LMH Archive

Document Title: Operational Research in Bomber Command

Author(s): Basil Dickins

Date(s): Not Dated.

Document Type/Physical Description: Type-written manuscript, 622 pgs.

Fonds/Collection Name: Ronnie Shephard Fonds

Series: Operational Research and Strategic Bombing

File/Box Number: Box 2

Original Archival Reference: N/A

Item Description: This is a draft manuscript of a lengthy report compiled by the RAF Bomber Command Operational Research Section, probably some time in 1945. The report was authored by Dr. Basil Dickins, a rising star in the field of physics who served as Section head during the war. Using a thematic approach it explores in excellent detail the challenges inherent in strategic bombing, making it a valuable source for both historians of air power and those studying Europe in the Second World War.

Keywords: Bomber Command; Operational Research; Operations; Technique; Bombing; Navigation

When citing material that has been digitized from other archives, the LMH Archive encourages users to cite the original reference information provided in the above field.

The purpose of the Laurier Military History Archive is to acquire, preserve and make available documents relating to the Canadian and international experience of military conflict in the twentieth and twenty-first centuries.

Website: http://www.lmharchive.ca/ E-mail: admin@canadianmilitaryhistory.ca

CHAPTER 4

THE STUDY OF DAYBOMBING TECHNIQUES, 1940 TO 1943 AND MISCELLANEOUS INVESTIGATIONS INTO BOMBING OPERATIONS

Attacks on Ships

Low-level attacks on Ships at Sea

On 12 March 1941 Blenheims of No. 2 Group, then attached to Bomber Command, commenced a series of low-level daylight attacks on enemy coastwise shipping, an offensive which reached its peak in April and was maintained until October of the same year. During this period, for a total of 2320 sorties dispatched, 72 ships of tonnages varying from 50 to over 8000 were sunk, a further 65 seriously damaged and 63 slightly damaged.(1) The ships attacked were mostly merchant and cargo vessels whose positions were the subject of definite intelligence, and reporting vessels which constituted the forward posts of the enemy raid warning system, whose position was known only approximately. The majority of these attacks took place off the enemy coast between Boulogne and Heligoland, with a smaller number off the southern tip of Norway and along the west coast of France between Brest and St. Nazaire.

At this time there was little information available, either on the accuracy of bombing to be expected from such attacks, or on the most efficient tactical methods to employ. It was even considered doubtful whether the damage inflicted on the enemy was sufficient to justify the wastage rate, which during the summer of 1941 continued to rise steadily, until by October it had reached the high value of 35 per cent of the sorties attacking. It was in order to answer questions of this kind and to provide data which would be of value in planning future operations of this type that the O.R.S., at the request of Sir Henry Tizard, undertook an extensive analysis of these anti-shipping attacks, based principally on the evidence from strike photographs taken by the attacking aircraft and on crew interrogation. Use was also made of data supplied by the Ship Damage Assessment Committee. A preliminary statistical survey covering operations from March to August 1941 showed that on the average 21 per cent of the sorties dispatched found and attacked their targets, that 42 per cent of these attacks resulted in damage to the ship, and that 22 per cent of the attacking aircraft became casualties.(2) These results compared very favourably with those achieved by Coastal Command on similar attacks, but the percentage of ships attacked which were sunk

/or

(1) A.H.B./IIK/10/46B (Bomber Cmd. O.R.S. Rept. No. 40 - Contemporary figures).
(2) Bomber Cmd. O.R.S. Rept. No.56.

or seriously damaged was somewhat less than that achieved by the enemy in his attacks on our own coastal shipping during the same period.(1) In Bomber Command O.R.S. Report No. 40 (2) more extensive data, covering the period from March to October, were given, and the effort, cost and results of the attacks were considered in relation to the tactical methods used. Amongst other things these investigations served to dispel certain impressions which until that time were generally held; in particular, the belief that the chance of hitting a ship was increased by making two attacks, and that losses could be reduced by attacking at mast height, were not substantiated. The probability of hitting a ship of 2500 tons from a height of 200 feet was found to be 0.13 from which it was estimated that the average error of bombing was of the order of 50 yards. This accuracy was of the same order as that achieved by No. 2 Group in pre-war practice bombing, and is one of the very few cases where the standard of accuracy achieved on the bombing range has been maintained under operational conditions. (See Page 103).

Cross ref to p. 103

After October 1941 the main responsibility for the anti-shipping offensive was taken over by Fighter and Coastal Commands and No. 2 Group was largely diverted to land targets. They continued, however, to operate on a reduced scale against ships, both at sea and in dock, throughout 1942 and details of all these attacks are to be found in the series of 'Day Raid Reports', written and published by the O.R.S. between February 1942 and July 1943.

Attacks on Ships at Night

Comparatively few night attacks against ships at sea have been carried out by Bomber Command. During May and June 1942, 96 such sorties were made, chiefly by Blenheims, Hampdens and Wellingtons, but a short analysis made by the O.R.S. (3) confirmed that these attacks were almost entirely unsuccessful, none of the ships being sunk and less than one per cent seriously damaged. This type of attack was subsequently discontinued.

Attacks on Shipping in Dock

Quite early in the anti-shipping campaign the question arose as to whether it was more profitable to attack merchant ships at sea or in dock. As very few of the latter type of attack were carried out, however, it was not until July 1942 that sufficient operational data

/had

(1) B.C./S.26627, Encl.5A
(2) AHB/IIK/10/46B.
(3) Bomber Cmd. O.R.S. Int. Mem. No.150 'Ship bombing at night, 1 May 1941 to 30 June 1942. (A.H.B. 2 unindexed).

had been collected to attempt to answer this question. Even then the data were not extensive, only 90 low-level and 235 medium level sorties having been despatched. The indications were, however, that mast-height attacks against concentrations of shipping in dock, although costly in aircraft, were considerably more economical from the point of view of tons sunk per aircraft lost than were similar attacks against ships at sea.(1) Medium-level operations (7000-13000 feet) on the other hand were found to be most uneconomical against this type of target, few ships being sunk and a high casualty rate sustained by the attacking aircraft.

Attacks on Capital Ships

A great deal of theoretical work was done, both in this country and America, on the best tactics to use and the chance of success in high level attacks on ships, particularly capital ships, and a useful summary of the problems involved and the main conclusion reached, as they affected Bomber Command, will be found in O.R.S. Report B.223.(2) In this paper use was made of theoretical data presented in a report by M.A.P. (R.D. Inst.7e), and operational data on bombing accuracy obtained by a study of attacks on land targets, and an attempt was made to estimate the number of bombs to be aimed for a 50 per cent chance of a direct hit on a ship of the Tirpitz class, using either the Stabilised Automatic Bombsight or the Mark XIV Bombsight. As it was not possible with the Mark XIV to make allowance for target speed the O.R.S. undertook, at the request of the Command, to calculate the necessary aiming-ahead allowances for ships of various sizes and speeds. These allowances, given as a multiple of the ship's length, were published in O.R.S. Memorandum No. 94,(3) and were later re-issued as a Bomber Command Armament Training Note.

Day Attacks on Land Targets

General Account

During the months of July to September 1941 a series of high-level day bombing attacks was carried out by Fortress aircraft of Bomber Command, but the main daylight offensive did not start until early the following year. This offensive, directed against enemy factories, shipbuilding yards, power stations and transport facilities was carried out mainly by Bostons of No. 2 Group, though later in the campaign, Mosquitoes, Mitchells and Venturas gradually replaced the Bostons. Aircraft of Nos. 1, 3, 4 and 5 Groups also participated, the latter in particular being responsible for many of the larger

/scale

(1) Bomber Cmd. O.R.S. Int.Mem. No.151 'Attacks on Shipping in Dock, 1 May 1941 to June 1942.' (A.H.B.2 unindexed)
(2) A.H.B./IIH/241/3/913.
(3) A.H.B./IIK/46B.

scale day attacks such as those on Danzig, Le Creusot, and Milan. This offensive continued until the end of May 1943, when No. 2 Group was transferred to Fighter Command, and it was not until June 1944 that any further daylight bombing was undertaken by the Command.

During this period a special study was made by O.R.S. of these daylight operations and, in addition to the routine series of 'Day Raid Reports' which were produced, a number of detailed investigations were carried out into the relative effectiveness of the different tactical methods employed, with particular reference to such features as height of attack, cloud cover and fighter escorts and formation versus non-formation flying. These investigations were based chiefly on the analysis of strike photographs taken by the attacking aircraft, supplemented by crew interrogation and intelligence reports. In assessing the success of a particular type of operation use was made of the concept of Efficiency which was defined as the percentage of bombs dispatched which fell on the primary target, and Economy which measured success in relation to wastage rate and was defined as the number of aircraft bomb loads falling on the primary target per aircraft lost.

Apart from certain special operations the majority of the daylight raids undertaken during this period fall into one of several well defined classes which are discussed in the following paragraphs.

Circus Operations

Attacks of this type were always carried out in clear weather at heights varying from 8-14,000 feet. The bombers, which were Boston III's normally flew in close boxes of six, each box being covered by a close escort wing of three squadrons of fighters flying 100 to 3000 feet above them. Still higher flew the escort cover wing whose function was to prevent surprise attack on the close escort, and finally all the formations were guarded by a high cover wing flying at still greater height. The primary object of these missions was to raise and engage that portion of the Luftwaffe fighter strength then based on the Western front. It was thereby hoped not only to prevent their transference to the Eastern theatre but to impose a higher wastage rate than could conveniently be borne. Previous experience had shown that enemy fighters were much more likely to oppose an operation on which bombers were involved than one in which fighters alone were employed, and the main role of the Bostons was that of 'decoy' to the German 'game'. A secondary object of the raids, however, was to cause damage to important objective in enemy territory and it was this aspect of the raids which chiefly engaged the attention of the O.R.S. at Bomber Command.

/The

The bomb-aiming on these operations was done by the leader of each vic of three using the Mark IX course setting bombsight, and the average radial error of the centroids of the bomb patterns from each vic was found to vary from 200 yards to 520 yards depending on the amount of opposition.(1) On the basis of these figures it was estimated (2) that Circus operations were the most efficient type of daylight raid, but only for targets exceeding 800 yards in radius, which was considerably larger than the usual type of target which was being attacked at that time. They were, on the other hand, extremely economical, even on quite small targets, as the protection afforded by the very strong fighter escort reduced bomber losses to a low level (1.8 per cent). At the same time the fighter escort imposed serious limitations both on the range and on the scale of the operations, and in view of this it was improbable that this type of attack would ever play more than a comparatively small part in our day bombing offensive.

Low level Operations.

This type of operation was also carried out mostly by Boston III's whose limited range of 500 miles confined them to targets in Northern France and Holland, though on some occasions longer range targets were attacked at low level by Mosquitoes and Lancasters. The bombers flew towards the enemy coast at sea level, approached their targets at low altitudes and attacked usually from less than 100 feet. The operations were generally carried out without the assistance of fighter cover, though on some occasions the withdrawal of the bombers from the target area was covered by a fighter screen patrolling five to 15 miles off the enemy coast. The majority of the raids were carried out in clear weather by aircraft operating in formation, though a smaller number were made by aircraft operating singly or in loose pairs, often making use of low cloud to avoid interception en route to and from the target.

These operations were, on the whole, very successful, and although the number of sorties involved was small judged by later standards (only 400 were dispatched over a period of 15 months between July 1941 and October 1942), appreciable damage was inflicted on Power Stations, factories, docks and similar objectives in Holland, France, Germany and Norway. Analyses of these raids (3) showed that although losses were high (17 per cent) the raids were very efficient and, for attacks on small targets, more economical than most types of day raid from the point of view of bombs on target per aircraft lost.(4) In Bomber Command O.R.S. Report No. S.71 the effects of cloud cover, fighter escort

/and

(1) A.H.B./IIK/10/46B.
(2) A.H.B./IIK/46/46B. (Bomber Cmd. O.R.S. Int. Mem. No. 94).
(3) Bomber Cmd. O.R.S. Rept. No. S.71. (A.H.B./II/39/1/1).
(4) A.H.B./IIK/46/46B.

and formation versus non-formation attacks are discussed both in relation to bombing efficiency and wastage rate, though in view of the somewhat small number of sorties involved it was not possible at that time to come to very firm conclusions regarding the influence of these factors.

High-level bombing

The small scale Fortress raids of July to September 1941 were mostly made by single aircraft of No. 90 Squadron, and were largely in the nature of experiments in high altitude flying. Although unable to reach the stratosphere, the Fortresses operated in the upper regions of the ~~stratosphere~~ atmosphere at altitudes varying from 27,000 to 35,000 feet and by doing so hoped to avoid fighter interception - the principal cause of high losses in daylight operations. This hope, however, was not realised, for of the 48 sorties dispatched nine were intercepted and two were shot down.(1) Neither was the bombing particularly accurate, for, in addition to the great difficulty in finding and seeing the aiming point, the Sperry 01 bombsight with which the aircraft were equipped was not adapted for heights above 20,000 feet and could not be used as a fully automatic sight. Moreover, numerous technical defects associated with high altitude flying were encountered, the most important of which were overheating of the engines, icing, and the formation of condensation trails. These, together with bad weather and various minor technical defects were responsible for the very high rate of abortive sorties, 52 per cent of aircraft returning to base without having bombed.

In 1942 a similar series of small scale high-level attacks was carried out by Mosquito aircraft and a comparison between these and the earlier Fortress raids was made by the O.R.S. (2) The Mosquitoes operated at lower altitudes (18-25000 feet) and, as a result, had very little trouble from icing and none from condensation trails, so that the proportion of effective sorties was increased to 76 per cent. It was found moreover that the danger of fighter interception was not appreciably increased by the reduction in height.

Although these high-level attacks were on far too small a scale to inflict any appreciable amount of material damage on the enemy, or even to have much indirect value as nuisance raids, they served to demonstrate several important points about high level bombing, viz:

(a) A further increase in height into the stratosphere would be needed if the danger of fighter interception was to be reduced.

(b) Failing the stratosphere it was better to operate at heights below, rather than above, 25000 feet.

(c) That precision bombing from high altitude could not be expected with the bombsighting equipment then in use.

/The

(1) A.H.B./II/70/289 (Bomber Cmd. O.R.S Rept. No. S.66).
(2) A.H.B./II/70/289.

The lessons learnt from these early experiments in high altitude flying later proved of value when, in December 1942 the Oboe system, necessitating the use of high flying aircraft, came into operational use.

Cloud Cover Raids.

During 1942 a small but persistent effort in cloud-cover raiding was maintained, mostly by Wellingtons of No. 3 Group, though Hampdens, Lancasters and Mosquitoes from other Groups also participated. Aircraft were dispatched singly in thick medium cloud, which had to be continuous, or nearly so, until the target was reached, when the aircraft broke cloud and bombed from below cloud base. Each aircraft was either given a specific target, or, in the true 'Moleing' operation, a roving commission to attack any target of importance seen on breaking cloud cover. These operations were chiefly intended as nuisance raids, the primary object of which was to harass the enemy warning system and cause loss of production through interruption of work. Their bombing efficiency was very low indeed, over 50 per cent of sorties being totally abortive, mostly owing to lack of adequate cloud cover, and only one per cent claiming to have bombed their targets visually. The loss rate on the other hand, which was four per cent, was low compared with other types of daylight operations at this time.(1)

From a study of the effect of enemy air activity on production in this country, and from intelligence information on the German raid warning system, an attempt was made to assess the nuisance value of these raids. It was estimated that, although they undoubtedly had a certain potential nuisance value, the rate of operation, averaging less than one sortie per day, was totally inadequate to have any adverse effect on production. It was thought however that a sustained effort of ten to 20 sorties per day might be expected to reduce production in the area concerned by about ten per cent, but in the light of subsequent experience even this appears to have been something of an overestimate.

Special Daylight Operations

From time to time during 1941 and 1942 Bomber Command carried out comparatively large scale daylight raids on special objectives, and as experience of such attacks was at that time very limited, these did not invariably go according to plan. As a result the O.R.S. were sometimes called upon to undertake special investigations into the less successful raids in order to determine the main causes of failure, and to suggest means by which the same mistakes might be avoided in

/future

(1) A.H.B./II/70/289 (Bomber Cmd. O.R.S. Rept. No. S.65).

future. Thus, on the dusk attack on the Schneider Works at Le Creusot by 81 Lancasters of No. 5 Group on 17 October 1942, the P.R.U. evidence revealed that the main weight of the attack had overshot on to a neighbouring housing estate and that the works themselves had escaped with comparatively light damage. (See page 105) Investigation revealed that the principal cause of the failure was the poor visibility due to the failing light, zero hour having been fixed for 15 minutes after sunset. Important subsidiary causes of failure were the incendiaries dropped by the first aircraft over the target, the smoke from which prevented visual identification by the later aircraft, mutual interference between aircraft attempting to bomb at the same time, and misuse of the bombsight.(1) The remedies in this case were fairly clear, and the experience gained on this attack was made use of in planning subsequent operations of similar type.

Cross ref to p 105

Investigations were also made into the raid on Augsburg on 17 April 1942, and into the part played by Bomber Command in the combined operations against Dieppe on 19 August 1942. On the latter occasion the bombing of the gun batteries was rendered quite ineffective by the activity of enemy fighters, and although the task of laying smoke screens from low level was successfully carried out, the casualty rate from flak was extremely high. It was pointed out (2) that, unless losses could be reduced it could not be hoped to maintain an offensive of this type for more than a few days with the reserves of aircraft and maintenance staff at that time available. In view of this a complete overhaul of the technique of smoke-laying from aircraft was suggested.

Bombing Accuracy on Daylight Operations

A number of investigations were carried out to ascertain the accuracy achieved under different conditions, using different types of bombsights, some of which have already been referred to. The average radial error of the Mark IX course setting bombsight from a height of 10000 feet when little opposition was encountered was found to be of the order of 350 yards, but the data available was not extensive enough to make any definite statement regarding the variation in bombing accuracy with height of attack. The effect of heavy opposition was to double the bombing error (3).

A preliminary investigation into the accuracy achieved with the Norden bombsight from 25,000 feet during August 1942 showed that the average radial error was of the same order as that achieved by the Mark IX course setting bombsight from 12,000 feet.

---

(1) A.H.B./IIH/258/1/276 (Bomber Cmd. O.R.S. Rept. No. S.76).
(2) Bomber Cmd. O.R.S. Int.Mem. 'A note on the losses sustained at Dieppe'.
(3) A.H.B./IIK/10/46B (Bomber Cmd. O.R.S. Rept. No. 41).

Miscellaneous Investigations

Investigations into the use of Decoys by the Enemy

The elucidation of the structure, location and methods of use of decoys by the enemy was primarily the responsibility of the decoy section ('Q' Section) at the C.I.U., but in so far as such decoys were factors liable to influence the success of operations they came within the purview of O.R.S. Moreover, the observations of 'Q' Section were based entirely upon photographic interpretation, whereas those of the O.R.S. depended on operational evidence, particularly sortie raid reports and plots of night photographs. It is consequently a matter of some satisfaction that these two quite independent lines of investigation led, in the main, to essentially the same conclusions.

Decoy Activity during 1941 and 1942.

During 1941 and 1942 the principal type of decoy used by the enemy at night was the fire site. These sites were readily recognisable on day cover and were described in a series of 'Q' reports issued by the C.I.U. They were seen to consist of groups of walled enclosures filled with combustible material which, when ignited, produced the effect of a group of burning buildings. These decoy fires were often recognised in action on night photographs by the close and regular light tracks which they produced, and numerous instances occurred where they were effective in diverting a considerable proportion of the attack. Thus on the raid on Essen on 25/26 March 1942, 15 of the 36 photographs plotted were concentrated just north of Rheinburg, about 20 miles West North West of the target and showed decoy fires burning.(1) This decoy site was not previously known, but its position was later confirmed from day cover of the area. Similarly 40 per cent of the photographs taken on the Cologne raid on 27/28 April were plotted in the neighbourhood of the Haumar fire site, seven miles South-east of Cologne, which was in action on this night.(2) Many other references to diversions of effort caused by fire sites will be found in the early reports of the 'B' Series and in the Night Raid Reports dealing with operations during 1942.

Evidence of Decoy Flares and Groundmarkers

With the introduction, in January 1943, of skymarking flares and the target indicator marker bomb, our aircraft ceased to bomb on fires, and the fire site consequently lost much of its effectiveness. The enemy was thus forced to modify his decoy system, and as early as February 1943 it was suspected that he might be using decoy skymarker flares.(3) Suspicions that he might also be making attempts to

/simulate

A.H.B./B/39/1/2

(1) Bomber Cmd. O.R.S. Rept. No.B.107 (~~Unindexed, but held in A.H.B.~~)
(2) Bomber Cmd. O.R.S. Rept. No. B.110 (Unindexed, but held in A.H.B.
(3) Bomber Cmd. O.R.S. Rept. B.126.

97

stimulate our target indicator markers were first aroused as a result of an analysis of the raid on Stuttgart on 11/12 March 1943.(1) During the final stages of this raid only a single salvo of green target indicators were burning. Nevertheless at least 37 aircraft bombing during this period claimed to have had red target indicators in their bombsight, and these aircraft were all plotted in an area well to the South-west of the target. There was no evidence available at this time to show whether these aircraft had in fact been deceived by an enemy decoy or had simply mistaken a fire burning in open country for a red target indicator marker, but in the opinion of the O.R.S. the former was the most likely explanation, as discrepancies of this nature had not been observed on previous raids.

More definite, although admittedly still controversial evidence, of decoy indicator markers was obtained for the raid on Bochum on 13/14 May 1943. On this raid, owing to Oboe failures there was a gap of 25 minutes in the middle of the raid when it was quite certain that no red target indicators were dropped by our own aircraft or were burning on the ground. Yet 118 aircraft, or 40 per cent of all those attacking during the gap in the marking, claimed to have bombed on red target indicators. A still more important point was that 33 crews reported seeing single red target indicators cascading during this period.(2) In view of these facts arrangements were made by the O.R.S. for the re-interrogation of all crews who claimed to have bombed on red target indicators during this period and various members of the O.R.S. attended some of the re-interrogations in person. The great majority of crews confirmed that they actually had the red target indicator in the bombsight at the time stated and they were confident that they had not mistaken fires for red target indicators. Throughout this and subsequent investigations the inherent unreliability of the crews' reports was borne constantly in mind, but in this case it was considered most unlikely that such a large number of crews, including some of considerable operational experience, should have been mistaken as to what they saw in the target area. There was, on the other hand, the evidence of the Senior Air Staff Officer of No. 3 Group, reproduced as Appendix B in Report No. B.137 who himself flew in this raid and was over the target for a period of five minutes during the gap in the marking. He claims to have seen nothing during this period which could possibly have been mistaken for a red target indicator marker, and this conflicting evidence cast a certain amount of doubt on the conclusions reached. As a result of this investigation certain recommendations were made by the O.R.S., the chief of which were:-

/(a)

A.H.B./II/39/1
(1) (Bomber Cmd. O.R.S. Rept. No. B.131.)
A.H.B./II/39/1C
(2) Bomber Cmd O.R.S. Rept No. B. 137.

(a) That crews should be warned of the possible existence of dummy target indicators.

(b) That as many new operational crews as possible should be given the opportunity of seeing the displays of target indicator markers arranged by the Pathfinder Force over this country, before taking part in operations.

Much evidence of a similar nature to that obtained on Bochum continued to accumulate during the summer of 1943. Particular examples will be found in many of the reports in the 'B' Series of Bomber Command O.R.S. reports and a summary of the principal raids on which decoy activity was suspected ~~was~~ given in a Bomber Command O.R.S. Internal Memorandum. In order to get more detailed information on the nature and method of use of these decoys the O.R.S. drew up a pro-forma to be filled up by experienced and reliable crews who, on Newhaven attacks, saw target indicators of the primary colour (i.e. as used by the visual markers) after Z plus 10 minutes. As the target indicators dropped by the visual markers had almost invariably burnt out by Z plus seven at the latest any target indicators of this colour seen after this time would almost certainly be of enemy origin. From an analysis of these questionnaires and from a study of night photographic evidence it was concluded that these decoys were in the nature of rockets fired from the ground, which burst in the air and cascaded to the ground in a shower of coloured candles in the same manner as our own target indicator markers, the principal difference being that the burning time of the candles was shorter, the number of candles fewer, and the colours less bright. These decoy indicators were thought to be shot up singly at fairly frequent intervals during the raid and to be used chiefly though not entirely in the neighbourhood of established fire sites. It was observed that the fire sites themselves were often, though not always, in action at the same time as the decoy markers. On some raids the use of decoy fire sites and decoy markers was observed to be associated with the use of smoke screens in open country (e.g. Cologne 3/4 July 1943). These conclusions were at first received with considerable scepticism particularly by the Pathfinder Force and by 'N' Section of the C.I.U. whose objections were based chiefly on the fact that at that time decoy target indicators had not been recognised with certainty on night photographs.

Study of Day-cover

Meanwhile, however, the Decoy Section ('Q' Section) at the C.I.U., working quite independently and on evidence of an entirely different nature, had come to essentially the same conclusions as the O.R.S. In Report No. QS.2 (1), published in November 1943, they suggested that certain

/emplacements

(1) A.C.I.U. Int. Rept. No. QS.2, 25th Nov. 1943.

emplacements which began to appear in the neighbourhood of German fire sites during the months of June to August 1943, contained firing pieces which might be used for firing decoy target indicator devices. Two basic types of emplacements were discovered, referred to as the 'A' and 'B' types. The 'A' type structures were circular whereas the 'B' type, which were found only in the Berlin area, were rectangular emplacements divided internally by cross walls. Continued study of day cover showed a sequence of simplification in these sites and, about the middle of 1944, certain non-emplaced sites in open country were interpreted as decoy target indicator layouts. It was not until September 1944 that decoy target indicators were recognised on night photographs by 'N' Section A.C.I.U. with any degree of certainty although several cases of suspected decoy target indicators on night photographs had been reported by the O.R.S. before that time. (1)

Ground-survey of Decoy Sites

Direct confirmation of the above conclusions regarding the nature and use of decoy markers was not obtained until the Spring and early summer of 1945 when ground surveys of the sites became possible. Towards the end of April a decoy site near Munchen Gladbach was visited by the Armament Officer of No. 8 Group, who confirmed that the decoy target indicators were in the nature of large rockets fired from the ground, and who brought back the first description of the decoy target indicator rocket and firing piece. Photographs of a similar site near Mayen were also published in April 1945 by the Office of the Chief Ordnance Officer Headquarters, European Theatre of Operations, U.S. Army. At the beginning of June 1945 two members of O.R.S. accompanied representatives of Colonel Sir John Turner's Department and 'N' Section, A.C.I.U. on a visit to the decoy sites in the Mannheim and Frankfurt areas. In all eight sites were visited and, in spite of extensive demolition by the enemy and further damage sustained in the subsequent fighting, sufficient evidence was found to reconstruct the main features of the sites and the equipment used, though certain details still remained obscure. The results of this visit are described in detail in Bomber Command O.R.S. Report S.224 (2) and, in general fully confirmed the conclusions reached by the O.R.S. and by 'Q' Section in 1943. On six of the eight sites visited devices for simulating target indicator markers both in the air and on the ground were found, and the existence of decoy flares was also confirmed. The conclusions of 'Q' Section regarding the nature and use of the 'A' type structures were also proved to be correct. Unfortunately little documentary evidence was discovered which might have given a clue as to the date on which decoy markers and flares were first employed, or as to the raids on which they were used.

/Effect of .....

(1) Bomber Cmd. O.R.S. Int. Mem. 'Observations on enemy decoy T.I. Markers, 14 Apr. 1944.
(2) A.H.B./II/S2/5.

Effect of Decoy Target Indicators on Operations

Although the use by the enemy of decoy marker bombs was undoubtedly a factor, and, on some occasions a very important factor. in influencing the success of our attacks, the overall effect on our bombing offensive was by no means as great as it at one time threatened to become. As a result of detailed analyses of most of the major area attacks in 1943 the general conclusion was reached that decoy target indicators were most effective under conditions when, owing to technical failures or to unexpected weather conditions, the marking technique did not go according to plan. Thus, although on a number of raids a high proportion of the main force did undoubtedly bomb decoy markers, these, in general, could only be considered secondary rather than a primary cause of failure. Whenever the weather was good and the marking technique carried out according to plan, the enemy decoys had little success, at the most causing some scattered bombing around the edge of the target.

The enemy decoy system remained active throughout 1944, but had even less effect on our bombing than in 1943. Although it is likely that they attracted a proportion of the bombing on some of our small scale Mosquito attacks, their effect on major operations was usually negligible. That this was so can probably be attributed to the following factors:-

(a) Improvement in our own marking techniques.

(b) The shortening of the duration of raids.

(c) The use of the Master Bomber.

(d) The fact that the enemy decoy target indicator markers were rather a poor imitation of our own, and that he seems to have made no attempt to improve on his earlier efforts. As a result the more expert crews soon became expert in recognising decoy target indicators and in distinguishing them from the genuine article.

(e) The fact that aircrews were warned of the existence of decoy markers and were kept informed as to their probable appearance and method of use, and on the best method of distinguishing them from our own markers. Several paragraphs along these lines were included in 'Methods of Target Marking', a publication prepared by the O.R.S. for the use of aircrews, and more detailed information on the Berlin decoys was given in Bomber Command O.R.S. Report B.222. (1)

Effect of Experience on success in Target Location

Early Investigations

The first attempt to assess the effect of the operational experience of the aircrew as a factor influencing the success of target location was made by O.R.S.* in June 1942. All the captains

/in

(1) A.H.B./IIM/a1/4a (Sept. 1944).

in No. 3 Group were classified into experience categories according to the number of operations which they had completed, and within each category the number and proportion of photographs plotted within varying distances of the target was determined for a series of operations. The photographic evidence at this time was too scanty to permit any very detailed investigation, and the results obtained did not demonstrate any correlation between experience and success. It was concluded that the effect of experience was probably being swamped by some other more important factor.

Analysis of attack on Kassel, 22/23 October 1943

A detailed investigation of this raid was undertaken in a further attempt to determine the effect of experience on bombing success. This was a very successful Newhaven attack, which took place under clear weather conditions, and the M.P.I. of both the primary and secondary markers remained close to the aiming point throughout the attack. This, combined with the fact that the approximate bombing positions of 338 aircraft were known from the plotted positions of their night photographs, made this raid a particularly favourable one for such an investigation.

It was shown that the distance from the aiming point at which a night photograph was plotted was influenced by the previous operational experience of the captain, and independently, to an approximately equal extent, by that of the air bomber.(1) The relationship was found to be a logarithmic one, so that from the point of view of improvement in bombing performance the experience gained on the first trip of the operational tour was equivalent to that gained on the next two equalled that gained on the next four etc. The second operations showed, on the average, an improvement of five per cent over the first, and thereafter the percentage improvement attributable to successive trips decreased on a logarithmic scale. The magnitude of the correlations demonstrated was small (r between distance of photo from the aiming point and logarithm of the number of operations completed by the Captain = 0.17) and showed that many other factors besides experience were undoubtedly operating.

These results suggested other lines of investigation which might have proved profitable had there been time to follow them up. How for instance, did the proportion of crews in different experience categories affect the concentration of bombing achieved, and to what effect was this factor influenced by fluctuations in the loss rate? A certain amount of data bearing on this question was collected early in 1944, but owing to other more urgent work the investigation was never completed.

(1) Bomber Cmd. O.R.S. Int.Mem. No. 67 'The effect of experience on bombing success, 16 Mar. 1944.' (A.H.B.2 unindexed)