pair of lights for use as an embryo funnel as they wished to house all equipment in one lorry. Flying Control pressed for an avenue flarepath and mobile funnel of standard type. In the end the Van was fitted according to Fighter Command's wishes and a Type E flarepath using the same equipment but in avenue form, was adopted by Flying Control as the standard type of mobile flarepath, unfortunately however no mobile funnel was evolved. The Department fitted out four Flying Control Vans complete with equipment in six weeks ending mid-June 1943, one as a prototype and the other three for training personnel. Except for training Flying Control Officers and C. and D. personnel in the use of the van and equipment, the Department had no further concern in flarepath design or production for a year. M.A.P. was made responsible for production and as usual after experimenting on the sets at Farnborough, some four months elapsed before production commenced, with the result that only five out of the eighty vans provisioned were issued by December 1943.

/8. On

8. On the 14th June, 1944, A.O.C. 2 Group, a part of 2nd T.A.F., approached the Department for urgent help in improving the official mobile lighting as supplied in the Flying Control Van by making use of existing decoy equipment which was to be altered to suit requirements; in particular a mobile funnel set was urgently needed. He pointed out that although the Flying Control Van equipment was satisfactory for day fighters for dusk and dawn landings, it was insufficient for night fighters and bombers operating in all weathers at night. In addition to the mobile funnel, various alterations were required to the single line Type E flarepath carried in the Flying Control Can, these included an avenue flarepath in place of the single line, and lamp-holders over which aircraft and lorries could run without damage to themselves or the lights: these replaced the existing Welsh hat type, which was constantly being destroyed by traffic and for which continual replacements on a large scale were necessary. In addition large numbers of a simple form of taxi light were required for use between runways and dispersal points.

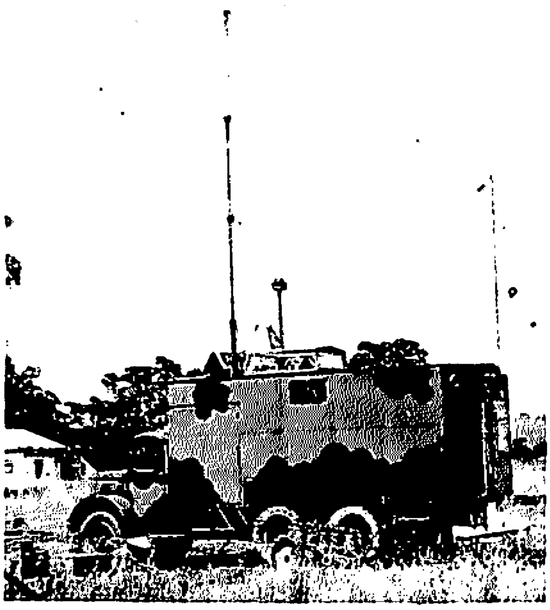
9. It was obvious that urgent action was necessary, as No.2 Group was due to go to France within two months, and it was also clear that existing equipment would have to be converted for the purpose, and the only equipment available consisted of the reserve decoy sets in the Department. Remembering the previous wrangle between Flying Control and Fighter Command, which delayed decisions on the requirements for the Flying Control Van, it was decided to make up prototypes to meet all 2 Group's requirements, and then to refer the matter to Flying Control for a decision as to production. After many experiemnts on 2 Group airfields, all the necessary prototypes were produced by the 14th July. Flying Control was at once informed, and one of their

/officer

officers visited the Department and inspected the equipment. He reproached the Department for not informing him earlier, assured us that the additional equipment was unnecessary, but agreed to settle the matter with A.E.A.F. and telephone us the result. A.E.A.F. however, insisted that the additions and alterations were essential, and the Department went into production pending the receipt of formal instructions from Flying Control or the Director of Operational Requirements, which incidentally never arrived. By this time 85 Group and 34 Wing had seen the equipment and asked that similar sets should be supplied to them. Later Bomber Command asked for a set for a lame duck airfield they were establishing in Belgium. The total number of sets required for these formations amounted to 12, and all were produced and handed over by early September; 8 more were produced as spares.

10. Each set represented the requirements of one airfield, and took into account what already existed in the Flying Control Van, allotted to each airfield, i.e. one single line Type E flarepath, and two pairs of portable battery driven funnel lights. It was originally intended to obtain one more single line Type E flarepath for the left hand side of a second runway, and to add two A.S.Drem sets, (converted from the dual purpose A.S.Q.) for the right hand sides of two runways, the two type E and two A.S. Drems thus providing two avenue flarepaths for each airfield. This would have been the better arrangement, as the A.S. Drem had no taxi light on the windward side of its lamps as did the Type E. Each avenue flarepath would then have had one line of taxi lights to enable aircraft to find their way down the runways to their take off point, which is always most desirable, if not a necessity. Unfortunately Type E sets were not available and a search throughout the country for the necessary parts to make up sets proved that they could not be made available within any reasonable time. As a result 3 A.S. Drem single line flarepaths had to be issued, which meant that one

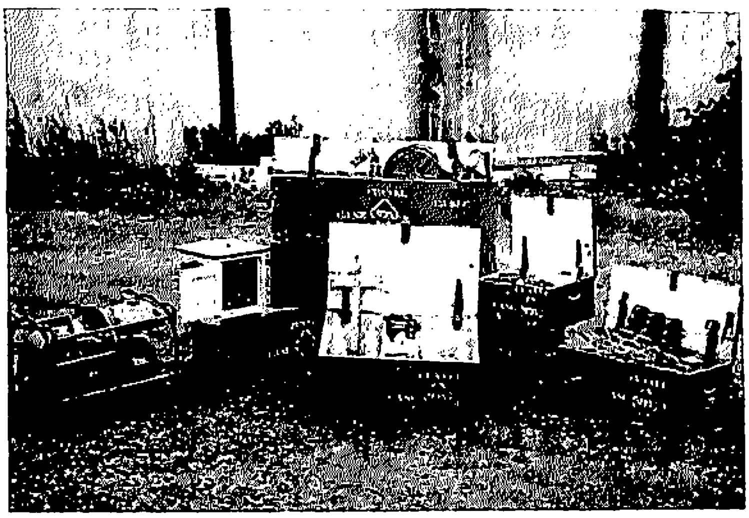
/flarepath



Flying Control Van.

A view of the prototype vehicle showing V.H.F. aerial, red obstruction light and astro hatch over controller's desk

Mobile Flarepath Equipment - Mushroom fittings as produced for A.S. Drem sets and Type E flarepaths.



Mobile Airfield Lighting Equipment - funnel set complete with Norman Lyon generator.

flarepath had no taxi lights to guide aircraft. A type of lamp holder, known as "the mushroom fitting", was provided which could be run over by heavy aircraft or lorries without incurring damage. Slots cut in the base permitted it to be used for either the Type E or the A.S. Drem lamps. This fitting was later made official and turned out by the Department in large numbers. With each complete airfield set two mobile funnels with four leading in lights were provided, one for each end of the main runway, the generator used being identical with that supplied for the Type E. For the second runway two pairs of funnel lights were provided from the existing equipment in the Flying Control Van. Finally 120 simple taxi lights per airfield completed the set.

It may be mentioned that letters were received later from both Nos. 2 and 85 Groups, stating that they could not have carried on without these sets.

11. The Department had stopped a gap, and had sufficient reserves of sets in hand to meet immediate demands for replacements and additions. It was not, however, in a position, unless officially given the responsibility for doing so, to meet indefinitely mobile lighting requirements for Europe and S.E.A.C. Moreover as the risk of air attack lessened, camouflage and decoys became less and less necessary, and it became only a question of time before their need vanished altogether, which would obviously result in the closing down of the Department. Efforts were therefore made to induce Flying Control to relieve the Department of further responsibility in the provision of equipment for mobile lighting. This could have been done by taking over the Department's reserve equipment, making it official, and putting it in production through official channels or alternatively by replacing it with new official equipment. It took several months to get any reaction.

12. After continuous pressure a meeting was held early in December, 1944, at which it was decided that the Department's equipment in Europe would be replaced either by official Type E sets or by static lighting, and that pending the completion of the change over, all spares of the equipment supplied by the Department would be taken over by the Director General of Equipment. Had this decision been implemented, all further responsibility for mobile airfield lighting would have been finally removed from the Department. As events turned out, only a partial change over was made; some Type E sets were sent out for flarepath lighting but the number was insufficient to replace all the A.S. Drems; no static funnel sets were sent out and the Department's sets continued to be used; on some airfields power was provided by German generators or local mains, on others the Department's generators were still used; spares were not taken over. Calls continued to be made on the Department by airfields in Europe for replacements. Meanwhile all decoys were being closed down and it was clear that the Department would soon cease to exist, and that its abolition would seriously affect airfield lighting in Europe. The matter was referred to A.C.A.S. (Ops.) who issued orders to Flying Control to take over spares and responsibility; no action was taken to obey this order. In January 1945 Colonel Turner proposed that Works should be made responsible for mobile as well as static airfield lighting, and that they should take over all remaining equipment for use in Europe or S.E.A.C. Although this proposal was generally accepted in principle by A.C.A.S. (Ops.), D.G.O., and Works, continual objections were raised in one form or other by Flying Control and the Director of Operational Requirements, and it was not until 6th July, 1945, that a final meeting was held by D.G.O. to clarify the position. By this time the war in Europe had ceased and S.E.A.C. was the only theatre where airfield lighting requirements had still to be met. It was decided that the A.S. Drem and Funnel sets designed by the Department were to be made

official sets, that 60 of each should be completed and tropicalised, ready for issue to S.E.A.C., and that pending arrangements to be made between D.G.E. and D.G.W., sets, as packed, were to be handed over to D.G.E. Meanwhile S.E.A.C. was asked whether they required C. and D. personnel to man the sets, and 300 men were retained by the Department pending a reply which was long delayed. On 4th July 1945, a demand came from S.E.A.C. for 20 A.S.Q. sets and 6 funnel sets to be sent out by air immediately and for the remaining sets by sea. The end of the Japanese war released the 300 C. and D. personnel for other duties, but the requirement for the remaining sets was confirmed by S.E.A.C. on the 31st August, 1945, to provide lighting for airfields in Malay and the Dutch islands as they were reoccupied.

It must be recognized that this record of the circumstances which led to C.T.D. designing all and supplying most of the mobile airfield lighting used in the war is based on the information available, and does not take into account the difficulties or conditions under which the Flying Control and Operational Requirement branches had to work. No criticism of persons is intended, nor would such be desirable. It would appear however that the basic cause of the apparent lack of response of these branches was their objection to taking action until they received a proper demand from the correct authority. They resented the direct approach to C.T.D. by A.O.C.'s and others, and also the Department's action in helping R.A.F. units, as they considered, unofficially. On the other hand, it is quite clear that the equipment produced was vitally necessary and possibly it was the system which was at fault. The proper channel according to these branches,

/started

started with an official demand from a Command, which was discussed between Flying Control and Operational Requirements. If accepted, the latter branch would arrange for an electrical expert in M.A.P., (who had no knowledge of the R.A.F.), to carry out experiments and produce a prototype. The prototype would be sent to Farnborough to be checked by the R.A.E., and would then be approved by Commands. The accepted design would then be forwarded to D.G.E. who would go to a production branch of M.A.P., who after months of delay would start to turn out the equipment. For a simple article which, as events proved, could be turned out in a few weeks by a small department (C.T.D.), such a channel was long and wrong. Now that Works have been made responsible they can produce any sets wanted through their own contractors, and with their close contacts with Farnborough and the Commands they can ensure that new types of equipment are adequately tested under service conditions, are approved by qualified pilots and produced without the delays which are inevitable if the responsibility is divided between a number of different departments of the Air Ministry.

CHAPTER XXII.

THE DEVELOPMENT OF 'Q' DISPLAYS.

1. The original 'Q' sites built in 1939-40 were set out in the form of a T simulating the gooseneck flares used during the early part of the war for night landings. The 'Q' lighting was electric, power being supplied from a $1\frac{1}{2}$ h.p. J.A.P. - Higgs lighting set installed in the 'Q' site control shelter which was located about 600 yards from the lighting.

2. Each site was equipped with 4 alternative T's to provide for different wind directions. Each T consisted of 7 lights, 5 in the long arm of the T, which was 450 yards in length. In addition to the lights forming the T, two Red obstruction lights on a separate circuit were located about 200 yards from each end of the flarepath as typical boundary lights. At the shelter a 500W. lamp, known as the "headlamp", was fitted in such a way that it could be switched on intermittently and swung slowly round and rocked by the operator: when viewed from a distance this provided a good simulation of an aircraft switching on its headlamp while taxi-ing and turning on rough ground. The object of this lamp was to attract the enemy's attention from a distance and bring him near enough to see the T lighting. It was important that the headlamp should not be operated when the enemy was near enough to get a close up view, and it was therefore necessary to muffle the noise of the generator sufficiently to enable the headlamp operator to listen for aircraft and switch off his headlamp when any aircraft approached the site. Experience showed that the headlamps played a large part in attracting enemy aircraft near enough to the 'Q' sites to see the other lighting.

/3.

3. The first 'Q' site shelters were built below ground and in most cases these proved to be unsatisfactory on account of damp and flooding, and later all shelters were constructed above ground level. The normal shelter consisted of two compartments, one housing the engine and generator and the other forming the control room, with switches, telephone, crew's quarters, etc. The normal crew for a T Type 'Q' site was 2 men, and Stations fitted with 'Q' sites had an additional establishment of 2 ACH GD's.

4. The 'Q' site crews required a certain amount of instruction and training in the care of the engine, generator and lighting equipment, and the operation of the lighting, headlamp, etc., and this was carried out by instructors from the Department who visited new sites as they became ready. When the site was operating, one man was on duty at the telephone and switches, and one man was outside to listen for aircraft and to operate the headlamp.

5. The actual or operational control of the 'Q' site and the decision as to when it should be lit and doused was invariably the responsibility of the R.A.F. Station to which the 'Q' site was tied. The termination of the telephone tie line connecting the site with the Parent Station varied with the type of Station, but normally the Ops. staff had control of the 'Q' site and the telephone terminated in the Operations Room. Later, it became the more usual practice for the 'Q' site to come under Flying Control at the Parent airfield. There was no set procedure that 'Q' lighting should be operated when the Station lighting was on or when the Station lighting was out, and all Stations were free to operate as they considered best under varying conditions, i.e. degree of enemy activity, visibility and geographical considerations, and different requirements as between Bomber, Fighter and Training Stations. A broad policy was however agreed between the Department and

/Commands

Commands that all 'Q' sites should operate for an average of 14-20 hours a week, as a general measure of protection, and also to ensure that the sites were kept serviceable and that the lighting was not turned on only when the enemy were actually approaching. There was a definite danger, if the enemy saw the lighting go on that he would suspect a decoy. This was borne out by frequent reports by our own Pilots flying over enemy territory, where one of the weaknesses of the German decoys was that they were often seen to light up as our aircraft approached.

6. The normal procedure was for the operators, on the close approach of enemy aircraft, to turn out the Red obstruction lights so as to present to the enemy the appearance of Station blacking out on receipt of a warning. The flarepath lighting was left on but it was the duty of the man on lookout to watch for friendly aircraft and put out all lighting if any friendly aircraft appeared to be circling the site with the intention of making a landing.

7. During the period when enemy intruders were active and frequently followed our own aircraft back to base, it was the practice at some Stations for all returning aircraft first to circle the lit 'Q' site and to defer lighting the Parent Station and all landings until the enemy intruders had left: this resulted in several attacks on these 'Q' sites. The fact that 'Q' sites in different parts of the country were all operated rather differently was an important factor in the success of these decoys.

8. In the autumn of 1940, when some 70 T Type 'Q' sites had been constructed, certain additional variations were introduced, such as wind T's, flashing HF - DF lights, bad blackout lighting, additional obstruction lights, aircraft navigation lights, etc., with the object of simulating realistic activity, and so that the sites should not all

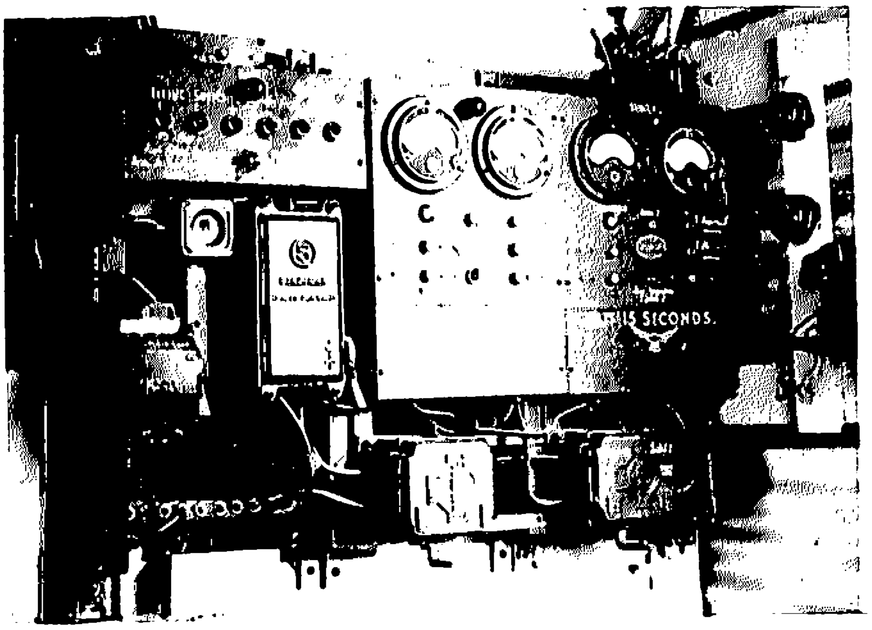
/appear

appear uniform, with a possible danger of detection by the enemy. A great deal depended on the skill and keenness of the men at the site, and these additions also gave the site crews more interest and scope in the operation of their lighting.

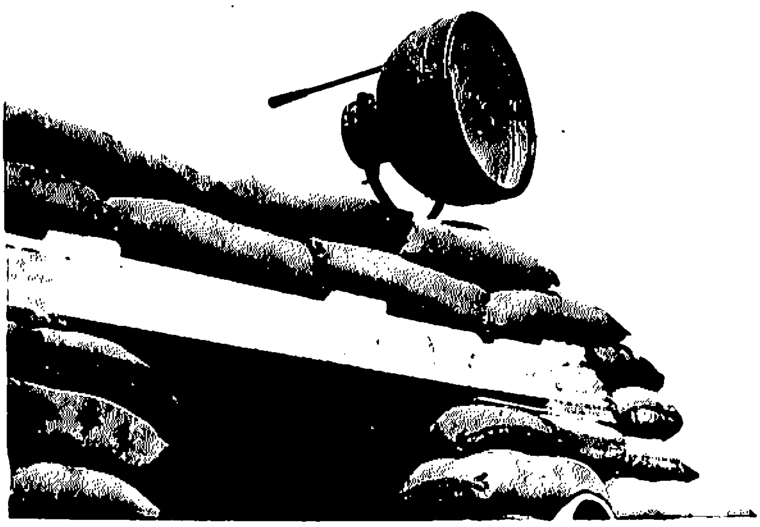
9. By 1941 most Stations were being equipped with Drem lighting and the number of airfields using naked flares was small. In June, 1941, the first Drem type 'Q' was constructed at HOUGHTON ('Q' Site for MIDDLE WALLOP). The lighting consisted of a single line flarepath of hooded lights 1,000 yards long, with the standard funnel of 6 lights on the North-East approach. In addition a floodlight was provided at the normal touch down point and this was fitted with a red obstruction light. An Angle of Approach Indicator was also fitted and the flarepath was reversible for use in either direction according to wind. Current was supplied from two generators as the floodlight required a 5 k.w. set, and the flarepath, floodlight and funnel were on separate circuits so that they could be independently operated in a realistic sequence as for aircraft landing or taking off. At the shelter a "Headlamp" was fitted as on the T. type 'Q' sites.

10. The lighting corresponded very closely to real airfield lighting, and with the large increase in the amount of night flying, both operational and training, it became essential to find some method of marking these new 'Q' sites so that our own aircraft would be able to recognise them and would not attempt to land on these sites. The problem was to provide some form of warning lights; visible to aircraft making a normal landing approach, but invisible to the enemy. After a number of tests a series of 9 hooded red lights in the form of a bar across the entrance to the flarepath was adopted. This "Red Bar" of lights was clearly visible to any aircraft coming in to land, i.e. up to 800 ft. over the funnel, but was not visible from above or from a side view. The Red Bar of

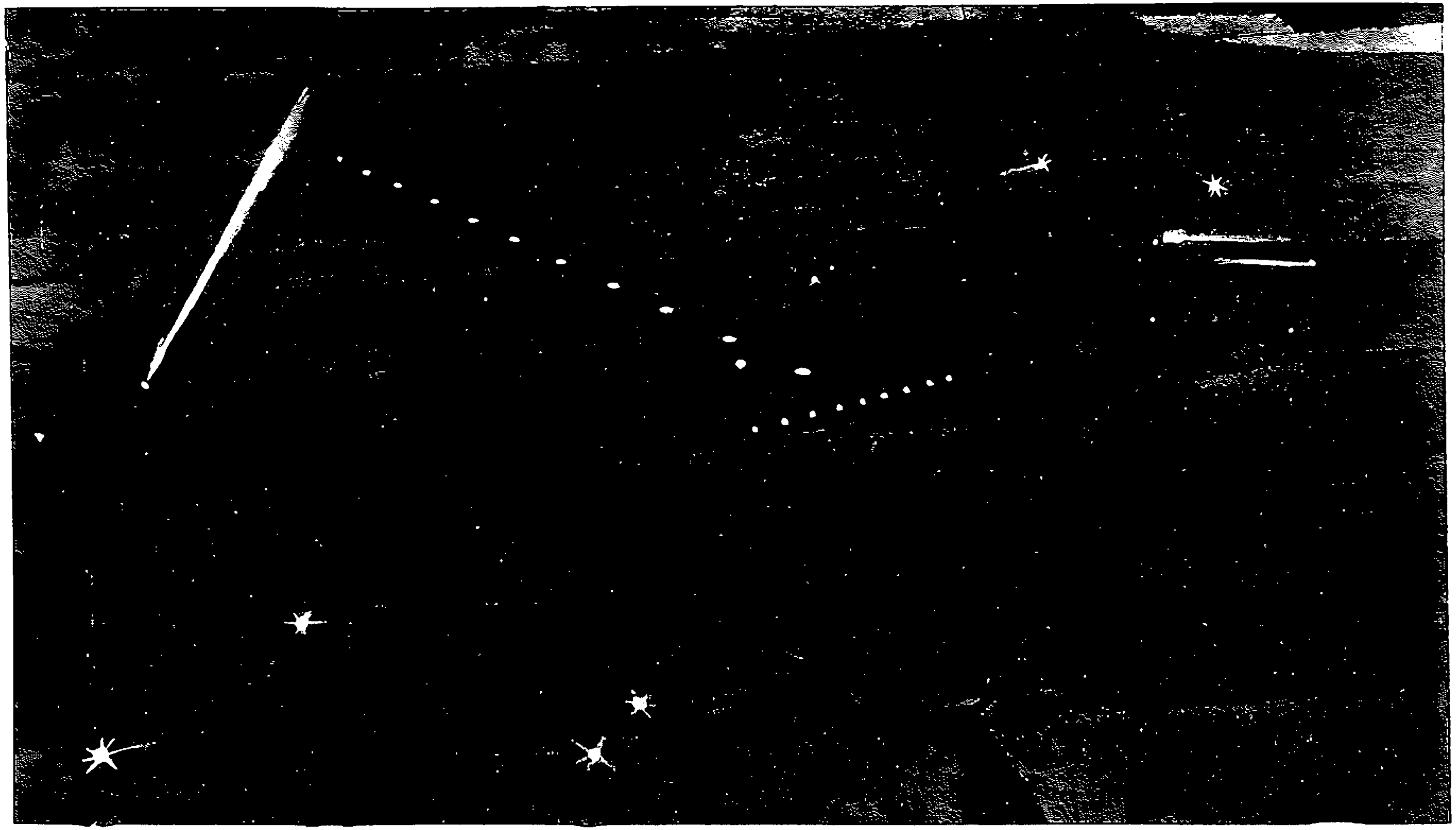
/9 lights



Q Site shelter control panel, showing flarepath switches and the controls for "Hares and Rabbits".



Q Site showing shelter Headlamp with Operator's handle for swinging the lamp.



Q. Lighting. A typical single line Q, showing position of "Red Bar" across the end of the flarepath, and the headlamp and miscellaneous bad blackout.

9 lights was fitted at both ends of the flarepath and special care had to be taken to see that the lights were not obscured by trees or other obstructions. As a further precaution the Angle of Approach Indicator was removed and the Red Bar lights were placed on the same circuit as the flarepath and a tell-tale light which could be seen from the shelter was also provided.

11. During 1941 and 1942, 124 Drem 'Q' sites were constructed, of these 90 were new sites and 34 were T. type sites converted. One of the difficulties with conversion to Drem was the considerably larger area required for the 1,000 yard flarepath and funnel, the overall distance of 2,300 yards. The normal crew for manning and operating a Drem 'Q' site was four - one Corporal and three A.C.H's.

12. In November, 1941, it was decided to construct 6 'Q' sites in Northern Ireland for the protection of the new airfields then being built. It was realized that there was a serious risk of information regarding such decoys in Northern Ireland reaching the enemy and possibly compromising all the 'Q' sites in the U.K.. It was therefore decided that the Northern Ireland sites should be entirely different in layout and that they should be on ground where aircraft could land, in fact landings with light aircraft were arranged so as to create a local impression that these sites were in fact E.L.G.'s. The lighting was in the form of a double "Avenue" flarepath, unhooded with Red Bar warning lights.

13. In the Spring of 1943, there were still some 50 T. type 'Q's in operation, mainly those sites where safety distances did not allow conversion to Drem type. Starting in May, 1943, 31 of these sites were converted to a new type of 'Q' known as the "Single Line". The lighting consisted of a single line of flarepath lights 1,100 yards

/long

long and hooded from above. There was no funnel but the former cable runs of the alternative 3 T's were utilized to provide miscellaneous lighting such as red obstruction lights, bad black-out, aircraft navigation lights, etc., all of which were on separate circuits so that they could be switched out one after the other. Some of these sites were very successful, e.g. the sites at KNIGHTON (for R.A.F. WARMWELL), and LULLINGSTONE (for R.A.F. BIGGIN HILL) on which the enemy made several determined and sustained attacks.

'Q' Site Difficulties.

14. In the U.K. the normal practice was not to requisition the land on which the lighting was installed but instead a "Works on Land" Notice was served on the local owners or tenants. 'Q' sites were frequently located on arable or grassland, and attention was paid to the minimum interference with agriculture. Lights had usually to be protected from cattle and the cable runs had to be buried either below turf level or 18" deep below plough level. In the second and third year of the war a great deal of grassland was ploughed up and this necessitated re-burying the cables at sufficient depth. Also all lights among crops had to be raised 3 to 5 ft. above the ground. A careful survey when the site was first constructed saved much work and alteration later on.

15. In many cases 'Q' sites had to be located on undulating ground and to avoid detection on this account some of the flarepath lights were set up on poles to get a reasonably level run. The maintenance of these raised lights proved difficult. Considerable clearances of hedges and trees had to be carried out in some areas particularly for the Red Bar lighting.

16. Every effort was made when siting to avoid streams and dykes which would cross the flarepath. In some districts, however, the choice of sites was limited and this was

/unavoidable.

unavoidable. In such cases instructions were issued that the sites should not be used in moonlight when they would be easily detected as dummy.

17. A problem which arose with some sites was the reluctance of the Station to use the 'Q' site at all, the theory being that they preferred a complete black-out in their district and that the 'Q' site might bring enemy aircraft into their area. Later, when 'Q' sites came to be regarded as a general measure of protection rather than for the particular airfields controlling them, this largely disappeared following instructions issued by the Commands regarding the lighting of 'Q' sites.

18. The problem of friendly aircraft attempting to land on 'Q' sites had to be kept constantly under review. One of the difficulties was that many pilots were being trained overseas and on arrival in this country they had no knowledge of 'Q' sites, or the means by which they could be recognized. The booklet issued by the Department in January, 1944 and illustrating the different types of 'Q' sites as seen from the air at night, proved to be the most effective way of dealing with this problem. The booklet "Beware 'Q' Sites" was issued, through the Commands, to "Flying Control" and in this way was brought directly to the notice of all night pilots.

<u>Moving Lights.</u>

19. Early in 1942 enemy intruders were becoming increasingly active and the attacks on our returning bombers when coming in to land and on trainees doing circuits and bumps were reaching serious proportions. As a means of protection against this form of intruder activity it was suggested by several formations that their 'Q' sites should be provided with moving lights which would simulate aircraft landing on the dummy flarepath and taxi-ing to

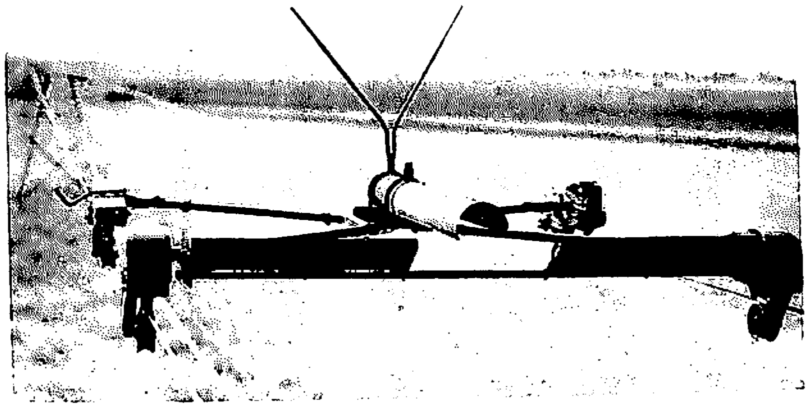
/dispersal

dispersal points. This equipment was developed and installed at the 'Q' site for MIDDLE WALLOP and came into regular use at this site in August, 1942. The moving lights went under the name of "Hares" (Landing aircraft lights) and "Rabbits" (Taxi-ing aircraft lights).

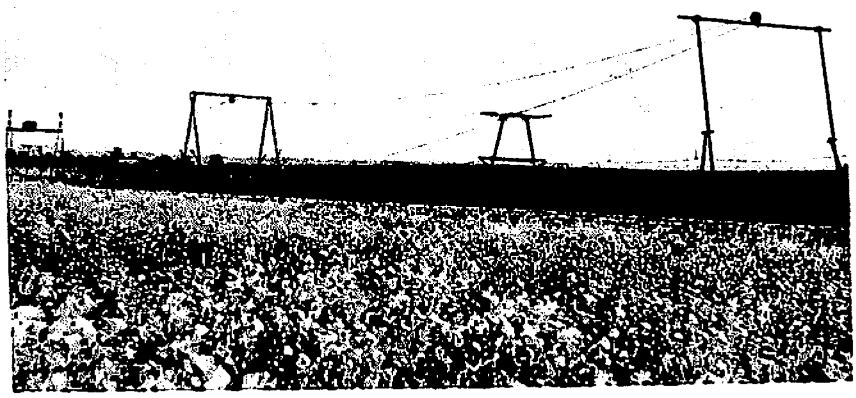
20. The "Hare" light was a set of navigation lights mounted on a trolley which travelled along a suspended cable track, about 12 feet high. The length of this cable was 1,000 yards and the trolleys were propelled by a specially designed rocket with cordite charge and special jet. It was found by observation that a minimum speed of 40-50 miles per hour was essential to simulate reality. This necessitated careful tensioning of the cable, special breaking arrangements at the end of the run and some means of adjustment for operating in varying wind strengths. It was also necessary to hood the flame of the rocket propulsion unit from the air view.

21. The "Rabbit" lights were lamps similar to aircraft headlamps and navigation lights, which were carried on suspended cables, one moving towards take-off point and one as for an aircraft that had landed and was taxi-ing away to dispersal. Motive power was supplied from electric motors, the course of the lights was curved and irregular, and to simulate reality the lights were automatically switched on and off while they moved along. Speed was approximately 8 m.p.h. and the distance travelled by each approximately 400 yards. The lights were operated in a definite sequence, e.g. "Rabbit" taxi-ing to take-off point, then pause for "Hare" to land, followed by the second "Rabbit" taxi-ing away to dispersal. All the controls for these special lights were located in the 'Q' shelter and were operated together with the Flarepath Funnel and Floodlight, as for aircraft taking off and landing. After 6 Hares had been fired, the 6 trolleys carrying the landing lights had to be pulled back by hand to the starting

/point

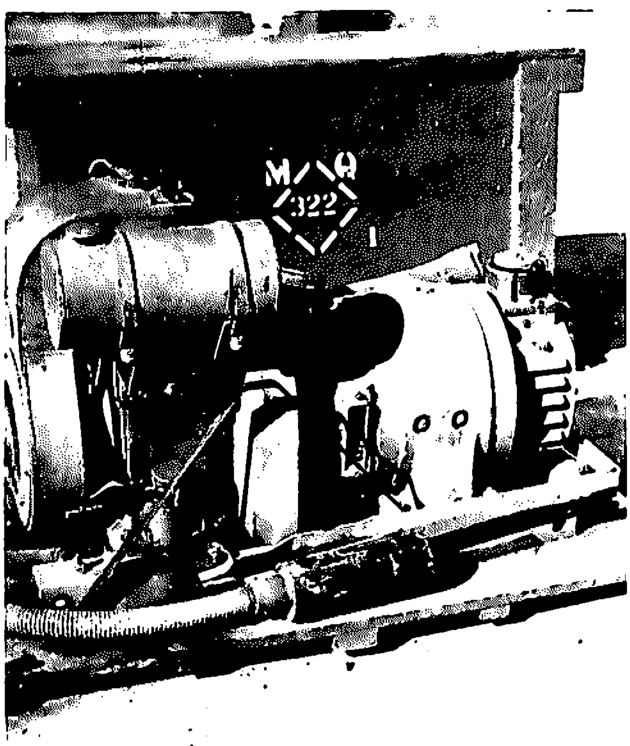


Q site Travelling Landing Lights ("Hares"), showing 3-colour navigation light of aircraft (centre-right), and reaction propulsion unit with flame-guard (centre). The Vee brake-fork for engaging trailing brake rope is seen above reaction unit, and the adjustable air-brake flaps are at rear of trolley.



Q site Travelling Lights equipment showing "Hare" Track and brake rope.

M.Q. set complete.



M.Q. Generator (1½ K.W. Jap-Higgs)

point and reloaded, this required approximately 40 minutes.

22. When seen from the air these moving lights were very effective and provided the movement and life which were often considered lacking in the normal 'Q' site. It is interesting to record that the "Hares and Rabbits" lighting was attacked by an intruder on the first night it was operated. This special equipment was not however proceeded with on other 'Q' sites owing to sudden decline in all intruder activity about the end of 1942.

Mobile 'Q' Sets.

23. The static 'Q' sites in the U.K. were constructed either by the Air Ministry Works Services or by civilian contractors, but in the early part of 1942 a more mobile equipment, with all the necessary cable, fittings, generators, etc., was required for future operations overseas.

24. A Mobile 'Q' set (M.Q.) was produced and a number of these sets were sent overseas. The equipment was similar to that in use on the static 'Q' sites, but the generator, cable (in 100 yards lengths fitted with plugs and sockets) light fittings, etc., were boxed so that the set could be easily transported and set up in the field. The M.Q. set provided a single line flarepath, 1,200 yards long with the warning bar of 9 Red lights. Two R/T sets were also provided to give communication to the parent airfield. Sundry extras were included such as tools, tent, spares, siting poles, etc. to make the equipment self contained and the complete set consisted of packages - total weight 26 cwt. As some of the loose 'Q' equipment which had been previously sent overseas for decoy purposes was in fact pressed into service for operational flarepaths on airfields, the M.Q. sets were supplied with special hoods for all flarepath and Red Bar lights, so

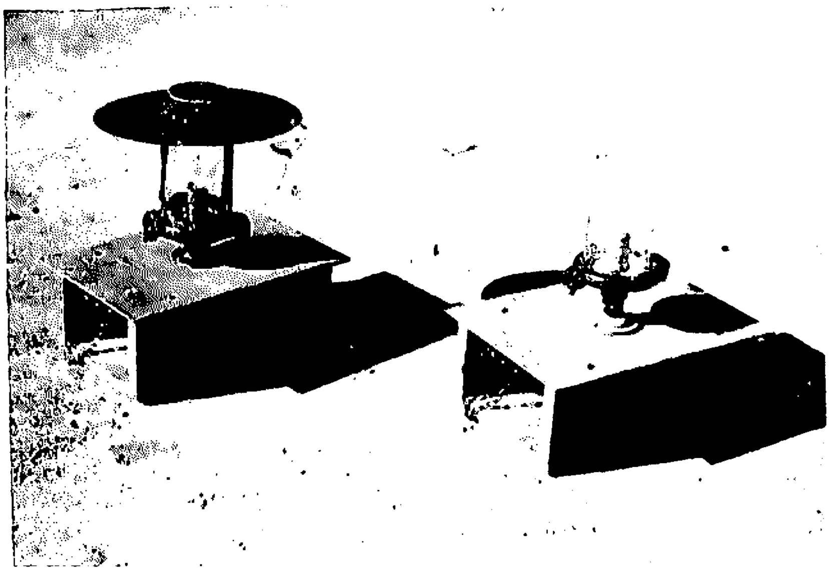
/that

that the set could provide a fully hooded operational flarepath of 1,600 yards if required.

25. In the summer of 1943 a light weight 'Q' set was produced (Assault Q or A.S.Q.) which could be more easily transported by air or manhandled by 3 or 4 men over rough country. A smaller light weight generator (J.A.P. Chore Horse) was employed fitted into a portable case. The cable (V.I.R.) was similarly supplied in 100 yard lengths and fitted with plugs and sockets. The light fittings (6 watt) were fitted with reflectors so as to give the same brightness as the M.Q. flarepath, but in one direction only. Red Bar lights and operational hoods were also supplied.

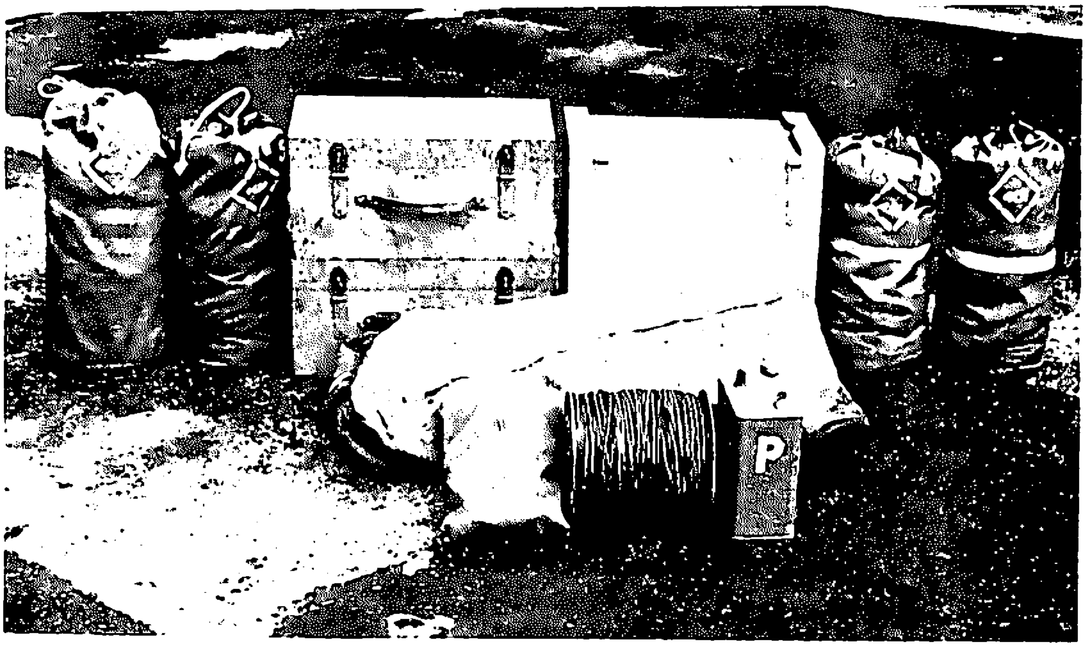
26. This set provided a decoy flarepath of 1,000 yards with Red Bar or alternatively an operational flarepath of 1,700 yards. To overcome the voltage drop and give a balanced load, the generator was located centrally and the power fed through 3 separate circuits. No R/T sets were provided but the generator was fitted with a detachable panel and remote control.

27. The set consisted of 10 packages the total weight being 6 cwt, 23 lbs. The normal time required by a trained crew of 6 men to lay out and get the flarepath working was 2½ hours. Two men were sufficient to operate. A considerable number of these A.S.Q. sets were produced. Some 36 sets were supplied to II Tactical Air Force. 25 were supplied to U.S.A. Army Air Forces and a large number were later incorporated in the Special Mobile Airfield Lighting sets for use as operational flarepath overseas.



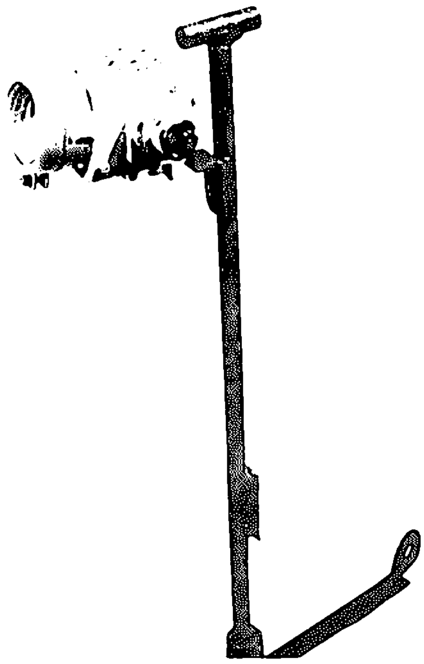
M.Q. hooded and unhooded flarepath lights

M.Q. Red Bar Light Fitting, showing type of hooding and thumbscrew for adjusting angle of visibility.

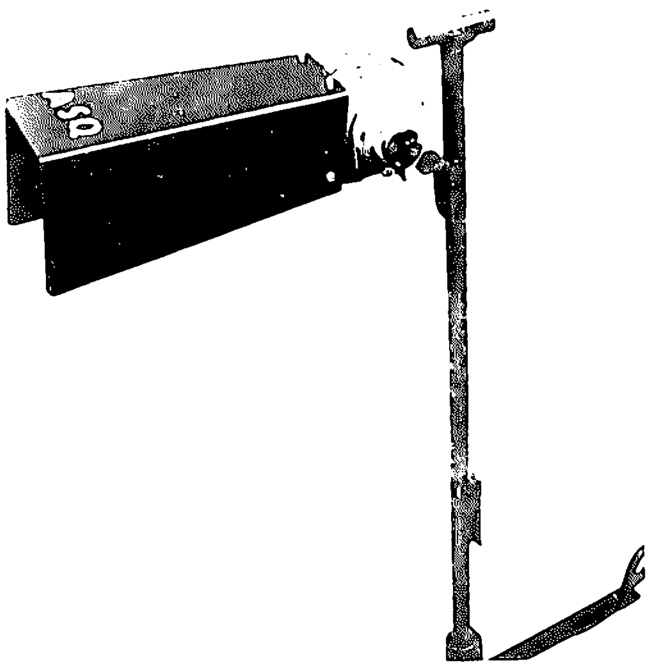


A.S.Q. set showing packages ready for transport

A.S.Q. Generator showing the 3 feeds to Flarepath.



A.S.Q. Flarepath light - unhooded



A.S.Q. Flarepath light showing the hood attached for use on the red bar and on the Flarepath lights when used operationally.

CHAPTER XXIII.

THE DEVELOPMENT OF Q.L. DISPLAYS.

1. The dummy lighting for the protection of important targets such as railway yards, docks, factories, etc., could obviously not be set up to any standard layout, as in the case of 'Q' sites, and the lighting at each QL site had therefore to be specially designed so as to correspond in all important features to the lighting in the nearby target. This simulation of the lighting in the parent target raised a variety of problems. Even where the same type of lights and fittings were used in the decoy as in the target, e.g. A.R.P. hooded marshalling yard lights, and occasional bare lights, the appearance of these lights from the air, when set up on the decoy sites, was noticeably different from the target: this was due to the difference in the reflecting surfaces of the ground, i.e. rough ground or grass, as compared with the roadways and yards, also the absence at the decoy site of any buildings, smoke, steam, and all movement, which in an industrial area gives many of the lights a constant blinking or flickering appearance.

2. Experience was gained by frequent air observations, both on parent targets and the QL lighting on various types of sites, and this showed that the required realism could be obtained in various ways, and without necessarily duplicating the exact type of lights or movement found in the target. With A.R.P. hooded pole lights (as used in marshalling yards), it was found preferable to vary the height of the poles in the decoy, and to site some of the poles on banks or uneven ground. The wattages of the bulbs were also changed, so as to get the right effect on the decoy site. It was also found that the appearance of

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the decoy was much improved if some of the hooded lights were fitted with amber bulbs or amber screens, which provided a further variation in the pools of light thrown on the ground from these A.R.P. fittings. This question of variation in the type, colour, and intensity of the lights, was important: in the target it occured on account of variety of different reflecting surfaces: in the decoy it had to be artificially arranged. Similarly, to provide for the blinking and flickering of lights, due to buildings, smoke, and movement in the target, a proportion of the lights in the decoy were partially screened by sheep hurdles, sticks, or reeds, or they were screened from certain directions: this had the effect of obscuring the lights irregularly, or of producing a flicker (according to the type of screening used), when seen from an aircraft travelling at over 150 m.p.h.

3. Furnace glows - typical feature at many factories and railway yards - had to be artificially reproduced: similarly, electric flashes, tram flashes, loco glows and acetylene welding work, were characteristic features of many targets, and these effects were reproduced with specially designed equipment so that a realistic simulation, capable of being mistaken for the target, could be built up.

4. The most important feature, however, of all QL sites, was the general layout or plan of the lighting which was made to conform as far as possible to the layout in the target, so that a pilot who had been briefed for an attack would recognise in the decoy the features he would be expecting to find in his target.

5. In the sites protecting railway marshalling yards, the main feature was the typical long lines of A.R.P. hooded lights, oriented where possible to correspond to the target. Many marshalling yards were so extensive that only a portion of the yard could be covered in the decoy, owing to the

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difficulty in getting sufficiently large decoy sites in the industrial areas. The remainder of the picture was built up with loco glows, red and green signal lights, flickering lights, and effects reproducing lit skylights, open doors and other miscellaneous bad blackout.

6. Factory lighting was built up in the same way, the decoy layout following the general plan of the factory, with its railway sidings, roadways, buildings, etc. Different types of factories and works required different treatment in detail, and special artificial glows had to be designed for particular purposes, e.g. for the decoys protecting aluminium works.

7. For docks and shipyards, the rectangular layout of the docks and wharfs was the main feature, and was reproduced in the decoy design with long lines of lights surrounding the unlit areas corresponding to the docks. Where possible, lights reflecting on water were appropriately sited, and the remainder of the picture was built up with flickering lights, electric flahses, loco glows, riveting fires, skylights, railway signal lights etc. These miscellaneous effects produced the characteristic features which can always be seen in dockyards and shipyards working at night, i.e. the features which an experienced pilot will immediately recognise from the air.

8. Dummy camp lighting was built up mainly of irregular and miscellaneous "bad blackout". This consisted of partially screened lights, either by siting the effects near trees, or by hurdle screening. Vehicle sidelights, occasional vehicle headlights, and small flashing lights simulating hand torches all assisted in producing the typical picture presented by a large military camp. Dumps and stores-parks were similarly reproduced, the lighting in this case usually taking a more regular layout following

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the characteristic plan of roadways, sidings, etc.

9. A series of special coastal sites was constructed, simulating embarkation points and embarkation activity. The main features on these sites were the accumulation of vehicles (sidelights) at the water's edge, jetty lights over the water, and the intermittent lights flashed by hand torches. Convoys of vehicles approaching the embarkation point were simulated by irregularly spaced lines of sidelights, headlights and red rear lights, sited as if the vehicles were approaching along the routes leading to the embarkation point or hard.

10. Practically all QL sites were fitted with two circuits, the main circuit or "Primary" consisting of what might be the "permitted" lighting, i.e. the additional lighting permitted on railways and in industrial areas, even during the blackout. The second circuit represented the reduced lighting which would remain on, and "bad blackout" which might also remain, after the "permitted" lighting had been turned out on receipt of a warning. On some sites which had large schemes, there were additional circuits which could be used independently, if required.

11. Details of the chief types of effects used are given below.

<u>Marshalling Yard Lights.</u>

These were the usual type of A.R.P. hooded light, carried on a pole, and throwing a pool of light on the ground. On the decoy sites, the wattages used varied from 25W - 60W, and the height of the poles was varied between 5 - 15 feet. These formed the main background of most schemes.

<u>Furnace Glows.</u>

These consisted of a series of 8 or 10 - 100W lamps fitted with red and amber screens and hooded from the air, and illuminating a patch of light earth or sand. The glows were always on

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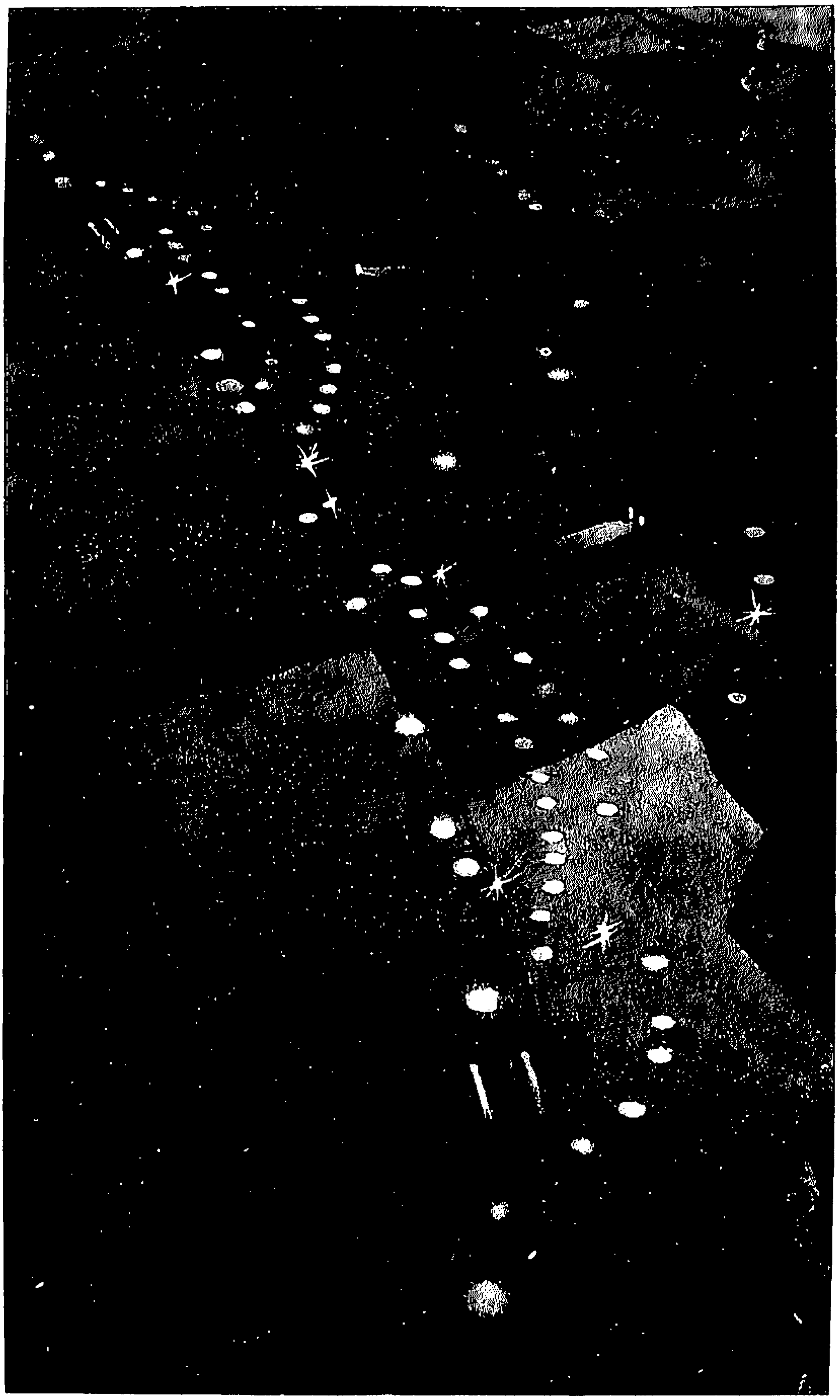
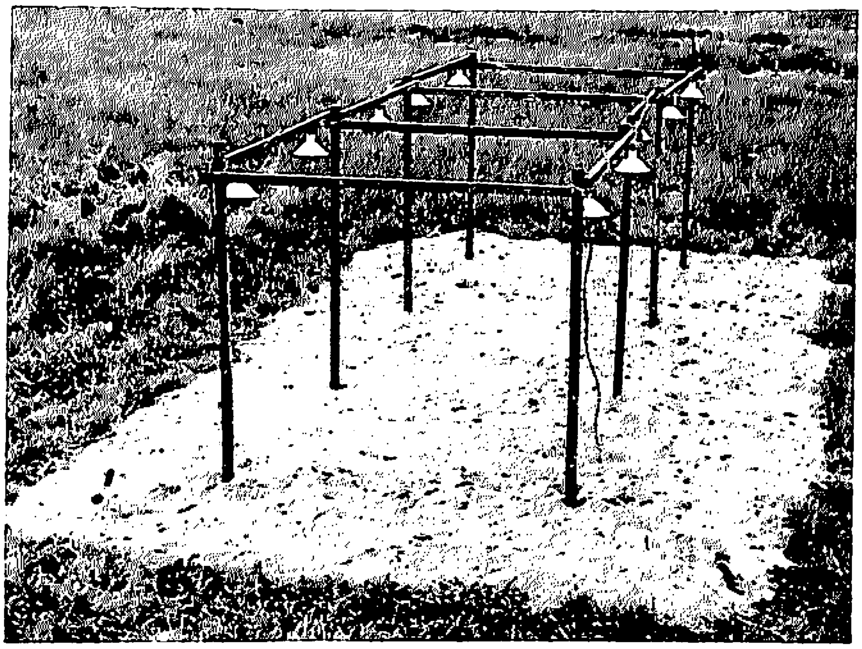
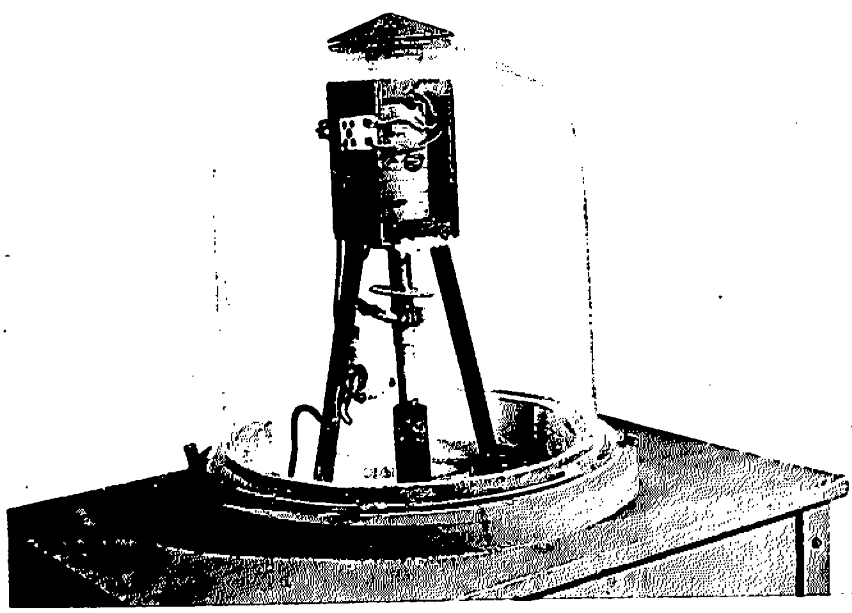


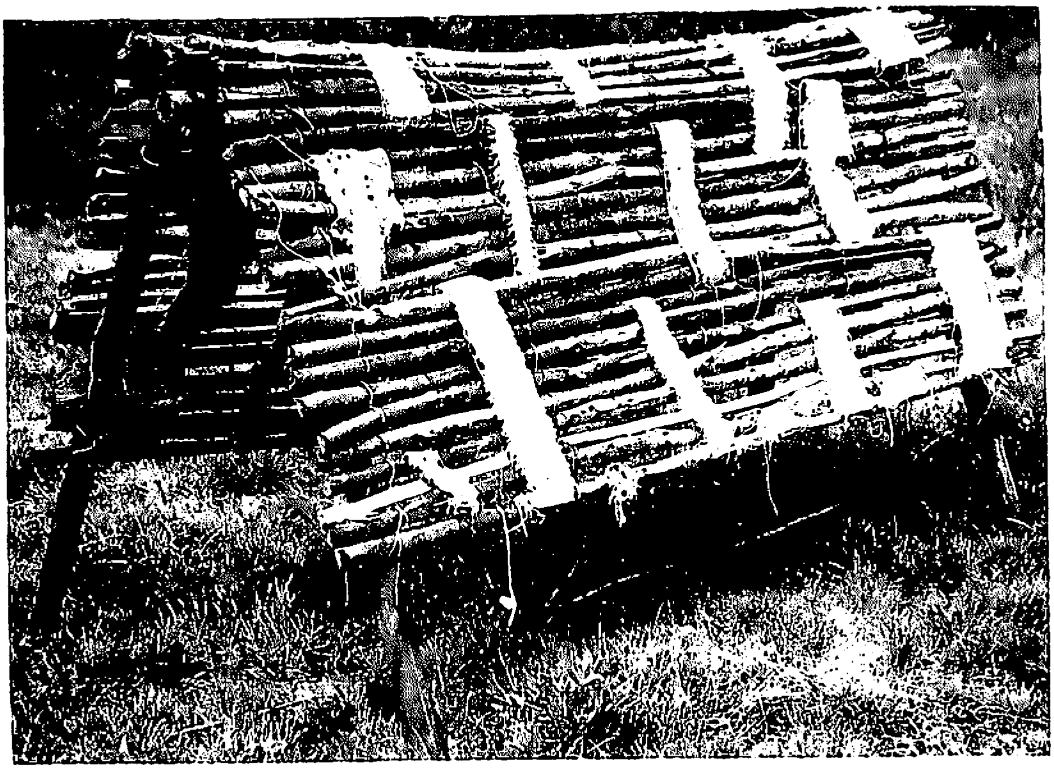
Q.L. Lighting. A typical Marshalling Yard with Permitted Lighting and illustrating the recognizable layout of hooded lights.



Q.L. Furnace glow showing the set-up of red and amber lights illuminating a patch of sand which reproduced the appearance of furnace and locomotive glows.

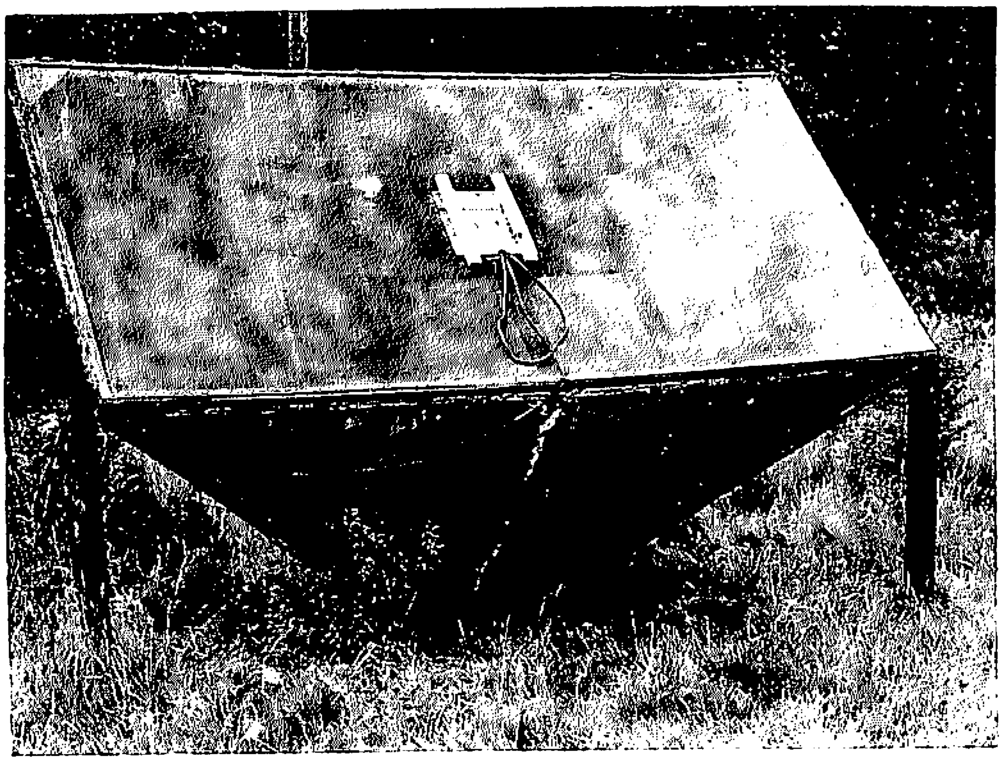


Q.L. Tram Flash showing the usual carbon arcs with glass cover for protection from weather.

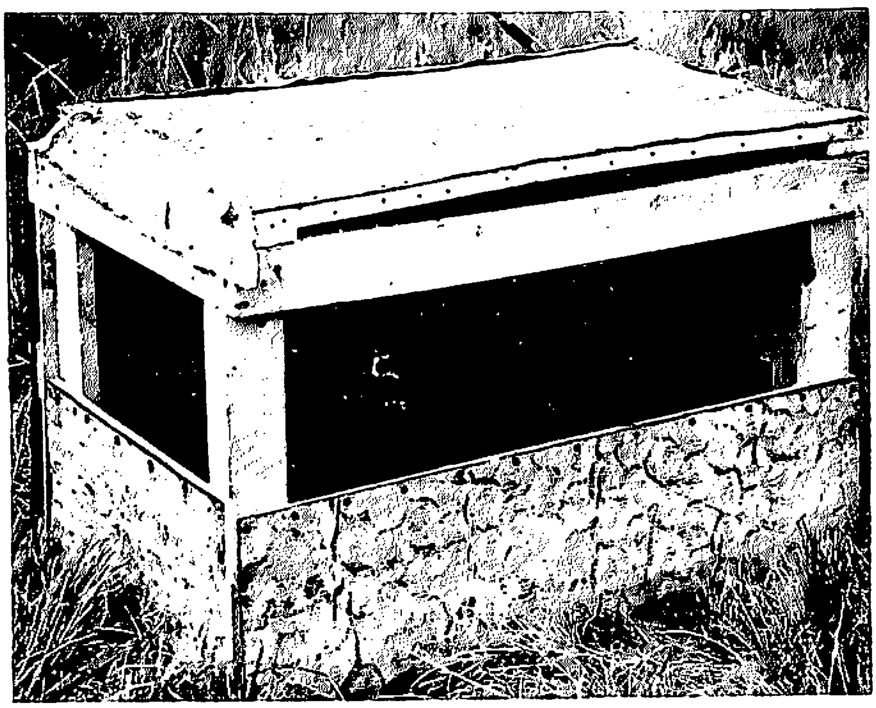


Q.L. Hurdle Light which provided a partial screening of the light and presented an irregularly blinking light to a moving aircraft.

Q.L. Reedlight. A modified form of Hurdle Light presenting to an aircraft more uncertain twinkling light, as the apertures were smaller.



Q.L. Skylight. The whitewashed interior reflected light from a lamp fixed under the wooden panel.



Q.L. Boxlight. Used for throwing diffused light on to walls, hedges, banks, etc.

a separate circuit and fitted with a dimmer, and the glow was operated by moving the dimmer slowly upwards and downwards, so as to stimulate the type of glow required. Loco Glows were constructed in the same way but were usually smaller, and the timing of the operation by the dimmer corresponded to the opening of the fire box in a locomotive and the gradual dimming down of the glow as the fire box was re-stoked: a feature of railway yards easily recognisable from the air.

Tram Flashes.

These were provided by carbon arc lamps fitted with a special mechanical switch which gave a single or compound flash intermittently. The glass lamp covers were blued over to give the right colour. The lamps operating at any one site were separated as widely as possible (usually one was at the shelter and one on the far side of the site), so that it could not be easily detected that these flashes were always coming from the same spot. Factory electric flashes were operated in the same way, with a variation of timing and colour.

Hurdle Lights.

These were naked lights in the usual type of bulkhead or wellglass fitting but particularly screened from the air with hurdles or sticks which, to a moving aircraft present a blinking or unsteady light. The Reed light was similar but the covering was by matting made of rush. Owing to the closer mesh, the uncertainty of these lights, when seen from the air, was more in the nature of a flicker. Bulbs of 15W, 25W and 40W were used in both Hurdle and Reed lights. Amber coloured lights were also employed to get variety.

Box Lights.

These were naked lights, boxed on two or three sides

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and completely hidden from above. They threw a diffused light in one direction and were used to illuminate a wall or bank, and where heavy shadows could be produced these lights were found to be a valuable addition to almost all types of QL's.

Riveting Fires.

Bare lights were used, covered by screens which were partially red, partially amber, and partially black out. From the air, these "fires" appeared to glow and die down. Items such as these either had to be on a separate circuit or were included in the residual or "bad blackout" circuit.

Vehicle Lights.

These were ordinary fittings adapted to resemble the lights of vehicles. They were normally set in pairs 5-6 ft. apart.

Railway Signal Lights.

These were normal wellglass fittings, screened from directly above. Red and green bulbs or screens were used. It was found that the most suitable strengths for these decoy effects were 40W for red lights and 25W for the green. They were only visible from one direction.

Skylights.

These were specially constructed effects, giving a rectangular patch of reflected light from a box frame approximately 8' x 5'. The interior of the structure was white-washed, the open top covered with a thin scrim and the bulb strengths were varied between 25W, 40W and 60W.

Open Doors.

These were similar effects with a strong bulb - usually 100W, illuminating a white-washed interior. "Leaky lights" and "Eave Lights" were similarly constructed, but experience showed that except from a very close up view such detail in shape was unnecessary, and the more important requirement

/was

was variety - in type, strength, colour and movement.

Torch Lights (or "Jinx").

The quick and irregular flash of a hand torch could only be simulated by a switched light or by a light which was actually moving behind some form of screening which would obscure the filament intermittently. This latter method was found to be both simple and effective. The bulb had to be of a type with a small bright filament to get a quick cut off, as the light was obscured. By suspending both the bulb and the latticed screen so that they could move independently, it was found that even in practically still air there was always sufficient swing and movement to produce a sharp flashing as the filament was exposed through the apertures of the screening. A group of these lights were occasionally used to simulate a light reflected on water. The 7 or 8 Jinx lights employed were set up irregularly over a circle 15-20' in diameter and produced a good simulation of water reflection.

12. These various miscellaneous effects, although individually unimportant, were collectively an essential feature of the successful QL. An aircraft first spotting the decoy from a distance would see only indefinite and unrecognisable lights; from nearer in, the general layout would begin to take shape, and a closer inspection would reveal more detail with the weaker lights coming into view and recognisable features building up the complete picture of night activity on the ground.

13. In the United Kingdom most of the static QLs were set up on ground near the Starfish sites, and the same crew operated both decoys. The area covered by the lighting varied from 4-5 acres in the case of small sites to 20-30 acres for large schemes, but on most sites the extent of the lighting was restricted owing to lack of

/space

space and the necessity to preserve the standard safety distances from occupied property. The static QLs were all built by contractors to the layout schemes prepared for each decoy.

14. Mobile QL sets.

As in the case of the Q decoys, it was found necessary in 1942 to provide some form of mobile equipment which could be transported as required and could be easily set up in the field by an R.A.F. crew of 5 or 6 men in a few hours. To meet decoy requirements of different kinds both at home and for overseas, 3 types of sets were produced - the MQL (Mobile QL), the ASQL (Assault QL) and the BQL (Battery QL).

15. The M.Q.L. Set.

This mobile lighting set was provided with a 1½ k.w. J.A.P./Higgs Generator Unit (D.C.) with control panel and dimmer, and two circuits which could be separately switched. The power unit operated at 235/240 volts to give a working voltage of 220/230. The feed cable, i.e. the 600 yard run from control point to site, consisted of 7/064 Twin with 600 yards 7/064 Single, acting as a common return for both Circuits. The site cable consisted of 3100 yards 3/029 in 100 yard lengths, plugged at ends, and carried on drums. The light fittings consisted of 36 wellglass mountings with 32 brackets and shades (Marshalling Yard Type), 6 "Jinx" shades, and a selection of bulbs of various strengths, coloured wellglasses, etc. The set included all necessary junction boxes, tools, spares, etc., together with a tent for the crew. The complete set consisted of 20 packages and the total weight was 31 cwts. 16 lbs. Poles for the Marshall Yard lights were not provided but the brackets could be easily attached to any poles available locally. Similarly, "Hurdle Lights", "Box Lights", "Signal Lights", etc., were improvised locally on the site. The M.Q.L. provided

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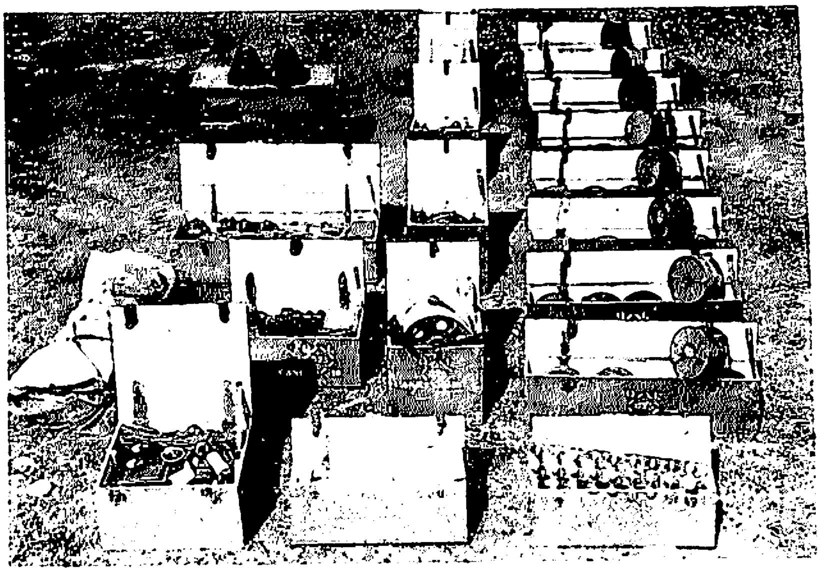
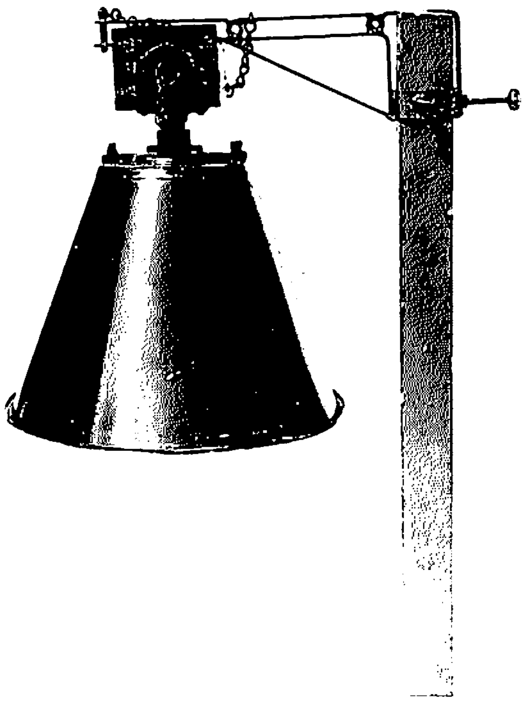
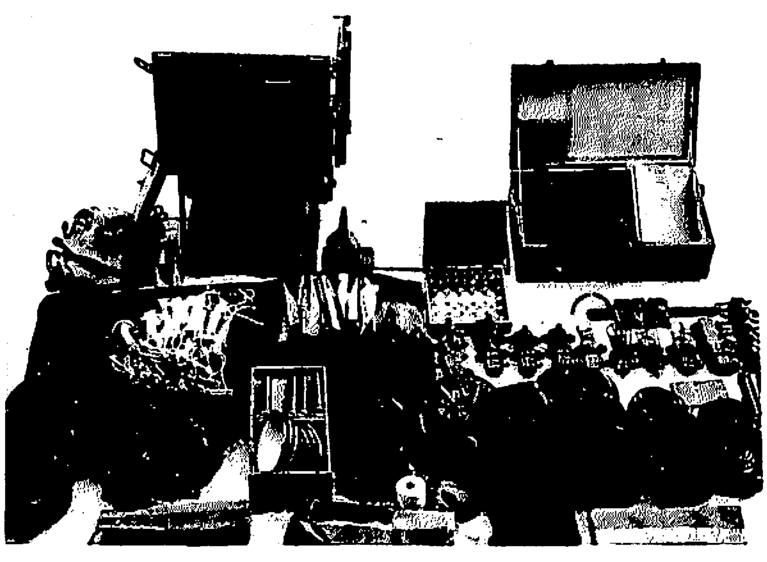


M.Q.L. set showing contents of boxes. The eight boxes of cable on the right provided 3200 yards of 3/029 in 100 yard lengths.



M.Q.L. Marshalling Yard fitting showing adjustable bracket, feed sockets and shade.

A.S.Q.L. showing the six packages comprising one complete set.



A.S.Q.L. showing contents of the six packages laid out.

sufficient equipment to set up the lighting required for simulation of a dump, camp or railway yard. For more extensive schemes such as large marshalling yards, docks, etc., two or three sets combined would provide all the essential lighting and features required. The area normally covered by one set was approximately 30-50 acres.

16. The A.S.Q.L. Set (Assault QL.).

To meet the operational requirements of Forces in the field, particularly in the early stages of invasion, a much lighter weight set was required which could be easily manhandled over rough ground, or carried ashore from landing craft, by 5 or 6 men. The A.S.Q.L. set was produced for this purpose, the set consisting of 6 packages, all easily portable, and with a total weight of 4 cwts. 32 lbs. The power was supplied by a J.A.P. Chore Horse engine (weight 95 lbs.) with Eleven hundred yards of Cable - V.I.R. in 100 yard hanks - plugged at ends, and 14 light fittings with a selection of shades, bulbs, "Jinx" hoods, etc. No feed cable was supplied, the set being designed to operate with the generator situated centrally in the lighting, but for remote control some of the sets were provided with a relay operated switch, together with 400 yards of D.8 control cable.

The A.S.Q.L. set provided sufficient equipment to simulate a small camp or dump, or other military activity: the area normally covered by one set was 12-18 acres. One feature of the A.S.Q.L. was that it could be set up to represent a convoy of vehicles with head lights, for which special collapsible hoods were provided. Two sets together could be used in a variety of ways, e.g. to represent a long convoy of vehicles with an irregular line of head lights and side lights up to approximately 1½ miles in length, or half this quantity of vehicles approaching a

/dump

dump camp or headquarters. The sets were successfully used to simulate embarkation activity near Hards in this country and night activity on specially selected decoy sites near the Beaches in Normandy. The A.S.Q.L. set was complete with full spares, tent for the crew, and all necessary tools. For invasion tasks on D day, all packages were specially waterproofed (including the generator case), so that the sets would remain serviceable even if immersed in sea water. The standard J.A.P. Chore Horse Generator used in these sets was fitted with a larger petrol tank so as to give a duration of 4 hours running, and although this set was not as robust as the heavier M.Q.L. it gave surprisingly little trouble provided it was properly looked after. One of the advantages with this equipment was the low operating voltage of 38/40 volts. As with the M.Q.L., the "Hurdle" lights, poles for Marshalling Yard lights, "Box Lights", etc., were improvised locally to avoid carrying any unnecessary items.

17. The B.Q.L. (Battery QL).

This equipment differed from all other mobile sets in that all the lighting was battery operated; there were no cables to a central control point and the lights had to be switched on or off individually. Primarily, this set was used for simulation of vehicle side lights, i.e. concentrations of Transport or Armoured vehicles of all types, stationary or in convoy. Each 2 volt battery carried a pair of lights and each set or unit consisted of 36 pairs, i.e. sufficient to represent 40-50 vehicles, as some lights and the red rear lights were used singly. A few "strong lights" were included and some "Jinx" lights added to provide the variety and movement which is essential for reality. As the spread which could be given to this type of lighting was not restricted by any connecting cables, the layout could be extended at will, and in fact a typical set out representing

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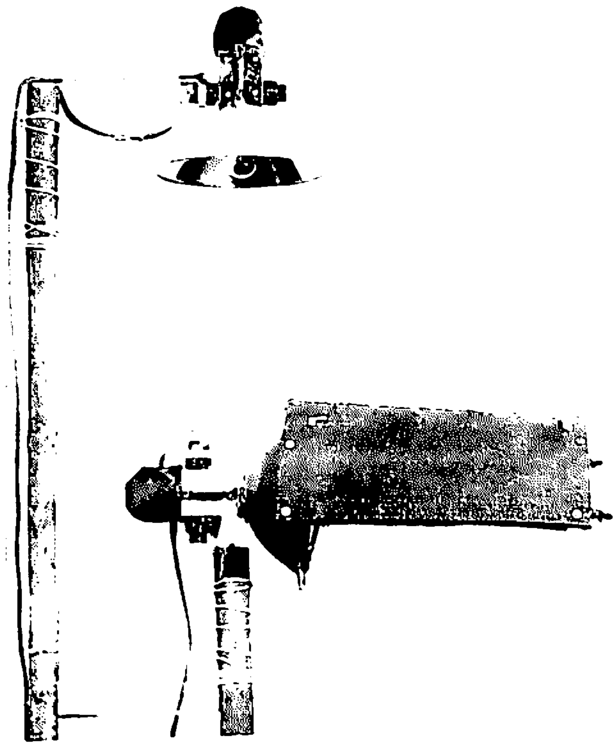
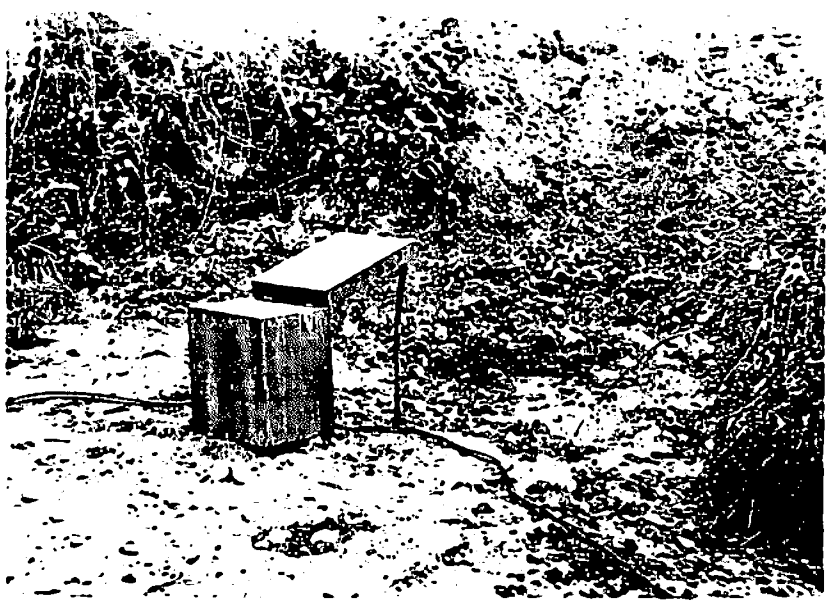
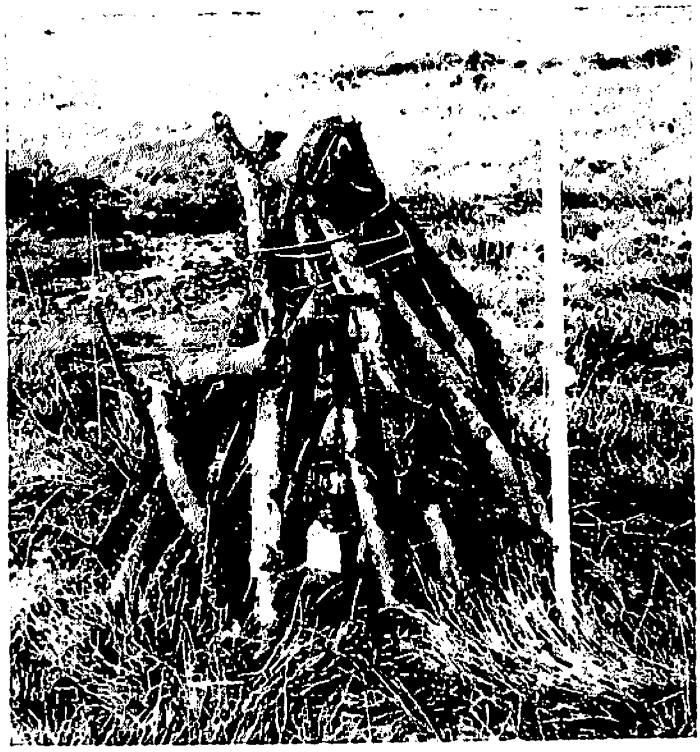


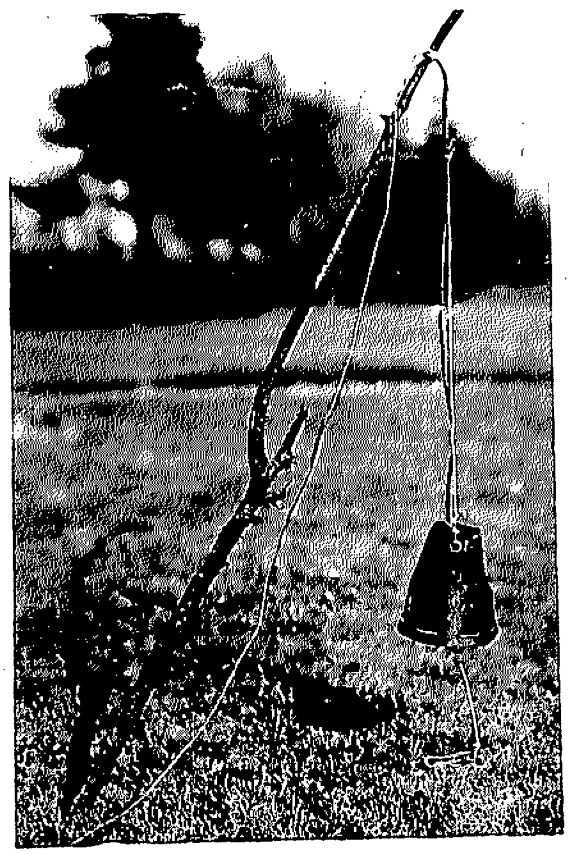
A.S.Q.L. showing attachments and fittings used for:- (a) Marshalling Yard Light.
(b) Vehicle Headlamp with collapsible louvered hood attached.



A.S.Q.L. Boxlight adapted from one of the packages.



A.S.Q.L. An improvised form of "Hurdle Light" constructed in the field.



A.S.Q.L. Jinx Light showing the collapsible type of swinging hood with apertures and separate swinging lamp as set up in the field.

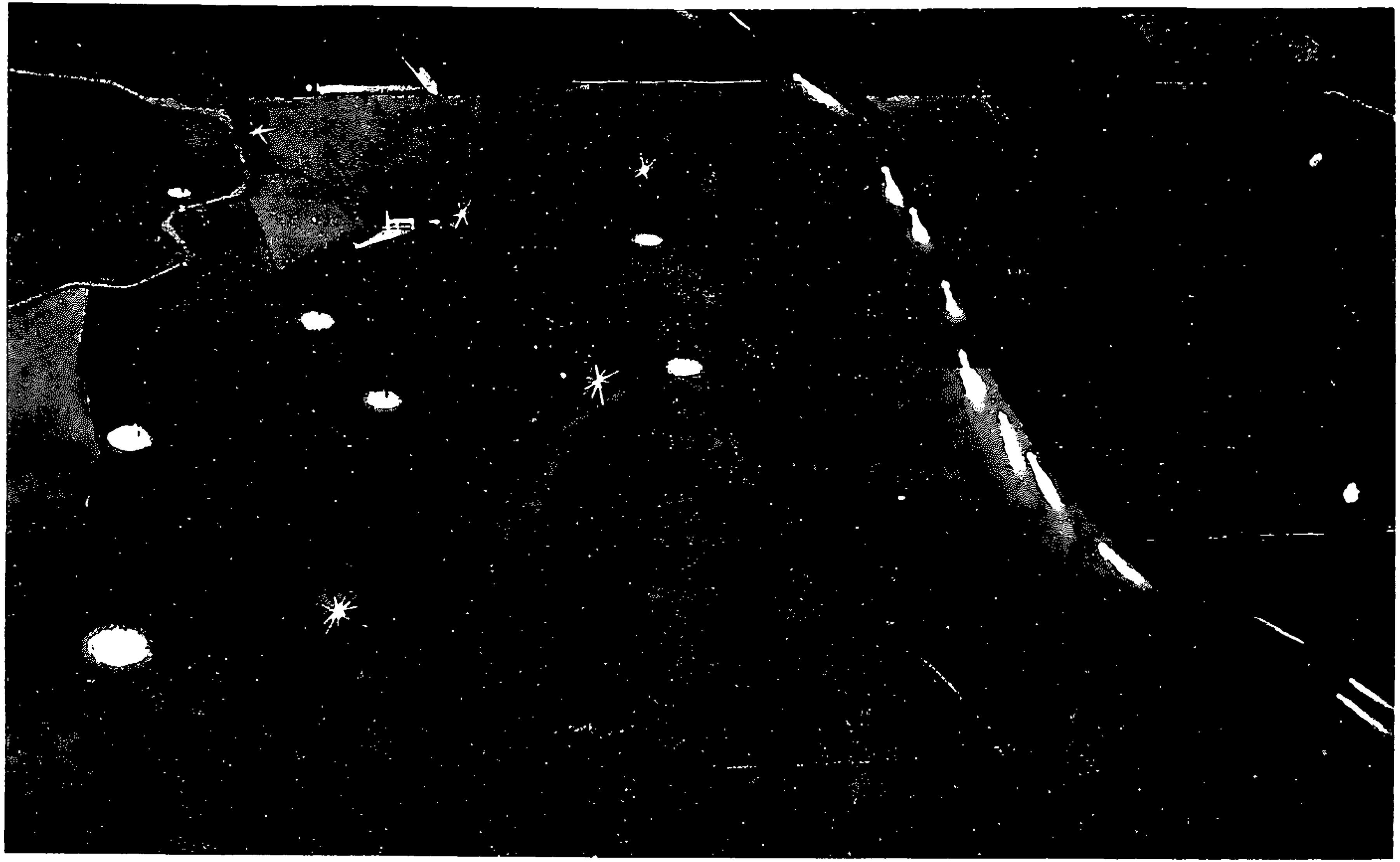
an Armoured Brigade might cover an area of 2-3 square miles (say 6 B.Q.L. sets representing 250/300 vehicles). When in use, lighting of this type had to be switched on before dark, as even in daylight the small batteries and lights were difficult to locate and had to be marked with stakes and flags which formed part of the set equipment. With fully charged batteries the burning duration was 25-30 hours for the side lights, with shorter periods for the "strong lights". When these B.Q.L. sets were used in conjunction with M.Q.L. or A.S.Q.L. sets, the re-charging of the batteries could be carried out during the daytime on the generators available, and sufficient spare batteries were supplied to allow for easy operation. Where no M.Q.L. or A.S.Q.L. generators were available, special charging engines and other accessories had to be supplied, the normal arrangement being one Norman Lyon charging engine and one box of B.Q.L. accessories (tools, acid, distilled water, etc.) per 3 B.Q.L. sets. The batteries were carried in crates of 12, and so arranged that a complete crate could be coupled up for charging as one unit.

Air observations on this type of lighting showed that the pairs of lights were distinctly visible as pairs up to 7000-8000 ft. The variations in spacing corresponding to cars, lorries and tanks, were also recognizable. The fact that lights were stationary could not be easily detected, particularly if some of the lights were partially screened so that they were intermittently obscured or flashed. Irregularity in strength was important and was arranged by partially smearing the bulbs with paint. In the layout there was a tendency to get the lights too close and congested and too regular in pattern, and this danger had always to be watched.

/Normally

Normally the B.Q.L. sets were used in conjunction with either M.Q.L. or B.Q.L. sets and this combination was very effective.

18. In all, approximately 1000 Mobile Lighting Sets were made up: this figures includes sets supplied to U.S.A. Forces (196 sets), 21 Army Group (40 sets), Admiralty (12 sets), II T.A.F. (270 sets), other Overseas Theatres (77 sets).



Decoy lighting with A.S.Q.L. sets illustrating camp and convoy layout.

CHAPTER XXIV

DEVELOPMENT OF DISPLAY FIRES (QF, AND STARFISH)

Long before the outbreak of the war it was realised that one of the major dangers in enemy air attack on this country would be from Fire: that is Fire caused incidentally as a result of HE. bombing, or wide-spread fires deliberately started by the use of incendiary bombs. The development and importance of this intentional fire raising type of attack, the enormous loads of IBs which were eventually to be carried by attacking aircraft, and the magnitude of the destruction that was to follow could hardly have been foreseen.

Incendiary bombs were first employed by the Germans on this country in March 1940; four days later we used them for the first time in an attack on the seaplane base at Hornum. The deliberate fire raising by air attack had begun, and it was soon realised that a fire, once started in the target area at night, brought with it a second and even more serious danger, in that the fire acted as a beacon to the following aircraft, and as an aiming point for a further attack. This led automatically to the development of decoy fires, the most important and probably the most effective of all night decoys, and which were, later, to be intensively developed both by us and by the Germans, for the protection of nearly all important targets.

Prior to August 1940, enemy air attack by night was scattered but confined mostly to coastal districts; there was no serious bombing of towns and cities or large centres of population. In anticipation of the objectives likely to be selected by the enemy as bombing developed, the first decoy fires in this country were built for the protection of

/particular,,

particular, and often isolated, factories or plant of vital importance, such as aircraft factories, oil installations, maintenance units, etc. These QF's (decoy fires for particular V.P.'s) were usually located 3-4 miles from the target; the fires were small and had a duration of 45-60 minutes. The decoy was under the direct control of its Parent V.P., and the policy was to light the decoy fire immediately any fire broke out in the Parent, and at the same time to get the fire started by the enemy under control as quickly as possible so as to present the decoy as the target for all following aircraft.

The types of fires built for these early QFs are illustrated in the photographs at the end of this chapter. They were fired electrically from the control shelter (situated some 600 yards from the fire) which, in turn, was connected by telephone tie-line to the decoy controller in the Parent V.P. The main requirement was a fire which would get going and show a big blaze quickly, and the No. 1 fire (the frame building in which the combustible material was tarred roofing felt) did this very well, but even with the additional rolls of roofing felt (these unrolled and fell at intervals as the holding strings burnt out) this fire did not last more than 20-25 minutes. The other types, in which the combustible materials were coal, paraffin and creosote, provided variety in size, colour and intensity and smoke; they were slower in starting up but lasted for approximately 1 hour: each decoy site consisted of a number of fires of the different types.

The first decoy site of this kind was built in the early summer of 1940 at Patchway for the protection of the Bristol Aeroplane Company's factory at Filton. Similar decoys were constructed for the protection of R.A.F. Maintenance Units near Gloucester; Armstrong-Whitworth

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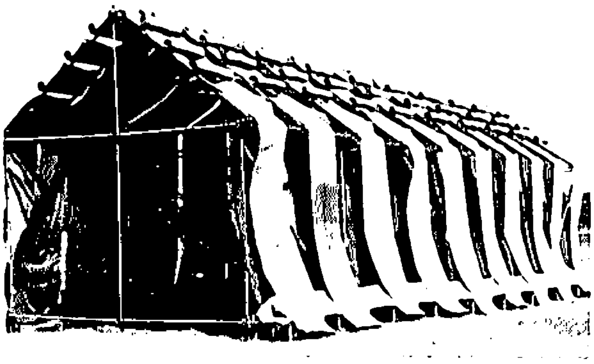
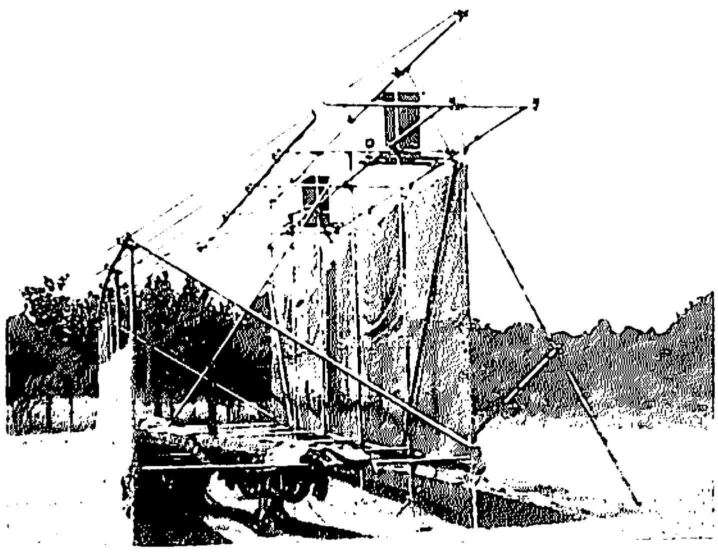
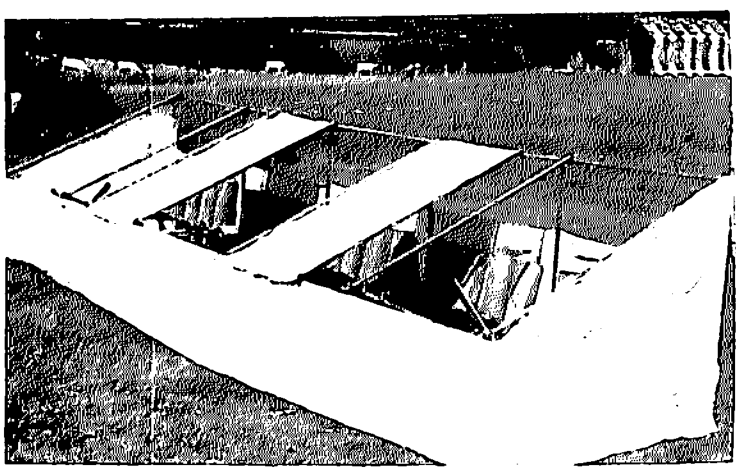


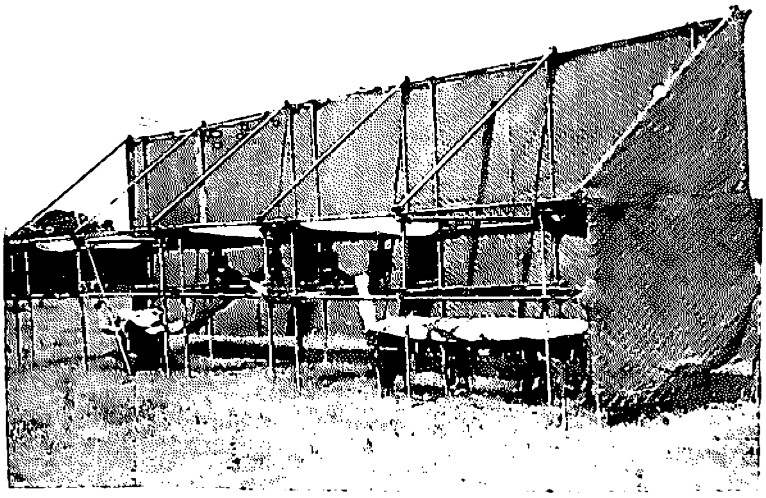
EARLY TYPE Q.F. FIRE (1). This shows framed building constructed of steel tubing, the structure being roughly lined with asbestos cloth (which did not burn). The lengths of wired roofing felt were ignited at the base, where they came into contact with the long trough holding creosoted wicks and the electric igniters, and which was covered with light roofing felt as a protection from the weather. In later types of fire equipment no attempt was made to construct the fires in the form of buildings as this refinement could not be detected from air view except from altitudes far below the normal operational heights.

EARLY TYPE Q.F. FIRE (2)
The basis of this fire was coal (seen in the long troughs between the walls), on to which paraffin oil was fed from the tanks above. The object of the screens was to simulate the walls of buildings obscuring the actual fire when seen from certain angles, and casting shadows. (These screens were also discontinued in later types).



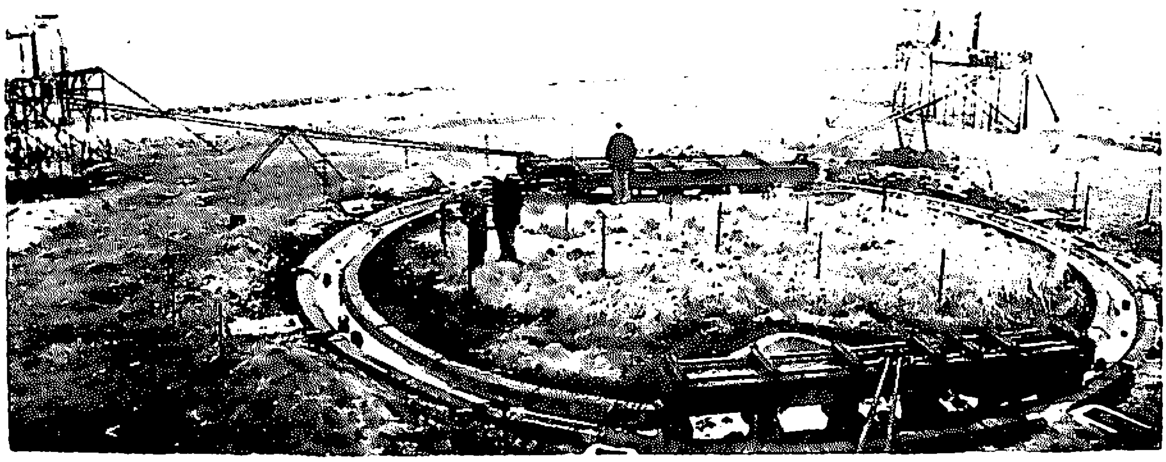


EARLY TYPE Q.F. Fire (3)
This fire consisted of eight 4-gallon drums of creosote with heavy cotton-waste wicks leading to 20 loosely coiled rolls of roofing felt (seen standing along the wall). This fire provided a large volume of smoke. The asbestos cloth screen was uncamouflaged when this photograph was taken.

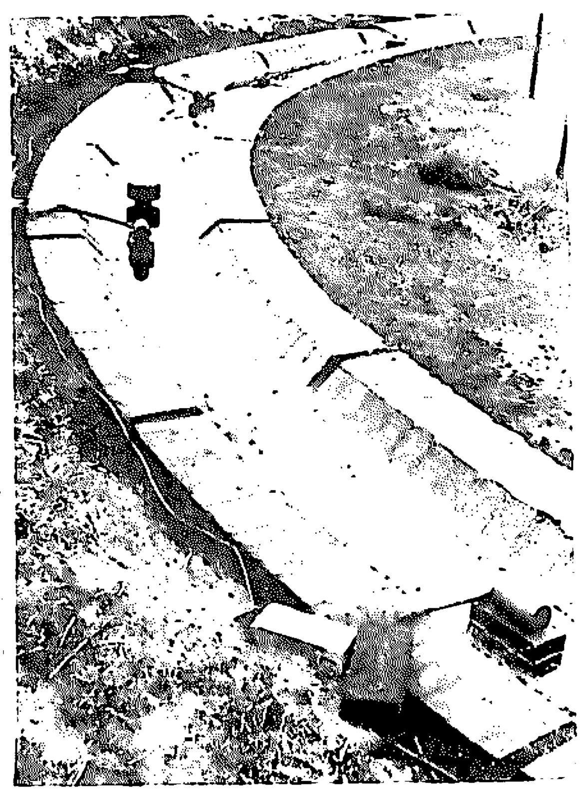


EARLY TYPE Q.F. FIRE (4)

This equipment consisted of long troughs made of expanded metal and filled with creosoted wicks, firewood and coal. The fire was slow in starting, but when fully alight burned with a red glow.



OIL Q.F. General view of a decoy oil ring with boiler fires added to the bulges. The white cement troughs at intervals round the ring are overflow sumps. The stakes inside and outside the ring were for hanging camouflage netting.



OIL Q.F.

Section of a decoy oil ring showing inlet valves.

(Leamington Hastings); Vickers at Brooklands; Hawkers (Brockworth), and a number of R.O.F.'s; in all some 30 QFs of this kind were constructed by the Autumn of 1940. The sites were mostly manned by civilian crews employed by the Parent factory under special arrangements with Air Ministry.

For the oil installations a different type of decoy fire was built of a more elaborate design and construction and which would simulate the large rings and crescents of burning oil tanks. The fuel for these fires was gas oil supplemented with petrol. The necessary tanks, pumps, pipe lines and fire rings were constructed by the local Parent Oil Installations, who were also responsible for the manning and maintenance of these sites. The typical Oil QF. is also illustrated in the photographs. The construction and subsequent maintenance of these sites proved somewhat difficult owing to cracking of the rings and crescents (made of fire clay and built into the earth) and to water seepage, and the leakage and evaporation of oil. The fires were, however, very realistic and effective when seen from the air; they had a duration of 5-6 hours, and the oil consumption was 2,000-2,500 gallons of gas oil per 1 hour burning. The object of the petrol, which was pumped in periodically - 50-100 gallons at a time - was to give an initial priming when touched off and thereafter to provide, intermittently, extra large bursts of flame. Eventually it was found that the petrol was not really essential and these fires operated entirely on gas oil. In all, 12 of these Oil QFs were constructed, covering the chief oil installations in the U.K., such as the Thames Haven, Avonmouth, Southampton (Fawley) and Liverpool (Stanlow).

On the 8th August 1940 the Battle of Britain began. It opened with daylight attacks on shipping, coastal towns and airfields. On the 24th August the first bombs fell in

/central....

central London. Attack then developed by night as well as by day and the widespread raids included Birmingham, Bristol, the South Wales area and Liverpool; London, however, continued to be the main objective. In October, during the final stages of the Battle of Britain, the daylight raids gradually gave way to prolonged night attack with London still the primary target. Early in October the question of building special fire decoys on the outskirts of London was considered, but, with such scattered bombing over so vast a target, it seemed doubtful whether they could be of any real use. Suitable sites, were, however, found and work was started on several QFs for the protection of London.

On the night of November 14/15th the enemy suddenly changed his tactics and made, what was then considered a record attack by 330 aircraft - on Coventry. This was the first mass attack directed on to one individual town and the destruction to the centre of the city both by H.E. and by Fire was enormous. It was known that the attack was led by a special and highly trained pathfinder squadron which employed large quantities of IBs, the main force following up with HE. and more IBS, and being guided to the target by the massive fires started by the pathfinders. The attack lasted for 10 hours, from 7 p.m. to 5 a.m. Within a few days the enemy, employing the same technique, made mass attacks first on Birmingham, then on Bristol, followed by Southampton and later, on a series of other towns.

Immediately after the heavy assault on Birmingham, it was decided that decoy fires for those towns considered especially likely to be attacked in this way, should be provided at once, and, if possible, for the cities of Birmingham, Coventry, Sheffield, Derby, Crewe, Bristol and Middlesbrough, within 24 hours. Hurried arrangements were made to organise fires of some kind, and parties of officers and men were despatched by air to the various centres with instructions to improvise

/fires.....

fires on any suitable sites, with oil and petrol run into trenches dug in the ground, or with any available supplies of timber or other combustible material: if necessary ricks and barns were to be fired. The requirement was for extensive fires which would look like a considerable number of buildings on fire, and the fires were to be on a scale which would enable them to burn throughout the night. With the help of local R.A.F. and Army personnel, these improvised fires were prepared and in fact, were used with some success in the attacks which took place within the next 14 days on Bristol, Derby and Sheffield. The Fires built in this way were, however, thoroughly unsatisfactory. They were unrealiable, they were far too small, and they did not last long enough: transport and access to the sites became almost impossible (the weather at the time was very bad), and except on heavy and waterlogged land most of the oil seeped away into the soil and was lost. To maintain the fires ready for firing proved quite impracticable and serious trouble arose later as a result of pollution of the soil and the local water supplies. As soon as possible these temporary fires were replaced with other equipment.

The requirement was now something totally different from the original small QFs. Groups of fires were wanted to simulate the large fires now being started by the mass raids directed on individual towns; the fires would have to last for at least 4 hours if required, with a reserve fire ready for a second period of 4 hours (or alternatively, for use on the following night): a supply of further reserve material for re-building at least one additional 4-hour fire was also necessary at the site owing to the difficulties of getting replacements in an area which had just been heavily attacked. In all, 77 towns were to be covered as quickly as possible with 2, 3 or 4 alternative sites for each town. This required considerable organisation as

/suitable.....

suitable sites had first to be found and agreed with other Ministries and authorities; personnel had to be collected, trained and accommodated, and, most important of all, new types of equipment had first to be designed, tested and produced in quantity, before work could start on the sites. The necessary experiments and tests were pushed forward and finally 4 different types of fires were selected, approved and put into production. The sites for these new fires were known as "Starfish" (Special Fire sites or "SF"), each site consisting of an assortment of the 4 different types of equipment. The normal Starfish site had two large composite Groups of Fires, each of which would burn for 4 hours and each having a capacity of 25 tons (measured in weight of combustible materials). Together with the rebuilding reserves for one further fire, each site had therefore approximately 75 tons of inflammable material. A limited number of sites had fires of double this size and these were known as the 50 ton fires. The programme called for some 200 sites in all.

The four different types of fire equipment incorporated in the Starfish were known as Boiler Fires, Grid Fires, Basket Fires and Coal Fires. (See photographs).

<u>The Boiler Fire (or Boiling Oil Fire).</u>

This was primarily an oil fire in which the fuel was either diesel or gas oil. The oil was fed from the supply tank into a specially constructed steel trough, in the top of which was a steel tray (the boiling tray); below this tray a 10 cwt. coal fire was built up together with firewood, creosoted wicks, and the electric igniters. When touched off the igniters started the coal fire and burnt the release cord controlling the oil valve. The oil flow was intermittent, being timed so as to give a 66-gallon flush of oil into the tray every three minutes: the first flushes

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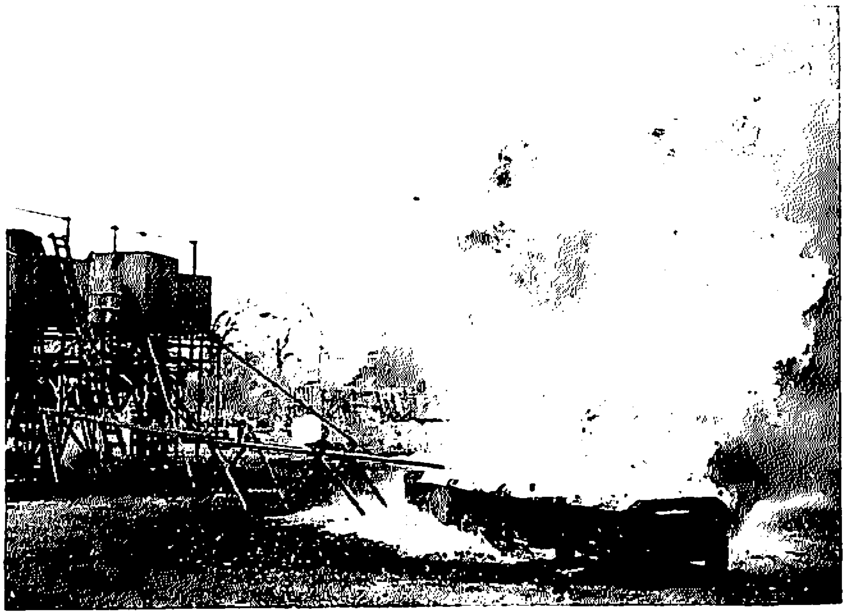
Boiler Fire in action when fully warmed up.



Boiler Fire in action. A water flush has caused an explosive burst of flame. The oil and water tanks feeding the fire can be seen on the left.

Grid Fire in action. The paraffin feed tank is on the extreme right. This fire provided a variation in flame colour, being very yellow.

of oil spilled over into the coal fire below, but in fifteen to twenty minutes the boiling tray reached such a high temperature that the oil started to boil and vapourise, the combustion becoming furious with brighter flame and less smoke. Alongside the oil supply tank was a similar tank containing water, and as soon as the fire was fully alight (actually after six flushes of oil) 2-gallon flushes of water were released and fed into the tray alternately with the 6-gallon oil flushes. The effect of the water mixing with the burning and boiling oil in the super heated tray was to cause violent explosive bursts of flame which reached a height of 30 - 40 feet. It was found that the timing of the flushes of water and oil needed to be carefully adjusted, and this was arranged with flushing cisterns (originally improvised with domestic water closet cisterns, and subsequently with an improved tank designed specially for the purpose). Owing to the great heat which developed in the boiling trays and steel troughs they had to be of very massive construction, but even so the boiling trays had to be replaced after several firings as they were liable to buckle and warp. The supply tanks held 480 gallons of oil and 200 gallons of water, sufficient to keep the fire in operation for approximately four hours. A normal Starfish site contained 12 to 14 Boiler Fires.

<u>The Grid Fire.</u>

This was also an oil fed fire, the fuel in this case being paraffin. The "Grid" was constructed of steel tubing to which was attached a quantity of wire waste and metal turnings, on to which the paraffin was fed from a sprinkler pipe running along the top of the grid. Wicks and electric igniters were attached to the lower part of the grid, which was then covered with roofing felt as a

/protection....

protection from the weather. When set off, one of the igniters burnt the release cord which controlled the oil valve, and the wicks and roofing felt set alight the paraffin fed on to the wire waste from the sprinkler pipe: when hot, much of the oil was vapourised and burned with a bright yellow flame. The oil consumption was approximately 45 gallons per hour, and supply tanks held 180 - 200 gallons of paraffin. The Grid Fire did not produce the same volume of flame as the Boiler Fire, and in strong winds the equipment was unsatisfactory, as the paraffin was apt to blow away from the Grid, and although it continued to burn on the ground the flame value was small and a good deal of the oil was lost. The chief merit of the Grid Fire was the bright yellow colour, and a proportion of these fires mixed in with the other types provided the variation required. Usually an SF. site contained 3 to 5 Grid Fires.

The Basket Fires.

These fires were built up from a number of transportable units or baskets, the inflammable material being scrap wood, shavings, sawdust, pine clippings (from felled timber), and similar waste material: each basket consisted of a roughly constructed wooden crate, approximately 3' x 2' x 2', lined with 3" wire netting, the complete unit weighing approximately 2½ cwt. The contents were well impregnated with pitch or creosote, and when erected on the site each basket was raised off the ground on a stand and covered with roofing felt so as to keep the contents reasonably dry. The individual baskets were set out into irregular rows and clusters, one basket group consisting of 8, 16, 24, or more separate baskets. Except when clustered together, each basket was separately detonated, the electric igniters being

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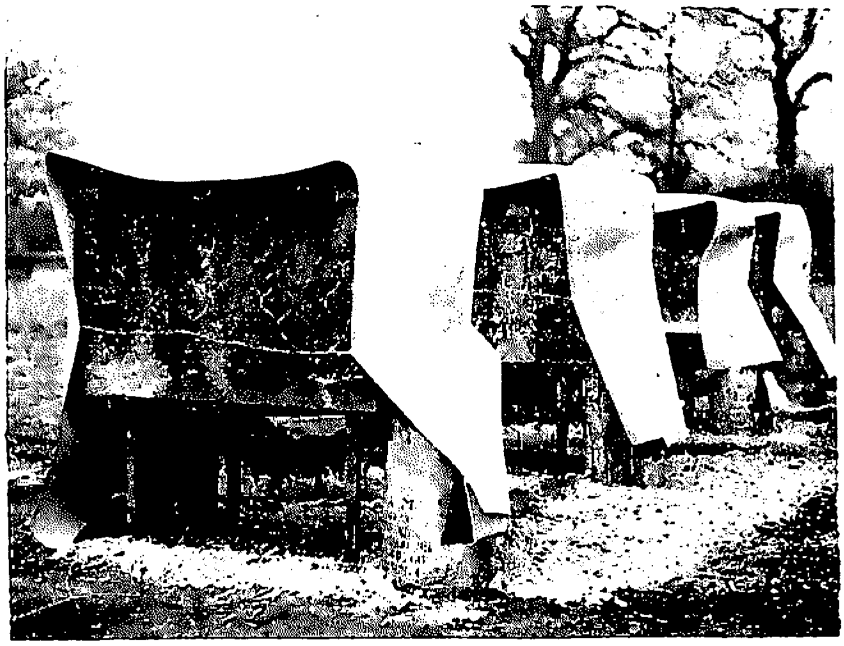
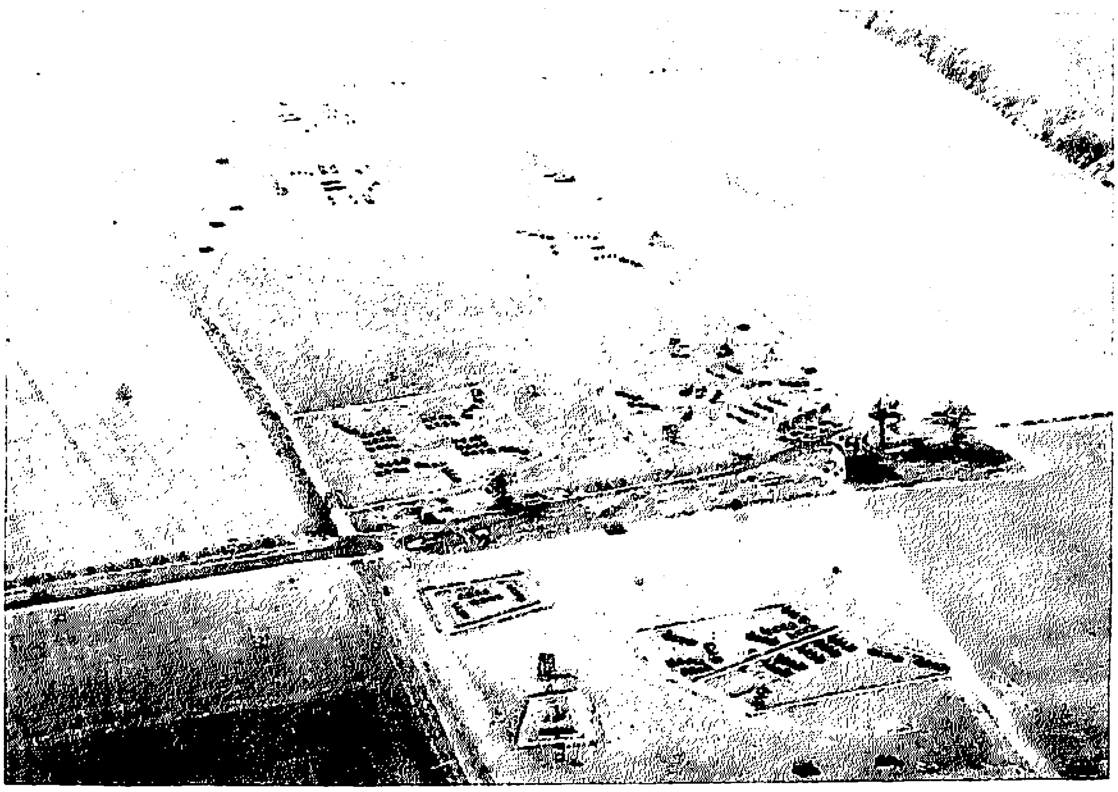


Basket Fires - showing stands and weather covering.

Basket Fires burning. These fires had a duration of approximately one hour and were fired in relays.



Typical Starfish Site, showing layout of basket and boiler fires.

inserted on the under side to give maximum protection from weather. At two opposite corners and just clear of the basket two "flare cans" (4 -gallon tins) were set up; these had vents cut in the side and each contained approximately one gallon of creosote or creosote pitch, with wicks leading from the flare can to the basket. When set off these fires produced a big blaze within 2 - 2½ minutes, and were particularly valuable on this account as in many cases the essence of success was dependent on producing a large scale fire as quickly as possible. Unlike the oil fires, the baskets of this type burned for 50/70 minutes only, and to provide for the four hour duration each bank or group of baskets was supplemented with three further groups to act as relays for the second, third and fourth hours: these relays being fired at hourly intervals. The relay banks or groups had to be far enough away not to catch fire from the earlier banks, and as a further precaution each separate group had to have a fire break cut around it to prevent fire spreading through dry grass from one group to another. These fire breaks had in fact to be cut around the separate fires of all types, so as to avoid not only the basket relays catching fire accidentally, but also to prevent the second night's fire and the reserve material for the third night's fire from going up in one big blaze. The number of individual baskets on a Starfish site varied, but a typical arrangement was:-

In the first night's fire - 128 baskets in one group divided into 4 relays.

In the second night's fire - 128 baskets in two groups each with 4 relays.

In reserve for rebuilding a further 128 baskets.

On some of the smaller sites the fire equipment was limited to basket type fires only. This was also done in areas where oil pollution from the oil fed fires might

/seriously......

seriously affect the local water supplies.

The Coal Fire (or Coal Drip Fire).

These fires were a modified form of those used in the early QFs. The equipment consisted of a single or double brazier 20 feet long, this being constructed of tubular scaffolding with expanded metal tray. The double brazier type required approximately 4 cwt. of small creosoted firewood and 3 tons of lump coal; creosoted wicks and the electric igniters were secured under the expanded metal tray: the diesel oil which was fed on to these fires from a sprinkler pipe was discontinued in later construction. The Coal Fires were slow in starting up but they produced a dull red glow and they were retained primarily for this purpose.

Firing Arrangements.

The individual fires and fire groups were each wired up on separate circuits to a central selector unit on the site, and from which the main firing leads ran back to the selector firing panel in the control shelter. In this way the separate groups which went to make up each of the two main fires could be set off as required. The firing instructions provided for four standard types of firing known as:-

(i). MINOR STARFISH

One small fire, usually of 8-16 baskets; often under the direct control of the N.C.O. i/c site.

(ii) SHORT STARFISH

One, two or three small fires, all baskets, without relays. Normally used as a try out before lighting the full S.F. A SHORT usually consisted of 16-32 baskets.

/(iii)....

(iii) FULL STARFISH.

Complete four hour fire, consisting of boilers, grids, coal fires and basket groups, with the normal hourly relays.

(iv) MEDIUM STARFISH.

This was introduced when raids became short and sharp as against the earlier attacks lasting 4-8 hours. The MEDIUM provided a large fire of one hour's duration only, and was arranged by utilising mainly baskets and grids; for this purpose the hourly relays in the basket groups were all fired simultaneously.

The circuits to the different fire groups were numbered, and the circuit numbers required to produce a MINOR, SHORT, MEDIUM or FULL were issued to the site crew and posted up in the control shelter.

Maintenance Difficulties.

The maintenance of the fire decoys in a complete state of readiness, often over long periods of inactivity and through all kinds of weather, presented a number of problems. As already mentioned, roofing felt was largely employed as a covering and protection from the weather, but rain and damp proved to be a minor difficulty.

With the oil fires there was a constant evaporation of oil from the supply tanks, in spite of the closely fitting tank covers, and this loss by evaporation had to be made good by regular topping up. Condensation in the oil tanks was a more serious trouble, and over a period of 2-3 months, particularly in certain districts, as much as 20-30 gallons of water collected in the bottom of the tank - quite sufficient to put the fire out in the early stages: this was overcome by constant testing and drawing off the water,

/and.......

and by syphon tubes used to drain from the bottom of the tanks. In winter, particularly on exposed sites, difficulties arose through freezing: the water for the boiling fires had to be discontinued during the winter months but it was also necessary to keep the oil piles and oil valves free of all water, as even a small quantity of condensation water seeping into the valves below the tanks was sufficient in frosty weather to prevent the valves operating and to cause bursts. This was overcome by fitting the oil outlet 3-4 inches above the bottom of the tank and ensuring that the unavoidable condensation water was kept below this level. With all types of fires the creosoted wicks needed frequent spraying with fresh creosote but this difficulty was subequently overcome by substituting waxed wicks, which required no further attention.

Accidental firing by lightning was another serious difficulty as all the sites in one area might be set off during one storm; sites were also fired by a build up of static electricity. Various measures were taken to overcome this risk: the groups of fires were bonded with copper wire and specially earthed; plugs were fitted in the firing leads so that the circuits could be disconnected by day; lightning conductor poles were erected on some sites particularly susceptible to be struck by lightning. None of these measures, however, proved entirely satisfactory, although the number of accidental fires was substantially reduced.

The maintenance of the electrical circuits required constant testing as the cables were liable to breakage, deterioration, particularly in marshland or brackish water, and to interference by cattle, sheep. rabbits, and even mice; sheep, particularly, were inclined to nibble the cables. Telephone communications from the shelter to the local controller had also to be constantly tested as they were liable to failure and complete breakdown after enemy attack

/in the....

in the area. Other difficulties included flooding, snow, heath fires and the spread of fire. There was little or no damage from sabotage, although some of the sites were very unpopular locally, and a tribute should be paid to the local farmers and residents in the neighbourhood of these sites as in the main they accepted the invonceniencce and risks willingly in the interests of the country as a whole. No smoking on the sites was permitted as this was the most likely cause of accidental firing. Special arrangements had to be made with all local fire brigades to prevent them from going to these fires when they were set off.

Dummy Incendiary Bombs.

Dummy I.B.s were fitted as an additional feature to a number of Starfish sites. At first A.R.P. practise "fire pots" were used, but these provied unreliable after exposure to the weather, and they were later replaced with flares made up specially for the purpose. The layout of the flares on the ground took the form of a typical spread or strike over an area approximately 500 x 100 yards. One strike consisted of 30 to 60 I.B. flares, which were fired electrically, and burned for 8 to 9 minutes. The dummy I.B.s were fired when enemy incendiaries were seen to have fallen in the neighbourhood. There is no doubt that these dummy I.B.s were very misleading to the enemy as, together with the fires, they presented to the enemy pilots who were following up, an exact replica of what they were really looking for.

Decoy Fires in Northern Ireland.

In Northern Ireland there was a danger that information concerning any decoys of this kind might leak back to the enemy via enemy agents across the border, and

/the....

the German Embassy in Dublin; there was a further danger that if this did happen any similar decoys in the U.K. might also be compromised. It was therefore decided that the decoy fires built for the protection of Belfast and Londonderry should be of quite a different type, and that special attention must be paid to secrecy and security. The area of each of the fire sites was heavily wired in with an inner and outer perimeter wire (barbed wire and Daniert): each site was strongly guarded by an R.A.F. detachment living inside the wires area: the actual fires were concealed inside small huts made of plaster board sections bolted to a steel tubular framework. The inflammable material consisted of bales of waste (grease proof) paper, tightly packed into 2 cwt. bales and well soaked in a mixture of diesel oil and gas oil. Each hut contained 20 to 30 of these bales, and a complete site consisted of 12 to 24 huts: additional fires were also built up with supplies of peat. It is believed that complete security was maintained with regard to the purpose of these sites; during construction, loads of bombs were taken to the sites in open lorries, and all inflammable material was delivered in covered vehicles. Although the construction at these sites raised some curiosity among the local people it was generally believed that these special sites were R.A.F. bomb dumps. Special precautions were taken against accidental firing, and the huts and fires were only detonated on receipt of a warning. This was possible in Northern Ireland as Fighter Command undertook to give at least a 20 to 30 minutes warning of any attack approaching this area.

Decoy Fires Overseas.

Decoy fires were also constructed and used in the various overseas theatres of operations, for the protection of special targets or V.P.s particularly liable to enemy attack. These fires had to be constructed with such material

/as.....

as was available locally. In the desert, where any combustible material was difficult to obtain locally, one method was to use bales of raw cotton soaked in waste oil or sludge oil. Those bales provided fires very similar to the basket fires in the U.K. and in the paper bales used in Northern Ireland. They burned for 3 to 4 hours. In Europe the fires were built of scrap wood or timber, bomb debris, or any material which could be gathered up locally. Although it would appear a simple matter to build fires in this way, in practise it was found that there was a serious danger that such fires would fail to get going quickly, or if wet or badly constructed, that they might fail altogehter. To ensure that these improvised fires would function when required, it was found necessary to train the C. and D. personnel in constructing them, and to provide, in addition to the electric igniters and firing leads, a limited quantity of roofing felt and cordite sticks; these materials being easily carried, were made part of the standard equipment of the C. and D. units. It was essential when these fires were built to arrange for ample air spaces; these were obtained by using brushwood to form a central hollow or chimney, and by making sure that the scrap timber of which the fire was built was sufficiently loosely packed to ensure ample draught. The roofing felt was used to cover and and protect the initial kindling point of the fire, and to keep it thoroughly dry, and the cordite, which was set alight by the igniters, gave sufficient heat at once to secure a thorough lighting. Without these extra materials the improvised or field fires were unreliable; the method of construction is shown in the photographs. Fires of this type were used in the Normandy and Antwerp decoys.

FIRING ARRANGEMENTS

FOR TYPICAL STARFISH WITH INCENDIARY STRIKE

Comprising No. 1 Starfish
No. 2 Starfish
Short Starfish
Incendiary Strike

Firing Circuits

1st Starfish

zero hour	1	4 Boiling Fires
"	2	2 Grids, 2 Boiling Fires
"	3	2 Boiling Fires, 1 grid
"	4	1 Boiling Fire, 1 grid
"	5	2 Grids
"	6	24 Baskets
Zero, plus 1 hour	7	24 Baskets
" " 2 hours	8	24 Baskets
" " 3 hours	9	24 Baskets

2nd Starfish

Zero hour	25	2 Boiling Fires, 1 grid 1 Coal Drip, 1 plain coal
"	26	24 Baskets
	27	24 "
	28	24 "
	29	24 "
	30	24 "

Short Starfish

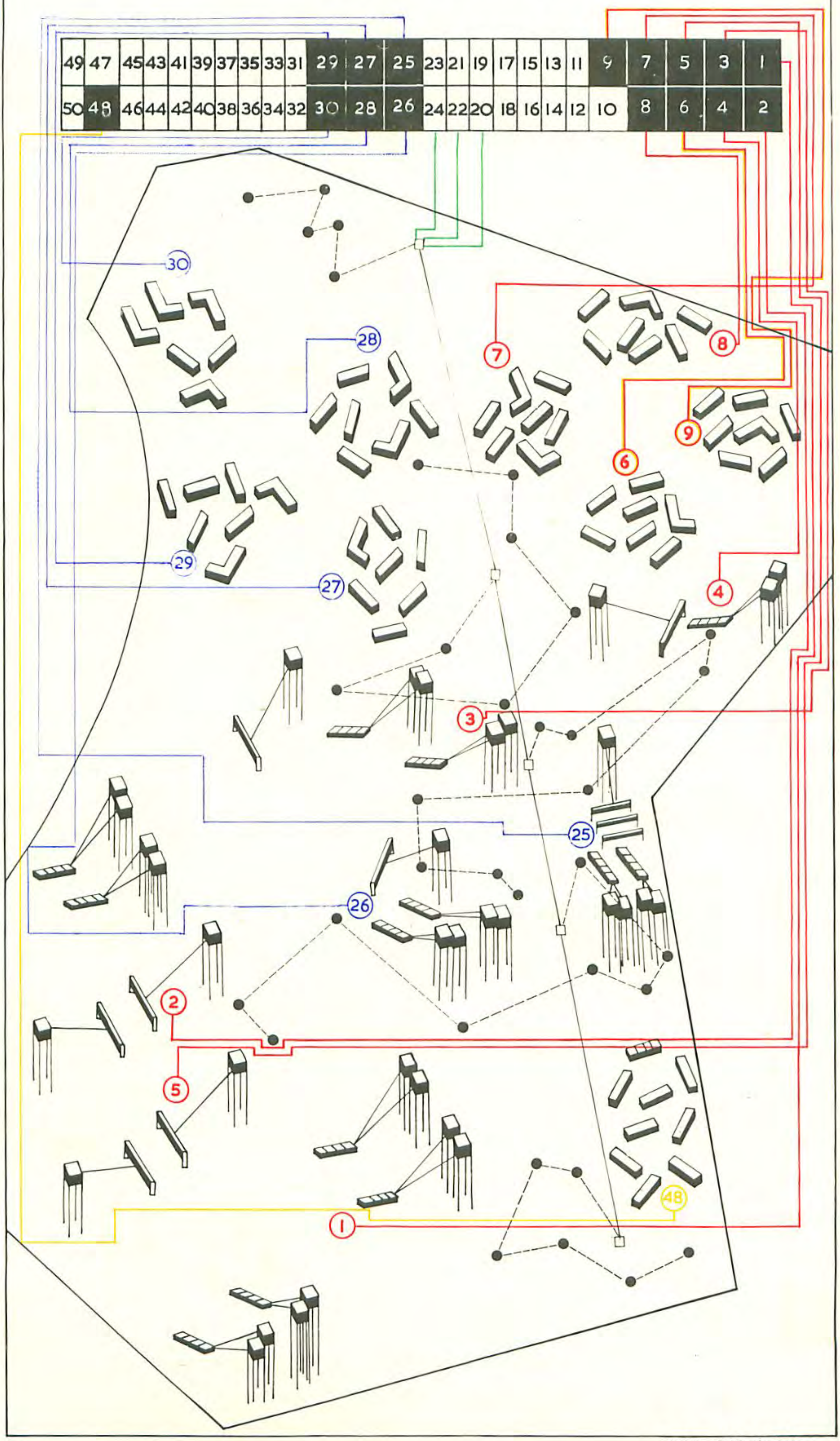
Zero hour	6	24 Baskets
	9	24 Baskets
	48	24 Baskets

Incendiary Strike 36 points

Zero hour	20	instantaneous
Zero, plus 3 minutes	22	3 minute delayed action
" " 6 "	24	6 " " "

(See diagram attached)

TYPICAL STARFISH WITH INCENDIARY STRIKE FIRING CIRCUITS



CHAPTER XXV

DEVELOPMENT OF AIRCRAFT HIDES AND NETS

Aircraft Hides

Previous to November 1941, when Colonel Turner's Department became responsible for the direction of R.A.F. camouflage, a certain amount of work had been going on at the request of the Commander-in-Chief, Fighter Command, to produce a hide for single engine fighter aircraft. A committee was formed to investigate design and production, and two types were produced - the "Luton" Hide and the "Artillery" Hide. The former, of which 500 were produced, proved unacceptable to Fighter Command owing to the fact that a daily inspection, including running up the engine, could not be undertaken beneath it. Further, it proved structurally unsound. The "Artillery" Hide also proved impractical.

Northolt Hide

In November 1941, experiments commenced at Shepperton to produce Aircraft Hides, first for single engine aircraft and later for twin engine aircraft, including Havoc and Beaufighter.

The difficulties found in constructing a hide which would provide effective camouflage, and at the same time prove operationally acceptable and capable of standing up to strong winds were considerable.

The Northolt Hide was designed for single engine aircraft - Spitfires and Hurricanes, and was a modified 'Flat Top Cover'. In order to economise space and materials and still conceal the aircraft from oblique views, the top was sloped down towards the rear and side curtains were added. The supports consisted of steel tubes, set in concrete blocks in the ground and braced by wire ropes. The prototype was produced by Messrs. Sound City (Films) Ltd. The netting was of the canvas square type, produced by Messrs. Morton Sundour Ltd.

The aircraft in the Hide could be completely serviced, refuelled, re-armed and taxied away without any adjustment to the Hide being necessary. Concealment of the aircraft was considered effective.

/The.....

The Northolt Hide was accepted by Fighter Command at the end of 1941, when it was decided that the distribution should be six Hides per Squadron. At the beginning of February, 1942, the Director General of Works, who was responsible for their construction was informed that the number required would be 1116. Some slight modifications in the construction were made by the Works Engineers and 200 were ordered. Of these 123 were delivered complete to some 18 airfields.

The Shepperton Hide (Sometimes called the Havoc or Wittering Hide.

Shortly after the Northolt Hide had been accepted and was in production, experiments were carried out by the Department with a view to producing a Hide on the same lines for Havoc or Beaufighter night fighter aircraft. The problem was made more difficult owing to the fact that the night fighters were painted black and therefore more likely to show through the Northolt type Hide net scrim.

With the greater inside area, it was necessary to depart further from the flat top cover basis. The side sections were proportionately larger than in the Northolt Hide, and were suspended inside the main supports. At the rear, separate sections of net were supported partly under the main top sections, and partly extending beyond with the object of concealing the tail of the aircraft from oblique views without enlarging the size of the Hide unduly. At the front, a movable part was incorporated, operated by a handle and ratchet, so that when raised it was level with the main part of the top sections. This allowed the aircraft to enter and leave the Hide easily, but it could be lowered to conceal the front of the aircraft from oblique views.

A prototype was constructed at SHEPPERTON and arrangements were made for the Hide to be subjected to operational and weathering trials at R.A.F. WITTERING.

/First....

Section of "Shepperton Hide" for twin engine aircraft, showing method of erection.

'X' type net over Mustang aircraft. Variations in the density of the scrim can be seen in the photograph.

'X' Type Net in three Valises. The total weight is $2\frac{1}{2}$ cwts.

'X' Type Net. Access to the engine is provided as shown in the photographs.

First aerial observations revealed that the scrim, which was of the same design and density as that of the Northolt Hide, was not sufficiently dense to conceal the black night fighter aircraft, and a new net had to be produced by Messrs. Morton Sundour.

Further tests were then carried out, but owing to the large surfaces, troubles were experienced with the nets breaking loose in high winds. Further, owing to the necessary height of this Hide, questions arose as to it forming a flying obstruction.

The Hide, with the modified scrim covering, did provide effective concealment to aircraft, but by October 1942, it had been decided to paint the upper surface of night fighter aircraft with normal camouflage colours, and the Shepperton Hide was never put into production.

<u>Aircraft Concealment Nets.</u>

In June 1942, the Department commenced experiments on a form of Concealment for Fighter aircraft which would be operationally acceptable to Fighter and Army Co-operation Commands, the Northolt Hide having been ruled out for this purpose on account of immobility in the field.

The Ministry of Aircraft Production had produced aircraft concealment nets of varying sizes, but these had been designed from a static point of view only; in other words, they were only suitable for concealing aircraft which, having been delivered from the factory, were stationary on M.A.P. airfields often for many weeks on end.

Experiments were undertaken therefore to produce a net which would effectively conceal the aircraft without unduly affecting operational requirements.

<u>'X' and 'Y' NETS.</u>

The 'X' type net was developed primarily for Spitfire, Hurricane and Mustang aircraft. It was found suitable in operations for the American Aircobra and it was later used on Typhoons and Tempests. The requirements were that the net, /and....

and equipment, should be light and easily transportable; that it could be rapidly put on and taken off an aircraft, and that a normal daily inspection could be carried out without removing the main portions of the net from the aircraft. Accordingly, a Cockpit opening was incorporated providing access to the Cockpit; refuelling arms were provided in the equipment, which, when required, raised the net well clear of the wings to permit refuelling and re-arming. Provision was made for easy access to the engine and tail unit.

Operationally, it was found that two men could net an aircraft in ten minutes once the ground wires were in position and take the net off in under one minute when orders were received to "scramble".

The 'Y' net was primarily designed for Typhoons and Tempests but it was also used on the American Thunderbolts. It was a slightly larger edition of the 'X' type net, to allow for a greater wing span. With one or two minor modifications it was exactly the same as the 'X' type in appearance and operation.

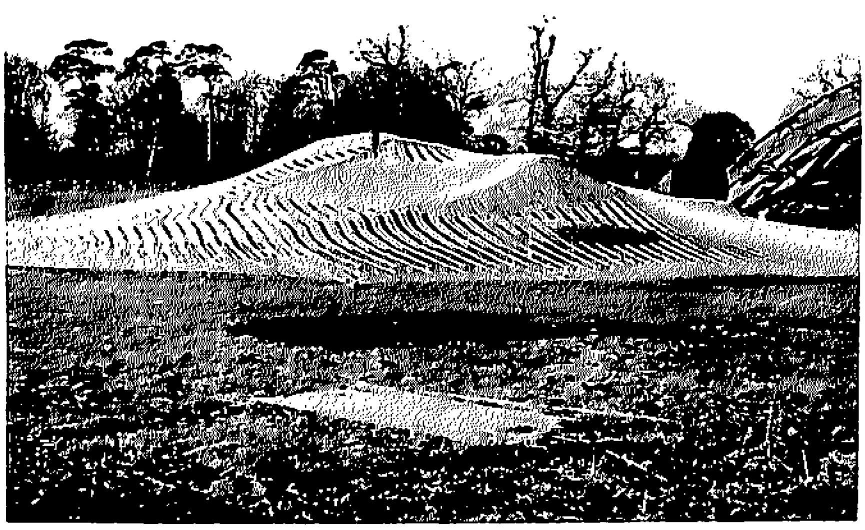
Both the 'X' and 'Y' nets were garnished with Hessian scrim (cotton having been rejected). At first they were sprayed olive green only, but it was ascertained by air observation that better results were obtained by disrupting them with a proportion of dark brown, and this two tone scheme was incorporated in the production of all 'X' and 'Y' type nets.

The nets which was in six sections was attached to four ground wires which were secured to the ground by pickets. The nets were lifted over the aircraft and attached to one another by a system of Dutch lacing which made the quick release possible.

/NETS....

Air view of single engine aircraft under 'X' Type Net. The aircraft has been well sited alongside a hedge and is indicated by an arrow.

'X' Type Net. Refuelling an aircraft, with concealment nets in position. The cockpit opening can be clearly seen.



Z.E. Type Net over Blenheim aircraft.

NETS FOR TWIN ENGINED AIRCRAFT.

'Z.E.' TYPE.

The problem of producing a net for twin engined aircraft - Beaufighter, Boston and Mosquito, was a very much more difficult one, owing to the size and weight involved. The 'Z.E.' net was designed on similar principles to the 'X' and 'Y' nets, but it was of course much larger. It was roughly octagonal in shape and consisted of nine sections. It incorporated Dutch lacing and the net was garnished with Hessian scrim. The weight was 10 cwt.

It was found that eight men were required for the proper handling of these nets, and although they could be released in two minutes, the time taken by a crew of eight men to net an aircraft was approximately half an hour.

For static purposes, the concealment afforded by the 'Z.E.' net was good and it was this type of net that was used to conceal the American P.38 (Lightning), aircraft in Cornwall preparatory to their departure to North Africa.

The 'T.E.' Nets (for Twin engined aircraft).

Because of the bulk weight and number of men required to operate it the 'Z.E.' net was superseded by the 'T.E.' type which aimed at not so much concealing the aircraft as disguising it to simulate a patch of scrub or small clump of bushes.

The principle employed was first tried out during the Spartan exercise. In this case, the fuselage and wing surfaces of Boston aircraft were covered with General Purpose (Tree) nets which would eliminate shine and a ground pattern consisting of gorse, bracken and branches of trees put down, whose texture would absorb the tell tale shadows cast by the aircraft, and merge them into the background. Aerial observations and photographs taken proved satisfactory.

/Experiments.....

Experiments were continued by the Department and a prototype set of light nets produced which would attain the same results, but which would prove acceptable operationally to the T.A.F.

Light shrimp nets, in eleven sections, were thrown over the aircraft and secured to it by means of cords, and the ground pattern consisted of light Hessian nets so placed that the patterning of the shrimp netting, which was disrupted in shades of green and black, linked up with the ground pattern nets, four in number, which were nigger brown in colour.

All the aircraft and ground nets were packed in seven coir matting sacks which were differentiated by coloured bands, and the complete outfit weighted 262 lbs. In some cases, it was possible for an aircraft to carry its own nets.

Nets for Auster Light Aircraft

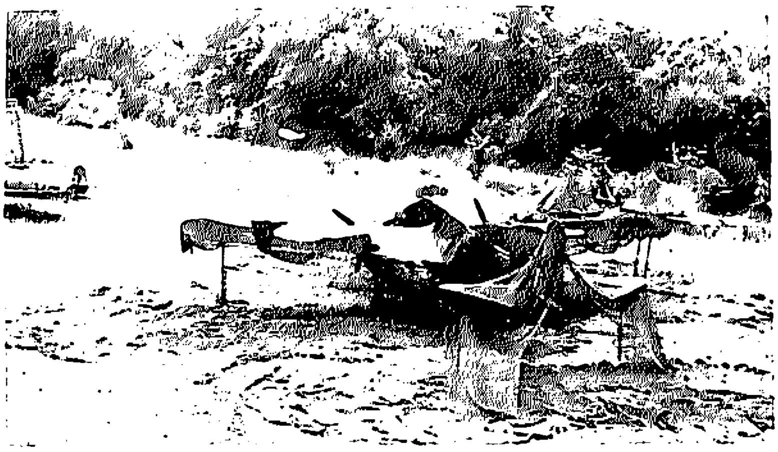
A request was received from the Army for a net to conceal the light aircraft used for A.O.P. work. The requirement was that the net should be sufficiently light to carry in the aircraft itself. The 'X' type was impractical and experiments were undertaken with a light shrimp net of the same type as that used for the T.E. nets (fuselage and wings).

A prototype net was produced in one piece, weighing approximately 30 lbs., which covered the wings and fuselage and was found by air observation to effectually eliminate shine. No ground pattern was included because it was found that with such a small aircraft, this was unnecessary. The net was coloured a dark shade of green. A limited number were put into production.

Concealment of White Aircraft.

In 1942, the fuselage and under surface of aircraft of Coastal Command engaged in anti submarine work were painted white and presented a most conspicuous target when on the

/ground...



T.E. Nets over Dummy Boston Aircraft, showing light shrimp netting in different shades of colour over the aircraft, together with ground nets (Hessian).

Auster light aircraft under Auster type net, consisting of shrimp netting, which eliminates 'shine'.

Air view of twin engine aircraft, netted with T.E. nets. The effect of the ground pattern can be seen in the photograph. The aircraft is indicated with an arrow.

ground. Indeed, under clear conditions, an otherwise well concealed aerodrome was given away by white aircraft from a distance up to 20 miles.

A request was made to the Department by Coastal Command to produce some form of concealment for the white Whitleys and Wellingtons. The first set of prototype covers consisted essentially of the standard canvas covers for engines, gun turrets, cockpit fins and rudders with extensions added to cover the remaining white surfaces from oblique aerial view. In addition, two nets garnished with Hessian scrim (one on either side) were stretched out from the top of the fuselage between the wings and tail planes to the ground where the outer edges were pegged down, approximately in line with the wing tips. From the concealment point of view, the scheme proved successful, but it was objected to by Coastal Command on the ground that Whitley aircraft had to be kept head into wind and the time taken to move and repeg the centre nets would take too long.

Experiments continued, with covers which were fastened over and round the sides of the aircraft by means of cords. The standard covers were again used, sprayed a dull tone of green, being extended as necessary. This system allowed for the aircraft to be moved about without disturbing the majority of the covers, and was finally accepted by Coastal and Maintenance Command, who were also interested as far as their Air Store Parks were concerned. Although a small number of sets were produced, these covers were never used owing to the fact that the man hours taken to operate them was not felt justified in view of the then small scale enemy attack on this country.

Concealment of Motor Transport

The concealment of Motor Transport was incorporated in the General Training Courses for C.T.D. personnel, but the issue of nets to R.A.F. Units was not in the hands of the Department.

/The....

The nets used were those designed for the Army and consisted of 24' x 24' flat garnish hessian type using four or five different colours and tones. Two 24' x 24' nets were required to net a large lorry. In some cases nets measuring 14' x 14' were issued for small vans.

<u>'G.P.' OR GENERAL PURPOSE NETS.</u>
(Sometimes called Tree Nets.)

A limited number of these were produced for the concealment of Dumps or vulnerable equipment. The garnish, which was cotton, was of 'knot' or 'bow-tie' style, and gave a good texture. The nets measured approximately 31' along two opposite sides, 19' along one 8'6" along the other. They were disrupted black on a dark green background and gave excellent concealment.

Owing to the limited supply they were restricted for special uses.

CHAPTER XXVI.

DEVELOPMENT OF DUMMY AIRCRAFT
AND OTHER EQUIPMENT.

Dummy Aircraft. 1. Three-Dimensional Wooden Dummy Aircraft.

The first prototypes consisted of the following types of aircraft:-

Wellington
Blenheim
Battle
Whitley
Hurricane.

These types were produced and delivered to the K. Sites by the 31st of March, 1940. The Wellington, Blenheim and Hurricane were of wood and canvas construction. The Whitley was of all wood construction, the wings being of three-ply. The larger types which were erected on a framework of steel scaffolding were found, operationally, to be exceedingly heavy and difficult to move.

The average time taken to move a Hurricane or Battle by a K. Site detachment was about hour; a Blenheim took from 2 to 3 hours; Wellingtons and Whitleys took approximately one day. As movement was one of the most important requirements on a K. site, the larger types, which were erected on steel scaffolding, were later fitted with wheeled frames or trolleys.

A quantity of Spitfires were also produced which utilised salvaged Moth airframes, complete with under-carriage and wheels. They proved considerably more mobile as they could be wheeled about with comparative ease; later, a quantity of Defiant aircraft were also produced.

The last type of three-dimensional wooden aircraft to be produced were the Bostons. They were fitted with tricycle under-carriage and were easily towed into position. These dummies, though heavy and cumbersome for erection, proved most effective in operational use.

All wooden dummy aircraft were full scale models, correctly camouflage painted, and from the air were indistinguishable from true aircraft. But although their movement was certainly

/facilitated

facilitated by the addition of trolleys, the number of men required to operate them was considerable and for mobile work in the field their use was considered impracticable.

2. The Collapsible Type of Dummy Aircraft.

These dummies were introduced in August, 1942, and were produced, not for K. sites, which had been given up, but to meet the requirements of operations in the field. The dummies had to be light in weight, capable of stowage in a small space and rapid in operation.

As far as the R.A.F. were concerned, they were restricted to Spitfire and Mustang aircraft, but a small number of Auster light aircraft dummies were produced at the request of the War Department on exactly the same lines.

The first experiments were carried out at Shepperton and consisted of utilising a flat piece of canvas, shaped and painted to conform with a single engine fighter aircraft, and stretched 3 ft. above the ground by means of an Artillery frame. Aerial observation showed this method to be ineffective, largely due to the lack of cast shadow, and it was found necessary to make the dummy three-dimensional. Prototypes were produced which utilised shaped formas for the fuselage and stretchers for the wings. They were supported by light tubular masts, stays and wires. Difficulties were at first experienced in finding a paint which was sufficiently glossy to impart shine, which was all important, and which would not crack or peel when the dummy was folded up. They further had to be treated against mildew.

After the initial experiments had been carried out, two prototypes were produced.

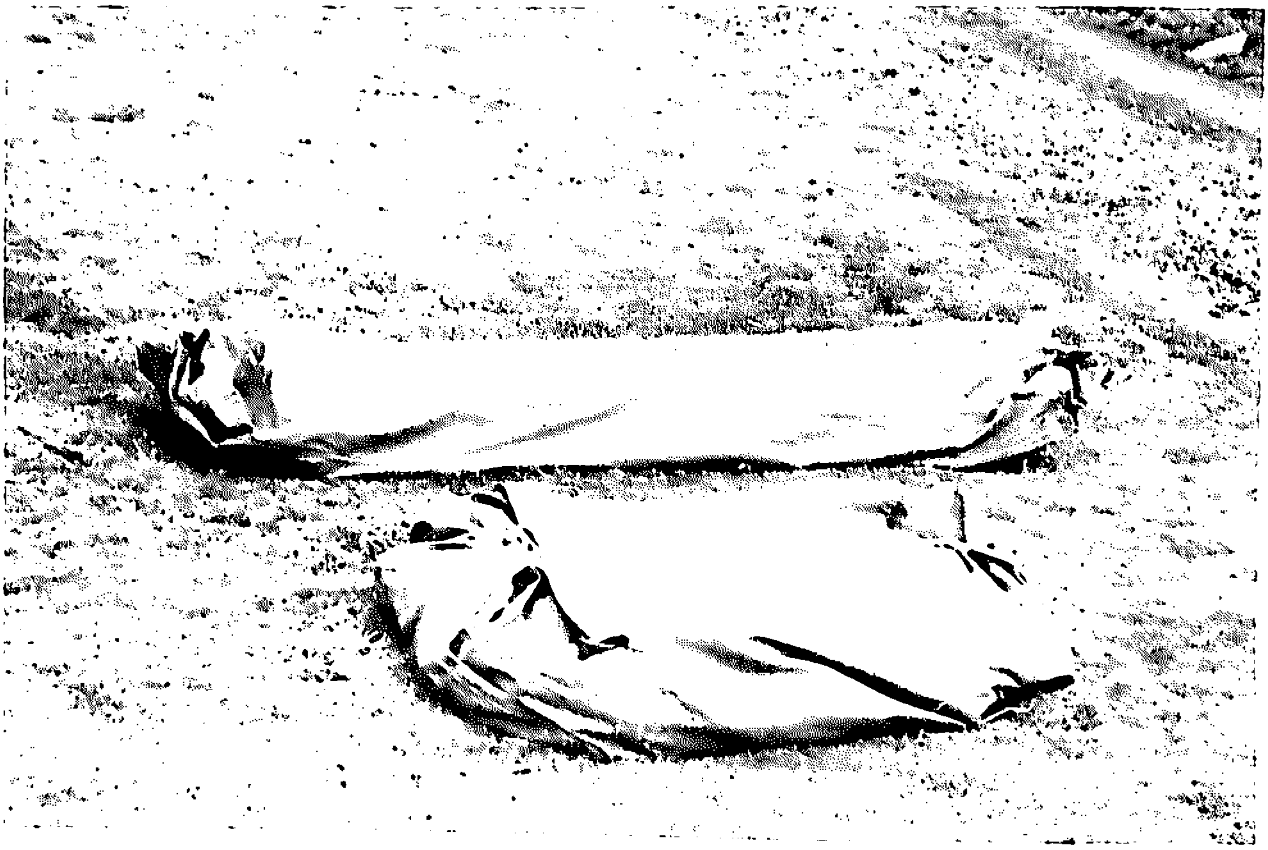
Messrs. Vauxhall Motors Ltd., evolved a Mustang, whose fuselage was supported by an overhead suspension wire between 2 masts and the wings by a considerable number of stays and wires. This type proved unsatisfactory and only a limited number were manufactured.

Messrs. Sound City (Films) Ltd., evolved a Spitfire, in

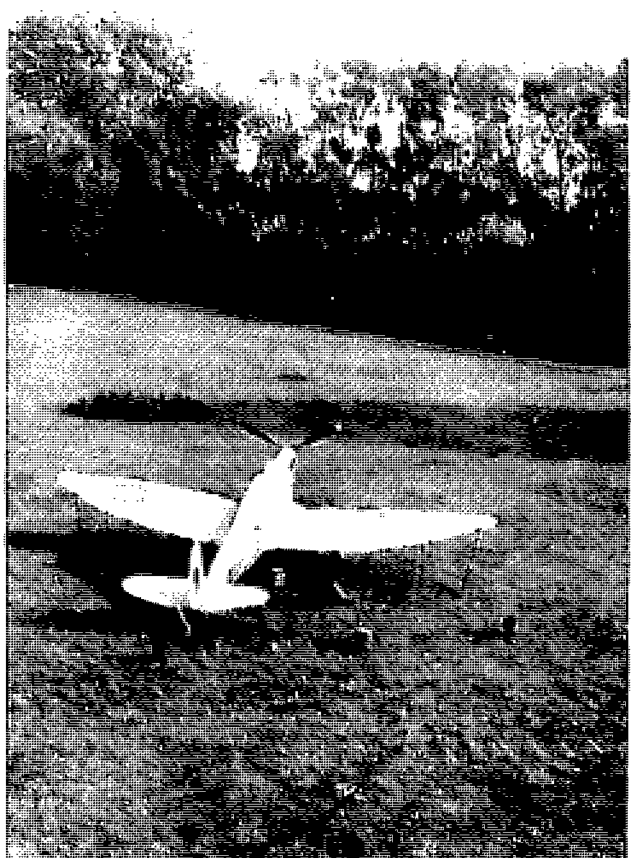
/which

Three-dimensional Wooden Hurricane utilising salvaged Moth airframe and undercarriage.

Three-dimensional wooden Boston complete with tricycle under-carriage



Dummy Mobile Spitfire complete, packed in two valises



Collapsible light mobile Spitfire

which the fuselage was of concertina construction with light metal formas; this was expanded by means of a handle at the rear and which was threaded and engaged into a socket attached to a metal forma in the fuselage.

The fuselage was carried between two light masts and the wings were positioned by stays and picketed to the ground. A two-bladed, and later a three-bladed propeller was incorporated in the boss on the nose. The method of construction was simple but strong.

This design was later used for the dummy Mustang and some 1,075 of both types were produced.

These dummies were subjected to vigorous wind tests, and whereas they would not stand up to a gale, they would ride a 40 m.p.h. wind for many hours on end. A Spitfire dummy was shot up from the air with tracer and ball ammunition and although badly holed, it neither caught fire nor completely collapsed.

The Spitfire dummy was packed into 2 valises, measuring 9'0" x 2'6" x 1'0" and 5'0" x 4'0" x 1'0". The weight of the two valises was 334 lbs. A tool box weighing 58 lbs. was supplied to every six aircraft. In order to facilitate easy identification, a series of coloured bands was painted on the valises.

In operation, a Spitfire or Mustang dummy could be erected by three men in 10 minutes and collapsed and put back in their valises in half that time.

In practice during operations, erection usually had to take place during the hours of darkness, and it was found that a Squadron of 18 aircraft could be erected in approximately 3½ hours, by a crew consisting of a Corporal and 5 men.

From the air, these light mobile dummies proved as effective as the original wooden ones, and they have deceived pilots from 10,000 ft. down to 500 ft.

/In

Other Equipment. In order that a display should be convincing from the air view it was found essential to expose the normal ancillary equipment as seen on a true airfield. In the original Tindal plan, for instance, it was found possible to obtain the use of real motor vehicles and petrol tankers to support the Dummy Boston Aircraft which were being displayed. Normally, however, such additions were not readily available and it was decided to produce a number of dummy M/T vehicles and tankers.

Dummy 10 cwt. R.A.F. Vehicle.

These were produced on exactly the same lines as the light Mobile Dummy Spitfire, using the same materials, and a similar method of construction. When extended, a threaded cranked handle engaged with a socket in the rear of the metal frame, which, when wound up ensured that the vehicle was properly rigid. The framework was of light metal construction and the body work and wheels consisted of canvas suitably painted and camouflaged to simulate the true vehicle. In operations, these dummy vehicles proved extraordinarily realistic from the air. They could be erected by two men in under one minute and at least one dozen could be carried in a 3-ton lorry.

Dummy Petrol Tanker.

These were constructed on similar lines as the 10 cwt. R.A.F. vehicle. They again proved of valuable assistance in promoting "life" to a display. The practice was to place one or two of these tankers alongside dummy aircraft to simulate refuelling in progress.

As in the case of aircraft, it was of course essential to keep the vehicles and tankers constantly on the move.

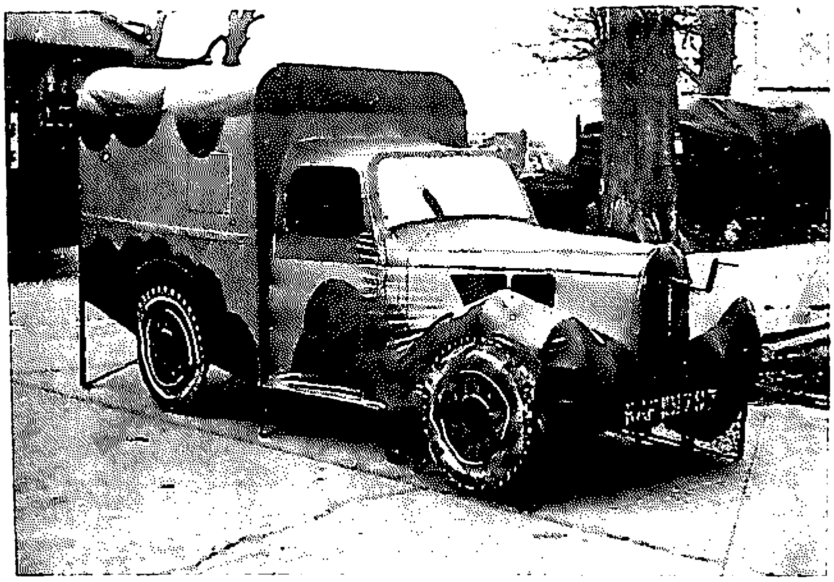
Airfield Extras.

Under this heading are included:-

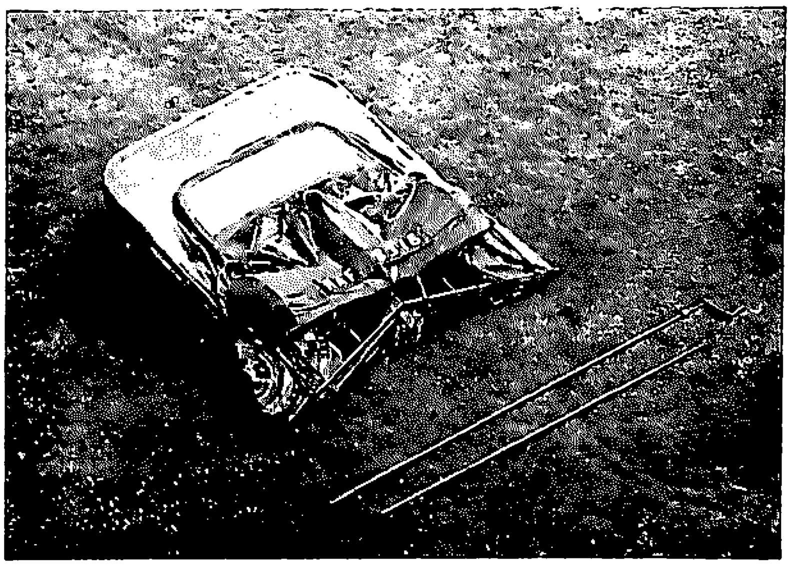
Propeller Boxes
Ammunition Boxes
Petrol Cans.

Constant air observation revealed that still further life and realism could be added to a display if the usual effects complementary to a true airfield were added. Thus, it was

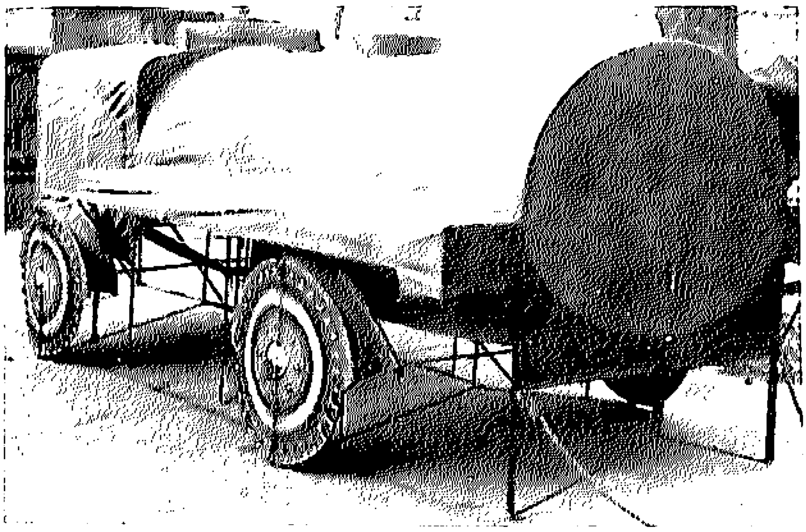
/usual



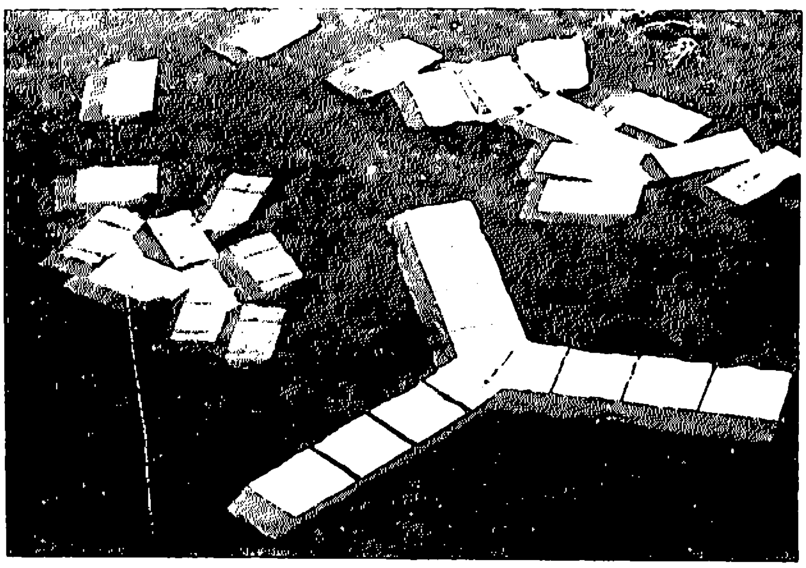
Dummy 10 cwt. R.A.F. Light Van. Corrent tension is ensured by the winding handle in the "radiator".



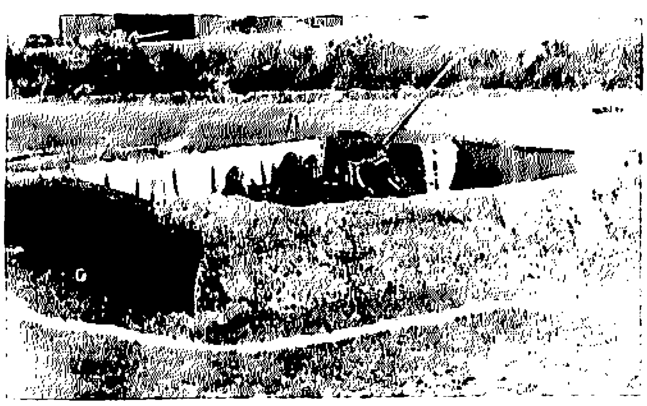
Dummy 10 cwt R.A.F. Light Van folded up, showing winding gear.



Dummy Petrol Tanker. Constructed on similar lines to the 10 cwt. vehicle.



Two-dimensional miscellaneous effects, Propeller Boxes, Ammunition Boxes and Petrol Cans.



Dummy A.A. Post. Constructed by means of sandbags (empty). Dummy tracks and spoil can be seen in the photograph.

usual to note round or adjacent to real aircraft, boxes containing spare propellers, or ammunition for re-arming, and petrol cans.

It was often found impossible to acquire these items for display purposes and consequently they were produced in dummy form. They consisted of sheets of canvas cut to shape and painted to represent the items above-mentioned. They were laid down flat on the ground, suitably adjacent to a dummy aircraft, and held in position by a light net pinned down. Air observations showed the results to be satisfactory.

Dummy A.A. Posts.

These were provided on certain displays at airfields where the true A.A. guns had been removed or were non existent. Usually 4 in number were provided per airfield. The equipment for a Dummy Bofors site consisted of the Bofors gun constructed of wood, together with 3 or 4 dummy men, placed in a gun emplacement which was constructed of bulks of timber, earth, and sandbags. The dummy men consisted of a light framework of wood, so constructed that a waterproof cape and tin helmet placed on it simulated a gunner. These dummy guns and men were obtained through War Office channels.

As in the case of the operation of dummy aircraft, the essence of these dummy gun posts was the liberal use of spoil and tracks.

Dummy Flying Control Van.

A very limited number of these were produced to simulate the Flying Control Vans used on airfields. They were constructed on the same principles as the dummy 10 cwt. vehicles and petrol tankers.

CHAPTER XXVII

ADMINISTRATION, FINANCE, CONTRACTS.

Administration. 1. This history would be incomplete without a chapter on Administration, as the circumstances were unusual even for a war-born organization. It must first be understood, that although the department was nominally a branch of the Air Staff, in practice it acted as an executive Command responsible for one form of defence against air attack.

Due to the operational character of the department's activities, and the additional responsibilities thrust on it from time to time, hurried attempts to meet sudden demands were quite a normal feature of its work. The necessity for speed was vital as delay often entailed increased casualties or heavy damage to some part of our war effort. Many of these demands were unpredictable, especially to the extent to which they might develop. As examples, mention may be made of the introduction of Starfish defence, the Abadan Smoke Screen, and the urgent supply of mobile airfield lighting equipment. Another feature was provided by the great range of the department's responsibilities which not only included some 500 separate sites in Britain, but also extended to all theatres of war abroad.

An administration to cope with these conditions had to be flexible and of shallow depth. Direct access was necessary to each and every authority controlling an activity of the department. Direct contact had to be arranged with each pertinent authority in each Ministry and with all R.A.F. Commands, Groups, and Stations, with Regional Commissioners, with factory owners, and with railway, the police, and many other local authorities. A very free hand was necessary, and given, both by the Air Staff in relation to policy, and by

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the administrative and financial branches in regard to strict conformity with regulations. Freedom, especially in financial matters, may be a source of danger or worse, unless accompanied by conditions which will minimise risks; some of these may be mentioned. The head of the department and his staff must have sufficient experience in administration and knowledge of regulations, and must be trusted to carry out the spirit of the latter, when it is impracticable to adhere to the exact letter. A first class finance officer must be allotted to the staff especially in the early days to advise and to act as contact with the Finance Branches; he should be fully informed of every activity. Inspecting finance and audit staffs should be given every facility, and their suggestions adopted when practicable. These conditions prevailed in C.T.D. and the administration ran smoothly throughout. One other administrative feature requires mention. It was not only the necessity for speed that made the cost plus fee form of contract a necessity. If normal contract procedure had been adopted, a gigantic staff would have been necessary to carry out measurements of all work as it was completed, of all fires as they were renewed, and of all forms of maintenance. This staff would have had to be organized in areas covering the whole country and even if obtainable (which it was not) would have added an enormous sum in overheads far exceeding the cost of any extravagance or waste occurring in the cost plus contracts.

Finance.

2. Special arrangements had to be made in regard to Finance. Time did not permit the forwarding of estimates, however rough, through normal channels for approval. The Treasury therefore agreed to allot lump sum credits from time to time, and to delegate the responsibility of sanction of individual expenditure to the head of the department.

In October 1939 the first allotment of £500,000 was placed at the department's disposal to cover the cost of the construction

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of dummy airfields, dummy aircraft, and lighting displays to protect R.A.F. airfields. Additional allotments of half a million at a time were approved to meet expenditure on decoys for civil protection and on other work undertaken by the department. It was later agreed that the Air Ministry should foot the bill for all decoy work, whether undertaken by C.T.D. or by other Ministries, which included the Admiralty, War Office and Petroleum Board. The Admiralty undertook the decoy protection of the main naval ports and some others, working in close contact with the department. The War Office in addition to providing a few decoys to protect Ordnance Factories, also helped in 1941 by constructing some civil decoys, which were afterwards taken over by C.T.D. The Petroleum Board constructed a few Oil decoys. As the Air Ministry and Army used the same contractors, the Air Ministry paid the Army bills direct. Naval and Petroleum costs were debited to the Air Ministry through the usual financial channels. The total capital expenditure amounted to £4,350,000 and was allocated approximately as follows :-

C.T.D.	£3,885,000.
Admiralty	£ 385,000.
Petroleum Board	£ 80,000.
Total	£4,350,000.

Note:- The C.T.D. figures include the cost of all R.A.F., Army and civil decoys at home, all camouflage and decoy equipment supplied to the R.A.F., Army and the U.S.A. Forces, all mobile airfield lighting equipment supplied by the department, and the Abadan Smoke Screen: this last cost amounted to £65,000.

Contracts.

3. In 1939, when the first decoys were under consideration, it was decided to employ Film firms for the construction of dummy aircraft, as their normal work necessarily provides

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considerable experience in the art of "faking". Two firms were given initial contracts, Gaumont British and Sound City Film Company. Gaumont British proved the less satisfactory of the two, progress being slower and the work not up to the standard of that of Sound City. The latter firm showed much ingenuity, speed and keenness in carrying out their first and subsequent orders, and became the department's principal contractor. In addition to production work, it rendered excellent service in carrying out initial experiments and in constructing prototypes of all forms of equipment, static and mobile.

Work on sites, including the clearing of hedges, shelter construction, etc., was carried out in the early days by "Works" contractors under the order of the Area Superintending Engineers. It was soon found that "Works" commitments in providing for the constantly increasing requirements of the R.A.F. did not permit them to allocate sufficient priority for decoys. The department therefore borrowed the requisite staff from the Works Services and arranged its own contracts first with Sound City and later with civil engineering firms of considerable standing. Each firm was allotted a suitable area and became responsible for the contruction and major maintenance of all decoys in that area. It is to the credit of these contractors that they accepted this work as their special contribution to the war effort, in spite of its many inconveniences. Sites were scattered over very large areas, and were often difficult of access especially in winter; all orders for new work had to be carried out immediately and the strain on the firms and their depleted labour must have been considerable.

Although it was necessary to provide R.A.F. crews for Starfish sites, every effort was made to arrange for civilian crews, preferably old men, to man the less important civil QLs.

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These consisted of single decoys protecting individual isolated targets or groups protecting built up areas. In the case of the single decoys the authority controlling the vital point to be protected, i.e. railway centre, factory, etc., was asked to take up a contract for manning and minor maintenance of its own decoy site. A large firm was chosen in a built up area and asked to make a similar contract for a group of sites protecting the area. Some 50 firms and civil authorities accepted this responsibility, and on the whole carried out their contracts satisfactorily. Tendencies towards extravagance or waste were checked, and some contracts were closed when the firms proved intractable.

All decoys were constantly inspected. The R.A.F. area officers were responsible for ensuring efficient operation and communications, and area inspectors who were trained civil engineers provided the necessary technical and financial checks. Contracts were arranged by the Air Ministry Contracts Department, C.8., and subject to certificates of completed work by the department, costing and accounts were handled by P.A.20 of M.A.P.

It has been previously stated that the necessity for speed and reasonable economy in staff ruled out the normal forms of contract, in which tenders are called and all work is measured up in detail. Three forms were adopted, the cost plus fixed fee, a fixed monthly sum which covered costs, overheads and profit, and a cost plus percentage contract. The first form was used, whenever possible, as it tended to lower the cost and prevent waste. The fixed sum form was limited to some of the civilian manning contractors and to the Sound City Film Company contract, where special circumstances prevailed. As soon as possible checks were imposed to prevent extravagances and waste. Many items of work and equipment were similar on decoys of the same type, and it was possible to

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check one contractor's cost against another; other checks were instituted on stores of all kinds. On the whole, though these forms of contracts are to be avoided if possible, it is reasonably certain that no major extravagance or waste occurred, and even if minor excess costs had to be passed, the total loss was far less than the cost of the large establishment required for complete check. Actually Sound City Film Company, the best contractor for speed, was the most difficult to deal with in settling bills. Film Companies appear to have unusual methods of accounting and store-keeping, and considerable pressure had to be exerted on this contractor to adopt a more normal system which permitted of check. The long delays before accounts could be settled, due to shortage of M.A.P. staffs, added to these difficulties.

Lands. 4. Land requisitioning was carried out under normal regulations and needs no description. The gradual clearing of sites enabled the department to settle nearly all claims before it closed down. Very great care was taken to ensure that all material was moved from sites and sent to salvage; roads were cleared, and disturbed ground levelled. The farmers and owners were fully satisfied with the trouble taken to rectify the sites; this they fully deserved as the decoys drew attacks into their neighbourhood, which otherwise would never have occurred.

Closing Down. 5. Many difficulties were encountered when the department started to close down in earnest. Apart from the clearing of over 500 sites and the settlement of claims of tenants and owners, the main problem was the transfer of equipment of all kinds to the correct authority. Items on the R.A.F. schedules had to be returned to D.G.E., and the Maintenance Units naturally asked for all stocks to be sent to them in a form ready for immediate binning. This entailed breaking down sets of equipment, sorting the serviceable from the unserviceable and transporting the stock items to the correct M.U. It was impossible to

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complete this task before the department closed down, and a Care and Maintenance Section had to be left behind to finish it. Other items not on the R.A.F. schedules had to be dealt with through the Ministry of Supply who were used at the end of the war as a Ministry of Disposal. Here the interests of the trade complicated matters. Generator sets which had been used on decoys during the war could not be sold, because the trade objected; they could not be transferred to a Ministry of Supply depot, because none could take them. Hence the position was approached that the department, otherwise ready to close, would have to continue in being merely to hold stocks, which it was not permitted to sell or to transfer. After months of wrangling, these items were transferred either to the Ministry of Supply or to Salvage.

DECOYS
IN THE
BRITISH ISLES

LEGEND

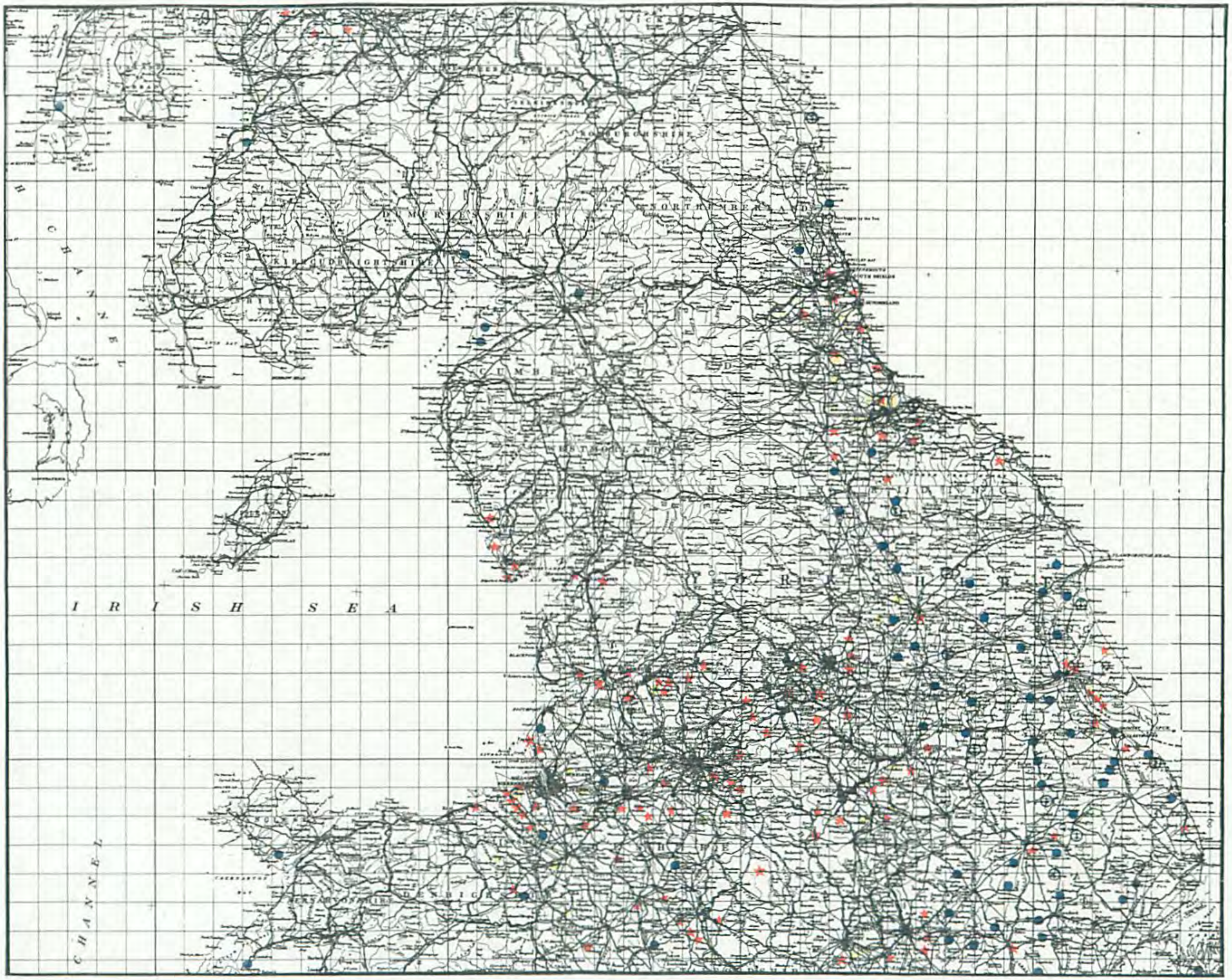
- Q. SITES
- S.F. SITES
- Q.L. SITES
- COVER PLAN SITES
- K. SITES
- DUMMY BUILDINGS

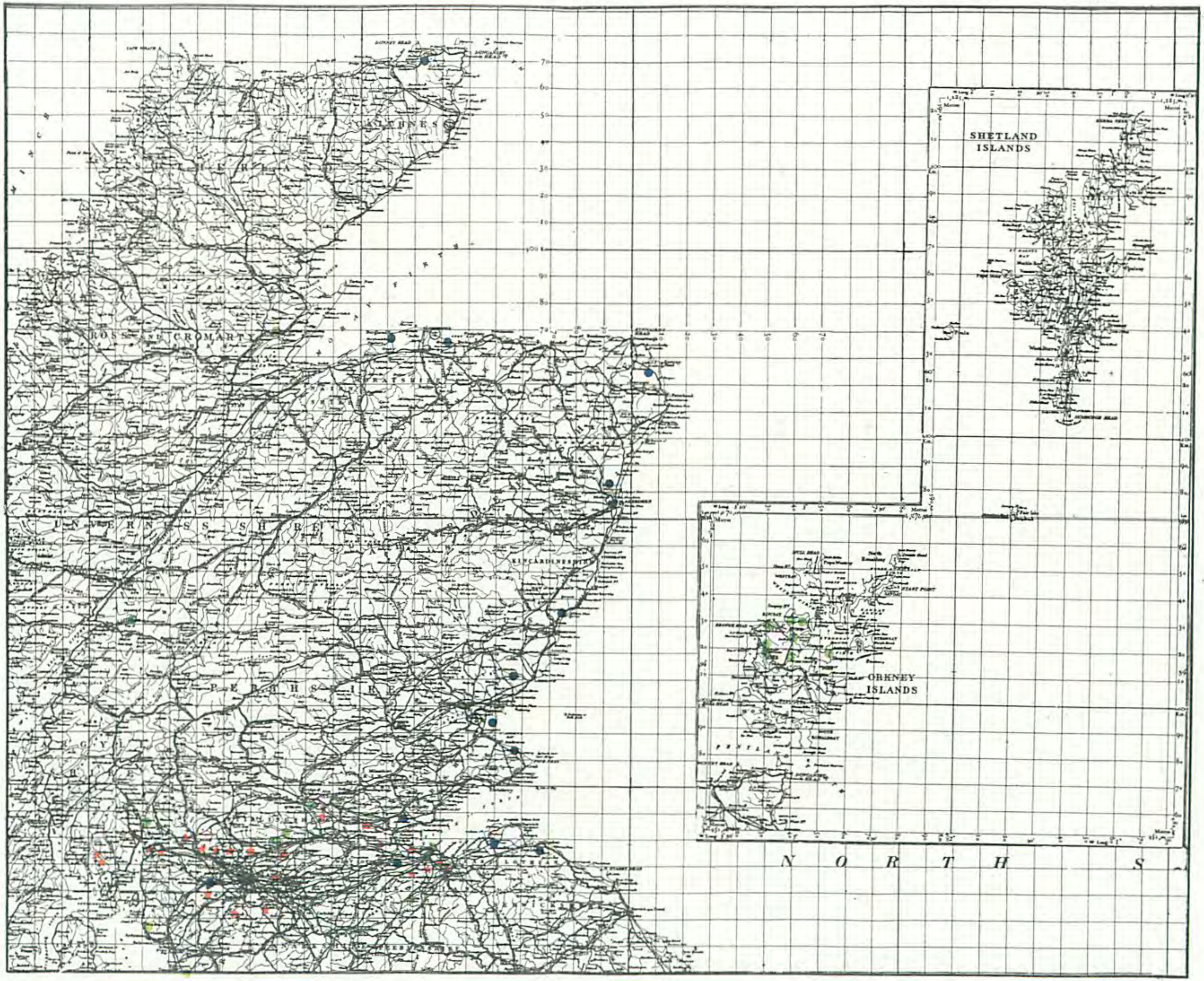
NOTE: MANY SITES INCORPORATED MORE THAN ONE TYPE OF DECOY, e.g. FIRE SITE AND LIGHTING. THE SYMBOLS INDICATE THE MAIN FUNCTION AT EACH SITE.

THE LEGEND IS COMMON TO ALL FOUR MAPS OF THIS SERIES.

SECRET


STAFFORDSHIRE
LEICESTERSHIRE
MONTGOMERYSHIRE
C H A N N E L
E N G L I S H   C H A N N E L
STRAIT OF DOVER


IRISH SEA
CHANNEL
NORTHUMBERLAND
DUMFRIESSHIRE
KIRKCUDBRIGHTSHIRE
CUMBERLAND
WESTMORLAND
YORKSHIRE
ROXBURGHSHIRE
DENBIGH


SHETLAND
ISLANDS
ORKNEY
ISLANDS
N O R T H S
KINCARDINESHIRE