

## **Chapter 7**

### **‘In the Dark’**

#### **Nocturnal Visualities and Concealment at Night**

In the preceding chapter, discussions of knowing, simulating and transforming the British landscape focused primarily upon observations made during day-light hours. However, as the war progressed, and the Luftwaffe began to shift their efforts towards a night-time bombing campaign, it was realised within civil camouflage that the transition to nocturnal forms of concealment should be made in order to protect industrial buildings. This evolution, though, would present somewhat unique and previously unencountered challenges. Indeed, it was accentuated that the visual and perceptual conditions of the night would require the evaluation and re-thinking of existing knowledge of the ‘bomber body’, and in line with this, the appraisal of ‘active’ approaches to camouflage. An important aspect of this shift was to acknowledge that, although, on the one hand, the night significantly diminished the capacity to visually appreciate and engage with the landscape, on the other, there continued to be ‘fleeting’ moments when the landscape would become visually present, enabling topographical landforms to still be interpreted and analysed from the air (albeit in different ways to day-time observations). In these visual and atmospheric conditions, the role of the camoufleur, therefore, was to produce methods of concealment which exploited and manipulated this visual environment defined by a more unsettled and unstable threshold between presence and absence.

In the first half of this chapter, I explore the transition towards nocturnal camouflage, commencing with some of the early engagements with the night-time landscape by civil camoufleurs. As part of this, I illustrate how they initially sought to make use of an array of lighting technologies in order to ‘baffle’, ‘dazzle’ and ‘deceive’ the nocturnal bomber body and how these ideas came into conflict with dominant popular and political imaginings of the ‘Blackout’ as a space of shelter and refuge. Following on from this, I highlight how a more sustained engagement with the night necessitated a re-connection with existing knowledge on the practices and visualities of the bomber body, with renewed investigations revealing the tactics being deployed by the Luftwaffe at

night as well as the specific techniques of the nocturnal aerial observer; subsequently, this revised knowledge would feed back into camouflage practice. In light of this, I examine how a reworked set of ‘aerial grammar’ was articulated about the visual conspicuousness of the landscape at night through the conducting of aerial survey flights during the winter of 1941/1942. The second half of the chapter, then, considers the ways in which these findings culminated in the modification of the viewing room and the techniques of simulation adopted within this space. Finally, the chapter discusses the reviewing of existing techniques of camouflage as well as the production of new methods, concluding with an assessment of the effectiveness of the various ideas and schemes proposed.

### **7.1: Early Attempts at Nocturnal Camouflage**

On the night of the 20<sup>th</sup>/21<sup>st</sup> May 1939, an Armstrong Whitworth Whitley bomber crew from No.10 Squadron, accompanied by a Mr Huddy (acting as a civilian observer for the A.R.P.D.) as well as Wing Commanders G.H. Mills and J.G.Hawtrey,<sup>1</sup> were making observations around the Humber Estuary. The conditions were noted to be ‘dark with no moon’ with visibility varying from one mile to a thousand yards and low cloud and haze restricting the observations to 3000ft and under.<sup>2</sup> The objective of the survey flight was to consider the effectiveness of Blackout regulations in the City of Hull and the large town of Scunthorpe, 16 miles to the South West. At Scunthorpe, it was recorded that:

‘the blackout...was complete, and...was only located at 0110 hours with the assistance of the marker beacon situated. The only light observed was a steady yellow light situated about 200 yards S.S.E. of the marker beacon’.<sup>3</sup>

For Hull, a much more conflicting assessment was given; in one report, it was remarked that at:

‘the beginning of the period the outlines of the City...were made discernible by the dim lighting of the streets, but later the blackout proved most effective and if it had not been for the marker beacons the city could not have been located’.<sup>4</sup>

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<sup>1</sup> Hawtrey would later be appointed to serve on the C.A.P. in November 1939.

<sup>2</sup> TNA, HO186/208: *Report on Humber Blackout Tests, Night of 20th/21st May 1939.*

<sup>3</sup> TNA, HO186/208: *Report on Humber Blackout Tests, Night of 20th/21st May 1939.*

In the view of Hawtrey and Mills, however:

‘the black-out of Hull itself was, we thought, poor and was certainly no better than Southampton in May 1938, and definitely worse than Leicester in January 1938. This we understand was because participation was purely voluntary. Most of the light probably came from private houses’.<sup>5</sup>

While these observations testify to an interest in the visual effectiveness of the ‘Blackout’, the survey flight was serving a dual purpose. As part of the flight, these observers were to assess one of the earliest forms of camouflage for nocturnal conditions, an experimental technique called ‘baffle lighting’. ‘Baffle lighting’ was a camouflage technique which entailed the use of artificial illumination to confuse the enemy bomber body as their location through the blurring of the distinctions between heavily and sparsely populated areas; electric light sources would be deployed around predominantly rural areas, ‘so as to make it appear lighted to the same extent as the built-up area with their exempted lighting lit’, thereby facilitating disorientation.<sup>6</sup> Through this ‘merging’ effect, it was contended, ‘it might be possible, from the lighting point of view, not to require exempted lighting such as that at railway yards, ship-yards, blast furnaces, etc., to be turned out on a Red Warning’.<sup>7</sup> As a result, it was maintained that industrial production could potentially continue during times of “air-raid action”.<sup>8</sup>

In the Humber test of May 1939, 4,000 hurricane lamps had been scattered around the estuary at regular intervals of ½ mile. From the aerial survey report of Mills and Hawtrey, it was clear that such a technique was considered to have great potential for mystifying enemy aircrews;

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<sup>4</sup> TNA, HO186/208: *Report on Humber Blackout Tests, Night of 20th/21st May 1939.*

<sup>5</sup> TNA, HO186/208: *Report on Humber Black-out*, Wng Cmdr G.H. Mills, and Wng Cmdr J.G. Hawtrey, dated 14th June 1939.

<sup>6</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>7</sup> TNA, HO186/208: *Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940. Under A.R.P., there were 3 warning grades. A ‘Yellow Warning’ indicated to the local populace that enemy aircraft were over Britain, a ‘Purple Warning’ suggested that the aircraft were coming in the direction of that particular location, and a ‘Red Warning’ signified that the attack was going to take place imminently upon that location.

<sup>8</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

‘we thought that the baffle lighting experiment was very encouraging indeed, and when the black-out really got started, we found it practically impossible to distinguish between chinks of light coming even from such a large place as Beverley, and the hurricane lamps themselves... the impression that the baffle lighting gave us was that of flying permanently over a large town which had not been successfully blacked out. A most confusing situation was produced by the impression that the town moved along with the aeroplane as it flew, as there were always about four lights showing down each lane of lights in every direction’.<sup>9</sup>

At the same time, it was acknowledged that further refinements of the technique would be required;

‘the hurricane lamps were visible from 3000ft but in the opinion of the observers they would have been invisible from 6000ft. They were not bright enough. It is possible that they were too evenly spaced and should NOT be layed [*sic*] out in straight lines. They might have proved more effective if an occasional clump of lights had been arranged’.<sup>10</sup>

With this in mind, it was proposed that ‘baffle lighting should be tested again as early as possible in...enforced [rather than voluntary] blackout conditions... [and] with lamps with cheap reflectors to increase their visibility [to 6,000ft]’, thereby proving the real value of this technique of deception.<sup>11</sup>

Following the experiment, a review of baffle lighting was undertaken by the Home Defence Committee, with the object being to employ the technique on a national level. In the process of these discussions, however, several issues were raised. Firstly, the expense of adopting the scheme on a large scale was considered to be problematic;

‘not only would the initial cost of the lamps assume considerable proportions, but...heavy charges would be incurred in maintenance and in respect of the personnel

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<sup>9</sup> TNA, HO186/208: *Report on Humber Black-out*, Wng Cmdr G.H. Mills, and Wng Cmdr J.G. Hawtrey, dated 14th June 1939.

<sup>10</sup> TNA, HO186/208: *Report on Humber Blackout Tests, Night of 20th/21st May 1939*.

<sup>11</sup> TNA, HO186/208: *Report on Humber Black-out*, Wng Cmdr G.H. Mills, and Wng Cmdr J.G. Hawtrey, dated 14th June 1939.

who would necessarily have to be employed to attend to the lamps and to see that the lights were kept burning'.<sup>12</sup>

Certainly, in the Humber trials:

'the preparation of a satisfactory scheme for the experiment involved much work and a large number of volunteer helpers had to be employed to place the lamps in position and to see that they were not interfered with by unauthorised persons'.<sup>13</sup>

Following on from this was the perceived reaction to the presence of 'unshielded' lighting in imposed blackout conditions by the general public. With respect to this, it was contended that:

'no doubt suitable publicity would go far to prevent interference with the lamps, but there would be the risk that ill-advised persons would have a tendency to put out lamps placed near their premises and so impair the efficacy of the system, especially during an air raid. This form of interference would be difficult to combat'.<sup>14</sup>

In line with this, it was argued that a national system of baffle lighting would also have:

'possible repercussions on the policy laid down by the C.I.D. requiring the complete obscuration of all lights...[it is] open to question whether the effects of exhibiting lights deliberately would enable the policy of complete obscuration to be enforced so successfully as would otherwise be the case. For example, it would be difficult to take a firm line in the case of a householder permitting a chink of light to escape, if a lighted hurricane lamp forming one of a pattern was burning in proximity to his house'.<sup>15</sup>

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<sup>12</sup> TNA, HO186/208: *Committee of Imperial Defence, Home Defence Committee: Summary of Report*, circa June 1939.

<sup>13</sup> TNA, HO186/208: *Committee of Imperial Defence, Home Defence Committee: Summary of Report*, circa June 1939.

<sup>14</sup> TNA, HO186/208: *Committee of Imperial Defence, Home Defence Committee: Summary of Report*, circa June 1939.

<sup>15</sup> TNA, HO186/208: *Committee of Imperial Defence, Home Defence Committee: Summary of Report*, circa June 1939.

It was clear that this presence of lighting could, therefore, undermine the official regulation of defensive measures, as well as destabilise popular conceptions that ‘total darkness as enabled by ‘Blackout’ provided an environment of security.

Despite these reservations, camoufleurs continued to develop schemes along the lines of artificial lighting for the purpose of confusion and deception. In October 1939, the Camouflage Branch (and later the C.D.C.E.) assumed responsibility for the development of baffle lighting, with examinations of the technique also being frequently discussed at meetings of the C.A.P.. At its third meeting, Hawtreys was invited to provide his observations on blackout conditions and address questions concerning the merits of deceptive lighting. In the course of these deliberations, several points were raised, most notably concerning the effectiveness of the ‘Blackout’ in London. In relation to this, Hawtreys expressed the view that:

‘it would be difficult to say how effective a complete blackout of London would be, but he doubted that London, in itself, could ever be entirely concealed, though aimed bombing would be impracticable and an enemy would be so confused by lack of light as to be unaware of his precise locality’.<sup>16</sup>

Furthermore, the value of lighting at night to ‘bewilder’ enemy aircrews was considered, with the assertion being made that:

‘any form of decoy lighting would not be in accord with the present policy of complete black-out..., but it might be necessary to consider exceptions in special cases, e.g. coke ovens and blast furnaces’.<sup>17</sup>

Emerging from these consultations was the development of an experimental programme, which would focus on two forms of ‘deceptive’ lighting. Firstly, there was the continued refinement of baffle lighting, with individual camoufleurs such as Hugh

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<sup>16</sup> TNA, HO186/171: *Minutes of the Third Meeting of the C.A.P.*, dated 17th Nov 1939. Note: a later aerial survey flight on the night of the 21<sup>st</sup> October 1941 suggested that many of the ‘chief roads’ in London could be easily identified, these being ordered in terms of levels of ‘brilliance’. From this, it was argued that ‘these form a pattern from which...London was readily identifiable as such from approximately 5 miles’ and could, if the enemy navigator was well-versed in road maps of the capital, be used to provide bearings to attack other parts of city. See TNA, HO186/1395: *London Black-out, Aerial Survey Report*, dated 21st Oct 1941.

<sup>17</sup> TNA, HO186/171: *Minutes of the Third Meeting of the C.A.P.*, dated 17th Nov 1939.

Cott expressing their support for the method. Indeed, Cott held a great apprehension about the effectiveness of the 'Blackout' to ensure the complete concealment of urban environments. At the sixth meeting of the C.A.P., he stated that:

'the difficulty of disguising geographical features at night is effectively met by the black-out only at times when the ground is already in darkness, e.g. on moonless nights. Under strong moonlight, land-masses stand out more or less distinctly from water, and country districts from towns, and the question arises whether the black-out system unmodified is the most effective method of reducing visibility under such circumstances'.<sup>18</sup>

For the meeting, Cott prepared a practical demonstration to emphasise the different tones between urban and rural environments and proposed that artificial illumination on moonlit nights could be utilised to overcome these differences. He, therefore, requested that 'experiments on a small scale...be carried out with a view to extensive application if successful'.<sup>19</sup> At the following meeting, held on 26<sup>th</sup> January 1940, a statement on the Humber experiments was given, with the Panel concluding that it was:

'of the opinion that the experiment...provided sufficient evidence to show that baffle lighting is effective in confusing the pilot by night, and while appreciating the present Government policy of complete black-out...considers that the potentialities of baffle lighting should not be neglected'.<sup>20</sup>

Cott was, therefore, authorised to proceed with his experiments into baffle lighting and, furthermore, to get in touch with Dr J.T. MacCurdy at Cambridge, another proponent of the method.<sup>21</sup> Almost immediately, however, Cott was confronted with the dilemma of finding appropriate laboratory facilities which would be large enough to carry out his experiment; by the end of February, he had begun discussions with the River Ouse

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<sup>18</sup> TNA, HO186/171: *Minutes of the Sixth Meeting of the C.A.P.*, dated 12th Jan 1940.

<sup>19</sup> TNA, HO186/171: *Minutes of the Sixth Meeting of the C.A.P.*, dated 12th Jan 1940.

<sup>20</sup> TNA, HO186/171: *Minutes of the Seventh Meeting of the C.A.P.*, dated 26th Jan 1940.

<sup>21</sup> TNA, HO186/171: *Minutes of the Eighth Meeting of the C.A.P.*, dated 10th Feb 1940. Dr John Thomson MacCurdy (1886-1947) was a lecturer in Psychopathology at Cambridge University, an appointment he had held since 1923. In his addition to his thoughts on 'baffle lighting', MacCurdy worked as a consultant psychologist for the RAF during the Second World War as well as working for a special branch of the Foreign Office.

Catchment Board's Research Station, where a large scale model of the Wash and its river systems was installed.

While these negotiations were underway, the C.A.P. had learnt about an attempt by the Air Ministry to try out the same technology and Cott's experiments were temporarily postponed until the results of this trial were released. In the Air Ministry scheme, it had been proposed that:

'hurricane lamps, with reflectors to prevent the ground being illuminated, will be installed at every observer and searchlight station in the neighbourhood of an aerodrome'.<sup>22</sup>

This would be carried out over an area of between 200-500 square miles, a zone to be determined by Fighter Command who also intended to use such lighting 'to enable machines taking off at night to orient themselves'.<sup>23</sup> In the event, the trial by the Air Ministry proved unsatisfactory, one report recording that:

'the Air Staff now regard low intensity baffle lighting as useful only on nights of bad visibility: and on the whole we are not inclined to recommend it as a practicable expedient'.<sup>24</sup>

Subsequently the question was raised that:

'[as] the bombing of specific targets by night is unlikely is there any point in confusing pilots, the black-out itself being very confusing, except possibly on moonlight nights with exceptionally good visibility (by no means a common occurrence)?'.<sup>25</sup>

Taking these critical assessments into account, baffle lighting as an experimental technique was abandoned at the end of April 1940.<sup>26</sup>

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<sup>22</sup> TNA, HO186/171: *CAP/4: Baffle Lighting*, circa Feb 1940.

<sup>23</sup> TNA, HO186/171: *CAP/4: Baffle Lighting*, circa Feb 1940.

<sup>24</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>25</sup> TNA, HO186/171: *CAP/4: Baffle Lighting*, circa Feb 1940.

<sup>26</sup> It should be noted that dismissal of baffle lighting also contributed to the resignation of Hugh Cott from the C.A.P. during this time period.



The second form of artificial ‘deceptive lighting’ to be proposed with civil camouflage discourses was ‘dazzle lighting’, a term applied to the use of searchlights, which were considered to have ‘a serious dazzling effect when a bomber is caught in the beam,...[making] accurate bomb aiming...impossible’.<sup>27</sup> As a technique, ‘dazzle lighting’ had been trialled by the Royal Engineer and Signals Board in the very early stages of the war, from which it had been concluded that ‘a dispersed-beam search-light completely confuses a pilot at 500 feet, but does not have the same effect at 1,000 feet or over’.<sup>28</sup> In April 1940, it was proposed to extend the application of dazzle lighting to include the ‘flashing [of] the search-lights (five flashes a second being the optimum rate) or by swinging the beams: this has not yet been tested’.<sup>29</sup> In terms of their deployment, it was suggested that:

‘if it is thought that defence is most needed against low or fairly low flying over estuaries or docks not protected by barrage balloons, we consider that the use of searchlights to dazzle an attacker would effectively prevent him from bombing with any precision’.<sup>30</sup>

In addition, it was contended that:

‘on the approach of an attacking plane, all the searchlights in the zone should be turned on so as to dazzle and confuse the attacker as to his position. This should at the same time assist the fighter planes in those parts of the zone where there are no guns’.<sup>31</sup>

Operationally, ‘dazzle lighting’ would become a standard part of anti-aircraft measures in the form of searchlights, with the ‘dazzling’ of the bomber body being positioned alongside their use by anti-aircraft gunners to aid targeting.

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<sup>27</sup> TNA, HO186/395: *Effects of the various aspects of operational bombing in wartime on A.R.P. shelter policy, camouflage and decoy lighting*, circa May 1940.

<sup>28</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>29</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>30</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>31</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

At the same time as these solutions were being discussed by ‘official’ camoufleurs, members of the general public were also offering their ideas, these predominantly focusing upon the use of bonfires as a means of “drawing Nazi’s Teeth”.<sup>32</sup> The Chief Constable of the Isle of Ely Constabulary, for example, wrote how:

‘I have noticed that, wherever a fire is seen, enemy planes generally drop bombs in the belief that a preceding plane has done a successful bombing. If on certain nights a number of fires were lighted in sparsely inhabited areas a large number of bombs would be unloaded by the enemy which would otherwise be carried on and dropped on some town....I could, if it is so desired, put this theory to the test in this area on any night when numbers of planes were coming over.’<sup>33</sup>

For port and harbour areas, another concerned member of the public proposed that a:

‘barge [be] moored in the centre of the selected area...stored with explosives...[and to be] set off at intervals to give the appearance to the Hun pilot, whose average altitude for attack gives him only the minutest view of results, that great chaos, and destruction is occurring’.<sup>34</sup>

The use of decoy fires and simulated explosions proposed by the public would eventually have greater gravitas within the Air Ministry, who were particularly concerned about the protection of the R.A.F.’s airfields. Indeed, a unit headed by Colonel John Turner<sup>35</sup> was responsible for the production of a combination of ‘decoy lighting’ schemes such Starfish, Q, QL and QF sites. These sites, which utilised both artificial illumination and fires, were established at various locations throughout the U.K. in an attempt to deceive inexperienced or lost Luftwaffe aircrews at night and protect valuable airfields and industrial spaces.<sup>36</sup> These developments would, however,

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<sup>32</sup> TNA, HO186/173: *Correspondence*, W.L.Towers, to MoHS, dated 2nd Dec 1940.

<sup>33</sup> TNA, HO186/173: *Correspondence*, Chief Constable of Isle of Ely Constabulary, to MoHS, dated 3rd Dec 1940.

<sup>34</sup> TNA, HO186/173: *Correspondence*, W.H. Prigg (Farlington, Hants), to MoHS, dated 4th Dec 1940.

<sup>35</sup> Colonel (later Sir) John Fisher Turner (1881-1958) had been commissioned into the Royal Engineers in 1900, before serving as a chief engineer with the Royal Air Force in India between 1928 and 1931. Following his retirement to the U.K., he took up the post of Director of Works and Buildings for the Air Ministry. Aside from his extensive work into decoys, he would later serve as the Air Staff representative on Cave’s Camouflage Committee.

<sup>36</sup> These different sites were assigned particular roles. A Q site was a night decoy of an airfield, with lighting being used to mimic runway flares; a QF site specifically deployed fires to simulate an airfield which had been attacked at night; similarly, QL sites were designed to replicated specific urban areas; and

take place beyond civil camouflage work, even though, in some cases, they were devised to protect industrial areas. In part, this was due to a continuing feeling of unease by MoHS representatives about the effects of artificial ‘distractive’ lighting upon ‘Blackout’. Indeed, as was apparent from earlier evaluations of ‘baffle lighting’ on the Humber, deceptive lighting was considered to significantly undermine established feelings of security which ‘Blackout’ was seen to afford. For instance, in discussions of the merits of deceptive lighting within one report, it was remarked how:

‘in the rural areas behind some of the important manufacturing districts [such as] the Midlands – some local criticism might be expected. The black-out policy is no doubt regarded as extremely inconvenient by practically everybody, but there is equally little doubt that it is regarded as a contribution to safety. The safe or reception areas may emphasize this later consideration if a policy is adopted which appears not only to bring them within a vulnerable area, but is apparently designed to attract hostile attention to them rather than to the vulnerable area’.<sup>37</sup>

This perceived de-stabilisation of the ‘Blackout’ through artificial illumination would shape the future course of nocturnal camouflage, with the visual backdrop of the ‘Blackout’ landscape becoming the observational and perceptual environment within which new camouflage techniques should operate; this point was later emphasised by the Mabane Committee in May 1941, who stated that ‘the Blackout is the *essential* background against which *all* forms of concealment and deception by night, must be set’.<sup>38</sup>

## **7.2: Reassessing the tactical situation: altitude, angular viewing and navigation**

With the demise of the C.A.P. in mid-1940, further discussion on camouflage for night-time conditions descended into a period of relative silence; as enemy air attacks intensified during the autumn, the C.D.C.E. were focusing all of their efforts on simply

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finally ‘Starfish’ sites were locations positioned around key industrial sites such as Birmingham, Coventry, Sheffield, Manchester, Derby as well as London and were mainly used to mislead bomber crews into dropping their payloads on the outskirts of these cities. In some cases, these sites involved the development of highly complex lighting devices to simulate particular effects, for instance, vehicle lights and railway signals. For further discussions on World War Two decoy lighting of this nature, see Dobinson, 2000. See also, Reit, 1978.

<sup>37</sup> TNA, HO186/975: *CAM (P&O) Paper 3: Interim Report of the Camouflage (Policy and Organisation) Committee*, dated 5th Apr 1940.

<sup>38</sup> Emphasis added. AIR20/5212: *Committee on Concealment and Deception: Interim Report*, dated 2<sup>nd</sup> May 1941.

producing as many camouflage schemes as it could for daylight conditions. However, into 1941, there was a significant transformation in civil camouflage policy, corresponding with observations which had been made of Luftwaffe tactics by the Air Ministry. In a note produced by the Air Staff, it was highlighted that:

‘since the Battle of Britain the weight of enemy air attack has been shifted from day to night. Heavy attacks under fighter cover may be attempted in the future, but so long as the Metropolitan Fighter Force remains in being it is unlikely that these will penetrate beyond the coastal regions of South and South-East England...It is concluded, therefore, that camouflage measures should be directed primarily to the concealment of objectives from visual observation by night. Protection against visual observation by day should be a secondary consideration, unless the objective is of very exceptional value to the war effort’.<sup>39</sup>

These tactical changes had already begun to be noted within the newly-formed Camouflage Directorate, with Dr Stradling being approached about ‘whether elaborate camouflaging against day-raiding is not now an over-insurance and whether a technique aimed against night-raiding only would now be adequate’.<sup>40</sup>

As an initial consideration, this shift towards a camouflage programme which emphasised nocturnal forms of concealment required civil camoufleurs to evaluate and review their established knowledges of the bomber body. Following discussions at a meeting of the Technical Sub-Committee (T.S.C.) in December 1941, it was outlined how ‘in order to determine the nature and extent of the measures necessary [for night-time conditions], three factors must be taken into account’.<sup>41</sup> The first aspect to be reviewed was ‘the probable height of the attacking aircraft, since this affects the visibility of the target’.<sup>42</sup> In response to this query, Sir John Turner asserted that:

‘the low level approach is improbable but aircraft may attack at low levels if the pilot can see the ground or lights sufficiently clearly to judge his distance from it. The presence of balloon barrages will offer a considerable deterrent to such action. Ground

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<sup>39</sup> TNA, HO186/1342: *Camouflage Policy: A Note by the Air Staff*, dated 4th Jan 1942.

<sup>40</sup> TNA, HO186/975: *Civil Camouflage: A note on the Present Position*, P. James, undated.

<sup>41</sup> TNA, HO186/1985: *T.S.C.12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

<sup>42</sup> TNA, HO186/1985: *T.S.C.12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

defences [also] play an important part in keeping aircraft at heights at which early recognition of the target is difficult'.<sup>43</sup>

It was, thus, determined from conversations with R.A.F. personnel that, at night, 'the normal operational height of enemy aircraft is from 8,000ft to 15,000ft., the greater heights being preferred if visibility permits'.<sup>44</sup> This was noticeably higher than the altitude of 5,000ft anticipated of the daylight raider. At these greater heights, it was contended that the interpretation of the landscape would be significantly different, with the visual experiences of nocturnal aerial observer being further impaired by the confines of the aeroplane; at 15,000ft., it was remarked that it 'is not possible to identify a particular target...visibility at this height is only possible through an open window; Perspex or even glass reduces the visibility very greatly'.<sup>45</sup> This significant difference in altitude, needed to be factored into the production of camouflage for night-time conditions, determining the heights at which the camoufleurs should make their critical observations from the air as well transforming their simulated experiences in the viewing room.

Overlapping with the anticipated attacking altitudes of night bombers, a second area of interest concerned the angles of viewing which night camouflage needed to subvert. It was contended that this was most important 'since this affects the appearance of the target, especially with regard to shine'.<sup>46</sup> In critical dialogues of this aspect, it was outlined that the angle of viewing which would enable the clearest examination of the landscape would be:

'from vertically above [or at the near-vertical], since from this view atmospheric interference and the actual distance of the target from the observer will be at the minimum...The vertical view is therefore considered to be of great[er] importance'.<sup>47</sup>

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<sup>43</sup> TNA, HO217/4: *T.S.C.18: Policy for Concealment*, Sir J. Turner, Air Ministry, dated Feb 1942.

<sup>44</sup> TNA, HO217/4: *T.S.C.18: Policy for Concealment*, Sir J. Turner, Air Ministry, dated Feb 1942; TNA, HO186/1985: *T.S.C. 12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

<sup>45</sup> TNA, HO186/171: *CAP/4: Baffle Lighting*, undated.

<sup>46</sup> TNA, HO186/1985: *T.S.C.12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

<sup>47</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, 21st Mar 1942, p.1

Angle of Viewing	Height							
	5,000ft		10,000ft		15,000ft		20,000ft	
	H.E.	I.B	H.E.	I.B	H.E.	I.B	H.E.	I.B
60°	15	21	40	51	66	82	96	115
45°	1	-	13	24	26	42	41	60
35°	-	-	1	12	10	26	19	35

**Table 7.1: Table showing the estimated amount of time available between sighting a target and releasing bombs. For night-time conditions, it was argued that at least 30 seconds would be required to achieve any sort of success.**

(Adapted from TNA, HO186/1985: *T.S.C.12*, dated December 1941)

Although the vertical view was emphasised as permitting the most uninterrupted viewing experience, insights into other angular perspectives which nocturnal conditions enabled and disabled were also sought; this entailed determining the optimum angle from the vertical at which targets could be identified and attacked, particularly from the higher altitudes anticipated. It was contended, for instance, that the angle of 75° from the vertical which corresponded with the daylight parameters of 3-4 miles at 5,000ft was ‘too high’, while the figure of 35° from the vertical suggested by ‘experienced observers’ was too ‘low’.<sup>48</sup> In order to work out this ‘optimum’ value, the civil camoufleurs calculated a series of theoretical timings between sighting the target and bomb release at different altitudes and from various angles of viewing (see Table 7.1). Emerging from this, it was ascertained that in nocturnal conditions it would take approximately 30 seconds for ‘moderate accuracy’ to be achieved. On this basis, it was argued that:

‘if we accept 15,000ft as the maximum height ordinarily employed, ...an angle of view of 45° would be indicated as a reasonable working assumption if H.E.s alone are considered’.<sup>49</sup>

Consequently, it became recognised that ‘except for light and shining surfaces, nothing can be seen outside a cone of 45° from the vertical’, forcing the enemy pilot to:

<sup>48</sup> TNA, HO186/1985: *T.S.C.12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

<sup>49</sup> TNA, HO186/1985: *T.S.C.12: Night Camouflage: Interim Report No.5*, dated Dec 1941.

‘either climb to a very considerable height, when the target will fall within the cone of vision, or...to bomb off some conspicuous feature near to the target [when] he cannot see [it]’.<sup>50</sup>

It was from viewing positions which fell within this ‘cone of vision’ that the civil camoufleurs would have to consider in the development of nocturnal concealment strategies.

The third and final point of deliberation concerning operational knowledge of Luftwaffe night attacks was how enemy bombers would navigate their way to their targets and commence their attacks. While this aspect had been studied thoroughly for day-time conditions, knowledge of how attacks were carried out at night was very limited within camouflage circles. In the first instance, it was acknowledged that electronic aids were increasingly being used by Luftwaffe crews to aid navigation at night. Although this was certainly the case, navigation by landmarks was still considered to be of significance. Civil camoufleurs, however, want to know exactly how the nocturnal bomber body utilised these and so composed a series of questions for consideration;

‘How far do outstanding landmarks distant from the target and less obvious landmarks close to the target contribute to the speed and certainty with which it can be found and attacked? What features are most satisfactory as such landmarks? How does a pilot locate the target sufficiently closely to drop flares which will illuminate it for accurate attack by following aircraft? What features assist him in this location?’<sup>51</sup>

To address these questions, numerous consultations were arranged with RAF aircrews from Bomber Command. On the 22<sup>nd</sup> April 1942, for instance, Dr Curtis, Gilbert Solomon and Mr B.D.L. Thomas met with three Bomber Command personnel and a representative from the Operational Research Station to discuss the methods used to locate and attack industrial targets. At this meeting, it was ascertained that for night raiding, pre-flight briefings as well as knowledge from previous flights would once again be helpful. In contrast to daylight flying, however, it was contended that the ‘briefing is likely to be as simple as possible, i.e. reducing the number of landmarks

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<sup>50</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage*, dated Aug 1943.

<sup>51</sup> TNA, HO186/1342: *Investigation of the effectiveness of Concealment by Camouflage*, T.R. Cave-Brown-Cave, dated 9th July 1942.

used to a minimum'.<sup>52</sup> While it was also argued that 'serious errors in locating position on operational flights were not unusual', it was emphasised that it was not uncommon for attacking aircraft:

'to make long detours to find a really good landmark within 50miles of their target. The target would then be approached on D.R [Dead Reckoning]...the exact position of the target would then be looked for by pinpointing nearer landmarks. The more landmarks that could be found, the better the chance of accurate bombing'.<sup>53</sup>

In terms of the landmarks which could be used for this purpose, lakes, bends in rivers, bridges, distinctively shaped woodland areas and railway marshalling yards were all identified by RAF aircrews as key points from which a 'fix' could be made. In another meeting between Cave and some RAF navigators in May 1942, the case of a horseshoe lake and woodland a few miles to the East of Coventry was deliberated, with it being 'agreed that if attackers could recognise these they would be able to bomb the built-up area of Coventry successfully on a D.R. run, but not a particular factory'.<sup>54</sup> Elsewhere, the oil tank installation at Llandarcy was discussed, with the RAF navigators stating that:

'Swansea docks would always make it possible to straddle the target with bombs, [although] precision bombing might be made more difficult if the lake to N.W. of the installation could be concealed. At present it would be possible for the exact whereabouts of the installation to be determined by an alignment of this lake and another lake alongside the Electric Power Station to [the] S.W.'.<sup>55</sup>

This desire to comprehend how particular industrial sites in the British landscape could be found through both artificial and natural landmarks was something which civil camoufleurs constantly sought to develop and Cave even requested that the Directorate

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<sup>52</sup> TNA, HO186/1342: *Notes of a Visit to Bomber Command on 22nd April 1942.*

<sup>53</sup> TNA, HO186/1342: *Notes of a Visit to Bomber Command on 22nd April 1942.*

<sup>54</sup> TNA, HO186/1978: *Minutes of an Informal Meeting to discuss Camouflage in relation of Target Identification, held 27th May 1942.*

<sup>55</sup> TNA, HO186/1342: *Notes of a Visit to Bomber Command on 22nd April 1942.*



be able to approach RAF bomber crews ‘from time to time [to] hear from them...how successful they were in locating specified targets and landmarks in this country’.<sup>56</sup>

Although these discussions highlighted landmarks as being useful navigational devices, glimpses of them were acknowledged to be fleeting and momentary, meaning that ‘a very high percentage of inaccurate identification’ was likely to occur at night.<sup>57</sup> This very short window for interpreting a landmark could work to the advantage of the camoufler; as Robin Darwin wrote, misidentification by a mobile, nocturnal aerial observer ‘suggests that quite simple measures may be sufficient to mislead the attacking pilot altogether and that elaborate treatment is unnecessary’.<sup>58</sup> This exploration into landmarks was therefore of exceptional importance, establishing insights into not only how industrial sites could potentially be found, but also how problems in navigating by them could be exploited for the purpose of camouflage.

### **7.3: Night sight: moonlight illumination and its effects upon the eye**

Seeking to go beyond the re-assessment of enemy bombing tactics and the viewing practices these enabled, understandings of the different atmospheric and sensory environments of the night needed to be developed if effective concealment strategies were to be devised. Although popular discourses conveyed the impression that the ‘Blackout’ would obscure everything except exposed artificial lighting, within civil camouflage it was argued that in the conditions of the night, particular features would still remain conspicuous. It was, therefore, contended that knowledge needed to be collected into how low levels of illumination would transform the visual appearance of the landscape at night. At a basic level, camoufleurs engaged with foundational knowledge of astronomy, considering how differing levels of illumination were associated with different phases and seasonal movements of the moon. At each of these cyclical phases, the changing altitude and elevation of the moon was considered to produce seasonal variations in the ‘horizontal intensity of moonlight’ (measured in footcandles), which, in turn, would present the landscape to the nocturnal observer in different ways. Working in conjunction with the R&E Department, civil camoufleurs were able to ascertain that the highest levels of ‘horizontal intensity’ fell during the ‘full

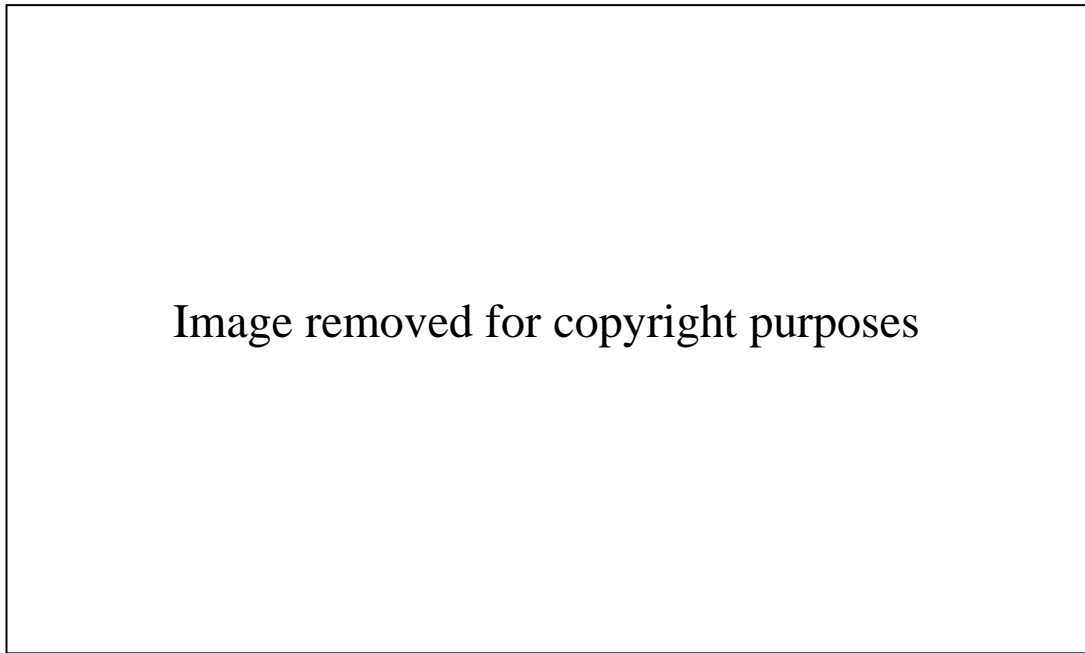
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<sup>56</sup> TNA, HO186/1978: *Minutes of an Informal Meeting to discuss Camouflage in relation of Target Identification*, held 27th May 1942.

<sup>57</sup> TNA, HO186/1342: *Night Camouflage: Notes*, R.V. Darwin, dated 29th April 1942.

<sup>58</sup> TNA, HO186/1342: *Night Camouflage: Notes*, R.V. Darwin, dated 29th April 1942.

moon' stage (see Plate 7.1), whereas in relation to the seasons, 'the greatest intensities occur when the moon attains its highest altitudes during the winter months'.<sup>59</sup>



**Plate 7.1: A graph produced by the R&E Dept. showing variations in horizontal intensity in accordance with the different phases of the moon.**

(Source: TNA, HO186/1342: *Bulletin No. B13*, p. 11).

Intensity (Foot-Candles)	Duration (Hours per annum)
Over 0.01	75
0.001 to 0.01	750
0.0001 to 0.001	750
Under 0.0001	1750

**Table 7.2: A table illustrating the estimated duration of different levels of horizontal intensity over the course of a year.**

(Adapted from TNA, HO217/4: *T.S.C.2*).

Building upon these findings, the frequency of particular intensity levels per annum were calculated (see Table 7.2). Once these calculations had been made, it was contended that nocturnal camouflage should be designed to deal with night-time conditions where horizontal illumination levels would be less than 0.01 foot candles.<sup>60</sup>

<sup>59</sup> TNA, HO217/4: *T.S.C.2: Interim Report on Camouflage for Moonlight*, R&E Dept., MoHS, dated November 1941.

<sup>60</sup> It should be noted that these illuminations levels would also be translated into the simulation of nocturnal environments within the viewing for model experimentation.

Illumination levels of higher intensity (for instance, during a full moon) were considered to be of such short duration that the elaborate measures needed to conceal industrial features during these phases would be uneconomical in terms of ‘time, labour and materials’.<sup>61</sup>

In addition to comprehending levels of illumination at night, civil camoufleurs also wanted to consider the effects of moonlight viewing conditions upon the visualities of the nocturnal bomber body; in doing so, they sought to refine existing knowledge on the limits of the aerial observer to discern features in the landscape. In a similar manner to earlier examinations of the physiology of the eye in daylight, these investigations looked at the ways in which the eye of the bomber body was transformed through its immersion in conditions of darkness and, ultimately, how its capacity to decipher differences in colours, tones and forms in the landscape was radically altered. It was through renewed interactions with ‘experts’ at the R&E Department that it was realised that in the dark, the bomber body was induced to visually engaging with the landscape with a different part of the eye to that utilised during the day. In a report on *Aerial Observation at Night*, this was related back to the role of the different nerve-endings of ‘cones’ and ‘rods’ in the eye, with it being noted that the former ‘react to bright light’, where the latter ‘come into their own when it is nearly dark’.<sup>62</sup>

The result of this knowledge about the structure and functioning of the eye in the conditions of darkness would have profound implications upon understandings of how the bomber body interacted with the landscape at night (see Plate 7.2). Firstly, it was accentuated that objects would only become discernible when viewed out of the corner of the eye, rather than being glanced at directly; ‘this is because there are no “rods” immediately opposite the front of the eye, so that the sides of the eye are more sensitive by low levels of lighting’.<sup>63</sup> Secondly, it was realised that in the dark, the eye was ‘left with only about one fifth of its power of resolving detail, even in the brightest moonlight’.<sup>64</sup> This inability to determine details was ‘due to the sparse distribution of

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<sup>61</sup> TNA, HO186/1985: *T.S.C. 12: Night Camouflage: Interim Report No.5*, dated December 1941.

<sup>62</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated January 1943, p.2.

<sup>63</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated January 1943, p.3.

<sup>64</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21<sup>st</sup> March 1942, p.1.



Images removed for copyright purposes

**Plate 7.2: Illustrations taken from *Notes on Aerial Observation at Night*, demonstrating the variations in clarity of view, detail and sense of colour.**

**(Source: TNA, HO186/1342).**

nerve fibres serving the “rods”<sup>65</sup> and resulted in relatively close objects merging together and forming an even medium tone. Thirdly, it was recognised that the reduction in levels of illumination as well as the shift from cones to rods in the eye resulted in the loss of colour, with the tone of certain colours becoming completely altered. This distortion, known as the ‘Purkinje effect’, meant that ‘dull colours fade to grey, bright red looks black, blue looks pale grey’ (see Plate 7.2).<sup>66</sup> Finally, and

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<sup>65</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.2.3.

<sup>66</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated January 1943, p.2.3.

coinciding with an inability to decipher colours, it was noted that tonal ranges also became greatly distorted:

‘Light objects stand out relatively more by night than by day. The darker a tone is, the nearer it approaches the level of brightness below which the eye cannot see at all (called the “threshold” of vision). Differences between black and a “middle” tone are therefore more difficult to distinguish than between a “middle” tone and white, which makes light tones seem relatively lighter by night’.<sup>67</sup>

These four central transformations of the viewing experience would have far-reaching consequences on how camoufleurs would carry out nocturnal camouflage.

#### **7.4: Night Flights: aerial surveying and the techniques of nocturnal observation**

Although these investigations furnished the civil camoufleurs with valuable insights into how the conditions of darkness affected the physiological capabilities of the bomber body, civil camoufleurs became quickly interested in how these nocturnal visualities translated into the actual appearance of the night-time landscape to the aerial observer. It was argued, therefore, that civil camoufleurs would need to ‘re-train’ their aerial observation skills to appreciate the landscape at night. Following a discussion with Squadron Leader Cummings,<sup>68</sup> Cave proposed that camouflage officers should undertake critical night surveys ‘in conjunction with a pilot really experienced in night observation’ and over regions with which they were already familiar with by day.<sup>69</sup> For Cave, as well as other proponents, survey flights of this nature would help to facilitate effective nocturnal observation skills by:

‘putting observers at greater ease,...by giving them a standard of what was good or bad visibility,...[and] by cumulative experience, which would enable particular points arising from previous observations to be checked’.<sup>70</sup>

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<sup>67</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.2.

<sup>68</sup> Squadron Leader Cummings was, at this time, the officer commanding the Camouflage Flight.

<sup>69</sup> TNA, HO186/1342: *Correspondence*, T.R. Cave-Brown-Cave, to H. Scott, dated 19th Nov 1941.

<sup>70</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 5th January 1942*, B.D.L. Thomas, dated 6th Jan 1942.

These initial observations, it was suggested, should be carried out initially during periods of full moon and when weather conditions were ‘good’, thereby enabling the camoufleur relatively ‘inexperienced’ in nocturnal conditions to observe the landscape at its most clearest; this would mean, however, that ‘observations can,...only be made on an average of three or four days per month’.<sup>71</sup> With winter approaching, Cave insisted that the opportunity be taken to carry out such work as soon as possible;

‘the present lull in enemy night raiding gives us an opportunity for this flying which may not continue for long. Observation in moonlight periods when enemy raiding has been resumed would be extremely difficult to carry out’.<sup>72</sup>

Cave, therefore, requested more aircraft, as well as pilots experienced in night-time flying, to enable this surveying to take place.

In terms of the selection of individuals for this ‘special’ type of work, camouflage officers were required to have a certain degree of visual competency. In one report, it was noted that while:

‘camouflage officers are usually artists and have good daylight vision...this does not necessarily imply good night vision, because, of course, different parts of the retina are used. Sometimes people with poor daylight vision have particularly good night vision’.<sup>73</sup>

‘Nocturnal’ camouflage officers were, therefore, selected upon their capacity to complete a night vision test, from which they would receive a ‘night vision grading’. This ‘grading’ would be determined through their ability to discern objects on charts:

‘viewed from a greater distance than in the official R.A.F. tests; also, for simplicity’s sake, it was decided to light charts from in front instead of silhouetting black letters against an illuminated background’.<sup>74</sup>

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<sup>71</sup> TNA, HO186/1342: *Correspondence*, T.R. Cave-Brown-Cave, to H. Scott, dated 19th Nov 1941.

<sup>72</sup> TNA, HO186/1342: *Correspondence*, T.R. Cave-Brown-Cave, to H. Scott, dated 19th Nov 1941.

<sup>73</sup> TNA, HO196/31: *R.E.N.537: The Mechanism of Vision*, T.A. Littlefield, dated 10<sup>th</sup> July 1945, p.7-8.

<sup>74</sup> TNA, HO196/15: *R.E.N.223: Investigation into the Camouflage of Factories for Moonlight Conditions: An illustrated summary*, R&E Dept., MoHS, dated Feb 1943.

The observer would be allowed half an hour for their sight to adapt to the dark conditions, before attempting to read the viewing charts at three levels of light intensity: 0.001 f.c., 0.002 f.c. and 0.004 f.c. If the camouflage designer completed this test successfully, they would then be passed to undertake nocturnal aerial survey flights as well as to carry out ‘moonlight’ camouflage within the Viewing Room.

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**Plate 7.3: An illustration showing the set-up for the night vision test to be undertaken by the civil camoufleur selected for nocturnal camouflage work.**

**(Source: TNA, HO196/15).**

In terms of the flights themselves, it was maintained that the camoufleur should ‘prime’ themselves before conducting the flight in a similar way to their Luftwaffe counterparts;

‘landmarks likely to identify the target area can be chosen from the map. Photographs of the area should be studied if possible in an epidiascope with a moonlight filter attachment. Allowance must be made, however, for changes in appearance due to the angle or direction of lighting shown in the photographs differing from what they will be at the time of observation’.<sup>75</sup>

Furthermore, the heightened sensitivity of the sides of the eye to discern features in the dark, rather than at its centre, meant that ‘scanning’ as a technique of observation was encouraged ‘to ensure that the field of vision is covered completely’.<sup>76</sup> Other ‘practical points’ for the camoufleur surveying the landscape were also emphasised: instructions such as ‘do not stare at bright lights’, ‘keep eye close to perspex’ and ‘be as comfortable as possible. You see worse when tired’ all helped to shape a ‘disciplined’ nocturnal camoufleur/observer (see Plate 7.4).

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<sup>75</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated January 1943, p.12.

<sup>76</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated January 1943, p.16.

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**Plate 7.4: ‘Scanning’ techniques for the nocturnal camoufleur/observer.**  
(Source: TNA, HO186/1342).



Armed with their new techniques of nocturnal observation, the programme of night-time survey flights began in the New Year with the first ‘exploratory’ flight on the 5<sup>th</sup> January 1942. On this flight over the South Midlands, three observers were on board: G. Grayston (the Regional Camouflage Officer), Mr B.D.L. Thomas and Mr G.W. Allen (both from the Camouflage Research Division at the R&E Dept). Earlier in the day, a brief preliminary flight had taken place serving:

‘to acquaint observers with the district by daylight...[when viewed] at 2000ft. Objectives were the City of Oxford, the Cowley factories and aerodrome, Morris Radiators Ltd, a gasworks, and a scarred site for a cold store. Visibility was bad, with much ground mist, 3/10 cloud coverage and a setting sun. The landscape was in diffused light’.<sup>77</sup>

This was followed by a second half-hour survey flight at 23.10, with the moon’s elevation at 25°, and the horizontal intensity being between 0.004 and 0.0048 f.c.. The conditions were described as consisting of ‘no cloud, but a strong E.N.E. wind had blown up a considerable ground mist, said to be caused by Midland factory smoke’.<sup>78</sup> In the course of both flights, observations of the landscape were greatly aided by the disrepair of the aeroplane being used; ‘the fact that one of the windows had been blown out was a great advantage to one of the observers’, particularly in light of the fact that Perspex windows were seen to impair the ability to see objects at night.<sup>79</sup> At the time of the flight, a slight frost had set in, also serving to heighten the visibility of the landscape. Although the flight itself was relatively short, its purpose had been to generate some initial thoughts on the appearance of the landscape, as well as provide ideas as to how observational training for night conditions might proceed. Indeed, the flight confirmed that the angles of viewing anticipated by night-time bombers corresponded with the experiences derived from this flight. For instance, it was noted that at angles less than 40° to the horizontal, only lights and glint off water could be

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<sup>77</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 5th January 1942*, B.D.L. Thomas, dated 6th Jan 1942.

<sup>78</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 5th January 1942*, B.D.L. Thomas, dated 6th Jan 1942.

<sup>79</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 5th January 1942*, B.D.L. Thomas, dated 6th Jan 1942.

seen, whereas at angles which fell within the ‘cone of vision’, a variety of objects could be seen: woods, hedges, roads, fields, scars and houses.<sup>80</sup>

Following this initial flight, several other night-time flights over the ‘South Midlands’ area were undertaken throughout the course of the year, with Birmingham, Walsall, Coventry, Redditch, Leamington, Rugby, Banbury and Oxford all being observed. Investigations were also progressively extended to other parts of the U.K.: areas such as Sheffield, Scunthorpe and Corby, for example, were observed as a result of concerns about the presence of coke ovens and steel works ‘illuminating’ these urban spaces. On each of these flights, precise information was collected on the nature of the visual conditions, with the altitude of the moon over the course of the flight as well as changes in the estimated illumination of horizontal surfaces all being recorded. In addition to this, notes were made of the prevailing weather conditions, with particular consideration given to their effects on the visual appearance of topographical forms. It was noted, for example, that the presence of patchy cloud cover ‘throw[s] confusing shadows looking like woods or steep valleys’.<sup>81</sup> Furthermore, it was observed that snow increased levels of horizontal illumination, extending the ‘cone of vision’ beyond 45° from the vertical; during the course of one flight over Oxfordshire on 28<sup>th</sup> January 1942, it was recorded that the ‘pattern of the landscape [was] visible at all heights to an angle of 75° from the vertical’ on account of the presence of ‘patches of snow, particularly on verges of fields and roads...[and a] slight ground frost’.<sup>82</sup> At the same time, survey flights also showed that snow could obscure particular features such as roads and ground scars. An examination of these different aspects was, therefore, considered to be of vital importance, enabling the development of knowledge about how the terrestrial landscape was revealed through temporally-variable nocturnal visualities.

### **7.5: Accounting for conspicuousness at night: interpreting the nocturnal landscape**

Through these early observational reports, extensive descriptive accounts and critiques of the visual appearance of the landscape were produced, with emphasis often being placed upon the similarities and divergences between day-time and nocturnal

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<sup>80</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 5th January 1942*, B.D.L. Thomas, dated 6th Jan 1942.

<sup>81</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.6.

<sup>82</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Wellesbourne Mountford on 28th January 1942*.

observation. In the first instance, it was clear that the night transformed the general appearance of the terrestrial landscape;

‘reduced illumination and haze interference obliterates a large number of the factors used for recognising features of the landscape by day. In place of clear outlines and a wide range of tones and colours, the landscape even by bright moonlight appears merely as a general silvery grey, mottled with a darker tone and a lighter tone, the degree of contrast depending on atmospheric conditions and altitude’.<sup>83</sup>

Corresponding with the physiological changes that darkness brought about in the eye, it was contended that:

‘very little can be distinguished...a few hazy objects may be visible, but it is not easy to say with certainty at first what they are. Since in general so little can be seen, however, added significance attaches to any objects which are distinguished, and their relative importance becomes far greater than by day’.<sup>84</sup>

In this respect, the aerial grammar used to account for ‘conspicuousness’ became redefined in different ways for night-time conditions than by day-time; contrasts in tone and texture, for instance, took on a heightened significance over other characteristics such as colour and form in the establishment of distinctions between natural and artificial spaces. Observational reports often reduced descriptions of the nocturnal landscape to the oppositional states of ‘dark’ and ‘light’ tones. Due to their heavy texture, ‘natural’ topographical forms were associated with uniformly dark tones in the landscape. For example, wooded areas appeared as ‘dark patches at all seasons and all angles of light’,<sup>85</sup> whereas hedgerows would ‘often clearly [be] visible as black bands composed of the hedge and its cast shadow. Ditches may reinforce hedge shadows’ (see Plate 7.5).<sup>86</sup>

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<sup>83</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.12.

<sup>84</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage: draft Camouflage Committee Memorandum*, dated Aug 1943.

<sup>85</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.14.

<sup>86</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.6.

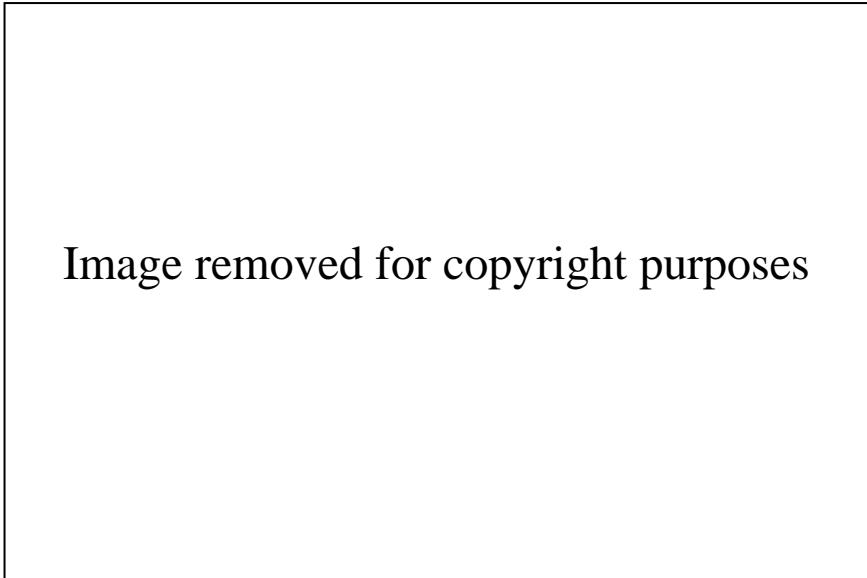


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**Plate 7.5: A vertical aerial photograph of distinctively shaped wooded area, with offshoots of hedgerows to the right.**

**(Source: TNA, HO186/1342).**

At the same time, however, varying elevations and the numerous phases of the moon, it was argued, produced critical variations in the ‘darkness’ of different natural surfaces. From their night-time survey flights, for example, it was concluded that

‘a *ploughed field* may look lighter than a *grass field* seen from above by a HIGH MOON. But by a LOW MOON, the furrows fill with shadow, while the grass, being translucent, is not darkened to the same extent’ (see Plate 7.6).<sup>87</sup>




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**Plate 7.6: Diagrams illustrating the effects of varying elevations of the moon upon the ‘darkness’ of natural surfaces.**

**(Source: TNA, HO186/1342).**

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<sup>87</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.12.

In contrast to the relatively ‘dark’ toned and patchwork-like appearance of ‘natural’ surfaces, ‘artificial’ urban spaces were noted to appear ‘slightly more “mottled” than open country’.<sup>88</sup> For example, Gilbert Solomon in an aerial survey report from January 1942 noted how Rugby was ‘discernible as [a] town in contrast to surrounding country from close quarters’ on account of its ‘general appearance of a uniform relatively light grey area slightly pock marked’.<sup>89</sup> This ‘mottled’ and ‘pock marked’ impression was produced on account of a combination of several distinguishing factors.



**Plate 7.7: ‘Pale areas: roofs, roadways, scars, steam plumes, etc’.**

**(Source: TNA, HO196/15)**

The first of these was the presence of ‘pale areas’ (Plate 7.7). Examinations into the physiology of the eye had already shown that when combined with a darker tone, pale areas had a tendency to become much lighter, and therefore discernible and prominent in the conditions of darkness. This became clear in the course of the aerial survey flights when several features became identifiable in this way. In one flight over Birmingham and Walsall on the night of the 26<sup>th</sup>/27<sup>th</sup> July 1942, it was highlighted how ‘the characteristic layouts of the newer Birmingham suburbs stood out with great clarity’ on

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<sup>88</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.14.

<sup>89</sup> TNA, HO186/1342: *Report of Night Flights*, G.B. Solomon, circa Jan 1942.

account of the pale appearance of ‘roads, side paths and individual houses’.<sup>90</sup> Pale concrete roads were also spotlighted as one of the most easily discernible man-made features in the landscape at night;

‘main roads [are] clearly visible when light in colour, often on account of being outlined with hedges, sidewalks, ditches etc...[The] regular layout of concrete roads in building estates [is] most conspicuous even when in shadow and seen through gaps in cloud’.<sup>91</sup>

In a similar vein to day-light observations, industrial structures fabricated from modern building materials such concrete and asbestos and geometrically shaped were also conspicuous at night; in observations of the Longbridge power station (Birmingham), for example, on the night of 29<sup>th</sup>/30<sup>th</sup> May 1942, it was remarked that ‘the cooling towers are at present light in tone, due to painting fading and this, together with their characteristic shape, made them an easily located target’.<sup>92</sup>



**Plate 7.8: Aerial photographs showing the presence of industrial white smoke plumes (left) and scarred ground (right) as observed at night.**

**(Source: TNA, HO186/1342).**

The issue of ‘paleness’ was not necessarily confined to buildings and architectural forms defined by smooth artificial surfaces, with other visibly pale traces in the landscape also being emphasised. Smoke and steam plumes from industrial chimneys

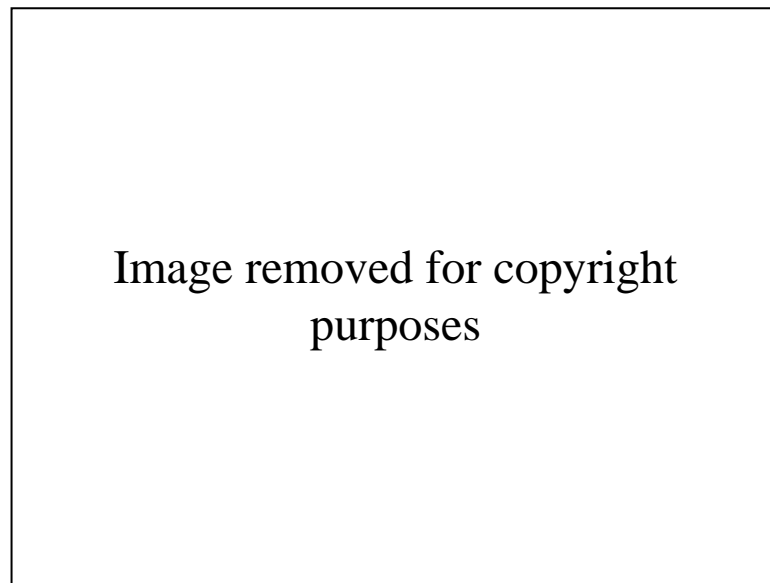
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<sup>90</sup> TNA, HO186/1342: *Report on night flights over Birmingham and Walsall*, G.B. Solomon, 26<sup>th</sup>-27<sup>th</sup> July 1942.

<sup>91</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.6. It should also be noted that activity occurring on roads was noted to attract attention from the air. One report from the Air Staff, for instance, remarked that ‘in England, vehicle lighting is often a very great aid in locating and identifying towns and built up areas’. See TNA, HO186/1985: *Policy for Concealment*, Air Staff, dated Feb 1942.

<sup>92</sup> TNA, HO186/1342: *Report on Moonlight Flights from RAF Honiley over Coventry on 29th-30th May 1942*.

and steam locomotives, for instance, were noted as being ‘narrow wedges of very light tone [and] extremely conspicuous when large in size’ (see Plate 7.8).<sup>93</sup> As with day-time conditions, the presence of smoke was considered to enhance the distance from which an industrial target could be located, although there was some difference of opinion as to whether they could be used for the actual identification of the target. In addition to smoke, areas of scarred ground were also noted to appear ‘usually light in tone and therefore visible’ (see Plate 7.8); these, however, were only considered to be important ‘if it helps to identify a vital target’.<sup>94</sup>



**Plate 7.9: An aerial photograph showing the presence of elongated shadows running along the sides of several rows of buildings.**

**(Source: TNA, HO196/15).**

A second distinguishing feature to be isolated from nocturnal observations of ‘mottled’ industrial areas was the presence of shadows, ‘showing as rather faint but regular lines, on the edges of blocks of buildings or along very large roof pitches’ (see Plate 7.9).<sup>95</sup> In comparison to the day-time, when shadows only had a tendency to ‘outline’ a building, the darker areas produced by shadows at night were considered to accentuate pale areas

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<sup>93</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.7.

<sup>94</sup> TNA, HO186/1985: *Policy for Concealment*, Air Staff, dated February 1942. In some cases, scarred ground was noted to even facilitate the concealment of particular structures. On the night of the 27<sup>th</sup>/28<sup>th</sup> February 1942, for example, aerial observations of the Kidlington cement works, Oxfordshire, suggested that the ‘actual buildings were not seen probably because these, being white, merged with the surroundings, which were either scars or dumps’. See TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 27th February 1942*.

<sup>95</sup> TNA, HO196/15: *R.E.N.223: Investigation into the Camouflage of Factories for Moonlight Conditions: An illustrated summary*, R&E Dept., MoHS, dated Feb 1943.

more profoundly when considered in relation to them. Furthermore, it was ascertained that the visual conditions of the night would make only some shadows ‘conspicuous’, whereas others would be relatively ‘absent’;

‘smaller shadows will not carry. Large shadows will be more conspicuous when they are long and repeated, e.g. shadows in the gulleys [*sic*] of factories. Broken shadows will probably not matter’ (see Plate 7.10).<sup>96</sup>

Moreover, it was noted that:

‘when a full shadow is in contrast with a “middle tone” it will not become noticeable at 6,000ft by bright moonlight until its width is roughly 15ft. and not really conspicuous until its width is about 30ft, unless it is very long’.<sup>97</sup>



**Plate 7.10: An illustration taken from a report into ‘moonlight camouflage’, demonstrating the conspicuousness of long shadows when compared to broken ones.**

**(Source: TNA, HO186/1342).**

Different viewing positions in relation to the moon were also considered to have profound implications on the shapes that cast shadows would form. When viewed ‘cross-moon’, it was contended that a ‘saw-toothed’ building ‘might possibly be observed as repeated L shapes of darkness...[with] the stripes of light and shadow in the sawtoothed roofing...merg[ing] to a dark middle tone’, whereas when viewed up-moon, shadows would be more concentrated, producing ‘conspicuous patches of intensely

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<sup>96</sup> TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

<sup>97</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.2.



black shadow’ (see Plate 7.11).<sup>98</sup> Finally, atmospheric conditions at night would also transform their presence/absence in the nocturnal terrestrial landscape. A clear sky with the full horizontal illumination of the moon would make shadows appear as sharp, intensely black areas, while in overcast skies, it was observed that ‘no shadows on buildings could be distinguished’ due to the obscuration of the moonlight.<sup>99</sup> In other instances, the presence of smoke plumes could produce cast shadows over an area; close-up observations made over the Hams Hall power station on the night of 22<sup>nd</sup> December 1942, for instance, suggested that the ‘mass’ of steam and smoke emanating from the cooling towers ‘cast a shadow over the area occupied by the station buildings and to a certain extent assisted in [their] concealment’.<sup>100</sup>

Image removed for copyright purposes

**Plate 7.11: Photographs of models with shadows representative of how they would appear when viewed ‘cross-moon’ (top) and up-moon (bottom). It should be noted that these images were taken in ‘daylight’ conditions in the Viewing Room, but utilised for illustrative purposes to indicate the ‘general’ appearance that shadows would have at night.**

**(Source: TNA, HO186/1342).**

Discussions of ‘dark’ artificial spaces were not exclusively confined to areas shaped by shadows. Communication networks such as railways and canals, for instance, were emphasised by their distinctive dark appearance (see Plate 7.12). One memorandum, for example, highlighted how railway tracks were ‘visible from all aspects as black bands running right across the landscape, sometimes made sometimes wider by shadows

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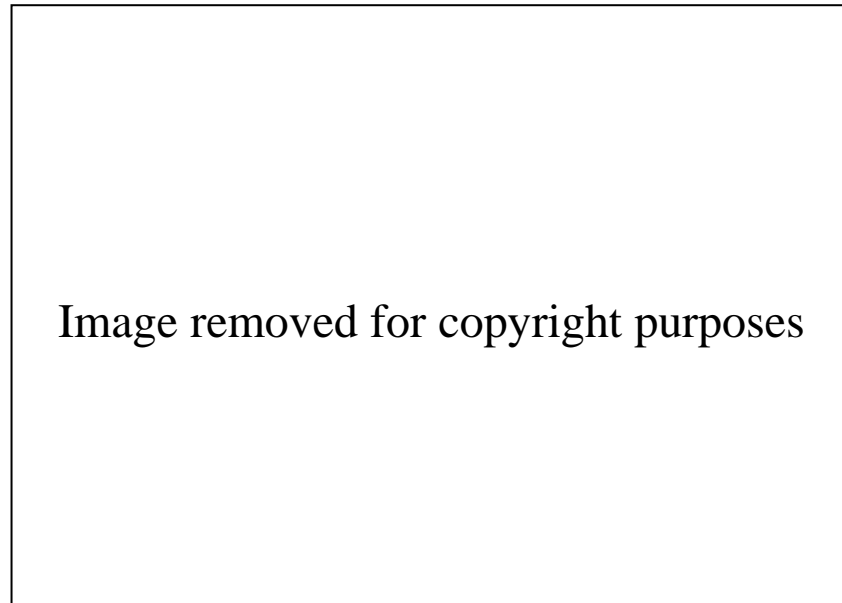
<sup>98</sup> TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

<sup>99</sup> TNA, HO186/1342: *Moonlight Flight from RAF Wellesbourne-Mountford on 27th March 1942*.

<sup>100</sup> TNA, HO186/1342: *Report on Aerial Survey of the Birmingham area carried out on the night of 22nd December 1942, between the hours of 10pm and 12pm at a height of 9,000ft*, L.J. Stroudley, dated 8th Jan 1943.

of embankments or cuttings'.<sup>101</sup> Dark tones also tended to emphasise other parts of the railway infrastructure; a flight over Rugby in March 1942 highlighted how the:

'marshalling yards [there] are extremely conspicuous as large, characteristically-shaped black areas, irrespective of their lights (which will presumably be switched off during a raid). Being long in shape they may very well be useful for giving a direction'.<sup>102</sup>



**Plate 7.12: A vertical aerial photograph of junctions between a main road (the pale line), a railway (the thin black line) and a river (the thicker black line).**

(Source: TNA, HO186/1342).

In addition to these textural and tonal contrasts as well as the presence of shadows and other 'darkened' spaces, a final characteristic through which the nocturnal landscape became known was the presence of 'reflected' and 'direct' light in terms of 'shine', 'glint', 'glare' 'gleam' and 'flash'. In the case of 'natural' surfaces, water spaces were considered to be particularly 'dangerous' in this respect, with the 'flash' emitted from these easily attracting the attentions of the aerial observer. For daylight conditions, it had already been contended that:

'large areas of inland water are perhaps the best landmarks especially if they are of a shape which can easily be identified; they are very conspicuous in good visibility; they can be seen clearly shining through the haze when the ground is hardly visible; and in

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<sup>101</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, p.7.

<sup>102</sup> TNA, HO186/1342: *Moonlight Flight from RAF Wellesbourne-Mountford on 26th March 1942*.

drizzle and low cloud when navigation by observation is only possible at low altitude they are still most significant' (see Plate 7.13).<sup>103</sup>



**Plate 7.13: An oblique aerial photographs showing the prominence of water when viewed from the air during the day time.**

**(Source: TNA, HO186/2769).**

In the conditions of the night, it was remarked that lakes, canals and water reservoirs continued to perform this role in aiding navigation, primarily as a result of the 'shine' or 'glint' which these surfaces emitted. Indeed, it was contended that:

*'still clear water* reflects [the] moon with a flash,...the more acute the angle of reflection, the brighter the flash... *ruffled water* scatters the light so that it will not look quite so brilliant at the angle of flash, but will be fairly bright over a wider angle' (see Plate 7.14).<sup>104</sup>

Additionally, varying elevations of the moon made water surfaces become 'present' in different ways. A low moon, for instance, would make large expanses of water appear as 'bright patches', while by high moon, they would only become discernible through a 'momentary flash', although this would be over a wider area (see Plate 7.14). Even in

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<sup>103</sup> TNA, HO191/8: *Summary Report No.3: Camouflage Research, Part I: The Camouflage Problem*, undated.

<sup>104</sup> TNA, HO186/1342: *Bulletin No. B13: Notes on Aerial Observation at Night*, R&E Dept., MoHS, dated Jan 1943, p.13.

wintery conditions, when water surfaces were frozen, reflections would continue to provide information to the nocturnal aerial observer through moments of ‘gleam’, an effect whereby water appeared ‘white from all aspects; at reflecting angles [water] does not glint with single flash but has [a] duller reflection diffused over greater area’.<sup>105</sup>

Images removed for copyright purposes

**Plate 7.14: Diagrams illustrating the effects of still clear water (left) and ‘ruffled’ water (right) on the dispersion of light during night-time conditions.**

(Source: TNA, HO186/1342).

It was through these moments of ‘shine’, ‘flash’ and ‘gleam’ that quite distinctive water features in the landscape could be determined and identified. Around London, for example, the Thames, was noted to appear as ‘a broad winding-ribbon sometimes lighter and sometimes darker than its surroundings’,<sup>106</sup> whereas the King George V reservoir and the ‘Welsh Harp’ (Brent Reservoir) were also isolated on this basis. Further afield, Aldenham Reservoir (Elstree), Stanton Mile Reservoir (Northwood), Binley Lake (Coventry), Crewe Hall Pool (Crewe), and the distinctively shaped horseshoe lake at Earlswood were all considered to act as important leading marks for attacks in the Midlands.<sup>107</sup> Equally, an abundance of water in particular locations was also considered to be capable of confusing the bomber at night; following a series of aerial survey flights in the Birmingham area on the night of 26<sup>th</sup>/27<sup>th</sup> July 1942, it was reported that:

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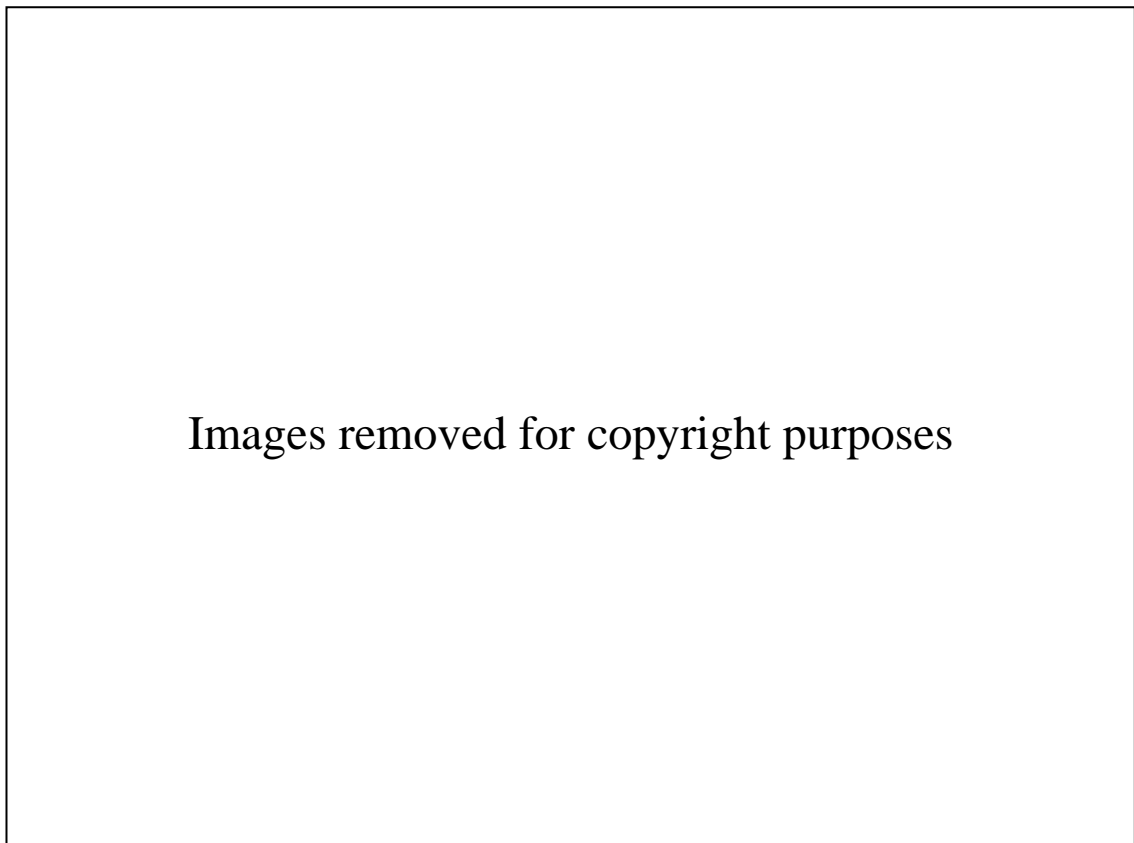
<sup>105</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.6.

<sup>106</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 27th February 1942*.

<sup>107</sup> TNA, HO186/1334: *Correspondence*, R.W.G. West (Air Ministry), to P. James, dated 26th Feb 1941; TNA, HO186/1342: *Interrogation Report of Home Security Exercise on the night of 22<sup>nd</sup> December 1942*, Sqd Ldr H.V. James, to Group Captain Bone and L.M. Glasson, dated 23rd Dec 1942.

‘at Walsall, Wolverhampton [and] Darlaston, the network of canals and the multiplicity of pithead ponds and abandoned workings composed too confusing a picture to be of value in locating sites’.<sup>108</sup>

It was, therefore, concluded in the debriefing after the flight that while ‘they would be principally useful as a whole in confirming...arrival over the Birmingham area’, they would not have ‘any great use as pin points’.<sup>109</sup>



**Plate 7.15: Aerial photographs showing the appearance of a lake in both low moon (top left) and high moon (top right) conditions; the appearance of a meander when viewed up-moon (bottom left); and the appearance a lake when viewed from vertically above (bottom right). (Source: TNA, HO186/1342).**

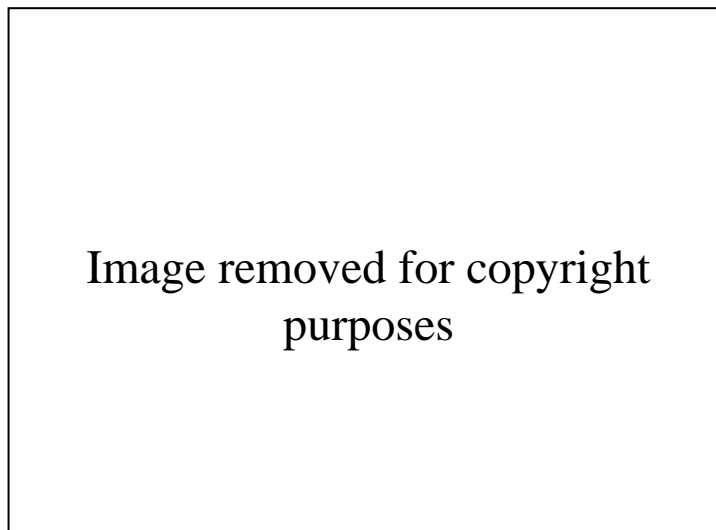
It should also be acknowledged that even in the absence of reflection, water surfaces were still considered to be of potential use to an enemy aircrew. When viewed from vertically above, lakes and reservoirs would appear as dark patches, enabling water

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<sup>108</sup> TNA, HO186/1342: *Report on night flights over Birmingham and Walsall*, G.B. Solomon, 26<sup>th</sup>-27<sup>th</sup> July 1942.

<sup>109</sup> TNA, HO186/1342: *Report and conclusions of special operation carried out by R.A.F. and other services on 22nd Dec 1942, to determine what points, if any, might be used by the enemy to fix the position of vital targets in the Birmingham area*, L.M. Glasson, dated 31st Dec 1942.

bodies with distinctive shapes to be identified (see Plate 7.15). Moreover, it was contended that particular points along a river course could also be identified through the inhibiting of reflection. In a flight over Leamington on 29<sup>th</sup> March 1942, it was recorded that the River Leam could be ‘very clearly seen’, with one bridge over it being ‘noticed by the absence of glint’.<sup>110</sup>



**Plate 7.16: An aerial photograph illustrating the visual appearance of ‘shine’ as emitted from a roof surface.**

**(Source: TNA. HO196/15).**

Beyond the issues of ‘shining’ water surfaces, the presence of ‘reflected’ and ‘direct’ light was also identified as making the industrial landscape conspicuous at night. It was noted, for instance, that ‘glint’ could be ‘occasionally observed’ off of railway tracks.<sup>111</sup> In most cases, however, it was ‘glint’ from roofs which were identified as the primary source of ‘shine’, particularly if they were ‘sloping sufficiently steeply to put the moon at the reflecting angle’ (see Plate 7.16).<sup>112</sup> During the course of the initial ‘exploratory’ nocturnal flights, several different types of roof surfaces has been noted to emit varying levels of ‘shine’ intensity, and, subsequently, ground assessments were carried out to determine the roofing materials which had produced these reflections. The most ‘reflective’ roof surface was considered to be metal ‘as on crowns of holders, tanks and containers’.<sup>113</sup> Indeed, in one flight over Banbury, the nearby gasholders were noted to

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<sup>110</sup> TNA, HO186/1342: *Moonlight Flight RAF Wellesbourne-Mountford on 29th March 1942.*

<sup>111</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.7.

<sup>112</sup> TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

<sup>113</sup> TNA, HO186/1985: *Policy for Concealment*, Air Staff, dated Feb 1942.

be ‘distinctly visible up-moon when their tops appeared as elliptical patches dimly gleaming in a row, in contrast to deep shadow on the near sides’.<sup>114</sup> Following on from this, other materials were listed, ranked in the following order of intensity: slate roof tiles; plain roofing felt; corrugated iron; Ruberoid;<sup>115</sup> asbestos pan-tiles; corrugated asbestos; and finally R.P.M. sheeting.<sup>116</sup>

Besides the type of roofing material, there were other factors which were also considered to produce ‘shine’ on these surfaces. The presence of moisture was highlighted with the roofs ‘assum[ing] the appearance of silver when viewed up-moon’ and the effect of the ‘glint’ extending to ‘an arc of 120 degrees, increasing to a maximum in the centre of the arc’.<sup>117</sup> This effect was particularly noticeable on a flight over Coventry on the night of the 29<sup>th</sup>/30<sup>th</sup> May, when ‘showery weather had resulted in surfaces being wet to various degrees’.<sup>118</sup> In his survey report, the Regional Camouflage Officer remarked that:

‘this flight was characterised by excellent visibility, enhanced by shine from wet surfaces. The low angle of the moon was responsible for creating a vigorous light and shade pattern and this combined with shine from wet surfaces, throwing the landscape into strong relief. Housing and road layouts were seen in comparative detail, units down to individual houses being clearly seen at all heights reached. In many cases the entire plans of factories were very conspicuous as silver shapes in a dark surround’.<sup>119</sup>

Discussions of the emission of light from urban spaces were not confined solely to ‘glint’ from roof surfaces. The visual appearance of ‘glare’, for instance, was a specific issue associated with iron and steel works as well as coke ovens, particularly those which had not been able to cease their operations before the onset of a Purple Warning. In one observational flight over Sheffield on the night of the 6<sup>th</sup> April 1942, for instance, it was noted how ‘glare was seen at the Sheffield Coal Co. Ltd during charging and this

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<sup>114</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Wellesbourne Mountford on 28th January 1942.*

<sup>115</sup> Ruberoid is, in many respects, very similar to roofing felt, although it is aggregates rather than asphalt which are combined together with tar or bitumen.

<sup>116</sup> TNA, HO186/1985: *Policy for Concealment*, Air Staff, dated Feb 1942.

<sup>117</sup> TNA, HO186/1985: *Policy for Concealment*, Air Staff, dated Feb 1942.

<sup>118</sup> TNA, HO186/1342: *Report on Moonlight Flights from RAF Honiley over Coventry on 29th-30th May 1942.*

<sup>119</sup> TNA, HO186/1342: *Report on Moonlight Flights from RAF Honiley over Coventry on 29th-30th May 1942.*

was continuous from some minutes'.<sup>120</sup> Elsewhere, over Scunthorpe, it was commented how:

'glare from a run of rimming steel (ingots in moulds) at R. Thomas [& Co.Ltd] and at [J.]Lysaght [& Co.Ltd] showed up badly from the air...[particularly when] the furnace was tapped at 6.25pm and the ingots were transferred without covers.'<sup>121</sup>

Further, on another flight over Stoke-on-Trent, the camouflage officer, Mr W. Lister, reported the presence of 'flashes' and 'glows' at the Shelton Iron and Steel Works when 'two ladles of iron [were] taken from [the] blast furnaces to [the] mixer building...[and] metal spilled out of ladle'.<sup>122</sup> In conclusion to these observations, it was proposed that:

'in view of the frequency of flashes from the coke ovens [and other installations] and their position with respect to the rest of the works and the neighbouring densely populated district, the question of total cover should be seriously considered'.<sup>123</sup>

In summary, the nocturnal landscape became known and interpreted through the refinement of an existing aerial grammar. Due to the visual conditions of the night, attention to the colours of the landscape were no longer of importance, whereas contrasts in tone and texture as well as the presence of shadows would take on a heightened significance in this 'silvery grey' landscape. Moreover, to this existing vocabulary would added the new dimension of 'reflection' as a 'way of knowing' about the presence of particular topographical forms in the nocturnal landscape. Civil camoufleurs would, therefore, have to embrace this redefined appreciation of the nocturnal landscape in both the spaces of simulation and in the camouflage techniques that they deployed.

### **7.6: Simulating the night: modifying the viewing room and modelling practices**

Aerial observations by night enabled civil camoufleurs to establish insights into the ways in which the landscape became 'present' and 'conspicuous' when examined through the (nocturnal) vertical visualities of the bomber body. With this knowledge of

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<sup>120</sup> TNA, HO186/1395: *Aerial Observation of Coke Ovens*, W. Lister, dated 11th Apr 1942.

<sup>121</sup> TNA, HO186/1395: *Air Observation, Scunthorpe*, E.W. Huddy, dated 10th Mar 1942.

<sup>122</sup> TNA, HO186/1395: *Aerial Observation over Stoke-on-Trent*, W. Lister, dated 19th Apr 1942.

<sup>123</sup> TNA, HO186/1395: *Aerial Observation over Stoke-on-Trent*, W. Lister, dated 19th Apr 1942.



the nocturnal landscape having accumulated, efforts could begin on the development of camouflage strategies; however, this would require modifications to be made to the Viewing Room in order that 'effective' camouflage methods could be devised to contend with the specific visual and perceptual conditions of the night.

Obviously, by this stage of the war, models had become an integral part of the camouflaging process. With the transition to a 'nocturnal camouflage' agenda, this role would remain unchanged; in one meeting on 'moonlight camouflaging techniques', it was contended that models should be used to determine whether 'daylight camouflage technique, with or without netting, was adequate for any moonlight conditions'.<sup>124</sup> Commencing in November 1941, modifications to the viewing room began; writing in a letter to the Secretary of MoHS, Cave outlined how efforts had been initiated in simulating:

'conditions of lighting which correspond closely with those of moonlight of varying intensity and of flare light. Various devices are being developed which enable night conditions to be studied even more carefully. They will enable us to determine by models under studio conditions what treatment ought to be given to various features to reduce their prominence when seen full scale at night'.<sup>125</sup>

Due to the limited amount of experience in night-time observations by civil camoufleurs at this stage, consultations with experienced R.A.F. personnel were held in order to articulate ideas about how the conditions of the night could be effectively simulated. The first visit to the 'modified' viewing room was on the 2<sup>nd</sup> December 1941 by Group Captain Livingstone, Deputy Director of the R.A.F. Medical Services, who was noted to have been 'working on these problems of night vision for so long that he is certain to be a very valuable and constructive critic of what it has been possible to do up to the present'.<sup>126</sup> Later, in January 1942, Colonel John Turner, who had been working on decoy schemes for night conditions, was invited to view the facilities for moonlight conditions himself. Although in the event he was unable to make a visit, he proposed that one of his associates, Squadron Leader Haney, attend, for he was described by Turner to have:

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<sup>124</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>125</sup> TNA, HO186/1343: *Correspondence*, T.R. Cave-Brown-Cave to H. Scott, dated 19th Nov 1941.

<sup>126</sup> TNA, HO186/1342: *Memorandum*, T.R. Cave-Brown-Cave, to W.E. Curtis, dated 24th Nov 1941.

‘done a very great deal of night flying recently, particularly with a view to seeing what is conspicuous at night. He will be able to tell you whether your laboratory conditions do really represent natural conditions at night’.<sup>127</sup>

These discussions with night observation ‘experts’, as well as the knowledge which was progressively starting to seep in from their own visual appreciations of the landscape in early 1942, culminated in the civil camoufleurs making several modifications to the standard viewing room. The turntable in the centre of the room was retained, as were the white walls and ceilings which produced a ‘diffused light’ effect similar to that which has been acknowledged in night conditions. However, as lighting was required to be kept to a minimum, ‘moonlight’ illumination would be provided through the designing and arrangement of several ‘Moon Cluster Boxes’, specially positioned so as:

‘to light the model from various angles. They are [also] placed as far from the model as possible, so as to give even illumination. By varying the numbers of lights switched on at a time, a considerable number of different light intensities can be obtained...it was found convenient to use .015, .008, [and] .002 f.c.’ (Plate 7.17 overleaf).<sup>128</sup>

In order to ensure that horizontal illumination intensities remained even throughout the assessment of the model, photometers would again be utilised, it being noted that the bulbs in the cluster boxes ‘soon lose brightness’ and so required frequent checking.<sup>129</sup> In addition, the camouflage designer would also utilise a more ‘portable haze box’, with the haze being ‘produced by the reflection from the plain glass of the flashed opal glass, the brightness of which can be varied by the sliding mask’.<sup>130</sup> It was under these simulated conditions of the night enabled by these new technologies that observations of ‘camouflaged’ model would now take place.

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<sup>127</sup> TNA, HO186/1342: *Correspondence*, J.F. Turner, to T.R. Cave-Brown-Cave, dated 21st Jan 1942.

<sup>128</sup> TNA, HO196/15: *R.E.N.223: Investigation into the Camouflage of Factories for Moonlight Conditions: An illustrated summary*, R&E Dept., dated Feb 1943.

<sup>129</sup> TNA, HO196/15: *R.E.N.223: Investigation into the Camouflage of Factories for Moonlight Conditions: An illustrated summary*, R&E Dept., dated Feb 1943.

<sup>130</sup> TNA, HO196/15: *R.E.N.223: Investigation into the Camouflage of Factories for Moonlight Conditions: An illustrated summary*, R&E Dept., dated Feb 1943.

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**Plate 7.17:** A page taken from *Investigation into the Camouflage of Factories for Moonlight Conditions*, illustrating the diverse equipment utilised for work into nocturnal camouflage in the Viewing Room.

(Source: TNA, HO196/15).

Precisely as they had done for day-time observations, a model would be constructed of the factory to be concealed, although, notably, this would be of a slightly smaller scale – 1:400, rather than 1:200. Furthermore, attention to the accurate reproduction of the textural appearance of both the surroundings and the structure to be concealed itself was considered to be of paramount importance, even more so now that contrasts in texture were a central expedient in nocturnal camouflage work. Indeed, it was contended that:

‘texture...must accurately match the original. Small details can, however, be omitted if they are not likely to be observed from an aircraft at night. It is unnecessary, for example, to paint doors and windows on houses or show individual trees of a wood’.<sup>131</sup>

For camoufleurs such as Stephen Bone, nocturnal flights were a valuable opportunity to collect visual information ‘on the “textures” of such surfaces as fields, different types of roads and roofs, railways [and] woods’ which could subsequently be brought back into the Viewing Room to enhance its ‘realism’.<sup>132</sup> However, to ‘scientifically’ confirm the ‘effective’ simulation of different textures within the simulated spaces of the Viewing Room, camoufleurs would still make use of a texture-meter to supplement their visual observations.

Having established simulated nocturnal conditions in the viewing room through these assemblages of visual observations, new illumination technologies, optical devices, and knowledge from ‘experienced’ nocturnal observers, civil camoufleurs began to evaluate their efforts. Under pressure to devise nocturnal camouflage methods ‘immediately’, C.D.C.E. camoufleurs headed by the Gilbert Solomon (the S.D.O.) held a meeting on the 9<sup>th</sup> February 1942 to critically examine:

‘the effect of moonlight given in the Research Viewing Room,...[and] to see whether it simulated natural conditions sufficiently well to warrant general conclusions being drawn from its use’.<sup>133</sup>

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<sup>131</sup> TNA, HO191/31: R.E.N. 525: *The Viewing Room of the Research and Experiments Department of the Ministry of Home Security at Leamington Spa*, T.A. Littlefield, dated 26th June 1945.

<sup>132</sup> TNA, HO186/1342: *Moonlight Flight from R.A.F. Abingdon on 27th February 1942*.

<sup>133</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

Their investigations began with the viewing of:

‘a sample model of four blocks of saw tooth on a board textured to simulate areas of grass and concrete,...placed on the viewing platform so that observers had a vertical view. This was illuminated at 45° with a moon of intensity of 0.02ft. candles (at the normal). This appeared to the observers as very bright. As such conditions are rather exceptional the intensity of the moon was changed to 0.01ft candles’.<sup>134</sup>

Shifting the position of the model to represent a more oblique view, the group proceeded to inspect the model from 15ft (simulating viewing from 3,000ft) and:

‘were surprised at the extreme clearness with which the model could be seen. Captain Solomon felt that conditions had not been so good on night flights which he had made. When, however, the observers stood at 30ft. (6,000ft) from the model, those who had flown at about this height by moonlight of about the same intensity over a factory a few nights before were of the opinion that the Viewing Room gave a not unreasonable representation of what they had seen. They felt, however, that absolute certainty was difficult in view of the extremely characteristic shape of the factory model on the turntable’.<sup>135</sup>

Following the viewing of another model of an ‘untextured’ factory in the same viewing conditions, some ‘tentative’ conclusions were made on their simulation attempts. It was remarked, for instance, that:

‘from vertical aspects the simulation of natural conditions were adequate...From [the] diagonal aspect, it was felt that it would be less reliable until some imitation of atmosphere could be introduced’.<sup>136</sup>

It was also noted that ‘the isolation of the factory from its surroundings made comparison with actual conditions rather difficult’, although it was proposed that the addition of ‘a large curtain of hessian to be hung immediately behind models when

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<sup>134</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>135</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>136</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

surveyed vertically’ would help improve matters.<sup>137</sup> Most importantly, however, was that in the opinion of those who had conducted night-time aerial observations, ‘the Viewing Room gave a far better simulation of moonlight conditions than any that had been obtained for sun and diffused light’.<sup>138</sup> In attempting to account for this, it was argued that this was due to:

‘the [simulated] “moonlight” [being] of exactly equal intensity to actual moonlight, whereas the sun lamps and diffused light systems are only reduced scale reproductions. The “moonlight” has also been colour corrected’.<sup>139</sup>

These relatively minor attentions to detail, it was contended, provided the ideal basis from which to begin experimentation into nocturnal camouflage methods.

### **7.7: Reconfiguring existing methods of camouflage**

The various investigations into night-time visualities and the nocturnal appearance of the landscape established a firm intellectual and critical basis from which to commence the reviewing of existing techniques of camouflage, as well as an opportunity to develop additional methods of concealment which could be utilised to suppress new challenges that the night had produced. From the outset, it was clear that night camouflage would be developed on different lines to day-time forms of concealment. Firstly, as the landscape was reduced to an overall ‘silvery grey’ appearance, it was contended that ‘camouflage by colour disruption is...of little value at night’.<sup>140</sup> Furthermore,

‘on account of the tremendous simplification of forms by the low intensity of moonlight...many camouflage expedients, such as colour contrast, countershading, subtle disruption, which have distractive effect by day are quite useless by night. Camouflage for moonlight will be simpler than that for daytime in that less attention need be given to disrupting or concealing the smaller forms such as roof pitches, but more exacting in the even greater demand for the concealment of the main shadows’.<sup>141</sup>

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<sup>137</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>138</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>139</sup> TNA, HO186/1342: *Meeting to discuss technique of Moonlight Camouflage*, held on 9th Feb 1942.

<sup>140</sup> TNA, HO196/31: *R.E.N.537: The Mechanism of Vision*, T.A. Littlefield, dated 10<sup>th</sup> July 1945, p.7.

<sup>141</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.3.

Another important assertion to be made was that the use of black paint to obscure objects in the dark was an inadvisable approach to be adopted. While popular discourses affirmed that black paint would render a structure invisible, in nocturnal conditions, where the landscape was presented as a visual composition of differing ‘pale’ and ‘dark’ tones, extensive black patches were considered to provide ‘a focus of attention, and possibly even an aiming mark’.<sup>142</sup> The use of black paint was also deemed to have an illusionary effect on the appearance of shadows;

‘if the surface adjacent to the shadow is painted a middle tone, light appears to blur across the shadow to reduce its intensity, but if the adjacent surface is painted black, the amount of light available for blurring across is reduced. The result will therefore be that the recognisable shape of the shadow will be obscured, but the actual darkness of the area under the shadow will be increased’.<sup>143</sup>

When viewed at night, the darkened tonal value of the shadow would appear much more conspicuous, thereby acting as a mark which would draw the attention of the enemy observer as they passed over the landscape.

It should be noted that the camouflage techniques which were subsequently devised during this time period were also to be greatly affected by external influences. From January 1942, the assessments to be given to factories were revised to DAY, DAY PLUS, NIGHT, NIGHT PLUS and NIL (see Table 7.3). These classifications would be assigned by the newly formed Civil Camouflage Advisory Committee as part of an attempt ‘to conserve our resources and direct them into the most profitable channels’.<sup>144</sup> Indeed, greater restraints were being placed upon civil camouflage work at this time in terms of the economising of materials and labour resources. For example, chromium oxide, a pigment used for green paint was now in extremely short supply. The result of these ‘cut-backs’ was two-fold: firstly, alternative materials for camouflage work were progressively being sought to resolve camouflage issues; and secondly, some features in the landscape would now have to be disregarded due to the heavy expense involved.

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<sup>142</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.4.

<sup>143</sup> TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

<sup>144</sup> TNA, HO186/1985: *T.S.C. 24: Notes on definition of NIGHT and NIGHT PLUS*, F. Wyatt, dated 19<sup>th</sup> Mar 1942.

Assessment	Conditions of Attack	Level of Concealment	Treatment
DAY PLUS	Deliberate search in daylight and bright moonlight	Maximum	Any reasonable measures including total coverage if necessary
DAY	Deliberate search in daylight and bright moonlight	Good	Reasonable measures including partial structural (2) camouflage if necessary
NIGHT PLUS	Deliberate search in bright moonlight and quick attack in poor daylight visibility (4)	Good; sufficient to delay recognition	The use of any standard colour; texturing; some structural (2) camouflage if necessary
NIGHT	Deliberate search in bright moonlight	Sufficient to delay recognition	Toning down (1) texturing if necessary, but no structural camouflage (2).
NIL	Casual (3) or area bombing	Sufficient not to attract notice	A small amount of toning down (1) of any features which reconnaissance has shown to be outstanding

**Table 7.3: A table illustrating the C.C.A.C. classifications introduced in early 1943 and used to determine the level of concealment to be applied.**

(Adapted from: TNA, HO186/1985: *Camouflage Committee: Scales of Concealment*, dated 22<sup>nd</sup> June 1943).

The new designations of NIGHT and NIGHT PLUS, therefore, placed certain limitations upon the extent to which nocturnal camouflage could be carried out. Under a NIGHT assessment, it was argued that:

‘it is...only necessary to reduce the visibility of the target to an extent which will prevent it from being easily recognisable...from the height and distance appropriate to normal bombing practice with H.E. bombs, or attracting the attention of bombers who have failed in their mission elsewhere’.<sup>145</sup>

On the other hand, NIGHT PLUS factories would be provided with:

‘a high standard of concealment against systematic search from all angles of view and from all altitudes down to 6,000ft, entailing the use of constructional treatment where necessary’.<sup>146</sup>

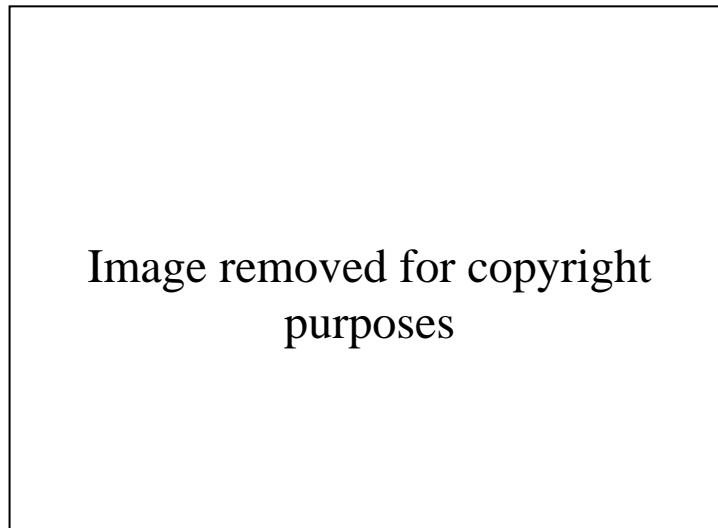
<sup>145</sup> TNA, HO186/1985: *T.S.C.24: Notes on definition of NIGHT and NIGHT PLUS*, F.J.C. Wyatt, dated 19th Mar 1942.

<sup>146</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.5.



These designations, therefore, had an important bearing on the maximum amount of treatment that conspicuous features could receive.

In terms of thinking about ‘design action’, Gilbert Solomon, who had been extensively involved in the nocturnal survey flights, wrote that ‘two methods of treatment present themselves: Fade-out [and]...Disruptive patterning’.<sup>147</sup> These two camouflage effects, Solomon argued, could be achieved through the deployment of a variety of existing methods, from paint-based solutions through to netting and textural materials, albeit modified to accommodate for the different perceptual and visual conditions of the night. Through these techniques, camoufleurs would tackle the specific visual conditions which rendered features conspicuous at night: shine and reflection, sharp tonal contrasts caused by textural differences and the presence of shadows.



**Plate 7.18: ‘Toning down’ to facilitate ‘fade-out’.**

**(Source: TNA, HO196/15).**

As with day-time camouflage, one of the simplest solutions for the concealment of the nocturnal landscape was the method of ‘toning down’, whereby ‘fade-out’ would be achieved through the use of a middle tone.<sup>148</sup> This could be accomplished in one of several ways. Firstly, toning down by ‘conventional’ paint-based techniques involved making use of medium tones from the ‘official’ Camouflage Colours palate: Numbers 1, 2, 7, 8, 12 and 13 (see Appendix 1). Indeed, it was argued that these ‘may be used

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<sup>147</sup> TNA, HO186/1342: *Deductions from reports of Night Flights in relation to Design action*, G.B. Solomon, dated 25th Aug 1942.

<sup>148</sup> Within discourses on nocturnal camouflage, the term ‘merging’ seems to have been replaced with ‘fade-out’, namely as the use of toning down was to reduce or ‘fade’ the presence of pale surfaces.

interchangeably, since by moonlight colour differences are hardly perceptible'.<sup>149</sup> However, by March 1942, this was reduced to Nos. 2 and 7 on account of concerns about pigment supplies for the other colours.<sup>150</sup>

At the same time, cheap alternative techniques of 'toning down' were also being encouraged to supplement these paint-based solutions. In the majority of cases, these substitutes consisted of the application of 'waste' or by-products from industrial or mechanical output. One such method was the use of coal-tar mixed with creosote, which was used to tone down 'absorbent' surfaces such as brickwork. Another technique which proved to be 'most promising' was the use of waste sludge oil. Indeed, it was argued that waste sludge oil was 'generally suitable for applying on all absorbent surfaces, but NOT on glass, rubber, asphalt or anything containing bitumen'.<sup>151</sup> Such material had initially been obtained from the shipbuilding company Cammell Laird in Birkenhead, who had:

'recovered [it] from the bottom of tankers sent to them for repair, and which is at present taken to sea and dumped. This material is far thicker than any normal fuel oil, and for that reason gives a very satisfactory coating on brick or asbestos cement. We formerly tried normal fuel oil, but that penetrated so rapidly into the surface that it was virtually useless. On the other hand, this sludge gives very small penetration and after a fortnight's exposure gives results which are entirely satisfactory'.<sup>152</sup>

Due to its availability in stocks 'probably many times that which we could use for camouflage purposes' and its effective visual appearance, Cave deemed sludge oil 'so satisfactory for darkening purposes that it might well replace almost the whole of the camouflage paint used for darkening...purposes'.<sup>153</sup> It was 'innovative' techniques such as this that demonstrated the capabilities of the camoufleurs to adapt to the conditions they were working within and adopt readily available, yet possibly 'unconventional' materials for concealment.

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<sup>149</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.3.

<sup>150</sup> TNA, HO186/1980: *Memorandum on the supply position for camouflage paints*, c. Mar 1942

<sup>151</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage: draft Camouflage Committee Memorandum*, dated Aug 1943.

<sup>152</sup> TNA, HO186/1331: *Correspondence*, T.R. Cave-Brown-Cave, to K.N. Stock, dated 28th Apr 1942.

<sup>153</sup> TNA, HO186/1331: *Correspondence*, T.R. Cave-Brown-Cave, to K.N. Stock, dated 28th Apr 1942.

While ‘toning down’ was promoted as a simple means of concealment, experimentation within the Viewing Room did highlight some issues with the method; it was noted, for instance, that:

‘toning down has...a tendency, by removing difference of local colour, to make the main shadows more noticeable. It will then be necessary in many cases to deal with the shadows’.<sup>154</sup>

In this case, the necessary deployment of other supplementary techniques to reduce the visual presence of the shadows would be detrimental to its ‘economical’ value. In addition to this, ‘toning down’ would require constant maintenance and attention, with the ‘deterioration in middle tones being exhibited as light areas by night’.<sup>155</sup> In the long term, this need to maintain the ‘toning down’ effect would consume additional materials and labour resources, which was detrimental to its operational deployment.

Following on from ‘toning down’, ‘disruptive’ or ‘patterned’ camouflage was also continued, albeit achieved through the use of contrasting tones, rather than differences in colour (Plate 7.19). In most situations, this would involve the strategic deployment primarily of black paint, often used in conjunction with either light or middle tones, depending on the visual appearance of the locality; this was a significant deviation away from ‘daylight’ disruption which made use of contrasting colours. In discussions of this technique, it was proposed that ‘disruption’ could be utilised, firstly, ‘to reduce the apparent size of tall buildings when seen by a low moon, when the face of a building may be picked out and the ground left in shadow’,<sup>156</sup> and, secondly, ‘for concealing shadows in extensive low buildings seen from near-down-moon aspects’.<sup>157</sup> With respect to the latter, dark irregular shapes would be spread across the surfaces of the building in an attempt to merge shadows cast on the ground with the actual building itself, thereby reducing its conspicuousness. In both cases, it was contended that the

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<sup>154</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.3.

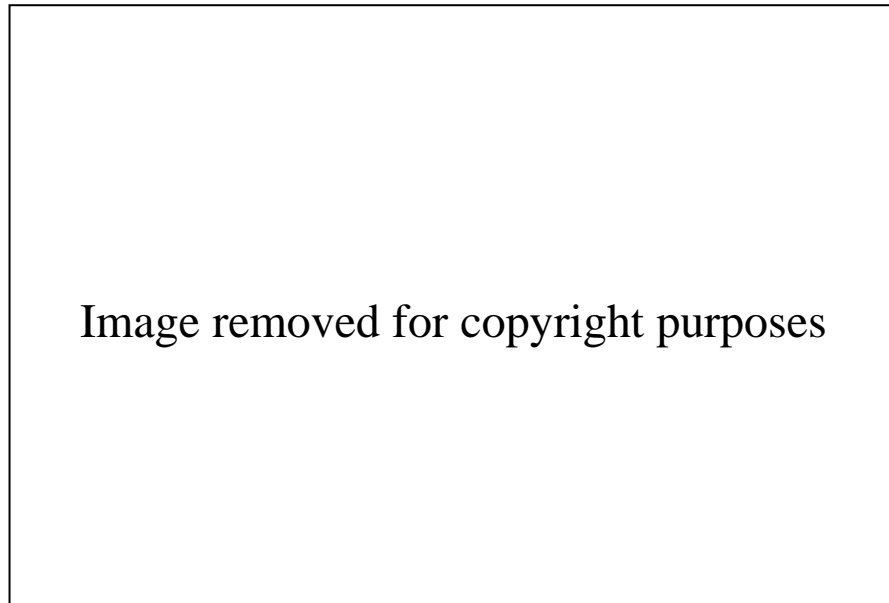
<sup>155</sup> TNA, HO186/1342: *Deductions from reports of Night Flights in relation to Design action*, G.B. Solomon, dated 25th Aug 1942.

<sup>156</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.2.

<sup>157</sup> TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

diminished sense of visual acuity brought about by the conditions of the night would mean that the disruptive:

‘pattern[s] will have to be very broad indeed. Camouflage pattern designed for day conditions, when the eye had at least five times greater resolving power, will almost always be too subtle to have any disruptive power at all by night’.<sup>158</sup>



**Plate 7.19: ‘Patterned Camouflage’.**

**(Source: TNA, HO196/15).**

The final paint-based method to be modified for the conditions of the night was ‘imitation’. For night-time conditions, this consisted either of the ‘decoy’ painting of roads in order to break up the shape of the factory (see Plate 7.20), or a ‘dwelling house’ treatment employed on a far simpler scale than had been adopted for day-time conditions. Rather than a reasonably well-detailed and colourful scheme, imitative patterning for night would be less grandiose consisting of the use of:

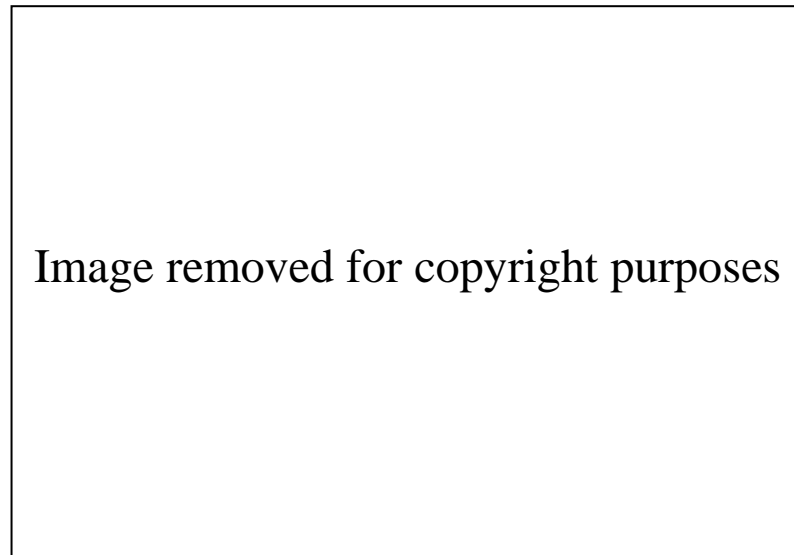
‘bands of black about 30ft. wide...to break up a light building into sections the same way as adjacent housing. Even when from greater distance the striped system thereby formed begins to merge, the middle tone achieved in this way by partial coverage with black

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<sup>158</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.1.

stripes is more economical than total coverage with No.13 paint. Such ‘housing’ treatment will be all the better by night if the scale is slightly too large’.<sup>159</sup>

In addition to this, it was highlighted that ‘windows’ would not need to be painted upon walls as vertical panes were not discernible in the conditions of the night.<sup>160</sup>



**Plate 7.20: A ‘distractive’ treatment: decoy roads painted over the top of an industrial building. (Source: TNA, HO196/1512).**

Aside from paint-based methods and the daubing of industrial features with waste by-products, ‘textural’ solutions were also extensively promoted to reduce contrasts between dark and pale surfaces, as well as to suppress ‘shine’ and reflection from roof surfaces. Predominantly, this would consist of the application of ‘granular’ treatments or B.G matting, there being issues with other ‘fibrous’ materials. Steel wool netting, for instance, was strongly discouraged; ‘from down-moon aspects the upstanding strands make steel wool rather light in tone; against the light its contained shadow makes it very dark’.<sup>161</sup> Despite this, texturing, in many ways, effectively supplanted paint-based solutions as the central camouflage technique in these nocturnal conditions. For

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<sup>159</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.4. For darker coloured facilities, the same effect would be produced through the use of medium toned stripes. See TNA, HO186/1342: *Second Interim Report on Moonlight Camouflage*, R&E Dept., MoHS, dated Jan 1942.

<sup>160</sup> However, it should be noted that where the camouflage scheme was to operate at both day and night, an imitative ‘housing’ pattern of this kind was considered to ‘be so dangerous by day that it is essential that they should not be employed without the advice of a camouflage officer’. The selection of the colours, therefore, had to be negotiated, with greens and greys encouraged in some cases over black. See TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, pg.4.

<sup>161</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.4.

example, as ‘toning down’ had a tendency to heighten the presence of shadowed areas, texturing was encouraged as a means of diminishing their visual appearance through the merging of the contrast between the overall ‘silvery grey’ appearance of the landscape and the ‘dark’ areas produced by cast shadows. Simultaneously, texturing could also be used for ‘disruptive’ purposes, with heavily textured areas being combined with lightly textured or un-textured patches. Indeed, it was argued that an all-over heavy textural surface would be unsatisfactory, both economically and visually;

‘from many up-moon and cross-moon aspects, an all-over application of heavy texturing is likely to make many factories conspicuous as black shapes outlined by lighter roads and aprons’.<sup>162</sup>

However, in utilising light and heavy texturing, attention had to be devoted to thinking about the shapes produced. Light texturing, for instance, had a tendency to become ‘reflective’ when wet, and so it was emphasised that ‘light textured areas should be designed as shapes which, if they do stand out, will not betray the factory’.<sup>163</sup>

The final existing treatment of camouflage to be ‘re-appropriated’ for nocturnal use was the use of netting and screens. As with their day-time use, camouflage nets and screens were to contend with the presence of shadows. Indeed, within one memorandum on ‘night camouflage’, netting was promoted as the most effectual solution to conceal the shadows cast within the gullies of saw-toothed roofing;

‘from low angles against the light from a number of directions, factories with saw-toothed or steeply pitched ridge-and-furrow roofing will appear as completely black rectangular shapes cut by illuminated, or even reflecting, gulleys. All investigation with the use of models points to their being extremely conspicuous from those aspects. The only possible treatment consists in disrupting with extensive canopies of horizontal netting used in a broad pattern. Small bites into the main shape are ineffective, as also are occasional canopies with gaps between’.<sup>164</sup>

It was argued, therefore, that:

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<sup>162</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.3.

<sup>163</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.3.

<sup>164</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.4.

‘if horizontal netting, even only a narrow band, can be erected along the sides of gulleys in extensive factories, it is likely that the width of the shadow in the gulleys will be reduced enough to allow merging to take place’.<sup>165</sup>

As had been noted in their nocturnal observations from the air, it was only shadows of a particular width which could be interpreted at the altitude of 6,000ft. At the same time as being used to ‘conceal’, experimentations on models demonstrated that at night, netting could:

‘also [be] useful when employed imitatively for “dummy roads” light in tone and carried over roofs – a very useful, bold expedient for distracting attention away from shadows – and for “dummy housing” where a greater emphasis is required than can be obtained with paint’.<sup>166</sup>

In the case of the former, it was argued that its success:

‘depends on achieving a successfully matching of the colour [with camouflage materials] of the existing roads, and on the possibility of marrying the netting “roads” on the factory roofs with the real roads on an adjacent housing estate’.<sup>167</sup>

## **7.8: New methods of concealment**

### *7.8.1: Ground treatments*

The unique challenges that were presented by the night also culminate in a wide range of alternative methods and strategies being developed by civil camoufleurs for deployment ‘in the field’ to supplement the existing array of camouflage techniques. The first of these was the use of ‘ground treatments’, it being argued that camouflage at night should be extended beyond the spaces of the building to include the immediate surroundings in an attempt to deal with shadows as well as tonal contrasts. Indeed, it was contended that:

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<sup>165</sup> TNA, HO186/1985: *Interim Practical Recommendations for Moonlight Camouflage*, undated, p.4.

<sup>166</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, pg.4.

<sup>167</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, p.14.

‘where the site allows, distortion of cast shadows can be achieved by the application of black ground treatment. This must be extensive to be effective and is best employed on small and isolated buildings or high structures covering a relatively small site plan’.<sup>168</sup>

To achieve this ‘darkening’ effect, it was proposed that the surroundings could be coated either by sprayed with tar or black paint or through the scattering of cinders, coal, slack, clinker, road-metal or brick particles over surrounding surfaces.<sup>169</sup> If the neighbouring ground was grassland, it was recommended that:

‘either the turf should be removed or weed killer applied...A solution of Tannin-iron has also been used with good effect for the darkening of grass. Frequent application is however necessary, especially in the summer months’.<sup>170</sup>

A further solution which was suggested was to put ‘black steel wool on the ground or suspending it...10 feet above it’.<sup>171</sup>

Simultaneously, ground treatments could also be utilised to ‘lighten’ the tone of certain features in the landscape. For railway tracks and marshalling yards, for example, it was proposed that material ‘light’ in tone could be used to reduce their ‘dark’ presence in the landscape. In May 1942, Cave made initial enquiries with the London, Midland and Scottish (L.M.S.) railway company about ‘whether it would be possible to add light-coloured ballast in order to lighten the tone of the surface as a whole’.<sup>172</sup> They had subsequently responded by experimentally using such ballast on sections of track at Dursley (Gloucestershire) and at Crewe, noting from aerial observations that:

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<sup>168</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage: draft Camouflage Committee Memorandum*, dated Aug 1943.

<sup>169</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage: draft Camouflage Committee Memorandum*, dated Aug 1943.

<sup>170</sup> TNA, HO186/1985: *T.S.C.74: Night Camouflage: draft Camouflage Committee Memorandum*, dated Aug 1943.

<sup>171</sup> TNA, HO186/1342: *Memorandum on Technical Principles in Amplification of Sir J. Turner’s Paper*, L.M. Glasson, dated 25th Mar 1942.

<sup>172</sup> TNA, HO186/966: *Note entitled ‘Alteration of Tone of Railway Tracks’*, T.R. Cave-Brown-Cave, to L.M.Glasson, dated 11th May 1942.



‘the lightening produced remains effective for a considerable time. Although there is much darkening of the ballast in the 4ft 8in. way, the ballast outside the running track has remained light for a very satisfactory time’.<sup>173</sup>

This treatment was, therefore, encouraged as ‘desirable’ to various railway companies by the Camouflage Directorate.

#### 7.8.2: *Water Camouflage*

From their observations of the nocturnal landscape, the identification of water surfaces through ‘shine’, ‘glint’ and ‘gleam’ had become one of the key ways through which the nocturnal bomber body was able to navigate and negotiate its ways to its target. Early versions of the K.P.I.B. ‘vitals list’ had included several water features which were deemed to be of particular significance for both day and night conditions, but as yet, no ‘effective’ camouflage technique had been designed to facilitate their concealment. On the one hand, this difficulty had arisen due to camouflage coming into conflict with other ‘social purposes’ of water.<sup>174</sup> Indeed, it was recognised that the use of water for drinking, fire fighting, transport, agriculture and industrial use restricted which methods could be trialled.<sup>175</sup> On the other hand, the challenge of concealing a fluid surface was also regarded as being exceptionally difficult. Attempts at concealment by the use of smoke screens were ruled out on account of being ‘fantastically expensive and difficult’.<sup>176</sup> Elsewhere, the use of water plants such as Duckweed and Azolla had also been discounted, it being noted that ‘the concealment given is...illusory. From the ground it may appear excellent, but, from the air, water covered with such plants reflects the light strongly’.<sup>177</sup>

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<sup>173</sup> TNA, HO186/966: *Note entitled ‘Alteration of Tone of Railway Tracks’*, T.R. Cave-Brown-Cave, to L.M. Glasson, dated 11th May 1942.

<sup>174</sup> For geographical work on water-society relations, see for example Gibbs, L.M. 2009: *Water Places: Cultural, Social and More-Than-Human Geographies of Nature*, *Scottish Geographical Journal*, 125(3-4), pp. 361-369; Sultana, F. in press: *Water, technology, and development: transformations of development technonatures in changing waterscapes*, *Environment and Planning D: Society and Space*; Swyngedouw, E. 1999: *Modernity and Hybridity: Nature, Regeneracionismo, and the Production of the Spanish Waterscape, 1890-1930*, *Annals of the Association of American Geographers*, 89(3), pp.443-465; Swyngedouw, E. 2007: *Technonatural revolutions: the scalar politics of Franco’s hydro-social dream for Spain, 1939-1975*, *Transactions of the Institute of British Geographers*, 32(1), pp.9-28.

<sup>175</sup> TNA, HO186/1334: *Note of administrative policy in respect of the treatment of water surfaces*, dated 23rd Feb 1941.

<sup>176</sup> TNA, HO186/171: *CAP/3: Information on Subjects for Consideration, Appendix C*, F.J.C. Wyatt, dated 21st Oct 1939.

<sup>177</sup> TNA, HO217/2: *Camouflage Committee Memoranda No.7: Concealment of Water*, dated 1943.



Images removed for copyright purposes

**Plate 7.21: Comparative oblique aerial photographs of a factory with extensive areas of water adjacent before (top) and after (bottom) treatment with coir netting on timber-framed rafts. In this case, the object was to distort the water's distinctive shape through partial coverage. (Source: TNA, HO186/1989).**

However, with the shift towards a night camouflage agenda, a renewed engagement and impetus to producing camouflage for water surfaces was initiated, with three solutions to the problem being proposed. The first technique was that of 'covering', whereby the water expanse would be either completely or partially covered, depending on whether the objective was to completely remove the water or reduce its shape and size in order to confuse the bomber crew (see Plate 7.21). To achieve this effect, three methods of coverage were trialled and deployed. An initial solution was the use of willow cradles, dressed up with onion bagging (jute) and floated on willow box floats. While valued for

its low cost, their lightweight made the cradles extremely fragile and susceptible to being easily taken away by currents.<sup>178</sup> Moreover, while it had been acknowledged that their production required very low levels of skilling, with it even being suggested that schoolchildren could be employed to manufacture them, it was asserted that:

‘this should be a factory operation and apart from the complications that the employment of juvenile labour would introduce as between the manufacturers and the Home Office and Board of Education, the supervision required by the employment of such labour would nullify any advantage gained’.<sup>179</sup>



**Plate 7.22: Photograph of an experiment being carried out at Compton Verney in April 1941 with rafts covered with Hessian material.**

(Source: TNA, HO191/2).

The second method of ‘covering’ was to use timber framed rafts 9ft long and 6ft wide supported by four one-gallon metal floats (see Plate 7.22).<sup>180</sup> Onto these frames would be nailed camouflage material, consisting of either hop-lewing (coir) or hessian painted with green No.6 non-gritty bituminous emulsion paint. These rafts would be constructed ‘on site’ and launched onto the water’s surface and anchored by wires to prevent

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<sup>178</sup> TNA, HO186/1985: *T.S.C.67: Report on Water Camouflage*, ‘C’ Division, R&E Dept., dated 15th Dec 1942. It was also discovered that onion bagging was also in short supply, and therefore an unsuitable material to utilise.

<sup>179</sup> TNA, HO186/1985: *T.S.C.67: Report on Water Camouflage*, ‘C’ Division, R&E Dept., dated 15th Dec 1942.

<sup>180</sup> Later approaches involved making rafts from scaffold poles and much larger drums.

drift'.<sup>181</sup> However, a central issue was that they impeded the mobilities of water transport and so their use was to be confined to relatively calm water expanses with no river traffic.

In response to this aspect, the final method of covering was the suspension of a canopy on cables attached to the banks of the water expanse and suspended over the water through the placement of floats (see Plate 7.23 and 7.24). By suspending the netting in this way, it was contended that water traffic would be able to continue unimpeded along the stretch of water, whilst also being concealed from viewing from the air. The floats which were deployed to support this form of water camouflage were developed at two key sites: Warwick Park Lake and in the grounds of Compton Verney House.<sup>182</sup> Emerging from the research at these sites, two types of floating supports were designed and promoted: the 'Table' support, which entailed creating a box-like wooden frame, supported by eight 4-gallon oil cans, and costing about £1000 per acre (£28,200 today); and the 'favoured' method known as the 'Pyramid' support, consisted of four planks of wood, arranged into a pyramid with the end of each leg being supported by four 10-gallon oil drums and costing £775 per acre (£ 22,258 today).<sup>183</sup>

Images removed for copyright purposes

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<sup>181</sup> TNA, HO186/1985: *T.S.C.67: Report on Water Camouflage*, 'C' Division, R&E Dept., dated 15th Dec 1942.

<sup>182</sup> Compton Verney, near Kineton, Warwickshire, was requisitioned by the Army at the outbreak of war. It was, however, a site also utilised by the MoHS's R&E department for a variety of experiments, including not only water camouflage but also the development of smoke screens. Compton Verney was, therefore, a key site of camouflage knowledge-production.

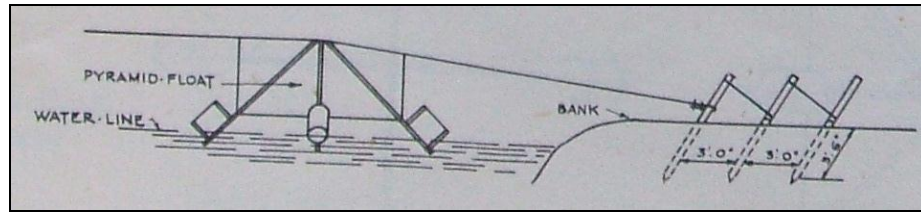
<sup>183</sup> TNA, HO217/2: *Camouflage Committee Memoranda No.7: Concealment of Water*, dated 1943.



**Plate 7.23: Photographs showing the arrangement of 'Table' (left) and 'Pyramidal' (right) floating supports.**

**(Source: TNA, HO186/1985)**

Images removed for copyright purposes



**Plate 7.24: Diagram illustrating the tensioning and arrangement of the wires over the water's surface.**

(Source: TNA, HO217/2).

For both examples, these floats were to be constructed on site, with it being deemed 'not necessary to employ carpenters on the construction of the floats, it being proved that good class handyman experienced no difficulty in constructing either type'.<sup>184</sup> Once constructed, the floats would be launched in rows of six and anchored temporarily. Cables would then be sent across the water expanse and taken over the top of the floats. With this completed, the floats would be securely anchored and the camouflage fabric rolled out over the top of the wires and fastened down.<sup>185</sup> All this was to be accomplished with extremely low levels of labour and equipment; experiments at Warwick Park Lake suggested that four men could be employed on the construction of the floats, six would be involved in the erecting of the structure and further five to attach the fabric. Equipment-wise, only three punts would be required for 'general work', with a single skiff being capable of towing the floats into position.<sup>186</sup> The resulting appearance of this suspended netting was deemed to be highly satisfactory, with civil camoufleurs approving the flat surface produced, as well as the 'good screening qualities' of B.G. sewn mats; cotton netting, on the other hand, was discouraged, it being 'not so satisfactory as a screen. Moreover, it quickly lost its colour'.<sup>187</sup>

<sup>184</sup> TNA, HO186/1985: *T.S.C.63: Report on Water Camouflage, Warwick Park Lake*, 'C' Division, R&E Dept., dated 20th Oct 1942.

<sup>185</sup> The material which was typically utilised for these nets was either hessian strips or B.G. sewn mats.

<sup>186</sup> TNA, HO186/1985: *T.S.C.63: Report on Water Camouflage, Warwick Park Lake*, 'C' Division, R&E Dept., dated 20th Oct 1942. A 'punt' is a river-based craft with a flat bottomed hull and a square-shaped bow. Similarly, a 'skiff' is also a small river boat, with a small engine to provide power, rather than being oar-driven.

<sup>187</sup> TNA, HO186/1985: *T.S.C.63: Report on Water Camouflage, Warwick Park Lake*, 'C' Division, R&E Dept., dated 20th Oct 1942.

Images removed for copyright purposes

**Plate 7.25: The fastening of the cables to the floats (top left); garnishing the netting (top right); and the visual effect created as viewed from the ground (bottom).**

**(Source: TNA, HO186/1985).**

Image removed for copyright purposes

**Plate 7.26: A photograph of the Coventry Canal camouflaged with a coal dust and fuel oil film.  
(Source: Reit, 1978)**

While rafts and suspended netting covered over the water and enabled it to be physically removed from the landscape, other techniques were devised to suppress the reflections emitted from it. In August 1939, one such suggestion had been received from the Commonwealth. Writing to the Ministry of Defence amidst popular concerns that the Thames acted as a discernible landmark at night, Mr William Newson of New South Wales, Australia, put forward the suggestion to:

‘have stacks of sawdust, light wood preferably placed in positions for strewing over the river, this would not impede navigation and eventually would be carried by the tide down to the Channel’.<sup>188</sup>

But perhaps the most innovative method to suppress shine in this way was spectacularly encountered by an unlucky member of the public walking his dog one evening in the Coventry Canal area;

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<sup>188</sup> CAB21/2703: *Correspondence*, William Charles Newson, (N.S.W., Australia) to the Minister for Defence, dated 25th Aug 1939.



‘Tired of trampling through the underbrush the stroller saw a smooth asphalt road up ahead, just visible in the gathering darkness. Whistling to his dog, he hurried toward the welcoming road and stepped from the grassy shoulder. There was a loud splash, a startling cry, a canine yelp of indignation. Man and animal were fished out by British soldiers nearby...the elderly gentleman and his dog had blundered into the Coventry Canal’.<sup>189</sup>

What this individual had stumbled upon was a form of water camouflage whereby a layer of coal dust would be spread over the water’s surface, suppressing shine and glint, but also enabling the mimicking of the appearance of other artificial features in the landscape, namely roads.

Early experiments with this medium had been carried out long before the transition to night camouflage. In 1936, the Air Ministry had spread 1 ton of fine anthracite dust over the Great Deep, a narrow non-tidal channel 1½ miles long by 100 yards wide that separated Thornley Island, West Sussex from the mainland. Here, the initial results were not promising, with it being discovered that:

‘in very light winds (about 5 m.p.h.) the dust became concentrated along the banks in such a way as to make the water surface more clearly defined from the air than before. In wind of 15 to 20 m.p.h., it was found that the dust sank after about one minute... no further experiments were made, as the results seemed to show conclusively that the method was not an effective means of camouflage’.<sup>190</sup>

The Great Deep experiment was followed by further trials on the Tees in May 1939, with varying quantities of powdered coal (between 10 and 40 tons per hour) being distributed by a steam tug in a 20ft. wide track. Here again, the results were unpromising;

‘even enormous quantities of coal failed to give a permanent film. It was concluded that for most of the year the weather conditions would cause the coal to coagulate and sink,

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<sup>189</sup> Reit, 1978, p.208.

<sup>190</sup> TNA, HO186/1334: *Camouflage of Water Surfaces: Summary of Experiments and Conclusions by the R&E Dept.*, dated 5th Sept1940.

and that the use of such a film was of value only for calm water, such as a dock basin'.<sup>191</sup>

Images removed for copyright purposes

**Plate 7.27: Photographs taken of experimental work being carried out on Ruislip Reservoir. These images illustrate the delivery of the film onto the water's surface and the initially thick film that was produced.**

**(Source: TNA, HO186/1334).**

Although these experiments suggested that the use of coal-dust would be restricted to calmer waters (in particular, canals, slow moving narrow rivers, and sheltered docks), civil camoufleurs persisted in developing the method further. In November 1940, trials were transferred to Ruislip Reservoir (Greater London), and later Compton Verney in April 1941, in an attempt to refine the method.<sup>192</sup> Large scale trials were even carried out on the Thames between Westminster and Vauxhall Bridges on the night of the 23<sup>rd</sup> February 1942 to test out its effectiveness. Daylight observations would also be made on the canals near Cambridge and at Coventry in order to confirm the camouflage effect. These latter experiments combined the coal dust with a thin layer of fuel oil to enhance its durability. Moreover, they enabled the civil camoufleurs to perfect the delivery method, with the mixture being spread by a boat with its own hopper at the rear, where coal dust would be mixed with the oil and distributed through a special nozzle to produce the film (see Plate 7.27). In this configuration, and when compared with other techniques which sought to cover the water, it was argued that the coal dust treatment:

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<sup>191</sup> TNA, HO186/1334: *Camouflage of Water Surfaces: Summary of Experiments and Conclusions by the R&E Dept.*, dated 5th Sept 1940.

<sup>192</sup> TNA, HO186/1985: *T.S.C. 32: Camouflage of Water Surfaces by Means of Dust Films*, circa May 1942.

‘offers no obstruction to the passage of boats and is perfectly “self healing” when broken. The materials employed are cheap and are readily available in unlimited quantities. Their preparation is simple and requires no new apparatus; ample plant suitable for preparation is already available. The machinery employed for distributing the film is simple and inexpensive and consists mainly of an assembly of components already standardised. Under favourable conditions the application of the film is simple and no difficulty should be experienced in covering...5 acres per hour with a single unit employing two men’.<sup>193</sup>

Furthermore, it was contended that, as a result of experiments carried out by the Water Pollution Research Laboratory, an oil-coal dust mixture would not ‘render the water unsuitable for drinking purposes...[although] special precautions would be necessary...in the case of a reservoir used for public consumption’.<sup>194</sup>

Despite this, experimentation from April 1941 onwards continued to show that the performance of the film would still be affected by the weather, with the effects of rain and wind being cited.<sup>195</sup> To contend with this, several options were proposed. Firstly, there was the suggestion ‘to provide turfs similar to weeds or reeds to which the film could adhere’, although this was never successfully instigated.<sup>196</sup> Secondly, was the proposal that the water expanse be broken up into large enclosures, protected by wind shields, but it was argued that ‘such screening to be effective must be almost as elaborate as the structure needed for rafts’;<sup>197</sup> it, too, was discounted. The final option was ‘to divide the lake into relatively small enclosures’ through the deployment of retaining cells arranged in either a labyrinth pattern or around narrow lanes to enable the cells to be filled (see Plate 7.28). However, such investigations concluded that:

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<sup>193</sup> TNA, HO186/1334: *Note on the Screening of Water by Coal Dust Films*, T.F. Hurley and E.T. Wilkins, Fuel Research Station, D.S.I.R., dated 17th Apr 1941.

<sup>194</sup> TNA, HO186/1334: *Note on the Screening of Water by Coal Dust Films*, T.F. Hurley and E.T. Wilkins, Fuel Research Station, D.S.I.R., dated 17th Apr 1941.

<sup>195</sup> It should be noted, however, that in some instance, ‘poor’ weather conditions could be quite favourable. A ‘light rain’ for instance was noted to help assist with spreading.

<sup>196</sup> TNA, HO186/1334: *Note on the Screening of Water by Coal Dust Films*, T.F. Hurley and E.T. Wilkins, Fuel Research Station, D.S.I.R., dated 17th Apr 1941.

<sup>197</sup> TNA, HO217/2: *Camouflage Committee Memoranda No.7: Concealment of Water*, dated 1943.

Image removed for copyright purposes

**Plate 7.28: Diagrams showing the arrangement of retaining cells for the labyrinth pattern (top left) and narrow lane configurations (top right); Photograph taken of the retaining cell used to investigate the retention of coal dust oil (bottom).**

**(Source: TNA, HO186/1334).**

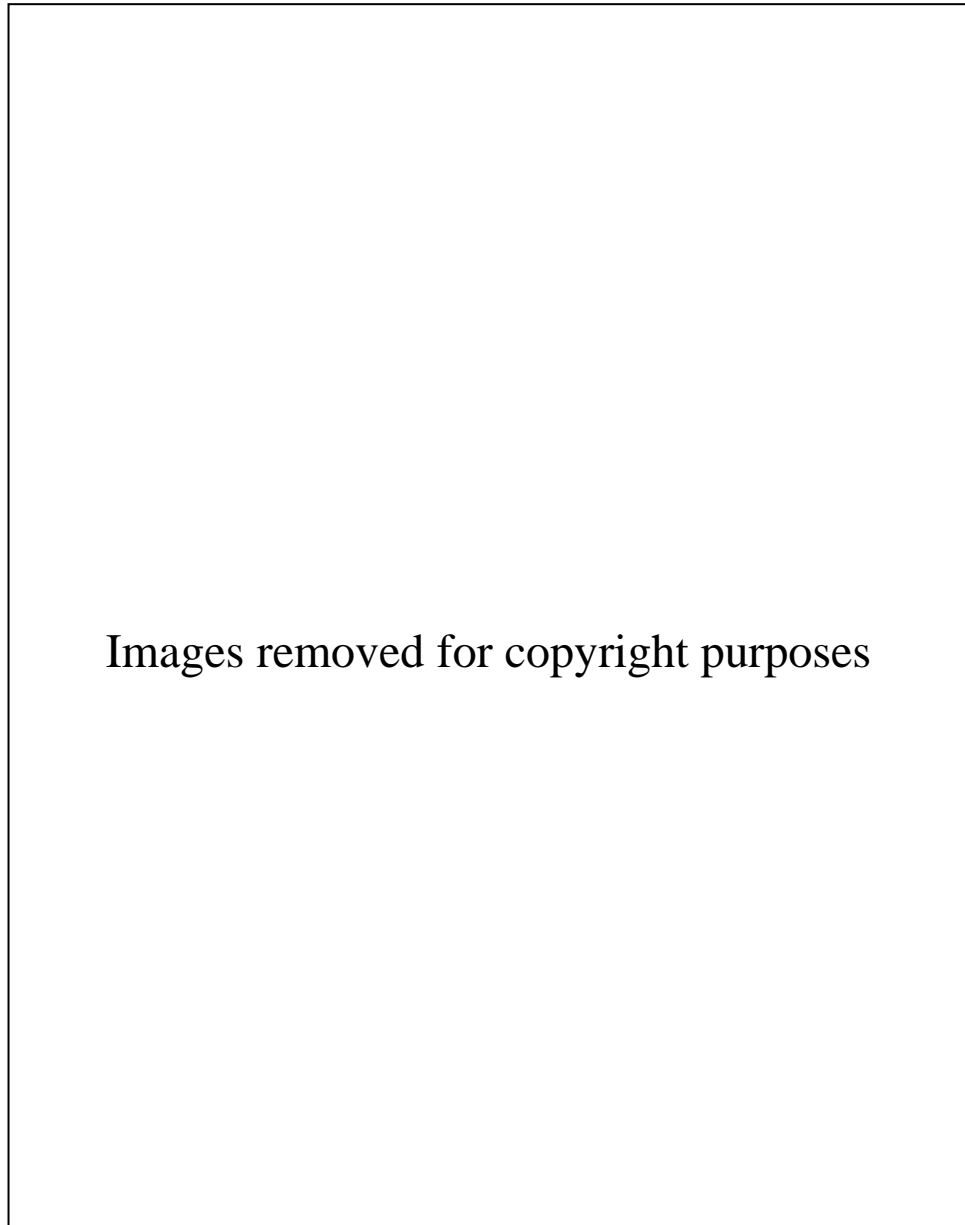
‘no satisfactory method has been found. All are extravagant in materials, involve[e] difficulty in laying the film, and obstruct navigation. Further, most would be likely to have a negative camouflage value in strong winds, owing to the conspicuous pattern produced by the regular repetition of partially filled “cells”’.<sup>198</sup>

The final solution for the treatment of ‘shine’ and ‘glint’ emitted from water entailed a completely different tact: removing the water completely through draining. In this case, the philosophy was taken that:

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<sup>198</sup> TNA, HO186/1985: *T.S.C. 32: Camouflage of Water Surfaces by Means of Dust Films*, circa May 1942.

‘drainage is...the best solution. Even if a pond cannot be completely drained, its area can often be considerably reduced. This reduced area of water may not greatly resemble the original pond and, if it should be decided that even the reduced area must be hidden, it presents a smaller problem’.<sup>199</sup>



**Plate 7.29: Aerial photographs showing the appearance before (top) and after (bottom) the artificial draining of Binley Lake for camouflage purposes.**

(Source: TNA, HO186/2769).

However, it was contended that once drained, the issue of conspicuousness would remain until the mud had properly dried out;

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<sup>199</sup> TNA, HO217/2: *Camouflage Committee Memoranda No.7: Concealment of Water*, dated 1943.

‘if draining of a pond leaves an area of wet mud, this may shine and display the characteristic shape of the pond. It may be possible to roughen the surface by digging, spreading cinders or perhaps horticultural treatment’.<sup>200</sup>

As a treatment this was suggested for several locations around the U.K. One of the early features to be earmarked for draining was the lake in St James’s Park, with concerns about its prominence being raised by several individuals, including Prime Minister Winston Churchill.<sup>201</sup> In this instance, however, draining was not implemented, but other locations were and proved to be quite successful. Yeadon Tarn, West Yorkshire, for example, was treated in this way. Consisting of an area of 20 acres and being surrounded by a footpath of white limestone, the tarn was adjacent to the Avro factory at Yeadon Aerodrome (now the site of the Leeds-Bradford International airport) and considered to a particularly prominent leading mark. It was, therefore, drained to reduce its area to 4 acres, with the path being darkened at a cost of £42.7.6 (approximately £1,217 today).<sup>202</sup>

Elsewhere, the decision was taken in November 1942 to drain Binley Lake in Warwickshire ‘in order to suppress its outstanding appearance’.<sup>203</sup> Cave, in particular, took a great deal of interest in this site, recalling in a paper for *Nature* in 1948, how:

‘water [was] passed out through sluices so placed that the lake would drain without difficulty when they were fully opened. Arrangements were made with the Fishery Board of the area to net the fish and transfer them to streams and reservoirs in the neighbourhood. The experts who did the work told me that they successfully decanted nearly a million fish ranging from pike of over 20lbs. to bream of about 30gms’.<sup>204</sup>

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<sup>200</sup> TNA, HO217/2: *Camouflage Committee Memoranda No.7: Concealment of Water*, dated 1943.

<sup>201</sup> CAB120/781: *Correspondence*, Chief of the Air Staff, to General Ismay, dated 13th Sept 1940; CAB120/781: *Correspondence*, W.S. Churchill, to General Ismay, dated 24<sup>th</sup> Oct 1940; CAB120/781: *Correspondence*, H. Strutt, to Capt. A.D.N Nicholl, dated 1<sup>st</sup> Nov 1940;

<sup>202</sup> TNA, HO186/2640: *CAM2600*.

<sup>203</sup> Cave-Browne-Cave, 1948: *The Draining of Binley Lake and its Ecological Consequences*, *Nature*, 161(4090), p.420.

<sup>204</sup> Cave-Browne-Cave, 1948, p.420.



**Plate 7.30: Photographs showing the appearance of Binley Lake during the initial post-drainage phase (left) and ten months after draining (right).**

(Source: Cave-Browne-Cave, 1948).

With the fish removed and the water drained, the initial post-drainage visual appearance of the site was equally as conspicuous as it had been full of water; drainage had left ‘ninety acres of flat wet mud...shin[ing] and reveal[ing] the distinctive shape just as well as the water would have done’.<sup>205</sup> While consideration was given to the horticultural treatment of this, this was deemed impossible until the mud had dried out. As Cave writes, it was not until July 1943:

‘some eight months later that I asked one of my camouflage officers to take an opportunity of looking at it during one of his aerial surveys. His report was rather surprising so I went to make an examination on the ground...The expanse of supposedly waterlogged and sterile mud was covered with a dense growth including some willows more than 8ft. high. Presumably the drainage and aeration had been rather better than expected. The crust had hardened sufficiently for us to walk across the lake with circumspection, but there was a pronounced jelly-like movement which reminded us of the mud underneath’ (see Plate 7.30).<sup>206</sup>

Concluding his assessments of the site, Cave contended:

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<sup>205</sup> Cave-Browne-Cave, 1948, p.420.

<sup>206</sup> Cave-Browne-Cave, 1945, p.268.

‘there can be no doubt of the excellence of the camouflage. The cost of making the change was small. It may be significant that, although Coventry had been heavily raided on two occasions previous to the draining, two raiders which came to that area not long after the Lake was drained dropped their bombs in open country within ten or fifteen miles of the vitally important area’.<sup>207</sup>

### 7.8.3: ‘Shadow Play’: a return to electric illumination at night

A final alternative method, which was never fully realised, was a return to the use of artificial illumination. Since the mid-1940s, the use of ‘decoy’ lighting as utilised by the Air Ministry had garnered particular notoriety as a tool to misguide and distract enemy aircrews as to the location of airfields urban areas. Within civil camouflage, further use of artificial illumination had been discounted due to the overwhelming opposition faced from other civil defence planners within the MoHS. Despite this, camouflage officers from the Camouflage Directorate and the R&E Dept. began renewed experiments into the use of electric lighting in late 1942 in an attempt to break up the form of cast shadows when viewed at night. Indeed, it was argued that illumination could be used:

‘for the flood lighting of wall-and-roof-shadows and cast shadows on the ground, so as to cause a “fade-out”,...[as well as] to create patches of light on the ground at intervals within long shadows in factories which are treated with “housing”, so as to imitate the required vibration of house roofs and at the same time break the shadows’.<sup>208</sup>

Such a technique was considered to have its advantages; for instance:

‘the cost and amount of labour and materials required for installing the electrical equipment, and the arranging for its control, would probably compare very favourably with a netting scheme large enough to have anything like the same effectiveness’.<sup>209</sup>

Initial experiments of this technique were tried out in the Viewing Room at Leamington, with a scale model of the Armstrong Whitworth flight shed at Baginton aerodrome (near Coventry) being utilised. In order to simulate the general appearance

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<sup>207</sup> Cave-Browne-Cave, 1948, p.420.

<sup>208</sup> TNA, HO217/4: T.S.C.22: *Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, p.5.

<sup>209</sup> TNA, HO217/4: T.S.C.22: *Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, p.5.



that floodlights would have upon the ground, strips of black paper coated in fluorescent paint were placed into shadows cast by the model, which when illuminated under ultra-violet light ‘fluoresced at known levels of brightness comparable with moonlight levels (about 0.001 f.c.)’.<sup>210</sup> This ultra-violent lamp would be moved around the room to simulate different moonlight elevations, thereby enabling the camouflage officers to observe the effects that the fluorescent paint (as artificial light) would have upon disrupting the cast shadows. From these investigations, it soon became clear that attention to the arrangement of this lighting would be needed; illumination should not be allowed to overlap, nor should the lighting be kept at full intensity all of the time, it being stressed that ‘if the moon is obscured, the lights will form a dangerous line’.<sup>211</sup>

Following on from this, a second stage of experimentation was commenced on one of the walls of the actual shed at Baginton, with the lighting being installed and supervised by the General Electric Company from Wembley. The lamps themselves consisted of 40W bulbs:

‘fitted into specially designed shades...[and] mounted on brackets at 40ft. from the ground and 20ft from the lattice girders above the doors of the shed. Ten shades spaced 50ft apart provided illumination of nearly one third of the length of the wall of the shed...The brightness of the lamps was controlled by two sliding resistances, one for each of the zones’.<sup>212</sup>

In terms of the arrangement of the lighting, this was to be organised into two zones: Zone 1 would shine light on vertical surfaces, whereas Zone 2 would be concentrated upon the horizontal (see Plate 7.31). These different zones would be switched on or off, corresponding with the ‘evolution’ of the shadow as the building received varying degrees of illumination on account of different moon phases and elevations. For long (wide) shadows, Zones 1 and 2 would both be utilised, whereas for medium shadows,

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<sup>210</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night (with a note by Wing Commander Cave-Brown-Cave, Director of Camouflage on “The application of artificial light to the concealment of shadow”)*, dated 23rd March 1945, p.1.

<sup>211</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night (with a note by Wing Commander Cave-Brown-Cave, Director of Camouflage on “The application of artificial light to the concealment of shadow”)*, dated 23rd March 1945, p.2.

<sup>212</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night (with a note by Wing Commander Cave-Brown-Cave, Director of Camouflage on “The application of artificial light to the concealment of shadow”)*, dated 23rd March 1945, p.2.

Zone 2 lighting would be extinguished, with light reflecting off the illuminated vertical surface being sufficient to reduce the size of the shadow below 15ft and so enable ‘fade-out’ when viewed from 6,000ft. For shorter (narrow) shadows of less than 10ft in width, the entire system would be switched off, these being considered to be insignificant from the nocturnal aerial perspective.

To judge the effectiveness of the technique, the first aerial observations of the site were carried out on the night of the 18<sup>th</sup> May 1943 from altitudes of between 5000 and 10000ft. Although assessments were hampered by the presence of a system of light signals at the aerodrome being used by other aircraft flying at the same time, it was nevertheless recorded that ‘where the light could be seen on the wall, a good match to moonlight surroundings was produced by the middle value’.<sup>213</sup> A second flight was arranged for full moon conditions on the night of the 18<sup>th</sup> July 1943, but this had to be abandoned on account of there being no shadows as a result of 10/10 cloud cover. Further observations were, therefore, planned for the four full moon nights in August, but, in the event, the experiment was terminated before they could be carried out.<sup>214</sup> Indeed, experiences of trialling the technique, suggested that ‘it would have a more limited use than might at first have been supposed’.<sup>215</sup> While the technique also provided for variations in moon elevation, it was argued that variations over the course of one night would need the system to be constantly attended to. In the event that the moon became obscured by moving cloud cover, the lighting would need to be instantly extinguished, otherwise it would ‘outline the factory and be exceeding[ly] dangerous’.<sup>216</sup> While it was subsequently suggested that a photo-electric relay could be installed or a ‘lookout’ be employed as a ‘light dimmer’, this form of camouflage would not be realised beyond the experimental stage.

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<sup>213</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night*, dated 23rd Mar 1945, p.3.

<sup>214</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night*, dated 23rd Mar 1945, p.4.

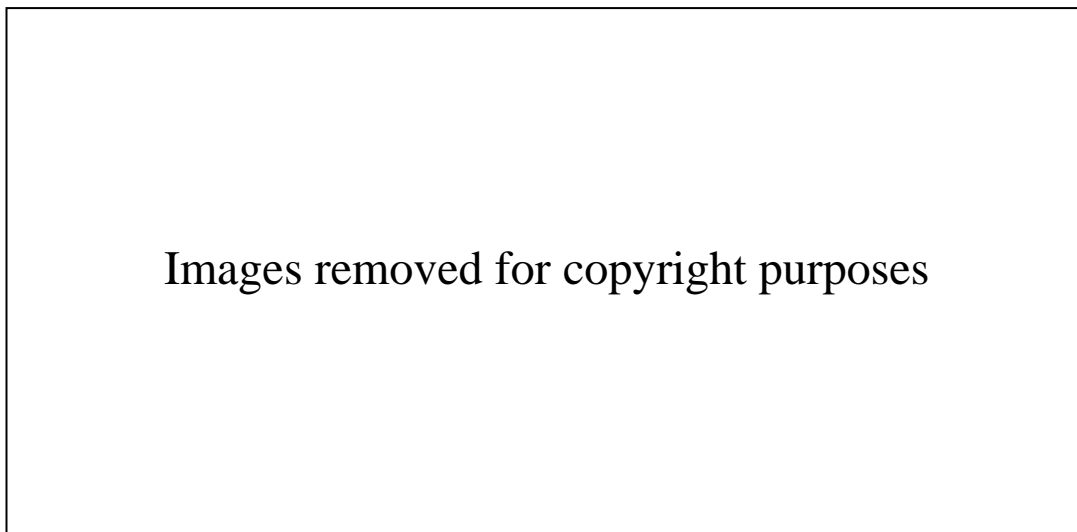
<sup>215</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night*, dated 23rd Mar 1945, p.4.

<sup>216</sup> TNA, HO196/29: R.E.N.494: *The Illumination of Shadows for Camouflage at Night*, dated 23rd Mar 1945, p.4.

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**Plate 7.31: Illustrations showing the suggested arrangement of lighting zones (top); the effects of 'vertical' and 'horizontal' lighting in breaking up shadows up to 60ft wide (centre); and the use of 'vertical' lighting for the suppression of 'medium' shadows. (Source: TNA, HO196/29).**

## 7.9: Demonstration models and camouflage effectiveness



**Plate 7.32: Comparative vertical photographs of a model of a group of ‘toned down’ factories in day (left) and night (right) conditions. These photographs have been orientated with the North to the top.**

**(Source: TNA, HO217/4).**

In order to discuss and illustrate the effectiveness of these various techniques and methods, I want to close this chapter by drawing attention to a series of demonstration models that were experimented upon in the viewing room. As a precursor to dealing with specific cases, six models representing ‘actual factories, chosen as fairly representative of common factory types’ were initially produced by the Design Section in February and March 1942 for night camouflage testing, the object being to ‘demonstrate camouflage which strikes a balance between really effective concealment and the limited availability of materials’.<sup>217</sup> To begin with, each model initially received a ‘toning down’ treatment and was observed in the simulated conditions of the Viewing Room before more elaborate methods conforming to the NIGHT and later the NIGHT PLUS designations were trialled. At each stage, the models would be subjected to varying moonlight conditions, with assessments subsequently being made as to the effectiveness of the scheme, as well as suggestions for further improvement.<sup>218</sup> Comparative vertical photographs representing the view of the landscape from a simulated altitude of 6,000ft would also be taken, with one image showing its ‘day-

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<sup>217</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.9.

<sup>218</sup> Within the Viewing Room, the moonlight conditions to be simulated consisted of moon elevations of between 45° and 15° as well as horizontal intensities between 0.015 and 0.002 foot candles.

time' appearance and the second its presence through nocturnal visualities (see Plate 7.32).

The first example to be considered consisted of 'a group of three factories with long parallel roof ridges running approximately north and south...the largest being 60 feet [long]...the highest being 40 feet to the ridge'.<sup>219</sup> In the brief of the site, these buildings were described as being located:

'approximately four miles from the centre of a large city...[with] a main railway line adjoin[ing] the factories on the north...[and] a branch line run[ning] along the west side...To the East of the factories are playing fields and allotments...[and] an extensive area of very recent suburban development...Fields and woods [are interspersed] for a great distance on all sides except in the north'.<sup>220</sup>

When initially 'toned down', the factory continued to remain highly conspicuous, with application of a medium tone heightening the presence of cast shadows when viewed under simulated nocturnal conditions (see Plate 7.32). As a result, it was contended that:

'it was useless, in this case, to attempt an intermediate scheme of concealment, between toning down and a "NIGHT PLUS" scheme, due to the position and constructional form of the factory'.<sup>221</sup>

As a result, two different NIGHT PLUS schemes were devised. In the first, it was highlighted how:

'the object of the scheme is to make the factory buildings indistinguishable, as far as possible, from the housing estates which covers such a large area in the neighbourhood'.<sup>222</sup>

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<sup>219</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

<sup>220</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

<sup>221</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

<sup>222</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

Dummy roads constructed of netting were laid across the factory roofs and extended onto the surfaces of adjoining fields; such treatment was also applied to the north-west corner to ‘disrupt the characteristic shape of the railway junction’.<sup>223</sup> Furthermore, an ‘imitative’ housing pattern was applied, making use of paint and textural material to achieve this look (see Plate 7.33).

Images removed for copyright purposes

**Plate 7.33: Comparative vertical photographs of the factory with a NIGHT PLUS ‘minimum’ scheme as viewed during daylight (top) and night-time (bottom) conditions.**

**(Source: TNA, HO217/4).**

While this first attempt was considered to be ‘reasonably satisfactory’, it was noted that ‘the main shadows of the building [continue to be] excessively prominent’ when it was illuminated at lower angles.<sup>224</sup> A more ‘elaborate’ NIGHT PLUS scheme was therefore developed, with additions to the previous scheme consisting of:

‘large areas of netting from ridge to ridge across the roofs of the largest factory [with] some horizontal canopies on the east side of this building...projecting from the ridges and terminating above the eaves. Netting to [further] simulate houses [is] arranged [on the west] so as to interrupt the shadows of the two long buildings’.<sup>225</sup>

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<sup>223</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

<sup>224</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.13.

<sup>225</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.14.

When viewed in the simulated conditions, this factory was considered to ‘effectively fade-out’ into the surrounding landscape (see Plate 7.34).

Images removed for copyright purposes

**Plate 7.34: Comparative vertical photographs of the factory with a NIGHT PLUS ‘maximum’ as viewed during daylight (top) and night-time (bottom) conditions.**  
(Source: TNA, HO217/4).

A second demonstration model to be examined was that of a ‘typical’ power station, a ‘tall’ and ‘rectangular’ structure with a ‘maximum height of about 80ft., with 8 tall chimneys...[and] coal dump with elevators...on the east side’.<sup>226</sup> These features produced a highly distinctive L-shaped shadow, a series of eight cast shadows over the roof from the chimneys, as well as light and dark contrasts as a result of the elevators over the black coal heaps. In addition to these elements, the power station was considered to be ‘extraordinarily’ conspicuous on account of its location:

‘on the northern outskirts of a small country house in a narrow site between a broad river and a railway, both running North and South. A U shaped road, the sides of the U also running North and South, form a half circle round the site...A sewage works is situated to the West of the building’ (see Plate 7.35).<sup>227</sup>

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<sup>226</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.16.

<sup>227</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.16.

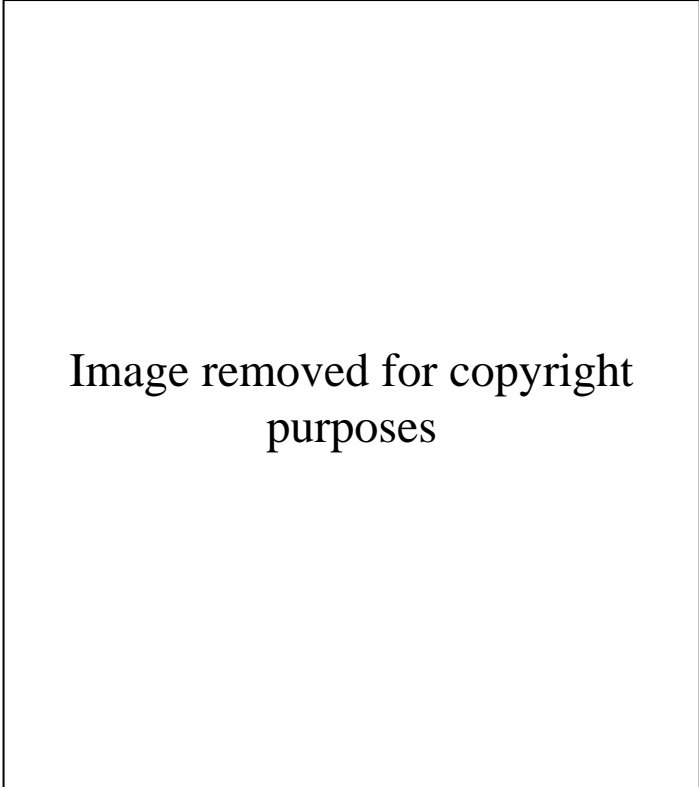


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purposes

**Plate 7.35: A vertical photograph of the model of the untreated ‘typical’ power station as viewed in simulated day-time conditions.**

**(Source: TNA, HO217/4).**

In terms of treatments to be applied, this power station model provided a unique contrast to that of the factory; here, the day-to-day operations of the site meant that the use of netting was deemed ‘impractical’, and, therefore, texturing, ground treatments and disruptive patterning was advocated. In the first instance, toning down was again discounted as this failed to contend with the large L-shaped shadow. Experimentation, therefore, proceeded to the application of a NIGHT scheme:

‘consisting of shapes of black, textured on roofs and painted on the walls, with ground treatment or an extended canopy of black steel wool on the West. The black shapes are intended to alter the shape of the shadow by bringing a dark area over the building and breaking its mass into smaller shapes, which will give the effect of a group of smaller buildings. Ground texturing is [also] used to alter the shape of the shadow on the other side’ (see Plate 7.36).<sup>228</sup>

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<sup>228</sup> TNA, HO217/4: *T.S.C.22: Memorandum on the Technique of Night Camouflage, No.6*, dated 21st Mar 1942, p.16.



Images removed for copyright purposes

**Plate 7.36: A vertical photograph of the power station model as viewed in both simulated day-light (top) and night (bottom) conditions with its NIGHT scheme applied.**  
**(Source: TNA, HO217/4).**

While this scheme was certainly acknowledged to make recognition more difficult, it was argued that it only achieved ‘partial success’, with the prominence of the surrounding roads, railway and river continuing to ‘advertise’ its location. In order to enhance the proposed scheme to NIGHT PLUS standard, it was suggested that flood lighting the shadows could be attempted to ‘fade-out’ the building, this being ‘used in conjunction with a simple decoy, designed to imitate the large scheme’.<sup>229</sup> With experiments into the artificial illumination of shadows faltering in mid-1943, the disruptive effects and ground treatments devised under the NIGHT scheme would be the only solution available to conceal features of this nature.

### **7.10: Conclusions**

This chapter has explored the geographies of nocturnal camouflage, focusing upon how civil camoufleurs sought to produce knowledge about nocturnal bombing tactics, night-time viewing practices, and ‘ways of seeing’ and engaging with the industrial landscape at night. The first section examined the initial engagements of civil camoufleurs with the night and how they made use of electric illumination to ‘baffle’, ‘dazzle’ and ‘deceive’ the eyes of the nocturnal aerial observer; unlike most histories on the ‘modern’ use of lighting, these narratives highlight how illumination has been utilised to produce landscapes of chaos, confusion and disorder rather than of clarity, progress and subjection. Through the use of lighting installations of this nature, it was contended that this would remove the need to extinguish all remaining traces of artificial light produced by industrial facilities prior to an aerial attack at night, a move which could potentially prevent the disruption of wartime production in the case of coke ovens and steel and iron works. However, as subsequent discussions illustrated, the use of these illumination techniques came into direct conflict with wider civil defence discourses which constructed the ‘Blackout’ as an environment of security and refuge for a ‘targetable’ populace; indeed, ‘unshielded’ lighting was considered to be too ‘revealing’ and too ‘dangerous’ in an enforced atmosphere of supposedly ‘complete obscuration’. Succumbing to pressures from civil defence planners at the MoHS, artificial illumination for camouflage was consequently abandoned.

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<sup>229</sup> TNA, HO217/4: T.S.C.22: *Memorandum on the Technique of Night Camouflage*, No.6, dated 21st Mar 1942, p.16.

Subsequent sections of this chapter, however, charted the continuing interests of civil camoufleurs in nocturnal spaces and practice, emphasising how they challenged popular and political discourses that the 'Blackout' produced an 'aesthetic vacuum', a veiling of the landscape in darkness which afforded 'total' protection. Indeed, it was demonstrated through their engagements with scientific knowledge, as well as the accumulation of information through direct observations of the nocturnal landscape themselves, that the night and the conditions of darkness produced new and different configurations of the embodied individual subject. Ultimately, it was contended that this would transform existing as well as facilitate new ways of interacting and visually engaging with topographical forms and features. On the one hand, their engagements with tactical knowledge of nocturnal bombing practices suggested that the visualities of the (nocturnal) bomber body would be considerably different from those of its day-time configuration; increased height, different angles of viewing and new tactics for negotiating and navigation through the nocturnal atmosphere produced different ways of interacting with the terrestrial landscape. Moreover, connections with knowledge surrounding the physiology of the eye demonstrated that rather than darkness generating a state of 'sensory deadness', the conditions of the night produced an adapted and transformed viewing subject capable of visually interpreting the terrestrial landscape through fleeting presences and glimpses of textural contrasts, 'pale' and 'darkened' patches, shadows, shine, glint, glare and array of other 'conspicuous' traces in the landscape. Certainly, while the night clearly inhibited the sensory competencies of the bomber body to grasp the landscape as a 'totality', the work of civil camoufleurs intimated that a recalibration of the embodied aerial subject permitted it to continue to perceive and experience the night-time landscape as it moved through (nocturnal) aerial space.

In the light of these assertions, the chapter proceeded to examine the implications of these constructions of the nocturnal aerial subject upon existing practices and methods of camouflage. In the first instance, it was highlighted how the techniques of the aerial officer/observer needed to be 'reprogrammed' to undertake camouflage work at night; only through the embodiment and possession of particular visual sensory abilities and skills could one become an 'effective' nocturnal observer and undertake 'moonlight' camouflage work. Following on from this, the chapter considered the implications of nocturnal viewing practices upon the established spaces of simulation which were

explored within Chapter Five, examining how these were reconfigured through the appropriation of new technological devices and discursive interactions with ‘nocturnally experienced’ aerial subjects from the R.A.F.; as discussions on this aspect showed, the ‘realism’ produced within these spaces was considered to be of a higher degree than what had already been achieved for daylight conditions.

The final sections of the chapter, then, considered how the threshold which defined the ‘presence’ and ‘absence’ of certain features in the nocturnal landscape was manipulated through the modification and development of camouflage strategies that sought to contend with the specific viewing and perceptual conditions of the night. Existing techniques were simplified or transformed in relation to both the sensory environment of the night as well as concerns about material supplies, whereas others were extended to produce camouflage effects which they had previously not done so (for instance, the use of netting for imitation). In addition to the re-appropriation of existing methods, new techniques of concealment were devised to contend with new challenges presented by the night: the use of ground treatments to distort and disrupt shadows cast on the surrounding landscape; water camouflage, to mask the ‘glint’, ‘gleam’, ‘flash’ and shine emitted from rivers, canals, lakes, and reservoirs; and, finally, the trialling of a technique to illuminate cast shadows to reduce their size and thus prevent them acting as a ‘conspicuous’ mark. Utilising the ‘Blackout’ as an ‘essential backdrop’, and drawing upon the knowledge which had been accumulated on how certain features became ‘present’, whereas others were relatively ‘absent’ in the conditions of darkness, these nocturnal camouflage strategies sought to artificially remove, fade-out or disguise ‘conspicuous’ traces in the landscape as well as imitate relatively ‘unobtrusive’ or ‘unremarkable’ features. By further subverting the aerial gazes of the bomber body in an already inhibited sensory environment, nocturnal camouflage techniques produced new spaces of subterfuge, security and refuge which were defined more in terms of ‘subdued presence’ rather than ‘total obscuration’ as envisaged with ‘Blackout’.

## Chapter 8

### ‘Ordered irregularity’

#### Camoufleurs, ‘self-concealment’ and the landscapes of construction

‘For several months building operations have been going forward on a site by a ‘Green Belt’ main road along which I pass every day. The site is adjacent to residential property. Until recently work had been confined to foundations and the erection of pillars. Now, a ceiling is being made to the ground floor by putting into position on the supporting pillars large concrete slabs of dazzling whiteness. In a week or two it would seem that four white acres will be on show to any aircraft cruising overhead...can nothing be done to camouflage such building work right from the cutting of the first turf, so that enemy airmen will find it difficult to spot, and to ensure that details cannot be transferred to German Air Force maps?’<sup>230</sup>

*Mr H.J. Wenyon in a letter to the editor of The Times, 9<sup>th</sup> October 1940.*

‘[One of the] trouble[s] is the habit of regarding camouflage as something you put on to a building when it is completed. The notion that it would be much easier and cheaper, and much more likely to achieve really good disguise if buildings were designed from the outset in relation to the problem of their camouflage, has scarcely entered the minds of authority or of builders. Buildings of the utmost regularity...continue to be erected, simply because that is the recognized pattern for that particular purpose’.<sup>231</sup>

*Julian Huxley, writing in the journal Nature, 12<sup>th</sup> October 1940.*

Both of these above statements, appearing in October 1940 and expressed within the popular media, testify to a contemporary frustration and anxiety over building practices and architectural aesthetics which were seen to ‘expose’ new structures to the eyes of the aerial observer. Furthermore, they represent an irritation with urban planners and architects who failed to recognise that the designs which they were producing were in no way conducive to facilitating camouflage. Throughout the preceding chapters, the overall impression generated has been one where, as a treatment, camouflage was to

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<sup>230</sup> Wenyon, H.J. 1940: Camouflage: Letter to the editor, *The Times*, 9th Oct 1940, p.5. No indication is given in the letter as to which ‘green belt’ area Wenyon refers to.

<sup>231</sup> Huxley, J.S. 1940: The Progress of Camouflage, *Nature*, 146(3702), 12<sup>th</sup> Oct 1940, pp.482-483.

rectify and counteract the symptoms of ‘bad’ planning practices and architectural styles which contravened and conflicted with the camouflage mentality. But as these two critiques suggest, contemporaries wanted to move away from conceiving camouflage as an ‘afterthought’, and to instead think about how camouflage could be integrated into all stages of development for new buildings: planning, designing and construction. In this penultimate chapter, attention will be shifted to considerations of how civil camoufleurs, drawing upon knowledges from urban planning, architecture, and horticulture, attempted to negotiate and rethink approaches to the design and construction of new industrial buildings. In doing so, it seeks to uncover the multiple associations of a variety of non-human technologies and objects (models, plants, technical instructions and booklets, building materials such glass, etc.) which are now considered to be ‘key components of the socio-technical networks that constitute buildings’ and their construction sites.<sup>232</sup> Driven by the adage that ‘prevention is better than the cure’, civil camoufleurs during this period sought to move away from a camouflage tradition centred upon applying paint and erecting netting, and to instead think about ways in which architects and builders could be influenced to produce a building style which would seamlessly enable buildings to ‘merge’ into and be ‘in harmony’ with the surrounding landscape. This chapter, therefore, focuses upon several aspects: early attempts at altering the structural appearance of new buildings; construction site discipline; treating scarred ground caused by construction work; and, finally, the articulation of a ‘self-concealing’ architectural style.

### **8.1: ‘Bolt something on’: early interventions in the modification of new buildings**

One of the earliest expressions of a desire to alter the physical appearance of a new building for the purposes of civil defence surfaced in July 1936. Appearing within a note produced by the newly formed Air Raid Precautions Department (A.R.P.D.), architects and builders were invited to think about the methods and types of building materials which could be utilised in the construction process. Placing particular emphasis upon the concealment of oil tank farms, the note stressed that:

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<sup>232</sup> Kraftl, P. 2010: Architectural movements, utopian moments: (in)coherent renderings of the Hundertwasser-Haus, Vienna, *Geografiska Annaler*, 92B(4), p.334. See also Gieryn, T.F. 2002: What buildings do, *Theory and Society*, 31(1), pp.35-47; Jacobs, J.M. 2006: A geography of big things, *Cultural Geographies* 3(1), pp.1-27; Jenkins, L. 2002: Geography and architecture: 11, rue de Conservatoire and the permeability of buildings, *Space and Culture*, 5(3), pp.222-236; Merriman, P. 2005: ‘Operation motorway’: landscapes of construction on England's M1 motorway, *Journal of Historical Geography*, 31(1), pp.113-133.

‘conspicuous roof coverings should be avoided...[Instead] dark green asbestos slates are [considered] very suitable roofs and, if the area is not large, it may be possible in some cases to erect over small tanks pitched roofs covered with roofing material similar to that of surrounding buildings’.<sup>233</sup>

Furthermore, the note suggested that ‘by judicious planting of trees it may be possible to break up shadows, etc’, although it did forewarn that they may ‘take some time to grow’.<sup>234</sup>

Whilst providing a brief and early indication that British civil defence planners were interested in the influencing of constructional methods in the pursuit of camouflage, further discussions in the late 1930s were few and far between. In February 1937, for example, the C.I.D.’s Camouflage Sub-Committee’s Interim Report paid brief attention to the matter, going only as far as suggesting that:

‘powers should be taken by the Government under which control could be exercised over the design and layout of new establishments of national importance, with a view to making them as inconspicuous as possible in relation to their surroundings’.<sup>235</sup>

Elsewhere, Francis Wyatt, in his ‘Notes on Deficiencies in Camouflage Organisation’ in October 1938, contended that:

‘new buildings should be designed and sited, if possible, so as to simplify camouflage: a great deal could be done in this way and cost no more. The architects involved should be placed in touch with this Department and, furthermore, the R.I.B.A [Royal Institute of British Architects] should be invited to think out the problem from the point of view of design and materials. There is also a new Institute in process of being formed – [the] A.R.P. Institute, to whom the problem could also be put’.<sup>236</sup>

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<sup>233</sup> TNA, AIR2/2081: *Camouflage*, W. Garforth, (A.R.P.D.), dated 31st July 1936.

<sup>234</sup> TNA, AIR2/2081: *Camouflage*, W. Garforth, (A.R.P.D.), dated 31st July 1936.

<sup>235</sup> TNA, HO186/14: *C.I.D. Report 1301-B*, dated 3rd Feb 1937

<sup>236</sup> TNA, HO186/390: *Notes on Deficiencies in Camouflage Organisation, October 1938*, F.J.C. Wyatt, dated 4th Nov 1938.

Although both Wyatt and the Camouflage Sub-Committee clearly expressed their conviction that something should be done to influence the designing of new buildings, and had suggested what necessary regulatory framework was required to enable this, the reality of the matter was that there was no clearly defined agenda as to how concealment could be integrated into the designing and construction process.

Despite such sporadic attention being paid to thinking about and influencing architectural aesthetics within ‘official’ camouflage discourses, this is not to say that no attempts at altering the structural form of new buildings were being proposed during this early period. Certainly, alternative constructional methods which entailed much more substantial additions to buildings than netting, or indeed any other ‘structural’ methods had hitherto required, were being put forward in an attempt to manipulate the built form of new buildings. These proposals, emanating primarily from independent architects and organisations, sought to break down the constructional form of new buildings, distorting their shape and layout, and thereby disrupting their recognition when viewed from the air. One such suggestion was outlined in a letter by Oliver Bernard in March 1937, in which he proposed a method he described:

‘as “distortion”, because as an architectural idea which has not been practised before, it embodies structural eccentricity in buildings to preserve the normality of their situation, and also adds protective value to concealment by nature of concrete and other materials employed’.<sup>237</sup>

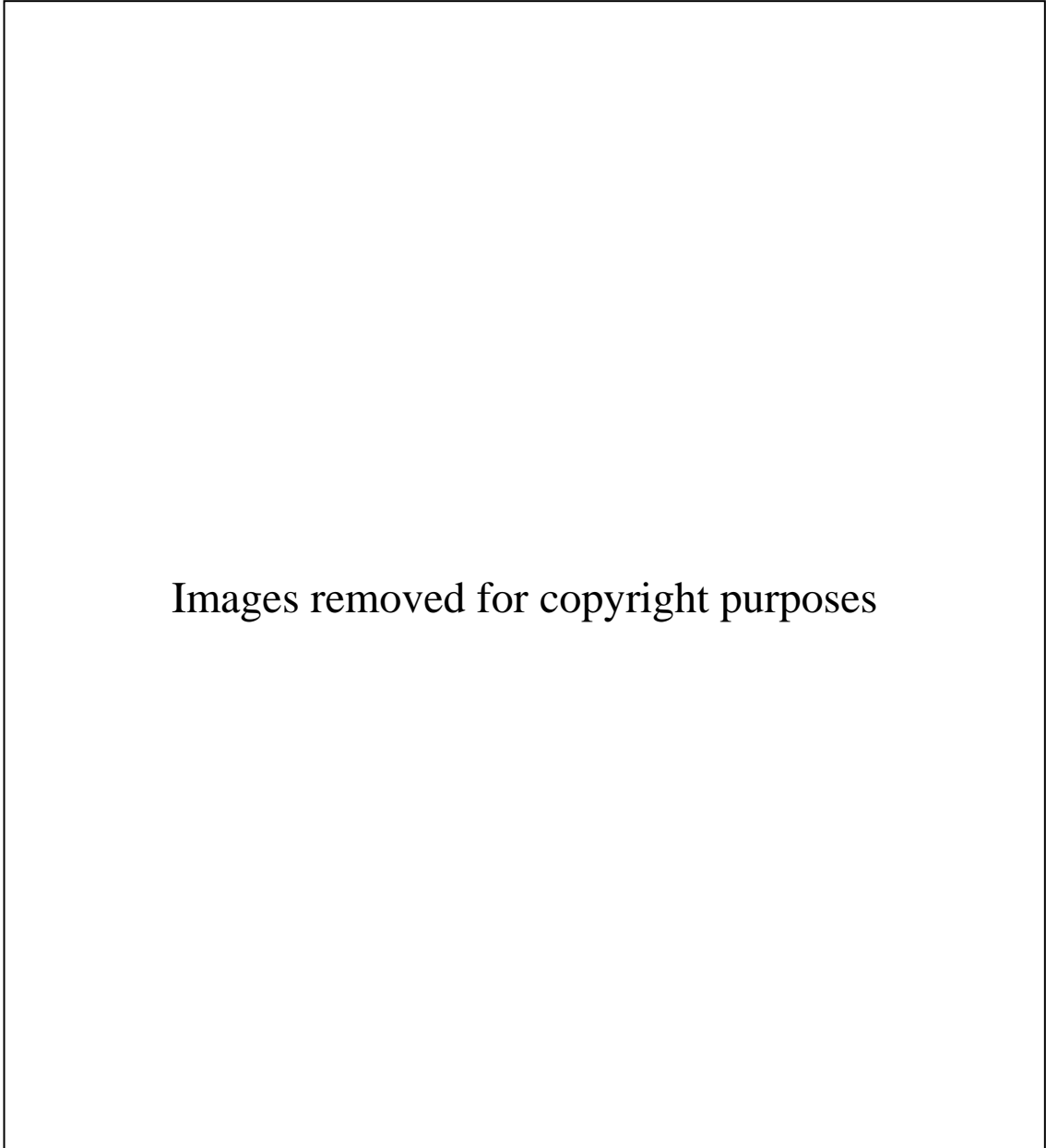
In order to achieve this ‘disruptive’ effect, Bernard proposed that structural additions should be made to the top of buildings to break up their regular appearance, sharp lines and smooth surfaces; in the sketches he provided, these additions took the form of overlapping, wispy, cloud-like shapes, which, it was suggested, would give the appearance of deciduous woodland when viewed from the air (see Plate 8.1). These structural additions, Bernard envisaged, could ‘be applied to an existing building or form

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<sup>237</sup> TNA, CAB16/170: Correspondence, O. Bernard, to the Minister for Co-ordination of Defence, dated 17<sup>th</sup> Mar 1937. Oliver Bernard (1881-1939) was an architect and designer who had established himself in the interwar period as an advocate of Art Deco interior designing. Into the 1930s, Bernard had expanded his horizons and had begun to undertake architectural work; notably, these were predominantly industrial buildings, with the Supermarine works at Southampton being one of his contributions.



an inherent part of [future] construction'.<sup>238</sup> In relation to the erecting of new buildings, Bernard even argued that his method of 'distortion' would 'depend for its success on forethought in siting and designing [of the] works'.<sup>239</sup> This was a significant admission, mirroring the desires of the governmental camouflage organisations to think about the location and construction of new buildings.



**Plate 8.1: Illustrations showing Bernard's proposals for the application of 'disruptive structural additions.**

**(Source: TNA, CAB16/170).**

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<sup>238</sup> TNA, CAB16/170: *Correspondence*, O. Bernard, to the Minister for Co-ordination of Defence, dated 17<sup>th</sup> Mar 1937.

<sup>239</sup> TNA, CAB16/170: *Correspondence*, O. Bernard, to the Minister for Co-ordination of Defence, dated 17<sup>th</sup> Mar 1937.

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**Plate 8.2: I.C.R.U. photographs showing the proposed structural additions to be made to gasholders, showing their appearance before (above) and after (below).**

**(Source: J.T.A., JOT/54/1, p.6A)**

Complementing Bernard's proposals, the Independent Research Camouflage Unit (I.C.R.U.), during its short existence, was working on several 'experimental' projects involving models of different industrial buildings, onto which had been applied structural material in order to manipulate their form. One example was a model representing 'an actual group of gasometers situated at the junction of three roads with railways and a canal in the immediate vicinity' (Plate 8.2).<sup>240</sup> Onto the model:

'a paint scheme [had been] carried out...in accordance with the general principles of the I.C.R.U., the colours being almost entirely restricted to brick-red, earth and greys in accordance with the built-up areas surrounding the site. A black (fuel oil) was

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<sup>240</sup> J.T.A., JOT/54/1: *Industrial Camouflage Research Unit Report, 1939-1940*, p.6.

taken across the junction of the roads in one case to cut the direction and lead the eye onto grey patches suggesting roads painted across the tops of the gasometers'.<sup>241</sup>

Acknowledging that upon the cylindrical form of a gasholder, 'a paint scheme will have little or no effect, as...in wet weather or low sun angles the tops must always show as reflecting disks', it was argued that 'constructional methods using such materials as expanded metal, strip metal or asbestos in various forms' should be employed.<sup>242</sup> Upon their experimental model of this particular collection of gasholders:

'strip metal or asbestos constructions were designed, [and arranged] in horizontal units covering the junction of two or more gasometers and in consequence breaking into their circumferences and casting a confusing shadow pattern on the container itself. Vertical units, composed of strips intersecting at right angles and forming a trellis-work about two foot in horizontal depth, were hung on the sides of the gasometers, hiding, in some cases, the dark gaps between them' (See Plate 8.2).<sup>243</sup>

Aside from gasholders, the I.C.R.U. focused its attentions on structural additions for oil tanks, utilising a published aerial photography of the oil depot at Thameshaven to produce a model demonstrating how six tanks could be concealed by this method.<sup>244</sup> In this case, the structural additions would break up the structure's illuminated 'disk-like crown through the production of cast shadows. These 'projections' would be composed of curved strips of steel or compressed asbestos cement sheets and would be bolted to the top of the oil tank and extended over the sides by up to 3m (10ft).<sup>245</sup> As with the gasholder example, these 'projections' would be used in conjunction with a paint scheme (see Plate 8.3).

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<sup>241</sup> J.T.A., JOT/54/1: *Industrial Camouflage Research Unit Report, 1939-1940*, p.6.

<sup>242</sup> J.T.A., JOT/54/1: *Industrial Camouflage Research Unit Report, 1939-1940*, p.6. See also, TNA, HO186/1331: *Correspondence*, S. Hayter, to R.E. Stradling, dated 5<sup>th</sup> Apr 1940.

<sup>243</sup> J.T.A., JOT/54/1: *Industrial Camouflage Research Unit Report, 1939-1940*, p.6.

<sup>244</sup> The results of this particular experiment were forwarded to Stradling at the R&E Department for consideration. See TNA, HO186/1331: *Correspondence*, S. Hayter, to R. Stradling, dated 5<sup>th</sup> Apr 1940.

<sup>245</sup> J.T.A., JOT/54/1: *Industrial Camouflage Research Unit Report, 1939-1940*, p.7.

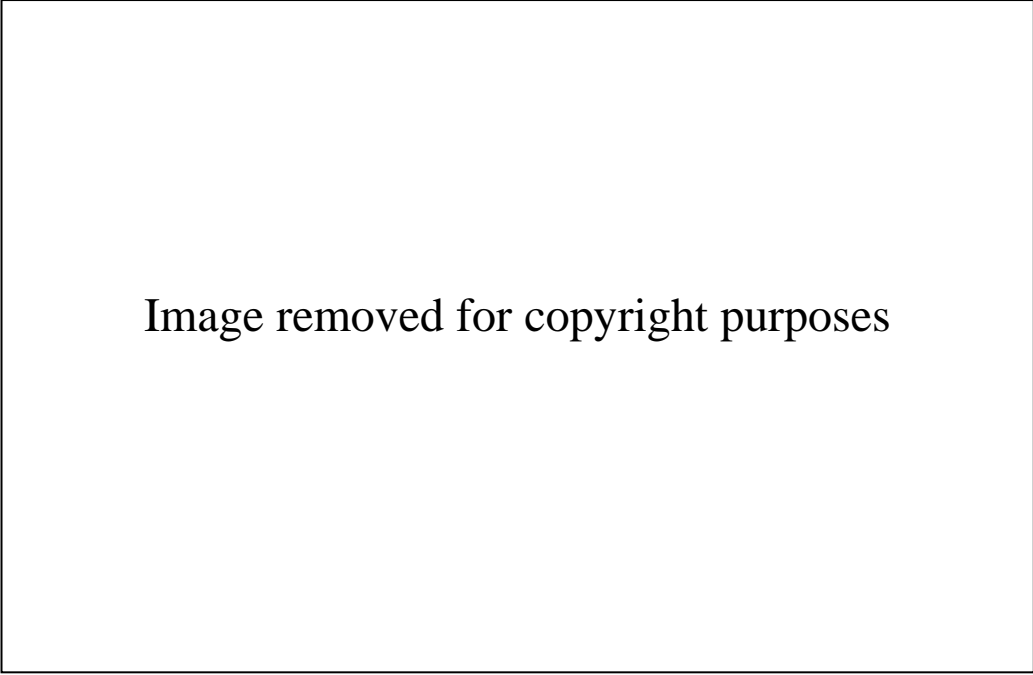


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**Plate 8.3: A photograph taken by the I.C.R.U. illustrating their model of a group of six oil storage tanks, representative of the Thameshaven oil depot. Coated in a disruptive paint scheme, they have curved steel strips attached to the crowns to break up the geometrical form and produce cast shadows.**

**(Source: J.T.A., JOT/54/1, p.7A).**

Both solutions proposed by Bernard and the I.C.R.U. were forwarded to the government's camouflage organisations for their consideration, but in the event, both were seemingly ignored. In both cases, however, it should be highlighted that while they both took a different approach to camouflage which deviated away from the more established methods of painting and netting, they nevertheless remained solutions which sought to deal with the symptoms of modern planning, rather than preventing issues of conspicuousness arising in the first place. In the case of the I.C.R.U., strips of metal and asbestos sheeting were merely 'add-ons' to accompany and enhance the effectiveness of traditional methods such as paint, whereas for Bernard, his wispy cloud additions remained an 'afterthought', something which could be applied during or after construction. While it could be contended that, on the one hand, both solutions transformed the visual appearance of new buildings, on the other, they represented a continuing unwillingness to move away from 'established', 'modernist' architectural design principles.

## 8.2: 'Easing the task of concealment': moving towards the more regular consideration of new sites

With the outbreak of war, the ever-increasing backlog of factories and key sites requiring camouflage treatment and the demand to construct new and 'shadow' factories for the production of war materials,<sup>246</sup> the necessity to erect buildings which either 'self-concealed' themselves or which made the task of the camoufleur much easier became an imperative. As a result, further 'official' discussions on integrating camouflage ideals into architectural design and practice re-surfaced in early 1940. In a letter to the Ministry of Supply, Sir John Anderson (Minister of Home Security) suggested that:

'more *regular* consideration should be given to the possibilities of easing the task of concealment of new vital factories by modification in external design, and possibly their siting. Such questions have recently been discussed between your department and mine, but I think it would help both of us if the general problem were examined more systematically',<sup>247</sup>

In light of this, a 'working relationship' was forged between the C.D.C.E. and the Ministry of Supply concerning new building work, whereby:

'[the] C.D.C.E. received advance particulars of the site and layout of the proposed factory and were thus able to offer constructive criticism before the site was finally selected or building operations commenced'.<sup>248</sup>

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<sup>246</sup> 'Shadow' factories were dispersed sites of industrial production located away from 'central' manufacturing sites in order to ensure the constant production of key technical and mechanical components, mostly for the aviation industry. They got their name as a result of their Air Ministry designation, the 'Shadow Scheme'. See, Lovering, J. 1985: Regional intervention, defence industries, and the structuring of space in Britain: the case of Bristol and South Wales, *Environment and Planning D: Society and Space*, 3(1), pp.85-107; Stratton, M. 1996: Skating Rinks to Shadow Factories: the Evolution of British Aircraft Manufacturing Complexes, *Industrial Archaeology Review*, 18(2), pp. 223-244; Zeitlin, J. 1995: Flexibility and Mass Production at War: Aircraft Manufacture in Britain, the United States, and Germany, 1939-1945, *Technology and Culture*, 36(1), pp. 46-79.

<sup>247</sup> TNA, HO186/395: *Draft Letter*, J. Anderson, to L. Burgin (Minister of Supply), circa Feb 1940.

<sup>248</sup> TNA, HO186/975: *Memorandum by the Ministry of Home Security on the recommendations of the 14th report from the Select Committee on National Expenditure*, circa Dec 1940. It should be noted that the Building Research Station (B.R.S.) were also included in these arrangements. The B.R.S. was founded in 1921 as a Government-funded research body carrying out work into constructional materials for buildings; amongst its earliest work was research into reinforced concrete, the production of B.S. bricks and a variety of constructional methods for domestic housing. It would later be involved in providing information and scale models of the Ruhr dams for the Dambusters raid. See Lea, F.M. 1971: *Science and building: a history of the Building Research Station*, HMSO, London.

While such a relationship was initially confined to the C.D.C.E. and the Ministry of Supply, it was shortly recommended by the Select Committee of National Expenditure that such an association should be replicated between civil camouflage practitioners and all other government departments. Within their Fourteenth Report, it was proposed that ‘Departments and industrial undertakings, when considering plans of buildings which may have to be camouflaged, should have to consult [this] central camouflage organisation’. In response, it was reported that Herbert Morrison (the new Minister for Home Security):

‘fully concurs in the principle underlying this recommendation which is that much expense may be saved and more effective camouflage secured if the requirements of camouflage are taken into account in the design and layout of the building and treatment of the site. Effect will be given to this principle in regard to any buildings erected for the Ministry of Home Security [as well as the Ministry of Aircraft Production] which may have to be camouflaged’.<sup>249</sup>

Having come to fully accept that government regulation for new construction work was required and the apparatus set in place to facilitate interaction between the departments concerned, attention began to shift towards engaging directly with those individuals involved in the designing and constructing of new factories. This would involve intervening in several fields. Firstly, it was argued that civil camoufleurs needed to engage with building contractors directly in order to tackle the issues of conspicuousness which arose during the construction process; this entailed getting contractors to think about the ways in which the ‘landscape of construction’ emerged and how it should be managed and regulated.<sup>250</sup> This required acknowledging that new construction work would produce and leave conspicuous ‘traces’ upon the landscape, namely through the presence of scarred ground. It was, therefore, proposed that pre-emptive planning should be taken to mitigate the effects of this. Finally, there was the necessity to cooperate more fully with architects and designers in order to foster a

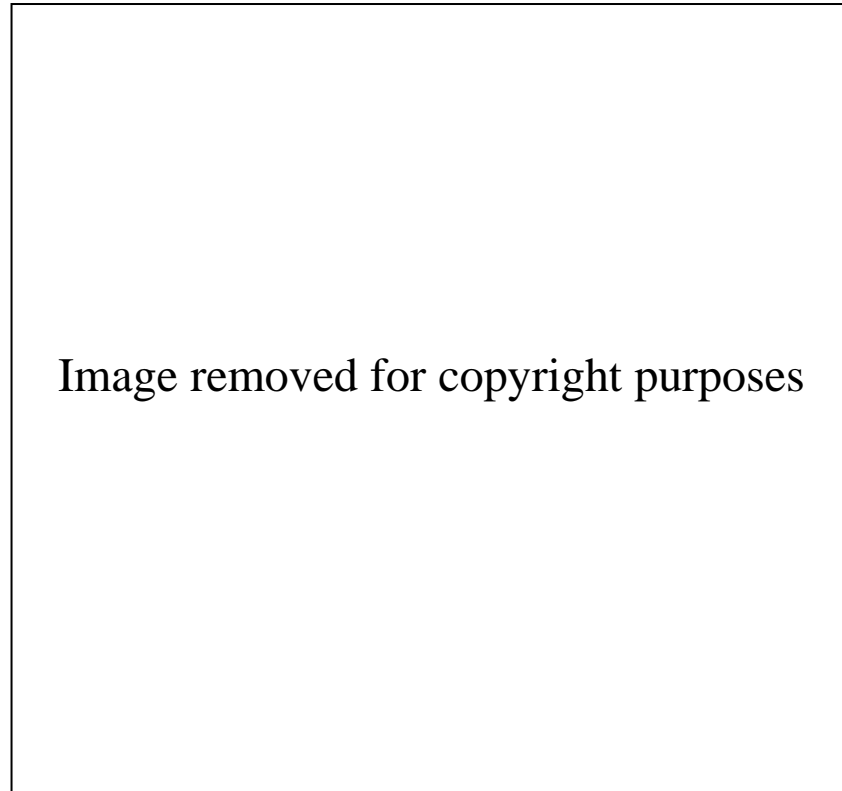
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<sup>249</sup> TNA, HO186/975: *Memorandum by the Ministry of Home Security on the recommendations of the 14th report from the Select Committee on National Expenditure*, circa Dec 1940.

<sup>250</sup> I utilise the term ‘landscape of construction’ in the same vein as Merriman, which he describes as ‘a landscape shaped by the movements of a diverse range of technological devices and bodies... [and] emerging as a result of the circulations and interactions of people, construction machines, soils, and public relations devices as well as other materials, knowledges, and atmospheres’. See Merriman, 2005b, p.118.

camouflage sensibility within mainstream architectural practice. By encouraging a design style imbued with the qualities of what contemporaries called ‘self-concealment’, civil camoufleurs sought to influence the appearance of new buildings and make them easier to merge into the British landscape, thereby enhancing their ‘survivability’. It is to these aspects that attention now shifts.

### **8.3: Landscapes of Construction I: site discipline**



**Plate 8.4: An aerial photograph illustrating the damage caused by construction work. From this image alone, it is clear how such damage was considered to greatly heighten the prominence of such sites.**

**(Source: TNA, HO186/2769).**

‘[An] aspect of the air view that is invariably overlooked by those unfortunate mortals who are confined to the surface of the earth, is the singular conspicuousness of tracks and the spoil thrown up by excavations and constructional works...in civil life the contractor is generally the camoufleur’s worst headache’<sup>251</sup>

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<sup>251</sup> Trevelyan, J. 1944: The technique of camouflage, *Architectural Review*, 96(573), p.69.

In their analysis of modern building work on industrial sites, the presence of scarred ground was considered to be a persistent problem by civil camoufleurs, with its ability to render a site exceptionally conspicuous from the air being frequently evoked in day and night-time aerial observational reports, as well as through aerial photographs (see Plate 8.4). For instance, the Rotax aircraft component factory at Willesden, was highlighted as:

‘a good example of a comparatively small factory which in itself is comparatively inconspicuous but stands out prominently by reason of the way in which the Contractor has treated the ground surrounding the site’.<sup>252</sup>

In their critical appraisals of sites such as this, civil camoufleurs argued that that ‘much of the scarring could have been avoided if the need for concealment had been realised during construction’.<sup>253</sup> Furthermore, it was contended that their presence made camouflage impossible; as one instructional leaflet put it, ‘no camouflage treatment on the factory buildings can [ever] be effective whilst they are framed by this’.<sup>254</sup> It was therefore contended that contractors should be held accountable for remedying such ailments on building sites; ‘the treatment of scarred ground cannot be left to chance in the hope that Nature will provide a covering’.<sup>255</sup> While it was acknowledged that in some soils:

‘annual weeds will appear during the growing season,...these are rarely of sufficient density to provide adequate concealment of the scarred ground from the air, and besides this the weeds generally die back leaving the ground almost bare again during the winter months’.<sup>256</sup>

Although it was accepted that the emergence of scars was inevitable, civil camoufleurs called for a more disciplined approach to construction work, whereby contractors were

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<sup>252</sup> TNA, HO186/973: *Note*, T.R. Cave-Browne-Cave, to H. Scott, dated 11th Oct 1941.

<sup>253</sup> Cave-Browne-Cave, 1945, p.267.

<sup>254</sup> TNA, HO217/2: ‘*Prevention is better than the cure*’ leaflet, circa 1941-1943.

<sup>255</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.

<sup>256</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.



instructed to regulate and manage where movement and excavations took place through the utilisation of various visual ‘markers’ or ‘boundary-making’ devices.

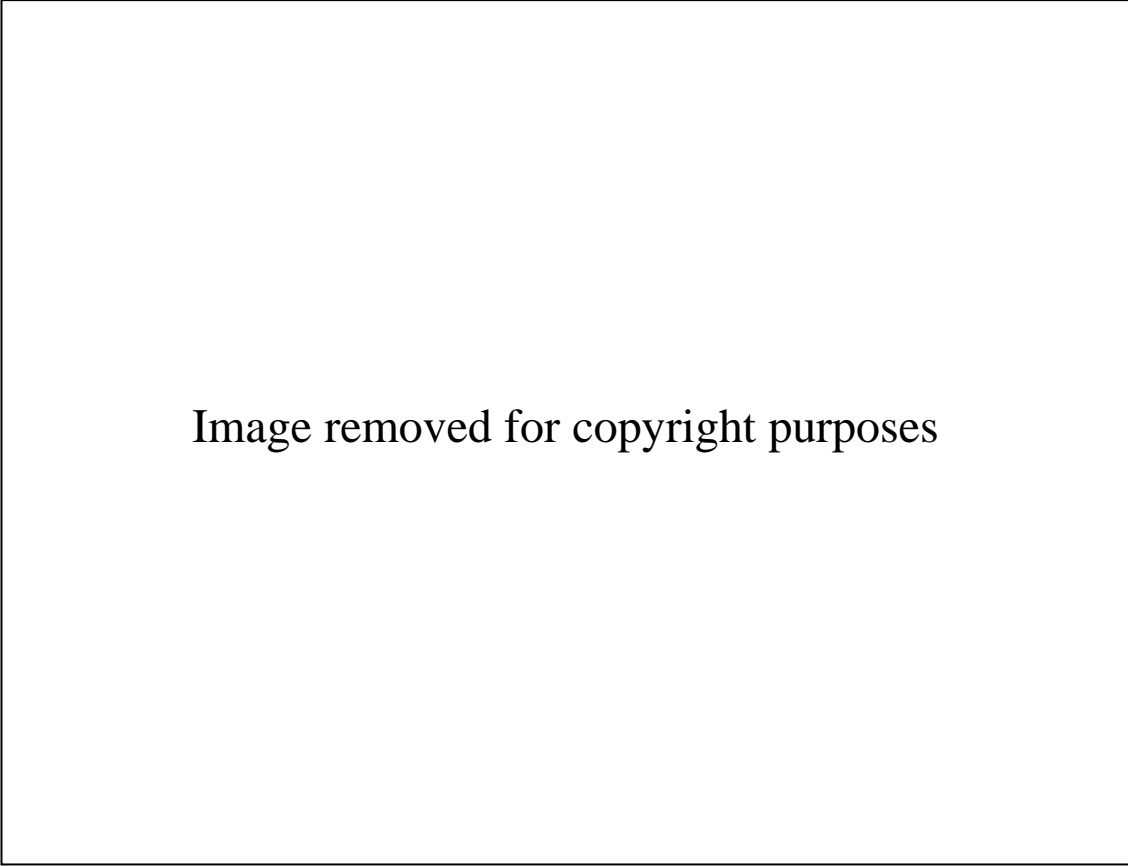


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**Plate 8.5: One side of the leaflet, *Prevention is better than the cure*, showing building contractors how they can impose ‘discipline’ upon construction sites.**

**(Source: TNA, HO217/2).**

In order to impose ‘site discipline’, several recommendations were put forward, with these being circulated to building contractors through the publication of an instructional leaflet, ‘Prevention is better than the Cure’ (see Plate 8.5). With it being contended that ‘careless tracks invite attacks’, the first proposal suggested on the leaflet was the erection of temporary fencing in order to ‘defin[e] the working area around the new building’.<sup>257</sup> This fencing would serve to regulate the movements of both workmen and construction transport, both of which were considered to contribute to the emergence of spoil and tracks which made a site conspicuous. In addition to this, contractors were also told to ‘make your roads and paths first and see that your men stick to these’,

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<sup>257</sup> TNA, HO186/1985: T.S.C.44A: *Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.

thereby reinforcing track discipline and preventing avoidable scarring of the ground.<sup>258</sup> As well as this, civil camoufleurs called for attention to be paid to the ways in which spoil and other building materials were deposited and stored. For example, it was insisted that ‘strict control [be] exercised over [the] dumping of excavated material and that the utmost care [be] taken to avoid...extensive spreading of the spoil’.<sup>259</sup> Furthermore, it was contended that building materials should be stored in an ‘orderly fashion’ rather than scattered around the building site;

‘building materials covering a wide area should be collected into stacks and covered with dark covers, such as tarpaulins, hessian or other suitable materials of a colour and tone to harmonize with the surroundings’.<sup>260</sup>

Moreover, it was proposed that ‘use should also be made of the screening afforded by hedgerows and trees for storing and dumping plant and materials’.<sup>261</sup> Finally, other traces of construction work should be disposed of when no longer needed; this included not only excess building materials, but also the builders’ huts which had been erected to house construction workers.<sup>262</sup>

#### **8.4: Landscapes of Construction II: scarred ground and horticultural camouflage**

While these solutions sought to minimise the effects of scarred ground, spoil and tracks during the construction process, once building work was completed, it was widely accepted that there would still be excesses of exposed ground which would require immediate attention. Industrial occupiers were, therefore, forewarned that these traces should be dealt with as soon as construction was completed in order to avoid nullifying the effects of any camouflage treatment which had been applied to the building while it was being erected. The simplest solution was to cover over the exposed ground with the top soil which had been removed in the first place. Once this top soil had been restored, ‘turfing’ could be carried out, this being regarded as ‘a useful treatment for obtaining an

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<sup>258</sup> TNA, HO217/2: ‘Prevention is better than the cure’ leaflet, circa 1941-1943.

<sup>259</sup> TNA, HO186/1985: T.S.C.44A: *Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.

<sup>260</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.30.

<sup>261</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.30.

<sup>262</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.30. Further discussions take place later within this chapter concerning the siting of these hutments.

immediate effect, and for concealing scarred ground under certain conditions'.<sup>263</sup> In other cases, plants grown at other locations around the U.K. would be transported into the site;

'all [such] plants shall be of Grade I quality, robust and hardy, with good root systems. Stock must be carefully lifted and the root systems covered up during transport and only exposed for the shortest possible period. Care must be taken to avoid damaging the roots'.<sup>264</sup>

A sample from each stock would also be shipped to the C.D.C.E. to ensure that the desired aesthetical appearance was attained when viewed from the air.<sup>265</sup> Although these solutions were applauded for their instantaneous results, both were regarded as being too uneconomical to be applied on a national basis. It was, therefore, suggested that much more inexpensive yet equally simple solutions be devised for wide scale adoption.

One of the primary methods for eradicating the issues posed by scarred ground was to resort to 'agricultural' or 'horticultural' camouflage. This entailed the ploughing and seeding of the disturbed topsoil to enable the growth of new vegetation which could be used to facilitate camouflage. Horticultural camouflage had its origins in May 1940, when during a phone conversation between Captain J. Clark (Deputy C.C.O.) and Philip James (C.D.C.E.) concern was raised 'about 15 cases of Factories in the course of construction with scars in the surrounding ground, which would ruin any camouflage scheme unless steps were taken to deal with the scars also' (see Plate 8.6).<sup>266</sup> Given the increasing number of camouflage schemes that were required for factories in the course of erection, this was emphasised by Clark to be becoming a problem which needed 'immediate attention'.<sup>267</sup> Emerging from this discussion, Dr Leslie Watson was approached by the C.D.C.E. to provide his insights into the possibilities of 'biological

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<sup>263</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.2.

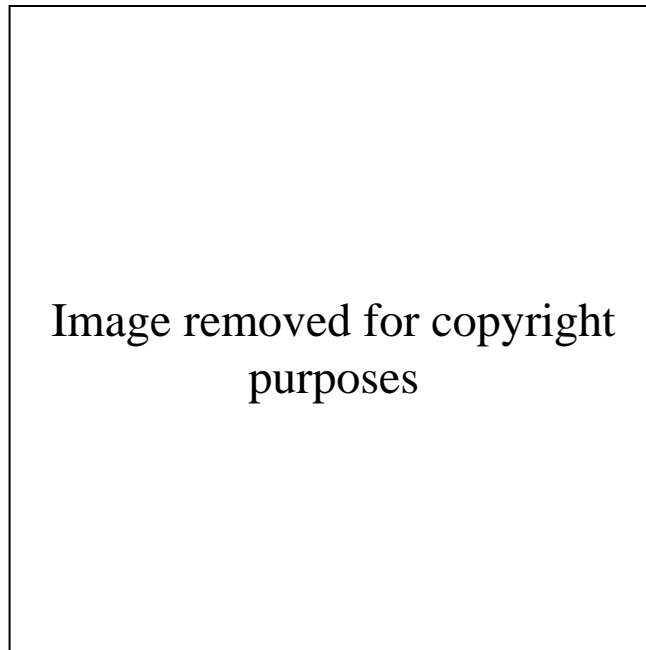
<sup>264</sup> TNA, HO186/973: *Technical Instructions: scarred ground and horticultural treatment of ground areas*, circa Feb 1941.

<sup>265</sup> Elsewhere, Merriman, in his work on the M1, has also examined the 'aesthetics' of planting in relation to landscape design and how particular species were selected based upon how they could be visually experienced through the mobile 'ways of seeing' of the motorist. See Merriman, 2006.

<sup>266</sup> TNA, HO186/1338: *Memorandum of telephone conversation with Captain Clark*, P. James, dated 2nd May 1940.

<sup>267</sup> TNA, HO186/1338: *Memorandum of telephone conversation with Captain Clark*, P. James, dated 2nd May 1940.

camouflage'.<sup>268</sup> In response to their concerns about exposed ground, Watson proposed that 'if the ground were ploughed and sown with grass and other green stuff a green carpet could be formed in 6 to 8 weeks'.<sup>269</sup> This signalled the commencement of the incorporation of horticultural knowledge into civil camouflage practice and thus initiating another interface between camoufleurs and scientific 'experts'.



**Plate 8.6: The list of 15 firms where horticultural treatment was deemed necessary to contend with scarred ground.**

**(Source: TNA, HO186/1338).**

The deployment of 'horticultural camouflage', it was contended, would require great horticultural expertise in terms of the selection of seeds, ploughing and planting techniques, as well as in the maintenance of plant growth. Glasson, for example, contended that while the building contractor was more than capable of replacing the top-soil, the 'cultivating and sowing with grass...[was] somewhat more difficult as it entails specialised knowledge and I do not think that the General Contractor would be a suitable man to do it'.<sup>270</sup> As a result, it was suggested that the Ministry of Agriculture be approached with the initial list of 15 sites, with it being contended that they would be

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<sup>268</sup> Unlike other camouflage 'characters' which have been examined in this thesis, producing a personal history of Leslie Watson beyond his work in camouflage is exceptionally difficult; no details are given in the archive as to his affiliations before his work in camouflage, nor were any insights gleaned from secondary literature. The only thing which said with certainty was that Watson was appointed as Head of the Horticultural Section at the C.D.C.E. and that his work focused upon horticultural camouflage for scarred ground and for military airfields.

<sup>269</sup> TNA, HO186/1338: *Memorandum of telephone conversation with Captain Clark*, P. James, dated 2nd May 1940.

<sup>270</sup> TNA, HO186/1338: *Correspondence*, L.M. Glasson, to P. James, dated 7th May 1940.

able to provide the desired advice on ploughing and fertilising as well as the loaning of equipment to enable sowing of the seeds. Subsequently, the C.D.C.E. were put into contact, through Watson, with the County War Agricultural Executive Committees (CWAECs)<sup>271</sup> who, as Glasson recorded:

‘state that they have available the necessary labour and implements, and would be prepared to cultivate and sow. They state the cost of this would be about £3.10.0 per acre. I suggest that...the services of this Organisation should be employed instead of attempting to obtain competitive tenders for this very specialised work’.<sup>272</sup>

In addition to the CWAECs, the C.D.C.E. commenced consultations with other locally-based institutions involved in horticultural research throughout the U.K.<sup>273</sup> On the 5<sup>th</sup> December 1940, for example, Watson, along with Mr F.P. Knight, were sent to a meeting with Mr R.B. Dawson, the Director of the Board of Gamekeeping Research at the St Ives Research Station ‘to discuss with him the question of the cultivation of grass etc. over scarred ground’, as well as to explore some experimental plots.<sup>274</sup> During the course of this visit, it was recorded that:

‘Mr Dawson has expressed a keen desire to help in this work and he would be willing to place his services generally at the disposal of the C.D.C.E....[and] suggested [therefore] that the organisation at St Ives should be called upon to act in an advisory capacity

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<sup>271</sup> The County War Executive Committee had been established before the war as a pre-emptive measure under Defence Regulation 49. As Brian Short writes, they were ‘composed of local groups of influential landowners, farmers and land-related persons, appointed to impart a sense of urgency and good agricultural practice. Owing loyalty to the Ministry of Agriculture, they were charged with the responsibility of taking ‘all necessary measures to secure that the land in their area was cultivated to the best advantage’. During the war, there were 49 CWAECs in England and 13 in Wales, each composed of between 8 to 12 members. See Short, B. 2007: *War in the Fields and Villages: The County War Agricultural Committees in England, 1939-1945*, *Rural History*, 18(2), pp.217-244 (page 221).

<sup>272</sup> TNA, HO186/1338: *Correspondence*, L.M. Glasson, to P. James, dated 7th May 1940.

<sup>273</sup> For geographical work which has explored the significance of local/regional sites of scientific knowledge production, see Naylor, 2006; Naylor, S. 2010: *Regionalizing Science: Placing Knowledges in Victorian England*, Pickering and Chatto, London.

<sup>274</sup> TNA, HO186/1338: *Report of a visit to the Board of Greenkeeping Research, St Ives Research Station on 5th December 1940*. The Greenkeeping Research Board based the St Ives Research Station, Bingley, West Yorkshire was established in 1929 by the British Golf Union in order to conduct research into the ‘science’ of golf greens. Later, they would extend their research to incorporate other types of sports turf under the title of the Sports Turf Research Institute. See Evans, R.D.C. 1991: *Cricket Grounds: The Evolution, Maintenance and Construction of Natural Turf Cricket Tables and Outfields*, STRI, Washington DC; Perris, J. 2008: *All about Bowls: The History, Construction and Maintenance of Bowling Greens*, STRI, Washington DC.

visiting sites and prescribing treatment when required, and that co-operation with the C.D.C.E. should be placed on an official basis'.<sup>275</sup>

It was the forging of relationship with horticultural research stations such as this which would later prove useful in determining which plant species should be used and how these should be planted.<sup>276</sup>

As forecasted by the C.D.C.E., the number of factories requiring horticultural treatment progressively multiplied. Writing in June 1940, Watson recorded that there were;

‘more than forty factories, in different parts of the country, which will require to have some part of their land cultivated and sown, in order that the camouflage schemes of these factories shall be effective. This number will be considerably increased as more factories are completed’.<sup>277</sup>

Projecting that ‘the average area of land adjoining factories requiring agricultural treatment, is about 15 acres’, Watson hypothesised that ‘it is possible that the total amount will not exceed 2,000 acres...5,000 acres should represent an outside figure’.<sup>278</sup> Throughout the year, the numbers of sites requiring horticultural treatment continued to increase to the extent that upon the formation of the Camouflage Directorate in early 1941, a Horticultural Section specialising in this form of camouflage, was formed alongside other sections (see Appendix 2) to deal with the escalating workload. In terms of civil camouflage practice, this accommodation of horticultural treatments meant that new sites would not only be visited by a Design Officer, but would now be inspected by a Horticultural Officer as well as a regional representative from the CWAECs who, it

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<sup>275</sup> TNA, HO186/1338: *Report of a visit to the Board of Greenkeeping Research, St Ives Research Station on 5th December 1940.*

<sup>276</sup> It should be noted that camoufler interactions with horticulturalists were primarily centred upon working with scientific research bodies, in some cases, those involved with crop cultivation. For example, in relation to work on the use of horticultural camouflage for airfields, the Welsh Plant Breeding Station at Aberystwyth was consulted, providing plant samples and the necessary soil to carry out experiments with ‘Watson’s Pots’ (discussed at the end of this section. See also footnote 1116); their involvement in horticultural camouflage for civil establishments does, however, remain unclear from surviving archival material. On the other hand, there is no record of camoufleurs ever interacting with the Royal Horticultural Society, a group involved in the preservation and promoting of gardens for leisure.

<sup>277</sup> TNA, HO186/1338: *The agricultural treatment of scarred land adjoining factory sites*, L.J. Watson, dated 10th June 1940.

<sup>278</sup> TNA, HO186/1338: *The agricultural treatment of scarred land adjoining factory sites*, L.J. Watson, dated 10th June 1940.

was argued, ‘will... be in a position to give advice as to the most suitable local resources which are available’.<sup>279</sup> In their analysis of new construction sites, the Horticultural Officer was advised to initially:

‘make what arrangements he can for confining the scars to as small an area as possible. This is generally difficult to do, but it is sometimes possible to prevent traffic from taking unnecessary “short cuts” over virgin land, and for this purpose it is well worth the trouble of erecting barbed wire fencing’.<sup>280</sup>

Following on from this, the Horticultural Officer was to also issue instructions to the building contractor to preserve the top soil, with it being asserted that:

‘every effort should be made to remove the topsoil by means of a scraper to a safe place before the diggers and excavators start work. It is of the utmost importance that it should be kept in a separate dump, and not covered up by the unfertile soil of subsequent excavations. If this is not done, the top soil will not be available when required, necessitating the importing of soil from elsewhere, and so involving considerable delay and expense’.<sup>281</sup>

In this sense the Horticultural Officer played a vital ‘inspector-like’ role in helping to enforce the regulation of the actions and practices carried out on a construction site and impressing upon building contractors the need for a sense of discipline and order. This served to not only prevent a site becoming conspicuous *during* construction, but also in the transition *from* construction site *to* operational use.

Once building work had been completed, the Horticultural Officer would subsequently be responsible for providing further advice on the treatment of the exposed ground before seeding commenced. The sub-soil, for example, was to receive a manure treatment before the top soil was replaced, it being contended by Watson that ‘by the use of artificials a satisfactory “take” of the seed is rendered more likely, and in

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<sup>279</sup> TNA, HO186/973: *Technical Instructions: scarred ground and horticultural treatment of ground areas*, circa Feb 1941.

<sup>280</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.2.

<sup>281</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.2.

consequence the highly desired early result is obtained'.<sup>282</sup> The top soil would then be reinstated before the sowing of the seed;

‘if the soil is not appropriate for the germination of seeds, the soil should be turned over and allowed to weather, temporary measures being taken to render the light-coloured “scar” less conspicuous by covering it with suitable materials such as brush-wood, branches, tree tops etc., which can be obtained locally’.<sup>283</sup>

Where the soil was deemed to be ‘unsuitable’ as a result of construction ‘rubbish’, the Contractor was required to remove the soil ‘to a suitable place and...provide, as required, soil adequate to encourage the growth of the plants after planting’.<sup>284</sup> With the soil prepared in the desired way, and with ploughing having taken place, seeding could commence.

In the selection of the plant types settled upon for horticultural camouflage, these were predominantly native species, with it being argued that national, regional and local variations in vegetation types were an essential factor in the determining of particularly effective plant species;

‘careful consideration has been given to the question of issuing instructions which could be applicable elsewhere and a number of experts consulted. The conclusion has been reached, however, that while many of the grasses and other plants referred to in this report could no doubt be utilised in other parts of the world this is a subject which should be taken up in detail with the botanical experts and agronomists of the particular county in question’.<sup>285</sup>

In terms of the seed varieties used, these consisted of agricultural crops as well as different types of grass seed. Amongst the agricultural seeds promoted by members of the Horticultural Section were Rape (*Brassica napus*), Sunflower (*Helianthus Annuus*),

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<sup>282</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.2.

<sup>283</sup> TNA, HO186/973: *Technical Instructions: scarred ground and horticultural treatment of ground areas*, circa Feb 1941.

<sup>284</sup> TNA, HO186/973: *Technical Instructions: scarred ground and horticultural treatment of ground areas*, circa Feb 1941.

<sup>285</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.



Field beans (*Faba vulgaris*), Clovers (*Trifolium*), Rye (*Secale cereale*) and Oats (*Avena sativa*). Maize (*Zea Mays*) was also encouraged, it being characterised as ‘a useful annual for producing areas of tall growing herbage’.<sup>286</sup> Jerusalem Artichoke (*Helianthus tuberosus*) was another variety of agricultural crop regarded as being:

‘one of the most valuable subjects in Horticultural Camouflage. The tubers are planted in the spring, 12” apart, and produce a dense growth which retains its covering power well into the winter. Useful for simulating certain types of waste land and undergrowth’.<sup>287</sup>

All of these crops, however, were only encouraged for the largest expanses of scarred ground, and in some cases, their use was regulated by their availability; in a memorandum on the ‘Agricultural Treatment of Scarred Ground’, it was highlighted how:

‘those species which are valuable in agriculture and at the same time in short supply, should be used most sparingly, if at all...Clovers [for example], should not be justified with the possible exception of wild white which might be sown at  $\frac{3}{4}$  to  $\frac{1}{2}$  lb./acre’.<sup>288</sup>

Due to the ‘scarcity’ of some agricultural crops, grass seed was invariably the preferred option. Indeed, the Horticultural Section encouraged the use of a variety of grass seeds: Perennial Rye grass (*Lolium perenne*), Italian Rye grass (*Lolium italicum*), Crested dogstail (*Cynosurus Cristatus L.*), Cocksfoot (*Dactylis glomerata L.*), Timothy (*Phleum pretense L.*) and Yorkshire Fog (*Holcus lanatus L.*) to name but a few examples. The selection of these seeds would, however, be strongly determined by a series of factors. Firstly, the morphology of the landscape and its visual appearance in terms of tones and textures was deemed to be a critical factor. Watson, for example, contended that ‘the

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<sup>286</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.3.

<sup>287</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.3.

<sup>288</sup> TNA, HO186/1338: *The Agricultural Treatment of Scarred Ground*, undated.

aim should be to simulate as closely as possible the type of herbage which exists on the adjoining land'.<sup>289</sup> Indeed, he wrote that:

[while] grass is generally satisfactory in most types of country,...it must be remembered that for some time newly seeded ground presents a lawn-like appearance, which may in some cases be an undesirable feature, causing a building to be "framed" by an area of bright green which bears no relation in tone and texture to its surroundings. This is particularly so in hill country, or where a site is adjoining waste land, heath or common. Although this effect will be less evident as the seedling grass matures, it is not difficult with a certain amount of ingenuity to counteract it from the outset. For example instead of only sowing a grass seeds mixture, patches of Lucerne etc, could be sown in irregular shapes to give a disruptive effect'.<sup>290</sup>

Furthermore, it was argued that fertilisers, such as Sulphate of Ammonia, Nitro Chalk, Basic Slag and Superphosphates, could all be used to 'strategically' produce particular camouflage 'effects'; as fertilisers produced 'more luscious' growth, it was contended that they could be utilised to produce 'tonal contrast'.<sup>291</sup> Moreover, the growth of perennial weeds was also encouraged to enable the mimicking of surrounding textural and tonal compositions. The use of weeds for horticultural camouflage did, however, provoke some resistance, particularly from the Ministry of Agriculture, who feared that the use of such weeds in agricultural districts would be harmful to crop cultivation.<sup>292</sup>

In addition to the visual mimicking of the surrounding landscape, the pedological characteristics of the area was also a decisive factor in the selection process of grass seeds to be used; this entailed thinking about acidity levels, the composition of the top soil and sub-soil as well as the terrain. For instance, it was noted that:

'perennial ryegrass is quite successful on fairly acid soils, certainly at pH value 5.5 which is the lower limit of acidity we should permit without liming, it grows quite well.

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<sup>289</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.3.

<sup>290</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.3.

<sup>291</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.24.

<sup>292</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.1.

Timothy is essentially a grass for heavy soils of high water holding capacity. It also grows relatively well on peat'.<sup>293</sup>

In order to tackle the different soil types expected, Watson and his fellow Horticultural Officers were involved in the devising of various grass seed mixes through 1941. Emerging from their experiments, they determined an assortment of mixes for specific soil types (see Appendix 4), each of which would provide effective coverage of scarred ground as well as producing the desired tonal and textural appearance required for camouflaging. It was suggested that these different seed mixtures would provide effective coverage of scarred ground as well as producing the desired tonal and textural appearance required for the geographical locations where these different soil types were found.

Like many other camouflage treatments, horticultural methods were not without their own unique challenges. Firstly, sites which had been sown with seed required protection from trampling in order to enable the flourishing and growth of the plants and so, in an instruction note for building contracts, it was maintained that 'the strictest control must be maintained over personnel to ensure that new cultivation is protected'.<sup>294</sup> As with the demarcating of construction work, these areas of new growth would be enclosed by fencing, thus ensuring their protection from trampling by construction workers. Secondly, the time of seeding was considered to be an important factor; Watson, for instance, contended that:

'effective horticultural treatment is entirely dependent upon the work being carried out at the proper seasons, for, unlike other mediums of camouflage, the Horticultural officer is dealing mainly with material which is alive'.<sup>295</sup>

While it was asserted that the ideal time for planting 'will obviously vary from district to district', it was argued that 'the idea of sowing as late as October must be looked on as hazardous, for most areas'.<sup>296</sup> It was, therefore, emphasised that:

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<sup>293</sup> TNA, HO186/1338: *The Agricultural Treatment of Scarred Ground*, undated.

<sup>294</sup> TNA, HO186/975: *Instructions for the maintenance of effective camouflage of factories*, dated 2nd May 1941.

<sup>295</sup> TNA, HO186/1338: *Correspondence*, L.J. Watson, to H. Eccles, dated 3rd Jan 1942.

<sup>296</sup> TNA, HO186/1338: *The Agricultural Treatment of Scarred Ground*, undated.

‘to obtain the best results from grass cultivation the seed must be sown during certain optimum periods which are, generally speaking, from March to early May, and from August to the end of October’.<sup>297</sup>

This factor was recognised to be so important that in early 1942, Watson recommended that changes be made to camouflage procedure ‘with a view to accelerating the execution of horticultural work’.<sup>298</sup> As with other forms of camouflage work, horticultural treatments were increasingly being stalled and hindered by the slow progress of firms in obtaining tenders. In a letter to Mr H. Eccles (Senior Construction Officer (S.C.O.)), Watson highlighted how ‘failure to carry out the work specified during the optimum period has sometimes caused...unsatisfactory results, but has also involved additional expenditure’.<sup>299</sup> On this basis, it was concluded that:

‘it is desirable that arrangements should be made whereby certain classes of horticultural work should be undertaken without awaiting [for] submission and approval of formal estimates...[this] immediate authorisation is a more important factor in horticultural work than with the other types of camouflage treatment’.<sup>300</sup>

Finally, then, was the matter of maintenance, it being accentuated that ‘it must be understood that the treatment of scarred ground does not end with the sowing of the seed, and that in nearly all cases after care will be necessary’.<sup>301</sup> Indeed, it was noted that:

‘at certain periods of the year all grass requires to be mown or grazed. This is of great benefit, particularly to young grass, and encourages strong growth. Another reason for keeping grass short is that in dry weather long grass may become a serious fire risk. Grazing with sheep or goats is sometimes a more convenient method of keeping grass down than by mowing, particularly on steep slopes, air-raid dugouts, etc.

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<sup>297</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.2.

<sup>298</sup> TNA, HO186/1338: *Correspondence*, L.J. Watson, to H. Eccles, dated 3rd Jan 1942.

<sup>299</sup> TNA, HO186/1338: *Correspondence*, L.J. Watson, to H. Eccles, dated 3rd Jan 1942.

<sup>300</sup> TNA, HO186/1338: *Minute*, H. Eccles, to W.S. Imrie, dated 3rd March 1942.

<sup>301</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.7.

Grazing may also be a solution to the problem in cases where there is not sufficient labour available for keeping large areas of grass under control'.<sup>302</sup>

As with other forms of camouflage, maintaining the illusion was of equal importance for the horticultural camoufleurs; failure to do so could have profound implication on the perceived 'protection' that camouflage afforded to new industrial sites.



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**Plate 8.7: Experimenting with 'Watson's Pots' at Dodwell Farm, July 1941.**

(Source: TNA, HO217/7)

By way of conclusion to the work conducted by horticulturalists, it should be noted that the desire to conceal ground scars caused by construction work represents only one dimension of how horticultural camouflage was adopted during this period. At the same

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<sup>302</sup> TNA, HO186/1985: *T.S.C.44: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.7.

time as his work for the C.D.C.E., Watson working for the Air Ministry, and with the support of the Welsh Plant Breeding Station, Aberystwyth,<sup>303</sup> was involved in the development of ‘Watson’s Pots’, an attempt to camouflage airstrips, aprons and light roads on airfields through planting grass into gaps in the concrete surface (see Plate 8.7). Such a method presented its own set of challenges; rather than simply covering over the ground to remove conspicuousness, the plants used in these ‘pots’ had to stand up to the wear-and-tear of heavy traffic (mainly aircraft), and therefore required the use of ‘strong growing species’.<sup>304</sup> These ‘pots’ became quite successful and were adopted at several military airfields around the UK; investigations of these spaces are, however, beyond the scope of this thesis. Nevertheless, their use demonstrates an emerging engagement between camouflage and horticultural knowledges in an attempt to merge conspicuous features through ‘planting’ and ‘landscaping’.

As the work of the Horticultural Section has illustrated, the treatment of ground scars was as much about thinking about ‘prevention’ as much as it was a ‘cure’; it promoted ‘responsible’ construction through the taking of pre-emptive action which regulated the damage caused by construction work and instantly and intuitively reacted to any damage which had been caused. In retrospect, the work of the horticulturalists was deemed to be a great success. In his presentation to the Royal Society of Arts in 1945, Cave-Brown-Cave applauded the work done by the Horticultural Section, hoping that their research and achievements could readily be transferred into post-war construction work;

‘the success which they achieved even on scars which were initially broken chalk or rock or sandy gravel was truly remarkable. Their knowledge and special technique should be most useful for giving decent clothing to the unsightly scars and tips of peace-time’.<sup>305</sup>

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<sup>303</sup> As mentioned earlier, the Welsh Plant Breed Station, Aberystwyth was one of several sites of scientific knowledge production which was being utilised for horticultural work. Founded in 1919 by the University of Wales, Aberystwyth, and funded by the Ministry of Agriculture, Fisheries and Food, ‘the primary activities of the Station concern[ed] the breeding and development of new seed strains and varieties of grass, clovers and oats’. See University College of Wales, Aberystwyth. 1955: *The Welsh Plant Breeding Station, 1919-1955*, University College of Wales, Aberystwyth, p.1.

<sup>304</sup> TNA, HO186/1985: *Handbook on Camouflage Practice, C.D.C.E., MoHS* Leamington Spa, 1942, p.97.

<sup>305</sup> Cave-Browne-Cave, 1945, p.267.

### 8.5: Landscapes of Construction III: artificial alternatives to treating scars

While horticultural camouflage was the predominant means by which scarred ground on construction sites was dealt with, there were other forms of concealment which were encouraged and promoted by the Camouflage Directorate. These ‘artificial’ treatments consisted of one of three solutions: ‘spreading’, ‘spraying’ and ‘placing’. Firstly, under ‘spreading’, locally sourced materials would be laid over the ground scars, thereby facilitating their immediate removal from the landscape. In one memorandum, it was outlined how:

‘seaweed in coastal regions, slag deposits in mining areas, coke dust or coal slack which is available in most [industrial] districts..., used black sand from foundries and screened dust from destructor plants are all suitable for the artificial treatment of scarred ground... crushed stone or broken brick which may be more readily available in some localities are equally satisfactory, but unless the material used is uncommonly dark it will be necessary for the area treated to be spray painted with a suitable and convenient staining or colouring agent that will give a finish not lighter than camouflage colour No.13’.<sup>306</sup>

Secondly, there was the technique of ‘spraying’, which entailed making use of matt black coal tar paint and waste products such as Sludge Oil. These materials would be distributed usually by a tractor-pulled device, similar to the one captured by Edwin La Dell in his painting *A Machine for Spraying Scarred Ground* for the W.A.A.C. (see Plate 8.8). Again, local availability determined the selection of the materials utilised;

‘Coal Slurry...is available from collieries at...low cost, and Tan Sludge, the waste product from Tanneries, are both satisfactory and cheap when supplies are obtained locally’.<sup>307</sup>

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<sup>306</sup> TNA, HO186/1985: T.S.C.44A: *Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.7-8.

<sup>307</sup> TNA, HO186/1985: T.S.C.44A: *Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.8.



**Plate 8.8: *A Machine for Spraying Scarred Ground*, 1943, by T. La Dell.**

**(Source: IWM, ART LD 3019)**

However, while these methods were considered cheaper than ‘spreading’, there were issues surrounding their temporal endurance;

‘the majority of [these] treatments may not be considered even semi-permanent, and it is to be anticipated that re-treatment dependent upon weather conditions may be necessary as often as three or four times a year’.<sup>308</sup>

Finally, there was the method of ‘placing’, which necessitated the arranging of artificial and natural materials such as steel wool netting, B.G., or tree trimmings onto the top of the ground scar itself. In the case of tree trimmings, it was contended that:

‘Scots Pine is by far the most suitable tree from which tops or thinnings may be obtained. The tops or thinnings vary in height up to about 15ft and as they should be placed so as to provide good concealment of the scar their distance apart is dependent

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<sup>308</sup> TNA, HO186/1985: T.S.C.44A: *Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.8.



upon their height and density of foliage. An average spacing of between 6ft and 7ft is usually satisfactory. After the lower branches have been removed, they should be placed in position by sinking the base into ground for a depth of about 2ft so that the bottom branches rest over the surface'.<sup>309</sup>

In order to assist with their preservation, it was recommended that these be painted with Bituminous Emulsion Paint conforming to Camouflage Colour No.13. These three techniques of 'spreading', 'spraying' and 'placing' combined were considered an artificial extension of the methods proposed by horticultural camoufleurs, 'toning down' the visual appearance of ground scars and facilitating their 'merging' into the landscape.

#### **8.6: 'Self-concealing' architecture I: producing a landscape of 'ordered irregularity'**

'An animal whose chances of survival depends on successful concealment is equipped with an appropriate disguise from the moment of birth; the problem of [civil] camouflage would be greatly simplified if a similar principle could be applied'.<sup>310</sup>

The disciplining of construction work and the application of horticultural and artificial treatments to contend with the issues of scarred ground and conspicuous building practices represented only half of the problem faced by the civil camoufleurs in their efforts to transform and re-think building practices. While these methods acted as pre-emptive solutions to prevent the emergence of conspicuousness on construction sites, camoufleurs also needed to transform the architectural aesthetics of new industrial buildings. As has been discussed throughout the thesis, the 'modernist' landscape which had been promoted by 'planner-preservationists' had produced an array of 'conspicuous' buildings: regular plans, geometrical shapes and light-coloured building materials, within camouflage discourses, had all served to emphasise and give them a particular 'presence' in the landscape. Consequently, such aesthetics had produced the

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<sup>309</sup> TNA, HO186/1985: *T.S.C.44A: Memorandum on the Horticultural Treatment of Scarred Ground*, L.J. Watson, dated May 1942, p.9.

<sup>310</sup> WORK28/11/8: *The Principles and Organization of Static Camouflage*, Camouflage Committee, 1944, p.28.

‘headache’ which camoufleurs were now trying to resolve; for them, it was clear that a new approach was required, an approach which embodied camouflage sensibilities.

In order to articulate this camouflage architectural sensitivity and reduce the cost of expenditure being required on additional camouflage treatments, civil camoufleurs wanted to engage directly with architects and civil engineers. While such sentiments had long been recognised, it was not until the findings of the Mabane Committee for Concealment and Deception’s Interim Report of 1941 that a fuller appreciation of the situation was realised; within this, it was accentuated that:

‘the effectiveness of camouflage had been prejudiced and money and labour wasted because considerations of concealment [have] not been taken into account early enough in the plans for the erection of new buildings. Further, in some cases it would have been possible to provide complete concealment by following different methods of construction’.<sup>311</sup>

With the emergence of the Camouflage Directorate, more systematic consideration was to be given to working with architects to help them design buildings which would ease the task of the camoufleur. A note from the Camouflage Committee in August 1941, for instance, stated that:

‘camouflage is now as essential a part of the architect’s task in preparing the plans of a new building as, e.g. sanitation. Camouflage ought not to be regarded as something to be superimposed after the architect has made his plans; it must be taken into account from the start in choosing the site and preparing the lay-out, as well as in designing the buildings’.<sup>312</sup>

However, despite their intentions to intervene in architectural practice, the ongoing and extensive development of new factories had been so great that civil camoufleurs were still unable to make an impact; in the words of one memorandum, ‘the urgent necessity

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<sup>311</sup> TNA, HO186/1985: *Interim Report of the Committee on Concealment and Deception*, dated 18th Aug 1941.

<sup>312</sup> TNA, HO186/1985: *Note: Camouflage*, Camouflage Committee, circa Aug 1941.

of getting new factories started at the earliest possible moment [has meant that] the importance of concealment was inevitably subservient to that of production'.<sup>313</sup>

Writing in October 1941, Cave-Browne-Cave expressed his concern about the limited impact that civil camouflage was having upon building work, and proposed that an alternative approach be taken;

‘we are...more than anxious to give as much guidance as possible in the initial stages of design. So many factories are being built that we cannot possibly be consulted about all of them and we must, therefore, depend upon simple instructions sent out in a form which is likely to attract the attention of architects’.<sup>314</sup>

It was, therefore, proposed that an instructional brochure be produced:

‘to...be of use to Architects and Officers of the Ministry of Works & Buildings, who may on occasions...have to work with such dispatch that there is no time to ask for expert advice’.<sup>315</sup>

In the putting together of this manual, it was argued that this particular booklet should act not only as an authoritative, instructive piece but should also adopt illustrative strategies to express and display the ‘self-concealment’ aesthetic which civil camoufleurs wanted to nurture. It was felt that an immensely visual approach should be adopted:

‘in order to catch the eye of the architect who finds his desk inundated with official papers as well as to give those without flying experience a better idea of some aspects of the problem’.<sup>316</sup>

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<sup>313</sup> TNA, HO186/1985: *Camouflage Committee: Draft Memorandum*, undated.

<sup>314</sup> TNA, HO186/1343: *Correspondence*, T.R. Cave-Browne-Cave, to G. Bairstow (Min. of Works and Buildings), dated 21st Oct 1941.

<sup>315</sup> TNA, HO186/1343: *Proposed Memorandum to be prepared by the new Technical Sub-Committee*, R.V. Darwin, to T.R. Cave-Browne-Cave, dated 4th Oct 1941.

<sup>316</sup> TNA, HO186/1343: *Correspondence*, R.V. Darwin, to G. Bristow (Min. of Works and Buildings), dated 13th Oct 1941.

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**Plate 8.9: The front cover of *Concealment of New Buildings*.**

**(Source: TNA, HO217/2).**

Entitled *Concealment of New Buildings* (hereafter referred to as *New Buildings*), and designed by Richard Guyatt, it was printed in colour in 1942 as part of the Camouflage Directorate's Camouflage Memoranda series (see Plate 8.9).<sup>317</sup> Although initially conceived as a booklet for wider circulation to architects, concerns about security were raised at the fourth meeting of the Camouflage Committee in January 1942 by Captain S.D. Culley (representing the Air Ministry), and ultimately, 'it was agreed that it should be issued as a confidential document and attention should be drawn in the text to the importance of treating it as such'.<sup>318</sup> This meant that access to it was limited to those working within governmental departments, rather than freelance and independent architects; this may have inevitably affected its impact factor during this time period.

Although the 'confidential' status may have impaired its distribution to architects to some extent, the booklet itself provided some unique insights into how civil camouflage

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<sup>317</sup> Richard Guyatt (1914-2007) was a freelance graphic designer who had worked for Shell-Mex and British Petroleum (BP) during the 1930s and was responsible for the creation of such posters as 'Racing Motorists Use Shell' (1939) and 'Sham Castle near Bath' (1936) as part of Shell's 'Visit Britain's Landmarks' collection. During the war, he acted as Regional Camouflage Officer for Scotland a post he held whilst undertaking the designing of *Concealment of New Buildings*. Post-war, he acted as co-designer for the South Bank 'Lion and Unicorn' pavilion for the Festival of Britain, 1951, and became a professor at the Royal College of Arts in 1948, acting as its Rector between 1978 and 1981. See Faryling, C. 1987: *The Royal College of Arts: one hundred and fifty years of art and design*, Hutchinson, London; Atkinson, H. 2012: *The Festival of Britain: A Land and its People*, I.B. Tauris, London.

<sup>318</sup> TNA, HO186/1343: *Minutes of the Fourth Meeting of the Camouflage Committee, held on 8th January 1942*.

practitioners sought to standardize architectural practice and produce a ‘self-concealing’ aesthetic. In terms of the structure of the booklet, this was arranged into three sections, each of which called attention to the characteristics which rendered a building conspicuous when viewed by the bomb aimer or aerial observer, and which architects should therefore consider in the production of their designs. The booklet contended that ‘to achieve satisfactory concealment, three principal factors must be considered: - Siting, Layout and Constructional Form’.<sup>319</sup> Consideration of each of these elements would enable the production of a ‘self-concealing’ building; ‘absence of such forethought may produce buildings which will be far more difficult and costly to camouflage’.<sup>320</sup> The booklet, therefore, represented a forum within which the civil camoufleurs were able to be immensely critical of interwar architectural aesthetics and foster a new aesthetical sensibility which was attentive to the needs of camouflage. Within the opening pages of the booklet, this critique is exceptionally clear; ‘in peacetime, if a factory shows up well from the air – so much the better. It makes a free advertisement...but in war, advertisement may be fatal’.<sup>321</sup> It was contended that these three fundamental factors of siting, layout and constructional form needed to be rethought in order to produce a landscape of ‘absence’ rather than one shaped by ‘presence’.

### 8.6.1: Siting

Writing in the *Architectural Review* in 1944, Trevelyan declared that ‘the most neglected principle of camouflage’ for new construction work was ‘siting to conform to the pattern of the country’.<sup>322</sup> In their examinations of aerial/bombing practices, civil camoufleurs had come to recognise the significance of prominent landmarks in the landscape and how these were used by enemy pilots and navigators to find their way to their target. As a start point, *New Buildings* warned the architect about this, stating that:

‘the navigation of the attacking bomber is checked and assisted throughout its journey by the recognition of well-defined landmarks and the final recognition of the target is greatly helped if it lies close to some feature which is easy to recognise from the air’.<sup>323</sup>

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<sup>319</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.7.

<sup>320</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.4.

<sup>321</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.5-6.

<sup>322</sup> Trevelyan, 1944, p.69.

<sup>323</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.9.

*New Buildings*, therefore, encouraged architects to engage in the aerial view themselves, to become ‘air-experienced’ and understand how downward-looking visual perspectives revealed features in new and unique ways. It was insisted that, if at all possible, the architect should make examinations from the air themselves, and from this seek to identify sites and spaces which would be best suited for locating a new building (effectively mirroring the approach which had now become an integral part of camouflage practice). Only through experiencing vertical visualities and aerial sensations could a full appreciation of the problem be comprehended and ideal sites for new construction be ascertained; ‘by air observation alone can assurance be obtained as to its freedom from objectionable landmarks’.<sup>324</sup>

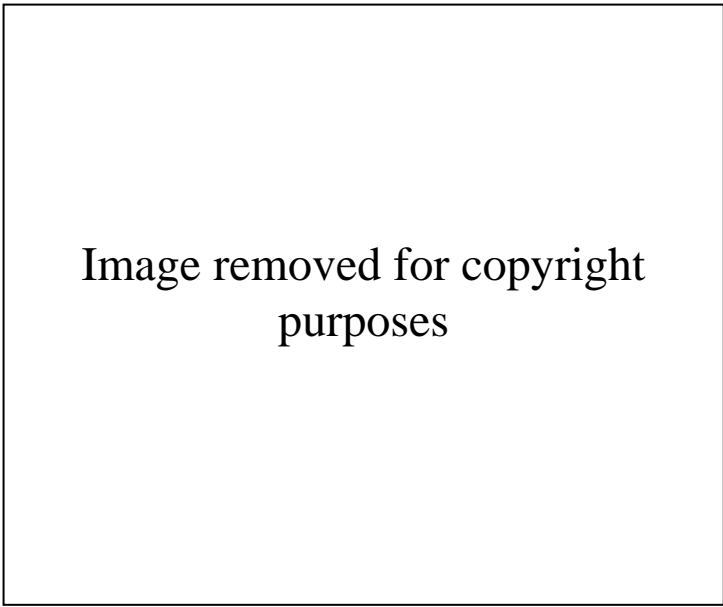


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**Plate 8.10: *Siting***

(Source: TNA, HO217/2).

Drawing on insights derived from their research into enemy bomber practices and targeting techniques, *New Buildings* highlighted how the presence of certain topographical features would have a direct impact on the selection of sites which could be used for development; it was argued that such landmarks:

‘will usually make concealment impossible despite anything which may be done by subsequent camouflage of the buildings. Once the landmark has been seen and

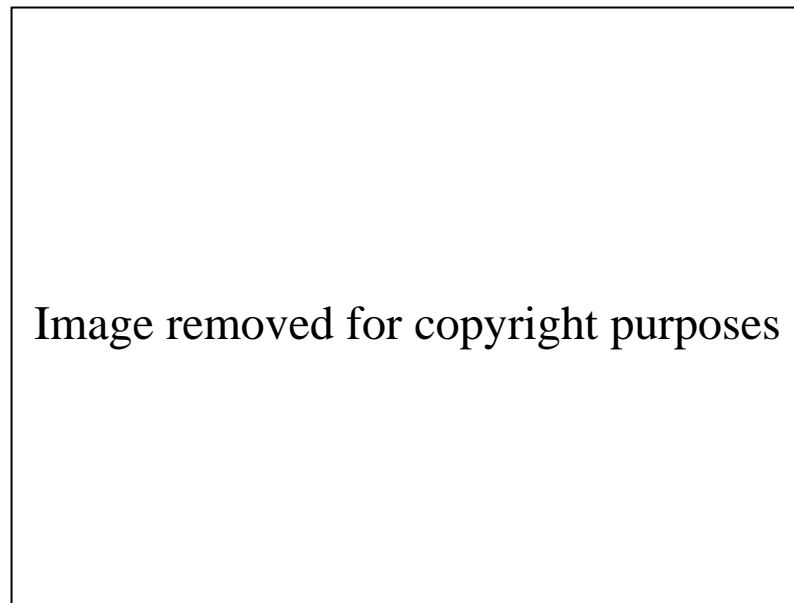
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<sup>324</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.9.

recognised, the position of the target, even if hidden, will be fixed; and the position once fixed, recognition will usually be possible'.<sup>325</sup>

In particular, it was highlighted how:

‘the intersection of rivers, main roads, railways or canals, and well-defined loops in any of these are dangerous. You might welcome a site like this for its good rail and road services, but the enemy would welcome it more as an easy target’ (Plate 8.11).<sup>326</sup>



**Plate 8.11: Aerial photograph illustrating the significance of intersections between rivers, roads and railway infrastructure.**

**(Source: TNA, HO217/2).**

Furthermore, critiques of siting were also directed towards the shape of urban areas when viewed from the air; it was noted how ‘modern town planning often makes conspicuous and characteristic patterns. A site near these is dangerous’.<sup>327</sup> Indeed, it was asserted that modern towns defined through regular forms and geometrical shapes (such as circular housing development) could be easily interpreted and identified on maps used by bomber crews, thus helping them to navigate towards and identify their target. The conspicuousness of these patterns when viewed from the air was, therefore, highlighted within the booklet through the inclusion of a series of aerial photographs to aid architects (see Plate 8.12).

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<sup>325</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.9.

<sup>326</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.11.

<sup>327</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.13.

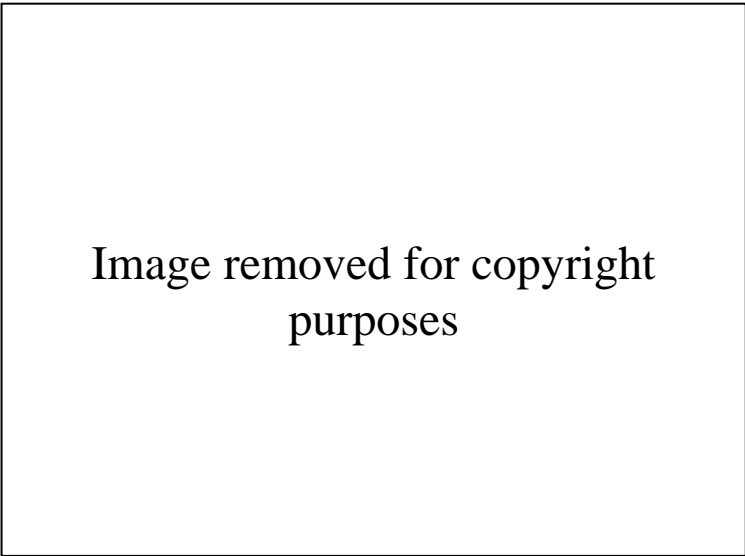


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**Plate 8.12: Aerial photograph illustrating the characteristic patterns of modern town planning.**

(Source: TNA, HO217/2).

At the same time, critiques of the landscape from the air were not simply about identifying features which would expose a location, but also about pinpointing attributes which could be of use to the architect in the designing of their buildings; it was noted that:

‘desirable features for a site are trees and hedges and other indistinctive objects, as well as undulations and changes of texture in the ground itself. A gentle slope, preferably in a southerly direction, is often helpful’.<sup>328</sup>

In order to aid architects with the selection of ‘good’ and ‘bad’ sites, *New Buildings* made use of a similar set of visual comparative devices which had similarly been deployed by planner-preservationists during the 1930s.<sup>329</sup> For instance, *New Buildings* deployed a cartographic representation of a ‘fictitious’ urban area, onto which ‘ideal’ and ‘inappropriate’ spots for new factories were pinpointed (Plate 8.13). On this, Site A was described as ‘an inconspicuous site on the edge of town free from landmarks....Buildings on this site could easily be made to look like an extension to existing housing’, whereas Site C was promoted on account of ‘the wood effectively

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<sup>328</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.53.

<sup>329</sup> For instance, see: Peach and Carrington, 1930; Matless, 1990.



screen[ing] the shadows cast to the north and west sides of the buildings'.<sup>330</sup> On the other hand, sites B and D were discounted as 'unsuitable locations'; at site B, for instance, 'the intersection of main roads and railway pinpoints this site' and therefore such a location is to be disregarded. In order to reinforce the 'suitability' of certain sites, aerial photographs were also included to give the architect a 'visual sense' of how the landscape appeared at these points (see Plate 8.13).

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<sup>330</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.18-19; p.20.

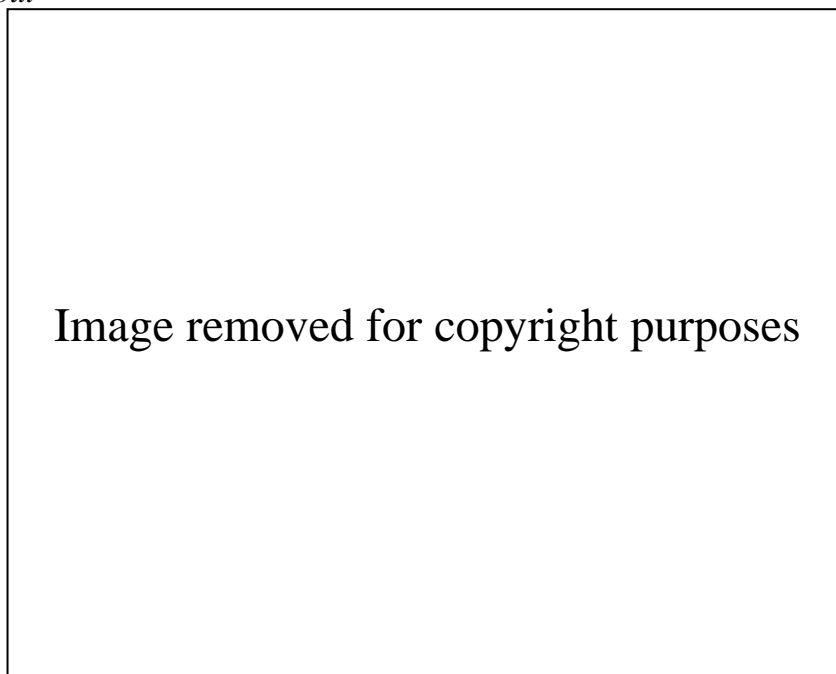


**Plate 8.13: A cartographic representation of a ‘fictional’ town identifying ‘good’ and ‘bad’ sites for the construction of a new building; Aerial photographs of the ‘good’ locations, sites A (bottom left) and C (bottom right).**

**(Source: TNA, HO217/2).**

It was through this visual contrasting of ‘good’ and ‘bad’ locations that it was hoped architects would, on the one hand, be able to acknowledge poor choices in siting and, on the other, seek to identify other locations more suitable to the demands of camouflage.

#### *8.6.2: Layout*





**Plate 8.14: *Layout.***

(Source: TNA, HO217/2).

Following on from ‘siting’, the next issue which architects were told to consider was that of ‘layout’. Within their discussions of how architects could influence this, civil camoufleurs sought to reinterpret and critique how ‘fitness for purpose’ was articulated within building aesthetics. Modern architectural sensibilities of the 1930s had promoted functionality, regularity and ordered structural forms, but as camoufleurs had shown, these sentiments rendered a site to be ‘conspicuous’. In a summary report on camouflage, it was argued that for modern planners:

‘the only rule which is of general application is that a disorderly plan is inferior to an orderly one; for the basic idea of planning is to create order and not disorder. The disorderly plan is perhaps a symptom of escape from regularity and repetition. Regularity and repetition may result in a considerable area being covered with buildings set out row upon row, with the associated network of avenues and cross avenues; the site must then always be conspicuous, especially in a countryside sprinkled with small villages and farmsteads’.<sup>331</sup>

To counteract this, civil camoufleurs suggested that:

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<sup>331</sup> TNA, HO191/8: *Summary Report No.3: Camouflage Research, Part I: The Camouflage Problem*, undated, p.11.

‘the answer to regularity is to be found in ordered irregularity, rather than in disorder and chaos; a large storage depot, covering several hundred acres, may be rendered inconspicuous by orderly planning when it is possible to avoid symmetry and uniformity’.<sup>332</sup>

While sharing British planner-preservationist sentiments for ‘order’ and ‘planning’, this ‘order’ was to be articulated in terms of ‘irregularity’ rather than ‘regularity’ of form. It was on this basis that camoufleurs sought to influence the layout of new buildings.

Within *New Buildings*, the selecting of an architectural layout which embodied ‘ordered irregularity’ was to be ‘controlled by the type of Camouflage to be employed’.<sup>333</sup> In the booklet, two forms of camouflage were outlined, each producing different camouflage ‘effects’. The first was ‘Camouflage for Concealment, in which it is sought to hide the object’ and the second was ‘Camouflage for Disguise where hiding is not attempted but rather a change in appearance from that of a vital target to one of little importance’.<sup>334</sup> This latter method was also referred to as ‘imitative planning’, whereby ‘plan shapes should be considered in relation to surrounding buildings when these exist or with a view to simulating them’.<sup>335</sup> Of these, it was argued that:

‘concealment is the ideal of Camouflage, but circumstances often make Disguise the more desirable method, whilst with large buildings or groups of buildings a combination of the two methods is usually most successful’.<sup>336</sup>

The booklet made it clear that the surrounding morphology of the landscape had a direct effect on which approach was taken, or indeed, whether a mixture of the two was required. In the case of urban environments, both concealment and ‘imitative planning’ were encouraged. In this environment:

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<sup>332</sup> TNA, HO191/8: *Summary Report No.3: Camouflage Research, Part I: The Camouflage Problem*, undated, p.11.

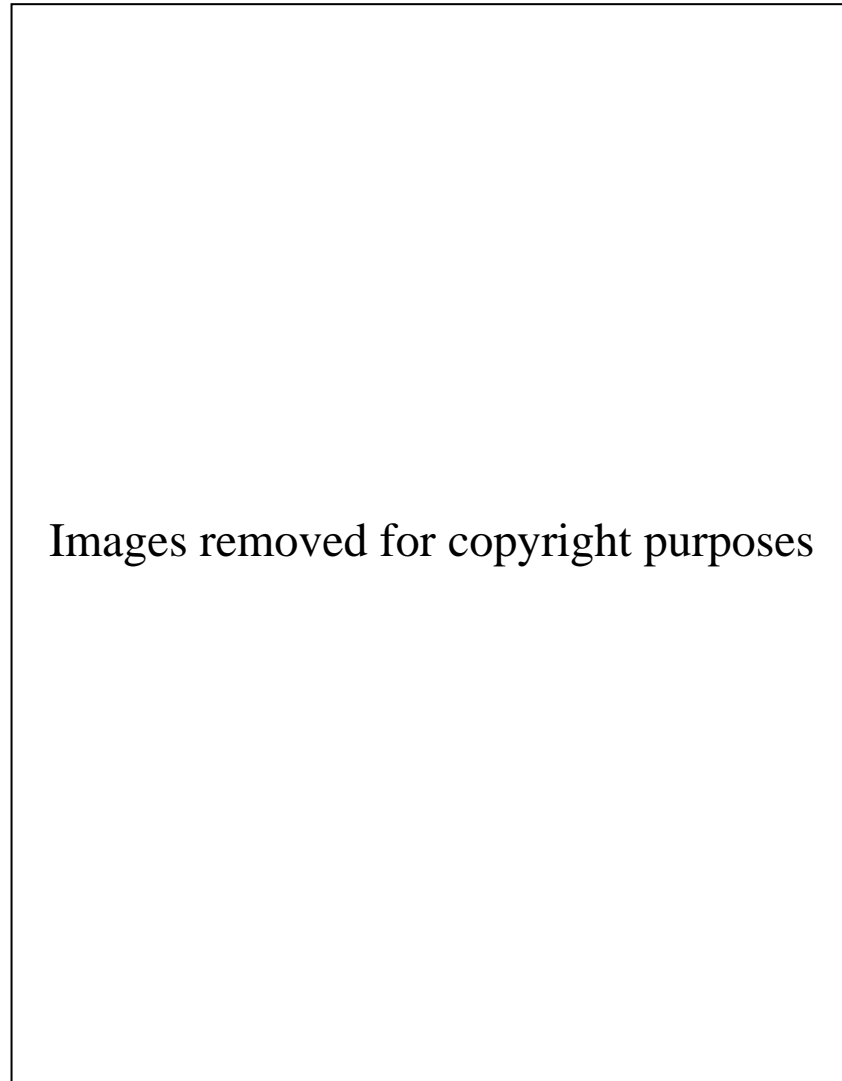
<sup>333</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.21.

<sup>334</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.23.

<sup>335</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.54.

<sup>336</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.23.

‘a normal layout would isolate the factory from its surroundings, service roads and car parks and tend to outline the buildings. But if suitably planned, the lay-out can continue existing development and the usual tell-tale service roads and car parks may be eliminated or screened’ (see Plate 8.15).<sup>337</sup>



**Plate 8.15: Illustrations showing ‘bad’ (top) and ‘good’ (bottom) layouts for a building in an urban area.**

**(Source: TNA, HO217/2).**

Indeed, it was argued that:

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<sup>337</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.26.

‘if the site is contiguous with suburban development, lay-out should as far as possible conform to and extend the neighbouring street plan, thus facilitating the concealment of the buildings as dwelling houses’.<sup>338</sup>

Furthermore, it was contended that maximum use be made of existing road networks, rather than devising new ones;

‘existing roads should if possible be used and new straight wide roads should be avoided; in fact, road making should be reduced to the minimum and a road should not terminate in an obvious way at the building it serves... roadways should be surfaced with dark non-reflecting materials’.<sup>339</sup>



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<sup>338</sup> TNA, HO191/3: *Camouflage of Vital Factories and Key Points, 1939-1945*, MoHS, Section4, p.10.

<sup>339</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.53.



**Plate 8.16: Illustrations showing ‘badly’ planned (top) and ‘effectively’ planned layouts (bottom left) for rural areas, with a further illustration indicating the location of the ‘self-concealed’ factory (bottom right).**

(Source: TNA, HO217/2).

For rural areas, where civil camoufleurs argued that irregularity dominated the landscape and where the challenges were somewhat different, the tactic of concealment alone was advocated;

‘concealment is...more suitable than disguise as houses. A normal layout...is obviously undesirable, as it is easily seen by its regularity and the light frame of its roads. A better situation [would be]..., where full use is made of the adjacent wood and where roads are no longer obvious and cars may be hidden in the trees’ (see Plate 8.16).<sup>340</sup>

Interestingly, within *New Buildings*, debates surrounding lay-out were not solely confined the designing of new factories but were also extended to include the temporary huts which were to provide accommodation for construction workers and their families. Due to wider anxieties that worker populations were themselves a target from the air, it was argued that construction worker lodgings should also be planned in order to prevent them acting as a ‘guiding mark’ or becoming a ‘targetable’ themselves. *New Buildings*,

<sup>340</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.26.

for example, argued that ‘huts scattered as if shaken from a dice box are sure to attract attention’.<sup>341</sup> Elsewhere, geometrical ground patterns were labelled as ‘a bulls eye’;

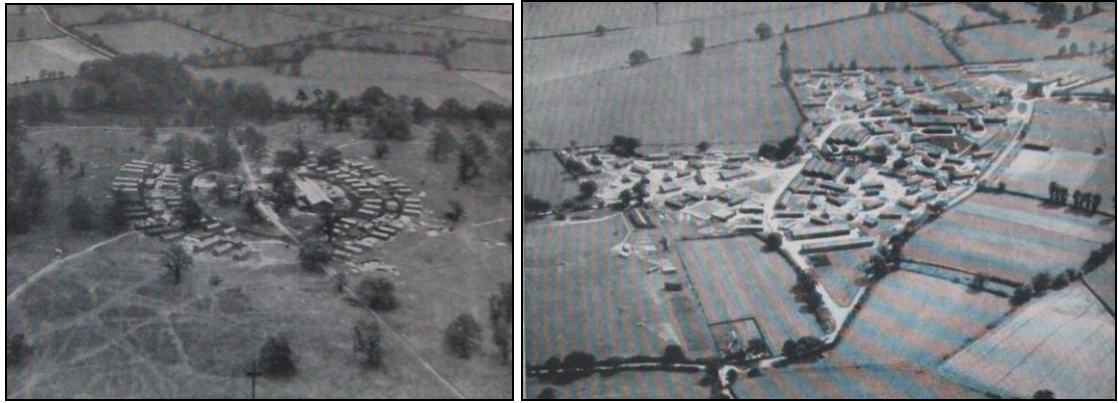
‘huted camps are often noticeable from the air because their lay-out is either geometrical or grid-like or dispersed over a large area with an aimless irregularity. They have usually no orderly lay-out of the kind common to domestic buildings, neither have they garden plots which are such a noticeable feature of housing estates when seen from the air’(see Plate 8.17).<sup>342</sup>

What is evident here is an extension of some of the debates of the planner-preservationists, where disordered, chaotic and scattered development was extensively frowned upon.<sup>343</sup>



Images removed for copyright purposes





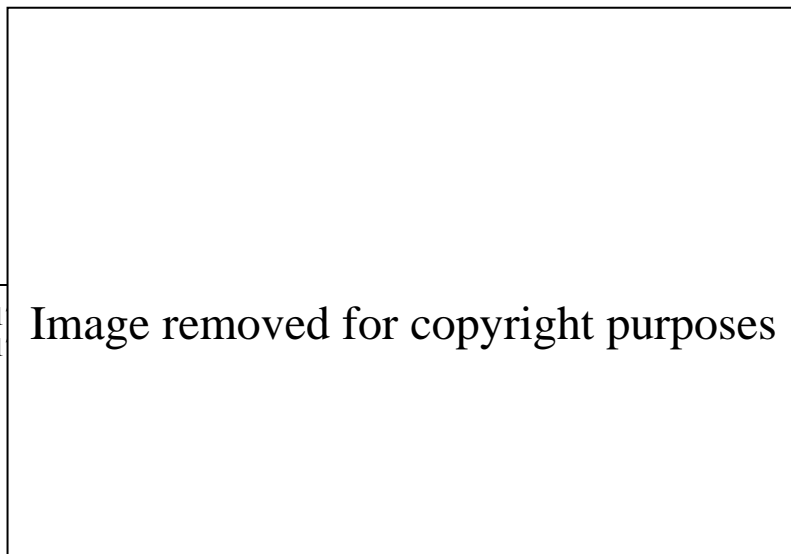
**Plate 8.17: Illustration warning that if scattered lodging development continued, ‘the Enemy will know that something big is happening’ (top); Aerial photographs taken of workers lodgings illustrating their ‘bulls eye’ (left) as well as ‘chaotic’ (right ) visual appearance from the air. (Source: TNA, HO217/2).**

For workers lodgings, then, the strategy of disguise was encouraged, by merging into or through the simulation of existing patterns of development. *New Buildings*, for instance, suggested that:

‘disguise may take the form of a suburban village or farm lay-out. New roads must be laid out to link up with existing roads and the huts sited so that the plan is in character with its environment’.<sup>344</sup>

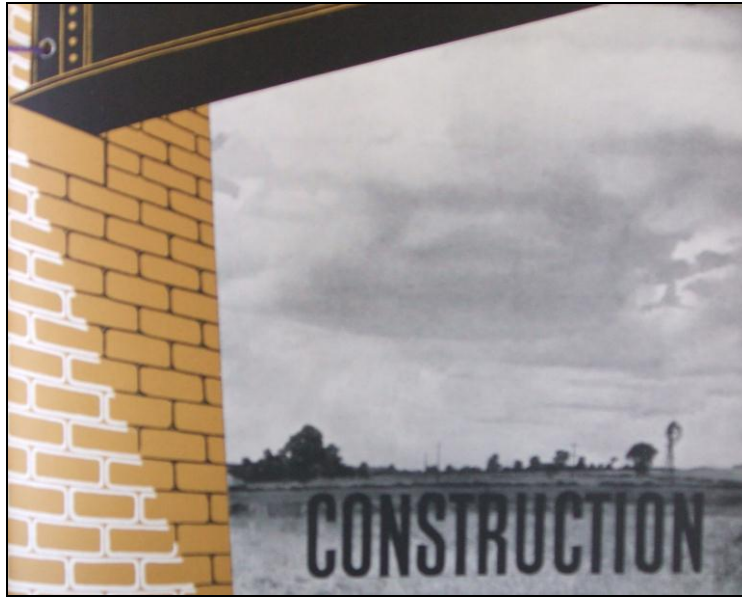
To complete the effect, architects were also instructed to pay attention to other natural and artificial ground patterns to complete the illusion. False hedges, crops, cultivation, tracks and roads were all encouraged to distract attention from the hutments themselves; ‘to the air view the treatment of the ground round a hutment is of more importance than the disguise of the huts themselves’.<sup>345</sup> Through these subtle variations, lodging spaces could become part of the everyday, mundane landscape, rather than acting as ‘advertisements’ that construction work was underway.

### 8.6.3: *Constructional Form*



<sup>344</sup> TNA, HO21  
<sup>345</sup> TNA, HO21

<sup>344</sup>, p.27.  
<sup>345</sup>, p.29.



**Plate 8.18: Construction.**  
(Source: TNA, HO217/2).

The final element which civil camoufleurs endeavoured to influence was that of ‘constructional form’. Unlike the other two aspects of ‘siting’ and ‘layout’, it was within discussions of constructional form that stronger relationships and communication networks between the architect and the camoufleur were greatly advocated. In *New Buildings*, it was contended that:

‘if proper consideration is to be given to a suitable form of construction giving improved concealment, the earliest consultation between Architect and Camouflage Expert is essential’.<sup>346</sup>

It is with this issue of ‘constructional form’ that accountability for the civil camouflage problem was perhaps most significant; the booklet discusses how:

‘the difficulty and costliness of camouflage for buildings has in the past been largely due to their external shape. This has been dictated by the requirements of production or function and by convenience in erection’.<sup>347</sup>

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<sup>346</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.42.

<sup>347</sup> TNA, HO217/2: *Concealment of New Buildings: Camouflage Committee Memorandum*, p.42.

In order to articulate a constructional form which facilitated self-concealment, it was recognised that architects must strike ‘a balance...between convenience of operation and the need for concealment’.<sup>348</sup>

Within official camouflage discourses, several suggestions had already been put forward as to how constructional form may be manipulated for the purposes of ‘self-concealment’. Within the *Handbook of Camouflage Practice* (1942), it was suggested that ‘the longest and highest side of a building should generally face towards the south’, and that:

‘no building should exceed 200ft. in its longest dimension and consideration should be given to the question of dispersal to minimise bomb damage...local colour should [also] be considered in the selection of external materials, otherwise these should be dark and neutral in colour... ornamental features, stone copings and string courses are to be avoided as is anything likely to cast a distinctive shadow, such as gable or parapet wall or a range of ventilators’.<sup>349</sup>

Furthermore, attention to the roof type deployed was also considered to be of significance, with the intention being to reduce conspicuous traits such as glint and glare as well as forms which were not conducive to camouflage. It was argued that:

‘the arched roof is almost invariably bad; the form is unusual, being only employed in normal construction to cover large spans; [on these roofs] camouflage by surface treatment is more difficult than on flat or pitched roofs’.<sup>350</sup>

Arched roofs were, therefore, discouraged, with flat roofs being the preferred method, for these were considered to be more favourable for enabling surface and netting treatments if required. On this point, however, it was stressed that ‘flat roofs when used

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<sup>348</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.53.

<sup>349</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.54.

<sup>350</sup> TNA, HO191/8: *Summary Report No.3: Camouflage Research, Part I: The Camouflage Problem*, undated, p.11.

should have more than the normal fall to obviate the possibility of standing rain water and to assist drying'.<sup>351</sup>

In contrast, *New Buildings* advocated a design which would physically be integrated into the landscape; the 'ideal', it was argued:

'is no doubt the buried or semi-buried factory, but short of this, one with a flat roof surrounded by banks which slope gently into the surrounding ground can be very effectively hidden' (Plate 8.19).<sup>352</sup>

Although the argument was made that 'for many reasons such construction may not always be possible', the booklet maintained that:

'the cost of building these types is often not much higher than for normal construction, whilst the amount of applied camouflage necessary to provide any given level of concealment is considerably less'.<sup>353</sup>

Furthermore, such a design, it was argued, 'gives complete disguise from the air whilst vital work goes on uninterrupted in the spacious factory below'.<sup>354</sup>

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**Plate 8.19: Plans for a buried Factory Type H (top left and right); Photograph of the appearance inside a buried factory (bottom).**

(Source: TNA, HO217/2).

This ‘buried’ constructional approach appears to have been advocated and deployed as an operational technique for the concealment of oil tanks. In Chapter Six, the complex difficulties of concealing cylindrical forms such as oil tanks were outlined. In short, existing forms of camouflage all had their drawbacks. Paint schemes were wholly ineffective, netting and textural treatments were considered a fire hazard, and even horticultural treatments such as the obscuring of the tanks behind trees had been demonstrated to have their own difficulties. At the Barry oil installation, for example, ‘extreme difficulty’ had been experienced with the planting of trees there;

‘the soil at Barry was largely composed of barren rock with very little top soil at all, and two Local Contractors had flatly refused to tender saying it would be impossible to plant tree tops here at all...[Furthermore] as there were no trees in this area...the sudden appearance of some might attract attention to the site’.<sup>355</sup>

Commencing in 1941, experiments had begun with the subterranean burial of oil tanks, and in the light of criticisms directed at other camouflage methods, it became more widely accepted as a method of concealment. Under ‘covered storage’, as it was branded by the Petroleum Department, oil tanks would either be buried individually or

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<sup>355</sup> TNA, HO186/1331: *Report of a visit to Petroleum Department and Petroleum Board on 27th October 1941.*

grouped together under a single mound. In the enacting of this burial, however, ‘ordered irregularity’ was key. For example, in 1942, Glasson was made aware of a group of oil tanks which had been buried individually and which were now ‘badly concealed from daylight observation, giving the appearance of two or three rows of puddings’ (Plate 8.20).<sup>356</sup> To resolve this issue, it was proposed that grouping them all under a single mound would be the preferred method.<sup>357</sup> In addition to how the tanks should be grouped, camoufleurs suggested that the mounds themselves should be of an ‘irregular’ shape, with side which ‘in plan...are built to a gentler slope to avoid casting heavy shadows’, which could heighten the visible presence of the buried tanks.<sup>358</sup> Mounds should also be ‘promptly seeded’ to enable the growth of grass. Finally, attention should also be given to obtaining ‘good siting’; new farms should be located in areas ‘free from landmarks’ and should, where possible, ‘mak[e] full use of all natural features such as trees and hedges which should be left undisturbed’.<sup>359</sup> Through an attentiveness to all of these dimensions, an oil farm could be successfully buried and merged into the landscape (see Plate 8.21).

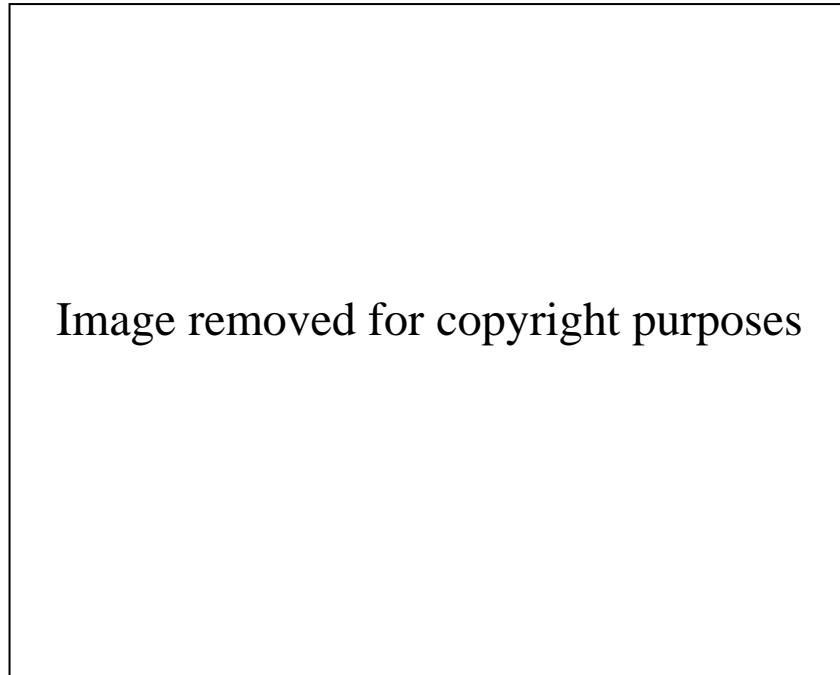
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<sup>356</sup> TNA, HO186/1331: *Correspondence*, L.M. Glasson, to T.R. Cave-Browne-Cave, dated 13th January 1942. Some stark comparisons could be made here between the images produced of the ‘pudding’-like appearance of these buried tanks and the visual traces of the ancient landscape (mounds, groundworks, etc) which had been ‘revealed’ to the interwar aerial archaeologist. See Hauser, 2007; Stichelbaut *et al.*, 2008.

<sup>357</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.56.

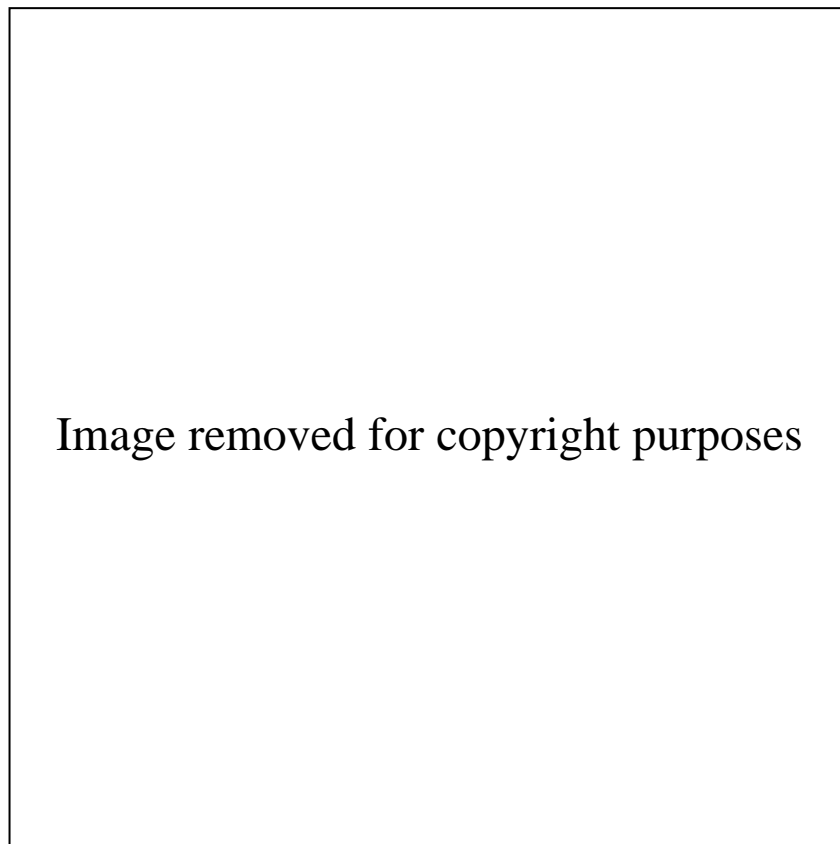
<sup>358</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.56.

<sup>359</sup> TNA, HO186/1985: *Handbook on Camouflage Practice*, C.D.C.E., MoHS, Leamington Spa, 1942, p.56.



**Plate 8.20: An aerial photograph illustrating an example of an ‘unfavourable’ burial of oil tanks. The siting was considered to be particularly ‘exposing’, with the tanks giving the appearance of ‘puddings’.**

**(Source: TNA, HO186/2769).**



**Plate 8.21: A more ‘effective’ approach to concealing an oil farm through burial. The tanks are located in the bottom right-hand corner of the image.**

**(Source: TNA, HO186/2769).**

### 8.7: ‘Self-concealing’ architecture II: some ‘unofficial’ alternatives

While discussions on siting, lay-out and constructional form within *New Buildings* may seemingly represent the ‘definitive’ way in which ‘self-concealment’ was to be attained, there were ‘unofficial’ camoufleurs who had taken an interest in the designing of buildings for concealment. Amongst those suggesting alternative techniques was Col. C.H.R. Chesney, who in his book *The Art of Camouflage* (1941), outlined his vision of how structural engineers and architects could contribute to the civil camouflage project. Like some of his biologist contemporaries, Chesney has been very critical of the privileged position that artists held within ‘official’ camouflage work, exclaiming that:

‘paint is only an accessory to the crime, and seldom by itself constitutes satisfactory camouflage...Camouflage is not *primarily* the job of a painter artist!...The more trained and expert he is as a painter, the less desirable is it that he should be placed in the position of controller’.<sup>360</sup>

For Chesney, ‘the best camouflage work upon an object is done before the object is sited or has even been designed’.<sup>361</sup> With this in mind, Chesney outlined within *The Art of Camouflage* how he envisaged architects being able to contribute to the fostering of a ‘self-concealing’ aesthetic. Chesney, for instance, suggested that buildings be made as low as possible; ‘many factories...are built unnecessarily high. Every inch of height that is not essential should be cut out’.<sup>362</sup> Furthermore, he encouraged architects to think about including trees in their designs in order to disrupt the shadows cast by buildings;

‘instead of cutting out all those in the immediate neighbourhood of the building as is the usual custom, they can be left when advantageous for camouflage purposes, and more planted to that end’.<sup>363</sup>

Chesney also called for more attention to the integration of glass into new buildings. Although the burying of factories and other industrial undertakings removed the need for glass and with it the issue of glare (a visual trace which could potentially contribute to the giving away of an industrial site), Chesney argued that the absence of any roof

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<sup>360</sup> Chesney, 1941, p.103.

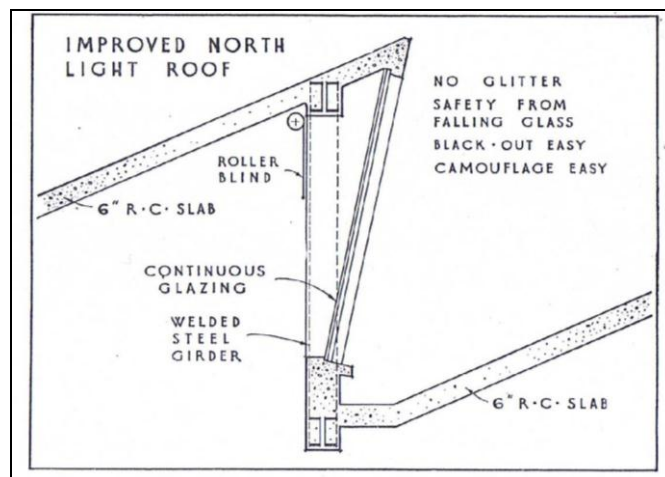
<sup>361</sup> Chesney, 1941, p.103.

<sup>362</sup> Chesney, 1941, p.117.

<sup>363</sup> Chesney, 1941, p.117.



lighting could be equally problematic. No roof windows in subterranean factories were considered to place a greater reliance upon the provision of electricity supplies, which themselves were targets for aerial attacks. Chesney, as well as others, contended that the removal of glass was not necessary, and that attention should instead be given to thinking about how glass could be included within the design. Chesney, for instance, remarked that if glass was required, ‘the orthodox glassed face towards the northern sector is the best arrangement possible. Reflection is thus reduced to the minimum’.<sup>364</sup>



**Plate 8.22: An illustration by Glover, showing his proposal for an improved north light roof.**  
(Source: Glover, 1941, p.584).

Elsewhere, Charles William Glover, another proponent of including architects in camouflage work, was also acutely aware of the issues which glass posed in the construction of new buildings. Within his work, *Civil Defence: a practical manual* (1941), he proposed that:

‘roof lights which reflect light from the sun and moon and which are particularly vulnerable to damage by blast, splinters and shell fragments [should] be superseded by solid glass bulls-eyes or prisms, which are embedded in flat reinforced concrete roofs’.<sup>365</sup>

Furthermore, he suggested that the glass should be angled, commenting that:

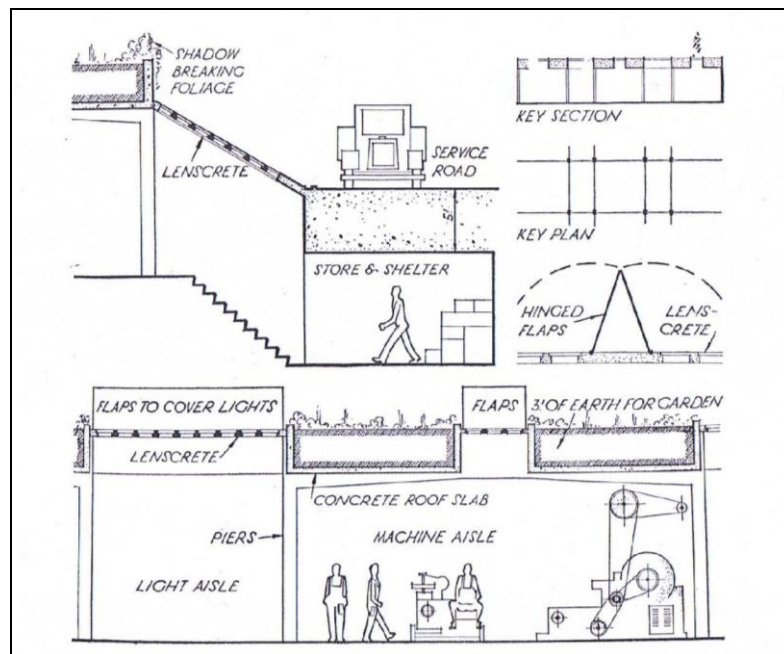
<sup>364</sup> Chesney, 1941, p.117.

<sup>365</sup> Glover, 1941, p.584.

‘the fact that the glass leans outwards at the top has the following advantages: (1) It is not possible to see a glittering reflection from it in the air; (2) Its camouflage is therefore easier; (3) Fractured glass could be caught safely on the exterior of the roof; (4) Blacking out by means of interior opaque roller blinds is facilitated’ (see Plate 8.22).<sup>366</sup>

In addition to contributing to discussions on the use of glass, Glover’s account also provided alternative recommendations for roof designs. In a slight deviation from ‘official’ commentaries, Glover proposed that roofs be constructed in such a way as to provide economy, permanence and protection. In contrast to submerged constructions which were covered over with turf or grass seeds, Glover instead suggested that agricultural crops be used, with the yields contributing to food production; in his design for the ‘factory of the future’, Glover outlined how:

‘the concrete roof carrying 3ft of earth makes possible the growing of crops on the roof, thus recovering to agriculture some of the lost acreage, proving automatic camouflage, protection against the incendiary bomb and increased thermal insulation’ (see Plate 8.23).<sup>367</sup>



**Plate 8.23: ‘The factory of the future’.**

(Source: Glover, 1941, p.585).

<sup>366</sup> Glover, 1941, p.584.

<sup>367</sup> Glover, 1941, p.585.

These alternative narratives suggest that ‘self-concealment’ could be achieved in many ways. Regardless of whether they were ‘official’ in origin or not, these ideas about influencing building style all shared a common agenda; lessons should be learnt from war to re-define and transform aesthetical traditions in the post-war, peacetime world.

### **8.8: Conclusions**

This chapter has explored the efforts of civil camouflage practitioners to intervene in building practices and the articulation of architectural aesthetics. In doing so, it has sought to reveal the assemblages of human and non-human actors involved in the reconfiguration of building spaces and practices as well as the nature of buildings in themselves. Inspired by recent geographical debates surrounding architecture and construction work, this chapter set out to explore how camoufleurs sought to ‘prevent’ the emergence of ‘conspicuous’ architectural aesthetics which had defined the interwar landscape. Taking the aerial view as a start point, the interventions of civil camoufleurs were conceived as a way of preventing the mass expenditure of materials and labour upon extensive camouflage treatments that were required to ‘cure’ the ailments of ‘bad’ planning practices. The chapter began by highlighting some of the contemporary critiques of construction sites and new buildings and the anxieties that these generated not only for camoufleurs but also the wider public. Following on from this, attention was given to some of the early suggestions to modify the appearance of modern structures that were shaped by regularity of form. Despite assertions from within ‘official’ camouflage circles that interventions needed to be made in the designing of new buildings, this first section noted how the initial proposals emanated from individuals working outside of government camouflage practices. Consisting primarily of ‘structural additions’, these solutions sought to break down the constructional form of a building through the distortion of their regular appearance when viewed from the air. However, as was demonstrated in the Chapter, these ideas remained hypothetical, with Bernard’s method of ‘distortion’ never progressing beyond the sketches he sent to the MoHS and the I.C.R.U.’s proposal remaining in ‘model’ form. In both cases, these solutions were considered to be very much ‘afterthoughts’ to be applied to buildings once constructed rather than suggestion much fuller re-interpretations of architectural style.

In light of this, the Chapter proceeded to explore how as the war progressed and the challenges of concealing construction sites and new buildings became ever more problematic, 'official' civil camoufleurs slowly began to re-consider the engagement with architects. As part of this, attention was devoted to the forming of relationships between camoufleurs and other actors involved in building work: this included not only other government departments but also building contractors and factory owners. Emerging from the establishment of these associations, this chapter illustrated how civil camoufleurs at the C.D.C.E. and the Camouflage Directorate first drew their considerations to the removing of the 'emerging' presence of a landscape of construction. Acknowledging that construction work produced particular traces in the landscape, civil camoufleurs were involved in the creation of a series of 'pre-emptive' practices which would prevent the materialising and surfacing of visual markers. In the first instance, this entailed civil camoufleurs advising building contractors on the 'disciplining' of the construction site and the practices being carried out by construction workers through a combination of formal and informal interventions. This included not only the use of 'informative' leaflets but also 'inspectors' in the form of the horticultural officers.

Following on from this, consideration was also given to a variety of horticultural and artificial treatments that were devised for the concealment of ground scars that often demarcated new building spaces both during and in the initial phases after construction. With respect to these two aspects, attention was given to the specific geographical dimensions of their practice as well as the particular issues associated with the localities in which they were to be performed. In the case of horticultural treatments, the initiation of horticultural camouflage was to be shaped through a variety of localised practices: regional CWAECs were deployed to carry out the work and small scale, yet highly specialised research clusters were consulted for knowledge on plant species and mixes, as well as for the uncovering of processes for 'successful' and 'effective' cultivation. Local pedology would determine which plant species could be utilised and the visual morphology of the landscape would also determine the type of horticultural treatment utilised; in the case of the latter, various combinations of plant seed as well as different concentrations of fertilisers were developed and operationally deployed to generate different textural appearances. In relation to artificial treatments, these techniques were very much determined by the local availability of materials and labour, with certain

areas being identified as ‘ideal’ locations for the obtaining of particular aggregates, waste products and ‘natural’ materials. Through the adoption of one or a combination of these techniques, civil camoufleurs sought to suppress the visual impact that construction impressed upon the landscape and, thus, reduce the ‘targetability’ from the air of new buildings.

In the final half of the chapter, the empirical focus was on the direct engagements between civil camouflage practitioners and architects. Fuelled by a desire to transform the visual appearance of new buildings so that concealment would be made easier and the task of the camoufleurs be significantly reduced, this section looked at how civil camoufleurs sought to produce a ‘self-concealing’ architectural style through an aesthetical attunement to the issues of siting, lay-out and constructional form. As part of this analysis, attention was focused upon the cultivation of a landscape shaped by ‘ordered irregularity’, with particular emphasis on the production of *Concealment of New Buildings*, an instructional booklet composed of visual comparative devices of ‘bad’ and ‘good’ building and planning practices as well as cartographic representations revealing ‘ideal’ locations; in some respects, there were parallels here with some of the representational devices utilised by interwar planner-preservationists, whose ideas about the modern landscape camoufleurs were extensively critiquing during this time period. In addition to this, insights into the wider discursive arguments about the constructional form of an industrial building were also examined, with ‘unofficial’ camoufleurs offering alternatives to the concealment in subterranean spaces which was being advocated by government camouflage practitioners. In some cases, these alternative narratives suggested a variety of solutions, from the relatively ‘mundane’ re-thinking about the positioning and construction of windows and the height of an industrial building to prevent cast shadows, to the much more ‘extensive’ and ‘spectacular’ production of a subterranean ‘factory of the future’ that enabled productivity both within the factory and above it. While these different architectural practices were encouraged in the name of the defence for industrial sites and locations, the emergence of a self-concealing aesthetic during the Second World War clearly represented a turning point in the redefining of conceptions about the aesthetical presence of the everyday landscape.

## **Chapter 9**

### **Conclusions**

Throughout this thesis, I have explored the spaces and practices of ‘civil camouflage’ as carried out in the British ‘Home Front’ landscapes of the 1930s and 1940s. This empirical example has been utilised to elucidate the spatial significance of camouflage in shaping and transforming conceptions and imaginings of landscape. In light of the relatively confined discussions of camouflage in relation to disciplines such as art, history, biology and architectural studies, this thesis has argued that a critical examination of the historical and cultural geographies of camouflage was required. In Chapter One, it was asserted that practices of camouflage possess inherent spatial characteristics and that these merited further exploration by historical and cultural geographers in their engagement with an array of conceptual and theoretical debates of interest to them. While the chapter highlighted a whole range of geographical debates which could have been engaged with through the adoption of a variety of alternative camouflage case-studies, for the purpose of this study it was decided that the selection of civil camouflage, as practiced within the British landscapes of the late 1930s and 1940s, would provide an empirically rich, highly detailed and thematically concentrated research project that would act as an entry point for a wider critical geography of camouflage. Through the selection of this particular case-study, the thesis has focused upon a specific set of geographical debates that are at the heart of contemporary discussions within historical and cultural geography. These themes were the cultural and historical imaginings of landscape, the effects of different atmospheric and perceptual conditions in shaping body-space engagements, the continuing role of the visual in constructing knowledge about, and the transformation of particular spaces, and the complex entanglements between aerial and terrestrial geographies. Subsequently, consideration of these various issues shaped the empirical discussions and narratives of the thesis in its approach to civil camouflage.

In this concluding chapter, I want to reflect upon the wider contributions of the thesis with the themes outlined above forming the basis of this discussion. The chapter is, therefore, divided into four sections, with each emphasising the spatial dimensions and

conceptual and theoretical debates with which this study of civil camouflage was positioned.

### **9.1: Spaces of Camouflage Knowledge Production**

To begin with I want to reflect upon the research findings in relation to the production of camouflage knowledge and the spaces involved in this process. In Chapter One, it was argued that camouflage is a highly inter-disciplinary practice, composed of and assembled through associations between different ‘specialist’ knowledges. More broadly, in Chapter Two, it was highlighted how military institutions draw upon a variety of knowledges in the conduct of war, with particular emphasis being placed upon existing work on geography’s relationship with the military and how geographical knowledges and specific skills associated with the discipline itself have been utilised for the purpose of military activities. However, it was contended that studies in relation to this association have focused on the role of ‘academic’ and ‘professional’ geographers in the production of geographical materials, rather than the broader utilisation by a variety of ‘militarised’ individuals. Given the inter-disciplinary nature of camouflage work, and also its inherent spatial characteristics, this thesis has explored some of the engagements between civil camouflage practitioners and a wide range of ‘geographical’ material cultures. In particular, attention was focused upon interactions between camoufleurs and cartographic material in helping to shape the ‘geographical imagining’ of a ‘conspicuous’ site before undertaking an aerial assessment, the use of aerial survey reports to record the general appearance of natural and artificial topographical forms, and the role of aerial photographs to capture the landscape and aid in the memory recall of particular industrial sites and locations. Furthermore, the use of models as a means of visualising geographical information has also been highlighted.

Going beyond these ‘geographical’ sources, this research has explored some of the other types of knowledges involved in the production of camouflage: networks of association with ‘aerially experienced’ individuals provided insights into bombing practices and tactics, as well as aerial viewing techniques. Elsewhere, ‘optical experts’ were able to generate understandings on the physiological capabilities of the bomber body during both day and night conditions as well as insights into the optical properties of various texturing materials. In addition to these sources of intelligence, civil camoufleurs were also inspired by, and included, other forms of knowledge within their practices. In

Chapters Four and Six, discussions of the utilisation of artistic forms of knowledge showed how the camouflage effects of toning down, imitation and disruption were achieved by paint-based solutions. Experts in ‘paint science’ provided information on the types of paint to be used on particular building surfaces as well as aiding in the monitoring and ‘governance’ of paint quality and the standardisation of particular colours and pigments. Various other ‘disciplines’ also attempted to negotiate a space for themselves within the broader discourses of camouflage: structural engineering was used in production of supporting frames and wires for camouflage netting and screens; chemists and physicists were involved in the development of camouflage treatments such as coal-dust films for water spaces and the darkening of smoke plumes; horticulturalists and biologists were employed in the treatment of scarred ground; and engagements with architects was encouraged in order to rectify and modify architectural aesthetics to prevent the emergence of ‘conspicuous’ building styles. These different engagements enabled the overcoming of the specific challenges presented by visual traces in the landscape such as the presence of shadows, tonal and textural contrasts as well as the unique issues presented by the need to conceal smoke and water surfaces.

As well as emphasising the different types of knowledges involved in camouflaging, Chapter One highlighted the need to consider the places in which these knowledges are produced, mobilised, contested and negotiated. In the context of this research, multiple geographical spaces in which knowledge was constructed and experiments carried out have been examined. In the first instance, the committee meeting room was an important site that enabled the discursive construction of the bomber body, the deliberation about which techniques should be trialled, and the discussion of the ‘success’ of various camouflage methods and how they could be improved. In addition, the Viewing Room was also an important site of assent, a proving ground to test the efficacy of a camouflage scheme when observed in variety of conditions. Other sites of experimentations and knowledge accumulation were also emphasised: the use of oil installations to trial paint-based methods in Chapter Four; the spaces of the aeroplane to make observations about the landscape in Chapter Five; the demonstrations held on gasholders to prove that fire-fighting efforts were not hampered by the presence of steel-wool texturing within Chapter Six; the use of militarily requisitioned spaces such as Compton Verney for the trialling of water camouflage methods in Chapter Seven; and knowledge obtained from agricultural and green-keeping research stations in



dialogues concerning horticultural camouflage in Chapter Eight. These different sites of experimentation vary significantly in terms of their size and the specific types of camouflage that were associated with them, but nevertheless combined together to form the ‘discipline’ of camouflage.

Through an attentiveness to the different sites of camouflage knowledge production, both in terms of the intersecting and interconnecting disciplinary and experimental spaces involved, a unique empirical contribution has been made here in relation to the broad subject matter of camouflage. As was highlighted in Chapter One, existing accounts of camouflage have testified to the wide range of disciplinary pursuits and explored, to some extent, the connections and conflicts between its natural and artificial manifestations. More often than not, however, the practice of camouflage is often reduced to a series of dialectical schools of thought: the artistic and the biological, the natural and the artificial.<sup>368</sup> In doing so, however, such an approach has closed off recognition of the multiple forms that camouflage can take. As was highlighted in the case-study rationale, civil camouflage provided an opportunity to explore the variety of knowledges involved in the shaping of the ‘discipline’ of camouflage and indeed the spaces where these knowledges have been produced, negotiated, challenged and re-appropriated; this re-emphasises the value of a geographical perspective in terms of thinking about the constitution of camouflage as a ‘discipline’.

## **9.2: Situated Vision**

Having highlighted an empirical contribution that a geographical engagement with camouflage has facilitated, I now want to focus on the series of contemporary geographical debates discussed in Chapters One and Two, which it was argued a study of civil camouflage would contribute to. I want to begin by considering the contribution of this research to ongoing debates about vision, visibility and visual culture. In the initial set up of the research, one of the spatial dimensions of camouflage highlighted was the notion that camouflage is a technology devised to subvert the gaze of a particular threat, this threat being imagined or realised. Critiquing the work of Shell that ‘disappearance is... always *from* something’, the argument was made that this

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<sup>368</sup> Forbes, 2011.

something has to be located *in relation to* somewhere.<sup>369</sup> Throughout the thesis, the continued importance of the visual in structuring socio-spatial engagements between human and non-human actors and the spaces in which they are situated has been strongly emphasised. Indeed, in line with recent work into visual geographies, this research has positioned vision (be it in terms of direct observation or a series of visual representations, cultures and practices) as being one of the central tenets through which we accumulate knowledge about ourselves, others and the world around us. At the same time, while geographers have long considered a wide range of ocular practices, visual regimes and optic technologies, this research into camouflage has suggested that more critical attention needs to be paid to the ‘situatedness’ of the visual encounter in three particular, yet interconnecting ways.

Firstly, it is argued that examinations of the visual experience need to consider the spaces in which viewing takes place; these spaces can be conducive to articulating a particular ‘way of seeing’ by the viewing subject or indeed, even affect the ways in which the viewing subject themselves may engage with spaces, places and landscapes that extend beyond their immediate vicinity. In the context of this research, a multitude of viewing spaces have been considered, from the confines of the aeroplane through to the simulated spaces of the camouflage viewing room, each shaping the viewing experience in highly specific ways. In the case of the former, the elevated position of the aeroplane produced new and unique ways of interacting with the terrestrial landscape (discussed in detail later in this chapter), with it also being highlighted that the experience of kinaesthetic motion and the ‘vibrations’ of flight and even the environment of the aeroplane itself (for instance, Perspex windows) could all serve to disrupt, disconcert, agitate and inhibit the visual experiences of the bomber body, producing moments of distanciation between viewer and landscape. Likewise, in the case of the viewing room, particular technologies and visual effects were produced and simulated in order to replicate the aerial experience and the encounters with the terrestrial landscape enabled by this; this in itself highlights how different spaces seek to not only replicate particular viewing experiences but also possess their own unique characteristics. These different examples, then, show how associations between the

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<sup>369</sup> Shell, 2012, p.10.

viewing subject, its immediate surrounds and its location within particular technological assemblages need to be considered in the examination of any viewing experience.

A second dimension to emerge in relation to this is the situatedness of the visual experience with respect to the subject engaged in the visual act and the effect of other embodied actions that accompany the viewing experiences of that individual. As highlighted throughout the thesis, while vision can play a central role in the production of knowledge and understandings about spaces, places and landscapes, it is not a sensory engagement that is disconnected from the influence of a wider variety of affects and sensations, nor is it detached from other embodied actions. Indeed, I have highlighted that acts of ‘looking’, ‘observing’, ‘gazing’ and ‘scanning’ (amongst other ‘ways of seeing’) entail a variety of embodied processes; looking at something or someone is not just simply looking, but incorporates acts of reflection, deliberation, judgement, inspection and recording. This research has contended that the visual encounter, then, needs to be situated in relation to these wider embodied actions because these affects can produce temporal and spatially specific shifts and variations in the affinities and distanciations between body and space. The case study of camouflage has shown that while vision is often at the heart of our understandings of the world, attention needs to be given to the effect of these surrounding affects, sensations and embodied actions and the ways in which they transform how we engage with, understand, represent and reproduce the spaces, places and landscapes that we inhabit and co-exist within.

A final theme to be considered here is the wider situatedness of the visual encounter. Building upon existing work that has considered the production of a variety of viewing practices such as the panoptic gaze and the medical *regard* (among a range of other viewing regimes), this thesis has argued that particular viewing experiences can be assembled, promoted and cultivated by a variety of social, cultural and political organisations and groups. However, somewhat uniquely, this assembling of particular visual experiences was cultivated for a specific political agenda, namely the subverting of the aerial gaze. Indeed, as was highlighted in Chapter One, camouflage is often defined as entailing the focusing upon a situated way of seeing, which social and political organisations attempt to encourage other individuals to engage in. In the case of camouflage, this entails getting the individual to transcend their own positionality

and instead adopt that of their adversary in what Jay refers to as the process of ‘autoscopy’.<sup>370</sup> Only by putting themselves in the position of the observer observing them can ‘effective’ camouflage be produced. Such an act is highly politicised; as was demonstrated in Chapter Four, ‘unofficial’ conceptions of camouflage were condemned for the lack of engagement in the aerial perspective, whereas the efforts of ‘official’ camoufleurs were elevated and privileged as more ‘effective’ approaches on account of the integration of this aspect into their work. Embracing this assembled and situated way of seeing, therefore, complicates the power relations between observer and observed, with the camouflage practitioner in effect becoming simultaneously both. The study of camouflage, thus, enables an opportunity to critique and complicate the long-standing power relations often mapped onto the viewing experience, but also to examine the often obscured and hidden rationales and agendas that initiate this process.

### **9.3: Landscape**

Following on from aspects of the visual, I want to now consider the contributions of the research for the cultural and historical geographies of landscape, with these reflections focusing upon several different dimensions. As was highlighted in Chapter Two, the visual experience has long been associated with landscape and encounters with it; indeed, within the discipline, the connections between landscape and vision have been at the heart of studies within cultural geography. However, in highlighting the critiques of ‘new’ cultural geographical approaches to landscape, this primacy of the visual within studies of landscape has been increasingly challenged, with geographers beginning to look at landscape through multi-sensory, tactile engagements. As part of these debates, the body has been positioned as ‘our most fundamental device of communication and interaction with the world’.<sup>371</sup> As a result of this, there has been ‘a move towards a new understanding of visible landscape in terms of sensuous practice’,<sup>372</sup> with studies of landscape locating vision within this broader corporeal framework. This research has attempted to provide an empirical contribution to this often highly theoretical work, demonstrating how vision may be situated within this broad schema of sensory engagements. Of theoretical importance to this research has been the implication of this shift in terms of how landscape has been conceptualised;

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<sup>370</sup> Jay, 1994, p.321.

<sup>371</sup> Lewis, 2000, p.68-69.

<sup>372</sup> Dewsbury et al, 2002, p.440.

certainly, landscape is now increasingly being theorised in terms of ‘animation’, ‘processual’ emergence and as ‘an imagination of, and a movement towards, presence’.<sup>373</sup> In thinking about the contributions of the thesis, Chapter Five illustrates how landscape can be animated by its narration through a set of visual grammar that gives an emergent presence. Indeed, through its discussion of aerial survey reports and aerial photographs, landscape emerged through the use of such grammar that alluded to contrasts in colour, tone, texture, form and the presence of shadows, reflections, glint, and glare. A contribution here is how this grammar is subsequently mobilised in terms of the interactions with the landscape by the self. In the context of civil camouflage, this grammar was utilised to inform contemporary understandings of the binary distinctions between natural and artificial surfaces, as well as rural and urban spaces, as imagined by the camoufleur. In this sense, the grammar that was utilised to ‘animate’ the landscapes that camoufleurs encountered whilst in flight played a key in the shaping of the imaginings and representations of landscape; indeed, in the context of civil camouflage practice, this visual grammar became a way of critiquing the modern, ordered landscape that had been encouraged by inter-war planner-preservationists, with characteristics of this modern architectural aesthetic – regularity, repetition, symmetry, smooth surfaces and pale-coloured buildings – coming into conflict with political discourses surrounding civil defence. This research, therefore, is suggestive of not only how historical and cultural geographies of landscape might draw upon such grammar as way of accessing and ‘animating’ an encounter with landscape, but also how such an empirical example might elucidate landscape as ‘processual’ emergence.

Developing this further, this research has shown how a particular narration of landscape can culminate not only its animation and critiquing but also its unique transformation to facilitate an alternative emergent presence. In Chapter Two, it was highlighted how body-landscape interactions are caught up in a complex tension between absence and presence; the ‘presence’ of the landscape is in continuous flux, perpetually endangered of becoming absent through the disengagement of the individual through an array of distractive and disruptive affects. Indeed, it was contended that this tension between presence and absence that shapes landscape encounters can be tactically manipulated for a variety of social, cultural and political reasons. In the case of camouflage, the

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<sup>373</sup> Rose, 2006, p.538.

suppression of the appearance of landscape facilitated the production of a landscape of defence, sanctuary and shelter. At the same time, it was highlighted that to conceive of this tension as a binary, with presence and absence as absolute terms was problematic; the two are co-constitutive and co-existent and, therefore, camouflage should not be considered as a form of absolute absence, but instead a relational absence when engaged through a particular situated 'way of seeing'. Drawing upon the assertions of Beck, 'hiddenness...is part of the condition of seeing and part of what is seen is the obscure, confused, dark and non-evident'.<sup>374</sup> A study of camouflage is, therefore, suggestive of how we theorise presence and absence as being co-existent; camouflaged landscapes are held in a tension between presence and absence, appearing absent at particular 'crucial moments', existing as an alternative form of presence and at risk of becoming present should the camouflage scheme be penetrated. In this sense, a study of camouflage highlights a unique set of relationship between landscape, absence and presence that merit further investigation and provides fertile ground for a future theoretical intervention into these debates.

A final point to be made here concerns the unique contribution of this study of camouflage in terms of thinking about the role of different experiential and atmospheric conditions upon the experiences of the individual in their encounters with landscape, which this thesis argues merits further critical attention. Chapter Two highlighted how geographers such as Wylie and Martin had explored the shifting and unfolding entanglements of affinities and distantiations between the body and landscape through mobile acts of walking and through sensory and atmospheric environment of fog, respectively.<sup>375</sup> While both of these accounts highlighted how varying affectual conditions produced different configurations of body and landscape, it was contended that other sensory atmospheres had been relatively overlooked. In this research, attention has been focused upon different types of atmospheric conditions and the ways in which the sensory engagement with landscape by the body can be disrupted and disengaged by these atmospheric affects. Chapter Five, for example, considered the role of haze, mist and smoke in disrupting the visual engagement with the terrestrial landscape from the air through the production of varying transmissions of light or the casting of confusing shadows that could prevent the 'revealing' of potential targets.

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<sup>374</sup> Beck, 2011, p.131.

<sup>375</sup> Wylie, 2005; Martin, 2011.

However, it is perhaps discussions in Chapter Seven, surrounding nocturnal camouflage and the night-time appreciations of landscape by civil camoufleurs, that I feel accentuate one of the key and unique contributions of the thesis. In reflecting upon Wylie's and Martin's respective works on atmospheric and sensory conditions, discussions about the night and its unique effects upon body-landscape engagements was a noticeable absence. Certainly, while there clearly is an emerging interest into the effects of darkness and sensory perception, as highlighted by Morris's work into night-time landscape art installations,<sup>376</sup> this research into camouflage has argued that we need to unsettle and destabilise long-standing conceptualisations of darkness as disconnecting the body from any engagement with landscape. Indeed, this research has shown how in the conditions of darkness, the human body continues to sense and encounter landscape through an attunement to the reduced sensory and tactile experiences that the night induces. At the same time, this research has suggested that while other bodily sensations such as smell, sound and touch may take on a heightened significance in the conditions of the night, visual encounters continue to play a key part in the constitution, understanding and interaction with the nocturnal landscape. Landscapes continue to unfold and reveal themselves, although as Chapter Seven has suggested, this is through different visual registers and regimes from that of the normative experiences enabled by day-time conditions. It is argued, therefore, in thinking further about the non-representational ways of engaging with landscape, we need to consider the multifarious atmospheric and sensory conditions through which landscapes are encountered; while glimpses and traces of the material landscape may be 'fleeting' in the conditions of the night, they nevertheless form a key part of our tactile, affectual and emotive encounters with landscape. The examples drawn upon within the thesis highlight the temporally and spatially shifting nature of affective atmospheres and the sensory engagements they enable and disable, which I would argue influence body-landscape interactions in unique and disparate ways.

#### **9.4: Aerial/Terrestrial Spaces, Practices and Bodies**

A final set of geographical themes I want to consider is that of the complex entanglement of aerial and terrestrial spaces and the effects of aerial bodies and the practices they enact in airspaces upon grounded individuals. The thesis opened with two

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<sup>376</sup> Morris, 2011, p.316.

examples of camouflage survey flights that took place in 1941, with a series of questions subsequently being raised about the effects of aeronautical technologies, the assembling of aerial spaces and subjects, as well as the effect of aerial practices in shaping and transforming our epistemologies and ontologies of the world. In addressing these issues, the thesis has attempted to make a series of contributions in relation to this field of enquiry.

Firstly, it is contended that this research has made a contribution to emerging geographical discussions on the imaginings of aerial spaces. Indeed, it was outlined in Chapter Two how airspace have been conceptualised by social and cultural commentators as being constituted through a series of ‘subject acts’ and ‘technological renderings’, be it through the use of software and computer codes in relation to civil aviation or the use of airspace as a tool for the projection of power.<sup>377</sup> This study into camouflage has sought to extend this work by focusing upon a specific set of movements within aerial space, namely those of an imagined enemy bomber body. Within Chapter Five, for instance, attempts were made to look at the assembling of knowledge about the specific practices, strategies and tactics utilised by the Luftwaffe bomber body and ultimately how the imaginings of such practices and individuals inhabiting these spaces gave shape to Britain’s aerial geographies. Indeed, as Chapter Four illustrated there were shifting social and cultural imaginings of Britain’s airspaces; indeed, the chapter opened by highlighting contemporary assertions that ‘the bomber would always get through’, that the spaces above Britain afforded a great freedom to the enemy bomber body. However as the chapter unfolded and as Chapter Five extended, the geopolitics of the aerial threat were re-interpreted in light of changes to the tactic and strategic situation; the mapping of priority areas on the ground and the strategic situation in the air provide the first expression of aerial spaces and practices being connected with the terrestrial. Looking at the assembling of knowledge about the specific practices, strategies and tactics utilised by the Luftwaffe bomber body in the air, therefore, not only shaped the imaginings of the threat in the air but also resistance on the ground.

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<sup>377</sup> Budd and Adey, 2009; Dodge and Kitchin, 2004; Graham, 2004; 2005; Williams, 2010; 2011.



Developing on from this articulation of aerial threat is the profiling and assembling of the enemy bomber body that constituted this aerial threat. A further contribution of this research has been to bring together a set of disparate literatures on aerial, military and mobile geographies that emphasise the need to differentiate different types of aerial bodies. As recent work by Adey has suggested, specific aerial subjects are profiled and assembled by organisations through the production and accumulation of scientific knowledge.<sup>378</sup> Building upon and extending his findings further, this research has focused on the profiling of the bomber body and the specific political motivations for doing so. Within civil camouflage work, strategic and tactical knowledge about Luftwaffe activities on the approach to their targets and the altitudes and heights at which an aerial attack was likely to occur was gleaned through interactions and associations with ‘expert’ individuals which civil camoufleurs considered to be ‘aerially experienced’. This intelligence on the movements of the bomber body was subsequently connected to the visual experiences of this embodied individual. Different bombing altitudes (for both day and night conditions) produced different viewing angles and perspectives from which the ‘bomber body’ engaged with the terrestrial landscape as well as recognising and identifying the target. Moreover, various stages of the ‘bombing run’ were acknowledged as generating varying intensities of visual concentration and focus within the bomber body. Through these engagements, ‘crucial moments’ when the bomber body was subjected to physical and perceptual limitations were identified, these acting as opportunities which the camoufleur could exploit in order to conceal an industrial building.

These findings bring together discussions of the visual experiences of this profiled aerial subject with encounters with the terrestrial landscape. One of the contributions of this research has been to reflect upon the specific visualities of a particular aerial subject and how these have shaped not only understandings and imaginings of the terrestrial landscape, but also its material transformation. In the first instance, the research has looked to extend ongoing debates surrounding the ‘aero-technological transformation of vision’,<sup>379</sup> with it being contended that the proliferation of vertical visualities has facilitated new ways of seeing and experiencing the world, leading in Budd’s contention

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<sup>378</sup> Adey, 2010.

<sup>379</sup> Schwarzer, 2004.

that there is ‘the emergence of a new form of spatial consciousness’.<sup>380</sup> As mentioned above, through the proliferation of vertical visualities, the terrestrial landscape has become known and engaged with in different ways from the grounded individual who is forced to examine the landscape through horizontal or upward-looking perspectives.

Yet, as the thesis has contended throughout, explorations of the practice of civil camouflage not only testify to this transformation of the visual encounter with landscape from the air, but also the ways in which these vertical visualities transform the material fabric of the terrestrial landscape. Indeed, extending empirical and theoretical work which has considered the terrestrial expression of airmindedness in spaces such as the airport, this thesis has sought to contribute a unique case study that demonstrates how aerial spaces and practices and the visualities they enable can affect the architectures and visual appearance of everyday mundane, spaces and landscapes. Camouflaged landscapes are spaces moulded by the ‘ways of seeing’ that the aeroplane enables, with the techniques and visual effects that are adopted being positioned in relation to this situated way of seeing. At the same time, this research has contended the terrestrial landscape and the practices that take place within it can act as sites that facilitate the ‘operational reversal of the target’s visual logic’.<sup>381</sup> Rather than simply imagining the aerial gaze as all-revealing, as has often been argued in the literature, the example of camouflage demonstrates how the ground can act as ‘one of the greatest forms of resistance to the aerial, the visible and the promise of omnipresent reach’.<sup>382</sup> In this sense, this empirical case-study further elucidates ongoing social, political and cultural conceptualisations of aerial and terrestrial spaces as being inextricably connected and entwined, but also how the terrestrial can be a site for the contestation and subversion of aerial practices that affect them.

### **9.5: Future Geographies of Camouflage: some concluding remarks**

In many respects, this thesis has sought to highlight the spatial significance of camouflage in three particular ways: firstly, it has asserted that camouflage is a technology determined by and through the visual appearance of the surrounding topographical landscape; second, it has argued that camouflage is very much an

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<sup>380</sup> Budd, 2006.

<sup>381</sup> Adey et al, 2011.

<sup>382</sup> Adey et al, 2011.

affective response to a particular 'situated' way of seeing, a view that is positioned within a specific socio-spatial context; and, finally, it has contended that camouflage is a practice that embodies and encompasses a variety of knowledges that are produced in and disseminated from a diverse range of disciplinary and geographical spaces. For me, the discussions contained within this thesis provide an entry point for a wider geographical engagement with camouflage; indeed, some of the potential avenues of a future research agenda were outlined in Chapter One in terms of thinking about the wider range of key conceptual and theoretical discussions that camouflage may enable with respect to the discipline. This doctoral research therefore represents a beginning rather than end, a fertile ground for the emergence of a critical examination of the practices and spaces of camouflage through a geographical engagement.

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- ID 006-003-000-069-C: *Oblique aerial image taken near Middlefield, Falkirk, Stirlingshire; Gasworks, Abbotshaugh area*, dated 20<sup>th</sup> May 1941.
- ID 006-003-000-085-C: *Oblique aerial image taken near Grangemouth, Stirlingshire; Oil tanks and refinery*, dated 20<sup>th</sup> May 1941.
- ID 006-001-002-120-C: *Vertical aerial image of Hillington, Glasgow, Scotland. Image taken from an aircraft of the German Luftwaffe*, dated 23<sup>rd</sup> March 1941.
- ID 006-003-000-225-C: *Oblique aerial image taken near Port Laing, Inverkeithing, Fife, Scotland facing North West; Forth Railway Bridge*, dated 22<sup>nd</sup> October 1941.
- ID 006-003-000-566-C: *Oblique aerial image taken near Dunipace, Stirlingshire; Carmuir electricity generating plant*, dated 15<sup>th</sup> April 1943.
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## Appendix 1

Official Camouflage Colours, as determined through consultations between the C.D.C.E. and the Paint Research Station.

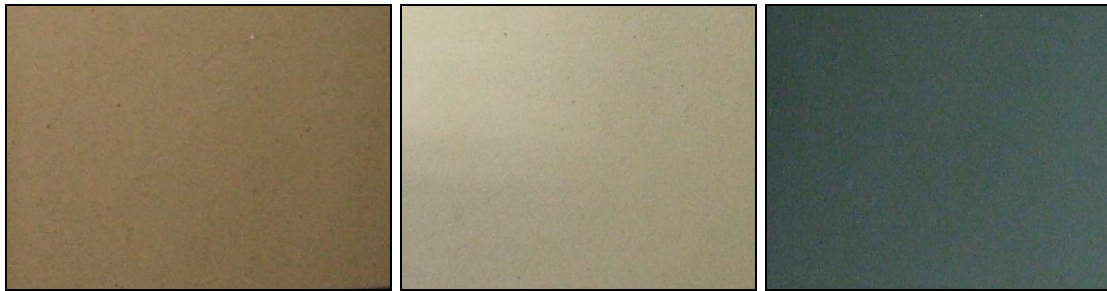
(Source: TNA, HO186/2769).



1A

1

2



4

5

6



7

Special Purpose Green

10



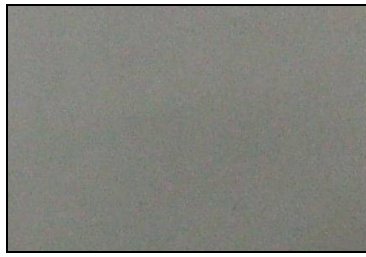
11

11A

11B



12

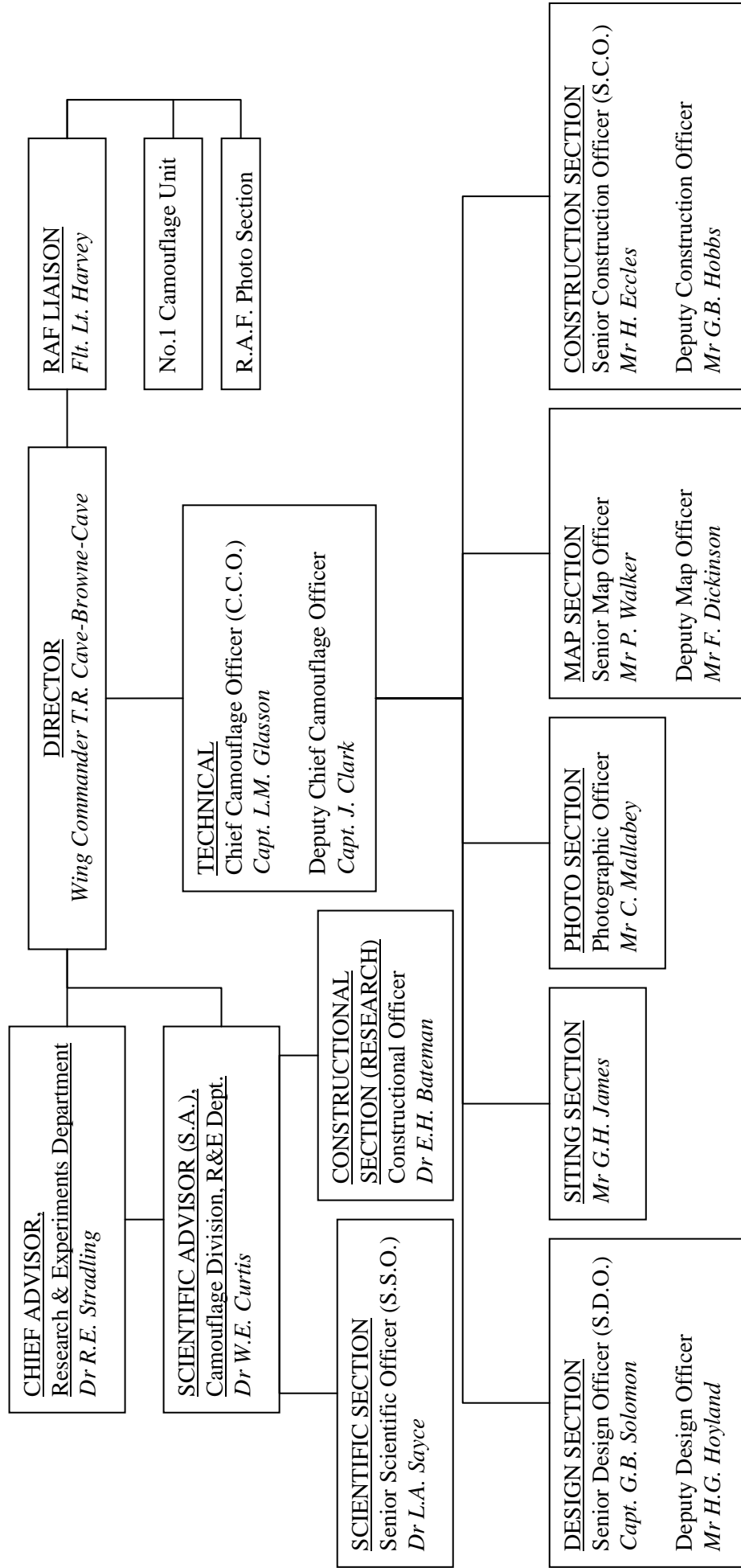


13



14

Appendix 2: Diagram illustrating the organisation of the Camouflage Directorate, 1941 to 1945.





### Appendix 3

Analysis of daylight bombing attacks by height of attack and types of target attacked for the period January 1942 to September 1942.

(Source: TNA, HO186/1990: A.W.A. Report No.BC/G/10)

Type of Target	Fighter-Bombers		Bombers		All Aircraft	
	Under 1,000ft	Over 1,000ft	Under 1,000ft	Over 1,000ft	Under 1,000ft	Over 1,000ft
<i>Gasworks</i>	21½	1	3½	1	25	2
<i>Electricity Works and Power Stations</i>	4½	-	-	1	4½	1
<i>Factories</i>	8	-	20½	9	28½	9
<i>Aerodromes and R.A.F. Stations</i>	10	-	13	3	23	3
<i>Railways</i>	24½	-	9	16	33½	16
<i>Military and Naval Stations</i>	6½	2	2	2	8½	4
<i>Docks, Harbours and Lighthouses</i>	7	2	2½	1½	9½	3½
<i>Other Attacks</i>	30	2	9½	17½	39½	28½
<i>All Attacks</i>	112	7	60	50	172	67

## Appendix 4

A table of seed mixes used for different types of soil types and conditions for the concealment of scarred ground.

(Adapted from TNA, HO186/1985: *T.S.C.44*, dated May 1942).

Soil Type/Conditions	Seed Mixture
Heavy Clay Soils	100lbs per acre consisting of: <ul style="list-style-type: none"> <li>• 50lbs Perennial Rye grass</li> <li>• 20lbs Italian rye grass</li> <li>• 15lbs Crested Dogstail</li> <li>• 10lbs Browntop</li> <li>• 5lbs Mixed Clovers</li> </ul>
Waste Stony land	240lbs per acre consisting of: <ul style="list-style-type: none"> <li>• 224lbs Yorkshire Fog (cleanings)</li> <li>• 16lbs Mixed Alsike and White Clovers</li> </ul>
Banks and Slopes	112lbs per acre consisting of: <ul style="list-style-type: none"> <li>• 45lbs Perennial Rye grass</li> <li>• 20lbs Short-stalked Meadow grass</li> <li>• 20lbs Crested Dogstail</li> <li>• 15lbs Creeping Red Fescue</li> <li>• 7lbs Ribgrass</li> <li>• 5lbs New Zealand Wild White Clover</li> </ul>
Moist Conditions	100lbs per acre consisting of: <ul style="list-style-type: none"> <li>• 45lbs Perennial Rye grass</li> <li>• 15lbs Italian Rye grass</li> <li>• 25lbs Timothy</li> </ul> 10lbs Rough-stalked Meadow grass <ul style="list-style-type: none"> <li>• 3lbs Ribgrass</li> <li>• 2lbs Clover</li> </ul>
Good soils	100lbs per acre consisting of: <ul style="list-style-type: none"> <li>• 70lbs Perennial Rye grass</li> <li>• 10lbs Short-stalked Meadowgrass</li> <li>• 10lbs Cocksfoot</li> <li>• 8lbs Timothy</li> <li>• 2lbs Clover</li> </ul>