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**BRITISH PHOTOGRAPHIC INTELLIGENCE DURING THE SECOND  
WORLD WAR:  
A STUDY OF OPERATION CROSSBOW**

**CRITICAL REVIEW SUBMITTED BY ALLAN ROBERT WILLIAMS  
TO THE  
UNIVERSITY OF EDINBURGH  
FOR THE DEGREE OF PhD (BY RESEARCH PUBLICATION)  
2016**

## ABSTRACT

In 2013 the candidate published *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*. Through a detailed examination of the relevant primary sources – including aerial photography recently released to the National Collection of Aerial Photography in Edinburgh - this book investigates the role of British photographic interpretation in the hunt for German V-weapons during Operation Crossbow. In so doing, it provides a wealth of information on such matters as the wartime development of photographic interpretation, the techniques used by the interpreters, the personalities involved, the significance of photographic intelligence to the operation, and the wider politics of wartime intelligence. In particular, it contests some of the claims made by R. V. Jones in his memoir, *Most Secret War* (1978), about the role of photographic interpretation in the Crossbow investigation. It also demonstrates the wider importance of photographic intelligence in the British military history of the war and offers some explanation as to why this has become a 'missing dimension' of wartime intelligence studies. The critical review seeks to provide an academic superstructure for the book, which was intended for a general readership, and demonstrates that the research included therein is commensurate with that required for a PhD.

## DECLARATION

I confirm that this critical review presented for the degree of PhD (by research publication), has been composed entirely by myself, is solely the result of my own work, and has not been submitted for any other degree or professional qualification.

**Allan Robert Williams**

**28 July 2016**

## **INTRODUCTION**

The purpose of this critical review is to summarise the aims and objectives, methodology, and the results and conclusions, of the candidate's book - *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons* - first published in the United Kingdom by Preface Publishing in 2013. This publication provides a case study of the role of photographic intelligence during Operation Crossbow (the operation to track down the German V-weapons between 1943 and 1945) in order to draw wider conclusions about the value of this source of military intelligence during the Second World War and the value of declassified military aerial photography for academic historians. As the book was written with a general readership in mind, this critical review provides an academic superstructure that demonstrates how the research undertaken contributes to the expansion of knowledge in the field of academic intelligence studies, and why the research project has academic merit commensurate with a PhD.

## **AIMS AND OBJECTIVES**

To demonstrate why the book fills a gap in the published literature, and makes an original contribution to knowledge, it is necessary firstly to provide an overview of the secondary literature on the application of photographic intelligence during Operation Crossbow, and more generally during the Second World War. This is achieved by reviewing the key published sources: official histories; memoirs that can be partly classed as secondary sources; and other published histories. By reviewing this literature, the historiography relating to this form of military intelligence provides an academic context for the research within the milieu of intelligence warfare. Following this review, the aims and objectives of the book are explained in the form of research questions that informed the research project.

## *Literature review*

In contrast to the secrecy that surrounded code-breaking at the Government Code and Cypher School at Bletchley Park, after VJ Day a press conference was held at RAF Medmenham (a country house located near Marlow in Buckinghamshire) on 5 September 1945 to celebrate the achievements of photographic intelligence<sup>1</sup> throughout the conflict.<sup>2</sup> Whilst the resultant articles published about the intelligence warfare undertaken by the Allied Central Interpretation Unit (ACIU) at Medmenham were small in number and only featured in specialist British aviation magazines,<sup>3</sup> the revelation that photographic intelligence played a central role during Crossbow would shortly draw a larger, and international, audience. Coinciding with the publication of an official history of the European Air War by the United States Strategic Bombing Survey,<sup>4</sup> which included a statistical analysis of Crossbow<sup>5</sup> - the resultant press coverage focused on Flight Officer Constance Babington Smith,<sup>6</sup> and indelibly connected her to a story that produced many myths at the time and later.

A photographic interpreter in the Women's Auxiliary Air Force (WAAF), Babington Smith was officer-in-charge of the Aircraft Section at Medmenham from its creation in April 1941 until her 1945 secondment to the Pentagon after VE Day. Whilst serving at the Washington, D. C.-based headquarters of the War Department with the United States Army Air Force,<sup>7</sup> Babington Smith was tasked with presenting an officially-prescribed briefing to the American press about Crossbow. As a result of the press conference at the New York office of the British Information Service, Babington Smith was hailed as the individual who ensured the Normandy landings were carried out without interference from V-weapons<sup>8</sup> - a claim she personally repudiated, arguing that the elucidation of vital intelligence was entirely the result of a team effort.<sup>9</sup> Nonetheless, the resultant press coverage included the comic-book proposition that she was the 'WAAF with X-ray eyes',<sup>10</sup> a distortion that proved to be a convenient cover for the true nature of photographic intelligence. Such historical manipulation serves to highlight the challenge for historians in judging the relative contributions of those involved in this type of intelligence activity.

## *Official histories*

As early as 1941 the Cabinet Office began to consider the post-war publication of official military histories that would provide ‘a broad survey from an Inter-Service point of view, rather than separate accounts by each of the three services’.<sup>11</sup> In order to best ensure the objectivity of these historical narratives, an advisory panel was created under the chairmanship of an academic historian, Professor James Butler, which consisted of senior military figures, civil servants and historians. The Cabinet Office duly commissioned the production of a specialised multi-volume series - under the umbrella title *History of the Second World War* - for publication by Her Majesty’s Stationery Office. In the resultant official history published between 1979 and 1990 - *British Intelligence in the Second World War* - a chronological account of the part intelligence warfare played in allied strategy and operations throughout the conflict was presented. This charted the evolution of British intelligence organisations and the challenge of wresting information from the enemy to the point where the distilled and evaluated information was presented to military commanders and political leaders.

In the third volume of the series, an assessment of the importance of intelligence in the identification of the V-weapons,<sup>12</sup> the associated offensives against them, and the effect they had on the course of the war,<sup>13</sup> was provided. However, based on a review of the intelligence briefings supplied to the chiefs of staff, rather than any systematic study of the photographic intelligence created at Medmenham, this macro-level study failed to investigate the scale and complexity of the photographic interpretation effort during the operation. This serves to highlight the value of a micro-level interpretation that considers the inner workings of the intelligence unit at Medmenham, the conventions by which the photographic interpreters operated, and the specific challenges tackled during the investigation. Indeed, the principal author of the official history, the wartime cryptographer Sir Harry Hinsley, readily acknowledged that photographic intelligence was one of the key sources of military intelligence during the conflict, alongside physical contact (captured documents, mail censorship, prisoner interrogation), espionage, and signals intelligence.<sup>14</sup>

### *Memoirs that are in part secondary sources*

The important contribution of published memoirs to the historiography of photographic intelligence during Crossbow, and more generally during the Second World War, can be demonstrated through a study of selected examples of the genre. Following demobilisation, from 1946 Babington Smith worked as a researcher for *Life* magazine, where her major assignment was to assemble illustrations for Churchill's influential six-volume part history/part wartime memoir,<sup>15</sup> *The Second World War*, which includes chapters on 'Hitler's Secret Weapon'<sup>16</sup> and 'The Pilotless Bombardment'.<sup>17</sup> In spite of the value Churchill placed on photographic intelligence, not least because his daughter Sarah served as a Medmenham interpreter, Churchill chose to refer to the intelligence unit only once in passing.<sup>18</sup> This marginalisation of such a significant intelligence unit in Churchill's magnum opus - alongside the total absence of any reference to the codebreaking undertaken at Bletchley Park, for reasons of national security - arguably set a precedent for the treatment of photographic intelligence in the history of the Second World War.

Meanwhile, based on privileged access to the then still-classified wartime photographic interpretation reports and associated Air Ministry records, eyewitness testimony, and in-part her first-hand wartime experiences, the first published history of photographic intelligence during the Second World War was written by Babington Smith. First appearing in the United States as *Air Spy*<sup>19</sup> in 1957, and promoted through a *Life* magazine article, 'How Photographic Detectives Solved Secret Weapon Mystery',<sup>20</sup> in 1958 the book was published in the United Kingdom as *Evidence In Camera*,<sup>21</sup> after having been serialised in *The Sunday Times* newspaper.<sup>22</sup> Although the publication can be considered part-memoir, and thus a primary source, since the author interprets, discusses and analyses sources of information relating to aspects of photographic intelligence beyond her direct wartime experience - and given the influence of the publication on the development of the historiography - it also has status as a secondary source. It was reprinted in 1974.<sup>23</sup>



Whilst the derring-do narrative reflects the author's journalistic background, the book accurately charts the development and growth of photographic intelligence in the European theatre of operations. It includes a chapter dedicated to the battle against the V-weapons, which is presented as the zenith of the interpreters' achievements during the conflict. Given the seminal status afforded to this publication in the secondary sources reviewed, any scholarly assessment of wartime photographic intelligence must draw on the Babington Smith narrative. But it was of course not intended for a scholarly readership and the author did not have access to all the primary sources.

In the same year that *Evidence in Camera* was reprinted, *The Ultra Secret* (1974) appeared.<sup>24</sup> This work, written by Frederick Winterbotham, who masterminded the organisation, distribution and security of signals intelligence code-named 'Ultra' throughout the war, revealed the work of the code breakers at Bletchley Park. In the introduction to his influential work, which was a turning point in the evolution of intelligence studies,<sup>25</sup> Winterbotham signposted the value of photographic intelligence as the primary source of accurate ground intelligence during the conflict, and beyond.<sup>26</sup> Yet this observation drew attention to the fact that as long as the aerial photography created during the war remained classified, its inaccessibility had an inhibiting effect on the writing of operational military history.

Shortly thereafter a dispute broke out among memoirists. In 1978 the wartime memoir of Dr. R. V. Jones – *Most Secret War* – was published. This provided a chronological account of his role as the Assistant Director of Intelligence (Science) at the Air Ministry, anticipating the 'German applications of science to warfare'. It also included his interactions with the photographic interpreters during Crossbow.<sup>27</sup> Through the careful presentation - and exclusion - of factual material Jones questioned the competency of the interpretation effort. The veteran Medmenham interpreter, Ursula Powys-Lybbe, was so disappointed by his 'marked lack of objectivity in his approach to the subject' that she was galvanised into action.<sup>28</sup> Her 1983 publication, *The Eye of Intelligence*, included a chapter on Crossbow in which the assertions by Jones about the Medmenham interpreters were challenged. Since the veracity of both interpretations could only be judged following the subsequent declassification of wartime aerial photography and associated public records, they

underscored the importance and value of exploiting primary source evidence to set the record straight. The case for such a reassessment was made more compelling by James Goodchild's doctoral thesis, 'R.V. Jones and the Birth of Scientific Intelligence' (2013),<sup>29</sup> which identified further doubts about the reliability of Jones's wartime memoir.

### ***Other published histories***

There is a limited treatment of Second World War photographic intelligence – and its role in Crossbow in particular - in other published historical works. Coinciding with the twentieth anniversary of the first deployment of V weapons against the United Kingdom, in 1964 two volumes on Crossbow appeared. In *The Battle of the V Weapons (1944-1945)*,<sup>30</sup> Basil Collier - author of the official *The Defence of the United Kingdom during the Second World War*<sup>31</sup> - drew on that aforementioned history, and other published sources, to provide a documentary account of the V-weapons offensives. But in the process he simply raised a series of further questions about the role of military intelligence in the operation.<sup>32</sup>

In *The Mare's Nest*,<sup>33</sup> David Irving charted the involvement of the different branches of military intelligence in the operation, the challenge to the Allies in interpreting the intelligence, and the German debate over the deployment of these revolutionary weapons. Yet when Duncan Sandys, the wartime Chairman of the Crossbow Committee, reviewed Irving's volume for the *London Evening Standard*, he faulted him for his reliance on the papers of Lord Cherwell, the Prime Minister's Chief Scientific Advisor, along with information provided by R. V. Jones. By treating the V-weapon challenge as principally one of scientific intelligence, Sandys considered that insufficient attention was paid to other more important aspects of the operation, notably photographic intelligence.<sup>34</sup>

More recently, the value of photographic intelligence during Crossbow was reconsidered by Colonel Roy Stanley II (retired) in *V Weapons Hunt: Defeating German Secret Weapons* (2010). Inspired to become a photographic interpreter after reading Babington Smith's *Air Spy*,<sup>35</sup> Stanley has written a series of books on photographic intelligence, principally from an American-centric perspective. In *V*

*Weapons Hunt* Stanley took a selection of ‘notable’ aerial photographs created during Crossbow and advanced the hypothesis that whilst a number of authors have investigated the Allies search for secret German weapons, and some have considered photographic intelligence, most have not evaluated the aerial photography. Furthermore, he postulates that some published works are frequently found to be incorrect.<sup>36</sup> These conclusions have helped to inform the research project. Meanwhile, the television producer and historian, Taylor Dowing, has produced *Spies in the Sky* (2011) for a more popular readership. Appearing in the wake of the BBC television documentary *Operation Crossbow*,<sup>37</sup> the author utilises unpublished personal memoirs held in the Medmenham Collection and oral history interviews with veteran photographic interpreters. But the book is reliant on the extant secondary literature and only scratches the surface of the primary sources now available.

In a wider historiographical sense, the potential use of aerial photography for military historians was advanced considerably by Ian Daglish’s *Operation Goodwood* (2005).<sup>38</sup> In this volume, he questioned historical assumptions about the Normandy campaign through an analysis of stereoscopic aerial photography taken above the battlefield whilst the largest tank battle of the north-west Europe campaign of 1944-1945 was in progress. Using the photographic evidence, the accuracy of eyewitness testimony was challenged and a revised chronology was advanced that contradicted aspects of the official history. As the lessons learned from this battlefield influenced the development of NATO strategy for the defence of Europe against the Warsaw Pact’s armoured divisions, this work highlighted the capacity of historical misunderstandings to influence the development of subsequent military strategy.<sup>39</sup> In companion volumes Daglish applied similar techniques to studies of Operation Epsom<sup>40</sup> and Operation Bluecoat.<sup>41</sup> In so doing, he demonstrates how a detailed study of air intelligence can serve to re-interpret military operations, including Crossbow.

Professor Robert Ehlers has followed this trend in *Targeting the Third Reich* (2009). In his book, he uses aerial photography to reassess the effectiveness of the wartime Allied strategic bombing campaign and, through this, draws attention to the close working relationship that developed between British and American air intelligence; the inter-Allied nature of the photographic interpretation effort at Medmenham; and how this inter-played ‘synergistically with the world’s best signals intelligence and

cryptographic units at Bletchley Park' to ensure the bombing effort targeted the right targets, at the right intervals, with the optimum payload.<sup>42</sup> The combinative value of signals and photographic intelligence was also highlighted in Christy Campbell's *Target London* (2102).<sup>43</sup> Both these publications further suggested the time was ripe for a re-evaluation of Crossbow.

In a different historiographical context, Christine Halsall has recently considered the gender aspects of photographic intelligence in *Women of Intelligence* (2012).<sup>44</sup> In this volume, the wartime lives of servicewomen who worked at Medmenham, many of whom subsequently joined interpretation units in the Middle East and India, were conveyed through a series of character studies. The author demonstrated that since a substantial proportion of its photographic specialists were women, who ranked equally to their male colleagues, and in some cases were their superiors (examples including Constance Babington Smith and Ursula Powys-Lybbe), Medmenham distinguished itself from other service establishments in that tasks and responsibility were allocated according to merit, rather than gender. But the book makes no pretence at re-evaluating Crossbow.

This literature review indicates that whilst British photographic intelligence was considered a key source of military intelligence during the war, the dearth of independent academic studies has constrained the development of knowledge about, and understanding of, the applied use of wartime aerial photography, and its role in Crossbow in particular. This desire to fill a gap in the literature inspired the candidate to write his book, *Operation Crossbow*, a project that only became possible, as is explained below, when classified wartime aerial photographs were released into the public domain between 2004 and 2008.

### ***Research questions***

The over-arching aim of the candidate's book *Operation Crossbow* was to use the primary source evidence now available to produce a comprehensive new study of the role of photographic interpretation in the Allies search for the German V-weapons. This would be a chronologically-driven account that covered all aspects of the hunt

for these weapons. But, mining down, two research questions in particular informed the writing of the book:

**Research Question 1:** This first question takes as its starting point the controversy over the claims made by Dr. R. V. Jones about the role of photographic interpretation in Operation Crossbow (as outlined in the literature review above). On the basis of the intelligence briefings provided, and the conventions under which they operated, were the claims made by Jones about the competency of their photographic interpretation effort during Operation Crossbow reasonable?

**Research Question 2:** This builds on the first to widen out the project. What can a study of Crossbow tell us about the importance of British photographic intelligence during the Second World War, and can it be considered a significant ‘missing dimension’ of academic intelligence studies?

## **METHODOLOGY**

In order to write this new study of the role of photographic interpretation in the Allies search for the German V-weapons, and in so doing address the research questions outlined above, a wide range of primary sources were exploited during the research project. The key archives used in the UK were: The National Archives of the United Kingdom (TNA); the Medmenham Collection at the Military Intelligence Museum (MC); the National Collection of Aerial Photography (NCAP); and the Imperial War Museum (IWM). The key archives used in the USA were: the Air Force Historical Research Agency (AFHRA); and National Archives and Records Administration (NARA). The key primary records exploited can be categorised as follows: Second World War aerial photographs and associated interpretation reports; unpublished histories and related documents; RAF Operations Record Books (Form 540); wartime propaganda; oral history; and unpublished memoirs.

## *Aerial Photography and Interpretation Reports*

The aerial photography and associated interpretation reports created during Operation Crossbow were a key source of primary information exploited in the book. Since 1972, the wartime photographic interpretation reports which record detailed intelligence elucidated in mono and three-dimensions have been publicly available in the TNA record series AIR/29 and AIR/34. However, this was in some ways unsatisfactory for historians since the interpretation reports infrequently included copies of the aerial photographs they describe. Although some photographs were made publicly available during the Cold War era, the opportunity for scholars to undertake a comprehensive re-assessment of the photographic intelligence created during Operation Crossbow has only been practical following the extensive release of Second World War aerial photography by the Joint Air Reconnaissance Intelligence Centre (JARIC) to NCAP between 2004 and 2008.<sup>45</sup>

Although searches for imagery of specific places is limited to the NCAP catalogued holdings, since the interpretation reports detail the sortie references and frames used to elucidate intelligence, aerial photography created during Crossbow can now be identified. By using the unpublished internal history of Operation Crossbow (see below),<sup>46</sup> along with the interpretation reports - notably the BS Series<sup>47</sup> - it is possible to construct a chronology of the interpretation effort during the operation to identify individual sorties and photographs containing specific intelligence. It should be noted that when undertaking the research project the candidate took advantage of his position as the curator of NCAP to access un-catalogued aerial photographs created during Crossbow, as detailed in the book. As a consequence, a growing number are now publicly accessible via the NCAP website - <http://ncap.org.uk/>.

In addition to the challenges of undertaking photographic interpretation, scholars of Second World War photographic intelligence face a further practical challenge: that of tracking down the whereabouts of all the surviving aerial photography detailed within interpretation reports. Photographic reconnaissance and intelligence was an inter-Allied activity in the European Theatre of Operations. In consequence, aerial photography of targets was undertaken by a range of Allied photographic reconnaissance squadrons and, as the American and Canadian air forces selectively

repatriated their wartime aerial photography, the material that survives is scattered across multiple collections. Notwithstanding this dispersal of the sources, the author was able to draw on the extensive archive of photographs relating to the operation in the NARA in the USA<sup>48</sup> and is confident that this collection, together with that of the NCAP, gave him access to the majority of the Allied photographic intelligence gathered at the time.

### *Unpublished histories and related documents*

A further important primary source for the research project was unpublished, internal wartime histories. These include a two-volume Air Historical Branch 'RAF Narrative', on the photographic reconnaissance and intelligence effort, which became publicly accessible via the Public Record Office in 1976.<sup>49</sup> The first volume, written in 1945, covering the period to April 1941, provides a detailed chronology of pre-war clandestine and early-war photographic reconnaissance missions, official interactions with the Aircraft Operating Company, and the complex and unorthodox structure of the Photographic Interpretation Unit at Wembley.<sup>50</sup> The second volume, written in 1948, charts the growth of the photographic reconnaissance and intelligence effort until August 1945.<sup>51</sup> The narrative is sufficiently detailed that individual photographic reconnaissance sorties are detailed and, alongside the aerial photography at NCAP, this enables scrutiny of the published historical interpretations.

At the behest of the Air Historical Branch, internal histories were also compiled for each of the Medmenham sections in September 1945, including the Crossbow team (Section B2). These detail section name and code-name; date and circumstances of formation; staffing levels throughout the war; the scope of work undertaken; the title and reference number of key reports; and the distribution of these reports during the war.<sup>52</sup> Particularly worthy of note is the official history of the Medmenham Print Library which explains the sortie referencing systems used throughout the conflict.<sup>53</sup> This is invaluable for the deciphering of aerial photography and the associated interpretation reports.

The internal history of Crossbow itself - *Crossbow: History of the P.I. Investigation (1943-1945)*<sup>54</sup> - which draws on 'notes on the contribution of photographic

interpretation to the Crossbow investigation' written in October 1944 by the Medmenham Technical Control Officer, Wing Commander Douglas Kendall,<sup>55</sup> provides a further important summary of the work undertaken by the photographic interpreters. Through a chronological presentation of the successive phases of the operation, it provides an overview of the network of sites throughout Nazi-occupied Europe associated with the development, manufacture, movement, storage and deployment of V-weapons. This document serves as another important route-map by which to navigate the thousands of interpretation reports written during Operation Crossbow, and in-turn the 1.6 million aerial photographs created during 4,000 photographic reconnaissance sorties flown for the operation.<sup>56</sup>

Other internal wartime materials have been drawn upon to assist in the interpretation of relevant photographic intelligence relating to Crossbow. These comprise training manuals and related documents used by Allied photographic intelligence personnel which are variously held by the TNA, NARA and AFHRA. These include such items as the 'Illustrated Handbook for Officers concerned with Examination and Interpretation of Air Photographs',<sup>57</sup> the 'Report on Tactical Reconnaissance in 2<sup>nd</sup> Tactical Air Force' and the 'Report on Ground Organisation in Support of Air Photographs in 2<sup>nd</sup> Tactical Air Force (1944-1945)'.<sup>58</sup> These documents reveal, for example, that when photographic interpreters were trained during the war a useful distinction was made between 'photograph reading' and 'photographic interpretation'. Whilst photograph reading was defined as the identification of common objects and topographical features in aerial photographs, and was likened to the comparatively simple process of reading a map, photographic interpretation was a much more complex task concerned with understanding the intelligence significance of a photograph.

When analysing features in stereo on vertical aerial photographs, interpreters were thus instructed to consider five key factors when identifying and describing objects: shape (their physical form in geometrical terms); size (their physical dimensions); shadow (to determine their shape, outline and height); tone (the factors that determine tone variation); and associated features (when an object remains unidentified after all other factors have been considered). Photographic interpreters were also trained never to base a conclusion on conjecture, on the basis that military commanders must only



be presented with known facts. If there was insufficient evidence to report findings with certainty, their intelligence assessment had to be qualified with the terms 'probable' or 'possible'.<sup>59</sup>

Further useful background sources available in the TNA are the internal magazines devoted to wartime photographic intelligence.<sup>60</sup> Between October 1942 and March 1945 the Air Ministry produced a regular twenty-four-page magazine: 'Evidence In Camera'. Compiled at Medmenham, 103 issues appeared, including special editions on D-Day, the flying bomb, and the Mulberry harbours, with a final issue on how photographic reconnaissance and intelligence developed throughout the war. As classified documents, the magazines chart the evolution of the air war in the European Theatre from an aerial perspective with a greater degree of candour than might otherwise be the case. Along similar lines, between April 1943 and September 1945 the United States Army Air Force published *Impact*. Available in NARA and AFHRA, approximately ninety per-cent of the 1,730 pages published in its thirty issues consists of aerial photographs that systematically record the USAAF in action.<sup>61</sup>

### ***Operations Record Books (Form 540)***

Additional sources include Operations Record Books (ORBs) held by the TNA.<sup>62</sup> These documents incorporate the official operational record of each RAF unit or formation and include the photographic reconnaissance squadrons /wings /groups that took part in Crossbow.<sup>63</sup> Whilst the level of detail contained within an ORB varies markedly depending on the compiler and the unit, and although references to some secret operations are notable by their absence, they are an invaluable chronological account of the relevant units. In the case of the photographic reconnaissance squadrons, they often contain detailed information about individual sorties: sortie reference, sortie date, serial number of the aircraft, name of the pilot and navigator (when appropriate), flight time, purpose of the flight, details of the target(s) photographed, and other information worthy of note. The sortie reference, for example, is most helpful in tracing the surviving photography and plotting at NCAP, as well as the associated interpretation report(s) at TNA. It is also sometimes possible to work out the identity of the photographic interpreter who elucidated the

intelligence. The ORBs relating to Medmenham and its satellite stations, the Photographic Interpretation Unit and the 106 (Photographic Reconnaissance) Group, provide similar insights.

### *Wartime propaganda*

The extent to which wartime propaganda impacted on understandings of the role of photographic intelligence in Crossbow, and wartime photographic intelligence efforts more generally, was a further aspect of the research project and thus such material provides another relevant source. During the war, a Press and Publicity Section was established at Medmenham to select photographic intelligence suitable for release for propaganda purposes. Working with the Air Ministry public relations branch (Branch PR3), chosen images were supplied, with suitable annotations and captions, to the Censorship Bureau at the Ministry of Information (MoI). Indeed, aerial photography featured prominently in pamphlets and posters issued by local authorities, in illustrated magazines and newspapers, in exhibitions on bomb-damaged Germany, and in leaflets dropped over enemy-occupied territory (so-called ‘white bombs’). After the Dambusters raid in 1943, for example, such leaflets were dropped throughout Nazi-occupied Europe showing ‘before’ and ‘after’ aerial photographs of the Möhne and Eder dams.<sup>64</sup>

When the photographic library at the MoI’s Censorship Bureau was closed in 1946 the aerial photography selected for wartime propaganda purposes became publicly accessible via the Imperial War Museum. These photographs have, however, been uncritically used by historians, publishers and broadcasters. In reality, they provide a distorted version of photographic intelligence.<sup>65</sup> To illustrate this, when analytical techniques developed by the National Photographic Interpretation Center at the Central Intelligence Agency to determine the ‘truthfulness’ of propaganda photographs during the Cold War<sup>66</sup> are applied to the Censorship Bureau photographs they confirm that many were forged, faked or otherwise altered to suit the purposes of the wartime propagandists. This highlights the importance of comparing unadulterated photographs (held principally by NCAP and NARA) with manipulated images to discover what was hidden, eliminated or altered at the time in order to reveal the intentions of the propagandists.

Another legacy of wartime propaganda was a generation whose knowledge of the war was strongly conditioned by the cinematic images to which they had been exposed. During the post-war decades photographic intelligence was portrayed in such films as the *Malta Story* (1953), *Mosquito Squadron* (1969) and *A Bridge Too Far* (1977). Most notably, in 1965 Metro-Goldwyn-Mayer produced the epic *Operation Crossbow*. Yet this film, partly inspired by the writings of Babington Smith, is a highly-fictionalised account of the operation and the role of wartime photographic intelligence within it. This further emphasises the need to reappraise the operation.

### ***Oral History***

Oral history was a further source utilised in the book. Clearly, such material has to be used with care. Apart from the issue of age clouding memory, difficulties sometimes arise when veterans fill the gaps in their narrow personal experiences with information from other sources. These can include popular wartime myths or inaccurate anecdotes which find their way into general histories and poorly-researched film accounts to be absorbed and re-told, thus creating a ‘feedback loop’ of misinformation. Many a war story, widely repeated and acquiring in the repetition the status of ‘historical fact’, is found to stem from unsupported anecdote<sup>67</sup> or ‘recollections’ which sometime owe as much to mental images absorbed from scenes in Hollywood movies. Yet, with due diligence, oral history can provide valuable historical insights.

Although few veterans involved with wartime photographic intelligence were interviewed for the Imperial War Museum’s oral history collections,<sup>68</sup> in recent years volunteer members of the Medmenham Association have interviewed additional veterans which have added to our understanding of their wartime roles. An opportunity to supplement this work arose in 2010 when the BBC commissioned a documentary on *Operation Crossbow*.<sup>69</sup> For the author, who worked as a research consultant for the BBC production team, this programme provided an opportunity to garner further personal testimony from surviving veterans. When the documentary became a co-production with the Public Broadcast Service (PBS) in the USA, this exercise was successfully expanded to include a number of veteran American

photographic interpreters.<sup>70</sup> The BBC and PBS documentaries, broadcast in May 2011<sup>71</sup> and January 2012 respectively,<sup>72</sup> furnish important personal narratives about wartime photographic intelligence, with a particular focus on Crossbow.

Some conclusions can be drawn from these recollections about the relative value of veteran testimony for the historian of photographic intelligence. For example, the second-phase photographic interpreters,<sup>73</sup> whose sub-teams monitored such targets as shipping, airfields and railways on a day-to-day basis, acquired a detailed tactical understanding of the composition, disposition and strength of enemy activity. In contrast, the specialist teams of third-phase interpreters, who systematically collated data from their analysis of aerial photography with a view to spotting emerging trends, developed a more strategic knowledge of wartime operations. But having said that, when Major Geoffrey Stone was interviewed he observed that the fragmented organisation of Medmenham, and policy of only sharing information on a need-to-know basis, coupled with inter-service, sectional and personal rivalries, meant that few individuals had knowledge of the bigger picture.<sup>74</sup>

The interviews undertaken by Babington Smith for *Evidence in Camera*,<sup>75</sup> now located in the Medmenham Collection, are another significant source of information. Throughout 1956 and 1957, Babington Smith interviewed senior British and American participants in photographic intelligence during the Second World War, on both sides of the Atlantic. These included most of the senior interpreters involved in Crossbow, notably Douglas Kendall, Neil Simon, Robert Rowell, and Hugh Hamshaw Thomas. She did not use audio recording equipment, but instead took verbatim notes during the interviews.<sup>76</sup> For a study of wartime photographic intelligence, these interview notes are an indispensable starting point for understanding the personalities involved.

### ***Unpublished memoirs***

Most useful for this study was the memoir of Wing Commander Douglas Kendall, the Technical Control Officer at Medmenham. Written in the 1980s, after the revelations about Bletchley Park, 'A War of Intelligence' was intended for publication, but never appeared.<sup>77</sup> Now housed in the Medmenham Collection, it reinforced the notion that

R. V. Jones misrepresented the contribution of photographic interpretation to the success of Crossbow, and photographic intelligence more generally. Since it was written by the highest ranking photographic interpreter at Medmenham, who was the only member of the staff to be Ultra-cleared, and who was involved across the whole spectrum of Allied military intelligence activity, this memoir is a most valuable source in investigating the controversy over Jones's views.

### ***Book structure***

Following a prologue, *Operation Crossbow* is arranged chronologically, with chapters covering the period before, during, and after, Crossbow. The first 'section' (if one can describe it as such) includes chapters one to four and introduces the concerns of British intelligence about the German secret weapons capability early in the war; the development of British photographic reconnaissance during pre-war SIS and early-war RAF missions; the technical reliance on the civilian Aircraft Operating Company Limited for photographic interpretation services given the failure of British intelligence to maintain a capability during the inter-war years; the requisition of this company and role of Winston Churchill in engineering this; the creation of the Central Interpretation Unit at Medmenham in April 1941 and its continued expansion in 1942 when it was concerned with the planning stages of practically every major operation. By covering the private-sector origins of wartime photographic intelligence, the reader is introduced in the early chapters to some of the civilian photographic interpreters who were central characters in Crossbow; and by charting the organisational structure and diverse range of specialist teams at Medmenham it equips the reader with the background knowledge required to understand the photographic interpretation effort during the search for V-weapons.

The second 'section', which is the main focus of book and incorporates chapters five to thirteen, provides a detailed case study of the role of photographic intelligence during Crossbow. With concern about secret weapons re-ignited in early 1943 by secretly bugging the conversations of German officers in captivity, as well as through intelligence from secret agents, these chapters cover the appointment of Duncan Sandys MP to investigate the rocket weapons threat; the disagreement amongst senior scientists over whether a liquid-fuelled rocket was a technical possibility; and the War

Cabinet decision to approve Operation HYDRA, the Bomber Command raid on Peenemunde, near Zinnowitz in northern Germany. As the battle against the V-weapons intensified throughout 1943 and 1944, a detailed chronological study is provided of the interpretation work undertaken at Medmenham to identify and monitor the network of V-weapons' sites throughout Europe. In order to draw conclusions about the complex relationship between Medmenham and the various Whitehall establishments involved in the assessment of German secret weapons' capabilities, an account is provided of the often-cryptic briefings that were passed to Medmenham and the corresponding challenges for the photographic interpreters. By chronologically following the investigation, and informed by a close study of aerial photography, associated interpretation reports, other primary sources identified through archival research, and the conventions which dictated how photographic intelligence was reported, claims about the veracity of the photographic interpretation effort in Crossbow are considered.

In the final 'section' of the book, which includes chapter fourteen and the epilogue, the wider lessons learned from the application of photographic intelligence by the Allies and Germans during the Second World War are considered. The importance of captured German Luftwaffe aerial photography for Anglo-American target intelligence, and the value placed on continued co-operation in photographic intelligence, is considered in order that its value to the air intelligence relationship during the early Cold War can be assessed. The book ends with an account of what happened to the enormous volume of aerial photography held by the RAF at Medmenham and the chain of events that led to the location of NCAP in Edinburgh.

## **RESULTS AND CONCLUSIONS**

A review of *Operation Crossbow* by John Ingham appeared in *The Daily Express* in June 2013. The reviewer praised the book as 'a fascinating and scholarly account of a secret sideshow of the war'. However, he also pointed out 'one weakness' of the volume. That was that 'it reads at times like an academic tome'.<sup>78</sup> Hopefully, this apparent criticism can be regarded more favourably in the context of this critical review - as an indication of the academic credibility of the book.

In broad terms the book relates how a team of photographic interpreters based at a country house in Medmenham on the banks of the Thames uncovered the secrets of the Germans' V-weapons programme, so enabling countermeasures to be deployed which saved thousands of lives. In so doing, it provides a wealth of information on such matters as the wartime development of photographic interpretation, the techniques used by the interpreters, the personalities involved, the significance of aerial intelligence to Crossbow, and the wider politics of wartime intelligence. These matters have much academic merit in themselves. However, more particularly, the volume also addresses two research questions outlined earlier.

**Research question 1:** On the basis of the intelligence briefings provided, and the conventions under which they operated, are the claims made by Jones about the competency of their photographic interpretation effort during Operation Crossbow reasonable?

During the Second World War the working relationship between the Air Ministry's Assistant Director of Intelligence (Science), Dr. R. V. Jones, and the Medmenham interpreters was frequently strained. This strain was at its height during the hunt for the V-weapons. Evidence of this fractious relationship is clear in Jones's wartime memoir.<sup>79</sup> He obviously resented the fact he was not chosen to lead the investigation and capitalised on any opportunity to discredit the photographic interpreters involved in Crossbow.<sup>80</sup> First, he lambasted the interpretation of aerial photography at the outset of the investigation, claiming the Medmenham interpreters failed to identify a rocket at the Peenemunde experimental site.<sup>81</sup> Second, he challenged the story of the identification of a V-1 flying bomb on a ramp at the same experimental site by the interpreters in L Section as being merely an 'accidental discovery'.<sup>82</sup> Instead, he took much of the credit for discovering it himself. Third, he criticised the failure of the Medmenham interpreters to spot a rocket on aerial photography of the Blizna experimental site.<sup>83</sup> It is contended that since Jones's memoirs have been influential in historical assessments of the role of photographic interpretation in Crossbow, the book's attempt to determine the veracity of these claims through an analysis of the relevant primary records is a valuable corrective.

### *Failure to spot a rocket at Peenemunde*

At the outset of the Crossbow investigation in April 1943, the photographic interpreter, Flight Lieutenant André Kenny, was tasked with searching for information about rocket testing at Peenemunde (in modern-day Mecklenburg-Vorpommern). During the initial weeks of the investigation, Kenny and the interpreters involved in the hunt for long-range rockets were advised by government scientists from the Ministries of Supply and Economic Warfare - rather than by R. V. Jones and his colleagues in scientific intelligence – as what to look for in the aerial photography.<sup>84</sup> At this stage, the emphasis was placed on the rocket threat and any suggestion that new weapons other than rockets might be involved was discounted. Moreover, the interpreters were instructed to look for launching rails and were advised that due to the weight of the rockets any Crossbow-related sites would be rail-served.

The archives reveal that, when the investigation began, this remote part of the Baltic coast in northern Germany had been photographed during four sorties: A/762 on 15 May 1942; N/709 on 19 January 1943; N/756 on 1 March 1943, and N/807 on 22 April 1943.<sup>85</sup> Using this aerial photography, Kenny examined the Peenemunde site and initially decided that installations photographed at the airfield were ‘sludge-pumping equipment’ related to land reclamation.<sup>86</sup> This miscalculation, along with the pre-war rejection of Kenny’s Cambridge PhD on hydraulic engineering in ancient Greece and Rome, combined with his engineering work on land drainage in the England fens, made him and his Medmenham colleagues an easy target for Jones.<sup>87</sup> To add insult to injury, Jones credited himself as being the first person to spot a rocket at Peenemunde when, on 18 June, he was studying aerial photography created during sortie N/853 flown six days earlier. He castigated the photographic interpreters for having ‘missed it’.<sup>88</sup>

However, the book comes to the aid of Kenny. On 14 May 1943, a photographic reconnaissance mission was flown over Peenemunde, sortie N/825, from which a detailed study of the elliptical earthworks and related structures was possible. In the associated interpretation report, Kenny recorded having spotted a column of five vehicles and that ‘the middle vehicle appears to carry a cylindrical object thirty-eight



feet by eight, which projects over the next truck'. On re-examination of the earlier photographs, he noted that similar objects could be seen and that activity over the whole site was intensive.<sup>89</sup> Furthermore, a detailed third-phase interpretation report of 16 June 1943 written by Kenny about sortie N/853 proves that *he* first spotted the rocket and identified it as an 'object' that measured thirty feet by eight feet.<sup>90</sup> When later commenting on the controversy, he claimed never to have doubted that it was a rocket but, not being a scientist, was constrained by the fact that interpreters were forbidden to speculate about objects until their existence had been officially accepted.<sup>91</sup> It is reasonable to suggest that Kenny was unfairly pilloried by Jones for simply not spelling out the word 'rocket' and the value of photographic intelligence during the operation was thus unreasonably slandered by Jones.

### ***V-1 flying bombs at Peenemunde***

Jones recorded in his memoir that a Bois Carré-type launching site at Zinnowitz in northern Germany, close to the nearby Peenemunde facility, was identified by a French agent Jeannie Rousseau (code-named Amniarix). Jones claimed that this revelation prompted him to request a photographic reconnaissance sortie of the area, sortie N/980 on 28 November 1943, in the hope that it would establish a definitive connection between the network of Bois Carré-type sites in northern France and Peenemunde. Furthermore, Jones suggested that by intercepting German radar tracks, which indicated when the Germans were firing projectiles, he recommended the optimum time of day for the sortie to be flown over Zinnowitz and Peenemunde thereby giving the best chance of photographing a pilotless aircraft in-situ.<sup>92</sup> Thus when Babington Smith and others thought that the important discovery of a V-1 on a ramp at Peenemunde, ready to be launched, had been a lucky break, Jones was able to claim it had all been the result of careful calculation.<sup>93</sup>

The chain of events that can be deduced from the evidence, however, suggests a different picture. Following a briefing on 3 November 1943 from Colonel Terence Sanders, the Director of Technical Development at the Ministry of Supply, that the Germans might be planning to deploy projectiles, possibly launched from two rails inclined at a steep angle,<sup>94</sup> Douglas Kendall tasked L Section - led by Flight Officer Babington Smith - with re-studying activity at Peenemunde in the hope that the

aircraft specialists could identify the projectile and associated launch ramps.<sup>95</sup> Revisiting the aerial photography of the experimental station, they duly spotted a small object, not beside the airfield but in a small enclosure behind the aircraft hangars, immediately adjoining a building the interpreters suspected was being used for jet engine testing. With a wingspan of only twenty feet it was christened 'Peenemunde 20'.

Meanwhile, to develop their understanding of the uniformly-constructed Bois Carré sites - and through a masterful example of photographic interpretation - Kendall analysed each of the buildings in turn and developed the hypothesis that the two longer ski-buildings were used to store the main body of a projectile and the shorter structure housed the wings. Since the platforms on the sites pointed towards London (the direction became known as the London Line), Southampton, Bristol and Portsmouth, the likelihood of this being a launch site of some form of projectile was thought high.

When Babington Smith showed Kendall a ramp spotted near the Peenemunde airfield, and Kendall confirmed its association with the 'Peenemunde 20', the third-phase interpreters began searching the photography from the Medmenham Print Library to understand the chronological development of the Peenmunde site. Photography from January 1943 revealed one completed firing site and a second under construction, while photography from May 1943 showed that the second site had been completed. When the most recent photographs from sortie N/980 were analysed by the aircraft specialists, on examining frame 4031, which covered the ramps at the start of the photographic run over Peenemunde (unfortunately no stereo pair had been taken), they could see a cruciform object at the bottom of a ramp. Medmenham thus had irrefutable evidence of a 'Peenemunde 20' sitting on a ramp, ready to be fired.<sup>96</sup> In Interpretation Report BS164, Kendall was also able to record the signature marks left by pilotless aircraft that had crash-landed into the estuary sands.<sup>97</sup>

A study of the Operations Record Book for 540 Squadron seems to contest Jones's version of events. The key sortie, N/980, was flown by Squadron Leader John Merifield, alongside his navigator Flying Officer, William Whalley, in a de Havilland Mosquito. They are recorded to have departed from RAF Leuchars at 09:55, on a flight that lasted six hours and ten minutes. The stated purpose of the mission was a

post-strike photographic reconnaissance of Berlin. On reaching the German capital that morning, and discovering their target was obscured by 10/10 cloud cover, they then photographed alternative high-priority targets in surrounding areas.<sup>98</sup> The Medmenham-created sortie plot records these as Stettin, where the Kriegsmarine's one and only aircraft carrier the *Graf Zeppelin* was docked; Swinemunde, where they photographed the German cruiser *Admiral Scheer*; airfields at Anklam, Greifswald and Stralsund; and vertical and oblique photography of the Peenemunde area, including the coastline near Zinnowitz.<sup>99</sup>

When Babington Smith interviewed Merifield during research for her book on wartime photographic intelligence, his testimony confirmed the official record of this being an aborted damage-assessment sortie, and provided evidence that the Peenemunde airfield was merely a target of opportunity, a means to 'finish up an odd bit of film on the way back', and that no briefing had been provided about photographing a specific geographical point at a specific time.<sup>100</sup> As this witness testimony matches the sequence of frames on the original roll of film from the sortie, which was declassified and released into the public domain between 2004 and 2008,<sup>101</sup> the veracity of Jones's account is brought into serious question. The case against him is further reinforced by the fact that the highest priority would have been afforded a photographic reconnaissance sortie that could have provided the evidence linking Peenemunde with the Bois Carré sites in France. Indeed, it would have surely involved a careful briefing of the aircrew involved in such a mission, a briefing Jones himself provided on many other occasions during the war.<sup>102</sup> When the evidence is considered, the suspicion is that Jones had a tendency to embroider the facts. Moreover, his account serves greatly to undermine the achievements of Kendall and L Section. Their masterful photographic interpretations, particularly given how little information was available to them, provided one of the most important and dramatic intelligence breakthroughs of the war.

### ***Failure to spot a rocket at Blizna***

Jones, unlike the Medmenham interpreters (with the sole exception of Douglas Kendall), had unrestricted access to Ultra-derived intelligence. This revealed that the

Germans were sending *geräte* (apparatus) between Peenemunde and Blizna (another experimental site in Poland). In the hope of proving a connection between the two sites Jones recorded in his memoir that one evening in early July 1944 he analysed copies of aerial photographs taken during sortie 60PR/385 over Blizna on 5 May 1944.<sup>103</sup> This was after Medmenham had already drawn up its own interpretation report of the photographs taken during the sortie.<sup>104</sup> Looking at frame 3240, and its associated stereo-pair, he identified a rocket ninety millimeters down from the top of the frame and twenty-six millimetres in from the right-hand edge. Jones then directly informed the Chiefs of Staff and Lord Cherwell about his discovery, in the process illustrating the alleged incompetence of the photographic interpreters at Medmenham.<sup>105</sup>

The book shows this to be a very partial view of the situation. The evidence indicates that although the photographic interpreters at Medmenham did in fact report the presence of railway wagons similar in appearance to ones spotted at the experimental sites at Peenemunde and Friedrichshafen, they had never been warned that signals intelligence indicated that rocket experiments were taking place at Blizna. This meant the location had never been thoroughly investigated from that perspective. Furthermore, they were not even asked to provide an opinion on the photographed object submitted to the Chiefs of Staff as being a rocket.<sup>106</sup> Indeed, Kendall dryly noted to his RAF superiors that on subsequent investigation the object in question at Blizna could be a rocket (which the candidate's examination of the original photography confirms it was), but this was by no means certain and there was a possibility it was merely an excavator.<sup>107</sup> Kendall's superiors, in turn, advised the Air Ministry that the passing of amateur efforts at photographic interpretation to the Chiefs of Staff was 'undesirable' because it was the surest method of discrediting photographic intelligence.

This episode also highlighted a constant problem suffered by the Medmenham interpreters during the war: that of not having access to all the available intelligence that existed.<sup>108</sup> This certainly allowed Jones to discredit the interpreters' skill while at the same time glossing over the fact that while it was easy to *look* it was not always so easy to *see*, particularly if one did not know what one was looking for. This was particularly the case during Crossbow given that the interpreters were hunting for a

new technology. Overall, and in short, the book therefore finds that Jones's memoirs cannot be taken as a reliable guide to the role of photographic intelligence during the operation.

**Research Question 2:** What can a study of Crossbow tell us about the importance of British photographic intelligence during the Second World War, and can it be considered a significant 'missing dimension' of academic intelligence studies?

The book shows that photographic intelligence was indeed a vital source of wartime military intelligence. It was certainly not without its limitations and it could not provide all the evidence required when planning military operations. Photographic reconnaissance, for example, was frequently impotent during periods of bad weather, or when targets were beyond aircraft range. Nevertheless, the information held within the millions of aerial photographs accumulated in the wartime Medmenham Print Library enabled interpreters to undertake vital analysis of enemy activity over time. This resource proved to be of particular importance during the planning of major military operations - and never more so than during Crossbow - when detailed chronological intelligence was required. And since vital intelligence could be extracted through the re-interpretation of existing photography, this usefully avoided the security risks associated with increasing the flow of information from other intelligence sources. The scale of the photographic reconnaissance effort made this possible and ensured that very little of major importance passed unrecorded. This made the Medmenham Library a unique A1 source of military intelligence during the Second World War.

The fact that aerial photography was regularly undertaken before operations to inform the planning stages - and during/afterwards to assess the outcome(s) - highlights the importance placed on this intelligence source during the war. So does the growth in scale of the photographic reconnaissance effort in the European Theatre. This is borne out by the enormous scale of the undertaking, in terms of highly-trained personnel, the development of purpose-designed aircraft, and the wherewithal to produce and distribute millions of photographic images. From the handful of individuals involved

in high-altitude unarmed photographic reconnaissance at the outset of the conflict, thirteen squadrons – five in the RAF, five in the United States Army Air Force, and three in the Royal Canadian Air Force – were allotted to strategic photographic reconnaissance. In addition to their efforts, every bomber - whether by day or night - and coastal patrol aircraft carried an aerial camera. All this photography was despatched to Medmenham, where the photographic coverage held was so total and frequent that remarkably complete information could be deduced for many targets.<sup>109</sup>

As for the wider question of intelligence studies, in recent years there has been an upsurge of interest in the Second World War in popular culture, historical fiction, television documentaries and film productions. This trend is reflected in academia, where the rise of social and cultural histories of the war have seen a new generation of academic historians begin the lengthy process of disentangling truth from wartime propaganda and post-war mythology.<sup>110</sup> But, as has been demonstrated above, this process of historical revisionism has only just reached the field of wartime photographic intelligence. At the same time, whilst the validity of ‘intelligence studies’ as a distinct academic entity has been challenged on the grounds it may be more of a bureaucratic-academic construct, rather than an academic-intellectual one,<sup>111</sup> academic intelligence studies has been identified as a rapidly evolving discipline in its own right - ‘one of the fastest growing subsets of international history, political science and strategic studies’<sup>112</sup> - which has successfully jostled for space and recognition among a myriad of other academic disciplines. This growth was understandably accelerated by the declassification of British and American intelligence records following the decline and fall of Soviet Communism, and the conclusion of the Cold War. As the initial growth and focus of academic writing on intelligence was characterised by a desire for discovery, it is understandable why the eagerness to move from the eradication of one ‘missing dimension’ to the next has led to some lacunae in research. One can argue that the systematic study of wartime photographic intelligence has itself become ‘a missing dimension’.

In chapter 14, ‘Open Skies’, and the epilogue, the book provides an account of what happened to the large volume of aerial photography accumulated by the RAF during the war, the development of Anglo-American photographic intelligence in the early Cold War era, the restrictive caveats that were placed on public accessibility to this

aerial photography, and the ramifications which eventually led to the location of NCAP in Edinburgh. In so doing, the book provides evidence of why British photographic intelligence during the Second World War became a ‘missing dimension’ of academic intelligence studies and, given the wide range of intelligence questions that were answered by photographic interpretation during the conflict, the potential of military-declassified aerial photography to transform our understanding of historical events.

Although, as has been alluded to above, the tens-of-thousands of photographic interpretation reports created at Medmenham became publicly accessible in TNA in the 1970s, the wartime aerial reconnaissance photography, which could not be viewed alongside them, severely limited researchers’ capacity to develop a knowledge and understanding of this important historical source. Although batches of wartime aerial photography were declassified during the Cold War, security and foreign policy considerations compounded the problems of access and ensured that millions of wartime images remained classified and inaccessible (in particular those covering Soviet bloc countries). Moreover, further accessibility challenges stemmed from the absence of a comprehensive cataloguing system for the Medmenham Print Library. This meant that when a collection of photographs was released by JARIC to the University College of North Staffordshire (now Keele University) in the early 1960s, there was no means to discover photographs of particular places, taken on particular dates, by particular squadrons, or relating to particular subjects. This was compounded by the fact that no information about what wartime photography had been withheld, or destroyed, was in the public domain. It was only in the 1970s that systems began to be developed to make the collection searchable.<sup>113</sup> Following the collapse of Soviet Communism, further photography was released to Keele University. But, once again, the lack of a search facility limited its usefulness and JARIC was not prepared to share its own finding aids.

The problem of accessibility, and searchability, only began to be resolved with the bulk declassification of aerial photography by the Ministry of Defence – some 20 million in total - to NCAP between 2004 and 2008. To provide a means of searching the collection, approximately 12,000 3M microfilm cassettes were provided by JARIC.<sup>114</sup> Developed progressively since the autumn of 1967, this microfilm

collection was created in tandem with the computerisation of cover-searching. This involved an Automatic Storage Retrieval Section inputting the geographical coordinates for each aerial photograph from sortie plotting into a database. Thereafter, sortie-by-sortie, JARIC photographers created a microfilm copy of each aerial image and the associated sortie plotting (which was subsequently destroyed).<sup>115</sup> When photography of a particular location was required, the database was interrogated with the latitude and longitude of a target area and details of available photography were provided. Using the microfilm, it was then possible for the photographic interpreters to view frames of aerial photography on a microfilm reader in order that the required film(s) and frame(s) could be selected for detailed photographic interpretation.<sup>116</sup> The digital revolution and growing availability of digital technology, particularly digital photography, has subsequently transformed both accessibility to the collection and the capacity to cost-effectively create high-resolution digital copies of the photography. With searches powered by geo-data, the collection is now becoming progressively searchable via a Geographical Information System and via the NCAP website - <http://ncap.org.uk/>.

The release of the aerial photography to NCAP thus represented a watershed moment and transformed the capacity of intelligence historians, military historians and others to utilise aerial photography as a means to help disentangle ‘truths’ about the conflict from wartime propaganda and post-war mythology. Indeed, the intellectual challenge for the historian is analogous with the basic function of a wartime intelligence unit. In the ‘war of wits’, intelligence services collected and procured information from sources, evaluated their reliability and trustworthiness, and the probability of the information being ‘true’. Whilst the *reliability* of sources was rated with the letters A to D (with A indicating that a source was highly reliable, and D indicating that it was from an unreliable or untested source), the *probability* of the information being ‘true’ was rated with numerals from 1 to 4 (with 1 indicating that the information was highly probable, accurate and corroborated, and 4 that it was improbable or inaccurate).<sup>117</sup> As the amount of reliable and accurate information during the conflict was never sufficient, photographic intelligence became highly prized for its capacity to help answer intelligence questions and, given the extent to which it informed military decision-making, the re-interpretation of declassified aerial photography provides a most fruitful means both to re-consider the merit of those decisions and



potentially transform our understanding of wartime events. The ‘missing dimension’ can now be relocated.

## Notes

The two main sources of primary information cited in this critical review are The National Archives (TNA) and the Medmenham Collection (MDM). References to TNA records commence with ‘TNA’, and are followed by the department code, series number, piece number, and where appropriate the item number (e.g. TNA AIR 34/75/1B). References to MDM sources commence with ‘MDM’ and are followed by class and item number (e.g. MDM DFG/5701).

The following abbreviations are used in the notes:

ACIU	Allied Central Interpretation Unit
AIR	Air Ministry
BBC	British Broadcasting Corporation
CIU	Central Interpretation Unit
IWM	Imperial War Museum
ORB	Operations Record Book
MDM	Medmenham Collection
NCAP	National Collection of Aerial Photography
PBS	Public Broadcasting Service
RAF	Royal Air Force
TNA	The National Archives

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<sup>1</sup> TNA AIR 25/791: ORB, 106 Group, RAF. Appendix AA. Programme: Press visit to RAF Benson and Medmenham, Wednesday 5 September 1945.

<sup>2</sup> For a more detailed account of the press conference, please see: A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, pp. 10, 362-363.

<sup>3</sup> N. D. Ryder (1945) Keeping Watch on Jerry. *Flight*, 13 September, pp. 290-291.

<sup>4</sup> United States Strategic Bombing Survey (1945) *Summary Report: European War*, Washington, D.C.: United States Government Printing Office.

<sup>5</sup> United States Strategic Bombing Survey (1945) *V Weapons (Crossbow) Campaign*, Washington D.C.: United States Government Printing Office.

<sup>6</sup> Editorial (1945) Now It Can Be Told: Curiosity of Woman Saved America from V-Bomb Blitz, *The Pittsburgh Press*, 7 October, p. 25.

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<sup>7</sup> MDM MHP/16: Unpublished memoir: *A War of Intelligence*, by Wing Commander Douglas Neville Kendall (retired).

<sup>8</sup> P. J. de la Ferté (1957) *Rocket*, London: Hutchinson, p. 102.

<sup>9</sup> C. Babington Smith (1958) *Evidence In Camera: The Story of Photographic Intelligence in World War II*, London: Chatto & Windus, pp. 203-238.

<sup>10</sup> A copy of the front cover, of this comic book, may be found in the image section of: C. Campbell (2012) *Target London: Under Attack from the V-Weapons During WWII*, London: Little Brown.

<sup>11</sup> S. Cox (2003) Setting the Historical Agenda: Webster and Frankland and the Debate over the Strategic Bombing Offensive against Germany, 1939-1945. IN: J. Grey (Ed) *The Last Word? Essays on Official History in the United States and British Commonwealth*, Westport: Praeger, pp. 147-174.

<sup>12</sup> F. H. Hinsley & E. E. Thomas & C. F. G. Ransom & R. C. Knight (1984) *British Intelligence in the Second World War: Its Influence on Strategy and Operations, Volume Three (Part 1)*, London: HMSO, pp. 357-458.

<sup>13</sup> F. H. Hinsley & E. E. Thomas & C. A. G. Simkins & C. F. G. Ransom (1988) *British Intelligence in the Second World War: Its Influence on Strategy and Operations, Volume Three (Part 2)*, London: HMSO, pp. 533-604.

<sup>14</sup> F. H. Hinsley (1987) British Intelligence in the Second World War. IN: C. Andrew & J. Noakes (Eds) *Intelligence and International Relations 1900-1945*, Exeter: The University of Exeter Press, pp. 209-10.

<sup>15</sup> M. Gilbert (1966) *Winston S. Churchill: Never Despair, 1945-1965*, London: Heinemann, p. 405.

<sup>16</sup> W. Churchill (1952) *The Second World War, Volume V, Closing The Ring*, London: Cassell, pp. 201-213.

<sup>17</sup> W. Churchill (1954) *The Second World War, Volume VI, Triumph and Tragedy*, London: Cassell, pp. 34-49.

<sup>18</sup> Ibid, p.651.

<sup>19</sup> C. Babington Smith (1957) *Air Spy: The Story of Photo Intelligence In World War II*, New York: Harper & Brothers.

<sup>20</sup> C. Babington Smith (1957) How Photographic Detectives Solved Secret Weapon Mystery, *Life*, 28 October, pp. 126-146.

<sup>21</sup> C. Babington Smith (1958) *Evidence In Camera: The Story of Photographic Intelligence in World War II*, London: Chatto & Windus.

<sup>22</sup> E. Kay (1989) *The International Authors and Writers Who's Who (Volume 7)*, Cambridge: International Biographical Centre, p. 26.

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- <sup>23</sup> C. Babington Smith (2004) *Evidence In Camera: The Story of Photographic Intelligence in World War II*, Stroud: Sutton Publishing.
- <sup>24</sup> F. W. Winterbotham (1974) *The Ultra Secret*, London: Purnell Book Services.
- <sup>25</sup> D. Syrett (1983) The Secret War and the Historians. *Armed Forces and Society*. Volume 9 (Issue 2), p. 298.
- <sup>26</sup> F. W. Winterbotham (1974) *The Ultra Secret*, London: Purnell Book Services, p. 6.
- <sup>27</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates, p.3.
- <sup>28</sup> U. Powys-Lybbe (1983) *The Eye of Intelligence*, London: William Kimber, p.13.
- <sup>29</sup> J. M. Goodchild (2013) *R. V. Jones and the Birth of Scientific Intelligence*. Thesis (PhD), University of Exeter, p.vi.
- <sup>30</sup> B. Collier (1964) *The Battle of the V-Weapons (1944-1945)*, London: Hodder and Stoughton.
- <sup>31</sup> B. Collier (1957) *The Defence of the United Kingdom*, London: HMSO.
- <sup>32</sup> B. Collier (1964) *The Battle of the V-Weapons (1944-1945)*, London: Hodder and Stoughton, pp. 138-152.
- <sup>33</sup> D. Irving (1964) *The Mare's Nest: The German Secret Weapons Campaign and the British Counter-Measures*, London: William Kimber.
- <sup>34</sup> University of Cambridge, Churchill Archives Centre, Papers of Lord Duncan Sandys: GBR/0014/DSND2/10A: Correspondence with David Irving.
- <sup>35</sup> R. Stanley (2010) *V Weapons Hunt: Defeating German Secret Weapons*, Barnsley: Pen & Sword Military, p. 245.
- <sup>36</sup> Ibid, pp. 9-10.
- <sup>37</sup> BBC (2011) *Operation Crossbow* [online]. Available from: <http://www.bbc.co.uk/programmes/b011cr8f> [Accessed 23 November 2015].
- <sup>38</sup> I. Daglish (2005) *Over the Battlefield: Operation Goodwood*, Barnsley: Pen and Sword.
- <sup>39</sup> Ibid. pp. 230-233.
- <sup>40</sup> I. Daglish (2007) *Over the Battlefield: Operation Epsom*, Barnsley: Pen and Sword.
- <sup>41</sup> I. Daglish (2009) *Over the Battlefield: Operation Bluecoat*, Barnsley: Pen and Sword.
- <sup>42</sup> R. Ehlers (2009) *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns*, Lawrence: University Press of Kansas, pp. 1-13.
- <sup>43</sup> C. Campbell (2012) *Target London: Under Attack from the V-Weapons During WWII*, London: Little Brown.
- <sup>44</sup> C. Halsall (2012) *Women of Intelligence: Winning the Second World War with Air Photos*, Stroud: History Press.
- <sup>45</sup> It should be noted that NCAP holds the Ministry of Defence declassified and JARIC-released aerial photography taken during Second World War of locations throughout the

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world. Aerial photography taken during training flights over England, Northern Ireland, Scotland, and Wales - and sorties flown by the RAF, No.1 Camouflage Unit to monitor the effectiveness of camouflage schemes across the United Kingdom - are respectively held by Historic England, the Public Record Office of Northern Ireland, NCAP, and the Royal Commission on the Ancient and Historical Monuments of Wales.

<sup>46</sup> TNA AIR 34/80: (Operation) Crossbow: History of the P.I. Investigation (1943-1945).

<sup>47</sup> The TNA-held BS Series of photographic interpretation reports constitute the following:

TNA AIR 34/117: Operation Crossbow - Interpretation Reports - BS 0001-0070;

TNA AIR 34/118: Operation Crossbow - Interpretation Reports - BS 0071-0100;

TNA AIR 34/119: Operation Crossbow - Interpretation Reports - BS 0101-0140;

TNA AIR 34/120: Operation Crossbow - Interpretation Reports - BS 0141-0170;

TNA AIR 34/121: Operation Crossbow - Interpretation Reports - BS 0171-0200;

TNA AIR 34/122: Operation Crossbow - Interpretation Reports - BS 0201-0240;

TNA AIR 34/123: Operation Crossbow - Interpretation Reports - BS 0241-0280;

TNA AIR 34/124: Operation Crossbow - Interpretation Reports - BS 0281-0310;

TNA AIR 34/125: Operation Crossbow - Interpretation Reports - BS 0311-0350;

TNA AIR 34/126: Operation Crossbow - Interpretation Reports - BS 0351-0380;

TNA AIR 34/127: Operation Crossbow - Interpretation Reports - BS 0381-0440;

TNA AIR 34/128: Operation Crossbow - Interpretation Reports - BS 0441-0490;

TNA AIR 34/129: Operation Crossbow - Interpretation Reports - BS 0491-0540;

TNA AIR 34/130: Operation Crossbow - Interpretation Reports - BS 0541-0600;

TNA AIR 34/131: Operation Crossbow - Interpretation Reports - BS 0601-0650;

TNA AIR 34/132: Operation Crossbow - Interpretation Reports - BS 0651-0700;

TNA AIR 34/133: Operation Crossbow - Interpretation Reports - BS 0701-0770;

TNA AIR 34/134: Operation Crossbow - Interpretation Reports - BS 0771-0840;

TNA AIR 34/135: Operation Crossbow - Interpretation Reports - BS 0841-0920;

TNA AIR 34/136: Operation Crossbow - Interpretation Reports - BS 0921-0989;

TNA AIR 34/137: Operation Crossbow - Interpretation Reports - BS 0990-1038;

TNA AIR 34/138: Operation Crossbow - Interpretation Reports - BS 1039-1089.

<sup>48</sup> D. Bottoms (1992) *World War II Records in the Cartographic and Architectural Branch of the National Archives*, Washington, D.C.: National Archives and Records Administration, pp. 51-53.

<sup>49</sup> TNA (2015). *Air Ministry and Ministry of Defence: Air Historical Branch: Narratives and Monographs* [online]. Richmond, TNA. Available from:

<http://discovery.nationalarchives.gov.uk/details/r/C2096> [Accessed 1 November 2015].

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<sup>50</sup> TNA AIR 41/6: RAF Narrative: Photographic Reconnaissance by the RAF in the War of 1939-1945 (Volume 1).

<sup>51</sup> TNA AIR 41/7: RAF Narrative: Photographic Reconnaissance by the RAF in the War of 1939-1945 (Volume 2).

<sup>52</sup> TNA AIR 34/84: ACIU Section Histories.

<sup>53</sup> TNA AIR 34/81: Historical record of the CIU / ACIU Print Library, April 1941 – September 1945.

<sup>54</sup> TNA AIR 34/80: (Operation) Crossbow: History of the P.I. Investigation (1943-1945).

<sup>55</sup> TNA AIR 34/75/1B: RAF Station Medmenham, Operation Crossbow, Historical Record File. Notes on the Contribution of Photographic Intelligence to the Crossbow Investigation, 2 October 1944.

<sup>56</sup> TNA AIR 34/80: (Operation) Crossbow: History of the P.I. Investigation (1943-1945).

<sup>57</sup> TNA AIR 10/3742: Illustrated Handbook for officers concerned with Examination and Interpretation of Air Photographs.

<sup>58</sup> TNA AIR 37/611: 2nd Tactical Air Force, Tactical reconnaissance and the ground organisation in support of air photography, 1944-1945: reports.

<sup>59</sup> NCAP/13/2/3: Ministry of Defence, Joint School of Photographic Interpretation, Lecture Notes (Number 3) Interpretation Technique.

<sup>60</sup> The master set of the Evidence In Camera magazine is held by The National Archives, as detailed below:

TNA AIR 34/234: Evidence in Camera: Vol. 1, Issues I-XI, October 1942 - December 1942.

TNA AIR 34/235: Evidence in Camera: Vol. 2, Issues I-XIII, January 1943 - March 1943.

TNA AIR 34/236: Evidence in Camera: Vol. 3, Issues I-XIII, April 1943 - June 1943.

TNA AIR 34/237: Evidence in Camera: Vol. 4, Issues I-XIII, July 1943 - September 1943.

TNA AIR 34/238: Evidence in Camera: Vol. 5, Issues I-XIII, October 1943 - December 1943.

TNA AIR 34/239: Evidence in Camera: Vol. 6, Issues I-XIII, January 1944 - March 1944.

TNA AIR 34/240: Evidence in Camera: Vol. 7, Issues I-XIII, April 1944 - July 1944.

TNA AIR 34/241: Evidence in Camera: Vol. 8, Issues I-XIV, August 1944 - March 1945.

<sup>61</sup> J. Parton (1980) How Impact Began, Was Edited and Used During World War II. IN: *IMPACT: The Army Air Forces Confidential Picture History of World War II (Book 1)*, New York: James Parton, pp. iii,vi-vii.

<sup>62</sup> Royal Air Force (2015) *Air Historical Branch: Official Sources of Information* [online]. Available from: <http://www.raf.mod.uk/ahb/sourcesofinformation/> [Accessed: 17 September 2015].

<sup>63</sup> It should be noted that Operations Record Books are held by The National Archives in the following record series: Squadrons (AIR 27); Wings (AIR 26); Groups (AIR 25).

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<sup>64</sup> For a more detailed account please see: A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, pp. 67-69.

<sup>65</sup> NAPLIB (1999) *Directory of Aerial Photographic Collections in the United Kingdom*, Dereham: NAPLIB, p.49.

<sup>66</sup> D. Brugioni (1969) Spotting Photo Fakery. *Studies in Intelligence*. Volume 13 (1), pp.57-68.

<sup>67</sup> I. Daghli (2009) *Over the Battlefield: Operation Bluecoat*, Barnsley: Pen and Sword, p.9.

<sup>68</sup> The Sound Archive at the IWM includes the following oral history recordings of Medmenham veterans:

Bulmer, Pamela (IWM interview). Made by IWM (Production company) 17 August 2001. Catalogue number: 22112.

Komrower, Shirley (IWM interview). Made by IWM (Production company) 17 August 2001. Catalogue number: 22107.

Morgan, Suzie (IWM interview). Made by IWM (Production company) 17 August 2001. Catalogue number: 22106.

Collyer, Myra Nora (IWM interview). Made by IWM (Production company) 24 October 2002. Catalogue number: 23845.

Scott, Hazel (IWM interview). Made by IWM (Production company) 17 August 2001. Catalogue number: 22105.

Wilson, Sophie (IWM interview). Made by IWM (Production company) 17 August 2001. Catalogue number: 22102.

<sup>69</sup> The author provided research consultancy services to the BBC, and worked in collaboration with Medmenham Association volunteers, Wing Commander Michael Mockford (retired) and Major Christopher Halsall (retired) on the production. The documentary was first aired on BBC2 on 15 May 2011.

<sup>70</sup> The documentary was significantly re-edited for an American audience, was re-titled *3D Spies of WWII*, and was first aired on the PBS network on the 18 January 2012.

<sup>71</sup> BBC (2011) *Operation Crossbow* [online]. Available from:

<http://www.bbc.co.uk/programmes/b011cr8f> [Accessed 23 November 2015].

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<sup>72</sup> PBS (2011) *3D Spies of WWII* [online]. Available from:

<http://www.pbs.org/wgbh/nova/military/spies-3d.html> [Accessed 23 November 2015].

<sup>73</sup> For a more detailed account of second-phase interpretation please see: A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, pp. 82-83, 217.

<sup>74</sup> For a more detailed account of the eyewitness testimony of Major Geoffrey Stone (retired) please see: A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, pp. 80-82, 87-89.

<sup>75</sup> C. Babington Smith (1958) *Evidence In Camera: The Story of Photographic Intelligence in World War II*, London: Chatto & Windus.

<sup>76</sup> For a more detailed account of the interview notes compiled by Constance Babington Smith, please see: A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, pp. 363-366.

<sup>77</sup> MDM MHP/16: Unpublished memoir: *A War of Intelligence*, by Wing Commander Douglas Neville Kendall (retired).

<sup>78</sup> J. Ingham, 'Book review: Operation Crossbow', *The Daily Express*, 12 June 2013.

<sup>79</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates.

<sup>80</sup> *Ibid*, p. 335.

<sup>81</sup> *Ibid*, pp. 339-348.

<sup>82</sup> *Ibid*, pp. 367-369.

<sup>83</sup> *Ibid*, pp. 451-452.

<sup>84</sup> A. Williams (2013) *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons*, London: Preface Publishing, p. 12.

<sup>85</sup> TNA AIR 34/196: CIU Interpretation Report DS1, New Development at Peenemunde, 29 April 1943.

<sup>86</sup> TNA AIR 34/80: ACIU (Operation) Crossbow, History of the P.I. Investigation (February 1943 – April 1945), p. 2.

<sup>87</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates, p. 339.

<sup>88</sup> *Ibid*, p. 340.

<sup>89</sup> TNA AIR 34/196: *CIU Interpretation Report DS4*, 26 May 1943.

<sup>90</sup> TNA AIR/34/196/9A: CIU Interpretation Report DS9, Peenemunde, 16 June 1943.

<sup>91</sup> U. Powys-Lybbe (1983) *The Eye of Intelligence*, London: William Kimber, p. 191.

<sup>92</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates, p. 360.

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<sup>93</sup> Ibid, p. 367.

<sup>94</sup> TNA AIR 34/80: ACIU (Operation) Crossbow, History of the PI Investigation (February 1943 – April 1945), p. 17.

<sup>95</sup> C. Babington Smith (1958) *Evidence In Camera: The Story of Photographic Intelligence in World War II*, London: Chatto & Windus, p. 218.

<sup>96</sup> MDM DFG/5701: Constance Babington Smith interview notes, Douglas Kendall, lunch at L'Escargot, Greek Street, Soho, the English Speaking Union and the Grosvenor House Hotel, Park Lane, Mayfair, London, 14 November 1956.

<sup>97</sup> TNA AIR 34/120: ACIU Interpretation Report BS164, Bois Carré Type Sites, 1 December 1943.

<sup>98</sup> AIR 27/2007/27: 540 Squadron ORB, November 1943.

<sup>99</sup> NCAP/JARIC/BP\_00601/PLOT: Sortie N/980 sortie plot.

<sup>100</sup> MDM DFG/5754: Constance Babington Smith interview notes, John Merifield, dinner at Oxshott, Surrey, 19 February 1957.

<sup>101</sup> It should be noted that sortie N/980 is now accessible via the NCAP website:

<http://ncap.org.uk/>

<sup>102</sup> Ibid, pp. 406-409.

<sup>103</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates, p. 435-436.

<sup>104</sup> TNA AIR 34/128: ACIU Interpretation Report BS485, 3 June 1944.

<sup>105</sup> R. V. Jones (1978) *Most Secret War*, London: Book Club Associates, p. 435-436.

<sup>106</sup> TNA DEFE/40/1: Ministry of Defence: Papers of R. V. Jones, Director of Scientific Intelligence. Letter dated 15 July 1944, titled 'Crossbow - Ground Reports'. From: Wing Commander Douglas Kendall, for Group Captain, Commanding, RAF Medmenham. To: Headquarters, No.106 (Photo graphic Reconnaissance) Group.

<sup>107</sup> TNA DEFE/40/1: Ministry of Defence: Papers of R. V. Jones, Director of Scientific Intelligence. Letter dated 15 July 1944, titled 'Crossbow - Ground Reports'. From: Wing Commander Douglas Kendall, for Group Captain, Commanding, RAF Medmenham. To: Headquarters, No.106 (Photographic Reconnaissance) Group.

<sup>108</sup> TNA DEFE/40/1: Ministry of Defence: Papers of R. V. Jones, Director of Scientific Intelligence. Letter dated 17 July 1944, titled 'Crossbow - Ground Reports'. From: Group Captain Peter Riddell, Senior Air Staff Officer, Headquarters, No.106 (Photographic Reconnaissance) Group. To: Air Ministry, Director of Intelligence (Operations).

<sup>109</sup> U. Powys-Lybbe (1983) *The Eye of Intelligence*, London: William Kimber, pp. 9-10.



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- <sup>110</sup> L. Noakes & J. Pattinson (Eds) (2013) *British Cultural Memory and the Second World War*, London: Bloomsbury.
- <sup>111</sup> J. Beach (2013) No Cloaks, No Daggers - The Historiography of British Military Intelligence. IN: C. R. Moran & C. J. Murphy (Eds) *Intelligence Studies in Britain and the US: Historiography since 1945*, Edinburgh: Edinburgh University Press, p. 202.
- <sup>112</sup> C. R. Moran & C. J. Murphy (2013) Introduction: Intelligence Studies Now and Then. IN: C. R. Moran & J. Murphy (Eds) *Intelligence Studies in Britain and the US: Historiography since 1945*, Edinburgh: Edinburgh University Press, p. 1.
- <sup>113</sup> A. D. Walton (1975) Air Photograph interpretation and the Keele University collection. IN: A. D. M. Phillips & B. J. Turton (Eds) *Environment, Man and Economic Change: Essays presented to S. H. Beaver*, London: Longman, pp. 492-496.
- <sup>114</sup> NCAP/7-3-2-1: Letter from Colonel R. N. Rigby, Assistant Director Geographic, Imagery and MASINT, Defence Intelligence Staff, Ministry of Defence, regarding disposal of archive film holdings held at JARIC, dated 2 June 2004.
- <sup>115</sup> NCAP/6-4-2: History and evolution of the Joint Air Reconnaissance Intelligence Centre, unpublished Ministry of Defence booklet.
- <sup>116</sup> U. Powys-Lybbe (1983) *The Eye of Intelligence*, London: William Kimber, p. 215.
- <sup>117</sup> L. Farago (1954) *War of Wits: The Anatomy of Espionage and Intelligence*, New York: Funk & Wagnalls, pp. 89-90.