



Medmenham: Anglo-American Photographic Intelligence in the Second  
World War

VOLUME 1

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Paul David Theo Stewart

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## ABSTRACT

The role of photographic intelligence during the Second World War at Royal Air Force (RAF) Medmenham and its predecessor at Wembley is investigated in this thesis. The development from 1939 to 1945 of photographic reconnaissance and photographic interpretation is examined. The growth of the Central Interpretation Unit (CIU) at Medmenham and its change to the Allied Central Interpretation Unit (ACIU) in 1944, with the arrival of a significant American influx is investigated. Medmenham is compared with Bletchley Park using an organisational lens to reveal similarities and differences in the growth and development of these two centralised intelligence organisations.

The thesis then explores four case studies: Operation *Sealion*, the Nazi planned invasion of Britain in 1940, Operation *Millennium*, the first 1,000 bomber raid of the war in 1942, Operation *Chastise*, the Ruhr dams raid in 1943 and Operation *Epsom*, the first large scale operation after D-Day to capture Caen in June 1944.

The primary methodology employed is a detailed examination of the photographic interpretation reports produced by Wembley and Medmenham during the operations. The core of the methodology used in this thesis, is an individual examination of every photographic interpretation report produced for each of the case studies.

The thesis provides an innovative interpretation of the role and importance of photographic intelligence during the Second World War. It therefore makes an original contribution to intelligence history.

## **DEDICATION**

To all those that served at Royal Air Force Medmenham  
in the Second World War.

## ACKNOWLEDGEMENTS

This thesis or the germ that developed into it started 40 years ago, when on a photographic interpretation course, I was introduced to the work of my Second World War predecessors at RAF Medmenham, by Wing Commander Mike Mockford. He was the driving force within the Medmenham Association to set up the Medmenham Collection, museum and archive. I owe Mike Mockford and his successors a debt of gratitude for all their help, patience, advice and guidance as well as allowing me access to the riches within the Medmenham Archive.

I have to acknowledge the assistance of the Air Historical Branch, who provided me with accommodation and easy access to the AIR series of files for my last six months in the Royal Air Force. Seb Cox, Group Captain Steve Lloyd and the team at the AHB were ever patient with my questions and copious demands for more and more files from the TNA. That period in 2013 provided the bedrock on which this thesis is based. I also owe a debt of gratitude to the United States Air Force Historical Studies Research Office on Bolling Air Force Base, Washington DC. They provided me with accommodation and access to the US Army Air Force archive and were ever helpful with my numerous requests, for which I thank Richard Wolf and his team.

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Then there is the sage advice, guidance and gentle direction from my supervisory team of Jim Beach, Paul Jackson and Claire Hubbard-Hall. My main supervisor Jim Beach warrants a special mention for all his hard work and encouragement, in so many areas of my research journey, but especially for turning my 40 years of service writing into something approaching English! I would also like to thank my examiners Martin Alexander and Drew Gray.

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## Abbreviations

2 TAF	2nd Tactical Air Force
3D	Three-dimensional
ACAS (I)	Assistant Chief of the Air Staff Intelligence
ACIU	Allied Central Interpretation Unit
ADI	Assistant Director Intelligence
ADI (Photo)	Assistant Director Intelligence for Photography
AFHSO	Air Force Historical Studies Office (United States)
AGPIU	Army Group Photographic Interpretation Unit
AHB	Air Historical Branch
AI 1	Air Intelligence 1
AI 3	Air Intelligence 3
ALG	Advanced Landing Ground
AOC	Aircraft Operating Company
AP	Air Publication
APIS	Army Photographic Interpretation Section
BEF	British Expeditionary Force
CIC	Combined Intelligence Committee
CID	Committee of Imperial Defence
CIU	Central Interpretation Unit
COS	Chiefs of Staff Committee
DDI (Photo)	Deputy Director of Intelligence for Photography
DF	Direction Finding
DI / DDI	Director of Intelligence / Deputy Director of Intelligence
DIO	Duty Intelligence Office
DMI	Director of Military Intelligence
DRR	Daily Railway Report
FBI	Federal Bureau of Investigation
FLAK	<i>Fliegerabwehrkanone</i> (Aircraft Defence Cannon)
FO	Foreign Office
GAF	German Air Force
GHQ	General Head Quarters

INS	Journal of Intelligence and National Security
JARIC	Joint Air Reconnaissance Intelligence Centre
JIC	Joint Intelligence Committee
JPRC	Joint Photographic Reconnaissance Committee
MA	Medmenham Archive
MECIU	Middle East Central Interpretation Unit
MFPS	Mobile Field Processing Section
MI5	Security Service
MI6	Secret Intelligence Service
MIB	Military Intelligence Branch (of the War Office)
NACIU	North Africa Central Interpretation Unit
NCAP	National Collection of Aerial Photography
OIC	Operational Intelligence Centre
ORB	Operations Record Book
OSS	Office of Strategic Services
PDU	Photographic Development Unit
PDUI	Photographic Development Unit Interpretation and Intelligence
PI	Photographic Interpreter
PIU	Photographic Interpretation Unit
PR	Photographic Reconnaissance
PRO	Public Record Office
PRS	Photo Reconnaissance Squadron
PRU	Photographic Reconnaissance Unit
RAF	Royal Air Force
RAFMA	Royal Air Force Museum Archive
SIGINT	Signals Intelligence
SIXTA	Signals Intelligence Traffic Analysis
SHAEF	Supreme Headquarters Allied Expeditionary Force
SRC	Situation Report Centre
TAF	Tactical Air Force
TCO	Technical Control Office
TNA	The National Archives

USAAF	United States Army Air Force
USAAFE	United States Army Air Force Europe
USSTAF	US Strategic Air Forces in the European Theatre
V1	Flying Bomb – <i>Vergeltungswaffe 1</i>
V2	A4 Long Range Rocket - <i>Vergeltungswaffe 2</i>
WAAF	Women’s Auxiliary Air Force
WRNS	Women’s Royal Naval Service
WX	Weather

## Chapter 1

### Introduction

This thesis provides innovative analyses of the development of photographic intelligence during the Second World War at Royal Air Force Medmenham and its predecessor unit at Wembley. The role of Medmenham as the primary producer of photographic intelligence reporting and its place within the broader intelligence community will be investigated. The investigation will follow an analysis of the organisational structure of Medmenham, comparing it with that of signals intelligence at Bletchley Park. By using the actual textual photographic interpretation reports the thesis will provide a new analysis of the importance of photographic intelligence during the Second World War and fill a significant gap in the intelligence historiography. The thesis proves conclusively that Medmenham functioned as a successful centre for Second and Third Phase photographic interpretation and provided over 38,000 photographic intelligence reports during the Second World War.

Intelligence historians have not previously analysed these photographic intelligence reports in any detail, so the contribution of photographic intelligence to the Allied intelligence picture has not previously been subjected to rigorous analysis. This thesis has researched and analysed these reports and followed the monthly growth of these intelligence reports which reached an all-time high in October 1944.<sup>1</sup> There has not previously been such a focused and detailed analysis of the actual intelligence output provided by photographic intelligence. The detailed examination down to the level of individual photographic interpretation reports is then used in four case studies to demonstrate the work undertaken at Medmenham.<sup>2</sup> This ground breaking and very detailed analysis of every photographic interpretation report used in the four case studies will properly allow the significant contribution made by

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<sup>1</sup> See Graph 2, Interpretation Reports 1940 to 1945.

<sup>2</sup> RAF Medmenham was the name given to the requisitioned Danesfield House, Marlow. Danesfield House and grounds ran down to the banks of the Thames. Once requisitioned in 1941, multiple huts (70+) were installed in phases in the grounds, for Medmenham working sections that outgrew the house as well as accommodation of staff. See Annex B for details on the Medmenham Sections and Picture 6 for a photograph of RAF Medmenham.

photographic intelligence and Medmenham to be firmly placed in the intelligence framework of the Second World War and the unit's role and that of photographic intelligence to finally be better understood.

The parallel development and availability of the reconnaissance aircraft and cameras are also reviewed, and the effects of advances in aerial photographic reconnaissance. These advances are set against the parlous state of British strategic photographic reconnaissance and interpretation at the outbreak of the Second World War, where the RAF had no dedicated strategic reconnaissance aircraft or photographic interpreters. The impact of these advances is shown across the four case studies used in the thesis.

This thesis provides a unique contribution to the historiography of the Second World War and photographic intelligence by examining in detail every photographic interpretation report Medmenham produced for four case studies and applying a structured and innovative analysis of all these textual photographic interpretation reports. This analysis will allow the thesis to show the actual intelligence Medmenham produced and the significant value and unique contribution that photographic intelligence provided to the overall Allied intelligence picture within the European theatre. Therefore, this thesis makes a ground breaking contribution to the intelligence historiography of the Second World War by placing photographic intelligence firmly as one of the most significant sources of intelligence available to the Allies.

This rebalancing and placing of photographic intelligence as a significant source of intelligence to the Allies redresses the under-reporting of the role of photographic intelligence in the Second World War intelligence historiography. The crucial role of Medmenham acting as centralised photographic intelligence centre for Second and Third Phase photographic interpretation, utilising state of the art photographic and interpretation machines and developing advanced analytical techniques has been examined and analysed. This analysis of Medmenham, its interpretation reports,



procedures and processes have enabled the significance and volume of the intelligence provided by Medmenham to be better understood and firmly placed as the centre for British and then Allied photographic intelligence within the European theatre. This has been achieved in the thesis by a review of the existing intelligence literature covering the Second World War, which has demonstrated conclusively that photographic interpretation and the intelligence it provided is in almost all cases glossed over within the historiography. This thesis provides an important counterbalance to the inadequate coverage of Medmenham in the historiography. The structure and organisation of Medmenham have been analysed and compared with Bletchley Park, as both were centralised producers of secret intelligence. Then the detailed analysis of the actual intelligence reports produced by Wembley and Medmenham has been conducted across four case studies.

Over seven decades there has been an extensive examination of the Second World War, both in the popular and academic literature.<sup>3</sup> The academic development of the historiography of the Second World War has been analysed and categorised by John Ferris and Evan Mawdsley in their introduction to *Fighting The War*.<sup>4</sup> They chose to divide the historiography into chronological phases: 'early, intermediate and recent'.<sup>5</sup> The early phase covered those histories written up to the middle of the 1960s and often involved personal experience and apart from the official historians, limited archival access to original documentation.<sup>6</sup> The intermediate phase from the middle

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<sup>3</sup> For general histories of the Second World War see: T Zeiler & D DuBois, eds, *A Companion to World War II* (USA: Wiley Blackwell, 2013); M Burleigh, *The Third Reich: A New History* (London: Macmillan, 2000); P Calvocoressi & G Wint, eds, *Total War: The Story of World War II* (New York: Pantheon, 1972); I Dear, ed, *The Oxford Companion to World War II* (Oxford: Oxford University Press, 2005); E Mawdsley, *World War II: A New History* (Cambridge: Cambridge University Press, 2009); R Overy, *Why the Allies Won* (New York: Norton, 1996); A Purdue, *The Second World War* (Basingstoke: Palgrave Macmillan, 2011); A Roberts, *The Storm of War: A New History of the Second World War* (London: Penguin, 2010); G Weinberg, *A World at Arms: A Global History of World War II* (Cambridge: Cambridge University Press, 2005); T Zeiler, *Annihilation: A Global Military History of World War II* (New York: Oxford University Press, 2011).

<sup>4</sup> J Ferris & E Mawdsley, eds, *The Cambridge History of The Second World War: Volume 1: Fighting the War* (Cambridge: Cambridge University Press, 2015) 7-18.

<sup>5</sup> J Ferris & E Mawdsley, eds, *The Cambridge History of The Second World War: Volume 1, 7*.

<sup>6</sup> A classic study in the early phase was the eighteen-volume British official history published in the 1960s. The ones most pertinent to this thesis are: *The Defence of the United Kingdom, Victory in the West* and the four volumes of the *Strategic Air Offensive against Germany*. J Butler, *History of The Second World War* volume 1 - 18 (Uckfield: Naval & Military Press, 2006); B Collier, *The Defence of the United Kingdom* (Uckfield: Naval & Military Press, 2004); L F Ellis et al, *Victory in the West* (London: Naval & Military Press, 2004); C Webster & N Frankland, *The Strategic Air Offensive Against Germany, 1939-1945, 4 vols* (Uckfield: Naval & Military Press, 2006).

of the 1960s to the 1990s provided the historians with far wider access to official documents as they were released into the archives, with on the intelligence front the first revelations of *Ultra* and Bletchley Park in the 1970s.<sup>7</sup> The recent phase covering from the 1990s to the present is notable for the growth in availability of more original documents such as intelligence files in the archives, including those of Russia, Germany, China and Japan.

These recent or modern histories are represented by excellent works which include the three volumes of the *Cambridge History of The Second World War*.<sup>8</sup> This set provides a wide ranging as well as detailed coverage of the conflict in Europe and the less well covered Pacific war, calling on both Japanese and Chinese sources. Also, firmly in the modern era, with new analysis, Williamson Murray and Allan Millett in *A War to be Won*, focus on how the campaigns were fought at the operational level of war. The generally accepted view of many recent historians that it was the Soviet land campaigns from the East, that defeated Germany is challenged in a well-researched and analysed more revisionist view in Phillips O'Brien *How the War was Won*.<sup>9</sup> His core argument was that the land armies and battles were not the key to defeating Germany or Japan, but the outcome of the sea and air battles were crucial.<sup>10</sup>

*Germany and the Second World War*, the ten-volume set from the German Research Institute for Military History provides another modern historical viewpoint and analysis.<sup>11</sup> The English edition provides a counter point to the Allied views of the war,

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<sup>7</sup> F W Winterbotham, *The Ultra Secret* (London: Weidenfeld & Nicolson, 1976).

<sup>8</sup> J Ferris & E Mawdsley, eds, *The Cambridge History of The Second World War: Volume 1*; R Bosworth & J Maiolo, eds, *The Cambridge History of The Second World War: Volume 2: Politics and Ideology* (Cambridge: Cambridge University Press, 2015); M Geyer & A Tooze, eds, *The Cambridge History of The Second World War: Volume 3: Total War Economy, Society and Culture* (Cambridge: Cambridge University Press, 2015).

<sup>9</sup> W Murray & A Millett, *A War to be Won: Fighting The Second World War* (Cambridge, MA: Harvard University Press, 2001); P O'Brien, *How the War was Won: Air-Sea Power and Allied Victory in World War II* (Cambridge: Cambridge University Press, 2015). See also: R Overy, *War and Economy in the Third Reich* (Oxford: Oxford University Press, 2002); R Overy, *The Air War 1939-45* (Washington DC: Potomac Books, 2005); R Overy, *The Bombing War: Europe 1939-1945* (London: Penguin, 2013).

<sup>10</sup> P O'Brien, *How the War was Won*, 479-488.

<sup>11</sup> Militärgeschichtliches Forschungsamt ed. *Germany and the Second World War* Volume I-X (Oxford, Clarendon Press, 2015 -).

by providing the historians' analysis from a German viewpoint. For this thesis, *Germany's Initial Conquests in Europe*, volume two in the series, provides a well-researched and analysed German view of the preparations for Operation *Sealion* and the Battle of Britain in the Nazi direct strategy against Britain.<sup>12</sup> *The Strategic Air War in Europe* provides a similarly extensive and well researched German view of the impact of the Allies Strategic Bombing Offensive and the impact of diversions of resources to the air defence of Germany.<sup>13</sup>

The role of aerial photography and the intelligence derived via photographic interpretation is almost totally absent across all of these Second World War histories. They do not analyse the role of aerial reconnaissance and photographic interpretation. However, as aerial photography and their analysis and interpretation is one of the sources of the intelligence system, the historiography of Intelligence studies will now be discussed. This will allow the place of aerial photography and photographic interpretation to be understood within the intelligence historiography of the Second World War.

The academic study of intelligence is often cited as starting in 1986 with the first issue of *Intelligence and National Security* (INS), with Christopher Andrew and Michael Handel as editors. In the editorial for the first edition they posit that the study of intelligence is worthy of academia: 'its subject matter is a proper field for scholarly research'.<sup>14</sup> They also suggest that a study of historical events 'which leaves intelligence out of [the] account is certainly incomplete and possibly distorted'.<sup>15</sup> The field of intelligence studies has matured over the thirty or more years since the first issue of INS, but there is still only a limited number of academic books focusing on

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<sup>12</sup> K Maier, et al, eds, *Germany and the Second World War Volume II: Germany's Initial Conquests in Europe* (Oxford, Clarendon Press, 2015).

<sup>13</sup> H Boog, et al, eds, *Germany and the Second World War Volume VII: The Strategic Air War in Europe and the War in the West and East Asia, 1943-1944/5* (Oxford, Clarendon Press, 2015).

<sup>14</sup> C Andrew & M Handel, eds, *Editorial, INS*, 1.1 (1986) 3.

<sup>15</sup> C Andrew & M Handel, eds, *Editorial, INS*, 1.1 (1986) 3.

the role of intelligence in the Second World War. There are few looking at the interaction of intelligence, strategy and diplomacy.<sup>16</sup>

There is a well-researched article in *INS* on the history of intelligence by David Kahn that surveys the use of intelligence in the Second World War, and provides a framework for the intelligence historiography of the war.<sup>17</sup> This article confines its scope to looking at the impact of intelligence from the American, British and German perspective. There is a good treatment of the tactical intelligence that the armies in contact with one another gain by simple ground reconnaissance and interrogation of prisoners, both at the front and for more senior prisoners at special interrogation and listening centres.<sup>18</sup> The article covers photographic reconnaissance and interpretation and mentions Medmenham a couple of times, especially in relation to the hunt for the V1 and V2 weapons, but no details of the interpretation or reporting is given.<sup>19</sup> Then, as is common across much of the intelligence literature, Bletchley Park and signals intelligence is covered in detail, with an interesting introductory quote: 'Though no other source could match the dash and excitement of aerial reconnaissance, it itself could not match the value of codebreaking... [which] was by far the most important source of intelligence'.<sup>20</sup> This quote shows what is a common view expressed in intelligence literature, that the intelligence appears direct from the photographic reconnaissance aircraft. The flying of these aircraft has a clear element of 'dash and excitement', but the painstakingly detailed analytical work of the

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<sup>16</sup> This area is well covered by: J Ferris, *Intelligence and Strategy: Selected Essays* (Abingdon: Routledge, 2005); M Herman, *Intelligence Power in Peace and War* (Cambridge, Cambridge University Press, 1996); C Andrews, R Aldrich & W Wark, eds, *Secret Intelligence: A Reader* (Abingdon: Routledge, 2009); also see: R George & R Kline, eds, *Intelligence and the National Security Strategist* (Oxford: Rowman & Littlefield, 2006); R Godson, ed, *Comparing Foreign Intelligence* (Oxford: Pergamon-Brassey's, 1988); M Handel, *War Strategy and Intelligence* (London: Routledge, 1989); C Andrew, *Secret Service: The Making of the British Intelligence Community* (London: Hodder & Stoughton, 1992); C Andrew, *The Secret World: A History of Intelligence* (London: Allen Lane, 2018) 497-668.

<sup>17</sup> D Kahn, 'Intelligence in World War II: A Survey', *Journal of Intelligence History*, 1.1 (2001), 1-20.

<sup>18</sup> See: K Fedorowich, 'Axis Prisoners of War as a Source for British Military Intelligence, 1939-42', *INS*, 14.2 (1999), 156-178; H Fry, *The M Room: Secret Listeners who Bugged the Nazis* (London: Marranos Press, 2012); H Fry, *The London Cage: The Secret History of Britain's World War II Interrogation Centre* (London: Yale University Press, 2017); K Jones, 'From the Horse's Mouth: Luftwaffe POWs as Sources for Air Ministry Intelligence during the Battle of Britain', *INS*, 15.4 (2000), 60-80; S Neitzel, ed, *Tapping Hitler's Generals: Transcripts of Secret Conversations, 1942-45* (Barnsley: Frontline Books, 2007).

<sup>19</sup> Kahn references Ursula Powys-Lybbe and her account of working at Medmenham and Roy Nesbit for his book on Photo-Reconnaissance in the RAF, both covered later in this Chapter.

<sup>20</sup> D Kahn, 'Intelligence in World War II: A Survey', 1-20, p9.

photographic interpreters to produce reports such as those shown in Appendixes 1 to 3, has no such glamour. Kahn then covers the work of signals intelligence and Bletchley Park, focusing on not only the German codes but also those of Japan.<sup>21</sup> Selected works on Bletchley Park are discussed later in this chapter. Kahn then moves on to cover agent reporting or as he calls them 'Spies'.<sup>22</sup> Kahn has given an overview of the main intelligence sources used during the Second World War and focuses on signals intelligence as the primary source of intelligence.

This focus on signals intelligence can be traced to the revelations of the existence of *Ultra* in the 1970s, which ignited an interest in studying the way Bletchley Park worked and the impact it had on the war.<sup>23</sup> The academic works on Bletchley Park and the impact of *Ultra*, fall into three broad categories, those looking at Bletchley Park and how it worked, those looking at the technical details of Bletchley Park and the cryptographic techniques and technology used and those looking at the details of the decrypted messages and how they were used to influence operations. Those looking at how Bletchley Park worked include works that give the personal experiences of the code breakers and other staff that worked there during the war. The Harry Hinsley and Alan Stripp work falls into this category with recollections of

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<sup>21</sup> See: A Bath, *Tracking the Axis Enemy: The Triumph of Anglo-American Naval Intelligence* (Lawrence: University Press of Kansas, 1998); P Beesley, 'Convoy PQ 17: A Study of Intelligence and Decision Making', *INS*, 5.2 (1990) 292-322; D Ford, *Britain's Secret War Against Japan, 1937-1945* (Abingdon: Routledge, 2006); W Gardner, *Decoding History: The Battle of the Atlantic and Ultra* (Annapolis, MD: Naval Institute Press, 1999); D Syrett, ed, *The Battle of the Atlantic and Signals Intelligence: U-boat Situations and Trends, 1941-1945* (Abingdon: Routledge, 2002).

<sup>22</sup> D Kahn, 'Intelligence in World War II: A Survey', 1-20, p14-15. For more on Agent Handling and Spies see: D Kahn, *Hitler's Spies: German Military Intelligence in World War II* (London: Hodder and Stoughton, 1978); K Jeffery, *MI6: The History of the Secret Intelligence Service, 1909-1949* (London: Bloomsbury, 2010) 327-610; J Persico, *Piercing the Reich: The Penetration of Nazi Germany by American Secret Agents during World War II* (New York: Viking, 1979).

<sup>23</sup> See: R Bennett, *Ultra in the West: The Normandy Campaign of 1944-45* (London: Hutchinson, 1979); R Bennett, *Intelligence Investigations: How Ultra Changed History* (Abingdon: Frank Cass, 1996); R Bennett, *Behind the Battle: Intelligence in the War with Germany 1939-1945* (London: Pimlico, 1999); W Gardner, *Decoding History*; R Ratcliff, *Delusions of Intelligence, Enigma, Ultra and the End of Secure Ciphers* (Cambridge: Cambridge University Press, 2006); M Robson, 'Signals in the Sea: The Value of Ultra Intelligence in the Mediterranean in World War II', *Journal of Intelligence History*, 13.2 (2014) 176-188. For how Bletchley Park worked see: R Bennett, *Intelligence Investigations*; R Erskine & M Smith, eds, *The Bletchley Park Code-breakers: How Ultra Shortened the War and Led to the Birth of the Computer* (London: Biteback, 2011); F H Hinsley & A Stripp, *Codebreakers: The Inside Story of Bletchley Park* (Oxford: Oxford University Press, 1993); J Jackson, *Solving Enigma's Secrets: The Official History of Bletchley Park's Hut 6* (Redditch: Booktower Publishing, 2014); J Roberts, *Lorenz: Breaking Hitler's Top Secret Code at Bletchley Park* (Stroud: History Press, 2017); M Smith, *Station X: The Codebreakers of Bletchley Park* (London: Macmillan, 1998).

twenty-seven former members covering how Bletchley Park worked from the codebreakers to those working in the more factory like environment on the machines used to break the codes.<sup>24</sup>

The actual details of how Bletchley Park decoded the German messages is covered in several books by former codebreakers, with Gordon Welchman providing one of the better with the intricate detail of how the cryptographers worked to break the codes.<sup>25</sup> There is an emerging literature on the technological advances used at Bletchley Park to speed up the decoding of the German signals which gives the technical details of how they developed and used these machines.<sup>26</sup> The more interesting treatments of Bletchley Park for this thesis are those looking at how Bletchley Park signals intelligence supported military operations, with the key works in this field written by Ralph Bennett.<sup>27</sup> His treatment of the Normandy campaign shows in detail the intelligence Bletchley Park was able to provide, and is unique in using over 130 *Ultra* examples and showing selected German signals and the Bletchley Park decodes, side by side. Bennett's detailed treatment of individual signals is mirrored in this thesis with a detailed analysis of individual photographic interpretation reports, with selected examples transcribed in Appendixes 1 to 3.

The study of intelligence is now able to draw upon a substantial body of official histories covering British Intelligence in the Second World War, the Security Service (MI5), the Secret Intelligence Service (MI6) and the Joint Intelligence Committee

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<sup>24</sup> F H Hinsley & A Stripp, *Codebreakers*. See also for personal account of what life was like at Bletchley Park: S McKay, *The Secret Life of Bletchley Park: The WWII Codebreaking Centre and the Men and Women Who Worked There* (London: Arum Press, 2010); J Thirsk, *Bletchley Park: An Inmate's Story* (Cleobury Mortimer, M & M Baldwin, 2012).

<sup>25</sup> G Welchman, *The Hut Six Story: Breaking the Enigma Codes* (Cleobury Mortimer: M & M Baldwin, 2012). Also see: A Hodges, *Alan Turing: The Enigma* (London: Vintage Books, 2014); S Cooper & J Leeuwen, eds, *Alan Turing: His Work and Impact* (Oxford: Elsevier, 2013); M & G Russell Jones, *My Secret Life in Hut Six: One Woman's Experiences at Bletchley Park* (Oxford: Lion Books, 2014).

<sup>26</sup> For details of the code breaking machines see: B Copeland et al, *Colossus: The Secrets of Bletchley Park's Code-breaking Computers* (Oxford: Oxford University Press, 2006); J Keen, *Harold 'Doc' Keen and the Bletchley Park BOMBE* (Cleobury Mortimer: M & M Baldwin, 2012) 30-61; D Davies, 'The Bombe A Remarkable Logic Machine', *Cryptologia*, 23.2 (1999) 108-138; D Michie, 'Colossus and the Breaking of the Wartime 'Fish' Codes', *Cryptologia*, 26.1 (2002) 17-58.

<sup>27</sup> R Bennett, *Ultra in the West*; R Bennett, *Ultra and Mediterranean Strategy* (London: Faber & Faber, 2009); R Bennett, 'Fortitude, Ultra and the Need to Know', *INS*, 4.3 (1989) 482-502; R Bennett, *Intelligence Investigations*; R Bennett, *Behind the Battle*.

(JIC).<sup>28</sup> All these works benefit from the authors having access to archives and material that is still classified and not available to the general historian. The official history of British Intelligence in the Second World War is extensively covered in the five-volume series, edited by Harry Hinsley, a respected historian who also worked at Bletchley Park during the war. This official history of intelligence is a good foundation for further research into the role of intelligence and follows in the main a chronological format. This official history is the first account that describes and assesses the role of *Ultra* and Bletchley Park and sets it in the wider picture of British intelligence during the war. To support its findings, there are appendixes of intelligence reports and transcripts on Bletchley Park signals intelligence.<sup>29</sup> However, it is not a complete picture, as although the PIU and CIU are mentioned a number of times across volumes one to three, they were not assessed in any detail. There are no Medmenham photographic interpretation reports in any of the volumes, so the contribution of photographic intelligence to British intelligence during the war were not assessed in this official history.

This lack of detailed investigation into the contribution of photographic intelligence in the official history of intelligence is perplexing. There are a few possible explanations, including the revelations about Bletchley Park and *Ultra* overshadowing photographic intelligence because of the compartmented and previously Top Secret nature of *Ultra*. There is also the possibility that because Hinsley had worked at Bletchley Park that contributed to a greater focus and bias on the importance of *Ultra* intelligence. It is especially perplexing the lack of analysis with regard to the role of photographic intelligence as an essential contributor to Bomber Command and the Strategic Bombing Offensive, as shown in case studies two and three in this thesis. There has frequently been a mindset that photographic intelligence springs straight from the aerial reconnaissance photographs and therefore the phrase ‘reconnaissance shows’

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<sup>28</sup> For MI5 see: C Andrew, *The Defence of the Realm: The Authorised History of MI5* (London: Allen Lane, 2009); MI6 see: K Jeffery, *MI6*; JIC see: M S Goodman, *The Official History of the Joint Intelligence Committee* (Abingdon: Routledge, 2014); The official history of GCHQ, which includes Bletchley Park is in preparation, expected to be published in late 2019; Second World War see: F H Hinsley, et al, *British Intelligence in the Second World War Volume 1-5* (London: HMSO, 1979-1990).

<sup>29</sup> *Ultra* is the code name the British gave to signals intelligence from Bletchley Park. F H Hinsley, et al, *British Intelligence in the Second World War Volume*; F H Hinsley, *British Intelligence in the Second World War abridged* (London: HMSO, 1994).

appears in many intelligence summaries, official histories and subsequent books without acknowledging the critical role of the work of Medmenham to produce the intelligence from the photographs. This thesis rebalances these omissions and shows the significant contribution Medmenham made to the overall intelligence picture.

The role of the Security Service or MI5 is covered in an official history by Christopher Andrew, who had full access to the MI5 archives. It charts the change of MI5 from a counter-subversion and counter-espionage organisation into today's agency more concentrated on counter-terrorism. The sister organisation the Secret Intelligence Service (SIS) or MI6 has also had an official history written by Keith Jeffery.<sup>30</sup> This official history was also commissioned by the intelligence service to mark its centenary and Jeffery had full access to the MI6 files. The shorter time frame of this history up until the start of the Cold War, allows more time to concentrate on the work of MI6 during the Second World War and the rapid expansion of MI6 during the war years. However, photographic interpretation and Medmenham are not mentioned, but the Sydney Cotton secret covert reconnaissance organisation is covered, albeit briefly, with MI6 taking credit for setting the RAF on the way to high altitude strategic reconnaissance flight. The official history series covering intelligence continues with the Michael Goodman book of the Joint Intelligence Committee (JIC).<sup>31</sup> The book covers the period from 1936 to 1956 and follows the development of the JIC from a mainly military intelligence body that had major successes during the Second World War to its role as a coordinating and central assessment organisation. However, despite its role in providing, albeit delegated, direction for photographic reconnaissance during the war, Medmenham and photographic intelligence is not mentioned by Goodman. These three official histories provide no details on the work of Medmenham or strategic photographic interpretation during the Second World War.

The evolution of the American intelligence community during the Second World War is relevant to this thesis because of the American reconnaissance assets and

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<sup>30</sup> C Andrew, *The Defence of the Realm*; K Jeffery, *MI6*.

<sup>31</sup> M S Goodman, *The Official History of the Joint Intelligence Committee*.



photographic interpretation staff assigned to Medmenham. The creation and evolution of that community is covered chronologically and succinctly in the Loch Johnson and James Wirtz edited *Strategic Intelligence* in the opening chapter by Phyllis McNeil an academic and former CIA intelligence officer.<sup>32</sup> The study of the US intelligence community shows how the major intelligence agencies, and especially the CIA, have a task and focus on providing secret intelligence up the command chain to the President. However, because of the lack of declassified Presidential security briefings, the impact of secret intelligence on past Presidents remains an opaque area. The book by Christopher Andrew covering the US Presidents' use of intelligence, when looking at the Second World War under Roosevelt does not mention Medmenham or the fact that Roosevelt's son Brigadier General Elliott Roosevelt tried to keep American photographic interpretation separate from the British at Medmenham.<sup>33</sup> That event is actually well covered in John Kreis's book on the US Army Air Force that covers in equal measure the war with Germany in Europe as well as the war against Japan. The book covers Medmenham, but only as it impinges on the US Army Air Force intelligence organisation.<sup>34</sup>

The longstanding intelligence relationship between Britain and America is covered by Martin Alexander who edited *Knowing Your Friends: Intelligence inside Alliances and Coalitions from 1914* and in *The Ties that Bind* edited by Jeffrey Richelson and Desmond Ball, as well as in *British and American Approaches to Intelligence* edited by K Robertson. These three books, via the individual articles provide a good overview of the longstanding relationships between Britain and America across the intelligence arena.<sup>35</sup> However, they all omit the close ties between Britain and America at Medmenham during the Second World War.

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<sup>32</sup> L Johnson & J Wirtz, *Intelligence and National Security* (New York: Oxford University Press, 2008); see also: P McNeil, 'The Evolution of the US Intelligence Community: an Historical Overview', in *Strategic Intelligence: Windows Into a Secret World*, ed by L Johnson & J Wirtz (Los Angeles: Roxbury Publishing Company, 2004); C Andrew, *For the President's Eyes Only: Secret Intelligence and the American Presidency from Washington to Bush* (New York: Harper Collins, 1995).

<sup>33</sup> TNA AIR 41/7, Draft RAF Narrative: Photographic Reconnaissance Vol 2. 11-14.

<sup>34</sup> J Kreis ed, *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Honolulu: University Press of the Pacific, 1996).

<sup>35</sup> M S Alexander ed, *Knowing Your Friends: Intelligence Inside Alliances and Coalitions from 1914 to the Cold War* (Abingdon: Routledge, 1998); J Richelson and D Ball ed., *The Ties That Bind: Intelligence Cooperation between the UKUSA Countries, the United Kingdom, the United States of America, Canada, Australia and New Zealand* (London: Allen & Unwin, 1985); K G Robertson, *British*

The history of photographic intelligence is inextricably linked to the history of aerial photographic reconnaissance and there is an abundance of popular books covering RAF and American planes of all types. The origins of photographic reconnaissance and the employment of it during the First World War are extensively covered by Terrence Finnegan in his *Shooting the Front*.<sup>36</sup> The book covers the development of the aircraft, aerial cameras and the photographic processing and then interpretation of the photographs from the French, British and American perspectives. The other book also covering photographic interpretation and the intelligence it provided during the First World War is *Haig's Intelligence* by Jim Beach.<sup>37</sup> The focus of the book is not aerial reconnaissance, but chapter 6 on Photography covers the development of aerial reconnaissance and photographic interpretation by the British army intelligence officers. These books confirm that because of the available aircraft technology, the reconnaissance missions were almost all tactical in nature. They provided glass plate negatives of areas of tactical interest to the army. The British set up a photographic printing plant at Amiens that started in 1916 producing 5,000 prints per day.<sup>38</sup> The production of prints was 80,000 in 1915 and hit a high in 1918, with almost 6 million being produced. These resulted from an increase in glass plate negatives from 8,000 per month in 1916 to over 20,000 a month in 1918.<sup>39</sup> These books show that the system of tasking, flying and providing annotated photographic prints and mosaics from aerial reconnaissance had matured into a robust system by 1918, with the ability to provide significant intelligence on the areas just behind the enemy lines.<sup>40</sup>

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*and American Approaches to Intelligence* (Basingstoke: Macmillan Press, 1987); see also: D Stafford, R Jeffreys-Jones, eds, *American-British-Canadian Intelligence Relations 1939-2000* (London: Cass, 2000).

<sup>36</sup> T Finnegan, *Shooting the Front: Allied Aerial Reconnaissance in the First World War* (Stroud: Spellmount, 2014).

<sup>37</sup> J Beach, *Haig's Intelligence: GHQ and the German Army, 1916-1918*. (Cambridge: Cambridge University Press, 2015) 143-154.

<sup>38</sup> T Finnegan, *Shooting the Front*, 169.

<sup>39</sup> J Beach, *Haig's Intelligence*, 149-153.

<sup>40</sup> See also: P Mead, *The Eye in the Air: History of Air Observation and Reconnaissance for the Army 1785-1945* (London: HMSO, 1983).

The literature on photographic reconnaissance during the Second World War will now be discussed, followed by that of the main strategic reconnaissance aircraft, the Spitfire. There are far fewer books looking at reconnaissance aircraft, but the subject is comprehensively covered by Roy Nesbit in his work on *Eyes of the RAF* and by Edward Leaf who concentrates on the Second World War in *Above All Unseen*, with the aviation author Alfred Price, covering the subject in his *Targeting the Reich*.<sup>41</sup> Nesbit concentrates on the RAF and covers aerial reconnaissance from the first balloon flights to the mid-1990s. Both Nesbit and Leaf cover all the reconnaissance aircraft and aerial cameras used by the RAF during the Second World War. The books clearly show the development of the Spitfire and Mosquito in the reconnaissance role and the associated aerial camera fits. They provide technical diagrams of the camera mounts for the aircraft as well as details of each of the cameras. However, the books give no detail at all about the interpretation of the photographs at Medmenham.<sup>42</sup> This is a particularly odd omission, as Leaf is a trained photographic interpreter. Price only provides a quick overview of the aircraft and cameras used, but provides numerous examples of the photographs that the Spitfire and Mosquito reconnaissance aircraft collected. Of interest, the majority of the photographs reproduced in it are taken from modern scans of the publication *Evidence in Camera*, produced by J Section at Medmenham, the Press and Publicity section. The book fails to mention photographic interpretation or Medmenham, despite using its products, including those annotated by Medmenham.

The Spitfire was the main strategic reconnaissance aircraft for the majority of the Second World War and there is a vast wealth of aviation authors providing numerous books on the Spitfire, usually concentrating on the fighter variants, and individual pilot memoirs.<sup>43</sup> There are fewer accounts analysing the Spitfire and how it performed

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<sup>41</sup> R Nesbit, *Eyes of the RAF: A History of Photo-Reconnaissance* (Stroud: Alan Sutton, 1996); E Leaf, *Above All Unseen: The Royal Air Force's Photographic Reconnaissance Units, 1939-1945* (Sparkford: Patrick Stephens, 1997); A Price, *Targeting the Reich: Allied Photographic Reconnaissance over Europe, 1939-1945* (London: Greenhill, 2003); Note: The use of the Spitfire for Tactical Battlefield Reconnaissance is well covered in G Millington, *The Unseen Eye: The Story of the Reconnaissance Men who Flew the Dangerous Skies above the Battlefields* (London: Anthony Gibbs & Phillips, 1961).

<sup>42</sup> Note: There are photographs of photographic interpreters at work in Medmenham illustrating Nesbit's book. R Nesbit, *Eyes of the RAF*, 110, 115, 157-158.

<sup>43</sup> A Critchell, *A Tale of Ten Spitfires: The Combat Histories of Spitfire VCs AR501 to AR510* (Barnsley: Pen Sword Aviation, 2018); D Crook, *Spitfire Pilot: A Personal Account of the Battle of Britain* (London: Grub Street, 2008); J Glancey, *Spitfire: The Biography* (London: Atlantic Books, 2006); J Hyams,

during the Battle of Britain. However, Dilip Sarkar a prolific writer on the Battle of Britain and the Spitfire, provides us with a well-researched and argued case for the performance of the Spitfire during the Battle of Britain.<sup>44</sup> He has analysed the tactics and strategy of the air battles and the numbers of Spitfires and Hurricanes shot down during the Battle of Britain. He has also analysed the numbers of enemy aircraft shot down by the Spitfire and Hurricanes. These he uses to balance views that the Hurricane was the aircraft that was central to winning the Battle of Britain. The book concentrates on the fighter variants of the Spitfire and there is no equivalent book looking at the development of the reconnaissance Spitfires. However, the Spitfire book that provided the most details of the reconnaissance versions is Eric Morgan and Edward Shacklady, *Spitfire: The History*.<sup>45</sup> This book is one of the bibles about the Spitfire, covering every mark of Spitfire produced, including design drawings, the Ministry contracts to produce the different Spitfires and then, by type, the serial number of every Spitfire produced. Chapter twelve, 'Air Spies' covers the reconnaissance Spitfires from the first one modified for Sydney Cotton's flight at Hendon to the final long-range Spitfires at the end of the war. The detailed listing of every PR Spitfire serial number proved invaluable in analysing and cross referencing the availability of reconnaissance Spitfires available for missions in Chapter 3.

The literature on photographic interpretation at Medmenham is rather more limited than the wider literature on British intelligence, covered by five books.<sup>46</sup> There are two books both written by Women's Auxiliary Air Force officers who were

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*Spitfire Stories: True Tales from Those Who Designed, Maintained and Flew the Iconic Plane* (London: Michael O'Mara Books, 2017); S McKay, *The Secret Life of Fighter Command: Testimonials from the Men and Women Who Beat the Luftwaffe* (London: Aurum Press, 2015); L McKinstry, *Spitfire: Portrait of a Legend* (London: Murray, 2008); J Nichol, *Spitfire: A Very British Love Story* (London: Simon & Schuster, 2018); A Price, *Spitfire: Pilots' Stories* (Stroud: The History Press, 2012); D Sarkar, *The Invisible Thread: A Spitfire's Tale* (Worcester: Ramrod Publications, 1992); D Sarkar, *Spitfire! Courage & Sacrifice* (Worcester: Victory Books, 2007); D Sakar, *Fighter Ace: The Extraordinary Life of Douglas Bader, Battle of Britain Hero* (Stroud: Amberley, 2014); J Taylor, *One Flight Too Many: The Saga of a Young Spitfire Photographic Pilot in WW2 and its Aftermath* (Leeds: Greystones Publishing, 2012); G Wellum, *First Light* (London: Viking, 2002).

<sup>44</sup> D Sarkar, *How the Spitfire Won the Battle of Britain* (Stroud: Amberley, 2010).

<sup>45</sup> E Morgan & E Shacklady, *Spitfire: The History* (London, Guild Publishing, 1987).

<sup>46</sup> C Babington Smith, *Air Spy* (New York: Ballantine Books, 1957); C Babington Smith, *Evidence in Camera* (London: Chatto & Windus, 1958); U Powys-Lybbe, *The Eye of Intelligence* (London: William Kimber, 1983); T Downing, *Spies in the Sky* (London: Little Brown, 2011); C Halsall, *Women of Intelligence: Winning The Second World War with Air Photos* (Staplehurst: Spellmount, 2012); A Williams, *Operation Crossbow: The Untold Story of Photographic Intelligence and the Search for Hitler's V Weapons* (London: Preface, 2013).

photographic interpreters at Medmenham during the war. The first book published on the work of Medmenham was by Constance Babington Smith, who was head of the aircraft section at Medmenham and it was this team that found the V1 Flying Bomb at Peenemünde on photography of 28 November 1943. The book was published in 1957 as *Air Spy* in America and *Evidence in Camera* in 1958 in Britain.<sup>47</sup> The book is aimed at the popular market and follows a chronological narrative highlighting the major successes of Medmenham. It also provides a good view of the life and some of the key personalities working at Medmenham. The book is based on the personal recollections of the author and an extensive series of interviews she conducted with personnel from Medmenham and senior officers in Whitehall during 1955/6. The official records from Medmenham remained classified until the 1970s so no Public Record Office (PRO) files were available. However, it is the book on Medmenham that is most often quoted in other books and publications.<sup>48</sup> It does not include any actual photographic interpretation reports, but does include a selection of aerial photographs, for example the invasion barges at Calais and the V 1 launching site at Bois Carré in France.

The other personal recollection on Medmenham was by Ursula Powys-Lybbe who ran the airfields section. Her book was published in 1983, almost forty years after she had left Medmenham.<sup>49</sup> However, many of the records on Medmenham had become available in the PRO and many of the photographs used in the book are from those files. The book is still aimed at the general reader and does not contain any real detail on the actual internal section set up of Medmenham. The book again follows a chronological narrative and gives a good overview of Medmenham and small details about different sections can be found through the book. Again, there are no actual photographic interpretation reports in the book. However, *Evidence in Camera* and *The Eye of Intelligence* are the only books written by photographic interpreters who served at Medmenham and provide more details than many

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<sup>47</sup> C Babington Smith, *Air Spy*; C Babington Smith, *Evidence in Camera*.

<sup>48</sup> Note: in his paper for *INS* Joseph Caddell analyses the books from those practitioners who worked at Medmenham and the subsequent books that draw upon them. See: J Caddell Jr, 'Seeing things differently: contrasting narratives of British and German photographic intelligence during the Second World War', *INS*, 34.1 (2019), 78-94.

<sup>49</sup> U Powys-Lybbe, *The Eye of Intelligence*.

standard memoirs. However, the authors worked in separate sections and were not privy to the totality of the Medmenham tasking or output, and the books are not based on contemporaneous notes, but on personal memories and interviews conducted many years later.

The highest profile work about Medmenham and the intelligence produced there during the Second World War was the BBC produced hour long documentary in 2011, for broadcast on BBC 2, called 'Operation *Crossbow*', that concentrates on the work of Medmenham to identify the V weapon systems.<sup>50</sup> The documentary was divided into segments with actors playing the part of photographic interpreters at Danesfield House. It contained interviews with three surviving photographic interpreters who worked at Medmenham and atmospheric clips of Spitfires flying past. The BBC used two members of the Medmenham Archive as expert commentators on the work of Medmenham on Operation *Crossbow*. The documentary was not an attempt to place photographic intelligence into perspective with other sources, but it played to a narrative of Medmenham shortening the war. This documentary for a short time increased the profile of Medmenham in the public eye and it was quickly followed by the appearance of three new books on Medmenham.

These three books, again in the general reader category on Medmenham, were all published between 2011 and 2013.<sup>51</sup> The first of these by Taylor Downing is *Spies in the Sky*.<sup>52</sup> This book follows a standard chronology from the pre Medmenham days at Wembley, through the move to and then key successes of Medmenham during the war. The book draws on material from the previous books by Powys-Lybbe and Babington Smith. It has also made extensive use of the interview notes taken by Babington Smith in the 1950s, which are now all held in the Medmenham Archive at RAF Wyton. It is also the first book on Medmenham to use documents from TNA, the most used appearing to be the draft RAF Narrative on Photographic

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<sup>50</sup> The documentary *Operation Crossbow* was first broadcast by the BBC on 12 May 2011. MA Acc No: 22500, Script of BBC Documentary *Operation Crossbow*.

<sup>51</sup> T Downing, *Spies in the Sky*; C Halsall, *Women of Intelligence*; A Williams, *Operation Crossbow*.

<sup>52</sup> T Downing, *Spies in the Sky*.

Reconnaissance.<sup>53</sup> However, it is a book for the general reader, not footnoted and does not contain any actual photographic interpretation reports from Medmenham. It builds on the two previous published memoirs and enhances the existing folklore around the Medmenham story by focusing on the key successes of Medmenham.<sup>54</sup>

*Operation Crossbow* is the most scholarly work on Medmenham of the published books and is for a general readership.<sup>55</sup> It charts the development from the early days at Wembley to Medmenham, with a focus on the V1/V2 Operation *Crossbow*. Allan Williams, the author, is the curator of the National Collection of Aerial Photography that hold over ten million original aerial photographs from Medmenham. He also assisted the Medmenham Archive and the BBC in the production of the BBC documentary in 2011 called *Operation Crossbow*. The book has a full bibliography covering all the relevant major archives as well as the Medmenham archive, however it does not use footnotes or end notes. The actual TNA files on Operation *Crossbow* are referenced and 30 Medmenham *Crossbow* reports are referred to in the book, but without any detail being given. This book therefore cannot be considered to provide a detailed analysis of the intelligence Medmenham provided for *Crossbow* as there are well over 1,000 individual reports in the archives.<sup>56</sup> The book in common with the other four published works on Medmenham does not include any actual photographic interpretation reports from Medmenham.

The women who worked at Medmenham made a considerable contribution to the intelligence produced there and Christine Halsall, has over the years met and interviewed many of the Medmenham era photographic interpreters. Her book takes a different view of Medmenham, based extensively on her research and interviews with the photographic interpreters, and Medmenham Archive and Imperial War Museum documents, she highlights the efforts of the women who worked at

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<sup>53</sup> AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1; AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2.

<sup>54</sup> J Caddell Jr, 'Seeing things differently', 78-94.

<sup>55</sup> A Williams, *Operation Crossbow*.

<sup>56</sup> Note: There are over 1,000 special reports on Crossbow from Sub-section B2 at Medmenham in the TNA AIR 34/117 TO AIR 34/138 series and many other special Crossbow reports produced by Medmenham.

Medmenham in *Women of Intelligence*.<sup>57</sup> The book provides an overview of the work of Medmenham, but as its main focus is on the women who worked at Medmenham, it provides a far better feel for what it was like to actually be at Medmenham during the war and is a valuable addition to the small band of books about Medmenham and is unusually, end noted.<sup>58</sup> However, it is again a book that enhances the folklore about the work of Medmenham, without any detailed examination of the actual intelligence Medmenham produced.

These practitioner and secondary accounts of Medmenham are well analysed by Joseph Caddell in his recent INS article.<sup>59</sup> He is careful to pay tribute to those who worked at Medmenham and the accounts provided by Babington Smith and Powys-Lybbe, but cautions other historians about the risks of 'sensationalism' in writing about intelligence and of 'Victory bias' and the 'illusion of universality' in these accounts by 'intelligence practitioners' connecting to the 'Medmenham magic'.<sup>60</sup> The three other books on Medmenham he places firmly into the secondary literature category continuing to follow the narrative on Medmenham set out by Babington Smith and Powys-Lybbe.<sup>61</sup> The Caddell paper further analyses these follow on narratives, identifying what he sees as 'inaccurate or incomplete characterizations' in the narratives and a tendency to 'overstate' the importance of the intelligence provided and the impact that had on the conduct of operations and the progress of the war.<sup>62</sup> This thesis by applying a structured and detailed analysis of individual photographic interpretation reports from Medmenham seeks to avoid such pitfalls.

The major primary sources for this thesis are the archival records of the National Archives at Kew. The archival records in the United States Air Force Research Agency. The records of the private Medmenham Collection, which has a museum of artefacts from RAF Medmenham and separate archive of documents and artefacts. The Medmenham Collection has its origins in the Medmenham Association which

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<sup>57</sup> C Halsall, *Women of Intelligence*.

<sup>58</sup> J Caddell Jr, 'Seeing things differently', 78-94, p 83.

<sup>59</sup> J Caddell Jr, 'Seeing things differently', 78-94.

<sup>60</sup> J Caddell Jr, 'Seeing things differently', 78-94, p 89-90.

<sup>61</sup> J Caddell Jr, 'Seeing things differently', 78-94, p 89.

<sup>62</sup> J Caddell Jr, 'Seeing things differently', 78-94, p 78.



was formed in 1946 by Dr Hugh Hamshaw Thomas and other photographic interpreters who had worked at Medmenham.<sup>63</sup> It was formed to maintain the camaraderie of all those who had served at Medmenham during the war and the Association is still in existence.<sup>64</sup> The Medmenham Collection and associated Archive developed out of the enthusiasm of members of the Association. The Medmenham Collection and Archive holdings cover the history of aerial photographic interpretation from the Boer War to the present. The Archive contains aerial photographs, papers, photographic interpretation reports as well as aerial cameras and photographic interpretation equipment, including a *Wild* A5 and A6.<sup>65</sup> The records in the Science Museum archive provided access to the Barnes Wallis papers and the Royal Air Force Museum archive at Hendon provided original and unamended RAF Air Publications on photographic processing and printing from the 1940s.<sup>66</sup>

The records in the National Archives provide a rich source of primary material to analyse. The records are mainly in the AIR series, with the actual photographic interpretation reports contained in the AIR 29 and AIR 34 series. The AIR 29 series holds the Air Ministry and Ministry of Defence, Operational Record Books on Miscellaneous Units of which Medmenham was one. The AIR 34 series holds the Air

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<sup>63</sup> Dr Hugh Hamshaw Thomas was a First World War photographic interpreter and returned to Medmenham as a wing commander in the Second World War. He was a world renowned palaeobotanist and Fellow of Downing College Cambridge, awarded the Darwin-Wallace Medal in 1958. MA Acc No: 1741, Directory of the Hamshaw Thomas Collection in the Medmenham Archive.

<sup>64</sup> Note: The Medmenham Association in 2018 is an association of Photographic Interpreters / Imagery Analysts from the UK, US, CAN, AUS and NZ. The Association publishes 2 magazines per year and continues in the Hamshaw Thomas tradition of maintaining links with current government Imagery Analysts, running social and technical meetings to maintain the camaraderie and links back to Medmenham. See: [www.medmenham.org](http://www.medmenham.org) [accessed 4 December 2018].

<sup>65</sup> For more on the Wild A5 see Annex G. Note: The Medmenham Archive is open to academic researchers and has an on-line catalogue of the 24,239 accessioned holdings. See: [www.medmenhamcollection.org](http://www.medmenhamcollection.org) [accessed 4 December 2018]. The archive continues to grow receiving donations of memoirs, scrap books and artefacts from the families of photographic interpreters. Note: The main holdings of British aerial film and photographs from the Second World War are held in the National Collection of Aerial Photography (NCAP) in Edinburgh. NCAP photography has not been used in this thesis, because it is the raw aerial photographs or film and not the actual intelligence reports written by Medmenham. The intelligence reports from these photographs are held in TNA at Kew. For NCAP holdings see: <https://ncap.org.uk>.

<sup>66</sup> Note: RAF Air Publications (AP) were produced loose leafed in binders and updates were frequently provided with the instructions to destroy the original pages and replace with the updated amended pages. The AP series on cameras and processing ran for over 20 years with many amendments and updates. The RAF Museum archive had original versions, unamended with the amendments still to be incorporated at the front of the APs.

Ministry files containing all the interpretation reports and some example photographs of the Central Interpretation Unit, its predecessors and related bodies. These are not the intelligence summaries often seen, but the actual photographic interpretation reports produced by Medmenham. These reports amount to a wealth of riches with over 38,000 intelligence reports in over 4500 appendices. These have been the major source of original Medmenham photographic interpretation reports. However, there have been some gaps that have been partially filled by the records and memoirs at the Medmenham Archive (MA) at RAF Wyton.<sup>67</sup>

Allan Williams in his book on *Crossbow* is the only previous writer to have examined these TNA files in any detail, in that his bibliography includes the AIR 29 and AIR 34 series.<sup>68</sup> However, as the book is not footnoted the extent of mining of these series is more difficult to ascertain. There are 30 *Crossbow* reports from the AIR 34/117 to AIR 34/138 series that are referred to in the book, out of a total of 1089 *Crossbow* reports, but no report is reproduced or discussed in detail. Therefore, this thesis with the focus of the four case studies being on the analysis of individual photographic interpretation reports provides a unique contribution to the historiography of photographic intelligence in the Second World War.<sup>69</sup>

The United States Air Force Historical Studies Office (AFHSO) at Bolling Air Force Base, near Washington provided access to the US Air Force archive and its predecessor the US Army Air Force archive. This archive allowed access to documents on the US Photographic Reconnaissance organisation in Europe and North Africa during the Second World War, documents, correspondence and interviews with General Spaatz and Brigadier General Elliot Roosevelt as well as reports on American visits and staff assigned to Medmenham. There was also a wealth of documents covering the American preparations for the tactical employment

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<sup>67</sup> The Medmenham Collection is now a small charity that runs the Medmenham Archive at RAF Wyton and displays at the Intelligence Museum at Chicksands, the Muckleburg Collection and at the Imperial War Museum Duxford.

<sup>68</sup> A Williams, *Operation Crossbow*, 397-426.

<sup>69</sup> See Appendixes 1 to 3 for Transcribed photographic interpretation reports.

of photographic reconnaissance and interpretation from the period after D-Day to the end of the war, in support of the US Army.

The major limitation of the primary material available in TNA AIR series is that they are not indexed for detailed research purposes. The documents are recorded at the file level and a single file could contain from a hundred to several hundred Medmenham photographic interpretation reports. The vast majority of the reports are not individually indexed or filed by country, but by Medmenham report number, which follows an ever-increasing numeric number sequence. This sequence does support a crude date-based access to the files. However, the Medmenham master report cross referenced card index did not survive the housekeeping and general clear out at the end of the war. Therefore, the primary reports in the AIR 29 series of files are not easily accessible by country or thematically. The AIR 34 series of Medmenham photographic interpretation reports cover the more detailed reports produced by the individual sections at Medmenham, but also in a simple incremental number sequence with a section prefix. The main exception to this system are the *Crossbow* reports, that are mainly contained in a small group of the AIR 34 series.<sup>70</sup>

This difficulty in accessing either thematically or geographically the Medmenham photographic interpretation reports in TNA is quite possibly why the previous writers on Medmenham have drawn so strongly on the personal accounts of the writers who worked at Medmenham or have cherry-picked selected highlights from TNA files. This thesis has passed that research barrier by examining the totality of the AIR 29 and AIR 34 series of files and then examining every report available for the four case studies in Chapters 3 to 5 and providing as exemplars transcribed reports in Appendixes 1 to 3, which are used for further analysis within the thesis of the work of Medmenham.

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<sup>70</sup> Operation *Crossbow* was the code name given to the operations to find and destroy the German Vengeance weapons, especially the V1/V2. The majority of the *Crossbow* interpretation reports from Medmenham, especially the B2 sub-section are in the AIR 34/117 to AIR 34/138 range of files.

There is sound advice given to historians by Ferris in his warnings of a 'Bloomsbury syndrome....focus on anecdote instead of analysis'.<sup>71</sup> That can be seen as a thread through the existing books on Medmenham. There is also, as a counter point to the Ferris warning, another to historians about exercising caution over the records released into national archives by governments from the intelligence services, due to concerns over what may have been held back or manipulated prior to release.<sup>72</sup> However, there are several reasons to believe that such caution may not be so appropriate when dealing with the photographic intelligence reports from Medmenham in TNA. The photographic interpretation reports were not considered to be a clandestine or sensitive source requiring protection. Agent reporting and signals intelligence were considered to be very sensitive sources requiring protection and the reports from those sources were highly classified and carefully protected. Aerial reconnaissance was a well-known source of intelligence that the Germans used and they knew about the RAF reconnaissance Spitfires, so the source did not need to be highly classified for protection as it was an overt intelligence source.<sup>73</sup> This photographic intelligence was also a military source exploited at Medmenham and classified within the normal military classification system, without any special handling caveats. The special handling and high security surrounding the Bletchley Park *Ultra* intelligence was therefore on a far more restricted access list than the widely available Medmenham product. Medmenham was also a RAF station and reported activity via the normal RAF clerical reporting systems. They completed the daily RAF Form 540, the Operations Record Book (ORB), recording all operational activity. The actual Medmenham photographic interpretation reports were all filed, with a sequential numbering system in date order and placed contemporaneously into appendixes to the Medmenham ORB.

As this source was not considered sensitive and the volume of reporting in the National Archives is extensive, there is good cause to believe that the Medmenham photographic interpretation reports are as written and have not been subject to censorship prior to release to open series. They are as close as one can get to the

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<sup>71</sup> J Ferris, *Intelligence and Strategy: Selected Essays*, 99-105.

<sup>72</sup> R Hughes, P Jackson & L Scott, eds, *Exploring Intelligence Archives* (Abingdon: Routledge, 2008) 13-39.

<sup>73</sup> J Caddell, 'Seeing things Differently', 78-94.

raw intelligence produced from photographic reconnaissance sorties by Medmenham and then used by higher formations.<sup>74</sup> Another major strength of research into Medmenham using the original photographic interpretation reports in TNA are the fact that they almost all survive in the archive. The use of these individual photographic interpretation reports, then aggregated for further analysis provides a methodology to avoid the Ferris 'Bloomsbury' trap, whilst being mindful of the Hughes/Jackson/Scott concerns about national archives.<sup>75</sup>

This thesis uses these photographic interpretation reports as the basis for further ground breaking analysis, in four case studies, of the intelligence provided by Medmenham in Chapters 3 to 5. The detailed examination of the actual interpretation reports can reveal the significant intelligence produced from a single RAF photographic reconnaissance sortie. The examination of the reports can show how many targets and over how large an area each sortie covered. The examination of reports from different sorties, but over the same target allows comparative analysis and changes to be observed. The analysis of the evolution of the format of the reports, distribution lists and even numbers of copies produced allows the development of Medmenham to be followed. The databasing and subsequent analysis of the sortie details, and targets covered over time allows a fuller picture of the intelligence available to be produced. This can then be cross referenced via the sortie numbers to allow an analysis of the performance of the reconnaissance aircraft as will be seen in Chapter 3. As already mentioned, selected photographic interpretation reports have been transcribed at Appendixes 1 to 3. The twenty-one carefully selected and transcribed reports that cover 1940 to 1944 are used in Chapters 3 to 5 to support the findings of the four case studies and this thesis. They are discussed, analysed and transcribed much as Ralph Bennett unpacks raw *Ultra* decrypts in his *Ultra in the West*, or Jim Beach uses raw reporting to overturn previous interpretations of First World War intelligence.<sup>76</sup>

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<sup>74</sup> Note: A sortie is the name the RAF gives to a single aircraft flight. Each RAF photographic reconnaissance aircraft when flying a photographic mission would have been allocated a unique sortie number as shown in the 1 PRU Operational Record Books as analysed in Chapter 3.

<sup>75</sup> J Ferris, *Intelligence and Strategy*, 99-105; R Hughes, P Jackson, L Scott eds., *Exploring Intelligence Archives*, 13-39.

<sup>76</sup> R Bennett, *Ultra in the West*; J Beach, *Haig's Intelligence*.

The methodology for this study has been to analyse in great detail photographic intelligence at Medmenham, to better understand its capabilities. To conduct this analysis the individual photographic interpretation reports produced by Medmenham were examined. These reports were subject to a detailed textual analysis, with relevant data extracted into tables for further analysis. The analysis was carefully planned to cover the period from 1940 to 1944 when the photographic interpretation was home based and conducted centrally at Wembley and then Medmenham.<sup>77</sup> Within this broad window four case studies were selected to cover photographic interpretation reporting with different focuses of sea, air and land. The selection of four case studies across the five years allowed the developments in techniques and organisation to be assessed. Within each case study, every Medmenham report within that time window was identified, examined and analysed. Then the photographic interpretation reports or echoes of the reports were traced in the wider intelligence reporting. This analysis and examination provided further avenues for research as shown in Chapter 3, with the detailed follow up analysis of the Photographic Reconnaissance Units' individual reconnaissance flights, following each individual Spitfire and pilot to allow further deductions to be drawn out of the reporting. This allowed a better understanding of the detail provided by Medmenham in its reporting across the wide range of photographic intelligence products they produced and how that contributed to the wider intelligence picture. However, due to the fact that TNA holds over 38,000 photographic interpretation reports from 1940 to 1945 a method of reducing the volume of reports was devised. This vast number of actual intelligence reports may have provided a barrier to previous historians analysing what Medmenham actually produced. The analysis in this thesis was conducted on four case studies, one from each of the three military environments and spanning the period from 1940 to 1944.

The four case studies Operation *Sealion* in 1940, Operation *Millennium* in May 1942, Operation *Chastise* in May 1943 and Operation *Epsom* in June 1944 were selected

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<sup>77</sup> From July 1944 photographic interpretation units and reconnaissance aircraft deployed into Normandy to support *Overlord*.

from a more extensive choice of eleven possible studies. Those considered included Operation *Jubilee* the Dieppe raid in August 1942, Operation *Torch* in November 1942, Operation *Crossbow* covering 1943 to late 1944, Operation *Overlord* preparations in 1944, Operation *Market Garden* in September 1944, as well as thematic case studies such as the Strategic Bombing Offensive against the synthetic oil industries and German capital ships. The selection of the case studies was considered against a design plan to cover the three environments of sea, air and land. They were also selected to sample across the period from 1940 through to 1944.

These four case studies were chosen in preference to the other case studies that were considered, primarily because the chosen case studies all have significant numbers of photographic interpretation reports available to analyse and were all significant operations. Then there are the case studies that were considered but rejected including, Operation *Jubilee* which was a contender for a case study but because it clashed with Operation *Millennium* for the period covered was not selected. Operation *Torch* though it also clashed with the periods covered by Operation *Millennium* and Operation *Chastise*, it was not selected because the majority of the photographic interpretation support came from theatre, not from Medmenham, therefore fell outside the thesis selection criteria. The Strategic Bombing thematic case study against the oil targets was not chosen because it covered too broad a time frame and because of the vast numbers of Medmenham reports that would have required analysis. The thematic case study against the German capital ships was not selected, because the focus for those attacks was on the First Phase reports from the PRU stations, rather than on detailed analysis provided by Medmenham. There are two operations that feature in the five books on Medmenham, D-Day and the preparations for it and the V weapon hunt in Operation *Crossbow*. These were considered as case studies, because the previous writers have not used my methodology for analysis. However, they were finally discounted because of the number of times they had already been covered.<sup>78</sup> Operation *Market*

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<sup>78</sup> C Babington Smith, *Evidence in Camera*, 199-233; U Powys-Lybbe, *The Eye of Intelligence*, 122-134, 188-212; T Downing, *Spies in the Sky*, 236-255, 276-310; A Williams, *Operation Crossbow*, 101-296; C Halsall, *Women of Intelligence*, 152-166.

*Garden* in September 1944 was also discounted as the majority of the photographic interpretation was provided by the deployed interpretation units in theatre and it was also covered in an AHB air reconnaissance pamphlet.<sup>79</sup>

The selection of the four case studies across five years allowed the thesis to show the development of photographic interpretation from the rather unsophisticated simple photo reading of the limited number of initial short reports in 1940 to the long, complex, comprehensive, detailed and numerous reports of 1944. The parallel development of a complex organisational structure at Medmenham to support a centralised Second and Third Phase photographic intelligence production unit. The growth from a small number of photographic interpreters in 1940 to the almost industrial scale of Medmenham from 1942 to 1945 with all the accompanying support services and systems needed to keep the organisation running.

Operation *Sealion* was selected as the first case study and was a sea-based study, looking at how photographic interpretation tracked the build-up of preparations for the invasion of Britain in 1940. This case study starts with the very first report from the Photographic Development Unit Interpretation and Intelligence (PDUI) at Wembley in May 1940 and analyses all the reports produced over a five-month period.<sup>80</sup> The case study also examines the reconnaissance aircraft available to conduct photographic reconnaissance in this early part of the war. It also allowed an analysis of the value, and use of photographic intelligence before the support from Bletchley Park became almost ubiquitous to those inducted into *ULTRA*. The second and third linked case studies were air environment studies looking at two significant operations during the Strategic Bombing campaign and examines Medmenham support to air operations.<sup>81</sup> The selection of Operation *Millennium* and Operation *Chastise* covered 1942 and 1943, and both were significant air operations. The selection of an area

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<sup>79</sup> MA Acc No 23329, S Ritchie, *Arnhem – The Air Reconnaissance Story* (AHB, 2015).

<sup>80</sup> The first 600 Photographic Interpretation Reports from 001, on 14 May 1940 to report 599 on 15 October 1940 are used in Case Study One. The first 100 reports have been examined and data extracted for further analysis and are at Annex M.

<sup>81</sup> The Strategic Bombing operations used are Operation *Millennium*, the first 1,000 bomber raid against Cologne an area bombing study and Operation *Chastise* the Ruhr Dams raid by 617 Squadron, a precision bombing study.



target in Operation *Millennium* and a precision target in Operation *Chastise* also allowed the comparative analysis of the support required from Medmenham to Bomber Command for these different targets. The study of Operation *Millennium* included investigating Medmenham reports on Cologne from 1941 as well as 1942 to provide a complete picture of the intelligence provided on Cologne. Operation *Chastise* in May 1943 provided a major Bomber Command precision bombing target to act as a comparator to the area bombing of Cologne. These two operations covered the air environment and also the development of Medmenham from 1941 to 1943.

Operation *Epsom* in June 1944 covered the land environment and provided the case study to allow the support Medmenham provided to Operation *Overlord* to be briefly investigated and then the detailed daily intelligence reports provided by Medmenham for the build-up and during Operation *Epsom* to be analysed. This operation was chosen because the photographic interpretation support was provided from the UK and before the deployment of the tactical photographic processing and exploitation cabins to France. This final case study also allowed the examination and analysis of how Medmenham had developed from 1940 through 1944 and the changes needed to support the Allied landings in Normandy.

The selection of these four case studies from 1940 to 1944 will allow an analysis of how the PDUI/PIU at Wembley evolved into the CIU/ACIU at Medmenham. They will also allow an examination of how the photographic interpretation reports and techniques developed as the war progressed. This will provide a sound academic basis for analysing the position of Medmenham and photographic interpretation in the intelligence structures of the Second World War.

Therefore, this thesis sets out to answer the question: What photographic intelligence was Britain able to derive at Medmenham from aerial reconnaissance during the Second World War?

This question is important as it addresses the issues raised by the absence of actual Medmenham reporting in the historiography as shown across the literature review. The understanding of what Medmenham reporting actually provided to the Allied intelligence organisation, will provide a measure of balance to the current almost omniscient, presence of Bletchley Park and *Ultra* in the intelligence historiography. The detail and quantity of the Medmenham reporting has been a barrier to incorporating it into this historiography. This is also the first detailed academic study of Medmenham and the Central Interpretation Unit and will highlight the wealth of photographic interpretation reports available for further research, suggest methods for analysis and provide pointers for further areas of study.

To answer this question this dissertation has examined where Medmenham sits within the broader British intelligence system, in Chapter 2 and continues in Chapters 3 to 5, using four case studies to analyse the actual Medmenham reporting. These chapters set out the background and arguments, with supporting detail in the annexes and transcribed reports in the appendixes.

## Chapter 2

### Organisation

RAF Medmenham provided the British government and allies with a central photographic intelligence centre providing detailed photographic interpretation reports from aerial photographic reconnaissance. However, the significance of the photographic intelligence from Medmenham can only be properly understood in the context of the broader intelligence machinery in Britain. Therefore, a brief outline of the intelligence machinery in the pre-war period and during the war will be described. The background of the US intelligence organisations will also be examined, to show how they developed and were able to collaborate with the UK. However, only the US reconnaissance and interpretation efforts will be examined in any detail, to understand the impact on Medmenham as the US joined the organisation in strength in early 1944. Within the British intelligence machinery, Bletchley Park has a high profile both in the public consciousness and in the historiography of intelligence in the Second World War.<sup>82</sup> Therefore, the development and organisation of Bletchley Park will be examined because, like Medmenham, it was a central intelligence unit providing the British government and allies with intelligence. Bletchley Park will then be used as a comparison for an innovative organisational analysis of the development of Medmenham. The growth, development and organisation of Medmenham analysed in this chapter will provide the detail and background needed to understand the unique photographic interpretation environment it provided for the following three chapters of detailed case studies.

This chapter will provide a counterbalance to the inadequate coverage of Medmenham in the historiography, by providing a ground breaking analysis of the organisational structure, staffing and technology employed by Medmenham to produce photographic intelligence reports. This detailed analysis of Medmenham is possible because of the thesis research leading to the creation of many of the

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<sup>82</sup> F W Winterbotham, *The Ultra Secret*. The Bletchley Park site has been preserved and a new visitor centre opened to the public, having received significant Heritage Lottery Funding in 2011. The National Archives hold a significant series of files on Bletchley Park in the HW Series, released from 1993.

annexes.<sup>83</sup> The rapid growth of Medmenham to cope with the increase in aerial photographic sorties will be analysed and compared with that of Bletchley Park and its growth to cope with the increase in signals intercepts and comparisons and conclusions drawn.

The highest level of the British defence and security system was the Committee of Imperial Defence (CID), chaired by the Prime Minister or a senior cabinet colleague and the Foreign Office (FO), other government departments, the COS were all members. However, it discussed defence in the round, not just intelligence, so with the setting up of the Joint Intelligence Committee (JIC) in 1936, the JIC became the top of the intelligence committee tree.<sup>84</sup> The JIC included members from the Secret Service, Security Service and the Government Code and Cypher School (GC&CS) and the three Service intelligence organisations as well as the political/diplomatic intelligence gathered by the FO.<sup>85</sup> The British intelligence system had remained quite static from early 1920 to the early 1930s. Then changes began to be made, to improve efficiency and co-operation but were not fully implemented until after the start of the Second World War.<sup>86</sup> The British intelligence apparatus and performance during the rise of Nazi Germany in the 1930s is described and analysed in detail by Wark, which exposes the British gaps in structure, analysis and intelligence on Germany.<sup>87</sup> The slow realisation that changes were needed in the British intelligence machinery is at odds with the concerns in government about the rapid rise of Nazi Germany.<sup>88</sup>

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<sup>83</sup> Especially Annexes A: List of CIU and ACIU Sections; B: Medmenham Sections; G: The *Wild A5* Stereo Autograph; I: Medmenham Manning, Production & Sortie Figures; S: Stereoscopes.

<sup>84</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1, 8; M S Goodman, *The Official History of the Joint Intelligence Committee*, 1-60.

<sup>85</sup> See: C Andrew, *The Defence of the Realm*; C Andrews, *Her Majesty's Secret Service: The Making of the British Intelligence Community* (New York: Penguin Books, 1987); C Andrew & D Dilks, *The Missing Dimension: Governments and Intelligence Communities in the Twentieth Century* (London: Macmillan Publishers, 1984); M Goodman, *The Official History of the Joint Intelligence Committee*; K Jeffery, *MI6*.

<sup>86</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1. 3-43; M Herman, *Intelligence Power in Peace and War*, 16-28; W Wark, *The Ultimate Enemy: British Intelligence and Nazi Germany, 1933-1939* (London: Tauris, 1985) 117, 212.

<sup>87</sup> W Wark, *The Ultimate Enemy*, 188-224.

<sup>88</sup> W Wark, *The Ultimate Enemy*, 117, 212; for more detail on German intelligence see: D Kahn, *Hitler's Spies*; J Holland, *The War in the West: Germany Ascendant 1939-1941* (London: Transworld Publishers, 2015); H Boog, et al, eds, *Germany and the Second World War Vol VI: The Global War: Widening of the Conflict into a World War and the Shift of the Initiative 1941-1943* (Oxford: Oxford

The JIC, developed out of the Inter-Service Intelligence Committee to ensure better collaboration between the various intelligence departments of the services and the three intelligence agencies. The creation of the JIC was finally approved by the Chiefs of Staff Committee in June 1936. The JIC was then formed as the Joint Intelligence Sub-Committee of the Chief of Staff Committee.<sup>89</sup> The JIC developed both as a manager of intelligence organisation and as a central analysis of intelligence and agreed-on intelligence report drafter. However, from 1936 to mid-1939 the FO was only an occasional member of the JIC. The FO from early 1939 had the Situation Report Centre (SRC) to coordinate FO intelligence and issue independent daily and weekly intelligence reports to other departments.<sup>90</sup> This created more duplication and the SRC itself recommended a merger with the JIC, which occurred in July 1939. The JIC was now in a form that lasted through the war, producing daily, weekly and long-term intelligence assessments. The JIC was not an intelligence collection organisation, but a centralised direction, analysis and reporting organisation.<sup>91</sup>

The SIS often known as MI6 was formed from the Foreign Section of the Secret Service Bureau in 1909. It was tasked with gathering secret intelligence against foreign nations and passed this intelligence on to its principal customers, the FO, and the military service intelligence departments. From its inception to the end of the Second World War, it was a human intelligence tasking and collection organisation, but not an intelligence analysis organisation. The raw intelligence reports were sent on to the FO relevant desks or to the military intelligence departments, where the reports were analysed and assessed. SIS during this period just graded the reliability

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University Press, 2015) also Volumes I to V and Vol VII to IX; E Westermann, 'Hitting the Mark, but Missing the Target: *Luftwaffe* Deception Operations, 1939-1945', *War in History*, 10.2 (2003), 206-221.

<sup>89</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1, 3-43; M Goodman, *The Official History of the Joint Intelligence Committee*, 11-20.

<sup>90</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1, 43.

<sup>91</sup> Aldrich, Cormac & Goodman, *Spying on The World*, (Edinburgh: Edinburgh University Press, 2014) 31-60; & for a detailed history of the JIC see: M Goodman, *The Official History of the Joint Intelligence Committee*; P Cradock, *Know Your Enemy: How the Joint Intelligence Committee Saw the World* (London: Murray, 2002).

of the agents providing the report but did not place the report in a broader context. They were strictly a human intelligence collection organisation.<sup>92</sup>

SIS was not able to provide significant intelligence on the German build-up and preparations for war, due to the difficulty of operating spies in a hostile secure totalitarian state and also the significant financial pressures it operated under during the 1930s. The official history of SIS could find no evidence that anything of value on a technical intelligence level was obtained on the Germans during the whole of the Spanish Civil War, which was an ideal opportunity to observe German tactics, techniques and procedures.<sup>93</sup> Despite these valid criticisms of SIS for failing to provide any useful technical intelligence on German, Italian or Russian aircraft and armaments during the Spanish Civil War, they of course did provide clandestine aerial photography of German and Italian territory for the RAF. They had funded a specially adapted civilian Lockheed 12A with hidden aerial cameras, which Sidney Cotton as a businessman flew around Europe, using the Aircraft Operating Company to interpret the photographs.<sup>94</sup> This was to provide the RAF with its embryonic strategic photographic reconnaissance force for the beginning of the war.

Signals Intelligence from GC&CS was considered to be separate from SIS but did come under the administrative control of the Chief of SIS, under his other title of Director of GC&CS. GC&CS moved to Bletchley Park in August 1939 and provided a significant stream of decrypted intelligence to those cleared senior commanders and

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<sup>92</sup> K Jeffery, *MI6*, X-XVI & 282-323; P Davies, *MI6 and the Machinery of Spying* (Abingdon: Cass, 2004) 76-186; S Dorril, *MI6: Fifty Years of Special Operations* (London: Fourth Estate, 2001) 7-19; N West, *At Her Majesty's Secret Service: The Chiefs of Britain's Intelligence Agency, MI6* (Barnsley: Frontline Books, 2016); N West, *MI6: British Secret Intelligence Service Operations 1909-45* (London: Random House, 1984); C Andrews, *Her Majesty's Secret Service*; C Andrew & D Dilks, *The Missing Dimension*, 101-125; R Aldrich, *The Hidden Hand: Britain, America and the Cold War Secret Intelligence* (London: Murray, 2001) 64-88; R Hughes et al, 'The British Secret Intelligence Service: 1909-1949', *INS*, 26.5 (2011) 701-729.

<sup>93</sup> D Bonilla & G Cano, 'Photographic Air Reconnaissance during the Spanish Civil War, 1936-1939', *War in History*, 20.3 (2013) 345-380; N Cerdá, 'The Road to Dunkirk: British Intelligence and the Spanish Civil War', *War in History*, 13.1 (2006) 42-64; G Kennedy, 'The Royal Navy, Intelligence and the Spanish Civil War: Lessons in Air Power, 1936-39', *INS*, 20.2 (2005) 238-263.

<sup>94</sup> K Jeffery, *MI6*, 282-323; R Barker, *Aviator Extraordinary: The Sidney Cotton Story* (London: Chatto & Windus, 1969); For SIS Cotton flight and coverage details see: AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1, Appendixes V-VIII.

War Cabinet.<sup>95</sup> The decrypted signals were reformatted into intelligence reports and to protect the source were classified as Most Secret *Ultra* and sent to a select list of specially cleared senior officers and officials. Signals intelligence, the supporting Y Service and especially Bletchley Park have dominated the discussions of intelligence during the Second World War, since the *Enigma* secret was disclosed in 1973-74.<sup>96</sup> Since then there has been a significant body of work that covers the GC&CS at Bletchley Park and its impact on the conduct of the war.<sup>97</sup> Bletchley Park grew from an organisation of around 200 in 1939 to almost 10,000 in 1944.<sup>98</sup> The Bletchley Park site was acquired by Sir Hugh Sinclair in 1938, for the use of GC&CS and SIS. The main house was initially use as a Head Quarters and for code breaking, but very soon numbers expanded beyond the house and it was then used for the headquarters section and administrative functions.<sup>99</sup> Numerous wooden huts were quickly built in the grounds to house the rapidly expanding sections, with brick two and three storey blocks being built later.<sup>100</sup> There are quite a few similarities and comparisons with the growth of Bletchley Park and that on a slightly smaller scale at Medmenham that will be examined in this chapter. The early 1940 organisational structure of Bletchley Park can be seen in the chart at Annex J, with a more detailed description at Annex K, of how Bletchley Park operated.

The collection of intelligence differs depending on the source of the intelligence.<sup>101</sup> Agent reporting requires the collector, usually a spy or double agent, to collect the intelligence secretly and pass it to the Allies. This can be passed verbally, by

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<sup>95</sup> F W Winterbotham, *The Ultra Secret*.

<sup>96</sup> Note: The *Enigma* was the German encryption machine used by the German forces. The existence of Bletchley Park and its work on providing decrypted intelligence from German encryption machines was first disclosed in FRENCH by General Gustave Bertrand in his 1973 book and then the *ULTRA Secret* by Winterbotham in 1974; G Bertrand, *Enigma ou la plus grande enigma de la guerre 1939 – 1945 (Enigma: The Greatest Enigma of the War 1939-1945)* (Paris: Plon, 1973); F Winterbotham, *The Ultra Secret*. See also F Winterbotham, *The ULTRA Spy: An Autobiography* (London: Macmillan, 1989); R Aldrich, *The Hidden Hand*; R Aldrich, *GCHQ* (London: Harper, 2010).

<sup>97</sup> For history of GC&CS see: P Davies, 'From amateurs to professionals: GC and CS and institution building in SIGINT' in M Smith & R Erskine, eds. *Action this Day* (London: Bantam Press, 2001).

<sup>98</sup> C Grey, 'The making of Bletchley Park and Signals Intelligence 1939-42', *INS*, 28.6 (2013) 785-807; C Grey & A Sturdy, 'A Chaos that Worked: Organizing Bletchley Park', *Public Policy and Administration*, 25.1 (2010) 47-66; R Lewin, *ULTRA goes to War: The Secret Story* (Great Britain: Hutchinson & Co, 1978); R Bennett, *Intelligence Investigations*.

<sup>99</sup> See Annex B - List of Bletchley Park Huts and Buildings with Functions.

<sup>100</sup> GCHQ, *History of Bletchley Park Huts and Blocks 1939-45* rev. by A Bonsall (Milton Keynes: Bletchley Park Trust, 2009).

<sup>101</sup> C Andrew, R Aldrich & W Wark, eds, *Secret Intelligence*, 1-77.

documents or transmitted by wireless radio. Signals Intelligence can only be collected by listening to wireless radio traffic and collecting it at intercept stations or Y Stations as they were known during the war.<sup>102</sup> Photographic intelligence required an aircraft to fly over the target to collect the intelligence. Signals intelligence was a passive process of listening to wireless communications, of no use if the Germans used land lines or couriers. However, you could task reconnaissance aircraft to fly over a target and collect intelligence, but of course bad weather would hinder your collection as would enemy anti-aircraft defences. It is known that at times when Bletchley Park were unable to collect enemy traffic because it was going via land lines, bombing missions would be planned to destroy the land lines and force the Germans to use wireless traffic, so Bletchley Park could intercept the radio traffic. They then had to find the key to decode the messages, translate them and analyse them to produce usable intelligence from the intercepted messages.<sup>103</sup>

Churchill, when Prime Minister from May 1940, demanded his own daily feed of *Ultra* intelligence from Bletchley Park that he used to inform his decision making. Churchill from his early days in the Army had a great interest in intelligence, and knew how to use it for strategic, political and military operations. He used *Ultra* intelligence with great care to protect the source, but also was very political in the way he used it to help convince the US to support Britain in the war against Germany. Churchill not only had regular intelligence from *Ultra*, but he also had intelligence from all the other intelligence agencies and the JIC. However, it is the regular supply of raw *Ultra* material from Bletchley Park that he valued the most as can be seen by his personal support for Bletchley Park in his famous 'action this day' intervention on behalf of them in October 1941.<sup>104</sup> Churchill was also a key player in setting up the American /

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<sup>102</sup> The UK also intercepted telephone and telegraph traffic from undersea cables, but these were usually in clear and not encrypted. See: 'The Zimmermann Telegram', *CIA: Studies in Intelligence*, 57.2 (2013) 71.

<sup>103</sup> M Smith & R Erskine, eds, *Action this Day: Bletchley Park from the Breaking of the Enigma Code to the Birth of the Modern Computer* (London: Bantam, 2001); R Erskine & M Smith, *The Bletchley Park Codebreakers*.

<sup>104</sup> C Andrew, 'Churchill and Intelligence', *INS*, 3.3 (1988) 181-193; D Stafford, *Churchill and Secret Service* (London: Murray, 1997) 59 - 85 & 189 - 205; P Milner-Barry, 'Action This Day: The Letter from Bletchley Park Cryptanalysts to the Prime Minister, 21 October 1941', *INS*, 1.2 (1986) 272-276; M Smith & R Erskine, *Action This Day*, ix-xiii.



British signals intelligence cooperation that worked so well during the war and was to be the basis of the longstanding 'Special Relationship' that is said to exist today.<sup>105</sup>

Bletchley Park grew rapidly from its original numbers to almost 10,000 by 1944, to be able to cope with the rapid increase in intercepted traffic. The cryptographers, almost all men, were the most regarded and key and elite people at Bletchley Park.

However, the vast majority and in large numbers, were the ordinary people that made the place work. These included those in administration, maintenance, transportation, specialist equipment operators, communications staff and intelligence administration staff, not to mention security staff.<sup>106</sup> The total mix of people at Bletchley Park included over half being female, but usually in support roles, not cryptography.<sup>107</sup>

The growth and maturing of the organisation can be seen from the organisation table of Bletchley Park from 1944 at Annex J.

Bletchley Park worked on intercepted wireless traffic, provided by the network of radio intercept stations called 'Y' stations, not land line traffic. The network of radio intercept stations sent the intercepts of German radio traffic to Bletchley Park. The FO, Radio Security Service, Metropolitan Police, General Post Office and three services all ran intercept sites, under the central control and oversight of MI8, that provided the bulk of the wireless intercepts for Bletchley Park. Bletchley Park did not run any intercept stations itself. This central management by MI8 and its 'Y' Board and sub-committees caused growing tensions between Bletchley Park and MI8 that continued for most of the war until Signals intelligence Traffic Analysis (SIXTA) was

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<sup>105</sup> R Erskine, 'Churchill and the start of the ultra-magic deals', *INS*, 10:1 (1997) 57-74.

<sup>106</sup> The Bombe was an electro-mechanical device used in breaking the daily German *Enigma* codes and Colossus was an electric valve based programable computer used in breaking the German Lorenz codes, for details on Colossus and the Bombe see: B Copeland et al, *Colossus*; J Keen, *Harold 'Doc' Keen and the Bletchley Park Bombe*, 30-61; D Davies, 'The Bombe A Remarkable Logic Machine', 108-138; D Michie, 'Colossus and the Breaking of the Wartime 'Fish' Codes', 17-58; for more on Colossus see: M Smith & R Erskine, *Action This Day*, 342-369; P Gannon, *Colossus: Bletchley Park's Greatest Secret* (London: Atlantic, 2006); for Lorenz see: J Roberts, *Lorenz*; for security see: C Grey, 'An organizational culture of secrecy: the case of Bletchley Park', *Management & Organizational History*, 9:1 (2014)107-122.

<sup>107</sup> S McKay, *The Secret Life of Bletchley Park*; M Smith, 'The Wrens of Bletchley Park', *ACM Cryptography*, 21:3 (2015) 48-53.

set up at Bletchley Park.<sup>108</sup> However, if the German messages were sent by land line or courier, this could cause problems as Bletchley Park was blind to them. This was a problem when the Germans had won the battles and troops stopped advancing and moved over to holding ground, as they quickly reverted to significant use of land line traffic. To have any material to work with, Bletchley Park was totally dependent on the feed of raw intercepts from the network of 'Y' stations and on the Germans using wireless communications rather than land lines. Annex K gives an outline of Bletchley Park, its structure and working practices, including the use of advanced devices such as the Bombe and Colossus machines to decode German messages.<sup>109</sup>

The JIC, SIS, SS, and GC&CS were part of the top level intelligence organisation within the UK during the war. They all were integrated into a system that provided the War cabinet and the COS with intelligence needed to inform decisions about the conduct and progress of the war. Below this top level of intelligence were the military intelligence organisations of the Royal Navy, Army and the RAF.

The Royal Navy by 1936 had already established Operational Intelligence Centres (OIC) for the Mediterranean and China fleets and then concentrated on setting up a central Admiralty Operations and Intelligence Centre, with special responsibility for Home Waters and the Atlantic. This centre could send intelligence out to all Naval commands and even ships and receive reports back from ships and commands, via the well-established Naval Reporting Officer network, set up by the Naval Intelligence Directorate. The OIC was an all source intelligence centre and included sub department 8P dedicated to photographic reconnaissance.<sup>110</sup> This gave the Royal

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<sup>108</sup> A Bonsall; 'Bletchley Park and the RAF Y Service: Some Recollections', *INS*, 23.6 (2008) 827-841; C Gray, 'The Making of Bletchley Park and Signals Intelligence 1939-42', 785-807; K Macksey, *The Searchers: Radio Intercept in Two World Wars* (London: Cassell Military Paperbacks, 2003); F H Hinsley et al, *British Intelligence in the Second World War Vol 1*; S McKay, *The Secret Listeners: How the Wartime Y Service Intercepted the Secret German Codes for Bletchley Park* (London: Aurum Press, 2012).

<sup>109</sup> For detailed background on Bletchley Park see: H Hinsley & A Stripp, *Codebreakers*; P Calvocoressi, *Top Secret Ultra* (Cleobury Mortimer: M & M Baldwin, 2001); M Smith, *Station X*; R Erskine & M Smith, *The Bletchley Park Code-breakers*.

<sup>110</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1, 11-13, 23-25, 103,285-287; P Beesly, *Very Special Intelligence: The Story of the Admiralty's Operational Intelligence Centre, 1939-1945*

Navy the structure needed to cope with the impending war and expand as the workload increased. A problem that remained to be solved was the almost institutionalized system of keeping naval intelligence within the Navy and not sharing it with the other services or Government departments. They also had the perennial problem, that even when they provided accurate and timely intelligence, operational commanders could make the wrong decision.<sup>111</sup>

The Army had a rather difficult relationship with intelligence, disbanding the Intelligence Corps during the inter-war period. The Army War Office, had the Military Intelligence Branch (MIB), which was tasked with the long term strategic intelligence requirements of the Army. They were also responsible for the administration and organisation of army intelligence across the Army. The actual responsibility for providing intelligence to the Army commanders in the field, fell to the indigenous intelligence staff of the individual commanders and their field intelligence officers. This set up was seen to be inadequate for the tasks and intelligence available as war approached. The War Office MIB was hard pressed to mobilise enough intelligence officers and staff for the British Expeditionary Force (BEF), in part due to the disbandment of the Intelligence Corps in 1918 and poor quality or gapped intelligence posts in Commands and down the structure to battalion level. They needed the help of MI5 to supply the intelligence component to the BEF. The Army by now had decided that they did need an Intelligence Corps and it was re-established in July 1940.<sup>112</sup> The Army intelligence organisation and the Intelligence Corps went on to provide a very successful and professional service to commanders and the Army through the rest of the war.

RAF Intelligence is particularly pertinent because of the RAF dominance of Medmenham. The RAF from its creation had an intelligence branch, but was

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(London: Chatham, 2006); C Hamilton, 'The Character and Organisation of the Admiralty Operational Intelligence Centre during the Second World War', *War in History*, 7.3 (2000) 295-324.

<sup>111</sup> For example, the order to scatter the Arctic convoy PQ17 – see F Hinsley, *British Intelligence in the Second World War*, Vol II, 220-223; P Beesly, *Very Special Intelligence*, 184-193; P Beesly, 'Convoy PQ 17: A study of intelligence and decision-making', 292-322.

<sup>112</sup> A Clayton, *Forearmed: History of the Intelligence Corps*, (London: Brassey's, 1996); K Strong, *Intelligence at the Top* (London: Cassell, 1969); J Haswell, *British Military Intelligence* (Worthing: Littlehampton Book Services, 1973).

subordinated as in the Army to the operations branch. The Air Ministry created the post of Deputy Director of Intelligence (DDI) in 1935, which placed intelligence on the same level as operations in the Air Ministry. The post was upgraded to full Director of Intelligence at the start of the war and to Air Board level by April 1941 with the appointment of Assistant Chief of the Air Staff - Intelligence.<sup>113</sup> The RAF hierarchy for intelligence had the Air Ministry, Air Intelligence Department, intelligence departments at each RAF Command, and sections at Group and station level. The flow of intelligence was two way, from Air Intelligence all the way down to station level, via daily and weekly intelligence summaries. The flow of intelligence went back up the chain from stations debriefing returning aircrew from missions and on reconnaissance stations the initial photographic interpretation was reported back up the chain.<sup>114</sup> The RAF had an administrative and special duties (intelligence) sub branch and the intelligence officers were mainly from the sub branch. However, it was not unusual to find aircrew, usually medically downgraded or between flying tours also filling intelligence officer posts. These staff would be trained by the RAF School of Intelligence at RAF Highgate, which ran basic intelligence courses, specialist courses for Bomber Command and senior officer intelligence courses.<sup>115</sup> This training did not include the specialist photographic interpretation training required by Medmenham, which ran its own training courses.<sup>116</sup>

There were no dedicated RAF photographic reconnaissance aircraft or squadrons, at the start of the Second World War but the RAF used the Blenheim medium bomber squadrons to also conduct photographic reconnaissance missions. However, the RAF did have an embryonic strategic reconnaissance unit at Heston, the Heston Flight, with a Lockheed 12A with its SIS background, Beechcraft, Blenheim IV and

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<sup>113</sup> F Hinsley, *British Intelligence in the Second World War*, Vol 1, 11-12; J Stubbington, *Kept in the Dark: The Denial to Bomber Command of Vital ULTRA and Other Intelligence Information during World War II* (Barnsley: Pen and Sword, 2010) 156-161, 168-170, 244, 250; S Cox, 'A Comparative Analysis of RAF and *Luftwaffe* Intelligence in the Battle of Britain, 1940', *INS*, 5.2 (1990) 425-443.

<sup>114</sup> Air Historical Society, *Bracknell Paper No 7 – Air Intelligence* (UK: Fotodirect Ltd, 1997) 10-17; F Hinsley, *British Intelligence in the Second World War*, Vol 1, 11-14; S Cox, 'A Comparative Analysis of RAF and *Luftwaffe* Intelligence in the Battle of Britain, 1940', 425-443; R Ehlers, *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns* (Lawrence: University Press of Kansas, 2009) 62-295; S Puri, 'The Role of Intelligence in Deciding the Battle of Britain', *INS*, 21.3 (2006) 416-439; J Stubbington, *Bomber Command*.

<sup>115</sup> TNA AIR 29/715, RAF School of Intelligence Highgate 1942-1948.

<sup>116</sup> See Annex B, PI School.

three Spitfire PR1 aircraft under the command of Wing Commander Sidney Cotton.<sup>117</sup> The acquisition of the three Spitfires for photographic reconnaissance was a significant coup for Cotton, as the initial Maurice Longbottom memorandum in August 1939 proposing high altitude strategic reconnaissance aircraft was not acted upon, but with Cotton's memorandum of late September 1939 and his ability to circumvent normal RAF bureaucratic procedures it resulted in the three Spitfires.<sup>118</sup> This flight underwent six changes of name between September 1939 and November 1940 when it finally was established as No 1 Photographic Reconnaissance Unit (PRU). The aircraft allocated to this Unit and name changes are shown in Table 1. The initial developments of the RAF strategic reconnaissance capabilities were rather chaotic during these initial nine months under Cotton, but essential to prove the utility of the Spitfire as a strategic reconnaissance aircraft. However, that was to change and the Unit settled down to become a more standard RAF unit once it became the Photographic Reconnaissance Unit in July 1940 under the command of a career RAF Wing Commander Geoffrey Tuttle.<sup>119</sup>

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<sup>117</sup> The RAF organised aircraft first into a flight of up to six or eight aircraft, then usually three flights make a squadron and three squadrons make a wing of aircraft. For the involvement of Sidney Cotton see: R Barker, *Aviator Extraordinary*.

<sup>118</sup> See Annexes E and F for the transcription of the Maurice Longbottom and Sydney Cotton memorandums setting out the requirements for high altitude strategic reconnaissance.

<sup>119</sup> TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1, 65-79; R Nesbit, *Eyes of the RAF*, 80-126; Wing Commander Geoffrey Tuttle continued his RAF career after commanding the PRU, commanding 324 Wing, eventually retiring in 1959 as Air Marshal Sir Geoffrey Tuttle, KBE, CB, DFC.

Table 1 Heston Units, Name Changes, September 1939 to November 1940<sup>120</sup>

Name	Aircraft Type	Dates
Heston Flight	Spitfire PR 1, Lockheed 12A Blenheim IV, Beechcraft	September to November 1939
No 2 Camouflage Unit	Spitfire PR 1, Lockheed 12A Blenheim IV	November 1939 to January 1940
Special Survey Flight	Spitfire PR 1	November 1939 to February 1940
212 Squadron	Spitfire PR 1	February to June 1940
Photographic Development Unit	Spitfire PR 1, Lockheed 12A Blenheim IV, Hudson	January to July 1940
Photographic Reconnaissance Unit	Spitfire PR 1, Blenheim IV Hudson	July to November 1940

The RAF strategic reconnaissance then developed the specialist units and squadrons detailed in Annex C. These were RAF reconnaissance squadrons with specially adapted aircraft fitted with aerial cameras to provide Medmenham, the RAF, other services and Whitehall with comprehensive photographic coverage of Axis targets. The two main reconnaissance aircraft used by the reconnaissance units and squadrons were the Spitfire and Mosquito, both of which were continuously developed during the war, providing longer ranges with extra fuel tanks and faster and higher-flying capabilities as new engines were developed.<sup>121</sup> The reconnaissance units and squadrons provided the RAF with, by the end of 1942, an average of over 60 specialist PR aircraft in 540 to 544 Squadrons. The numbers of

<sup>120</sup> The Special Survey Flight was formed from part of No 2 Camouflage Unit and deployed to France. See: TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1, 79-82; R Nesbit, *Eyes of the RAF*, 324. The Special Survey Flight was renamed 212 Squadron in February 1940 and then re-joined the Photographic Development Unit in June 1940. See: TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1, 141-152; R Nesbit, *Eyes of the RAF*, 324. See Annex C, for No 1 Photographic Reconnaissance Unit, November 1940 to October 1942.

<sup>121</sup> For more details on the Spitfire see: E Morgan & E Shacklady, *Spitfire*, 235-238; for the Mosquito see: E Shacklady, *Classic WWII Aviation: De Havilland Mosquito*, (Bristol: Cerberus, 2002).

reconnaissance aircraft increased until by the end of 1943 there were 80, made up of 40 Spitfires and 40 Mosquitos in 540 to 544 Squadrons. The numbers of Mosquitos in service had been expanded to cover long range reconnaissance missions.<sup>122</sup> The number of strategic reconnaissance aircraft provided by four UK based squadrons from late 1942 onwards provided sufficient aircraft to meet the reconnaissance tasking. This is a distinct change from the shortage of Spitfires seen in Chapter 3. See also Annex D for the details on the aerial cameras. The reconnaissance aircraft were able to collect photographs against many targets during one flight and each aircraft flight was called a sortie and given a unique sortie number. The films from each flight were then identified with the unique sortie number from that flight and these sortie numbers were included in each Medmenham photographic interpretation report.<sup>123</sup>

The USAAF and the arrival of the American photographic interpreters at Medmenham had a direct impact on how Medmenham would work.<sup>124</sup> The impact of the US and its intelligence organisation had a direct influence on the British intelligence organisations, especially during the period just before the US entered the war, and then to the end of the war. In summary, the USA had at government level, an Interdepartmental Intelligence Coordinating Committee, but without a permanent chair it lacked any real authority over Departmental intelligence. The Federal Bureau of Investigation (FBI) held the responsibility for counter espionage. The US Navy had a Naval Intelligence Department as did the US Army. As is usual with the US, the Marine Corps also had its own intelligence department. With war in Europe, the President created a Coordinator of Intelligence office, reporting directly to him. However, after the failures of intelligence over the Japanese attack at Pearl Harbour as well as improvements in Military intelligence, the Coordinator of Intelligence office

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<sup>122</sup> Note: These numbers are for the PRU and its successor squadrons and does not include those allocated to the Tactical Air Force. See Chapter 5 for TAF reconnaissance aircraft. TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 17-21.

<sup>123</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 10-30.

<sup>124</sup> Note: Graph 1 shows the build up of American at Medmenham from 1942, but the impacts began to be felt from the arrival of the US 8 Air Force at RAF Mount Farm near Benson in February 1943 and especially from July 1943 and the arrival of the 7 Photographic Reconnaissance Group at Mount Farm.

was too small and grew into the Office of Strategic Services (OSS).<sup>125</sup> OSS had strained relations with the Army and FBI for much of the war and with pressure from the other departments it was disbanded after the end of the war. However, it could be considered the forerunner of today's CIA. The Air Force was not an independent force during the war, but part of the Army, but it had its own intelligence department, which included a photographic / reconnaissance department, which would be the initial interface with Medmenham.<sup>126</sup>

The main parts of the US intelligence organisation that worked closely with Medmenham were the US Army Air Force reconnaissance and interpretation units. The main USAAF reconnaissance organisation in the UK from 1944 on, was the 8th Air Force, Photographic Reconnaissance Wing, commanded by the US President's son, Colonel Elliot Roosevelt. This was based at Mount Farm and conducted First and Second Phase photographic interpretation work.<sup>127</sup> The Third Phase strategic interpretation work was carried out at Medmenham, where US photographic interpreters joined and the Unit became the Allied Central Interpretation Unit in May 1944, with the US making up 15% of the Unit.<sup>128</sup> The US had placed a small number of staff at Medmenham since late 1942, growing to over 100 staff from July 1943. The growth of the American staff at Medmenham can be seen in Graph 1 at Annex I. The proximity of the British and American bases centred around Medmenham can be seen in the map at Annex H and clearly shows the advantage of the location of Medmenham. The concentration of Third Phase strategic interpretation at Medmenham, and the assigning of US interpreters to Medmenham was not universally supported by the US. Colonel Elliot Roosevelt disagreed with the centralisation of strategic interpretation at Medmenham. He believed it was in the US interest to build up its own strategic reconnaissance interpretation facility and succeeded in initially bringing General Spaatz, Commander of U.S. Strategic Air

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<sup>125</sup> See R Wohlstetter, *Pearl Harbor: Warning and Decision* (Redwood City CA: Stanford University Press, 1962).

<sup>126</sup> See: P McNeil, 'The Evolution of the US Intelligence Community: An Historical Overview', in L Johnson & J Wirtz, eds, *Strategic Intelligence*; L Johnson & J Wirtz, *Intelligence and National Security*, 6-9. D Rudgers, *Creating the Secret State: The Origins of the Central Intelligence Agency, 1943-1947* (Lawrence: University Press Kansas, 2000) 5-17.

<sup>127</sup> See Map showing Mount Farm in relation to Medmenham at Annex H.

<sup>128</sup> Note: In May 1944 there were 273 US personnel working at Medmenham. See Annex I Graph 1, RAF Medmenham Manning Nov 42 – May 45.



Forces in the European (USSTAF) Theatre to his way of thinking. However, General Spaatz was eventually persuaded to support an Allied centralisation of Third Phase interpretation at Medmenham, as long as he controlled the American reconnaissance aircraft.<sup>129</sup> The USAAF concentrated its reconnaissance on a few aircraft types, using the F-5 Lightning and F-6 Mustang, though they did fly reconnaissance Spitfires and Mosquitos as well. This arrangement worked well for both the British and the US, with Colonel Lewis Powell, Chief of Operational Intelligence at HQ USSTAF, stating in early 1945 that 'perhaps the most important intelligence source is photo reconnaissance'.<sup>130</sup> The USAAF reconnaissance organisation and camera types are outlined in Annexes C and D.

The German reconnaissance and photographic interpretation organisations will be briefly outlined, and will show that the Germans were well aware of the capabilities of aerial reconnaissance and used this knowledge to inform their camouflage deception and countermeasures.<sup>131</sup> The German photographic reconnaissance and interpretation organisations consisted of 53 dedicated reconnaissance squadrons at the start of the war. These reconnaissance squadrons were established for twelve aircraft each and in total had 342 aircraft in 30 squadrons for short range missions to support tactical reconnaissance. They had 260 aircraft in 23 long range reconnaissance squadrons for strategic reconnaissance. This is a significant reconnaissance organisation which compares extremely well with the very poor RAF start in 1939, with no dedicated photographic reconnaissance squadrons.<sup>132</sup>

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<sup>129</sup> T Downing, *Spies in the Sky*, 231-235 & J Kreis, *Piercing the Fog*, 80-93, 111-246; AFHSO IRISNUM 00216944, United States Strategic Air Forces in Europe: History of Directorate of Intelligence, 1 January 1944 to 1 May 1945.

<sup>130</sup> LOC MSS40725 Box121, Carl Spaatz papers, 1910 -1981, HQ USSTAF Minutes A-2 Meeting 23 January 1945. This quote is from an intelligence officer who was cleared into *Ultra*, but for the selection of targets for bombing photographic intelligence was more important. See: J Kreis, *Piercing the Fog*, 80-94.

<sup>131</sup> For more details on the German Intelligence Organisations during the war see: D Kahn, *Hitlers Spies*; J Holland, *The War in the West*; H Boog, et al, eds, *Germany and the Second World War Vol VI* also Volumes I to V and Vol VII to IX; E Westermann, 'Hitting the Mark, but Missing the Target: *Luftwaffe* Deception Operations, 1939-1945', 206-221; J Caddell Jr, 'Seeing things differently', 78-94; R Stanley, *To Fool a Glass Eye* (Shrewsbury: Airlife, 1998).

<sup>132</sup> D Kahn, *Hitler's Spies*; TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1; R Nesbit, *Eyes of the RAF*; J Caddell Jr, 'Seeing things differently', 78-94.

The reconnaissance squadrons all had photographic processing and analysis sections based on the airfield with them. The photographic processing and analysis sections were usually truck based to allow them to move with the squadrons as they moved airfields. The photographic interpreters provided both tactical and operational interpretation on the station. This equates to the British First and Second Phase interpretation. They then send strategic photographs, but not the tactical and operational ones, for analysis at the *Luftwaffe* General Staff Intelligence Branch in Berlin in a converted block of apartment houses. This strategic section also worked on new interpretation techniques and training material. However, there is no evidence of them providing significant strategic intelligence to the German high command. In fact, from the middle of 1941 onwards as Germany lost air superiority, its reconnaissance flights over the UK diminished to zero. They were unable to confirm V1 and V2 impact areas during 1944 and failed to discover the scale of the Allied build up for D-Day or its target. They were unable to do any strategic photographic analysis of the UK industries essential to the war effort, for example, aircraft industry, fuel and refineries, ports and harbours. This would have aided any strategic bombing offensive against the UK mainland. This contrasts significantly with the work of Medmenham and the strategic bombing offensive against Germany<sup>133</sup>

The Germans used a small number of aircraft types for reconnaissance missions, short range and long range, and did not develop specialist reconnaissance aircraft as the Allies did with the special photographic marks of Spitfires.<sup>134</sup> They started the war with a significant advantage in the quality of photographs taken, due not only to the cameras, but the excellent optical quality of the Zeiss lenses. However, they made very little progress on development of the reconnaissance cameras during the war, as their performance was adequate.<sup>135</sup> The Germans did not use officers as photographic interpreters and they and intelligence staff were not regarded as part of

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<sup>133</sup> H Boog, 'German air intelligence in the Second World War', *INS*, 5.2 (1990) 350-424; T Downing, *Spies in the Sky*, 128-9, 337-9; J Corum & R Muller, *The Luftwaffe's Way of War: German Air Force Doctrine, 1911-1945* (Baltimore MD: Nautical & Aviation Publishing, 1998) 88-89, 169-171, 201-203, 215- 222; R Overy, *The Bombing War*.

<sup>134</sup> See Annexes C & D for more on German Reconnaissance Aircraft and Aerial Cameras.

<sup>135</sup> D Kahn, *Hitler's Spies*, 114 – 135.

the elite.<sup>136</sup> The German tactical photographic reconnaissance and analysis had proved to be very successful in the early stages of the war during *Blitzkrieg* and the fall of Europe. However, they did not develop these techniques or build on these successes and failed to develop a centralised Second and Third Phase equivalent of Medmenham. This can probably be traced back to the early successes in reconnaissance support to *Blitzkrieg*, and success in the early phases of the war, leading to a complacency on the use and possible expansion potential for photographic intelligence across the German war machine.<sup>137</sup> The main German aircraft and cameras used for photographic reconnaissance can be seen at Annexes C and D.

In Britain, the JIC and Air Ministry provided clear direction and structure to the tasking of photographic reconnaissance flights and the tasking of photographic interpretation and analysis of the photographs from those flights. The JIC had directed that the task was performed by the DDI (Photo) and his staff. They provided a central clearing house for all requests for aerial photographic reconnaissance and analysis. They also controlled the training of photographic interpreters. They had a small team of photographic interpreters on the staff in AI 1(h), who would collocate and later merged into the new interpretation unit at Wembley. The main collection of photographic interpreters at the start of the war was based in the AOC at Wembley, run by a retired army Major Harold Hemming who now specialised in photographic interpretation and photogrammetry.<sup>138</sup> Hemming was given an honorary commission into the RAF initially as a squadron leader and then as a wing commander during his time as the commanding officer of the PIU. The AOC was requisitioned by the RAF in May 1940 after Churchill wrote in February 1940 to the Secretary of State for Air about the importance of the stereoscopic work of the organisation 'The interpretation of photographs ... proved the value of the stereoscopic arrangement'.<sup>139</sup> The AOC became the PDUI at Wembley, and the name changes that the unit underwent and commanding officers are shown in Table 2. The Wembley site was requisitioned by

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<sup>136</sup> J Caddell Jr, 'Seeing things differently', 78-94.

<sup>137</sup> H Boog, 'German air intelligence in the Second World War', 350-424.

<sup>138</sup> TNA AIR 29/434, PIU Operational Record Book.

<sup>139</sup> For transcripts of the correspondence see: TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, Appendix XXI.

the RAF and renamed RAF Wembley with the unit becoming the Photographic Interpretation Unit in July 1940.<sup>140</sup> The PIU now contained seventy three RAF and 59 civilian staff forming a PIU of 133 personnel.<sup>141</sup> The unit was renamed the Central Interpretation Unit in January 1941 and, for protection from German bombing raids, had completed a move to RAF Medmenham for the rest of the war by 23 May 1941.<sup>142</sup> The majority of strategic interpretation work from spring 1941 was done by the Central Interpretation Unit at RAF Medmenham. This arrangement worked well for the rest of the war, with CIU growing from a small unit of 231 staff to almost two thousand at the end of the war in 39 sections.<sup>143</sup> The basic structure of the PIU at Wembley and the CIU/ACIU at Medmenham are shown in Table 3 below, with a separate Table 4, showing the dates when the sections were formed. The detail of the individual Medmenham sections is shown in Annexes A and B, with the growth in personnel numbers shown in Graph 1 at Annex I. That annex also shows the growth in sorties and prints received by Medmenham with the numbers of interpretation reports and prints produced shown in Graphs 1 and 2.

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<sup>140</sup> TNA AIR 29/434, PIU Operational Record Book.

<sup>141</sup> Note: Figures are from an analysis of TNA AIR 29/434, PIU Operational Record Book.

<sup>142</sup> Note: The Wembley offices had been hit by three *Luftwaffe* incendiary bombs on the 2 October 1940, destroying the PI School hut and killing Leading Aircraft Man R W Ammon (903874) a RAF policeman and again on the 17 October, this time damaging the main building, roof, most windows and blowing the doors of the *Wild* room. See: TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1, 215-216, TNA AIR 29/434, Enclosure 1A, Details Required of Enemy Attack on RAF Station Wembley (undated); TNA AIR 29/434, Enclosure 2A, Report on Damage to PIU Wembley on 17 October 1940, dated 18 October 1940; TNA AIR 29/434, Enclosure 5, Details Required of Enemy Attack on RAF Station Wembley, dated 18 October 1940.

<sup>143</sup> TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1. 248-252.

Table 2 Photographic Interpretation Unit, Name Changes 1939 – 1945 <sup>144</sup>

UNIT Name Changes	Place	Date	Commanding Officer
Aircraft Operating Company	Wembley	Pre-war	Harold Hemming
Aircraft Operating Company	Wembley	April 1940	Harold Hemming
Photographic Development Unit	Wembley	June 1940	Harold Hemming
Interpretation and Intelligence (PDUI)			
Photographic Interpretation Unit (PIU)	Wembley	July 1940	Harold Hemming
Central Interpretation Unit (CIU)	Wembley	April 1941	Ronald Carter
	Medmenham	May 1941	Ronald Carter
		July 1941	Alexander Laing
		December 1941	John Woodin
		June 1942	Peter Stewart
		November 1942	Peter Stewart
		August 1943	Francis Cator
Allied Central Interpretation Unit (ACIU)	Medmenham	May 1944	Francis Cator

The CIU started at Medmenham as an independent unit, with self-accounting powers, independent of any reconnaissance units. It had an initial establishment of 231, which was made up of 114 officers, of which 104 were to be photographic interpreters, and 117 other ranks. This was expected to grow to 469 as the sections grew to fill a new establishment and as additional sections were added, including the plotting section from the PRU and the army section.<sup>145</sup> However, due to a shortage of trained photographic interpreters, the Unit had a large number of Women's Auxiliary Air Force (WAAF) officers who were trained as photographic interpreters as

<sup>144</sup> Note: Mr H Hemming was a retired Army major and owner of the AOC, then with the acquisition of the AOC by the RAF, commissioned as a RAF squadron leader and then wing commander; The exact dates in March of Wing Commander Hemming and Wing Commander/acting Group Captain Carter change of command have conflicting records, these dates are from an analysis of the Medmenham ORBs, AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1 & AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, and associated correspondence; Note: The exact dates Wing Commander Carter was replaced by Wing Commander Laing are not recorded in the Medmenham ORB but it was in July 1941; Note: Group Captain John H Woodin was posted to Medmenham to take command on 9 December 1941 from the Air Ministry; See MA [unaccessioned] RAF Medmenham F540 ORB entry for 9 December 1941; Note: Group Captain Stewart posted in covering posts as both ADI (Photo) and Commanding Officer RAF Medmenham between 22 June and 29 November 1942, then relinquished the ADI (Photo) post and continued in command of RAF Medmenham from 30 November 1942. TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 5, 68; Also see MA Acc no 22631, JARIC History – List of Commanding Officers.

<sup>145</sup> TNA AIR 29/434, PIU ORB, dated 30 January 1941.

well as civilian staff from the old AOC at Wembley.<sup>146</sup> This meant that the unit started with about 50% of its actual establishment in spring 1941 under the command of a regular RAF officer, Wing Commander Ronald Carter, a highly-decorated pilot who had won his Distinguished Flying Cross during operations in 1937 in Waziristan.<sup>147</sup> The CIU when it started at Medmenham had fifteen sections, which included the Photographic Interpretation school.<sup>148</sup> Medmenham was already a very well recognised intelligence asset by Autumn 1941, with the Director of Military Intelligence (DMI) considering it as having 'almost identically the same objects as MI9 and the 'Y' Service' and it was to 'provide the Intelligence Staffs with the best information about the enemy which can be obtained through the medium of air photographs'.<sup>149</sup> Of interest in his letter he reports he has set in motion the compulsory acquisition of Nuneham Park near Oxford from Barclays Bank so that it can be set up as the main PI training school and a backup location for the CIU should Medmenham be destroyed.<sup>150</sup>

This intervention by the DMI, indicates how important the photographic intelligence produced by Medmenham had become in the minds of the senior intelligence officials in Whitehall. Medmenham had a steady flow of senior visitors from The Duke of Kent in his role as Honorary Air Commodore in June 1942, Air Chief Marshal Sir Hugh Dowding visiting twice in March and May 1942 and General Carl Spaatz in

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<sup>146</sup> With a growing shortage of men to undertake many military tasks women played an increasingly important role - For women at Medmenham see C. Halsall, *Women of Intelligence*, for wider roles of women in the WAAF; B Escott, *Our Wartime Days: the WAAF in World War II* (Stroud: Sutton, 1995); B Escott, *The WAAF: A History of the Women's Auxiliary Air Force in the Second World War* (Princes Risborough: Shire Publications, 2008); & for the wider role of women in the military see N Storey & M Housego, *Women in the Second World War* (Princes Risborough: Shire Publications, 2011); L Noakes, *Women in the British Army: War and the Gentle Sex, 1907-1948* (Abingdon: Routledge, 2006); R Pennington, ed, *Amazons to Fighter Pilots: A Biographical Dictionary of Military Women. 2 vols.* (Westport CT: Greenwood Press, 2003).

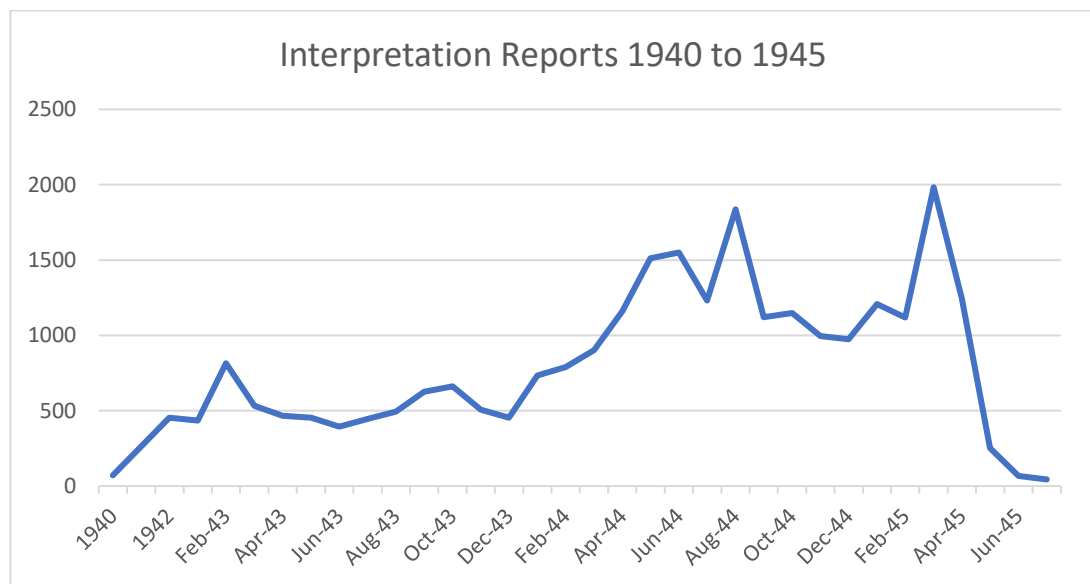
<sup>147</sup> Wg Cdr R H Carter DSO, OBE, DFC after his posting to Medmenham went on to be the Senior Air Staff Officer at the Air Headquarters West Africa as a Group Captain and using his experience from Medmenham acquired Spitfires for reconnaissance duties. See: TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 68; *The Air Force List: January 1942* (London: HMSO, 1942) 76; *The London Gazette*, 21 December 1937.

<sup>148</sup> TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1. 256-258 & Annex A, Table of Medmenham Sections & Annex B, for more detail on Medmenham Sections.

<sup>149</sup> TNA AIR40/1169 ADI (Photo) Correspondence, Letter from MG Davidson DMI dated 3 September 1941.

<sup>150</sup> Note: Nuneham Park near Oxford was 22 miles from Medmenham.

September 1942.<sup>151</sup> This shows Medmenham to be considered a major organisation in intelligence analysis and production. Medmenham would have been a major source of intelligence, comparable to Bletchley Park, but closer to London and easier to visit as no special induction into *Ultra* was required.<sup>152</sup> Graph 2, shows the volume of interpretation reports that Medmenham was producing, with an average of 263 intelligence reports per month in 1941, growing to over 450 per month in 1942 and an average of almost 1500 per month during 1944 and early 1945, with a rapid fall in reporting after April 1945. This made Medmenham a prodigious producer of intelligence through the war.



Graph 2

The Medmenham workload reached a high in 1944 and again in 1945 with peak manning figures between June to September 1944. It is interesting to note that the RAF contingent, which was the largest at ACIU, consisted in June 1944 of 699 RAF and 714 WAAF. This shows the significant contribution the WAAF made to ACIU, including commanding sections. The US high point for manpower was in May

<sup>151</sup> Note: Visitors extracted from an analysis of the Medmenham ORB. General Carl Spaatz was Commander USAAF 8 Bomber Group when he visited and he would go on to finally recommend US PIs join Medmenham in 1944, when he was Commander of Strategic Air Forces in Europe. Air Chief Marshal Dowding had been head of Fighter Command during the Battle of Britain, but in March and May 1942, Dowding was running a study into RAF Manpower before he retired in July 1942.

<sup>152</sup> Medmenham was only 36 miles from London and on the banks of the Thames, Bletchley Park was 51 miles from London.

1944.<sup>153</sup> This coincided with the maximum number of reconnaissance sorties received at Medmenham. The Graph 5 at Annex I, shows the total sorties received at Medmenham during 1944. The graph clearly shows the increase in sorties from January through to the peak of 1875 sorties received in June 1944, and then the rapid decline in sorties from August to December 1944. The build-up in sorties in the first half of the year is due to the increase in sorties gathering reconnaissance in preparation for Operation *Overlord*. This is achieved by combining the RAF PR and USAAF PR and Tactical Air Force reconnaissance aircraft. This provided a wealth of reconnaissance aircraft to allow the significant uplift in sorties from January to June. Then after August to the end of the year there is a drop off in US and Tactical Air Force (TAF) sorties as well as a decline in RAF PR sorties received at Medmenham, part of this decline is due to the movement of the TAF sorties to Advanced Landing Grounds (ALG) in France and being processed and analysed at the Mobile Field Processing Sections (MFPS) which by the end of August 1944 were deployed to France.

Medmenham by 1942 had grown to a unit of over a thousand people with 23 sections.<sup>154</sup> The CIU was the central organisation for all Second and Third Phase photographic intelligence. The tactical First Phase interpretation was conducted by the relevant commands.<sup>155</sup> This made Medmenham central to providing all detailed photographic interpretation reports for all the sorties that they received. Medmenham by the end of the war was at its maximum size of almost two thousand staff in 39 sections. The major change for the CIU came with the arrival of the Americans, now in significant numbers with 273 American service personnel in the unit, and it was formally renamed the Allied Central Interpretation Unit on the 15 May 1944. The build-up of Americans at Medmenham can be seen in the manning Graph 1 at Annex I.<sup>156</sup> The Americans and the associated politics behind the scene, resulted in the

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<sup>153</sup> The data in the three graphs is extracted from an analysis of the Medmenham Archive RAF Medmenham F540 Operational Record Book from 1942 to 1945.

<sup>154</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2. 31-46 & Annexes A & B for more detail on Medmenham Sections.

<sup>155</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2. 39-41.

<sup>156</sup> The first Americans arrived for a fact-finding tour and PI course in July 1941 with Lieutenant Robert Quackenbush attending the PI course and a short stay at RAF Medmenham, with 8 more Americans arriving at Medmenham in August 1941, gaining experience in the Sections of how Medmenham worked and departing in November 1941. There was then a steady flow of Americans through



name change and a significant change to its leadership, with day to day tasking now under joint control of a British wing commander Douglas Kendall and an American lieutenant colonel William O'Connor, who jointly ran the unit day to day from the Task Control Office.<sup>157</sup> The RAF Station Medmenham, which included CIU/ACIU was commanded from June 1942 by Group Captain Peter Stewart, who was also dual hatted as ADI (Photo), where he had been previously.<sup>158</sup> This gave top cover to the Unit and a commanding officer with very good knowledge of the workings of the higher Whitehall intelligence organisation. However, the workload on the Whitehall staff soon grew to such an extent that the post of commanding officer of Medmenham was separated from ADI (Photo) in November 1942, with a new Group Captain being posted to Whitehall.

As was normal for a RAF Station, the rank stayed at group captain for the rest of the war, with Group Captain Francis Cator, a pilot, taking over Medmenham in September 1943 and remaining until June 1945.<sup>159</sup> He had been sent to RAF Medmenham because he had a reputation for instilling discipline and order to units he ran and the Air Ministry felt Medmenham should be more like a normal RAF station. He imposed normal RAF discipline and timekeeping practices at Medmenham and ran the station to the obvious satisfaction of the RAF hierarchy for almost two years. However, during his time in command of Medmenham, it is Wing Commander Kendall, the PI specialist who appears in the majority of minutes and reports for the Air Ministry on any intelligence matter. The memoirs of Cator and

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Medmenham, reaching a high in June 1944. AFHSO IRISUM 109772, History of Photo Intelligence in the UK.

<sup>157</sup> Wing Commander Douglas Kendall was one of the early RAF PI staff commissioned in the RAFVR Administrative and Special Duties Branch (For Intelligence Duties) and sent to the PIU at Wembley as a Pilot Officer for PI duties and was promoted to Squadron Leader in September 1943 at Medmenham and latter at Medmenham promoted , to acting Wing Commander where he was the senior Technical Control Officer and one of the most experienced and respected PI's, He was in overall charge of the work on Operation *Crossbow*, the V1/V2 weapon hunt and awarded an OBE for his work at Medmenham. MA Acc no: 2609, D N Kendall, *From My Memory* (Unpublished autobiography) 37-115; Air Force List: December 1940, (London: HMSO, 1940) 436; Air Force List: July 1945, (London: HMSO, 1945) 620; The London Gazette, 12 November 1943, 4979; The London Gazette, 15 March 1946, 1380.

<sup>158</sup> Group Captain Peter Stewart was a member of the General Duties Branch and was promoted to Group Captain in June 1941. Air Force List: October 1944, (London: HMSO, 1944) 140.

<sup>159</sup> Group Captain Francis Cator was a member of the General Duties Branch and was promoted to Group Captain in March 1942. See Air Force List: January 1945, (London: HMSO, 1945) 143; MA Acc no: 516, Unpublished memoirs of Group Captain Francis Cator; TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 40-41.

Kendall also show that effectively Kendall ran CIU/ACIU for Cator, who commanded RAF Medmenham, chairing CIU/ACIU meetings when top cover was needed. The RAF commanded Medmenham and with that came the military, social and cultural norms that the RAF would expect. The top of the RAF pyramid had always been the officer elite and those that flew, with fighter pilots considered the elite within that elite. The ground branches, engineers, administrative and special duties such as intelligence, whilst being essential to the operation of the RAF, were lower down the pyramid, as were those women in the WAAF. However, the RAF was the most meritocratic of the three services, realising that it was a technocratic service and ability was highly regarded and trumped background or elite education.<sup>160</sup> The structure of the PIU and Medmenham can be seen in Table 3 and Medmenham in more detail at Annex A with the individual sections described in detail at Annex B, and summaries of the growth of staff, sorties and prints received shown in Annex I and reports and prints produced shown in Graphs 2 and 3.

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<sup>160</sup> M Francis, *The Flyer: British Culture and the Royal Air Force 1939-1945* (Oxford: Oxford University Press, 2013); B Escott, *The WAAF*; P G Hering, *Customs and Traditions of the Royal Air Force* (Aldershot: Gale and Polden, 1961); J James, *The Paladins: A Social History of the RAF up to the Outbreak of World War II* (London: Futura, 1991); F Monahan, 'The Origins of the Organisational Culture of The Royal Air Force', (unpublished doctoral thesis, University of Birmingham, 2018).

Table 3 Organisation of PIU Wembley and CIU/ACIU Medmenham.

PIU Wembley 1940/41		
Core Intelligence Sections	Intelligence Support Sections	Clerical Support Sections
Intelligence First Phase Interpretation Second Phase Interpretation Third Phase Interpretation Naval Section Army Section	Head Quarters Duty Office Photographic Section Mosaic Section Map Section Drawing Office Intelligence Library PI School	HQ Support Despatch Section Typist Section Telephonists Teleprinter MT Section General Duties (driver, stores, carpenter, cleaners, labourer)
CIU/ACIU Medmenham 1941/45		
Core Intelligence Sections	Intelligence Support Sections	Clerical Support Sections
A Naval B Army & HQ Element B1 FLAK Defences B2 Army <i>CROSSBOW</i> B3 Army SIEGFRIED LINE B4 USAAF S Germany & Austria B5 Far East B6 <i>Crossbow</i> Underground Factories C Airfields D Industries E Camouflage F Communication and Transportation G Wireless H1 Control Commission H2 Control Commission Military K Bomber Command/ Damage Assessment L Aircraft and Aircraft Industry M British Photography N Night Photography Q Decoys R1/R2 Combined Operations S Signals Intelligence S Shipbuilding T Targets W <i>Wild</i> or Photogrammetric Z Second Phase X Navigation Aids	GI Ground Intelligence J Press and Publicity O Overseas P Plotting S Survey Liaison V Model Making Z Coversearch sub-section TCO Technical Control Office/HQ DIO Duty Intelligence Office Photographic Progress Coversearch Print and Map Library PI School Intelligence Library	HQ Support – RAF Medmenham Central Registry Despatch Signals Teleprinter Typing Pool Telephone Exchange

The development of the Medmenham section organisational structure can be traced back to the AOC and PDIU/PIU days in 1940/41. The important basic structure of how to organise photographic interpretation into time based tasks of First Phase,

Second Phase and Third Phase interpretation were developed at the PIU.<sup>161</sup> The First Phase reporting was to be completed as soon as possible, preferably within two hours of the aircraft landing. The photographic interpreter would quickly look at the just developed film from the sortie and select any frames that showed significant activity to have contact prints made. The photographic interpreter would then quickly interpret the prints and dictate a short immediate photographic interpretation report, called a Form White to be sent by secure signal. The majority of First Phase Reporting was conducted by photographic interpreters based at the RAF stations with the reconnaissance aircraft.<sup>162</sup> There is an example of a Form White signal from the PIU that is used in Chapter 3 and is transcribed in Appendix 1.<sup>163</sup>

The Second Phase interpretation was conducted at the central interpretation centre, the PIU until 1941 and then at Medmenham. The films from the reconnaissance sortie would be sent either by air or dispatch rider to Medmenham as soon as the Form White was completed. The Second Phase interpreters would aim to get the report out within 24 hours of receiving the film. The Second Phase reports provided details on every target and items of interest seen during the whole sortie. The Second Phase reports were produced by Z Section at Medmenham and there is a more detailed description of Z Section in Annex B. There is an example of a Second Phase report from Medmenham used in Chapter 4 and transcribed in Appendix 2.<sup>164</sup>

The Third Phase interpretation sections were the major strength of Medmenham. The detailed Third Phase interpretation of the photographs was conducted in up to 17 specialist sections and could take from days to months to complete. These sections were thematically organised, with for example A Section covering all Third Phase naval interpretation, B Section covering all army related Third Phase interpretation, C Section covering all airfield related interpretation, D Section all interpretation on industries and K Section all damage assessment interpretation for Bomber

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<sup>161</sup> TNA AIR 29/434, PIU ORB, dated 30 January 1941.

<sup>162</sup> This speed of First Phase and often Second Phase reporting compares very well with Bletchley Park, where it would often take from hours to days to break the German keys to be able to read the signals messages.

<sup>163</sup> See: Appendix 1, Form White to Report No 230, dated 1 August 1940.

<sup>164</sup> See: Appendix 2, Interpretation Report No 3190, dated 24 April 1942.

Command and other customers. These five Third Phase sections are all major intelligence contributors that provide the majority of the intelligence analysed in the following three case studies. Table 3 shows all the sections at Medmenham organised under intelligence and interpretation, support to intelligence and then clerical support. There is a full list of all Medmenham Sections at Annex A and a more detailed descriptions of each section at Annex B. There are examples of reports from Third Phase sections from Medmenham used in Chapter 3 and 4 transcribed in Appendix 2 and 3.<sup>165</sup>

There is one specialist section that can be considered Third Phase and intelligence support and that is the W Section, the *Wild* section. This section was both a direct intelligence producer and an intelligence support function, where it provided plans and measurements to the other sections. The *Wild* A5 Stereo autograph machine was a special analytical device for interpreting terrestrial or aerial photographs in stereo. It had very high-quality optics that provided high magnification and complex mechanics to allow what was viewed in stereo to be 'plotted' in exact scale onto paper or a map. Britain had one working *Wild* A5 stereo autograph machine at the start of the Second World War. The original *Wild* A5, the first in the UK was privately owned by the AOC of Wembley. The AOC had seen the large German Zeiss Aero-cartography stereo plotting machine in 1938 and also the Swiss *Wild* A5 stereo autograph plotting machine.

The Swiss machine was significantly smaller, had greater precision and better mechanical movements. The AOC purchased the *Wild* in 1938 for £5500. The *Wild* A5 was still a large machine as shown in Picture 7 at Annex G and required a special vibration free base and air-conditioning to get the greatest precision out of the machine. It allowed the very accurate production of mapping from stereo aerial photographs, which was a far more efficient method of producing maps than by the manpower intensive ground surveying methods. Due to the high-quality optics,

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<sup>165</sup> See: Appendix 2, Interpretation Reports N.31 dated 22 April 1942, K.1319 dated 3 May 1942, K.1333 dated 2 June 1942, N.26 and map dated 10 August 1942, D.264.A dated 4 April 1943, K.1559 dated 17 May 1943.

magnification and stereo viewing it also allowed photographic interpretation of very small-scale high-altitude photographs that was not possible by normal instruments.<sup>166</sup>

The AOC used the *Wild A5* to produce maps from stereo aerial photography in a cost efficient and fast method. They then moved on to also use it for photographic interpretation for the SIS and Sidney Cotton prior to the start of the Second World War. The *Wild A5* and AOC staff were moved to RAF Medmenham in 1941 after the damage to the AOC offices at Wembley on the 2 and 17 October 1940 in German bombing raids.<sup>167</sup> The *Wild A5* was installed in January 1941 in the old wine cellars at Danesfield House where additional air conditioning was installed that assisted with maintaining the accuracy of the instrument. The machine stayed in that location for the rest of the war.<sup>168</sup> The *Wild A5* machine was as important to Medmenham as the Bombe and Colossus were to Bletchley Park. The extraordinary lengths that Britain went through to acquire additional *Wild* machines as well as a more detailed description of the *Wild A5* Stereo-autograph are in Annex G.

Medmenham, also required intelligence support sections that provided essential services to the interpretation sections. These sections are listed in the Table 3 above and in more detail in Annexes A and B. All the intelligence support sections were important to the efficient running of Medmenham. Selecting just two of the key intelligence support sections to illustrate this importance, P Section, the plotting section plotted every frame of every sortie received by Medmenham. The other often overlooked support section is the Photographic Section. This section was essential to all the interpretation sections as it provided the contact prints and print enlargements that they worked with on a daily basis, as well as providing prints to accompany the interpretation reports. The Photographic Section produced over 15 million photographic prints during the war as can be seen in Graph 3. This level of

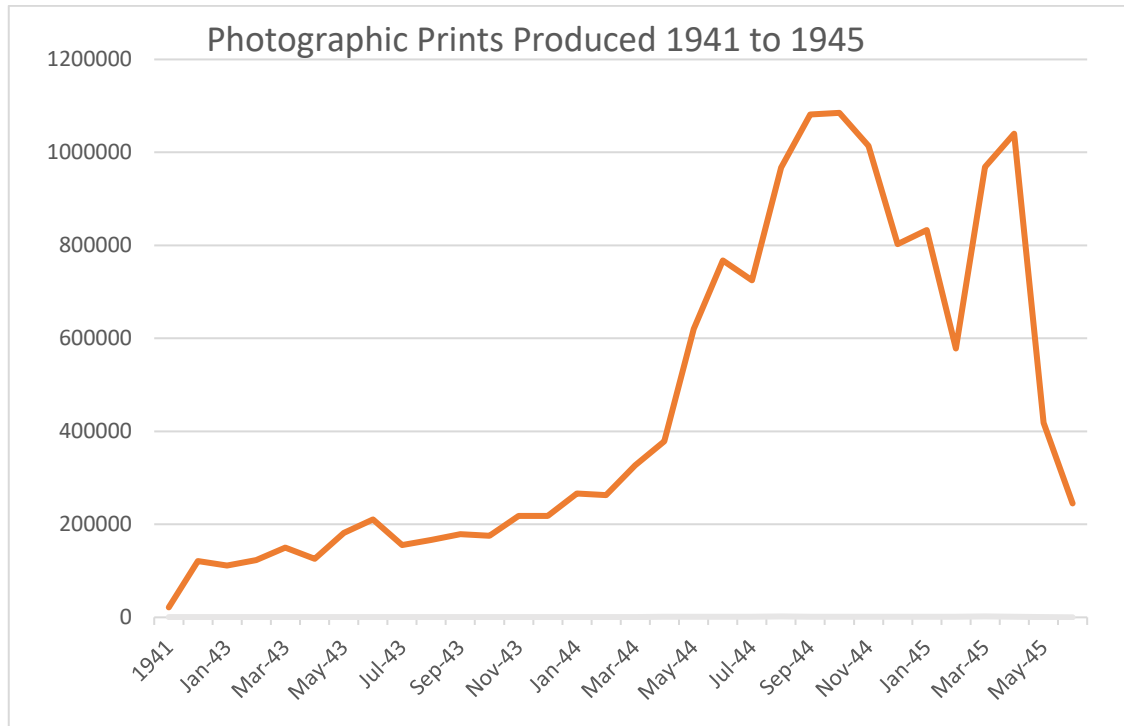
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<sup>166</sup> K A Whitaker, 'The *WILD* Heerbrugg A5 in Britain in 2014', *Photogrammetric Record*, 29 (December, 2014) 456-462.

<sup>167</sup> TNA, AIR29/434 Enclosure 1A & 2A & Note the AOC offices were now called 'RAF Station Wembley'.

<sup>168</sup> TNA, AIR29/434 Enclosure 13A, dated 15 February 1941.

print production was made possible by the introduction of the automatic Williamson Multiprinter machines in 1941.<sup>169</sup>



Graph 3.

The clerical sections which are normally ignored in the books on Medmenham, were also essential to the smooth running of Medmenham. The typing pool was a crucial section, typing out all the interpretation reports, the teleprinter operators who sent out all the immediate secret reports and the telephonists running a very busy Medmenham exchange. The dates for the establishment of these clerical sections have not been found in the secondary literature or the archival material, but they must have existed in some form from the original PIU days and certainly by April 1941 at Medmenham.

Table 4 shows when the majority of the Medmenham sections were created. However, it does highlight a couple of surprisingly late dates for the creation of important sections. Medmenham could not have functioned without an efficient Coversearch section, yet it is only shown as being formed in 1944. It existed from

<sup>169</sup> See Picture 5. Williamson Multiprinter. For comparison in 1918 the British Army printing units produced 6 Million prints and now with the Multiprinter a single unit, Medmenham produced 15 Million.

the outset within the Plotting section and as a sub-section of Second Phase prior to becoming a stand-alone section. The army sub-section B2 existed before 1944, working on targets along the French coast up to Belgium, however it is only recorded as being created when it became responsible for *Crossbow* reporting on the German vengeance weapons.<sup>170</sup>

Table 4 Formation of CIU/ACIU Sections by Date.<sup>171</sup>

Date	Section
1939 Q3	Bomber Command PI, <i>Wild</i> ,
1940 Q1 Q2 Q3 Q4	Plotting, PI School, Photographic Second Phase, Prints and Map Library Army Siegfried Line, Press and Publicity Army HQ element, Airfields Naval, Night Photography
1941 Q1 Q2 Q3 Q4	Plotting, PI School, Photographic Wireless, Aircraft and Aircraft Industries Industries, Camouflage, Communication and Transportation, Ground Intelligence, Model Making Damage Assessment, Decoys, Targets British Photography, Signals Intelligence
1942 Q1 Q3 Q4	Combined Operations, Progress Flak Defences, Shipbuilding, Ground Intelligence & Targets combined <i>Crossbow</i> Underground Facilities
1944 Q1 Q2 Q3 Q4	Coversearch <i>Crossbow</i> as a separate Army sub-section, Technical Control Officer Control Commission, Overseas Far East
1945 Q3	Survey Liaison
Not known	USAAF S Germany & Austria, Navigation Aids, Duty Intelligence Office

The sorties and prints received at Medmenham are the raw material that the Medmenham photographic interpreters had to work with to produce the Medmenham intelligence reports. There was a seven-fold increase in the number of reconnaissance sorties and sixteen-fold increase in prints received by Medmenham from 1940 to the peak in 1944.<sup>172</sup> When the sorties received at Medmenham in 1944 are analysed it shows Medmenham had four and a half as many sorties to work on in May as it had in January 1944, but with only a small increase in manpower. Medmenham had increased in staff, developed new procedures and become more

<sup>170</sup> Note: B2 sub-section is discussed in Case Study Three.

<sup>171</sup> Note: Table 4 for completeness also shows the dates when known of sections that had formed prior to the creation of the CIU/ACIU.

<sup>172</sup> Peak Sorties received 16,000 and over 2.5 Million prints in 1944.



efficient to deliver enhanced intelligence reporting from a vast increase in photographic reconnaissance missions from 1940 to 1945.<sup>173</sup> See Annex I for detailed graphs showing the build-up of Medmenham personnel, sortie and print numbers received, and in Graphs 2 and 3 the reports and prints produced.

Having outlined the high-level organisation of British intelligence this thesis will now look at both Medmenham and Bletchley Park through an organisational lens. Bletchley Park has been chosen for this comparison with Medmenham, because it was also a centralised intelligence production and analysis centre. Bletchley Park, like Medmenham did not collect intelligence, relying on the 'Y' Service as Medmenham relied on the photographic reconnaissance aircraft. They were also both set up specially to provide intelligence as the Second World War started. There have been no previous studies of Medmenham. Bletchley Park organisation or lack of organisation has not been studied as much as the intelligence it produced, and the impact that intelligence had on the outcome of the war. Those that have studied the organisation of Bletchley Park have all commented on the chaotic nature of the organisation, or even lack of organisation bordering on anarchy.<sup>174</sup> The most recent published research into organisational theory and Bletchley Park has been by C Grey and A Sturdy. They posit that because of the chaotic organisational structure of Bletchley Park, such organisational chaos assisted in the success of the organisation.

This thesis will look at Grey's methods and conclusions on Bletchley Park and use the same lens to analyse, compare and contrast how Medmenham evolved over the period of the war. To summarise the major threads of the arguments they lay out, Bletchley Park was an organisation in a constant state of chaos because of numerous factors.<sup>175</sup> The research into the organisational structure of Bletchley Park

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<sup>173</sup> Data in the 1940 to 1945 Sorties and Prints received tables extracted from MA Acc no: 5 History of Air Reconnaissance, Appendix C.1. Data for the 1944 monthly Sorties calculated by analysis of the RAF Medmenham F540 from MA RAF Medmenham F540 January to December 1944.

<sup>174</sup> H Hinsley, *British Intelligence in the Second World War – Vol 1*, 273. M Herman, *Intelligence Power in War and Peace*; P Davies, *From Amateurs to Professionals*; R Ratcliff, *Delusions of Intelligence*.

<sup>175</sup> C Grey & A Sturdy, 'The 1942 Reorganisation of the GC&CS', *Cryptologia*, 32.4 (2008) 311-333 & C Grey & A Sturdy, 'A Chaos that Worked', 47-66; C Grey, 'An organizational culture of Secrecy', 107-

by Grey and Sturdy has been reviewed by both those that study intelligence and signals intelligence as well as those from organisational studies. The general consensus of these reviews is that the papers and book looking at Bletchley Park from an organisational view point provide a useful addition to both intelligence and organisational studies. However, if there is a criticism of the Grey organisational lens, it is that it has focused on what is in the archives and the management and upper echelons of Bletchley Park and not those thousands of staff working on the more mundane routine work.<sup>176</sup>

The factors included how GC&CS was initially formed and organised from 1919, with the role of ensuring the separate service signals intelligence organisations worked together under GC&CS. This was from the beginning a relationship with many tensions, as the service organisations resented working for the SIS controlled GC&CS and they kept a line of command back to each parent service organisation.<sup>177</sup> These tensions continued as Bletchley Park was formed during 1939 and continued through the war. The organisation suffered from tensions created by civilians working in the organisation, who had come from many disparate careers in civilian life and academia, who were then forced to work with service personnel. Many of these service personnel were not career military, but only weeks or months before they had also been civilians.

The service organisations kept a chain of command to all the service personnel, able to post them at will to other jobs on other units and the Bletchley Park management was never able to resolve the staffing and manning tensions this caused with the services. The service organisations also expected special intelligence feeds from the staff they provided. The management of Bletchley Park did not control the maintenance and building work; that was controlled by yet another government

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122; C Grey, *Decoding Organization: Bletchley Park, Codebreaking and Organisation Studies* (Cambridge: Cambridge University Press, 2013).

<sup>176</sup> C Christensen, Review of Christopher Grey, *Decoding Organization: Bletchley Park, Codebreaking and Organization Studies* (2013), *Cryptologia*, 37.2 (2013)184-188; M Catino, Review of Christopher Grey, *Decoding Organization: Bletchley Park, Codebreaking and Organization Studies*, (2013) *Public Administration*, 93.2 (2015)547-556; C Land, 'Decoding Organization: Bletchley Park, Codebreaking and Organization Studies', *Organization Studies*, 34.10 (2013),1566-1570.

<sup>177</sup> C Grey & A Sturdy, 'A Chaos that Worked', 47-66.

department, the Ministry of Works. This all led to a very unorthodox and difficult to manage organisation that Grey has described as multiple little organisations working within Bletchley Park. How did this complex and chaotic organisation prove to be a successful signals intelligence provider?

The cultural practices used at Bletchley Park are credited with overcoming the organisational chaos. There was a culture of meritocracy, where it did not matter what your rank or civilian status was, the best person, male or female for the job, did it to the benefit of the whole organisation. This on the whole worked across most sections at Bletchley Park.<sup>178</sup> The core initial members of the Bletchley Park organisation were almost handpicked, by way of a network of like-minded academics in Oxbridge, many who by 1939, were professors or in senior positions in Oxbridge, but had been involved either in signals intelligence or intelligence during the First World War. This allowed Bletchley Park to have a core of personnel with a similar background and way of thinking and working, or as Grey describes it a shared social capital.<sup>179</sup> This extended to the fact that for all the people working at Bletchley Park, they came from a nation that was at war, fighting for its very survival, so had a common sense of purpose and drive.

The key personnel in the main were all recruited from similar backgrounds, as discussed above mainly from Oxbridge and by word of mouth, and worked on ever changing difficult problems. However, Bletchley Park also had thousands of people working on repetitive mundane tasks. These staff were on the whole directed to Bletchley Park by the Ministry of Labour, often providing people who had little interest or motivation in the work. In these areas, Bletchley Park instituted standard hierarchical management systems, as used in factories before the war. The output per machine, or per person was measured and measures taken to weed out

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<sup>178</sup> C Grey, *Decoding Organization*; C Grey & A Sturdy, *A Chaos that Worked*, 47-66; G Welchman, *The Hut Six Story: Breaking the Enigma Codes* (Cleobury Mortimer: M & M Baldwin, 1997).

<sup>179</sup> C Grey & A Sturdy, 'A Chaos that Worked', 47-66.

weaknesses, improve or increase productivity as needed, in an almost factory like system.<sup>180</sup>

Another organisational reason for Bletchley Park's success was the fact that all signals intelligence work was on the whole centralized at Bletchley Park. This allowed the best minds and best ideas to work on new problems and collaboratively solve the cryptographic problems of *Enigma* and other codes. The diverse work force at Bletchley Park also contributed to its success, recruiting managers from John Lewis, the GPO, banks, libraries and other organisations allowed Bletchley Park to develop some of the best indexing methods, combining library and commercial expertise.<sup>181</sup>

To summarise the three reasons Grey proposed that Bletchley Park was successful were, firstly highly shared social capital in critical areas, or the Oxbridge effect. The second was the ability of the organisation to contain multiple organisational models, or organisational hybridity. The third organisational construct contributing to Bletchley Park success was the ability of Bletchley Park to centralise signals intelligence, knowledge sharing and its organisational porosity.<sup>182</sup> These three areas will be used to also look at the organisation of Medmenham and compare and contrast the two organisational structures and cultures. For those who do not agree with the thesis proposed by Grey, see Ratcliff's book and conclusions comparing Bletchley Park and its organisation and that of the German signals intelligence system, for an alternative discussion.<sup>183</sup>

The literature on Medmenham frequently compares the organisation with Bletchley Park, especially the social and cultural background of Medmenham staff and Bletchley Park staff. The accounts and recollections that have been published talk

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<sup>180</sup> C Grey, *Decoding Organization*; C Grey & A Sturdy, 'A Chaos that Worked', 47-66; G Welchman, *The Hut Six Story*.

<sup>181</sup> C Grey, *Decoding Organization*; C Grey & A Sturdy, 'A Chaos that Worked', 47-66.

<sup>182</sup> C Grey & A Sturdy, 'A Chaos that Worked', 47-66.

<sup>183</sup> R Ratcliff, *Delusions of Intelligence*.

about Medmenham also having an academic quality about it and the way work was done by the photographic interpreters.<sup>184</sup> However, these previous comparisons are all rather superficial without any detailed comparative analysis, with the best being by Taylor Downing who does compare briefly the work of the staff at Bletchley Park with those at Medmenham, especially the large numbers of women working at both organisations.<sup>185</sup> The photographic interpreters can be considered the Medmenham equivalent of the cryptographers at Bletchley Park, as they were the key staff at Medmenham. So, the collegiate and socio-cultural links existed amongst a number of photographic interpretation staff at Medmenham. However, these staff were not as critical to the success of Medmenham as the equivalent were at Bletchley Park. The key staff at Medmenham, reported in the small number of books published on Medmenham and in the official RAF narrative on reconnaissance, were already in the RAF at the start of the war or soon after. Medmenham, was also almost entirely a military unit, with the majority of the staff being uniformed staff from the services, even if many of them were only recently recruited into uniform. So, Medmenham did not suffer from the civilian / military tensions reportedly suffered at Bletchley Park. Of note, Bletchley Park staff were made up of about 1/3 Civilian, to Military and 3/4 of all staff were female, Medmenham also had significant numbers of female military staff, over 45% in October 1944.<sup>186</sup>

Medmenham, also did not to any great extent suffer from organisational hybridity as seen at Bletchley Park. Medmenham was a standard RAF non flying station, based around Danesfield House, with numerous additional huts used as extensions over the grounds to house the growing number of sections and staff. Medmenham did diverge from the normal RAF station, because of the number of staff from the other two services, including large numbers of female service women from all three services. Medmenham also found that women made very good photographic interpreters and plotters.<sup>187</sup> RAF Station Medmenham produced through the war the

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<sup>184</sup> See T Downing, *Spies in the Sky*; C Halsall, *Women of Intelligence*; A Williams, *Operation Crossbow*; U Powys-Lybbe, *The Eye of Intelligence*; C Babington Smith, *Evidence in Camera*.

<sup>185</sup> T Downing, *Spies in the Sky*, 9-10,75-76.

<sup>186</sup> For Medmenham staff numbers see Graph 1, Annex I.

<sup>187</sup> C Halsall, *Women of Intelligence*.

standard RAF F540 monthly Operational reports to headquarters.<sup>188</sup> The only real complications Medmenham suffered from organisationally, were the moves from command to command within the RAF during the war. Medmenham, due to the fact that it was always a RAF Station, cannot be said to have exhibited the organisational hybridity shown at Bletchley Park. Medmenham was also for most of the war a smaller organisation than Bletchley Park, so possible less likely to display organisational hybridity. This is shown in Table 5.

Table 5 Comparison of Bletchley Park Size / Medmenham Size, 1939 - 1945<sup>189</sup>

Date	Bletchley Park	Medmenham
September 1939	200	Not Yet Formed
July 1940		133
February 1941		173
Winter 1941	2500	
March 1942	1576	1068
August 1943		1453
November 1944	8743	1715
V E Day 1945	5781	1666

Grey and Sturdy in their organisational analysis of Bletchley Park gave a third reason for Bletchley Park's success, being the centralization, knowledge sharing and organisational porosity of Bletchley Park.<sup>190</sup> Medmenham does have direct comparisons with Bletchley Park as far as it was also a centralised photographic interpretation unit for the majority of Second and Third phase interpretation. This pooling of all photographic interpreters working on Second and Third phase work did allow and encourage knowledge, technique and idea sharing. Medmenham like Bletchley Park had a large centralised index of all photographic interpretation reports produced that was cross referenced by place and subject, a centralised index and

<sup>188</sup> See F 540 Operations Record Books at The National Archives for RAF Medmenham Air 29/227 to Air 29/329.

<sup>189</sup> Data compiled from, C Grey, *Decoding Organization*; TNA AIR 41/6 & AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 1&2; Medmenham Manning Graph 1 in Annex I; The reduction in staff numbers at Bletchley Park from 1941 to 1942 is due to the move of the commercial team back to London. See: C Grey, *Decoding Organization*, 72.

<sup>190</sup> C Grey & A Sturdy, 'A Chaos that Worked', 47-66.

library of all photographs used at Medmenham for the duration of the war. Medmenham also had a large centralised index of all sorties received and of master plot sheets to allow rapid cover-search of any area of interest. This allowed rapid access into the large numbers of reports and films that Medmenham held, the numbers of which and the growth over time are shown in Annex I.<sup>191</sup> This like Bletchley Park and also the MI5 registry, became a resource of great utility and value as the war continued and more and more comparative analysis was carried out at Medmenham to solve difficult intelligence problems.<sup>192</sup> The organisational analysis lenses used by Grey and Sturdy do have utility in the analysis of Medmenham. They show some similarities, but also structural differences. The most significant of these is that Medmenham was first and foremost a Royal Air Force Station, under standard RAF military discipline, command and control, and did not suffer the multiple command chains of Bletchley Park.<sup>193</sup>

As Bletchley Park was reliant on the complex mix of intercept or 'Y' Stations to capture the wireless messages out of the air and then transport them to Bletchley Park. Medmenham was totally reliant on aircraft to take reconnaissance pictures and return with them so they could be transported to Medmenham for analysis. These photographs were initially almost totally supplied by the RAF from its specialist photographic squadrons of 1,2, 3 and 4 PRUs.<sup>194</sup> There is a rather complicated and convoluted build up to the creation of the PRUs as they changed names frequently from September 1939 to the creation of the initial PRU at Heston in July 1940 as shown in Table 1.<sup>195</sup> These units were based at Benson (Oxford), Hendon and Heston (near London), Oakington (Cambridge) and Leuchars (St Andrews) as well as

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<sup>191</sup> See Annex B, Medmenham Sections especially P Section and Cover-search; MA [unaccessioned paper] *How to Use the Card Index System, RAF Medmenham, Secret, dated 2 August 1942.*

<sup>192</sup> For details of the importance and use of the registry H2 Section at MI5 see: C Andrew, *The Defence of the Realm*; R Brunt, 'Information Management of British Military Intelligence: The Work of the Documentalists, 1909-1945', *Library Trends*, 62.2 (2013) 360-377; A Black & R Brunt, 'MI5, 1909-1945: An Information Management Perspective', *Journal of Information Science*, 26 (2000) 185-197; R Brunt, 'Special Documentation Systems at the Government Code and Cypher School, Bletchley Park during the Second World War', *INS*, 21.1 (2006) 129-148.

<sup>193</sup> The National Archive Air 29/230, Operational Record Book Central Interpretation Unit RAF Medmenham 29 Jul 1941 to 21 Aug 1941; TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1.

<sup>194</sup> E Leaf, *Above All Unseen.*

<sup>195</sup> For a full description of the creation of the RAF reconnaissance squadrons see: TNA AIR 41/6, Draft RAF Narrative Photographic Reconnaissance Vol 1; R Nesbit, *Eyes of the RAF.*

the General Reconnaissance Flight in Malta and others in Africa and Italy. However, these changes and geographic dispersal did not affect the central point, RAF aircraft had to be tasked to collect photographs over enemy territory to provide Medmenham with the raw material to analyse.<sup>196</sup>

Medmenham with its centralisation of all Second and Third Phase analysis, did realise that due to the distances involved, smaller versions of Medmenham would be required to support the war in distant commands and locations. After a fact-finding tour of the Middle East and India by a staff officer from the Air Ministry, it was proposed in November 1941 to form a Middle East CIU (MECIU) at Heliopolis with a staff of 63 analysts.<sup>197</sup> They would support deployments to Malta, the Levant, Iraq, Egypt and the Western Desert as required. Medmenham provided staff to create the MECIU. However, this did not initially resolve the problems of photographic interpretation in the area. The Army had unilaterally created its own Army photographic interpretation unit, which initially created significant confusion and duplication of effort. This came to a head in May and June 1942, with the increased tempo of operations in Egypt. It was successfully resolved when the Army photographic interpretation unit was ordered to co-operate with the MECIU detachment to the Eighth Army. They then both successfully worked together and produced significant intelligence for the battle of El Alamein, where they had produced a comprehensive photographic mosaic of the whole of the battle front lines. This has been described as a first successful use of tactical photographic reconnaissance and interpretation, which was then used so successfully during the European campaign.<sup>198</sup> CIUs based on the Medmenham model were also set up in North Africa, The Far East in Singapore and at Air Headquarters India. All these overseas CIUs also supported deployments of staff to support forces in the local theatres. The records of the MECIU, especially the interpretation reports covering Italy are the most complete of the overseas CIUs in the National Archives, but there

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<sup>196</sup> See Annex C – for more detail on the British, American and German Reconnaissance Organisations and Annex D for aerial cameras.

<sup>197</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2. 59-65.

<sup>198</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2. 60-61; R Nesbit, *Eyes of the RAF*, 142.



are few actual interpretation reports surviving for the other overseas CIUs.<sup>199</sup> The thesis concentrates on the work of the parent CIU at Medmenham.<sup>200</sup>

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This chapter has discussed the organisation of British intelligence during the build up to the start and during the war. To allow placing British intelligence in the context of Allied and German intelligence, the US intelligence organisation has been outlined, especially the reconnaissance sections. The German intelligence organisation was outlined and its reconnaissance organisation shown. This has allowed the Medmenham organisation to be considered in the wider context of the British/American intelligence systems and the German equivalents. The organisational theory lens of Grey and Sturdy as applied to Bletchley Park has been for the first time used to look at the organisational developments at Medmenham and this has altered our understanding and insights of how Medmenham developed. As mentioned, the Annexes show the breakdown and detail every section at Medmenham and a short description of the role and manning of the sections, with tasking, interpretation report numbers and manning graphs.

This Chapter has shown that whilst there are similarities between Medmenham and Bletchley Park, especially in some of the methods of recruiting the photographic interpreters in the early days. However, because Medmenham was firmly an RAF station, the more standard methods of recruitment and posting of staff with the aptitude for photographic interpretation quickly became the norm. This can be seen by the significant numbers of RAF staff postings detailed in the RAF Medmenham Operational Record Book which this thesis has researched for the first time.<sup>201</sup> There was a distinct difference between the often-chaotic organisation of Bletchley Park

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<sup>199</sup> Note: The records for the overseas interpretation units are not as complete as Medmenham.

<sup>200</sup> For more details on the overseas CIU's see TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 60.

<sup>201</sup> MA [Unaccessioned document] RAF Medmenham Operational Record Book. This ORB has been subject to a detailed analysis and all postings from 1941 to 1944 extracted into a database.

and its multiple lines of control and the far more formal RAF station structure running Medmenham, with Medmenham having a more normal hierarchical command and control system than Bletchley Park.

This Chapter has demonstrated that Medmenham grew rapidly from 1941 after the move to Medmenham, but did not have the exponential growth experienced by Bletchley Park. This difference in growth can be explained by the fact Medmenham grew in size to be able to process, interpret and report on the sorties it could receive in a day. The maximum number of sorties was limited by the number of Allied aircraft providing the film for Medmenham to interpret and though this increased from 1940 to 1944 the maximum daily intake was resource limited. Bletchley Park grew to over five times the size of Medmenham because of the breaking of multiple German encryption keys provided an exponential growth in the number of signals to decrypt and analyse and that required a rapid growth in staff and resources. This difference in the growth of the two organisations has not been highlighted in the historiography before or the reasons for the difference explained. Therefore, this comparative analysis of Medmenham and Bletchley Park has made an important and fresh contribution to our understanding of the two organisations.

This Chapter has shown that Medmenham developed rapidly after the move from Wembley, growing into a large complex photographic intelligence organisation by the end of 1942. The organisational structure and main interpretation processes and procedures were then in place until the end of the war, with only minor additions and changes needed to deal with the major increase in workload in 1944 caused by the arrival of the Americans and Operations *Overlord* and *Crossbow*.

This Chapter has also highlighted that there is a possible future avenue of research to investigate in more detail the information management practices and techniques used at Medmenham to cope with the rapid increases in sorties and prints received from 1942 to 1945 and increase in intelligence reports produced compared with those of the increase in codes decrypted at Bletchley Park and vast increase in

intelligence output. The following three chapters will analyse the development of the PIU at Wembley and the rapid growth of photographic interpretation following the move to Medmenham.

### Chapter 3

#### Sealion, 1940

This chapter will look in detail at the work of the PIU at RAF Wembley between May and October 1940 and the work on monitoring the German activity for an invasion of Britain, from the analysis of aerial reconnaissance photographs. The case study will show the frequency of reconnaissance flights across the occupied enemy territory and the speed and volume of intelligence reporting from the PIU. The case study has followed the monitoring of aerodromes and the build-up of barges at the invasion ports to carry the troops and used those reports in an analysis to show the utility of photographic intelligence. Textual analysis of all the original photographic interpretation reports is an opportunity to explore the historical details available in photographic interpretation reports contemporaneously to the actual operations. This thesis is innovative producing for the first time a detailed analysis of the first 600 of the original PIU interpretation reports. This analysis has been undertaken to understand in detail what photographic intelligence was available to the JIC, COS and the CIC as well as other decision makers during this period. The detailed analysis of the PIU reports is then used to break new ground, methodologically, by being cross-referenced and analysed against the actual Spitfire reconnaissance missions flown by the PRU. This study will provide a new analysis and interpretation of the frequency of coverage and reporting of activity seen at the invasion ports, that challenges the traditional historiography.

The German plan for invading Britain in 1940 was called Operation *Sealion*. This chapter will briefly examine the background of the German planning for the operation, the build up and then eventual postponement of the invasion.<sup>202</sup> The British preparations and planning for defence against the invasion by Germany will also be briefly examined.<sup>203</sup> This case study will place in context the conditions and

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<sup>202</sup> K Maier, et al, *Germany and the Second World War* Volume 2, 361-416; R Wheatley, *Operation Sea Lion: German Plans for the Invasion of England, 1939-1942* (Oxford: Clarendon Press, 1958); R Forczyk, *We March against England: Operation Sea Lion 1940-41* (London: Bloomsbury, 2016).

<sup>203</sup> See B Collier, *The Defence of the United Kingdom*.

environment that intelligence and, specifically, photographic intelligence worked under during this period in 1940.<sup>204</sup> As Medmenham had not yet been requisitioned for military use, over this period the commercial premises of the Aircraft Operating Company (AOC) at Wembley, which had been contracted to the Air Ministry, housed the PIU.<sup>205</sup> Operation *Sealion* was selected as the first case study as significantly it covered the period from the initial foundation of the PIU and allowed a detailed examination of the setup and growth of the embryonic photographic intelligence organisation in 1940. This case study will show how the PIU developed the innovative three phase photographic interpretation and reporting system and how the analysis developed from simple photo reading to in depth comparative analysis. The case study will show how photographic intelligence was uniquely able to provide monitoring and warning of the German invasion preparations. The case study by the detailed analysis and use of tabulated results also highlight one of the main shortcomings or dependencies of aerial reconnaissance, that of good weather over the target area. This and later case studies will provide an opportunity in the thesis to compare and contrast the activities and reports from the PIU, an embryonic version of the CIU in 1940, with those at Medmenham during later phases of the war and to follow developments in photographic interpretation techniques, procedures and use of the intelligence.<sup>206</sup>

The unexpectedly rapid fall of France in 1940 gave the Germans an opportunity to consider invading Britain, so Operation *Sealion* planning was approved in July 1940, with a proposed date for the invasion of mid-September 1940, a very compressed

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<sup>204</sup> See TNA AIR 29/413, *Photographic Development Unit*, AIR 29/434, *Photographic Interpretation Unit (PIU), Wembley (UK)*, AIR 41/6, Draft RAF Narrative on Photographic Reconnaissance, Vol 1, 189-239.

<sup>205</sup> TNA AIR 41/6, Draft RAF Narrative on Photographic Reconnaissance, Vol 1, 109-117.

<sup>206</sup> TNA, AIR34/83, *Aircraft Operating Company, P.I.U. and C.I.U.: internal organisation procedure and personnel*.

timeframe.<sup>207</sup> Hitler then postponed the invasion on the 17 September 1940.<sup>208</sup> Britain had looked at the possibility of a German invasion of the country since the start of the war, and with greater urgency as the tide turned against the allies in France during the first half of 1940. Britain did not stop considering the possibility of the invasion until well into 1942 and keep revisiting it in 1943 and 1944.<sup>209</sup> However, the first key date is the authorisation of the formal planning for the invasion on 2 July 1940. The second key date is the proposed date for the invasion on 15 September 1940 and the third key date, Hitler's postponement on the 17 September 1940. This chapter will look at the build-up of photographic intelligence reports from the PIU from report number 1 to report number 599, that covers the period of the 12 May to 16 October 1940.<sup>210</sup> This study will allow analysis of photographic interpretation reports over the three key dates.

The analytical framework and methodology used for the case study involved a full textual review of all photographic interpretation reports produced by the PIU at RAF Wembley, from report 1 to 599 and the extraction of data to form an analytical

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<sup>207</sup> See K Maier, et al, *Germany and the Second World War* Volume 2, 361-416, A Shennan, *The Fall of France, 1940* (Harlow: Longman, 2000); J Jackson, *The Fall of France: The Nazi Invasion of 1940* (Oxford: Oxford University Press, 2003), P Jackson, 'Returning to the fall of France: recent work on the causes and consequences of the 'Strange Defeat' of 1940', *Modern & Contemporary France*, 12.4 (2004) 513-536, M Alexander, 'The Fall of France 1940', *Strategic Studies*, 13.1 (1990) 10-44; M Alexander, 'Radio-Intercepts, Reconnaissance and Raids: French Operational Intelligence and Communications in 1940', *INS*, 28.3 (2013) 337-376; M Alexander, 'Prophet Without Honour?', *War & Society*, 4.1 (1986) 53-77; M Alexander & W Philpott, 'The French and the British Field Force: Moral Support or Material Contribution', *Military History*, 71.3 (2007) 743-772; M Alexander, 'After Dunkirk: The French Army's Performance against 'Case Red', 25 May to 25 June 1940', *War in History*, 14.2 (2007) 219-264; M Alexander, 'French Grand Strategy and Defence Preparations', in *The Cambridge History of the Second World War*, ed. by John Ferris and Evan Mawdsley (Cambridge: Cambridge University Press, 2015) 78-106; J Blatt, *The French Defeat of 1940: Reassessments* (Providence RI: Berghahn Books, 1998); B Bond & M Taylor, *The Battle of France and Flanders 1940: Sixty Years On* (London: Leo Cooper, 2001).

<sup>208</sup> K Maier, et al, *Germany and the Second World War* Volume 2, 361-416.

<sup>209</sup> TNA, CAB 80\10\41, C.O.S. (40) 332, Seaborne and Airborne Attack on the United Kingdom, 252-258; CAB 80\18\18, COS(40)711, Invasion: Vital Importance of Dover Area, 88-89; JIC (40)268, Seaborne Invasion of the United Kingdom: Report by the Joint Intelligence Sub-Committee, 99; For British preparations for the Land defence of the United Kingdom see: D Newbold, 'British Planning and Preparations to resist Invasion on Land, September 1939- September 1940' (unpublished doctoral thesis, Kings College London, 1988).

<sup>210</sup> All the following reports have been analysed and those reporting on barges or airfields have been included in an analytical database. The reports reviewed were TNA, AIR 34/290, Preliminary Interpretation Reports: 1 – 100; AIR 34/291, Preliminary Interpretation Reports: 101 – 199; AIR 34/292, Preliminary Interpretation Reports: 200 – 299; AIR 34/293, Interpretation Reports: 300 – 399; AIR 34/294, Interpretation Reports: 400 – 499; AIR 34/295, Interpretation Reports: 500 – 599.

database.<sup>211</sup> The data extracted includes the date of the reconnaissance flight, the mission number, date of the report, key areas covered, location and count of barges and any airfields covered. The reports have been coded into areas to assist in further analysis.<sup>212</sup> The analysis has been conducted on a week by week basis and during September on a daily basis to help identify trends and changes as the invasion planning progressed. The reports of the PIU include sorties flown by the specialist reconnaissance Spitfires of the PRU as well as reconnaissance sorties from Coastal Command and Bomber Command aircraft. Six original reports have been selected from the PIU, from across the period for this case study and have been transcribed to show the format and type of photographic intelligence reports produced and the developments and change in the reports over this period.<sup>213</sup>

Germany only seriously started planning for an invasion of Britain in July 1940. However, the army and naval staffs had both prepared staff papers on the requirements for an invasion of Britain in November and December 1939. The naval staff had produced a comprehensive staff paper on the potential for an invasion of Britain by the end of November 1939.<sup>214</sup> The naval staff concluded that an actual invasion might not even be necessary if all the prerequisites they had identified were in place. The critical requirement they had identified was the strangulation of sea supply lines to Britain, which they believed was achievable via an unrestricted U-boat offensive against these supply lines. They had identified significant problems that would need to be addressed before a seaborne invasion of Britain could be attempted leading to Hitler and his staff giving four prerequisites for such an invasion. These were: air superiority, a secured seaborne corridor including clearing British minefields, installing protective German minefields on the flanks of the invasion

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<sup>211</sup> Annex M shows extracted data from the first 100 reports produced by the PIU.

<sup>212</sup> The analytical areas used are: Barges – A: Germany, B: Amsterdam to IJsselmeer, C: Rotterdam including Rhine / Meuse, D: Antwerp & Scheld, E: Ostend & Belgian Coast, F: Calais & Dunkirk, G: Boulogne, Somme & Dieppe, H: Le Havre, I: NW France, J: Italy. Airfields – K: Germany, L: Netherlands, M: Belgium, N: France, P: Channel Islands, Q: Denmark, R: Norway, S: Italy.

<sup>213</sup> See: Appendix 1, Transcribed Interpretation Reports. The Appendix has reports No 10 – 17 May 1940, No 54 – 11 June 1940, No 377 – 2 September 1940, No 470 – 20 September 1940 and No 593 – 14 October 1940, TNA, AIR34/ 290 to 295.

<sup>214</sup> R Wheatley, *Operation Sea Lion*, 1-28; L McKinstry, *Operation Sealion: How Britain Crushed the German War Machine's Dreams of Invasion in 1940* (London: Murray, 2014); D Grinnell-Milne, *The Silent Victory September 1940* (London: Bodley Head, 1958).

corridor and good weather.<sup>215</sup> The strength of the Royal Navy was only one of the problems. The German naval staff identified suitable ports to be used in an invasion from Harwich to Blyth. They dismissed the possibility of beach landings due to the need to disembark large numbers of troops and equipment quickly, hence the focus on existing British harbours. These they intended to secure by airborne landings as used against Holland when the assault gliders DSF 230 were used, and these were included in the plans for an airborne element of the British invasion. The airborne element of the invasion was intended to secure the flank to the west of Folkstone, Lympe airfield and the Military Canal in Kent.<sup>216</sup> This plan was at odds with the German army staff requirements for an invasion of Britain. They preferred a landing over a larger area of the Channel facing area, to allow a broader area for attack, which would offer more chances for a break out from the landing areas and less chance of being quickly stopped on the beaches.<sup>217</sup> This previous work by the German staff on how to mount an invasion of Britain would assist them when Hitler finally authorised invasion planning in July 1940.

The first and critical prerequisite for Germany to be able to launch an invasion was gaining air superiority over Britain.<sup>218</sup> This plan led to the sustained German air force offensive against Britain during July, August and September 1940. This German air offensive and the successful RAF defence has an almost iconic status within the historiography of the Second World War. In the early stages of the battle and up to 6 September 1940, when the German air force concentrated the majority of the attacks against RAF fighter command stations, the outcome of the battle for air superiority was finely balanced. However, when Germany from 7 September concentrated day and night attacks against London, the RAF began to win the air battle, though the *Luftwaffe* would probably still have been able to provide local air superiority over the invasion crossing and landing areas for *Sealion* to proceed.<sup>219</sup>

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<sup>215</sup> F-K von Plehwe, 'Operation *Sealion* 1940', *RUSI Journal*, 118.1 (1973) 47-53.

<sup>216</sup> L McKinstry, *Operation Sealion*, 70-157.

<sup>217</sup> F-K von Plehwe, 'Operation *Sealion* 1940', 47-53.

<sup>218</sup> F-K von Plehwe, *Operation Sealion 1940*, 48-49.

<sup>219</sup> M Connelly, *We Can Take It! Britain and the Memory of the Second World War*, (Oxford: Routledge, 2014); T James, *The Battle of Britain*, ed, S Cox (London: Cass, 2000); D Richards, *Royal Air Force 1939-1945 Volume 1: The Fight at Odds* (London: HMSO, 1974) 151-197; C Bergstrom, *The Battle of Britain* (Oxford: Casemate, 2015); S Bungay, *The Most Dangerous Enemy: History of the Battle of*



No detailed planning for an invasion of Britain had been undertaken before the success of the invasion and fall of Belgium and France. Therefore, once invasion planning was authorised, the planning was undertaken at great speed, but also in considerable detail and with significant effort. There was conflict and friction between the German navy and the army, as there had been in the earlier planning work. The German army and air force were both over-confident after the rapid successes in Belgium and France. The German navy, however, had the might of the Royal Navy to contend with and they believed that the Royal Navy Home Fleet would be more than capable of defending Britain against any invasion threat.<sup>220</sup> However, as the air war intensified, the German war machine gathered from industry and trade over 2,300 barges to transport the troops and equipment needed for the invasion. This rapid collection, build up and in some cases, modification of barges was a critical element that reconnaissance photographs could detect as an indicator and warning, as well as the build-up of shipping and naval units to escort the barges.<sup>221</sup> This build-up of barges was not seen in German reporting decoded by Bletchley Park. The German plan called for the invasion barges to be rapidly massed at Rotterdam, Antwerp, Ostend, Calais, Boulogne, Etaples and Le Havre, ready for the invasion on 15 September 1940.<sup>222</sup> The German plan also called for an initial airborne assault to secure landing areas and ports, as they successfully used on Crete in May 1941.<sup>223</sup>

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*Britain* (London, Aurum Press, 2001); R Overy, *The Battle of Britain: Myth and Reality* (London, Penguin Books, 2004) also see Sebastian Cox, 'A Comparative Analysis of RAF and *Luftwaffe* Intelligence in the Battle of Britain' in *Intelligence and Military Operations*, ed. by Michael Handel, (Abingdon: Cass, 1990) 425-443.

<sup>220</sup> K Maier, et al, *Germany and the Second World War Volume 2*, 361-416; R Wheatley, *Operation Sea Lion*, 1-13; B James, 'Pie in the Sky', *History Today*, 56.9 (2006) 38-40; F Hinsley, *Command of the Sea: The Naval Side of British History from 1918 to the end of the Second World War* (London: Christophers, 1950) 45-47; D Grinnell-Milne, *The Silent Victory September 1940*; D Redford, *A History of the Royal Navy: World War II* (London: Tauris, 2014) 96-100; C Barnett, *Engage The Enemy More Closely: The Royal Navy in the Second World War* (London: Hodder & Stoughton, 1991) 189-192; A Hendrie, *The Cinderella Service: RAF Coastal Command 1939 -1945* (Barnsley: Pen & Sword Aviation, 2006); C Goulter, *A Forgotten Offensive: Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940-1945* (London: Cass, 1995).

<sup>221</sup> L McKinstry, *Operation Sealion*, 303-305.

<sup>222</sup> R Wheatley, *Operation Sea Lion*, Map 3.

<sup>223</sup> F Hinsley, et al, *British Intelligence in the Second World War Volume 1*, 415 – 421; J Keegan, *The Second World War* (London: Hutchinson, 1989) 160-172; A Beevor, *Crete: The Battle and the Resistance* (Boulder CO: Westview Press, 1994); C MacDonald, *The Lost Battle: Crete 1941* (New York: Free Press, 1993).

Intelligence on German intent was very sparse during 1939-40. Bletchley Park was not yet able to read many German *Enigma* messages, and those they did usually took considerable time to read. They did start to read the *Luftwaffe Enigma* keys from the 6<sup>th</sup> January 1940 but lost access to them again on the 1 May 1940 when the method of enciphering the messages was made more secure. Bletchley Park broke back into the key for 20 May and Hut 6 continued to solve this *Luftwaffe* cypher in significant volume for the next months. However, even when reading the cypher in volume the success of deciphering the messages was 56% of intercepted messages by January 1942.<sup>224</sup> This traffic was low-level *Luftwaffe* communications and did not give any indication of German high-level intent. There are claims, primarily by Winterbotham and Lewin, for the 'great advantage' *Enigma* gave the UK during the Battle of Britain, but these are much exaggerated and now generally thought to be disproved.<sup>225</sup> The commander of fighter command, Air Chief Marshal Dowding was probably inducted into *Ultra* on the 16<sup>th</sup> October 1940, too late to have had any influence on his thinking or conduct of the air battle.<sup>226</sup>

After the fall of France, the German army quickly reverted to using landlines for communication, which significantly reduced the intelligence available from this signals intelligence source. After the retreat at Dunkirk and fall of France, agent reporting sources dried up, and those that remained were of little use.<sup>227</sup> Landlines were used more and more for the German army and air base communications with headquarters. This use of landlines significantly reduced the ability of the 'Y' Service

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<sup>224</sup> M Smith & R Erskine, eds, *Action This Day*, 47-76.

<sup>225</sup> R Lewin, *Ultra Goes to War*; F Winterbotham, *The Ultra Secret*; H Probert & S Cox, eds, *The Battle Re-Thought: A Symposium on the Battle of Britain* (Shrewsbury: Airlife, 1991) 42-46; J Ray, *The Battle of Britain: New Perspectives* (London: Weidenfeld Military, 1994) 59; M Gilbert, *The Second World War* (London: Weidenfeld & Nicolson, 1989).

<sup>226</sup> There are conflicting accounts of when Dowding was inducted, August or October 1940. These are discussed in the article by S Cox, 'A comparative analysis of RAF and *Luftwaffe* intelligence in the battle of Britain, 1940', 425-443. The balance of probability being on the 14 October date after a directive from Churchill.

<sup>227</sup> SIS reputation for agent reporting had suffered a significant setback with the capture of two of its officers in the November 1939 Venlo incident. They also had no agents in Germany at any of the German ports providing Naval ship movement details and suggested that it would have to be provided by RAF reconnaissance sorties. They had relied on close relationships with friendly foreign intelligence sources, especially French sources which dried up after the fall of France, until it was re-established with the Vichy intelligence services. See K Jeffery, *MI6*, 327-369; D De La Marck, 'De Gaulle, Col Passy and British Intelligence, 1940-42', *INS*, 18.1 (2003) 21-40; M Thomas, 'Signals intelligence and Vichy France, 1940-44: Intelligence in defeat', *INS*, 14.1 (1999) 176-200.

to collect intelligence for Bletchley Park to decode, but of course direction finding and traffic analysis was still providing significant intelligence without Bletchley Park decryption. However, without Bletchley Park decryption, German intent had to be inferred from other sources, such as the build-up in invasion barges, shipping and at aerodromes the assembly of transport aircraft for airborne troops.<sup>228</sup> The Royal Navy continued to provide visual reconnaissance reports from surface ships and submarines, but these provided little usable intelligence and at significant risk to the vessels.<sup>229</sup> However, British photographic reconnaissance provided a reliable source with detailed coverage of ports, harbours, airfields, railways and canals. This photographic reconnaissance was both extensive and timely, with over 90% of the photographic interpretation reports being sent on the same day as the mission was flown.<sup>230</sup> The work of the PIU at Wembley during the German invasion threat period of 2 July to 17 September 1940 is covered in *Evidence in Camera*, which reports in glowing terms the work of the PIU in monitoring the build-up of the invasion fleet and this has entered into the PI historiography.<sup>231</sup> So much so that it is perpetuated in *Spies in the Sky* and *Crossbow*.<sup>232</sup> However, this case study by examining all the photographic interpretation reports from the Photographic Interpretation Unit at Wembley over the invasion period and subjecting them to detailed analysis will then be able to assess the capabilities of the RAF reconnaissance and photographic interpretation system in 1940, and its contribution to the UK intelligence picture on the German preparations for an invasion of Britain.

The hundreds of interpretation reports, all of which are still available for analysis, provide a clear picture of what photographic interpretation was capable of with the

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<sup>228</sup> S Cox, A Comparative Analysis of RAF and *Luftwaffe* Intelligence in the Battle of Britain, 425-443, p 429.

<sup>229</sup> D Grinnell-Milne, *The Silent Victory September 1940*, 89-98; C Barnett, *Engage The Enemy More Closely*, 188.

<sup>230</sup> See Annex M, Table of PIU Interpretation Reports No 001 to 100. The majority of PIU sorties were interpreted on the same day, with late sorties being interpreted overnight and the next day. The few photographic sorties from other squadrons of Coastal and Bomber Command were interpreted as soon as the pictures reached the PIU, which could take from a day to a week to arrive in August/September 1940.

<sup>231</sup> C Babington Smith, *Evidence in Camera*, 62-87.

<sup>232</sup> T Downing, *Spies in the Sky*, 64-67; A Williams, *Operation Crossbow*, 48-49.

technology and resources available in 1940.<sup>233</sup> However, this wealth of reporting was from a single intelligence source and required careful analysis and interpretation to provide usable intelligence for the conduct of the war. The photographic interpretation reports gave details of the movements of the barges and ships that were to be used for the transportation of invasion troops and equipment. They provided details of the movement of fighter aircraft, transport aircraft and extensions being built to airfields in France and Belgium. They also provided coverage of the railways and any troop movements, and German positions of shore batteries to protect any invasion force.<sup>234</sup> These reports were one source that provided Britain with the detail that was required by an effective military indicators and warning system. The indicators are any event or sequence of events that an enemy must take to prepare to attack, which allow warnings to be issued to government and military staff.<sup>235</sup> In the context of Operation *Sealion*, any massing of naval shipping, and especially the barges at invasion ports, would provide such a warning. The tracking of aircraft movements and any massing of transport planes or gliders capable of delivering airborne forces would also indicate an airborne invasion threat.<sup>236</sup> The PIU tracking of the fighter and bomber aircraft movement and the extensions to the airfield runways also provided warnings of the build-up in preparation for the German air offensive about to be launched against Britain.<sup>237</sup> To see an example of the aircraft and airfield monitoring the transcribed report number 230 is at Appendix 1, and shows the discovery of a new military airfield and extensions to the runways at another including individual aircraft counts seen at that airfield.

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<sup>233</sup> TNA, AIR 34/290, Preliminary Interpretation Reports: 1 – 100; & AIR 34/291, Preliminary Interpretation Reports: 101 – 199; AIR 34/292, Preliminary Interpretation Reports: 200 – 299; AIR 34/293, Interpretation Reports: 300 – 399; AIR 34/294, Interpretation Reports: 400 – 499; AIR 34/295, Interpretation Reports: 500 – 599.

<sup>234</sup> Appendix 1, Transcribed Interpretation Reports. The Appendix has reports No 10 – 17 May 1940, No 54 – 11 June 1940, No 377 – 2 September 1940, No 470 – 20 September 1940 and No 593 – 14 October 1940. Also see AIR 34/291 Interpretation Report 65.

<sup>235</sup> Indicators and warnings (I&W) are part of a standard military intelligence system used by all three military services to task and use collected intelligence and reconnaissance reports in an analytical framework to provide warnings of enemy future action(s).

<sup>236</sup> TNA, CAB 80/14, COS (40) 533 (JIC) 167-8.

<sup>237</sup> S Puri, 'The Role of Intelligence in deciding the Battle of Britain', 416-439; Annex M, Photographic Interpretation Reports 1 to 100; Appendix 1, Transcribed Report no 230.

The PIU produced 699 reports from 14 May 1940 to 14 November 1940, from simple single page reports on German anti-aircraft positions to large multi-page reports on every target covered by the reconnaissance mission. A single photographic reconnaissance Spitfire could cover targets from the Dutch coast down to the French coast at Calais easily on one flight.<sup>238</sup> The PIU would produce one report per flight, often with many annexes, and occasionally a correction to the report, if subsequent analysis found a mistake in the interpretation. The reporting of this photographic intelligence was undertaken in phases, First Phase, Second Phase and Third Phase. First Phase reporting was time critical and conducted as soon as the still wet photographs were available. A photographic interpreter would scan the wet negative film looking for significant activity and select those frames of the film to be 'rush printed' for further analysis and reporting. Photographic interpreters then quickly scanned the photographs looking for any significant military activity, which was then reported out as rapidly as possible on a 'Form White' by secure teleprinter to a small distribution of the Air Ministry, Admiralty, Bomber Command and Coastal Command. The Form White was a preformatted form that the photographic interpreters filled in with important information as they quickly scanned the images and then the teleprinter sent it. The Form White was sent as soon as possible, which was usually within a couple of hours of the aircraft landing.<sup>239</sup>

Second Phase reporting allowed a more detailed look at the photographs, more advanced analysis by the *Wild* A5 stereo autograph if needed, and comparison with previous photographs and reports on the target.<sup>240</sup> Second Phase reports were sent out as typed Interpretation Reports and to a much more comprehensive distribution list. A typical distribution of the reports would include: the head of the RAF staff branch, RAF Coastal Command, for the Navy the Admiralty, RAF Air Intelligence (Liaison with SIS, MI5, attachés, wireless and air photographic intelligence), for the Army the Military Intelligence Departments in the War Office dealing with geographic

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<sup>238</sup> See Annex L, Map of Spitfire Photographic Sortie Range.

<sup>239</sup> See Appendix 1 Form White Example and for the more detailed transcription of the Second Phase Interpretation Report No 230, which was produced later the same day from the same sortie as the Form White report. Form White times see: Air Historical Branch, The Second World War 1939 – 1945 Air Ministry Intelligence Narrative, Part II Chapter 5 Photographic Intelligence, 32-34.

<sup>240</sup> See Annex E, The *Wild* A5 Stereo Autograph.

intelligence for Germany, the Army department dealing with the Secret Intelligence Service, RAF Air Intelligence responsible for Germany, the Army General Staff Intelligence Headquarters, the Defence Policy and Requirements branch, the branches dealing with future operations, as well as the Director of naval operations, Air Ministry staff & relevant Commander in Chiefs as well as copies for use at the PIU.<sup>241</sup>

The detailed textual analysis of individual photographic interpretation reports and the comparison of them over time allows a more detailed understanding of what these intelligence reports can provide. As can be seen from the original Form White which is transcribed at Appendix 1 of Sortie N/10 which was a quick readout from the wet prints of the mission just after the aircraft had landed, mis-interpretations were sometimes made. Comparing the Form White report of 29 aircraft at Kristiansand aerodrome, with the more detailed PIU report, the latter gives the number as 39 aircraft and provides far more detail identifying the majority of the aircraft by type. This error can be seen in the transcribed PIU Report Number 230 and corresponding Form White.<sup>242</sup> That was the role of the PIU report, to give well-analysed detail from the whole aircraft sortie in the report and expand upon and correct if necessary the quick initial report in the Form White. The most detailed reports were Third Phase reports, which were not generated from every sortie, as First and Second Phase reports were, but only if the targets warranted the more detailed analysis, and additional information was available following the detailed examination of the photographs. These Third Phase reports usually went out on the same distribution lists as the Second Phase reports.

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<sup>241</sup> A typical distribution list of the time would include Chief of the Air Staff, Coastal Command, Admiralty, Air Intelligence Department 1 (Liaison with SIS, MI5, attaches, wireless and air photographic intelligence), Military Intelligence Department 14 (War Office geographic intelligence department responsible for Germany), Military Intelligence Department 6 (Secret Intelligence Service), Air Intelligence Department 3 (A geographical intelligence section responsible for Germany), General Staff Intelligence General Headquarters, Defence Policy and Requirements, Future Operations 2, Director Naval Operations, Air Ministry & relevant Commander in Chief's as well as copies for use at the PIU, see Appendix 1 for Transcription of Intelligence Report Number 377, dated 2 September 1940, TNA, AIR 34/290.

<sup>242</sup> See Appendix 1 Form White Example and for the more detailed transcription of the Second Phase Interpretation Report No 230, which was produced later the same day from the same sortie as the Form White report.

The division of photographic interpretation into these phases was started at the PIU, as can be seen from a copy of their 'Internal Operating Instructions' dated 1 August 1940, and continued at Medmenham, as seen in Medmenham instructions dated March 1941. This way of dividing interpretation into three phases continued throughout the war<sup>243</sup> This three-phase process for photographic interpretation was not used or recognisable in the First World War, but developed in the late inter-war years and is first seen in the work of the Aircraft Operating Company at Wembley.<sup>244</sup>

The format and detail in the PIU reports developed substantially during this short period from May to October 1940. The first report that ran to two pages was Preliminary Interpretation Report No. 10, dated 17 May 1940. The report format gives the date of the aircraft sortie, the date the photographs were interpreted and the sortie number. This report covered Amsterdam, the ship canal to IJmuiden and then south along the coast to Schoowen airport. The report is of a simple format and provides details of what can be seen on the photographs and lists the photographs that are used in the analysis. It does not have a distribution list included or the name of the intelligence officer who produced the report.<sup>245</sup> The first report to include a distribution list was report number 12 dated 18 May 1940 and had a simple distribution list of the Air Ministry, FO 7, the War Office, Bomber Command and a file copy for the PIU, and the photographic interpreter also signed it.<sup>246</sup> In the space of just under a month, the format of the reports had evolved as had the detail that was reported.

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<sup>243</sup> For details of the phases of interpretation see the interpretation procedures for the AOC, PIU and CIU in TNA AIR 34/83 AOC, PIU and CIU internal organisation procedure and personnel.

<sup>244</sup> The First World War processes can be seen in TNA AIR 1/724/91/6/1, *History of Photography in the Air Branches of His Majesty's Service, 1914-1918*, undated & J Beach, *Haig's Intelligence*, 143-154; T Finnegan, *Shooting the Front*, 159-171. The three phase process is seen in the interpretation procedures for the AOC, PIU and CIU in TNA AIR 34/83.

<sup>245</sup> See Appendix 1 for Transcription of Intelligence Report Number 10, dated 17 May 1940, TNA, AIR 34/290.

<sup>246</sup> See TNA, AIR 34/290 Report Number 12, dated 18 May 1940.

Interpretation Report No. 54 was again a two-page report, on Italy covering the area of Cagliari Naval Base and was taken on 8 June 1940.<sup>247</sup> It was interpreted back at Wembley on 11 June 1940. This was a period where only one or two reports were produced a day at Wembley. The report gives a readout of what can be seen on the photographs, detailed numbers of ships and aircraft as well as type, where this can be identified. The report also refers to a plan where the position of the ships in the harbour is indicated, and compares the photographs to a chart of the harbour and points out where there are differences. This plan was probably created on the *Wild A5 Stereo* autograph machine. The report has a distribution list included and the names of the intelligence officers. This shows a development in the standard operating procedures and better photographic interpretation of the photographs taking place over a very compressed timeframe.<sup>248</sup>

The number of reports produced per day and the detail in them had to expand to keep pace with the invasion threat and demand for reconnaissance. In May the average number of reports per day was two short reports, three in June and July, with a high of five. In September they had a high of ten long detailed reports with annexes in a single day, with many days of seven, eight and nine long detailed reports and annexes.<sup>249</sup> The report produced on 2 September 1940 from a flight the previous day was Interpretation Report No. 377 and was five pages long. The report covered the areas from Bruges to Ghent, South Beveland canal to the Mouth of the Scheldt on to Flushing and Middleburg. The photographic interpreters reported on shipping, airfields, engineering works, the oil industry and storage, railways, ammunition dumps as well as naval operations. The report shows clear development on the detail that could be interpreted from the photographs and the increasing demand for more intelligence, as well as the ability of Wembley to increase its analytical report output. Two more reports are included as transcriptions. Supplementary Report No. 470 on Amsterdam dated 20 September 1940 is a 5 page very detailed report on Amsterdam harbour and docks, that was sent after more

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<sup>247</sup> The use of scarce reconnaissance assets continued against Italy until 15 June 1940. TNA, AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, Appendix XXX.

<sup>248</sup> Appendix 1, Transcription of Intelligence Report Number 54, dated 11 June 1940, TNA, AIR 34/290.

<sup>249</sup> See TNA, AIR 34/293 Report Numbers 372-399 & TNA AIR 34/294, Interpretation Reports: 400 – 499 & TNA AIR 34/295. Interpretation Reports: 500 – 529.



detailed interpretation at Wembley. The final transcribed report is Interpretation Report No. 593 dated 14 October 1940. This report covers Antwerp, Flushing, Ternheuzen, Zeebrugge, Ostend, Boulogne, Dieppe, Fecamp and Le Havre and runs to 10 detailed pages. The distribution list evolved and grew during the first few weeks, but from report number 68 dated 19 June 1940 stayed almost the same, as can be seen by comparison with report 599 dated 16 October 1940.<sup>250</sup>

Detailed analysis of the PIU reports covering barge movements show some interesting reporting characteristics. Many of the early reports do not give numbers of barges seen, often only referring to movement or increases or decreases from when last seen. This method of reporting was undoubtedly the principal method used up until mid-August. Then there is a significant increase in the reporting of exact numbers of barges seen at each location and of increases or decreases by number, where the photographs allowed individual barges to be seen.<sup>251</sup> The transcribed report number 593 is an excellent example of how the reporting process evolved giving far more detail than before and now also including the previous counts of shipping, barges and aircraft that were present at a location, as well as what is present now. They had evolved the reporting to include quantified changes since previous reconnaissance sorties, making each report easier to digest its content and to assess the importance of what was being reported. There is also an increase in the number of in-depth Third Phase reports, concentrating on modifications that had been made to barges to make them usable for transporting armoured vehicles for the invasion.<sup>252</sup> The change from vague reporting of increased or decreased barge numbers to far more detailed reporting of exact numbers including referencing increases or decreases from previous sorties provided the intelligence officers at higher headquarters with a far more precise picture. The greater detail and clearer picture provided by these photographic interpretation reports allowed the intelligence officers at the higher formations to draw conclusions of invasion preparations and when a seaborne assault could be launched.

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<sup>250</sup> See TNA, AIR 34/290 Report Number 68, dated 19 June 1940 & TNA AIR 34/295, Interpretation Reports: 500 – 599.

<sup>251</sup> See Tables 6 - 12, Barge Counts from Photographic Interpretation Reports 010 - 593.

<sup>252</sup> TNA AIR 34/294, Interpretation Reports: 400 – 499, Report 477.

When reading a large number of individual photographic interpretation reports, often multiple reports per day by late August onward, it is challenging to see a clear picture of what the Germans intended, just from the reports. A large number of interpretation reports and the fact they cover multiple targets on most of the missions from July onwards provides a very fragmented view of individual areas and it is difficult to see what the intent was behind all the movement clearly. The reports often gave numbers of barges in the canals and river networks as well as the invasion ports. However, the pressure on scarce reconnaissance assets had the impact of not allowing daily or at times even weekly coverage of all the critical invasion port targets.<sup>253</sup> This is seen in the next few tables that are compiled from the database formed from the analysis of the photographic interpretation reports.

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<sup>253</sup> Reconnaissance sortie priorities were decided by the Air Ministry much to the annoyance of the Admiralty. See: F Hinsley, et al, *British Intelligence in the Second World War Volume 1*, 278 – 282.

Table 6 Report Totals on Barges and Shipping, 16 May to 2 October 1940<sup>254</sup>

Date of Reports	No. of Relevant Reports	No. of Barges and Shipping Reports				
		Total	N.France, Belgium, Netherland Channel Coast	W. Coast of France	Germany	Italy
16 - 22 May	7	5	1		1	3
23 -29	5	5	5			
30 - 5 June	14	11	5			6
6 - 12	14	14	3		3	8
13 - 19	4	4	1			3
20 - 26	5	5	5			
27 - 3 July	10	10	8		2	
4 - 10	15	9	6	2	1	
11 - 17	11	9	8		2	
18 - 24	18	11	9	1	1	
25 - 31	33	17	12	3	2	
1 - 7 August	28	16	9	2	5	
8 - 14	30	15	13	2		
15 - 21	23	11	9		2	
22 - 28	18	5	5			
<b>29 - 4 September</b>	<b>29</b>	<b>14</b>	<b>10</b>	<b>1</b>	<b>4</b>	
<b>5 - 11</b>	<b>40</b>	<b>30</b>	<b>26</b>	<b>1</b>	<b>5</b>	
<b>12 - 18</b>	<b>22</b>	<b>20</b>	<b>16</b>	<b>3</b>	<b>1</b>	
<b>19 - 25</b>	<b>20</b>	<b>18</b>	<b>16</b>	<b>1</b>	<b>1</b>	
26 - 2 October	14	11	11			
<b>Total:</b>	<b>360</b>	<b>240</b>	<b>178</b>	<b>16</b>	<b>30</b>	<b>20</b>
<b>Percentage of Total reports</b>	<b>68%</b>	<b>45%</b>	<b>33%</b>	<b>3%</b>	<b>6%</b>	<b>4%</b>

Table 6 shows the period 16 May to 2 October 1940, when Wembley produced 532 reports in total. Of those reports, 360 mention barge, naval movements, or aerodromes, a total of 68% of all the reports produced by the PIU. Over the same period, 240 reports mention barges and invasion shipping activity, a total of 45% of all

<sup>254</sup> Over the period 16 May to 2 October 1940 the PIU at Wembley produced 532 interpretation reports.

the reports produced by PIU over the period. Over the same period, 252 reports mention aerodromes, aircraft and associated activity, a total of 47% of all the reports produced by PIU over the period. They concentrated a third of the reporting on coastal areas of Northern France, Belgium and the Netherlands, looking for any naval activity and reporting on all barge movements. Over the same period 40% of the reports over France, Belgium, the Netherlands and the Channel Islands reported out on any aerodromes and aircraft related activity. This shows a considerable effort looking at these two indicators that could give a warning of a German invasion of Britain.

There is a distinct increase in reporting from 25 July to 2 October, which highlights a period of greater concern with German invasion preparations. The Joint Planning Staff of the Chiefs of Staff were sufficiently concerned about the vast increase in German shipping in Channel ports and in particular the large concentration of barges that they requested a raid to gather more information on the barges and the equipment on the barges. This was to fill in a gap in intelligence that even detailed examination of the barge photographs could not provide.<sup>255</sup> It is of interest that this request was made at the height of the build-up of barges in the areas around and at the invasion ports of Rotterdam, Antwerp, Ostend, Calais, Boulogne and Le Havre, and just after Hitler postponed the invasion. It indicates that the Chiefs of Staff were most likely not getting an intelligence feed from Bletchley Park at the time that provided them with Hitler's intent and his 17 September postponement of any invasion plans for Britain.

The tables help identify the reconnaissance gaps that required more photographic reconnaissance missions to give a clear picture of what was being planned. However, when one looks at the totality of reporting on barges, naval units and harbours they appear to show an excellent coverage and detailed reporting as shown by the high percentage of reports in Table 6 and of the aerodromes in Table 7.

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<sup>255</sup> TNA CAB 84/19 J.P.(40) 455 dated 18 September, 1940.

Table 7 Report Totals on Aerodromes, 16 May to 2 October 1940.<sup>256</sup>

Date of Reports	No. of Aerodrome Reports				
	Total	France, Belgium, Netherlands	Germany	Scandinavia	Italy
16 - 22 May	4		1		3
23 - 29					
30 - 5 June	3				3
6 - 12					
13 - 19					
20 - 26					
27 - 3 July	1	1			
4 - 10	14	13	1		
11 - 17	9	8	1		
18 - 24	14	12	1	1	
25 - 31	32	27	2	3	
1 - 7 August	25	18	5	2	
8 - 14	29	28		1	
15 - 21	19	15	4		
22 - 28	18	15	1	2	
<b>29 - 4 September</b>	<b>28</b>	<b>23</b>	<b>4</b>	<b>2</b>	
<b>5 - 11</b>	<b>27</b>	<b>24</b>	<b>4</b>		
<b>12 - 18</b>	<b>13</b>	<b>12</b>	<b>1</b>		
<b>19 - 25</b>	<b>8</b>	<b>8</b>			
26 - 2 October	8	8			
<b>Total:</b>	<b>252</b>	<b>212</b>	<b>25</b>	<b>11</b>	<b>6</b>
<b>Percentage of Total reports</b>	<b>47%</b>	<b>40%</b>	<b>5%</b>	<b>2%</b>	<b>1%</b>

This good coverage is questionable as soon as the data is further extracted and placed in a table that shows that there are significant gaps in coverage. The build-up of barges at Rotterdam, a major invasion port was only reported on four times during September. Calais, an invasion port, was only covered successfully sixteen times during September, but the cover was only good enough to report out on the count of

<sup>256</sup> Over the period 16 May to 2 October 1940 the PIU at Wembley produced 532 interpretation reports.

barges ten times, though that coverage does capture the rapid build-up of the barges and also the decline towards the end of September as shown in Table 8.

The coverage of Italy in May, June and July is interesting as scarce resources were used by 1 PRU to send Spitfires to provide detailed coverage over Italy, especially as Italy was for most of this time a neutral country and only declared war against the Allies on 10 June 1940. The intelligence gathered was of use for targeting purposes by the Navy and Bomber Command, but the missions appear to have been authorised at the local level by 1 PRU, with a blind eye being turned by higher command. However, the secret photographic interpretation reports on Italian targets were sent out on a distribution list that included the Air Ministry, Bomber Command and the Admiralty Naval Intelligence Division as can be seen in the transcribed report PIR No 54 at Appendix 1.<sup>257</sup>

The Tables 8 and 9 show a weekly analysis of the PIU reports, concentrating on barge movements at the major German invasion ports from May to October 1940. The peak time for the invasion was in September and is highlighted in the tables.

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<sup>257</sup> TNA AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, 166-172 & Appendix XXX; & M Knox, *Hitler's Italian Allies* (Cambridge, Cambridge University Press, 2000) 69-74; P Morgan, *The Fall of Mussolini: Italy, the Italians, and the Second World War* (Oxford: Oxford University Press, 2008) 34-71.

Table 8 *Sealion* Invasion Ports, Barge Reports, 16 May to 14 October by Week

Week	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre
16 - 22 May						
23 - 29	x			x		
30 - 5 June						
6 - 12						
13 - 19						
20 - 26	x					
27 - 3 July	x					
4 - 10	x			x		
11 - 17			x	x	x	
18 - 24	x		x			x
25 - 31	x	x	x	x		
1 - 7 August	x			x		
8 - 14				x		x
15 - 21	x			x		x
22 - 28				x		
<b>29 - 4 September</b>		<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>	
<b>5 - 11</b>	<b>x</b>		<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>12 - 18</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>
<b>19 - 25</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>	<b>x</b>
26 - 2 October	x	x	x			x
3 - 9						
10 - 14		x				

Key: x = PIU Reports mention barges present.

Table 8 shows the coverage by week where PIU reports mention barges at the significant German invasion ports. The table shows the gaps in reporting, especially on Antwerp, Ostend, Boulogne and Le Havre in May, June, July and August. These gaps in reporting on barges made it more difficult to precisely follow the build-up of barges as Germany prepared for the invasion of Britain. The period 22 to 28 August, for example, shows very poor coverage of the invasion ports with only Calais being covered. The detailed analysis of the PRU operational Record Books shows that bad weather and significant cloud cover prevented more successful photographic reconnaissance sorties being flown during that period.

Table 9 *Sealion* Invasion Ports, Barge Count and Coverage, 16 May to 14 October by Week

Week	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre
16 - 22 May						
23 - 29	x			x		
30 - 5 June						
6 - 12						
13 - 19						
20 - 26	-40					
27 - 3 July	-60					
4 - 10	x			76		
11 - 17			-7	No change	x	
18 - 24	x		65			x
25 - 31	x	x	x	No change		
1 - 7 August	150			x		
8 - 14				x		x
15 - 21	-100			x		6
22 - 28				x		
<b>29 - 4 September</b>		<b>-100</b>	<b>120</b>	<b>x</b>	<b>50</b>	
<b>5 - 11</b>	<b>x</b>		<b>298</b>	<b>140</b>	<b>67</b>	<b>7</b>
<b>12 - 18</b>	<b>x</b>	<b>625</b>	<b>298</b>	<b>266</b>	<b>230</b>	<b>205</b>
<b>19 - 25</b>	<b>650</b>	<b>600</b>	<b>170</b>	<b>147</b>	<b>No change</b>	<b>No change</b>
26 - 2 October	245	450	79			140
3 - 9						
10 - 14		430				

Tables 8 and 9 show the significant gaps in coverage and the associated reporting on the invasion ports. The dates 29 August to 25 September are highlighted to show the period the build-up of German invasion barges and shipping was at its highest. There is no reporting on the number of barges at these invasion ports until Rotterdam in late June and Calais in early July. Table 9 shows the long periods where no reporting on barge numbers was being produced by the PIU. This lack of exact barge count numbers in May, June, July and August from reporting on the invasion ports would make the job of the intelligence officers at the Air Ministry and CIC more difficult as they tried to assess when an invasion was imminent as they had no basis for deciding what was normal barge traffic at these ports in May, June and July. PIU



would also report out on any signs of German troop and equipment build-up and loading at the invasion ports, which of course would indicate that any invasion was imminent.

Table 10 shows the barge counts each day during September, collected into eight geographical areas, which include part of Germany, Netherlands, Belgium and North France and their hinterlands. Again, this visualisation of the data shows that the reconnaissance missions reported out on invasion barges on an almost daily basis when taken across the eight geographic areas. Table 10 concentrates on September and shows the day's barges were reported in the eight areas analysed.<sup>258</sup>

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<sup>258</sup> The reports were analysed and placed in 8 areas: Germany, Amsterdam, Rotterdam area, Antwerp to West Scheldt, Belgian coast, North French coast to Calais and Dunkirk, North French coast to Boulogne and Dieppe, Rest of North French coast.

Table 10 *Sealion*, Barge Reports, 1 to 30 September by Location.

Location & Area	Germany	Amsterdam	Rotterdam area	Antwerp – West Scheldt,	Belgian coast	North French coast – Calais Dunkirk	North French coast – Boulogne Dieppe	North French coast
September								
1	x			x				
2	x			x				
3		x		x				
4				x			x	
5		x	x				x	x
6	x	x		x	x	x		
7			x	x		x		
8					x	x		
9	x			x	x		x	
10				x		x	x	
11					x	x	x	
12	x	x		x	x		x	x
13						x		
14								
15			x	x			x	
16								
17						x	x	
18		x		x	x	x	x	x
19								
20						x		
21			x	x		x		
22							x	x
23				x				
24			x					
25	x					x		x
26			x					
27			x	x		x	x	x
28				x	x			x
29			x					
30			x				x	

Table 11 *Sealion*, Barge Reports and Counts 1 to 30 September by Location<sup>259</sup>

Location & Area	Germany	Amsterdam	Rotterdam area	Antwerp – West Scheldt,	Belgian coast	North French coast Calais / Dunkirk	North French coast Boulogne / Dieppe	North French coast	Probable Total
September									
1	21			-100					
2	49			200					<b>249</b>
3		45		415					<b>509</b>
4				110			50		
5		90	68				55	15	<b>621</b>
6	No Num	52		400	374	184			<b>1181</b>
7			28	400		199			<b>1156</b>
8					298	301			<b>1181</b>
9	13+			Large Concentration No numbers	200		67		<b>1161</b>
10				200		140	41		
11					300	200	45		
12	Reduction	No Change		795	300		64	34	<b>1400</b>
13						120			
14									
15			60	150			102		
16									
17						501	150		
18		300		140	227	447	230	205	<b>1500</b>
19									
20						Increase			
21			650	600		220			<b>1800</b>
22							230	205	
23				No numbers					
24			500						
25	L.Reduction					147		70	
26			245						
27			235	125		300	175	345	
28				135	73			165	<b>900</b>
29			245						
30			235				160		

<sup>259</sup> TNA AIR 34/294, Interpretation Reports: 400 – 499; Report 457 describes the reduction and distribution of barges from Flushing down the coast despite Force 4-5 weather. Report 477 reports on position of barges in Dunkirk and how they can each carry 30 mechanised units. Report 479 describes slight increase in barges at Dunkirk, but no numbers. Report 485 describes unusual superstructure on barges, possibly for transfer of heavy units to shore. TNA AIR 34/295. Interpretation Reports: 500-599; Report 519 describes dispersal of barges from Flushing into Middelburg Canal probably as a dispersal against attack.

Table 11 shows that across the eight geographic areas a reasonably accurate picture of the build-up of invasion barges was seen as shown in the total column, reaching peak numbers on 21 September not long after Hitler postponed the invasion. Therefore, from the analysis of the PIU photographic interpretation reports it was possible to follow the build-up of invasion barges and the military preparations for an invasion. Four of the PIU photographic interpretation reports which show the format and detail of the reports have been transcribed at Appendix 1. The transcribed report No. 377 is a good example from early September as it shows how they reported out on the invasion barges and the barge movement. They clearly report out on a large increase in barges around Ghent and the 'abnormal' increase in barges on the Hansweert canal. This report was sent to the Foreign Office, MI6, Admiralty, Air Ministry and Bomber Command, which would have alerted them to the increasing barge traffic and numbers. The transcribed report No. 593 from mid-October is one of the longer reports and on the first page shows a reduction of barges in one of the Antwerp canals. The movements of the barges and slight reduction in barge numbers in the report are the start of the barges returning to use in the normal economy, where they were an important part of the transportation system.<sup>260</sup>

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<sup>260</sup> L McKinstry, *Operation Sealion*, 405.

Table 12 shows a day by day analysis of the PIU reports, concentrating on Barge movements at the major German invasion ports in September 1940.

Table 12 *Sealion* Invasion Ports, Barge Reports and Counts 1 to 30 September

September	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre	Probable Total
Base Count	Probably 210		80	60		6	
1		-100					
2							
3			120	X			<b>120</b>
4			115	X	50		<b>165</b>
5	X				55	7	<b>177</b>
6	X		205	53	X	X	<b>303</b>
7			270	102	17	X	<b>437</b>
8			298	85	7	X	<b>437</b>
9			200	X	67		<b>450</b>
10				140	41		<b>481</b>
11			300	X	45	X	<b>504</b>
12		625	300		64	34	<b>1125</b>
13				120			<b>1105</b>
14			P	P			
15	X		30	X	102		<b>1143</b>
16			X	X			
17				266	150		<b>1343</b>
18			227	255	230	205	<b>1500</b>
19			X			X	
20			X	235	X		
21	650	600					<b>2100</b>
22					230	205	
23			170			X	
24	500						
25				147	X	X	
26						X	
27					175	140	
28			73			165	
29	245					X	
30	235		79	123	160		

Key:

P = Pilot report – not confirmed by photographs

X = Location covered but no reports on Barges



Picture 1. Boulogne 18 September 1940<sup>261</sup>

Picture 1, above is included as an example of the annotated prints that accompanied some of the PIU interpretation reports and is from the 18 September 1940 cover of Boulogne port and the outlined areas on the photograph show 230 barges. Table 12, gives the most precise picture of the very rapid build-up of barges at the invasion ports between 4 to 21 September. Initially, the lack of daily coverage of the invasion ports shown in Table 12 can be challenging to understand why were more reconnaissance sorties not flown? Tables 6 and 8 show that numerous missions were tasked and reported out on barges on an almost daily basis during September, but not enough missions were flown to cover the invasion ports on a daily basis. This can be explained by bad weather and two constraints on the reconnaissance system as it existed in 1940. The Spitfires of the PRU conducted the majority of the reconnaissance sorties and they were still a very rare aircraft even by the end of July 1940. The PRU only had twelve Spitfires at the end of July, with only one of the very long range Spitfire PR1F, which had a range of 650 miles, and the Spitfire ranges from base can be seen in the map at Annex L.<sup>262</sup> The specially adapted Spitfire PR 1D, which required design modifications to hold even more fuel and had a range of

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<sup>261</sup> MA Acc no: 14941, Photograph of Boulogne Port. Showing 230 invasion barges outlined.

<sup>262</sup> R C Nesbit, *Eyes of the RAF*, 100 – 114. The PRU had an establishment for 16 Spitfires in July 1940, but not unusually was not filled to establishment and appeared to have only had 12. See TNA, AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, 196-198.

875 miles, did not enter service until the end of October so did not contribute to the reconnaissance during the German invasion threat. It can be seen that with only twelve reconnaissance Spitfires and very high demand, prioritisation of sorties was paramount.

The Battle of Britain in the air was the priority for Spitfire production, and the supply of more significant numbers of reconnaissance Spitfires would have to wait until the battle was won.<sup>263</sup> However, even with these constraints, the Spitfires of the PRU flying from their three bases of Heston, St Eval and Wick flew 619 sorties between July and the end of October with 479 sorties being successful, and with the loss of six Spitfires. The other reconnaissance aircraft of the PRU were the old Hudson, which over the same timeframe flew 30 sorties, with only 13 being successful, and with the loss of two Hudsons.<sup>264</sup> The figures show a high rate of reconnaissance sorties being flown by the Spitfires with a high 77% success rate for the sorties. This helped confirm the Spitfire at the time as the primary reconnaissance aircraft. The PRU Operational F540 and F541 log books show the details by day of each Spitfire by serial number that flew that day, where they were tasked and what photographs the pilot thought had been collected as well as weather reports over the target areas. There were a high number of missions that had bad weather and were unable to collect photographs during late August and September. The pilots reporting of successfully collecting photographs does not always correlate with a photographic interpretation report. Pilots sometimes reported collecting photographs of a target area, but the haze, cloud or distance to the target made the photographs uninterpretable or only part of a target was visible on the photographs or at times the

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<sup>263</sup> The RAF had a total of 750 Spitfires and Hurricanes available during the Battle of Britain and 2500 pilots – see: D Richards, *The Fight at Odds*, 151-197. The PIU never managed to get more than 8 Reconnaissance Spitfires in the air on any one day and had a small pool of forty-one reconnaissance pilots – see TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940. The PRU Reconnaissance Spitfire pilots during the critical month of September were: FL Baxter, FL Blaker, FL Clarke, FL Corbishley, FL Daleif, FL Fowler, FL Le Mesurier, FL Purally, FL Ring, FL Rush, FL Surally, FL Wilson, FO Baxton, FO Blackwell, FO Blatchford, FO Croxton, FO Dakeyne, FO Dalufer, FO Hills, FO Hood, FO Hyde-Parker, FO Illingworth, FO Miller, FO Parker, FO Taylor, FO Watts, FO Wilson, FO Wise, FO Wisen, FO Wysiekierski, FO Young, PO Featherstone, PO Hesketh, PO Hills, PO Hood, PO Millen, PO Mullen, PO Panton, PO Shorthouse, PO Williams & Sgt Morgan see TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940.

<sup>264</sup> TNA, AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, Appendix XXXII & Appendix XXXIII.

target was completely missed, so coverage of a target does not always equate to a report being produced.<sup>265</sup> Table 13 shows the number of Spitfires tasked per day during September and the number of times they were tasked against the invasion ports.<sup>266</sup>

Table 13 Photographic Spitfire Sorties for September 1940, Targets Tasked

Date	Where flown											
	September 1940	No. sorties	No. sorties +photo	No. Spitfires	Amsterdam	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre	Other
1	1		1									
2	4	2	3	2			1	1				1
3	5	4	4	1				1				3
4	9	9	6	1	1		1	1	3	1		5
5	6	4	5		1			1	1	1	1	5
6	4	4	3			1			1	1	1	1
7	8	8	5				2	2	1	1		5
8	7	4	4				1	3	3	2		2
9	8	8	7	1			1	1	1			5
10	2	2	2						1			1
11	9	8	7				2	2	2			5
12	7	6	6	2			1	1				4
13	4	2	3				1	2	2	2		1
14	4	3	4	1			1	1				2
15	5	3	3	1	1	1	2	1	1	1	1	3
16	2	0	2				1	1	1	1	1	1
17	9	7	8	1			1	1	2	2		7
18	1	1	1									1
19	4	2	4				1	1	1	1	1	2
20	5	5	5		1	1	2	2	1	1		1
21	3	1	2				1	1				2
22	3	1	3		1				1	1	1	1
23	9	7	6	1			1	1	1	2		5
24	3	0	3		1	1	2	2	2	1		
25	8	8	6				1	4	4	1		4
26	7	4	5				1	2	2	1		5
27	6	4	5				2	2	2	2		3
28	4	3	4				1	1	1	1		3
29	5	5	4				1	1	1	1		3
30	6	5	6				1	1	1	1		5
Total:	158			11	7	3	29	38	35	25		86

<sup>265</sup> From analysis of TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940 compared with PIU reports and comments in TNA AIR 29/227 Medmenham Operational Record Book.

<sup>266</sup> The data for the Spitfire sortie table has been compiled from an analysis of: TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940.



The highest numbers of reconnaissance Spitfires to fly on any one day were eight and the average over September was four Spitfires for photographic missions. The definitive history of the Spitfire, by Morgan and Shacklady, which lists every Spitfire by serial number, suggests that the PRU should have had fifteen Spitfires. However, those figures include those damaged, undergoing repairs and those not on the unit, but away having the alterations made for the cameras to be fitted. This analysis of the number of reconnaissance Spitfires flying missions is a valuable new perspective on photographic intelligence during Operation *Sealion*. When considering that this is the peak period of invasion threat from Germany it has to be remembered that the majority of Spitfire production was going into replacing losses sustained during the Battle of Britain to maintain 'The Few'. The total Spitfire production from the end of July to the end of September was 565, with over the same period 616 being lost, which shows why Spitfires for conversion to reconnaissance were very limited in number.<sup>267</sup> These reconnaissance Spitfires were a precious and scarce resource during June to October 1940 and were, in fact, the 'Very Few'.<sup>268</sup> As these very few specially adapted Spitfires were the only ones capable of flying reconnaissance missions safely in the contested skies over the invasion ports, a counter-factual history of the *Luftwaffe* specially targeting these aircraft on the ground would have quickly blinded the embryonic RAF reconnaissance efforts during a critical period.

Table 14 shows the number of times the Spitfires were successful in collecting photography against the invasion ports.

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<sup>267</sup> T James, *The Battle of Britain*, ed, S Cox, 389.

<sup>268</sup> TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940; E Morgan & E Shacklady, *Spitfire*, 235-238.

Table 14 Spitfire Sorties for September 1940, Targets Photographed<sup>269</sup>

Date	No. sorties	No. sorties +photo	No. of Spitfires	Where Photographed							Weather	
				Amsterdam	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre		Other
September 1940	No. sorties	No. sorties +photo	No. of Spitfires	Amsterdam	Rotterdam	Antwerp	Ostend	Calais	Boulogne	Le Havre	Other	Weather
1	1		1									
2	4	2	3				1	1			1	2 bad, 1 good
3	5	4	4					1	1		3	1 bad, 1 cloud & gaps
4	9	9	6	1	1		1	1	3	1	5	hazy or good
5	6	4	5		1		1		1	1	3	hazy or bad
6	4	4	3	1	1		1	1	1	1	1	good, hazy
7	8	8	5				2	2	2	2	5	good
8	7	4	4						1	2	2	bad or slight cloud
9	8	8	7	1	1		1	1	1		6	good or v cloudy
10	2	2	2						1		1	bad - cloud & rain
11	9	8	7				2	1	3	1	4	bad-good
12	7	6	6				1			1	5	variable cloud
13	4	2	3				1	1			1	bad - low cloud
14	4	3	4		1		2	1			1	variable cloud
15	5	3	3			1	1	1	1	1	1	bad
16	2	0	2									bad
17	9	7	8					1		1	6	variable, some bad
18	1	1	1								1	
19	4	2	4				1	1		1		mainly bad
20	5	5	5		1	1	2	2	1	1	1	variable cloud
21	3	1	2								1	bad
22	3	1	3						1	1		bad
23	9	7	6		1		1		1	1	4	variable cloud
24	3	0	3									bad
25	8	8	6					2	3	1	4	mainly heavy cloud
26	7	4	5				1	1			2	variable cloud
27	6	4	5						1		3	good - bad
28	4	3	4				1			1	2	variable
29	5	5	4				1	1		1	3	variable cloud
30	6	5	6				1	1	1	1	4	variable
<b>Total:</b>				<b>3</b>	<b>7</b>	<b>2</b>	<b>22</b>	<b>20</b>	<b>23</b>	<b>19</b>	<b>70</b>	

The PRU had forty-one reconnaissance pilots available in September, which with an average of four and a maximum of eight Spitfires available on any day confirms that the pilots were not the critical resource.<sup>270</sup> The Spitfire was the critical resource in

<sup>269</sup> TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940.

<sup>270</sup> TNA AIR 29/413 Operations Record Book Photographic Development Unit (PDU), later 1 Photographic Reconnaissance Unit 1939 – 1940; E Morgan & E Shacklady, *Spitfire*, 235-253.

the photographic intelligence chain during this period. An order for thirty reconnaissance Spitfires was placed in July 1940 with the Ministry of Aircraft Production, with the first six expected within a month, but the bulk of the order taking up to six months.<sup>271</sup> Without enough reconnaissance aircraft to cover all the invasion ports and all the other competing priority targets, a prioritisation system of tasking scarce reconnaissance missions was devised. This system had to balance the competing requirements of the three services, and the other government departments' need for intelligence from reconnaissance missions. The prioritisation and tasking process developed over time. In June 1940 the Combined Intelligence Committee prioritised and managed the requests for reconnaissance that pertained to any invasion, and this had priority on reconnaissance aircraft allocation.<sup>272</sup> The day to day allocation and control continued to rest with of the Air Ministry. This would in particular cause numerous complaints and dissatisfaction within the Admiralty, who even looked at recreating a special reconnaissance flight, with specialist civilian aircraft to ensure they would get priority.<sup>273</sup>

Another constraint on the production of reports by the PIU was the insufficient number of trained photographic interpreters available. The AOC in August 1940 had a total of twenty-seven civilian interpreters and an additional nine photogrammetry specialists for *Wild A5 Stereo* autograph work.<sup>274</sup> The RAF which was now running the PIU at Wembley, in addition to the AOC staff, had a photographic interpreter establishment of thirty-six, but could only fill sixteen of the positions by mid-August 1940. The total of forty-three photographic interpreters and nine photogrameters was a significant constraint on the ability to produce photographic intelligence reports, in a unit working twenty-four hours a day.<sup>275</sup> They would have had to concentrate on the production of reports from all the sorties and had very little time to consider more advanced techniques or procedures. The shortage of military photographic interpreters continued well into 1941 when the photographic

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<sup>271</sup> E Morgan & E Shacklady, *Spitfire*, 238-239.

<sup>272</sup> TNA, AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, 193-194

<sup>273</sup> R Barker, *Aviator Extraordinary*, 211-212,

<sup>274</sup> See Annex G for details of the *Wild A5 Stereo* autograph.

<sup>275</sup> TNA, AIR 34/83 *Aircraft Operating Company, P.I.U. and C.I.U.: internal organisation procedure and personnel*. Aug 1940 – June 1941. The PIU ran a simple 12-hour day and night shift system.

interpretation course at Nuneham Park was able to train sufficient photographic interpreters.<sup>276</sup>

The further analysis and consolidation of the PIU reports was undertaken by Admiralty and Air Ministry intelligence staffs on a daily basis. The Combined Intelligence Committee (CIC) in the Admiralty provided daily intelligence summaries of German preparations for an invasion. These CIC reports included analysis and consolidation of the photographic interpretation reports, providing an easier to digest view of the German invasion preparations and barge movements and total numbers.<sup>277</sup> The barge numbers were derived from analysis and consolidation of the PIU interpretation reports. However, the reports as shown in Tables 6 to 14 do not give complete or comprehensive coverage of the barges at the invasion ports. The PIU reports also include some details of the number of naval units at each port and the numbers of smaller merchantmen and fishing vessels.

When examining what signals intelligence was able to provide during this period, it is interesting to note that the first Bletchley Park decodes that mention *Sealion* were not issued until the 10 October 1940, and they did not give any detail of naval or barge movements nor did it indicate that Hitler had already postponed the operation. *Enigma* decrypts over this period were in fact totally silent on the build-up of barges at the invasion ports, dates for any invasion or landing points for the invasion in Britain.<sup>278</sup> The decodes were from *Enigma* decrypts of messages on the 21, 24, 25 and 27 September.<sup>279</sup> There would be no conclusive *Enigma* decrypt providing proof that the invasion had been postponed and then cancelled.<sup>280</sup> The photographic reports from PIU were the most frequent reports on German movements, from which the CIC could draw informed conclusions on German barge concentrations and thus capabilities during this part of the war until Bletchley Park was able to fill that void.

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<sup>276</sup> T Downing, *Spies in the Sky*, 85.

<sup>277</sup> TNA AIR 40/1637, *Admiralty daily summary of intelligence of German preparations for invasion of UK, Nos 1-147*. May – October 1940.

<sup>278</sup> P Calvocoressi, *Top Secret Ultra*, 90-91.

<sup>279</sup> TNA HW 48/1 Bletchley Park Operation *Sealion* Decodes, dated 21,24-25,27 September 1940; F Hinsley, et al, *British Intelligence in the Second World War Volume 1*,188.

<sup>280</sup> F Hinsley, et al, *British Intelligence in the Second World War Volume 1*,159-190.

The real possibility of an invasion by barge was taken very seriously, and the picture was built up and created from reconnaissance and photography as seen in a Joint Planning Staff note on invasion plans using barges dated 18 September 1940.<sup>281</sup> However, this also shows that they required more intelligence and suggested a raid was required. This report was produced when the massing of shipping and barges was at or near its maximum as seen in Tables 11 and 12, the day after Hitler postponed Operation *Sealion*.

The reports of the CIC started to report that the invasion of Britain was unlikely to take place before the Spring of 1941, from the 24 October 1940. The CIC report No.147 stated 'It is reported that the invasion of England is unlikely to take place before the Spring of 1941'. From the wording of the report it is very unlikely that it was just from an analysis of PIU reports. The wording, comment and side reference (CX 23.10.B.3) suggest it is from an Agent reporting source.<sup>282</sup> What is not reported as a significant indicator of postponement of the invasion are the PIU reports from 18 September on through October that shows movement and reduction in barges at critical ports.<sup>283</sup> This appears to show that the reduction in barges was not assessed by the CIC as a critical indicator for the postponement of invasion and that the CIC believed that they could be very quickly returned to invasion duty. They also countered the reduction in barge numbers at locations, with the hypothesis that the barges were moving between locations and incomplete photographic coverage precluded a complete picture. They did not appear to have taken account and given due weight to the reported return of the barges in large numbers to regular trade during the period mid-September and October.

As can be seen from the tables above and the transcribed interpretation reports at Appendix 1 the PIU reports give a reasonable if incomplete coverage of the German

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<sup>281</sup> TNA CAB 84/19, *Barge Borne Invasion*, J.P.(40) 455.

<sup>282</sup> CX was a prefix used by SIS for agent reporting. See: F Hinsley, et al, *British Intelligence in the Second World War Volume 1*, 138.

<sup>283</sup> TNA AIR 34/294 & AIR 34/295, Reports from No 469 18 Sep 40 to 593 14 Oct 40.

main invasion centres, the movements of aircraft, traffic and build-up of troops and equipment at these locations. The reports also show the build-up of a fleet of invasion barges, naval units and commercial shipping as well as keeping enemy airfields under observation. Then from late September through November 1940, the reports show the return of many of these barges and other vessels back to regular trade. The tables also give a good indication of how difficult it is to gain a complete picture of the German capability from one source of intelligence. The photographic interpretation reports, with the surveillance technology of the time not being able to see through cloud and limited aircraft availability, could not provide daily coverage of all the invasion ports, and in bad weather, the photographs could be difficult or entirely useless for interpretation.

With the insufficient number of Spitfires available, an average of four per day during September for reconnaissance missions, to try to mitigate that shortfall, visual reconnaissance missions were also conducted to monitor the Channel invasion ports. Coastal Command was tasked by the Air Ministry with conducting these visual reconnaissance missions, and the visual sightings were to be passed to the CIC for collation, added to the invasion picture being built up by the CIC. How successful these visual missions were in providing intelligence on their regular patrols has not been assessed as the CIC reports do not allow that detail to be extracted.<sup>284</sup> However, when one compares the visual sightings reported by PRU pilots, they give a general indication of activity but do not have the detail provided by close interpretation of the photographs. They could have given a general indication of activity but would have had great difficulty in giving any precise counts of barges or shipping, and when the weather was poor, they would have been as affected if not more so than the photographic reconnaissance aircraft.<sup>285</sup>

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<sup>284</sup> For the tasking of these missions see TNA, AIR 41/6 Draft RAF Narrative on Photographic Reconnaissance Vol 1, 193-194 and for the visual reconnaissance report input to the CIC see TNA, AIR 40/1637 Admiralty daily summary of intelligence of German preparations for invasion of UK, Nos. 1-147, 1 May 1940 to 31 October 1940. The Coastal Command visual reports were produced from the routine Coastal Command sorties and the details of what they contributed to in the CIC reports is not evident in the reports at reference.

<sup>285</sup> A Hendrie, *The Cinderella Service*.

The CIC sent out a daily summary of the intelligence report on German preparations for an invasion of Britain, which was a consolidated report and analysis of all the intelligence the CIC had been able to gather.<sup>286</sup> The CIC reports also provide a count of barges and other vessels, and they reported up to 1,700 barges being available by 14 September and identified Amsterdam as a major invasion loading port. They also reported on 14 September, the day before Hitler's chosen invasion date that the invasion threat was imminent. From the report wording, it would appear that they had identified all the barge concentrations in and around ports, but had also identified from the reconnaissance photographs that there had been no loading of the barges.<sup>287</sup> The fact that loading of the barges had not started was a good indicator that the invasion was not imminent in the next 24 hours.

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This case study has shown that the reports from PIU gave coverage of Channel ports, canals and airfields. The initial early reports from the PIU were not analytical and did not offer opinion or intent, but were in today's parlance only providing advanced photo reading. They provided descriptions of what was seen, and the only indications of any advanced techniques were when they extracted measurements from the photographs to try and confirm what shipping was present when the scale precludes simple visual identification. As they developed experience and built up a library of past reports, the later reports show evidence of using the previous cover for comparative analysis to identify change. They start to provide numeric assessments of barge and shipping numbers, including on many occasions increases and decreases. However, the reports were not an attempt to provide all-source analysis, but strictly confined to single source analysis from photography of what is seen on each photograph within the mission and then comparing that with previous library photographs and reports.

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<sup>286</sup> TNA, AIR 40/1637 Admiralty daily summary of intelligence of German preparations for invasion of UK, Nos. 1-147, 1 May 1940 to 31 October 1940.

<sup>287</sup> TNA, AIR 40/1637 Admiralty daily summary of intelligence of German preparations for invasion of UK, Nos. 1-147, 1 May 1940 to 31 October 1940. Report No: 107.

The PIU reports did provide the indicators and warnings needed to give alert of the build-up to an invasion. The JIC and the COS committees correctly interpreted the build-up of barges and small ships as meaning an invasion was imminent. They were, however, slower to realise that the invasion had been postponed as the PIU reported dispersal of the barges and small ships in late September and October. This case study has shown that the photographic interpretation reports from the PIU were a crucial source of intelligence in monitoring the invasion threat, but the problems of lack of frequent photographic reconnaissance coverage over the invasion ports is not admitted in the PI historiography. The PI historiography is also silent on the failure of the CIC Invasion reports to correctly interpret the reduction of barge numbers in late September and October as a postponement of the invasion. The first mention in the CIC reports about the postponement of the invasion comes from a CX report in October, not from the decline in shipping and barges at the invasion ports.

The case study has shown how the detailed comparative analysis and fusing of the PIU reporting with other intelligence sources was done centrally in London by the CIC, who produced detailed daily 'German Invasion Reports'. The study has shown a progression in the detail and analysis provided by the PIU in the reports as they gained expertise in analysis and experience. From the beginning they developed and followed good standard operating procedures, creating the three phases of analysis to produce First, Second and Third Phase reports. They quickly increased report output over the period as the number of reconnaissance sorties increased. They were also working as a centralised interpretation centre, working on photographs from Coastal Command, Bomber Command and the two PRU outstations at St Eval and Wick as well as those from the main PRU base at Heston. This centralisation of scarce resources such as the photographic interpretation staff and specialist equipment like the *Wild* at a single location allowed optimum use of resources and rapid development in reporting techniques and procedures.



The case study has shown by ground breaking analysis the significant intelligence that can be derived from photographic interpretation. The challenges included competing resources for Spitfires, obtaining enough photographic Spitfires to provide frequent coverage over targets to provide daily reporting of enemy movements, and the impact severe weather had on photographic reconnaissance. It has also demonstrated how difficult it was to interpret correctly the build-up and decline in barge numbers at the CIC, additional intelligence from other sources was needed to convince them the invasion had been postponed by October 1940. All this experience and expertise gained by the PIU would move with them as they changed their name to the Central Interpretation Unit in January 1941 and completed a move to RAF Medmenham in April 1941.<sup>288</sup> The following case studies will investigate how they developed the analytical and interpretation techniques to report out on far larger volumes of photographic sorties from far more aircraft and missions as the war continued.

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<sup>288</sup> MA RAF Medmenham F540 entry for 30 April 1941.

## Chapter 4

### Strategic Bombing, 1942 - 1943

These two case studies follow on from the naval-themed case study Operation *Sealion* and move to air themed case studies. The case studies will examine the support and intelligence that Medmenham provided to the Air Staff in Whitehall and in particular Bomber Command at High Wycombe for the planning of the bombing operations and then the assessment of the outcomes of those operations. The case studies will look at two significant operations during the RAF strategic bombing campaign against the Axis forces. The first is Operation *Millennium* in May 1942, the massed 1,000 bomber raid against Cologne, an already well-known target for Bomber Command by 1942. The second operation is Operation *Chastise* in May 1943 which by contrast was a precision attack against the Ruhr dams. These two operations will provide evidence of the capabilities of Medmenham to support increasing numbers and complex Bomber Command operations and to provide analysis of the operations by interpretation of the post-attack photographs. The case studies will also show how Medmenham and photographic interpretation techniques had advanced from the early days of the PIU as shown in Chapter 3.

The 1,000 bomber raid against Cologne has been chosen as one of the operations as it was possibly a seminal event in the survival of Bomber Command as a Strategic bombing force when other services were calling for the reallocation of Bomber Command aircraft to provide support for Coastal Command and direct support to the Army.<sup>289</sup> It was against this background that Bomber Command and in particular Sir Arthur Harris pushed for the first of the 1,000 bomber raids, Operation *Millennium*, a night attack on the 30/31 May 1942 against Cologne. The Operation *Millennium* case study highlights the level of photographic intelligence support needed to plan and assess the impact of an area bombing attack against a large target, in this instance, the city of Cologne. The attack against Cologne was deemed a success, with more

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<sup>289</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries* (Barnsley: Pen & Sword Aviation, 2014) 269 & C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945 Vol 1*, 378,402.

damage inflicted on Cologne than in any previous raid and with, what was deemed at the time to be, an acceptable level of aircraft losses.<sup>290</sup>

The second operation used in these case studies is again against strategic bombing targets, but this time a precision attack against the Ruhr dams on the night of 16/17 May 1943 by 617 Squadron. The dams raid is not only a world-famous event but an iconic one in the historiography of the RAF and Bomber Command but again at a critical time when the USAAF was questioning the ability of the RAF to mount precision attacks at night.<sup>291</sup> The attack against the dams was also considered a great success, hence the status the raid has in the Bomber Command historiography. This precision attack case study will look at the photographic intelligence used in the planning of the raid as well as the photographic intelligence used to assess the damage caused by the raid. The two operations in this chapter were conducted just over a year apart and showed how Medmenham provided intelligence for both operations, but the differences in that support provide a useful comparison to allow the development of a clearer picture of photographic intelligence and how it supported Bomber Command operations during the war.

These two case studies show the photographic intelligence support that Medmenham provided to Bomber Command and compare the support needed for area targets against that for precision targets. The comparison of the area target in Operation Millennium against Cologne during May 1942 with the precision attacks against the Ruhr dams in Operation Chastise during May 1943 provide good studies of the differing intelligence requirements. This is the first time the photographic intelligence requirements of these operations have been examined in detail, using all the Medmenham photographic interpretation reports. Therefore, this chapter provides a ground breaking and detailed analysis of photographic intelligence reporting from

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<sup>290</sup> TNA CAB 66/25, W.P. (42) 262 War Cabinet: Summary of Operations of Bomber Command for Fortnight Ending 1200 Hours Sunday June 7 1942.

<sup>291</sup> The dams raids have an iconic place in Royal Air Force history and were made into a 1955 British film, *The Dam Busters*. The raids have also been covered in numerous documentaries and continues to be of interest with the latest being a BBC documentary the *Dam Busters Declassified*. 17 October 2010. See also: J Holland, *Dam Busters: The Race to Smash the Dams 1943* (London: Bantam Press, 2012); R Owen, 'Considered Policy or Haphazard Evolution? No. 617 Squadron' (Unpublished doctoral thesis, University of Huddersfield, 2014).

Medmenham to Bomber Command. The case studies will draw out the importance of stereoscopic or 3-D photographic coverage was to the photographic interpreters in producing the detailed Medmenham reports. The fact Medmenham had developed into a large complex alphabet soup of photographic interpretation sections and the workload placed on many of these sections to support Bomber Command will also be shown in this chapter.

The RAF as an independent air force was formed partially because of the political belief that the bomber would always get through. This came from the experience gained during the First World War and especially the bombing of London by German Navy Zeppelin and later Gotha bombers. The creation of the RAF as an independent force can trace part of the argument back to those early German bombing raids. The competition for aircraft between the Royal Naval Air Service and the Royal Flying Corp and the single service focus on support to their own battles meant they did not collaborate or concentrate on air defence during 1914 to 1916. That left London with very poor or almost non-existent air defences for protection against the German air raids. It was finally the pressure from politicians and the two Smuts reports that forced through the creation of an independent RAF, rather than the services pressing for its creation.<sup>292</sup> The impression that the bomber would always get through was consolidated by the interwar experience of the Germans bombing Spain, Japan bombing China and also the British imperial policing experiences and was part of the perceived wisdom in 1939, hence the creation of Bomber Command.<sup>293</sup> The intelligence support provided to Bomber Command during the Second World War is

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<sup>292</sup> The first Zeppelin attacks against the UK were on 19 January 1915, with the first raids on London 31 May 1915. The Gotha bombers first attack against the UK was on 25 May 1917 and on the 13 & 14 June attacked central London killing 162. See for the Smuts Reports: TNA AIR 1/515/16/3/83; see also: T Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914-1945* (Princeton NJ: Princeton University Press, 2004)11-68; S Cox & P Gray, *Air Power History: Turning Points from Kitty Hawk to Kosovo* (London: Cass, 2002) 3-20; H Jones & W Raleigh, *The War in the Air: Being The Story of the Part Played in the Great War by The Royal Air Force. Vol I – VII* (Uckfield: The Naval & Military Press, 1937); J Morrow, *The Great War in the Air: Military Aviation from 1909 to 1921* (Washington DC: Smithsonian Institution Press, 1993) 310-312; R Overly, *The Birth of the RAF, 1918: The World's First Air Force* (London: W.W. Norton, 2018); I Philpott, *The Birth of the Royal Air Force: An Encyclopedia of British Air Power Before and During the Great War – 1914 to 1918* (Barnsley: Pen & Sword, 2013); J Terraine, *The Right of the Line* (London: Hodder and Stoughton, 1985) 7-10; AP3003, *A Brief History of the Royal Air Force* (London: HMSO, 2004)16-34.

<sup>293</sup> J Terraine, *The Right of the Line*, 7-10; D Bashow, *Soldiers Blue: How Bomber Command and Area Bombing Helped Win the Second World War* (Ontario: Canadian Defence Academy Press, 2011) 1-6.

well covered by Stubbington and Ehler. However, Stubbington praises photographic interpretation and reconnaissance, but does not cover it in any detail in his book, which is a gap this thesis seeks to fill. Stubbington instead concentrates on how signals intelligence and the Whitehall intelligence machinery supported or failed to support Bomber Command.<sup>294</sup>

Modern books assessing the impact of the strategic bombing offensive of the Allies are numerous. However, from a research perspective those by Overy, and Baldoli, Knapp & Overy, are rigorous studies and cover the political, social and industrial aspects of strategic bombing and are significant works on the use of bombing as a means of war and include discussions of the controversies and moral arguments about the British conduct of the campaign.<sup>295</sup> These books cover the broad picture and to look in more detail at the strategic bombing offensive, Webster and Frankland have produced an excellent official military history of the strategic air offensive in their four volume set, which was part of the British official history of the Second World War series.<sup>296</sup> These cover the development and progress of the offensive from the beginning, looking back to 1914 and covering the whole of the Second World War. They cover both Operation *Millennium* and Operation *Chastise* in detail, but with no mention of the role of Medmenham in these operations. For more detail derived from the operational record books of every Squadron that was part of Bomber Command during the war Martin Middlebrook and Chris Everitt have produced an excellent book detailing every Bomber Command raid, including details of each aircraft that took off on the raids and the results of the attacks which is a researcher's bible and provides

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<sup>294</sup> J Stubbington, *Kept in the Dark*, 321-356; R Ehlers, *Targeting the Reich*.

<sup>295</sup> See: C Baldoli, A Knapp & R Overy, eds, *Bombing States and Peoples in Western Europe 1940-45* (London: Continuum, 2011); B Bond, *Britain's Two World Wars against Germany: Myth, Memory and the Distortions of Hindsight* (Cambridge: Cambridge University Press, 2014) 100-124; R Overy, *The Bombing War*; also see: J Friedrich, *The Fire: The Bombing of Germany 1940-1945* (New York: Columbia University Press, 2008); S Garrett, *Ethics and Airpower in World War II: The British Bombing of Germany Cities* (New York: St. Martin's Press, 1993); M Obschonka, et al, 'Did Strategic Bombing in the Second World War Lead to German Angst?', *European Journal of Personality*, 31.3 (2017) 234-257; P Gray, 'A Culture of Official Squeamishness? Britain's Air Ministry and the Strategic Air Offensive against Germany', *Journal of Military History*, 77.4 (2013) 1349-1377; R Irons, *The Relentless Offensive: War and Bomber Command 1939-1945* (Barnsley: Pen and Sword Aviation, 2009); I Primoratz, ed, *Terror from the Sky: The Bombing of German Cities in World War II* (New York: Berghahn Books, 2014); A Tooze, *The Wages of Destruction: The Making & Breaking of the Nazi Economy* (London: Penguin Books, 2007).

<sup>296</sup> C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945*.

a solid framework for further analysis into other areas of the Bomber Command raids.<sup>297</sup>

The official UK report of the British Bombing Survey Unit remained classified for decades after the war and was only published in 1998 in the Cass series of Studies in Air Power. The report was published with an editorial preface, introduction and analysis of the whole report by Sebastian Cox, the head of the Air Historical Branch (AHB). This survey showed the difficulties that Bomber Command had in the early stages of the war in identifying and hitting targets at night. The Butt report in August 1941 had confirmed that only a third of bomber aircraft were actually dropping the bombs within five miles of the target.<sup>298</sup> It was against this background of poor strategic bombing accuracy that Sir Arthur Harris, colloquially known as 'Bomber' Harris, took over as the commander of Bomber Command in February 1942 and continued until September 1945. The majority of the secondary sources always comment on the importance of Sir Arthur Harris and his leadership and direction of Bomber Command. They also comment on the controversies surrounding how he conducted the strategic bombing campaign.<sup>299</sup> There has been much said and written about 'Bomber' Harris.<sup>300</sup> Henry Probert, a former head of the RAF AHB has produced one of the more rounded and complete books on Sir Arthur Harris in *Bomber Harris His Life and Times*.<sup>301</sup> Group Captain Dudley Saward, who was Harris's chief radar officer from 1942 has written the authorised biography of Harris in

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<sup>297</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*.

<sup>298</sup> See TNA AIR 14/1218, The Butt Report for an analysis of how far from the aim point on targets Bomber Command was in a report covering 2 June 1941 to 25 July 1941. The report was mainly based on the analysis of photographic evidence of the attacks and showed at least one third of bombers dropped the bombs over five miles from the target. Also, the Official UK Bomber Survey uses the plotting of night photographs to support the improvements in bombing accuracy, see S Cox, ed, *The Strategic Air War Against Germany, 1939-1945: Report of the British Bombing Survey Unit* (London: Cass, 1998) 46-47; A Harris & S Cox, *Despatch on War Operations: 23 February 1942 to 8 May 1945* (London: Cass, 1995) 75; See also a transcribed version of the Butt Report in C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945 Vol IV*, 205-213.

<sup>299</sup> See: R. Cording, 'The Other Bomber Battle: An Examination of the Problems that arose between the Air Staff and the AOC Bomber Command between 1942 and 1945 and their Effects on the Strategic Bomber Offensive', (unpublished doctoral thesis, University of Canterbury, New Zealand, 2006).

<sup>300</sup> J Grehan & M Mace, *Bomber Harris* (Barnsley: Pen and Sword, 2014); C Messenger, *Bomber Harris and the Strategic Bombing Offensive, 1939-1945* (London: Arms and Armour Press, 1984); H Probert, *Bomber Harris: His Life and Times* (London: Green Hill Books, 2001); D Saward, *Bomber Harris* (London: Buchan & Enright, 1984).

<sup>301</sup> H Probert, *Bomber Harris*.

*Bomber Harris The Authorised Biography*.<sup>302</sup> There is also *Bomber Offensive* by Sir Arthur Harris which provides his account of his time as the Commander of Bomber Command, the conduct of the strategic bombing offensive and dealings with his seniors from Churchill down and produced to balance what he believed was an attempt to re-write and denigrate the sacrifices of 'his boys' in Bomber Command. We also now have his declassified official report on the strategic bombing offensive.<sup>303</sup> However, for the whole period of the case studies in this chapter and to the end of the war, Sir Arthur Harris was the commander and provided the operational leadership and direction for Bomber Command.

For another academic and opposing view of the strategic bombing campaign that added to the controversies around Sir Arthur Harris's conduct of the campaign, A C Grayling provides a thought-provoking view in his book.<sup>304</sup> The chapters on the bomber war are a clear and concise account of the bombing campaign. However, to summarise his main argument, the Allies fought a Just War, but that the strategic bombing campaign was not just in the way that the RAF conducted an 'unjust' area bombing campaign, rather than just precision bombing. Grayling does praise the USAAF in Europe for conducting a just precision bombing campaign against industrial war targets and uses that as a lever to show that the RAF Bomber Command area bombing campaign was not the only option available with the technology available at the time, but a decision taken by Bomber Command and supported by the War Cabinet.<sup>305</sup> Grayling has added a postscript in the paperback version of the book, in which he addresses comments and criticisms of the first edition, but remains firm in his findings of an unjust area bombing campaign.<sup>306</sup>

*Bombing, States and Peoples in Western Europe 1940-1945* edited by an international team of historians, Baldoli, Knapp and Overy take a broader view of the

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<sup>302</sup> D Seward, *Bomber Harris*.

<sup>303</sup> A Harris, *Bomber Offensive* (London: Collins, 1947); A Harris and S Cox, *Despatch on War Operations*.

<sup>304</sup> A Grayling, *Among The Dead Cities: Is the Targeting of Civilians in War Ever Justified?* (London: Bloomsbury, 2007).

<sup>305</sup> A C Grayling, *Among The Dead Cities*, 47.

<sup>306</sup> A C Grayling, *Among The Dead Cities*, 283-293.

bombing campaigns looking at the cultural, moral, social and political areas of the multiple bombing campaigns during the Second World War. Bond in his book looking at both the First World War and the Second, provides a detailed rebuttal of the distortions he sees in many criticisms of the bombing campaign and attacks against Bomber Command and Sir Arthur Harris and is scathing of what he sees as cherry picking of historical facts by A C Grayling in his book.<sup>307</sup> The constant flow of post-attack detailed reports of damage assessment from Medmenham of all Bomber Command operations, as shown by detailed examination of the two operations in this chapter, show the Medmenham reports provided significant detail that could contribute to building up a picture of the moral impact of the British approach to strategic bombing. This impact could be assessed by looking at the detail of the attacks with all damage carefully itemised in the Medmenham damage reporting and often supported by detailed photographs of the destruction. These reports and photographs provided the details needed for comparative analysis of the impact of the Bomber Command attacks over time.

The first 1,000 bomber raid has been covered in the official histories and several books concentrating on the raid. The official history covers the raid with a matter of fact account of the inter service politics of building up a force of 1,000 bombers, the actual raid and then an analysis of the statistics of the raid, with the conclusion that it was a success. Overy covers the raid with a simple narrative account of the run up to

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<sup>307</sup> Baldoli, Knapp & Overy, *Bombing, States and Peoples in Western Europe 1940-1945*. Also see: J Arnold, *The Allied Air War and Urban Memory: The Legacy of Strategic Bombing in Germany* (Oxford: Oxford University Press, 2011); A Atkins, *Air Marshal Sir Arthur Harris and General Curtis E. Lemay: A Comparative Analytical Biography* (Bloomington IN: 1<sup>st</sup> Book Library, 2002); B Bond, *Britain's Two World Wars against Germany*, 100-124; M Connelly, *Reaching for the Stars: A New History of Bomber Command in World War II* (London: Tauris, 2001); D Edgerton, *England and the Aeroplane: An Essay on a Militant and Technological Nation* (Basingstoke: Macmillan, 1991); S Cox, ed, *The Strategic Air War against Germany 1939-1945*; R Ehlers, *Targeting the Reich*; J Friedrich, *The Fire*; S Garrett, *Ethics and Airpower in World War II*; M Obschonka, et al, 'Did Strategic Bombing in the Second World War Lead to German Angst?'; P Gray, *The Leadership, Direction and Legitimacy of the RAF Bomber Offensive from Inception to 1945* (London: Bloomsbury Academic, 2012); R Irons, *The Relentless Offensive*; W Murray, *The Luftwaffe 1933-45* (Washington DC: Brassey's, 1996); R Overy, *The Bombing War*; R Overy, *Why the Allies Won*; R Overy, 'Bombed Into Defeat?: Air Power and the End of the Second World War', *RUSI Journal*, 160.4 (2015)10-13; R Overy, 'Making and Breaking Morale: British Political Warfare and Bomber Command in the Second World War', *Twentieth Century British History*, 26.3 (2015) 370-399; I Primoratz, *Terror from the Sky*; B Von Benda-Beckmann, *German Historians and the Bombing of German Cities* (Amsterdam, Amsterdam University Press, 2015) and for a view from A Harris see: A Harris, *Bomber Offensive*; A Harris & S Cox, *Despatch on War Operations*.



the raid and then lists the results. Primoratz also details the results of the raid, but mentions that Churchill was highly satisfied with the raid and that was the one opinion that really counted.<sup>308</sup> The greatest success of the 1,000 bomber raid may well have been the survival of Bomber Command as a strategic bombing force and its future growth.<sup>309</sup> For those wishing to look at the raid in detail, it is well covered by aviation author and historian Ralph Barker and also by aviation author Eric Taylor. Barker gives a good and accurate account of the chronology of the planning, preparation, execution and aftermath of the raid.<sup>310</sup> He rather grandly identifies it as one of the critical turning points of the Second World War. Taylor also has excellent coverage of the planning, execution and aftermath of the operation, but also provides an interesting perspective. As he had lived in Cologne for a few years, he includes interviews with eye-witnesses and an extract of the effects of the raid on Cologne from the Cologne City archives.<sup>311</sup>

The Ruhr dams raid, Operation *Chastise* has been covered in the official histories, 617 Squadron unofficial histories and personal accounts of those involved in the raid as well as film and documentaries. There is a very long list of narrative accounts of the raid, but for a more balanced and authoritative account of Operation *Chastise*, the historian John Sweetman has produced one of the best.<sup>312</sup> It covers pre-war Air Staff plans for attacking German dams, through the development of the *Upkeep* weapon and modified Lancasters, the raid and its results as well as an analysis of the significance of the operation. In the same vein, James Holland has produced a good and well-analysed account of the Operation.<sup>313</sup> The aviation author and specialist on 617 Squadron and the dams raid Alan Cooper has produced four books on the dams raid, with his latest being a good and easy to read narrative account.<sup>314</sup> For an account from the German perspective Helmuth Euler in his book provides an

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<sup>308</sup> R Overy, *The Bombing War*, 292-293; I Primoratz, *Terror from the Sky*, 29-30.

<sup>309</sup> C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945 Vol 1*, 402-417.

<sup>310</sup> R Barker, *The Thousand Plan: The Story of the First Thousand Bomber raid on Cologne* (London: Chatto & Windus, 1965).

<sup>311</sup> E Taylor, *Operation Millennium: 'Bomber' Harris's Raid on Cologne May 1942* (Staplehurst: Spellmount, 2004) 203-204.

<sup>312</sup> J Sweetman, *Operation Chastise: The Dams Raid, Epic or Myth* (London: Jane's, 1982); see also: J Sweetman, G Johnstone, D Coward, *The Dambusters* (London: Time Warner Books, 2003).

<sup>313</sup> J Holland, *Dam Busters*.

<sup>314</sup> A Cooper, *The Dam Buster Raid: A Reappraisal 70 Years On* (Barnsley: Pen and Sword Aviation, 2013).

insight into how Germans viewed the raid.<sup>315</sup> The book covers the development of the weapons, the attack and aftermath like many other books, but includes recollections, German official records and pictures as well as accounts of German attempts to develop a bouncing bomb. There is also as well as the official 617 records, Wing Commander Guy Gibson's posthumously published account of the dams raid in his book.<sup>316</sup> There is almost no discussion of the intelligence picture available to Bomber Command for Operation *Millennium* and when mentioned at all, it is that photographic reconnaissance provided the confirmation of the results of the raid. The accounts are completely silent on the amount of work Medmenham had to undertake to provide the post attack damage assessment reports.

Medmenham received reconnaissance photographs mainly from the specialist PRU aircraft as well as from Bomber Command and Coastal Command aircraft that were also fitted with cameras.<sup>317</sup> Chapter 3 on Operation *Sealion* showed how the very few Spitfires available for photo-reconnaissance, never more than eight a day provided the photographs for the photographic interpreters to analyse and track the German build-up of invasion barges. This was undertaken with the first versions of the Photographic Reconnaissance Spitfire the PR Mk1, Mk II, Mk III and Mk VI all of which had entered service by April 1940. The Spitfire PR Mk IV was the longest-range PR Spitfire of the early Spitfires, but did not enter service until October 1940 and only one Mk V was ever produced. These aircraft differed from one another by the range and altitude they could reach and the size of the fuel tanks.

They used the already old F 8 survey cameras and F 24 cameras as shown in Annex D. The F 24 camera though already an old camera was very flexible in its use as it could be mounted vertically, obliquely or even used as a hand-held camera. It was the workhorse camera for the RAF at the start of Second World War. These were the reconnaissance aircraft and cameras that were the collection capability of the RAF

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<sup>315</sup> H Euler, *The Dambuster Raid: A German View* (Barnsley: Pen & Sword Aviation, 2015).

<sup>316</sup> G Gibson, *Enemy Coast Ahead* (London: Michael Joseph, 1946).

<sup>317</sup> Bomber Command & Coastal Command provided almost half of all sorties received by Medmenham for analysis. They were mainly for damage assessment work by Medmenham. See Annex I Reconnaissance Sortie Graph 4.

between 1939 and 1941. The arrival of the Mosquito PR Mk 1 in September 1941 provided the RAF with a longer-range reconnaissance aircraft and one that being twin engine and larger than the Spitfire could easily hold several cameras. The first new camera of the war the F52 did not enter service until early 1942, but with its longer focal length, increased film format and larger film magazine provided the photographic interpreters with more and better photographs for interpretation.<sup>318</sup> Then in 1943 to compensate for blurred images on low level fast flying Spitfire missions a derivative of the F 52 was introduced, the F 63 that allowed the film to continuously move as the picture was taken to compensate for the aircraft movement. This movement compensation allowed sharp photographs to be acquired for the Medmenham photographic interpreters. There were also developments in film processing with a KODAK high speed film processor being delivered in 1941 that developed, dried and spooled the film at a rate of two hundred and forty foot per hour.<sup>319</sup> This continuous film processing system was a significant advance over the previous manual bench processing method. This film processing advance coupled with advances in printing with the introduction of the Williamson Multiprinter also in 1941 that could produce up to one thousand four hundred prints per hour allowed very rapid development and printing of the film as soon as the reconnaissance aircraft had landed.<sup>320</sup> The multiprinter also allowed Medmenham to rapidly produce prints to distribute with the intelligence reports.<sup>321</sup>

However, the major advance in the photographic collection capability from 1940 to 1942-43 was the vast increase in the number of photographic reconnaissance Spitfires available from the very few in 1939-40. This growth of reconnaissance collection capability from 12 to over 190 Spitfires allowed a vast increase in the

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<sup>318</sup> MA Acc no: 23832 Air Publication 112P-0021-1 Aircraft Camera Type F52.

<sup>319</sup> MA Acc no: 18404, Air Publication 1355 Manual of Air Photography Section M Vol 1 Section 1, Chapter 1.

<sup>320</sup> MA Acc no: 18404, Air Publication 1355 Manual of Air Photography Section M Vol 1 Section 1, Chapter 1; MA Acc no: 18666, *Copy of article from FLIGHT Magazine 1943, The Williamson Universal Multi Printer*; R Holmes, *Sky Spy: from Six Miles High to Hitler's Bunker* (Shrewsbury: Airlife, 1989) 267.

<sup>321</sup> For more details on the Continuous Film Processor, Multi-Printer, Bench Processing and Aerial Film Duplication see: RAFMH, T520746, AP 1355 *Processing Printing and Duplicating Machines Section G* Vol 1, dated 1944; 'Photographic Reconnaissance in World War II', *RAFHS Journal*, 10 (1991) 4-75.

number of sorties flown and targets photographed and at better quality.<sup>322</sup> The main technical developments in the RAF photographic collection capability from 1940 to 1942-43 were the incremental increases in range, and altitude by the Spitfires as new versions became available as well as the introduction of the Mosquito for long-range reconnaissance missions. All these missions were aided by the development of the new F52 camera with its longer focal length lenses, the F63 derived from the F52 for low level missions with the image movement compensation advances it incorporated and incremental advances in the F24 camera during this period. At the same time, the photographic interpreters had increased in numbers and moved from the Photographic Interpretation Unit at Wembley to Danesfield House in April 1941 with an establishment of 231, but was only manned to about 115 personnel. However, with the additional space the Unit at Medmenham provided and increased tasking it soon expanded and by November 1942 was already ten times larger having grown to 1122 personnel.<sup>323</sup> There was also an improvement in the stereoscopes that the photographic interpreters could use, from the basic D Type stereoscope that gave good stereo, but no magnification to the more advanced Universal Stereoscope Type SV-3 and the Fairchild F-71, both mirror and magnifying stereoscopes that provided two and four times magnification.<sup>324</sup> See Annex S for more details on the stereoscopes.

For this case study, all reports produced by Medmenham on Cologne from January to August 1942 and on the dams from February to May 1943 have been examined, data extracted into a database, which has been used for analysis and extracted to form some of the tables in this study. The reports on both Cologne and the dams have been analysed in detail, and the significant items from each report are

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<sup>322</sup> The PRU had 12 reconnaissance Spitfires in September 1940, growing to 32 Spitfires for reconnaissance in May 1941, The number of reconnaissance Spitfires then rapidly grew to over 190 from 1942 to 1945. There were a total of 382 Photo Reconnaissance Spitfires manufactured, out of a total Spitfire production run of almost 23,000. All PR Spitfire serial numbers and details were extracted into a database for analysis. Sources TNA AIR 29/415 1 PRU ORB; AIR 29/432 3 PRU; AIR 27/2007 540 Squadron ORB, AIR 27/2013 541 Squadron ORB; AIR 27/2017 542 Squadron ORB; AIR 27/2025 543 Squadron ORB, E Morgan & E Shacklady, *Spitfire*, 245-248 & [www.airhistory.org.uk](http://www.airhistory.org.uk) [accessed 14 July 2016]; The increase in sorties from 2239 in 1940 to 8510 in 1943 is shown in the Graph 4 at Annex I.

<sup>323</sup> Database of Personnel numbers extracted from analysis of Medmenham ORB.

<sup>324</sup> MA Acc no: 3588, F-71 Stereoscope and instruction book; Acc no: 723, Type D Stereoscope; MA Acc no: 3598, Universal Type SV-3 Stereoscope; see Annex S for the Type D and SV-3 Stereoscopes.

discussed. The examination of each of these Medmenham reports in detail, is a key part of the methodology used in this thesis. The vast numbers of reports produced by Medmenham during the war can provide a daunting amount of detail as Medmenham produced over 38,000 Interpretation Reports and 15.5 million photographs to illustrate the reports from 1940 to VE-Day.<sup>325</sup> However, by selecting case studies for this thesis, it has been possible to review in detail every intelligence report produced by Medmenham for those case studies. This allows a fuller understanding of what intelligence they were able to produce for each operation and the analysis of the success of the operations via the post-attack photography. The frequency and detail of the reconnaissance needed to provide that level of detail and the ability to analyse how Medmenham performed and evolved during the war can be investigated from the examination of these case studies.

From the initial examination of the Cologne reports, it is only those from late March on that are of relevance to this case study and are listed in Table 15.

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<sup>325</sup> See Graphs 2 & 3.

Table 15 Medmenham CIU Reports covering Cologne, 23 March to 10 August 1942<sup>326</sup>

No	CIU Report No	Date of Sortie	Date of Report
1	Interpretation Report 3190	23 March	24 March
2	Interpretation Report K.S.3	From 12 March 1941 to 13 October 41 using 12 Sorties	2 April
3	Interpretation Report 3393	15 April	16 April
4	Night Photography Plotting Report N.31	22 April	24 April 42
5	Interpretation Report 3475	25 April	26 April
6	Interpretation Report N.S.11	22/23 April & 27/28 April	19 May
7	Interpretation Report K.1309	15 April	27 April
8	Interpretation Report 3497	28 April	29 April
9	Interpretation Report 3508	29 April	30 April
10	Interpretation Report K.1315	29 April	30 April
11	Interpretation Report K.1319	25/29 April	3 May
12	Interpretation Report 3573	6 May	7 May
13	Immediate Damage Report K.1323	6 May	7 May
14	Interpretation Report K.1325	6 May	9 May
Cologne Raid Night of 30/31 May 1942			
15	Immediate Interpretation Report K1333	1 June	2 June
16	Interpretation Report 3718	2 June	3 June
17	Interpretation Report K1333	1 June & 5 June	8 June
18	Interpretation Report 3731	3 June & 4 June	5 June
19	Interpretation Report 3743	5 June	6 June
20	Supplement to Interpretation Report K1333	1 June & 2 June	14 June
21	Interpretation Report K1345	20 June	25 June
22	Interpretation Report N.S.18	30/31 May	1 July
23	Interpretation Report N.26	Multiple	10 August

Table 15 shows fourteen Medmenham Photographic Interpretation reports that mention Cologne before the 1,000 bomber raid. These include six standard Second Phase reports, two-night photography reports and six K Section damage assessment reports. The organisation of Medmenham had evolved from April 1941 into an almost

<sup>326</sup> The reports in the table are in TNA in AIR 24/242, AIR 24/243, AIR 24/244, AIR 34/320, AIR 34/321, AIR 34/322, AIR 34/324 and in the MA in MA Acq 11480 and MA Acq 11486. No 20 is a supplement to Report K.1333 and is a good example showing how Medmenham continued to examine photographs and if the second or Third Phase photographic interpreters found additional information it would be sent out as a supplemental report under the same report number.

industrial factory organisation to accept, process, analyse and report out on all photographic sorties. To do this Medmenham had grown in size and complexity from its early days. Medmenham was now an organisation of over one thousand, divided into twenty-three sections to efficiently sort, analyse and report out on the reconnaissance sorties.<sup>327</sup> This growth can be compared with that of Bletchley Park as shown in Table 5. The twenty analytical sections were a crucial resource able to concentrate on specialist reports.<sup>328</sup> Medmenham produced all the interpretation reports with a sequential serial number. The immediate interpretation reports and then the Second Phase Z section reports had plain sequential numbers, while all the other specialist sections reports were produced with the Section letter designator followed by a sequential report number.<sup>329</sup>

K Section was a specialist Medmenham Section and produced the Bomber Command damage assessment reports, which reported out in detail on the results of the Bomber Command raids.<sup>330</sup> These K Section reports accurately reported on where Bomber Command bombs fell and what damage they did as well as any repair work and were usually produced from photographic reconnaissance sorties over the target area flown after the raids, usually the next day. When Bomber Command in the early years of the war had great difficulty in identifying the targets at night, these reports showed how far from the targets many of the bombs fell. This photographic proof of where the bombs fell, compared with the planned target area contributed to the development and advances in navigation and bomb aiming equipment to increase bombing accuracy.<sup>331</sup>

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<sup>327</sup> See Annexes A, B & I.

<sup>328</sup> See Table 3, Note: There were only 19 analytical sections if the *Wild* as considered photogrammetric only, or 20 if the *Wild* was counted as an intelligence section. For this thesis it is considered an analytical section.

<sup>329</sup> For example, from Z Section Interpretation Report 3393, from K Section K.1325 and from N Section N.26 see Annex O.

<sup>330</sup> See Annexes A, B & I.

<sup>331</sup> See TNA AIR14/1218, The Butt Report for an analysis of how far from the aim point on targets Bomber Command was in a report covering 2 June 1941 to 25 July 1941. The report was mainly based on the analysis of photographic evidence of the attacks and showed at least one third of bombers dropped the bombs over three miles from the target. Also, the Official UK Bomber Survey uses the plotting of night photographs to support the improvements in bombing accuracy, see S Cox, ed, *The Strategic Air War Against Germany, 1939-1945*, 46-47; A Harris and S Cox, *Despatch on War Operations*, 75.

N Section produced the night photography reports, and these were also sequentially numbered but in the N series. These night photography reports were complex to analyse from the night photography and included photography from many of the night-time bomber command aircraft.<sup>332</sup> The photographic interpreters in N Section became expert at identifying the mass of information hidden in the photographs. These reports due to the complexity of identifying the location of the photographs and the detail in them were produced between a few weeks and up to a couple of months after the actual bombing raids. The night photography reports also provided information on the evasion tactics of the aircraft and weapon effectiveness, which included helping analyse and develop the target indicators used by the Bombers.<sup>333</sup>

Medmenham was producing special FLAK reports from H Section on a monthly basis, special decoy site reports from Q Section and reports on German camouflage from E Section.<sup>334</sup> Bomber Command would try to avoid FLAK defences on route to target areas, however the density of FLAK around major targets and cities made complete avoidance impossible. The FLAK reports were created by taking details from every Bomber Command photograph and PRU reconnaissance photograph to identify FLAK sites, produce reports on these sites and also produce FLAK maps.<sup>335</sup> The photographic intelligence that went into creating the FLAK reports was produced from daily methodical analysis of all these relevant photographs and compiling lists of what they could see and compare that with what they already knew from previous sorties in a comparative analysis. However, the FLAK maps had to be updated daily, and that was the responsibility of the Station intelligence officers to keep them updated for the aircrew from the daily Medmenham reports. This shows how Medmenham provided Bomber Command with important intelligence on an almost

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<sup>332</sup> The cameras on the Bomber Command aircraft in 1940 to late 1941 tended to be fitted to the aircraft with the best crews, so there is some skewing of results compared with the average crew. All Bomber Command aircraft were to have cameras fitted that automatically produced photographs when the bombs were released, this was finally achieved in late 1942. See A Harris and S Cox, *Despatch on War Operations*, 75.

<sup>333</sup> TNA AIR 41/7 Draft RAF Narrative Photographic Reconnaissance Vol 2. 46.

<sup>334</sup> See Annexes A and B.

<sup>335</sup> FLAK was also reported in normal daily Medmenham Second Phase reports when they identified FLAK, the specialist H Section reports providing a consolidated picture of FLAK locations.



daily basis that allowed the German FLAK defences to be plotted and avoided when possible. Bomber Command certainly planned routes around the densest concentrations of FLAK. The concentrated effort the Germans placed into the FLAK defences were based on their operational experience from the use of the 88mm FLAK gun during the Spanish Civil War, where it had been very successful.<sup>336</sup> These FLAK and decoy site reports were also used by Bomber Command for the planning of the nightly bombing missions.

Medmenham also produced special reports on decoy sites, the sites the Germans built to confuse Bomber Command crews to bomb the wrong target. The decoy sites were reported out by Q Section at Medmenham, and Decoy Report Q.3 included details of all the known decoy sites around Cologne. These continued to be updated, and report Q.14 contained the last additions to the decoys around Cologne before the raid.<sup>337</sup> Medmenham also produced a map of all the known decoys around Cologne. The details in the interpretation reports analysed above do not show any real tasking of CIU for intelligence to support Operation *Millennium*. As already mentioned, this is not a surprise given the regularity and frequency that Bomber Command had been attacking Cologne, so that the Bomber Squadrons would have been used to Cologne as a target and the target packs they kept would have been up to date and would not have required any additional special reports from Medmenham for the operation.

The fourteen reports that cover Cologne before Operation *Millennium* are listed in the Table 15, and the content of each report is examined in detail in Annex O. From the analysis of the reports before Operation *Millennium*, it can be seen that there are no

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<sup>336</sup> The Germans had great success with FLAK guns during the Spanish Civil War and therefore used dense FLAK defences to protect German cities. However, the FLAK guns were very efficient against low level aircraft, but far less effective against high level bombers and analysis shows they expended significant numbers of shells for each aircraft brought down, in the case of the 88mm FLAK gun an average of 16,000 shells. W Murray, *The Luftwaffe 1933-45*, 15, 132, 190 & 199; B Kroener, R Muller, H Umbreit, *Germany and the Second World War Vol V Part II: Organization and Mobilization in the German Sphere of Power: Wartime Administration, Economy and Manpower Resources 1942-1944/5* (Oxford: Clarendon Press, 2015) 631-638. However, FLAK did inflict significant damage to many Bomber Command aircraft at a rate of 8.6% up until Operation *Millennium* and 8.1% on the actual raid see: C Webster & N Frankland, *The Strategic Air Offensive against Germany 1939-1945*, 409.

<sup>337</sup> MA, Aqc No: 8475, Q Section Decoy Report Q.3 Cologne.

interpretation reports from Medmenham specially tasked and prepared for Operation *Millennium*. Out of the fourteen reports, six were the normal Second Phase Medmenham reports from Z Section and five of those covered multiple targets, not only Cologne. These five reports covering multiple targets are part of the normal work of Medmenham and the Second Phase Section, who examine all photography flown and produce detailed reports on all areas of interest seen on the photographs. The single Second Phase report that concentrated on Cologne, Report 3508 was concise, covering invasion barges and dummy sites and of little strategic value. It is evident by how short and superficial the report is, that it was not tasked as a special report for the conduct of an vital operation like Operation *Millennium*.<sup>338</sup> All six of these Z Section Second Phase reports only provided minor details on waterway activity, airfield activity and some air defence activity in and around Cologne. They were not the detailed reports that would have been produced to support a major operation.

The rest of the reports are all damage assessment reports derived from photographs. The analysed detail of these reports is in Annex O, and they are tabulated in Table 15. The damage assessment reports always reported out on all damage to transportation infrastructure, industrial, military and civilian buildings as well as any defensive anti-aircraft installations that were visible. These damage assessment reports would have been of use for Operation *Millennium* as they set the baseline for what had already been damaged or repaired in Cologne so that the reports after the 1,000 bomber raid could assess the damage the raid created and not mistake damage from previous raids. One of the damage assessment reports stands out as being of particular interest, Report N.S.11. This report was on the results of the experimental GEE raid on Cologne on the 23/24 April.

The GEE system was a radio navigation system that helped bombers navigate to the target with better accuracy than the traditional navigation aids and ground observations. The raid on the 23/24 April was one of the initial operational tests of

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<sup>338</sup> TNA AIR 34/322 CIU Report 3508 dated 30 April 1942.

the GEE system. An earlier operational test of GEE was on a very successful raid against Cologne on 13/14 March.<sup>339</sup> For the actual Operation *Millennium* raid against Cologne, the lead bombers were fitted with GEE and had experienced crews to use it to help with the accuracy of bombing for the rest of the bomber stream following behind the lead aircraft.<sup>340</sup> Two of the damage assessment reports were from two night time photography reports that covered damage where it could be seen as well as the fall of the bombs and incendiaries. These night photography reports required photographic interpreters skilled in the procedures and techniques needed to interpret these difficult photographs. These reports always required significantly more time to analyse than the normal day light photography but produced intelligence not available from the daytime post-attack photography. The night-time photography could produce intelligence on the actual track of the bomber and the fall of individual bombs and incendiaries as well as the location of Germany decoy sites. The German decoy sites often proved more successful in attracting bombs than the real target as the failed raid against Mannheim on 19/20 May 1942 showed.<sup>341</sup> The Medmenham reports could also provide the location of the German anti-aircraft guns or FLAK batteries as they were known, as well as searchlight locations, fire pit decoys and smoke generators to obscure targets.<sup>342</sup> All this intelligence helped build up the defensive picture around Cologne and helped in the production of the Medmenham FLAK reports.<sup>343</sup> These were all part of the normal process for Medmenham to interpret both Bomber Command night photographs and PRU Spitfire daytime reconnaissance sorties to assess the damage inflicted on a target by bombing missions. The Medmenham Q Section that worked on German decoys, as well as E Section that worked on German camouflage, would also be contributing to

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<sup>339</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 248.

<sup>340</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 270.

<sup>341</sup> The Germany decoy sites would be set up in the countryside and have fires lit in an attempt to get the bombers to drop the bombs in the countryside at the decoy sites, rather than on the target area. These decoy sites could be made to look like the towns, industrial sites, airfields or other targets. See E Westermann, 'Hitting the Mark, but Missing the Target', 206-221. For a more detailed investigation of the successes of the German ground based air defence system see also the PhD by E Westermann, *Defending Hitler's Reich: German Ground Based Air Defences, 1914-1945* (unpublished doctoral dissertation, University of North Carolina, 2000).

<sup>342</sup> See TNA AIR 24/242 Night Photography Plotting Report N.31 & AIR 24/243 Interpretation Report NS.11 for examples of Medmenham reports from Bomber Command night time photography.

<sup>343</sup> For a detailed analysis of the German Air Defence system, including aircraft, FLAK, decoys and other ground based defences see: H Boog, G Krebs & D Vogel, *Germany and the Second World War Vol VII*, 159-240.

the whole picture of what the Germans were doing in and around Cologne to defend against, confuse and misdirect the bombing attacks.

Table 16 Bombing Raids on Cologne, January to May 1942<sup>344</sup>

Pre Operation <i>Millennium</i>			
No	Date	No of Bombers	Raid Results
1	13/14 February 1942	39	Poor bombing results reported and poor weather, thick cloud.
2	13/14 March 1942	135	First raid to use GEE and good bombing results reported, later analysis showed the raid to be five times more effective than previous raids on Cologne.
3	5/6 April 1942	263	Main target was Humboldt works, which were missed by over five miles.
4	22/23 April 1942	69	Experimental Raid, all bombers equipped with GEE. Results were mixed with both accurate bombing and others up to ten miles off target. Only minor damage to Cologne.
5	27/28 April 1942	97	Good weather and good results, nine industrial targets and over 1500 houses damaged.
Operation <i>Millennium</i>			
6	30/31 May 1942	1047 Bombers dispatched, between 868 and 898 bombed Cologne.	The raid produced the most damage of any previous raid and was considered a success. 3,330 buildings destroyed, 2,090 buildings severe damage, 7,420 light damage. Casualties between 469 and 486, 5,027 injured, over 45,000 people bombed out of homes.

Cologne was a well-known target for the Allies and had been attacked by Bomber Command at least thirty times in 1941 and five times since January 1942 up to Operation *Millennium* on the 30/31 May 1942.<sup>345</sup> The distance to Cologne placed it in the category of a short-range target for Bomber Command, and it was often used as

<sup>344</sup> Table data extracted from: M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 229 - 273. The sources of the data used in this book were drawn from UK National Archives, Belgium, French, German and other archives and are detailed on pages 787-790.

<sup>345</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 124 -268.

a stand-in or alternative target when other targets were covered by bad weather.<sup>346</sup> Cologne also had the advantage for Bomber Command of being outside the heavy FLAK and searchlight belts that protected the Ruhr.<sup>347</sup> The fact that Cologne was such a frequent target for Bomber Command meant that they did not need to request any detailed or special reporting from Medmenham to assist with any attack against Cologne, even one as big as the first 1,000 Bomber raid.<sup>348</sup> The previous raids against Cologne in 1942 can be seen in Table 16. The standard Medmenham reports and photographs all provided enough details to update the target maps that the bomber crews would use for the mission. They relied upon the coverage of Cologne provided by the usual reporting, out of regular sorties, rather than tasking special sorties and reporting.

The importance of the Medmenham damage assessment reports is demonstrated by how essential they were to confirming how successful the operation had been and to detail the extent of the damage caused. The photographs and the photographic interpretation reports from Medmenham were the most important intelligence reports for providing accurate damage assessments. They were far more reliable than reports from the aircrew because they were based on actual photographic evidence. The Medmenham reports also had all the photography of previous damage to Cologne, so were able to tell what had been achieved by the 1,000 Bomber Raid, and not confuse that with previously inflicted damage from earlier raids. The main bomb damage assessments of Cologne were flown on the 1 and 2 June, and they provided clear evidence of the extensive damage inflicted on Cologne.<sup>349</sup> The individual damage assessment reports are analysed and summarised below with a detailed report by report analysis at Annex O.

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<sup>346</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 124.

<sup>347</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 124.

<sup>348</sup> During the planning of Operation *Millennium*, Hamburg was the primary target, with Cologne as a second target. Because of the adverse weather forecast for Hamburg, Cologne was chosen as the target for the 1,000 Bomber raid – see: C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945 Vol 1*, 404-406.

<sup>349</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, p104.

Medmenham K Section produced damage assessment reports to a set of procedures and based on training documents. The methodology for damage assessment was that they would first produce very quick immediate interpretation reports on any damage seen.<sup>350</sup> These immediate interpretation reports were sent out as quickly as possible under sequential K series numbering, usually the next day after an operation.<sup>351</sup> Medmenham would then produce far more detailed damage assessment reports on the target, but these would take longer to produce. These more detailed damage assessment reports kept the same K series reference numbers as the immediate damage assessment reports. Medmenham could also produce supplemental reports on the target if any additional information or damage was subsequently observed and they kept the same K series reference numbers. These supplemental reports could also include any corrections. Medmenham also produced the specialist night photography reports from the aircraft on the raid, and these were produced by N Section. Medmenham could also produce its normal Second Phase reports on the target areas by Z Section. Medmenham produced all of these reports for the 1,000 Bomber Raid, and they are discussed below and each report summarised and analysed in Annex O.

After the 1,000 Bomber Raid reconnaissance aircraft were tasked to acquire photographs to show the damage to Cologne. The weather was not ideal and only partial coverage was obtained from three sorties flown on 1 June with full coverage having to wait until sorties on 5 June 1942. However, the results from the sorties on 1 June produced rapidly a short K Section, immediate interpretation report, see Table 15, entry 15, that proved the operation had been a success.<sup>352</sup> Report 17 is the main K Section report on the operation, dated 8 June 1942, that gives far more detail than the immediate report 15, and reports all the damage seen over the city and it includes a photographic mosaic and multi-page annex with more analytical detail of the damage highlighted on the mosaic. The mosaic is shown in Picture 2 and is an

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<sup>350</sup> To see the type of training Medmenham PIs received see MA Aqu No 1924 CIU PI Notes – Lecture on Damage Assessment.

<sup>351</sup> The Immediate Interpretation Report would only be delayed if no photographs were available on which to do the analysis. This was most frequently happening because of bad weather / low cloud cover over the target area.

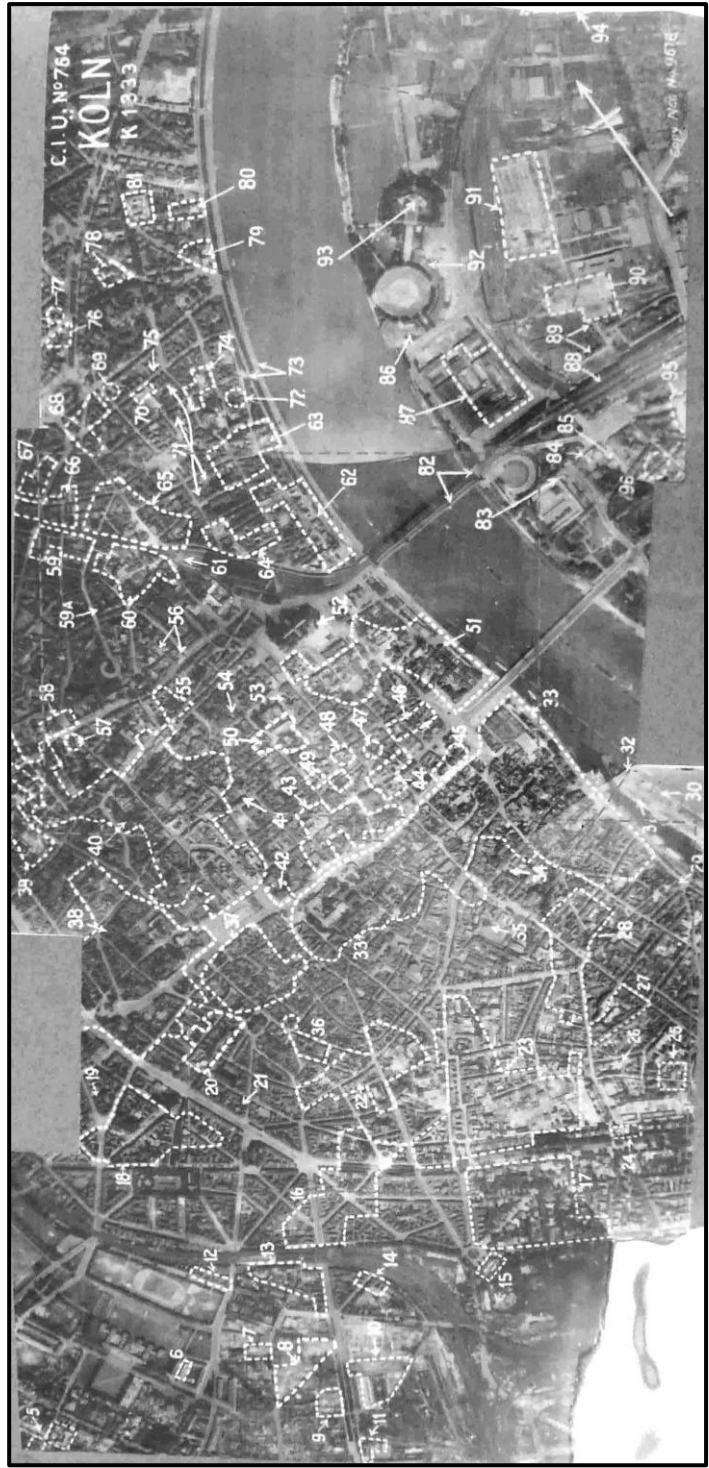
<sup>352</sup> Immediate Interpretation Report K1333 is transcribed at Appendix 2 and is summarised in Annex O.

example of the photographs that Medmenham supplied with the interpretation reports by this stage of the war.<sup>353</sup> The mosaic shows how sophisticated Medmenham had become to combine the photographic interpretation with the creation of a complex mosaic from multiple frames and then adding over ninety-four annotations before photographing it and producing it as a single photo-mosaic to accompany the report.<sup>354</sup> Medmenham produced one hundred and forty-five copies of the report and one hundred and twenty-seven copies of the mosaic for distribution.

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<sup>353</sup> A photo-mosaic would be one of the more complex photographs, but it was normal to include simple annotated prints with the Medmenham reports. See: TNA AIR 24/243 for examples.

<sup>354</sup> Report K.1333 is transcribed at Appendix 2 and summarised in Annex O.



Picture 2 - Mosaic of Cologne produced to accompany Medmenham Report K.1333.

Report 20, also a K Section report was sent out two weeks after the raid as a supplemental report to Report 17 providing a minor update on additional damage seen in further analysis of the photographs. This was normal practice to send out immediate, normal and supplemental reports on the same target and shows the



sophistication of the reporting system that Medmenham had developed. Report 21, almost three weeks after the raid is the final K Section report on Cologne in this series and provided additional information of damage in areas previously not photographed and reports on the repair work visible in the city.

The next stage in the reporting on Cologne are Reports 22 and 23 dated 1 July and 12 August. They are both N Section reports, complex and produced from the night photographs of the cameras on the Bomber Command aircraft. The time they take to produce is due to the difficulty and complexity of interpreting night photographs as well as the number of photographs that required analysis to produce the reports. Report 22 is a preliminary report of the analysis with Report 23 being the full report and accompanying map.<sup>355</sup>

The K Section and N Section reports from Medmenham are the key reports sent to Bomber Command that can confirm what results were achieved during the 1,000 bomber raid. These reports from Medmenham were able to provide Bomber Command with significant amounts of detail as shown in Annex O and Appendix 2. However, they were shortcomings as well, the reconnaissance aircraft required good weather conditions to get good photographs for analysis. There was also the problem of working out how much damage had been done. If a building or factory had been totally destroyed, that was easy to report. However, if the damage was less extensive, it could be difficult to tell if the heavy machinery inside the factory was destroyed and out of action, or if only superficial damage was done to the factory buildings, with the heavy machinery still in working order. These were problems that Medmenham and Bomber Command knew about but even with stereo photography and analysis, it was a difficult problem for photographic interpretation.<sup>356</sup> It is only with the continuing reconnaissance over a target that patterns of use could be

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<sup>355</sup> Report N26 and Map are transcribed at Appendix 2 and summarised in Annex O.

<sup>356</sup> Stereo interpretation of the photographs allowed Medmenham to provide far more detail in the reports than could be seen with just mono photographs. For a quick example, look at the mosaic of Cologne, Picture 2 which is a mono mosaic and what stands out is all the areas annotated by Medmenham, but the detail of the destruction is not easily visible. When the photographs are viewed in stereo, the Medmenham photographic interpreters would have seen the damaged buildings in 3D and damage was much easier to observe and report than on mono photographs. See transcribed report K.1333 in Appendix 2 for the detail obtained by Medmenham.

assessed and the full impact of raids worked out and the speed of repair work and recovery calculated. This provided a continuing flow of photographs for Medmenham to use for comparative analysis and interpretation.

Medmenham also produced two Second Phase reports from Z Section that covered Cologne over this period, reports 18 and 19 in Table 15. These reports did not duplicate the K Section damage assessment reports, but reported on river and barge traffic as well as reporting new FLAK batteries. The format and content of these reports is normal for Z Section reports from Medmenham. The increase in FLAK batteries could be a response to the 1,000 bomber raid. These reports are summarised in Annex O.

As already mentioned earlier, but now expanded upon, from an analysis of the database of pre and post Cologne Operation *Millennium* Medmenham reports it is clear that no special reports were requested from Medmenham. No special reconnaissance flights were tasked and then analysed by Medmenham to produce a detailed report on the city, and a comprehensive list of defences present, decoy sites and previous damage inflicted. Bomber Command relied upon the normal flow of reports from Medmenham that reported out on previously seen defensive anti-aircraft FLAK locations, bombing decoy sites and past damage to the city.<sup>357</sup> However, to see what damage had been inflicted by the very significant first 1,000 bomber raid the Medmenham reports after the bombing raids of the 30/31 May 1942 covering damage assessment were essential. The nine reports between 2 June 1942 and 10 August 1942 provided Bomber Command with a comprehensive analysis of damage inflicted on Cologne by Operation *Millennium* and to an extent the performance of individual bombers and the fall of bombs and especially incendiaries. These reports were also used as part of the Bomber Command fortnightly reporting to the War Cabinet as can be seen in the report W.P. (42) 262, Summary of Operations of

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<sup>357</sup> See analysis by Overy that area bombing only required a minimum of intelligence, R Overy, *The Air War 1939-45*, 109-110.

Bomber Command for Fortnight Ending 1200 Hours 7 June 1942, where Picture 2 is also included in the War Cabinet report.<sup>358</sup>

The analysis of the pre-raid reporting by Medmenham shows that the reconnaissance system now had enough collection resources to cover vast areas of German occupied territory on a frequent basis. The growth in numbers of trained staff at Medmenham, together with the organisational and working practice developments enabled the prompt interpretation, analysis and reporting out on the reconnaissance material gathered. These photographs and reports were then stored for further use and comparative analysis. The standard operating procedures at Medmenham allowed Bomber Command to be provided with a constant flow of updated photographs and reports, giving them an accurate picture of the regular Bomber Command targets. The damage assessment reports produced by Medmenham were vital in determining how successful a mission had been, providing proof of where the bombs and incendiaries had fallen, evidence of the damage inflicted on the targets, and monitoring of German reconstruction efforts. That Medmenham could produce these reports on a daily basis, and in such detail, demonstrates how Medmenham had developed its capabilities from the early days. The separation of Medmenham into specialist sections, each working in detail on specific problem areas such as damage assessment, night photography, FLAK reporting, decoys, camouflage can be seen from the analysis of the reports above to have worked well and provided Bomber Command with a dedicated flow of targeting and damage assessment reporting.

The official intelligence history states that 'Photographic reconnaissance, and to a smaller extent night photographs, were still the only reliable sources of visible evidence about bomb damage', and it was to the Medmenham reports accompanied by annotated prints showing the damage that the Official History refers. The central role Medmenham reporting played in both planning attacks and assessing the results

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<sup>358</sup> See transcribed Medmenham Reports 3190, N.26 and Map, N.31, K.1319 and K1333 for Medmenham post-attack reporting selection on Operation *Chastise*; TNA CAB 66/25, W.P. (42) 262 War Cabinet: Summary of Operations of Bomber Command for Fortnight Ending 1200 Hours Sunday June 7 1942.

is mentioned in the official history of the *Strategic Air Offensive Against Germany* which states that 'Its surveys were not only indispensable in planning the attacks on the targets and in revealing the effects of the bombing'.<sup>359</sup> Both these sources provide pointers to the importance of photographic reconnaissance to Bomber Command, but do not provide any detail of how Medmenham provided this reporting or the extent, frequency and detail of the reporting. This study shows how Medmenham had already grown its support to Bomber Command into a well-oiled machine by mid-1942.<sup>360</sup>

Operation *Millennium* was an area bombing target, and this next case study will now look at Operation *Chastise* a year later and a precision bombing target against the Ruhr dams to provide a comparison with Operation *Millennium*. It is of interest to see the changes in the amount of intelligence reporting that Medmenham was producing by May 1943. It had grown into a large organisation of 1320 personnel, almost 200 more than in 1942, with fifteen sections producing 453 intelligence reports, forty-six models and over 181,000 prints that month.<sup>361</sup> The intelligence output of Medmenham had increased dramatically in 1943 as a review of reports produced by Medmenham in 1942 shows it to be in the order of 1500 for the whole year and, as can be seen, over 450 reports in a single month in May 1943, which includes the reports produced for Operation *Chastise*.<sup>362</sup> This increase in reporting resulted from a dramatic increase in the number of reconnaissance sorties received by Medmenham in 1943, compared to 1942. The number of sorties received more than doubled from 1942 to 1943 with over 8500 received by Medmenham in 1943, providing significantly more photographs to be interpreted and reported.<sup>363</sup> However,

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<sup>359</sup> F Hinsley, *British Intelligence in the Second World War*, 294; also see C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945: Vol 1*, 268.

<sup>360</sup> See Bomber Command Sortie, Reporting and Print information for Medmenham in Sortie, Report and Print Graphs 4 to 6 in Annex I.

<sup>361</sup> MA unaccessioned, RAF Medmenham F540, Entries on page 82/83 for May 1943, show an actual strength of people on the Unit of 1320. This included 35 American service personnel, and attached to the Unit two Norwegian and one Czech officer.

<sup>362</sup> MA Air 34/317 to Air 34/329 cover CIU Reports from Jan 1942 to December 1942. May 1943 report numbers obtained from Medmenham F540 from MA at RAF Wyton. The 1942 monthly statistics cannot be obtained from the F540 Operational Record Book as they were not recorded, but after a change in Commanding Officers at Medmenham the F540 in 1943 showed daily detail of the number of reports issued by section and is probably a more accurate record of Medmenham output than those found in the AIR 34 Series of Medmenham reports in the National Archives.

<sup>363</sup> See Annex I Medmenham Manning, Sortie and Print statistics.

as the organisation had only grown by around 200 staff, it shows that the structures and procedures and staffing were robust enough to support the increase in reconnaissance and support operations like Operation *Chastise*.

The attack on the Moehne, Sorpe and Eder dams required significant photographic reconnaissance efforts both before and after the attacks, with Medmenham providing significant and in respect to water levels, crucial photographic intelligence for the conduct of the attacks as well as the standard damage assessments after the attacks.<sup>364</sup> The important Medmenham CIU reports for Operation *Chastise* planning are listed in Table 17 below.

Table 17 Medmenham Reports on Ruhr Dams, February to May 1943<sup>365</sup>

No	CIU Report No	Locality	Date of Photographs	Date of Report
1	No Reference but titled: 'Special Interpretation Report on Defences'	Moehne	19 February 1943	21 February 1943
2	D.240.A	Moehne Dam		27 February 1943
3	D.244.A	Moehne Dam		5 March 1943
4	D.264.A	Moehne Valley Barrage	4 April 1943	5 April 1943
5	D.265.A	Moehne Valley Barrage	5 April 1943	6 April 1943
6	D.281.A	Eder Dam & Sorpe dam	13 May 1943	14 May 1943
7	D.282.A	Moehne Valley Barrage	15 May 1943	16 May 1943

As can be seen from Table 17 above, Medmenham produced six special D Section reports for Operation *Chastise*. D Section was another of the specialist sections at

<sup>364</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 116-118.

<sup>365</sup> MA unaccessioned, The RAF Medmenham F540 entry for 17 May 1943 records that report number 1, was prepared by Capt Espenhahn of CIU and issued on 21 February 1943. The report was not prepared specially for Operation *Chastise*, but for Combined Operations and Operation *Cornet* – see TNA DEFE 2/164 for more details on Operation *Cornet*. The fact the 21 February 1943 report was produced by the Army section of CIU by Capt Espenhahn makes sense when it was for Combined Operations. All pre-attack Operation *Chastise* CIU reports were produced by the Industries Section D Section by Fg Off d'Arcy. Report number 3 is listed in the CIU report as D.282.A and in the Medmenham F540 entry for 17 May 1943, but the actual report is missing from TNA.

Medmenham, and they reported out on industries. D Section was further sub-divided into five specialist teams, with team four reporting on electrical power and dams. Hence all the special reports for Bomber Command for Operation *Chastise* were tasked to D Section, and all the D Section pre-attack reports were produced by Flying Officer d'Arcy.<sup>366</sup> However, none of these six reports can be found in the appropriate AIR series files in the National Archives.<sup>367</sup> There is a possibility that the missing Medmenham documents on Operation *Chastise* are amongst those stolen from the National Archives over a period of over ten years by the now discredited and convicted military historian Alex Bateman or the earlier theft of over 15000 Air Ministry and War Office documents by Timothy Graves a reader at the Public Records Office.<sup>368</sup>

It has now been possible to find copies of four of the reports in other National Archive files and an extract from the first report D.240.A. That leaves only the report of 5 March 43, D.244.A as unaccounted. Sweetman suggested that pre and post attack CIU reports went to Barnes Wallis and therefore these six reports could be found in the Barnes Wallis papers, which are now at the Science Museum archive.<sup>369</sup> However, research into the Barnes Wallis papers did not reveal any copies and found a receipt for other CIU reports on dams, confirming the return of the reports to the Air Ministry.<sup>370</sup> What is clear is that the CIU reports and photographs on the dams both before and after the attacks were sent to Barnes Wallis. He produced a 'Note of Recent Activity Observed at the Moehne dam' which was based on two Medmenham Interpretation reports, D/264A dated 5 April 1943 and D/265A dated 6 April 1943 and

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<sup>366</sup> The dedication of one PI to produce the pre-attack reports allowed the PI to become very familiar with the targets, but also helped increase the operational security on the targets. See this thesis Chapter Two for more detail on the Medmenham Section structures and D Section.

<sup>367</sup> The reports D240.A, D244.A, D264.A, D265.A, D281.A and D282.A should all be in the AIR 34/203 and AIR 34/204 series Medmenham F540 as these cover the appendixes for these reports but they are all missing.

<sup>368</sup> N Harley, *Man who stole Dambuster hero's mission book also took hundreds of items from the National Archives to sell in the US*, Daily Telegraph, 13 January 2017 < <https://www.telegraph.co.uk/news/2017/01/13/man-stole-dambuster-heros-mission-book-also-took-hundreds-items/> > [accessed 11 September 2018]; J Burrows & D Cooper, *Theft and Loss from UK Libraries: A National Survey 1992* (UK: HMSO, 1992) 18-24.

<sup>369</sup> J Sweetman, *The Dams Raid*, 209.

<sup>370</sup> J Sweetman, *The Dams Raid*, 209; T SMA Barnes Wallis Papers D2/10 Papers Returned to W/C Morley, 10.7.43.

two photographs from the sorties.<sup>371</sup> However, the notes Barnes Wallis made and his report then includes details taken from the 19 February CIU report and compares the poor condition of the boom defences in the February CIU report with the good condition of the boom defences in the two April CIU reports. He then reassuringly confirms that the boom defences will not hinder the *Upkeep* weapon.<sup>372</sup> The fact Wallis did not mention the missing March report does not mean he did not see it or include findings from it in his report. However, it is possible that the March report had no significant items reported that he needed to draw out in his report. The fact that Barnes Wallis was using, and on at least one occasion asking for reconnaissance of the dams clearly shows the importance of the Medmenham reports to the preparations for Operation *Chastise*. They were not merely sent to Air Intelligence, Bomber Command and used to brief the 617 Squadron aircrew, but were instrumental in providing up to date information for the detailed technical meetings and discussions Barnes Wallis had on the use of the *Upkeep* weapon. *Upkeep* was an experimental bouncing bomb designed by Barnes Wallis to skip and bounce over the water to avoid the boom defences, then sink down the dam wall and detonate thirty foot below the surface producing shockwaves in the water to weaken and destroy the dam walls.<sup>373</sup>

The Barnes Wallis report on the changes and possible defences at the Mohne dam, use the Medmenham reports and photographs to not only provide the up to date picture of all defences and any work on specific defences against pressure wave blast attack, but also to check the water levels at the dam, which were essential to the operation of the *Upkeep* weapon. Barnes Wallis requested the Air Staff at a meeting on the 5 May 1943 to collect more reconnaissance over the targets to again assess the water levels and the minutes of the meeting report that the reconnaissance was tasked that day to collect stereo pairs of all three targets to

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<sup>371</sup> TNA AIR 20/4797 contains copies of CIU Reports D.264A and D265A which are from Spitfire Sorties D361 dated 4.4.43 and D366 dated 5.4.43.

<sup>372</sup> TSMA D2/6 Barnes Wallis Papers contain an 8 page copy of 'Notes On Recent Activity Observed at The Moehne Dam on Sorties D/361 & 366, 4 & 5 April 1945' and CIU reports D.264.A & D.265.A by Barnes Wallis.

<sup>373</sup> See TNA AIR40/840, *Upkeep* Mine; A Cooper, *The Dam Buster Raid*, 25-27; I Murray, *Bouncing-Bomb Man: The Science of Sir Barnes Wallis* (Sparkford: Haynes, 2009) 84-105.

assess water levels.<sup>374</sup> Without the correct level of water above the weapon, the pressure wave would have diverted into the air rather than focus on the dam walls. This use of Medmenham reporting is just another example of Medmenham support to the scientific community. Medmenham was already providing support to the scientists on new aircraft, U-boats, German radar developments and the V Weapon developments.<sup>375</sup>

Medmenham produced seven reports in advance of Operation *Chastise*, one for Combined Operations and six for the Air Staff and Operation *Chastise*. Medmenham also produced numerous annotated photographs from the Spitfire flights over the dams and also three very detailed scale models of the dams. The first report on the Moehne dam produced by Medmenham was not produced for Bomber Command, but for Combined Operations and Operation *Cornet* a plan to use troops parachuted in to the dam to plant explosives and destroy the dam.<sup>376</sup> The report was produced by the Army B Section of Medmenham and not given the usual Medmenham sequential report number but just the title: 'Special Interpretation Report on Defences'.<sup>377</sup> The report used photographs from the Spitfire sortie on the 19 February 1943, and the report was completed on 21 February 1943. The first three paragraphs cover the Moehne dam and immediate area around the reservoir. The report identifies the location of a light FLAK battery and the possibility of a light FLAK gun on top of each of the dam towers. The report then covers two other non-dam related areas, two decoy sites, again not dam-related and the location of barracks at Soest and Arnsberg.

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<sup>374</sup> The request for stereo pairs shows that Barnes Wallis and the Air Staff had at least a working understanding of how stereo photographs could be used for analysis of the water levels and measurements taken. See TSMA D3/2 Air Ministry Minutes of *Upkeep* Meeting 5 May 1943.

<sup>375</sup> For more details on Medmenham support to the scientific community see: R V Jones, *Most Secret War: British Scientific Intelligence 1939-1945* (Sevenoaks: Coronet, 1979); & for a more critical analysis J Goodchild, 'R.V. Jones and the Birth of Scientific Intelligence', (unpublished doctoral thesis, University of Exeter, 2013); J Goodchild, *Most Enigmatic War: R.V. Jones and the Genesis of British Scientific Intelligence 1939-45* (Solihull: Helion & Co., 2017); The Dams raids also feature in the Medmenham folk law see: A Williams, *Operation Crossbow*, 98-99.

<sup>376</sup> See TNA DEFE 2/164 for more details on Operation *Cornet*.

<sup>377</sup> See transcription of the report in Appendix 2.



The fact that this report was produced and, especially, that reconnaissance Spitfire sorties had been requested for Moehne as a target was of great concern within the Air Ministry. They were concerned that the secret operation they had planned, Operation *Chastise*, could be compromised by another service. This concern was increased when in the Air Ministry the ADI (Photo), who controlled all requests for photographic reconnaissance and tasking of Medmenham confirmed that to get the report there had been seven unsuccessful attempts by the PRU to cover the Moehne dam, but that the dam had not been the only target on any of the attempts.<sup>378</sup> The successful flight on the 19 February 1943 flew seven times over the Moehne dam and collected 208 photographs, but due to the high altitude of the Spitfire, the consensus was that the flight would not have raised any German suspicions, mainly due to the very high number of reconnaissance flights conducted over Germany.<sup>379</sup> However, the Air Staff decided that the Assistant Chief of the Air Staff Intelligence (ACAS (I)), as well as ADI (Photo), should be involved in sorting out arrangements for future reconnaissance over the dams.<sup>380</sup> This concern with the operational security of the dams raid continued to the point that Spitfire pilots flying sorties to collect photographs of the dams for Medmenham were briefed to crash the Spitfire by bailing out so it and the photographs would be destroyed when the aircraft crashed, rather than attempt a landing if they developed a problem or were disabled after the photographs were taken.<sup>381</sup>

The Air Staff and Bomber Command were very concerned about operational security and Operation *Chastise* so all seven of the Medmenham reports produced for the planning of the operation were classified 'Most Secret' and all had a very restricted distribution list of who could see them. However, as soon as the operation was completed all the subsequent reports for assessing the damage reverted to the standard Medmenham Secret classification. For comparison, all the reports for Operation *Millennium* were just classified at the standard Medmenham Secret.

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<sup>378</sup> TNA AIR 20/4797, Letter ADI (Photo) to DDB Ops dated 28.2.43.

<sup>379</sup> There were over 200 dedicated reconnaissance flights and almost 500 flights by bomber aircraft with cameras per month during 1943. MA Acc no: 1170, Photographic Reconnaissance during World War II Appendix C.1.

<sup>380</sup> TNA AIR 20/4797, Minute to VCAS and note to DB Ops dated 1 March 1943.

<sup>381</sup> TNA AIR 14/840, Report of Meeting held in Air Ministry ACAS Ops dated 5 May 1943.

Medmenham then produced the six special D Section reports, five on the Moehne dam and one covering the Eder and Sorpe dams, for the Air Ministry and Bomber Command. The six reports followed a set format of an introduction, then a set of paragraphs under the heading Barrage and then more paragraphs under the heading Defences. These reports were produced between February and May 1943 as seen in the Table 17. These reports provided details of the target that the Air Ministry and Barnes Wallis needed to plan the operation, with the water levels in the dams being a critical factor for the correct functioning of the *Upkeep* weapon. The reports are examined in detail in Annex P.

The seven reports and the plans and photographs, including annotated photographs that accompanied them, were not the only work that Medmenham undertook for Operation *Chastise*. Medmenham was tasked through ADI (Photo) in February to produce a scale model of the Moehne dam and surrounding area, see Picture 3 showing the completed Moehne dam model at Medmenham.<sup>382</sup> Medmenham ended up being tasked to produce models of all three dams for the Operation *Chastise* raid. The high security around Operation *Chastise* continued, with Medmenham using code names of Manchester, Warrington and Stockport for the dam models.

Medmenham was tasked very early in February 1943 to produce the model for the Moehne dam for Bomber Command and had completed the model by 17 February



Picture 3. Photograph of Moehne Dam Model at Medmenham

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<sup>382</sup> See MA Box 221 Three Glass Plate Negatives of Moehne Dam Model & MA unaccessioned Model Section Master Index and Log Book.

1943 and updated it by 1 March 1943. The model was an exact scale terrain model, accurate enough for measurements to be taken from it for use in planning the raid against the dam. The model was also used for briefing those about to conduct the operation, as it provided an accurate three-dimensional view of the target and surrounding area. The model was at a scale of 1:6000 and was four foot six inches by three foot six inches. The model for the Sorpe dam was tasked on the 7 April 1943 and completed on the 19 April 1943. This model was also an exact scale model at 1:6000 scale and measured six foot four inches by two foot eleven inches.<sup>383</sup>

The model for the Eder dam was ordered very late for the operation on the 11 May 1943, completed and delivered on the 17 May 1943. This is a remarkable speed of production of a model for Medmenham. This model was also an accurate scale model at 1:6000 scale. Medmenham provided secure wooden cases to cover the models and also to protect them during transportation. These wooden cases would also have hidden from view what the models were and added to the security of the operation. The Moehne and Sorpe models were made well in advance of the raids, but the Eder dam model was only tasked on 11 May 1943 and delivered on 17 May 1943. It is difficult to tell why the Eder dam model was not tasked earlier.<sup>384</sup> The *Chastise* Operation was executed on the night of 16/17 May 1943, so the Eder model was never used for planning the attack. This is different from the myth that has surrounded the dams raids, where the film and secondary sources including Gibson's book talk about the three dam models being used to brief 617 before the raid.<sup>385</sup>

To make these accurate topographic models, W Section that specialised in *Wild A5* stereo photogrammetric machine work would have provided accurate dimensions for the areas, lakes, and especially the dam walls and water levels. Then V Section, the model making section would have looked at stereo pictures of the dams to see in

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<sup>383</sup> MA unaccessioned V Section Master Log Book, entries for tasks Manchester, Warrington and Stockport 1943.

<sup>384</sup> Sqn Ldr Fawcett, a Bomber Command intelligence officer sent 20 copies of the information sheet on the Eder dam to the Senior Air Staff Officer No. 5 Group Gp Capt Satterly on the 10 May 1943 and it was noted no model had been built of the dam. J Sweetman, *Operation Chastise*, 72; MA unaccessioned V Section Master Log Book, entry for task Stockport 1943.

<sup>385</sup> See Associated British Picture Corporation film *The Dam Busters* 1955; A Cooper, *The Dam Buster Raid*, 70; G Gibson, *Enemy Coast Ahead Uncensored* (Manchester: Crecy Publishing Ltd, 2012) 229.

detail what the areas looked like to assist with building the models. They would then create a wooden baseboard, with contoured wooden frames to allow for building up the model. Then a Plaster of Paris like compound, jollop was used to fill in spaces between the contours. This was smoothed out ready to have a re-scaled photo-mosaic of the area stretched across the model. Then the structures were built to scale and attached to the model and coloured in to match. The process required considerable attention to detail and skilled craftsmen and women to produce the models. The Model Section had already provided models of new German aircraft and German radar installations as well as models for planned operations. The model making techniques used for the dams raid were further developed so that flexible rubber models were produced for D-Day and these could be copied. However, by way of comparison, D-Day in June 1944 was a more significant task producing models for all the D-Day landings, a total of 109 models and 250 copies.<sup>386</sup>

After the Operation *Chastise* mission on the night of 16/17 May, Medmenham produced eleven reports between 18 May and 25 May 1943 that concentrate on the impact of Operation *Chastise*. This case study will not look at the reports Medmenham produced beyond May that follow the ongoing rebuilding and restoration of services that was undertaken by Germany. To facilitate rapid analysis of the effects of the dams raids, Medmenham sent three experienced photographic interpreters to the PRU base at RAF Benson. The three photographic interpreters included Flying Officer d'Arcy who was the photographic interpreter in D Section who had produced the six special pre-attack reports on the dams.<sup>387</sup> The post-attack reports produced by Medmenham are listed in Table 18.

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<sup>386</sup> For a description of how they worked at Medmenham in the Model Section, see L N Abrams, *Our Secret Little War* (Bethesda MD: International Geographic Information Foundation, 1991); A Pearson, 'Allied Military Model Making during World War II', *Cartographic and Geographic Information Science*, 29.3 (2002) 227-242.

<sup>387</sup> MA unaccessioned, The RAF Medmenham F540 entry for 17 May 1943, p43.

Table 18 Post Raid Reports for Operation *Chastise*.<sup>388</sup>

No	CIU Report No	Locality	Date of Photographs (All May 1943)	Date of Report (All May 1943)
1	Immediate Report No: K.1559	Moehne, Sorpe, Eder Dams	17	18
2	Interpretation Report 4962	Moehne Reservoir, Moehne and Ruhr Rivers, Sorpe Reservoir and Eder Reservoir and Eder River	17	18
3	Interpretation Report 4970	Moehne, Sorpe, Eder Dams	18	19
4	Interpretation Report 4979	Ruhr Valley – Sorpe Reservoir	17 & 19	20
5	Immediate Report K.1562	Moehne and Eder Dams	18	19
6	Immediate Report No: K.1564	Moehne, Sorpe, Eder Dams	19	20
7	K.S.85	Sorpe Dam	13/17/19	21
8	K.S.85A	All 3 dams	Not reported	22
9	Interpretation Report 4993	Sorpe Dam	17/19/21	23
10	F.S.116	Weekly Report of Rail, Port and Inland Waterway Activity Observed (3 page report 14 page annex listing rail movements)	Sorties for week ending 15 May 1943	20
11	F.S.117	German Railway and Other Communication Damage		25
12	F.S.118	Weekly Report of Rail, Port and Inland Waterway Activity Observed (5 page report 22 page annex listing movements)		27

Table 18 details the twelve reports Medmenham produced within ten days of the Operation *Chastise* raids. There include three damage assessment reports from K Section that detail all the damage that can be seen at the three targets. The first report, number one above, was an Immediate Report and was produced by the team of three from Medmenham sent specially to Benson where the reconnaissance aircraft would be landing, to report as soon as the aircraft returned with the photographs of the raid. This report is transcribed at Appendix 2 and clearly reports

<sup>388</sup> Table compiled from: TNA AIR 2/8395; AIR 19/383; AIR 29/275; AIR 29/276; AIR 34/609.

the damage to Moehne dam.<sup>389</sup> The rest of the reports were produced at Medmenham. The three K Section reports confirmed the breaches to the Moehne and Eder dams and that the Sorpe dam was still intact, but had damage. They also reported on extensive flooding to the Ruhr and Moehne valleys. Report number 5 above, is the first K Section report to also mention the alternative targets of the Lister and Ennepe dams and that there was no damage to them. K Section then produced two more follow-on reports, K.S.85 and K.S.85A with more details of damage, flooding and, where seen, any repair work.

Medmenham also produced four Z Section Second Phase reports (2, 3, 4, 9 in Table 18). These detailed Second Phase reports cover a significant area around the dams and report out on significant damage and flooding in the Moehne, Ruhr and Eder valleys with flooding seen up to thirty-nine miles away. They report out on damage and destruction to bridges, railways, industries and housing as well as the arrival of barrage balloons and other defences at the dams to hinder further attacks. These reports were accompanied by photographs to illustrate the damage and also sketch maps of the flooded areas.

Then two Medmenham F Section reports also covered damage caused by the dams raids. F Section produced specialist reports on communications and transportation. They reported on railway movements and barge movements on the rivers and canals. The two reports, eleven and twelve in the Table 18, cover all the damage to railway infrastructure and inland waterway structures seen from the attacks on the dams. Where they differ from the earlier reports is in the analysis they give of the impact the disruption to the transportation networks will have on regular German traffic and the significant diversions that will be needed until major repair and rebuilding work is completed.

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<sup>389</sup> The transcribed report K1559 as well as all the damage reported, shows how even in May 1943, Britain was sending Medmenham reports to the Americans as the report is Classified SECRET (American CONFIDENTIAL).

One of the short-term side effects of the extensive flooding of the area caused by Operation *Chastise* was short-term access by Bletchley Park to the special cypher that was used to carry Police and other organisations working to repair the damage in the Ruhr. The access to the decrypts shows the speed with which the emergency caused by the flooding in the area was controlled. This access to internal German communications from within Germany was unusual at this time as access to internal communications were not made regularly until 1944.<sup>390</sup>

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It can be seen by comparing Operation *Millennium* and Operation *Chastise* that the two forms of Bomber Command operations required different support from Medmenham and imposed different loading on the reconnaissance and reporting systems, but also shows the similarities when damage assessment was required after the Operations. The analysis of all the reporting from Medmenham in the three months running up to Operation *Millennium* does not show a single special reconnaissance mission or Medmenham report being produced. There appears to have been no special tasks placed on Medmenham for the raid. This can be partially explained by the familiarity of Bomber Command squadrons with Cologne as a target and the frequency with which they had bombed it during 1941 and on into 1942. Bomber Command was able to use the now normal steady stream of reporting coming from Medmenham to build up the defensive picture around Cologne, with the reports on enemy airfields and anti-aircraft gun battery positions in the FLAK reports. The clear picture of the enemy decoy sites around Cologne from the Medmenham Q Section decoy reports meant that the bomber crews knew where they were and could attempt to avoid them. The mapping quality stereo photographic coverage of Cologne that allowed maps to be updated and good quality high altitude photographs showing the City could be used in the Bomber Command target folders. This was all part of what Bomber Command intelligence received on a daily basis from Medmenham, and it provided all the photographic intelligence they needed for

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<sup>390</sup> F.H. Hinsley, *British Intelligence in the Second World War*, Vol 2, 673.

Operation *Millennium*. This shows part of the development of Medmenham from the early rather simple photo reading reports seen in chapter 3 to the complex, large and well staffed multi-section organisation Medmenham had developed into and the spread of reporting from simple First Phase reports, to multiple detailed Z Section Second Phase reports and then the complex specialist reports from E Camouflage, K F Damage Assessment, N Night Photography and Q Decoy Sections.<sup>391</sup> All these reports were needed to build up a complete picture of Cologne and the surrounding area. This range and complexity of reporting was not available in the Chapter 3 case study and shows the growth of analytical techniques developed by the analysts as well as the growth of Medmenham into a more substantial and complex organisation.

Compared to no special reconnaissance flights or Medmenham tasking for Operation *Millennium*. Special reconnaissance sorties and tasking of Medmenham was required for Operation *Chastise*. This special precision attack operation required detailed Medmenham reports on the three dams and reconnaissance flights to collect up to date photographs until the day before the attack so that water levels, as well as defensive measures, could be confirmed.<sup>392</sup> The seven reports specially prepared for attacking the dams were not the only products produced by Medmenham for Operation *Chastise*. Medmenham produced considerable material for the planning and execution of Operation *Chastise*, including special models of the three dams, which is in complete contrast to the lack of reporting in advance of Operation *Millennium*. This clearly shows the need for detailed intelligence and photographic cover to support special precision targets and by contrast the apparent routine requirements for large-scale area bombing. The detailed reconnaissance over the dams was also used by the scientific community, in this case, Barnes Wallis to confirm that conditions were right for the use of the new experimental weapon.

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<sup>391</sup> E Section reported on Camouflage, K Section reported on damage assessments after Bomber Command attacks, N Section reported out on night photography primarily from Bomber Command and Q Section reported on Decoy sites, see this thesis Chapter two. Special KODAK Infra-Red film was used to show up German camouflage on some sorties. See AFHSO IRIS 01025079.

<sup>392</sup> Report D.282.A used a Spitfire sortie flown on 15.5.43 and Medmenham distributed the report on 16.5.43, the day before the attack.



However, both types of operation required considerable effort from Medmenham to assess the damage inflicted by both operations. Medmenham produced nine different reports after Operation *Millennium* that reported out on the damage to the city and surrounding areas and eleven reports for the damage caused by Operation *Chastise*. The reports on damage from Operation *Millennium* were produced from 2 June 1942 up until 10 August 1942 when the final Medmenham Night Section Report N.26 was completed.<sup>393</sup> This reporting was over a period of two and half months. The majority of reports were produced from three distinct areas of Medmenham, K Section which specialised in damage assessment reports for Bomber Command, normal Medmenham Second Phase reports from Z Section and specialist N Section reports from the night photographs taken by Bomber Command aircraft involved in the actual raid.<sup>394</sup> Of interest is the fact that the reports that required the most time for analysis and reporting were the night photographs, with the final report N.26 not ready until 10 August 1942. Three separate sections also produced the eleven Operation *Chastise* reports from 18 May 1943 to 25 May 1943. Medmenham produced five K Section damage assessment reports from the 18 May to 22 May 1943, four Second Phase reports from 18 May to 23 May 1943 and Operation *Chastise* damage reported in two F Section transportation reports on 20 May and 25 May 1943. Though the damage assessment was spread because of the flooding, over a much broader area with Operation *Chastise*, as there was no night photography reporting the final damage assessments were completed within only twenty-three days.

One can see that Medmenham reporting was required to support planning for both Bomber Command area bombing missions and precision attack missions. The precision attack missions required the more detailed Medmenham reporting for successful planning, while the area bombing missions could use the normal flow of intelligence reporting from Medmenham for planning. However, both types of mission required significant Medmenham effort to assess the damage caused by the attacks. Both K Section and N Section at Medmenham were already running well by

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<sup>393</sup> See Table 15.

<sup>394</sup> Decoy reports from Q Section and Camouflage reports from E Section were also produced by Medmenham for Cologne.

May 1942, and the workload only continued to grow for the remainder of the war. In fact, all the sections involved in the operations, D Industries, E Camouflage, F Transport, K Damage Assessment, N Night Photography, Q Decoys, V Model Making, W *Wild* Photogrammetric and Z Second Phase had all increased in size since 1941.<sup>395</sup> D Section that provided the special reports on the dams had increased from two to twenty-five analysts, as an example. The Medmenham reports had also developed from the simple reports seen in Chapter 3 into multiple different types of reports, providing great detail on numerous areas of enemy activity. The organisation was now a complex multi-sectioned organisation and able to cross collaborate between sections. It is this investment in staff and growing the organisation and its analytical abilities that contributed to the flow of complex and detailed reports from Medmenham. Bomber Command appeared to be content with the photographic intelligence provided by Medmenham and did not try to re-establish an independent Bomber Command PRU and analysis organisation.

The analysis of the Medmenham reports has confirmed that far more work was required by Medmenham to support precision target operations than area bombing. However, the requirements for damage assessment reports after the attacks was similar, but with the area targets requiring more work by Medmenham because of the large amount of night bomber photographs involved. These night photographs taken by cameras on the individual bombers of the Cologne raid were very complex to analyse and required weeks of complex interpretation and analysis to complete. These night photographs were not used and would not have worked on the ultra-low level attacks used against the Ruhr dams. The two linked case studies also demonstrated how Medmenham had grown into an intelligence organisation capable of feeding Bomber Command with a constant supply of photographic intelligence including the essential damage assessment reports that provided the evidence of the impact of strategic bombing operations against the Axis targets. There remains the question of the importance of Medmenham reporting to Bomber Command compared to that from Bletchley Park. However, as Stubbington shows, much of the *Ultra* intelligence was not shared at the correct levels if at all with Bomber Command, but

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<sup>395</sup> See Annexes A & B on the Medmenham Sections for more detail.

lower level signals intelligence and direction finding from the 'Y' service was well used.<sup>396</sup> What is not in doubt as shown by this thesis is the vast amount of photographic intelligence Medmenham produced for Bomber Command.

It is also interesting to note that Bomber Command did not seem to use the Medmenham reports to provide an overall assessment of how the Strategic Bombing offensive was working and the impact it may have been having on German moral. This leads to an avenue for further research into the use by Bomber Command of photographic intelligence and other sources of intelligence to assess and direct the Strategic Bombing offensive. It further raises the question, did Bomber Command make the best use of all the photographic intelligence that Medmenham was supplying.

These case studies have shown how successfully a central photographic intelligence organisation could support the war efforts of Bomber Command and the strategic bombing campaign. Photographic interpretation had grown from a small organisation as seen in Chapter 3 to a large and complex intelligence producer by the mid-war years of 1942/43. This centralised support continued after the American Army Air Forces in Europe arrived in the UK and they also used Medmenham reporting.<sup>397</sup>

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<sup>396</sup> J Stubbington, *Kept in the Dark*.

<sup>397</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2. 45. The exception was the interpretation of US Bomber attack photographs which were conducted in house by the USAAFE.

## Chapter 5

### Normandy, 1944

This chapter will investigate the strengths and weaknesses of the photographic reconnaissance and interpretation available to the Allies during 1944 for support to ground forces. The case study briefly examines the photographic interpretation support provided by Medmenham to the 21st Army Group in the build up to D-Day, 6 June 1944. Then it concentrates in detail on the photographic intelligence support during Operation *Epsom*, 26 to 30 June 1944, the attempt to take Caen after the failure to capture it on D-Day. Operation *Epsom* was chosen as it is the first major operation after D-Day with the strategic aim of capturing Caen, and all the photographic reconnaissance and intelligence was still being provided from the British mainland and not from deployed reconnaissance aircraft and photographic interpreters. This period was also selected due to the sheer volume of 1550 Medmenham reports in June 1944 and the necessity to narrow down the number of reports requiring analysis.<sup>398</sup> *Epsom* is also seen as one of the decisive points in the battle for Normandy as after *Epsom* the Germans never recovered from the severe damage inflicted on their forces, leading to the final Allied breakout in early August 1944.<sup>399</sup>

The Operation *Epsom* case study is from a period that Medmenham staffing and its output of photographic intelligence was at a peak. Medmenham had competing priorities with support for *Overlord*, the hunt against the vengeance weapons, known as Operation *Crossbow*, as well as supporting the Strategic Bombing Offensive. However, the support for *Overlord* was the top priority for Medmenham and the photographic reconnaissance aircraft. Operation *Epsom* had as well as the usual flow of damage assessment reports from Medmenham, three large complex and detailed photographic intelligence reports produced on a daily basis. The Daily Airfields Report (DAR), the daily B Section army ground activity report and the Daily Railway Report (DRR). This case study will show from a detailed examination of all

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<sup>398</sup> See Graph 2.

<sup>399</sup> J Buckley, *Monty's Men: The British Army and the Liberation of Europe* (London: Yale University Press, 2014) 72-87. W Murray & A Millett, *A War to be Won*, 411-434.

these reports, that it was the DRR that was most mentioned in the intelligence flows from the deployed army headquarters, and draw fresh conclusions from this reporting that will provide a new interpretation of the importance of the Medmenham photographic intelligence and the DRR to the battle for Normandy.

When considering where Operation *Overlord* sits within the grand strategic framework of the Second World War there is a wealth of historiography to draw upon. This helps contextualise where the Normandy operations fell within *Overlord*. The Soviet allies were planning to launch Operation *Bagration* and were already confronting Germany on the eastern front, which contained over two hundred German divisions, and in Italy the Allied armies were faced by over twenty divisions. These campaigns drew significant German military force away from the defence of western Europe and the Normandy campaign. Calais would be the obvious choice for an invasion, with such a short Channel crossing and excellent port facilities, but it was also very well defended. Normandy was chosen as the best place for the invasion, and a deception plan, Operation *Fortitude* was designed to make the Germans think Calais was the focus for the invasion.<sup>400</sup>

As part of the preparations for the Normandy landings the heavy bomber forces of the Allies were placed under direct command of General Eisenhower at Supreme Headquarters Allied Expeditionary Forces (SHAEF) from April to September 1944.<sup>401</sup> This allowed the diversion of the heavy bomber forces from the strategic targets in Germany under the *Pointblank* directive, which were part of a combined bomber offensive, to invasion targets in France. These invasion targets included coastal defences, airfields, radar sites and transportation. This diversion of the heavy

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<sup>400</sup> L Baker, *The Second World War on the Eastern Front* (Harlow: Pearson, 2009) 87-94; M Barbier, *D-Day Deception: Operation Fortitude and the Normandy Invasion* (Mechanicsburg PA: Stackpole, 2009) 74-147; R Bennett, *ULTRA in the West*, 30; F H Hinsley, et al, *British Intelligence in the Second World War Vol 3, ptII*, 177-179. L Ellis, *Victory in the West, Vol 1*, 102-104; W Murray & A Millet, *A War to be Won*, 411-450; P O'Brien, *How the War was Won*, 316-373; E Ziemke, *Stalingrad to Berlin: The German Defeat in the East* (Washington DC: Office of the Chief of Military History, 1968) 313-345; MA Acc no: 5062 Operation *Fortitude* The Backbone of Deception; MA Aqn No: 11848, The Success of Operation *Fortitude*.

<sup>401</sup> C Messenger, 'Bomber' Harris and the Strategic Bombing Offensive 1939-1945, 163-169.

bombers from strategic targets to invasion targets was controversial in certain quarters, especially amongst some in the Air Staff and at Bomber Command.<sup>402</sup>

However, the attacks on the French airfields, railways and bridges were a critical part of *Overlord* by reducing the ability of the German forces to intervene successfully in the air and to bring reinforcements quickly by rail into the invasion area to counter the Allied landings. The attacks against airfields had forced the *Luftwaffe* to base most of its aircraft in Germany leaving only just over three hundred fighters in France, with a plan to quickly deploy over twelve hundred forward into France to oppose any landings. That plan failed because of the destruction of the French airfields and Allied fighter attacks destroying the aircraft as they deployed forward from Germany.<sup>403</sup> The attacks against rail targets which began in early March had reduced the railway movements to 30% of normal by the 6 June 1944 and to around 10% by early July 1944 severely impacting troop, equipment and resupply movements and were considered a success. Bomber Command had successfully attacked all thirty-seven of the railway targets allocated to it by the 6 June 1944.<sup>404</sup>

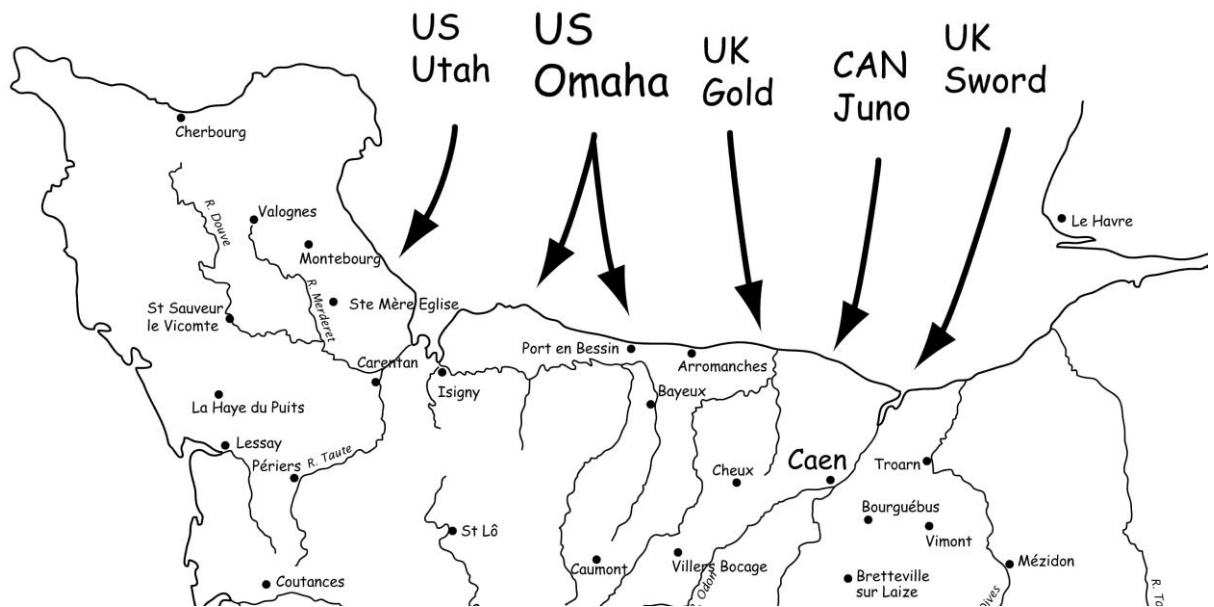
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<sup>402</sup> General Montgomery was very aware of these tensions of using Bomber Command for tactical operations and was fast to praise them for their support as shown in his signal dated 8 July 1944 which praises Bomber Command: 'we also know well that you are always ready to bring your mighty effort closer in when such action is really needed and to co-operate in our tactical battle. When you do this your action is always decisive'. TNA WO 223/28, Secret Cipher Telegram From General Montgomery Tac HQ 21 Army Group to War Office for Harris dated Time1212, 8 July 1944.

<sup>403</sup> P O'Brien, *How the War was Won*, 365; W Murray, *The Luftwaffe 1933-45*, 279.

<sup>404</sup> S Cox, ed, *The Strategic Air War Against Germany, 1939-1945*, 18-20; T Biddle, *Rhetoric and Reality in Air Warfare*, 233-234; A Harris and S Cox, *Despatch on War Operations*, 23-27, 124-125; R Hart, 'Feeding Mars: The Role of Logistics in the German Defeat in Normandy', *War in History*, 3.4 (1996) 427-429; C Messenger, *Bomber Harris and the Strategic Bombing Offensive, 1939-1945*, 154-169; M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 489-490, 509-537; W Murray & A Millett, *A War to be Won*, 413-416; C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, 27-39; P O'Brien, *How the War was Won*, 364-370; R Overy, *The Air War 1939-45*, 76-78; R Overy, *The Bombing War*, 312, 574-578.

## Map 1 Overlord Landing Beaches 6 June 1944



The *Overlord* plan was for the landings in Normandy on five beaches, code named Utah, Omaha, Gold, Juno and Sword, see Map 1, to be swiftly followed by the capture of Carentan, St. Lo, Bayeux and Caen, and a swift build-up of invasion forces, then to break out from Normandy. These plans were delayed with the failure to capture any of these objectives on D-Day the 6 June, and a delay until the 12 June to link up all five invasion beaches, because of the strength of the German forces. The capture of Caen on D-Day was thwarted by the reinforcement of Caen defences just before D-Day by 21 Panzer Division. Signals intelligence had provided General Montgomery, commanding 21 Army Group, with warnings about the presence of 21 Panzer defending Caen, but they had to continue with the attempt to take Caen as it was such an important objective.<sup>405</sup> However in spite of these setbacks, the Allies had secured the Cotentin Peninsula and Cherbourg by the end of June. They did not secure the whole of Caen until the 21 July. The Allies had three major operations to capture Caen, *Epsom* at the end of June, *Charnwood* which captured the northern parts of the city by 10 July and *Goodwood* which completed the capture of Caen by

<sup>405</sup> R Bennett, *Behind the Battle*, 252-266. Bennett reports that it was the Army 'Y' Service that located 21 Panzer, *Ultra* intelligence had identified the location of the majority of German defending forces, apart from 21 Panzer moving to defend Caen and 352 Division in the area of Omaha Beach; A McKee, *Caen: Anvil of Victory* (London: Souvenir, 2000).

21 July. The Allies, in a series of operations, had won the battle of Normandy by 22 August and had reached the Seine river and liberated Paris by 25 August.<sup>406</sup>

The historiography of the Normandy campaign consists of narrative histories such as the official history series narratives by Ellis as well as the memoirs of Churchill and Montgomery, which glossed over any British weaknesses.<sup>407</sup> The seventy plus years since *Overlord* have allowed time for more analytical and revisionist histories to be produced, that are critical of the commanders and troops on the Allied side. These books provide a narrative that supports the claim that the British in particular were cautious and used overwhelming force from airpower, artillery and armour to defeat the Germans.<sup>408</sup> This view had become part of the mainstream view of historians during the 1970s through to the 1990s and acknowledges the tactical weaknesses of the Allied troops compared with the battle-hardened Germans. However, more recent histories are looking more favourably on the British performance in the round, given the resources and trained manpower available and after careful analysis on the Allied conduct of *Overlord*.<sup>409</sup>

The opening chapter of John Buckley's *Monty's Men*, has a comprehensive discussion of the historiography of the campaign under Montgomery from D-Day to VE Day. It is focused on the ground war and Buckley takes us from the narrative official history of Ellis, through the analytical and revisionist historians questioning the abilities of the British generals and soldiers to the more nuanced and balanced modern interpretation of the performance of the British and Allied troops and

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<sup>406</sup> L Ellis, *Victory in the West – Vol 1*, 149-459.

<sup>407</sup> L Ellis, *Victory in the West – Vol 1*. Other early histories include: H Darby & M Cunliffe, *A Short History of 21 Army Group* (London: Gale & Polden, 1949), H Essame & E Belfield, *The North West Europe Campaign 1944-45* (Aldershot: Gale & Polden, 1962), W Churchill, *The Second World War Vol 1-6* (London: Cassell, 1948-54), B Montgomery, *Normandy to the Baltic* (London, Hutchinson, 1947).

<sup>408</sup>For revisionist accounts see: J Ellis, *Brute Force* (London: Deutsch, 1990); M Hastings, *Overlord* (Leeds: BCA, 1984); B Hart, *The Other Side of the Hill* (London: Cassells, 1951); C D'Este, *Decision in Normandy: The Real Story of Montgomery and the Allied Campaign* (London: Penguin, 1994); J English, *The Canadian Army and the Normandy Campaign* (Mechanicsburg PA: Stackpole, 2009); R Lamb, *Montgomery in Europe, 1943-45: Success or Failure* (London: Buchar & Enright, 1983); N Hamilton, *Monty: Master of the Battlefield, 1942-1944* (Sevenoaks: Sceptre, 1987); T Royle, *Montgomery* (New York: Palgrave Macmillan, 2010).

<sup>409</sup> J Buckley, *Monty's Men*, 1-114; J Buckley, ed, *The Normandy Campaign 1944: Sixty Years On* (Abingdon: Routledge, 2006) 11-21, 48-63, 158-169. J Buckley, *British Armour: In the Normandy Campaign 1944* (Abingdon: Cass, 2004); D French, 'Invading Europe: The British army and its preparations for the Normandy campaign, 1942-44', *Diplomacy and Statecraft*, 14.2 (2003).



generals. This more nuanced view is also seen in Stephen Hart's *Colossal Cracks*, acknowledging the weaknesses of the Allied troops in early tactical battles, but showing how using the strengths of superior massed artillery and overwhelming airpower integrated into the operations, proved victorious over the Germans.<sup>410</sup> This more nuanced view continues with W Murray and A Millett in *A War to be Won*.<sup>411</sup> The interpretations of the performance of the British troops continue with recent scholarship looking at the performance of individual divisions which diverge from the cautious approach and show that battles were planned and fought at a fast pace, using artillery to compensate for what they lacked in anti-tank and armoured support.<sup>412</sup>

The intelligence support for *Overlord* had been meticulously planned.<sup>413</sup> Sources included *Ultra* intelligence from Bletchley Park as well as tactical signals intelligence, traffic analysis and Direction Finding (DF).<sup>414</sup> The Allies also had Agent reporting from multiple sources including MI6, SOE, French resistance and prisoner interrogations.<sup>415</sup> Added to this there was also the vast quantities of intelligence gained from photographic reconnaissance with over sixteen thousand sorties and two and three-quarter million reconnaissance prints received by Medmenham in 1944.<sup>416</sup> The modern histories have had the benefit of the knowledge of the intelligence produced by Bletchley Park and this can have the effect of overshadowing all the other sources.<sup>417</sup> However, the *Ultra* intelligence from Bletchley Park was kept on a

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<sup>410</sup> S Hart, *Colossal Cracks: Montgomery's 21st Army Group in Northwest Europe, 1944-45* (Mechanicsburg PA: Stackpole, 2007); Also see: L P Devine, 'The British Way of War in North West Europe 1944-45: A Study of Two Infantry Divisions', (unpublished doctoral thesis, University of Plymouth, 2013).

<sup>411</sup> W Murray & A Millett, *A War to be Won*, 270, 411-434;

<sup>412</sup> L P Devine, 'The British Way of War in North West Europe 1944-45'.

<sup>413</sup> H Hinsley, *British Intelligence in the Second World War – Vol 3, pt 2*, 3-225.

<sup>414</sup> R Bennett, *ULTRA in the West*.

<sup>415</sup> K Jeffery, *MI6*, 327-610; Air Historical Branch, *RAF and SOE: Special Duty Operations in Europe During WW2: An Official History* (Barnsley: Frontline, 2016); K Fedorowich, 'AXIS Prisoners of War as a Source for British Military Intelligence'; M Seaman, ed, *Special Operations Executive: A New Instrument of War* (Abingdon: Routledge, 2006).

<sup>416</sup> This is the highest number of sorties and prints received by Medmenham and was a combination of a vast increase in reconnaissance tasking and the USAAF reconnaissance also being received at Medmenham. See Annex I for year by year figures for Medmenham.

<sup>417</sup> For history of GC&CS see: P Davies, 'From amateurs to professionals'; C Grey, 'The making of Bletchley Park and Signals Intelligence 1939-42', 785-807; C Grey & A Sturdy, 'A Chaos that Worked', 47-66; R Lewin, *ULTRA goes to War*; R Bennett, *Intelligence Investigations*; R Bennett, *ULTRA in the West*.

very limited distribution and was not passed down below higher headquarters. The intelligence that was seen at divisional and brigade level in the form of intelligence summaries were created from those other intelligence sources, with occasionally carefully downgraded paraphrased and disguised information from *Ultra* decrypts.<sup>418</sup>

Bletchley Park and its *Ultra* intelligence had allowed the Allied Commanders to build up a clear picture of the German forces that opposed the D-Day landings.<sup>419</sup> The *Ultra* intelligence had provided most of the detail of *Luftwaffe* dispositions, so that the Allies knew that they faced very little air opposition from aircraft in France and that reinforcements would need to be flown in from Germany and that they faced severe fuel shortages, even before D-Day.<sup>420</sup> The *Ultra* intelligence on the German army provided a comprehensive breakdown of what the Allies had to face during the initial D-Day battles and then was to give warning of the transport and arrival of reinforcements. However, it did fail to locate 21 Panzer Division moving to Caen and also the German 352 Infantry Division opposite Omaha beach. The *Ultra* intelligence also provided the Allies with the regular status reports from senior commanders as they reported back to Berlin. These reports along with other *Ultra* intelligence reassured the Allied commanders not only that the deception plan Operation *Fortitude* was working, but the successful impact of attacks on the French transportation system, airfields and bridges was greatly reducing the flow of traffic on the rail and road networks.<sup>421</sup> However, because of the time to break the new German codes each day, there was an inbuilt delay in providing *Ultra* intelligence to the few cleared to receive this intelligence, which could affect its tactical usefulness.<sup>422</sup> The supply of *Ultra* intelligence would provide a steady stream to the Allies, especially after the break out from Normandy, but it did have some periods of providing very little intelligence of tactical use and Operation *Epsom*, with one notable exception was one of those periods. As well as the highly classified *Ultra*

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<sup>418</sup> See: 2 Army Intelligence Summaries, TNA WO171/220, 20-30 June 1944.

<sup>419</sup> R Bennett, *Behind the Battle*, 252-266.

<sup>420</sup> R Bennett, *ULTRA in the West*, 58-65.

<sup>421</sup> R Bennett, *ULTRA in the West*, 64-65; M Barbier, *Operation Fortitude and the Normandy Invasion*, 74-147.

<sup>422</sup> For discussions of how Bletchley Park worked to break the *Enigma* codes see: J Jackson, *Solving Enigma's Secrets*; R A Ratcliff, *Delusions of Intelligence*, 56-72; H Hinsley & A Stripp, *Codebreakers*; P Calvocoressi, *Top Secret Ultra*; R Erskine & M Smith, *The Bletchley Park Code Breakers*; M Smith, *Station X*.

intelligence, signals intelligence also provided a steady stream of traffic analysis and DF of German wireless traffic. It was in fact Army DF that located 21 Panzer moving to reinforce Caen on D-Day.<sup>423</sup>

The air support to *Overlord* had undergone a strategic change with the control of all heavy bombers as well as tactical aircraft being given to General Eisenhower in April 1944. In the planning for photographic reconnaissance for *Overlord* it had been appreciated very early that a reorganisation of air support to the Army would be required by the RAF to support the land invasion of Europe. The RAF proposed reorganising the Army cooperation squadrons into a much larger organisation, the 2nd Tactical Air Force, with embedded in that organisation the 34th, 35th and 39th Photographic Reconnaissance Wings. The 2nd Tactical Airforce was to move forward with the advancing Allied troops and fly from Advanced Landing Ground (ALG) facilities, as well as captured airfields. The RAF could build an ALG in less than two days, but they were very austere facilities and prior to the break out from Normandy susceptible to German artillery attack as well as from the *Luftwaffe*.<sup>424</sup>

The case study concentrates on RAF Medmenham support to Operation *Epsom* 26 June to 30 June 1944 and uses it as the model to show the vast number of photographic intelligence targets covered every day and the long and detailed reports produced by Medmenham from this analysis of the photographs. The fact that the photographic intelligence was being supplied from Medmenham is key to the selection of Operation *Epsom*. Operation *Epsom* was initially planned to start earlier in June, but because of very bad weather affecting the build-up of forces, armaments and supplies Operation *Epsom* was postponed until 26 June. This was before any reconnaissance aircraft were forward based in France at ALGs and before the Army

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<sup>423</sup> R Bennett, *Behind the Battle*, 266.

<sup>424</sup> The RAF developed a bare /austere airfield type called an Advanced Landing Ground (ALG), which were quick to deploy and operate from with runways made from a variety of materials including pierced steel planking or square meshed track. They were built along the south coast of England to support air operations around D-Day with the majority of direct support and fighter cover missions flown from these airfields. They were then built on the continent with ALG B5 being completed on 16 June 44. C G Jefford, *R A F Squadrons: A Comprehensive Record of the Movement and equipment of All RAF Squadrons and Their Antecedents since 1912* (Shrewsbury: Airlife Publishing, 1987) p179-187.

mobile photographic processing and interpretation sections of the Army Photographic Interpretation Sections (APIS) were deployed. The first reconnaissance aircraft flew from France in July and APIS 21 Army Group deployed to France on 6/7 August 1944.<sup>425</sup>

Medmenham had been preparing for *Overlord* since 1943 and this work is frequently mentioned in the Medmenham popular histories. These accounts have tended to concentrate on the pre-invasion work of Medmenham, the fact it became the Allied CIU and especially the models for the invasion beaches and on all the work for *Crossbow*. All the popular accounts are silent on the intelligence support provided post D-Day by Medmenham in the airfield, railway and army reports covered by this case study.<sup>426</sup> The ACIU was tasked to provide detailed intelligence on all the visible German defences, troop locations and the type of beaches, countryside and obstacles the Allies would encounter in France during the initial invasion phases. This photographic intelligence included not only ACIU reports, but thousands of annotated photographs of the invasion beaches and defended areas inland for all the initial invasion objectives. They were also provided with very detailed and accurate topographic models of all the invasion beaches and inland areas, produced by the ACIU Model Section. These detailed models covered as far inland as Caen and just beyond Caen. The Model Section produced 109 detailed invasion models and 250 copies of them were made using a new special rubber, to allow all invasion troops to be briefed on the invasion targets.<sup>427</sup> The detail and accuracy of the ACIU models were exceptional for 1944, and General Eisenhower wrote to ACIU a week after D-Day to express his thanks for their hard work and 'contribution to our ultimate victory'.<sup>428</sup> The 109 models that were produced by the Model Section are listed in the ACIU Model Section Master Log Book, which includes a map of all the areas covered by the invasion models, and a more detailed map around Caen of the six detailed models in that area, and one area model.<sup>429</sup> The Caen area models were completed between 13 February 1944 and 14 May 1944 and were very detailed at a scale of 1

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<sup>425</sup> MA Acc No: 3343, *Report on the Work of APIS 21 Army Group 20 July 1945*.

<sup>426</sup> C Babington Smith, *Evidence in Camera*; Powys-Lybbe, *The Eye of Intelligence*; T Downing, *Spies in the Sky*; C Halsall, *Women of Intelligence*; Williams Allan, *Operation Crossbow*.

<sup>427</sup> MA Acc no: 9454 Master Model Section Log Book.

<sup>428</sup> MA Acc no: 2046, Letter from General Eisenhower to Sir Archibald Sinclair, 14 June 1944.

<sup>429</sup> MA Acc no: 9454 Master Model Section Log Book & Acc no: 8329 ACIU Model M1013, Caen, Bayeux, Falaise & Argentan Areas, Five photographs of the Model.

to 5000 and were on average 60 by 36 inches, with multiple rubber copies made of several of the models. All this pre-prepared intelligence would have been available for the planning of Operation *Epsom* and had an additional advantage of having made the Medmenham photographic interpreters very familiar with area.

Medmenham also provided photographic intelligence to many departments in the War Office, Admiralty and Air Staff as shown on many of the standard distribution lists on the Medmenham reports.<sup>430</sup> These reports were used and assimilated into products from the various departments, which included significant input from Medmenham. This can be illustrated by the very detailed tactical target books that were produced for *Overlord*. Within the Air Ministry intelligence staff, the department A.I.3c was responsible for amongst other items, target lists. They produced a whole series of tactical target books for *Overlord*. One is devoted to tactical targets in the Caen area. The book at over 100 pages includes all the identified defensive locations as targets, the road and rail targets and a general description of the whole area as well as the military significance of the Caen area. The book includes detailed descriptions of each target which are from the Medmenham reports, target maps, produced from Medmenham intelligence and detailed fold out photographs of all the tactical targets in the Caen area, from Medmenham photographs, with detailed overlays added.<sup>431</sup> These target books, based on Medmenham intelligence would provide the planning and intelligence staffs with excellent details on which to plan forthcoming operations and the Caen target book provided that detailed target intelligence on Caen to a level that it would only need the tactical updates of any new German defensive laydown.

Medmenham had been steadily growing with an increase in the numbers of staff and also significant growth in tasking so they produced significantly more reports and

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<sup>430</sup> For full list of all Medmenham standard distribution lists see: TNA AIR 40/1173.

<sup>431</sup> TNA AIR 40/1280 Tactical Targets Caen Area, May 1944. R Bennett, *ULTRA in the West*, 86. It is interesting to note that the Allies included Land Line Systems as targets for Bomber Command to try to force German communications away from disrupted land lines to wireless and therefore *Enigma* encoded communications. In the CAEN Tactical Targets Book, land line systems were included as a target category, with the important repeater station at Caen being identified as a target in the Post Office Building. See ADM 199/1608, Caen Tactical Targets page 78 to 81.

photographs then at any time before.<sup>432</sup> This was achieved through a combination of increased staff numbers, better equipment, improved procedures and a significant increase in reconnaissance sorties. There was also a build-up of American staff at Medmenham and the USAAF Eighth Reconnaissance Wing at Mount Farm. Mount Farm had been a satellite airfield for the PRU at RAF Benson and was in use by the American reconnaissance aircraft by March 1943, so was a logical airfield for the USAAF Eighth Reconnaissance Wing to take over.<sup>433</sup> With all these changes it was time for Medmenham to make some significant organisational changes. There were 60 American photographic interpreters working at RAF Medmenham in the CIU by the beginning of 1944.<sup>434</sup> There were also fifty American enlisted personnel working in the expanded Model Section.<sup>435</sup> The Central Interpretation Unit formally changed names on 1 May 1944 to the Allied Central Interpretation Unit (ACIU).<sup>436</sup> The ACIU also changed the top-level organisation within the Unit. Group Captain Cator stayed as the commanding officer of RAF Medmenham, but the next level down within ACIU, the Task Control Officer post was split in two, with Wing Commander Douglas Kendall and USAF Lieutenant-Colonel William O'Connor sharing the role of coordinating all tasking within the organisation.<sup>437</sup> The majority of the ACIU work was on *Overlord*, *Crossbow* the hunt for the German V weapons and the German war industries.<sup>438</sup> The Medmenham popular histories and folklore as previously mentioned can unduly concentrate on *Crossbow* and the significant work of Medmenham in the identification of the V1 and all its fixed launch sites, which were named Bois Carre sites, and the smaller harder to identify prefabricated Belhamelin launch sites, as well as the V2.

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<sup>432</sup> See Annex I, which shows graphs of Medmenham personnel numbers from 1942 to 1945, Report and Print production numbers and Reconnaissance Sortie numbers for 1940 – 1945 as well as Reconnaissance Sortie numbers by month for 1944.

<sup>433</sup> TNA AIR 41/7, Draft RAF Narrative: Photographic Reconnaissance Vol 2, 78.

<sup>434</sup> MA, RAF Medmenham Operational Record Book, 31 December 1943, 31 January 1943 & TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2.

<sup>435</sup> MA, RAF Medmenham Operational Record Book, 31 December 1943, 31 January 1943 & TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2.

<sup>436</sup> MA, RAF Medmenham Operational Record Book, 30 April/1 May 1944.

<sup>437</sup> MA, Acc no: 557 TCO Organisation; MA, Acc no: 516 Unpublished Memoirs of Group Captain Cator.

<sup>438</sup> TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance, Vol 2, 44. The codename for the V weapon hunt had been Bodyline but changed to Crossbow in November 1943. However, Bodyline tasking was still seen in the Medmenham ORB in 1944 and at times almost half of the tasking on W Section was for Bodyline tasks. See MA RAF Medmenham ORB entries dated 30 April, 31 May & 30 June 1944.

This was a significant task on Medmenham, with staff being reallocated from routine work to support *Bodyline* and *Crossbow* tasks as well as those already reallocated to support *Overlord*.<sup>439</sup> Medmenham had been involved in the *Crossbow* hunt since 1942 and this would continue until April 1945, initially trying to identify the German vengeance weapon research and development facilities. The first photographic evidence of the V1 was found on photography over Peenemünde in May 1942. Medmenham had C Section, which specialised in aircraft and the army B 2 sub section hunt for evidence of these flying bombs and new vengeance weapons. Medmenham succeeded in identifying a new type of construction, the Bois Carré or ski sites that were to launch the V1s. Then B 2 sub-section was tasked with examining all photography of 160 miles radius from London in occupied territory to try and identify all the Bois Carré sites. They were successful in identifying all 96 of these permanent sites and Bomber Command launched a series of attacks against all the sites. *Crossbow* restrike targets were a very high priority for Medmenham and had to be reported out within two hours of receiving the photography. The whole procedure and list of personnel detailed to reinforce the section making the reports is covered in ACIU memorandum.<sup>440</sup> The success that Bomber Command had in destroying all the Bois Carré fixed launch sites had an unfortunate side effect, the Germans developed a much smaller launch site for the V1s based on just a firing ramp, components of which were prefabricated, without any of the storage or control buildings and were much quicker to build and also more difficult to identify and locate. These new sites were called Belhamelin sites and became a *Crossbow* priority to find. *Crossbow* also covered the hunt for the V2 and its launch sites, which were mainly small concrete pads and very difficult to find.<sup>441</sup>

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<sup>439</sup> Note: *Bodyline* was the previous code name for *Crossbow*.

<sup>440</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 68 dated 23 June 1944.

<sup>441</sup> TNA AIR 34/66 *Crossbow* Targets; AIR 34/68 *Crossbow* Manufacture of V1 & V2; AIR 34/70 Joint *Crossbow* Committee; AIR 34/75 CIU *Crossbow* Historical record; AIR 34/182 *Crossbow* Interpretation Reports DS10-DS1088; AIR 34/80, Operation *Crossbow*: History of the Photographic Interpretation of V1 and V2 sites, February 1943 – April 1945; MA Acc no: 2, Complete Report on Operation *Crossbow*; MA Acc no: 1971, Memoirs of Wing Commander Douglas Kendall; MA Acc no: 5535, Historic Record of RAF Medmenham, Section B2 – Operation *Crossbow*; MA Acc no: 8753, Notes made by Constance Babington Smith on Operation *Crossbow*; C Babington Smith, *Evidence in Camera*, 199-232; B Collier, *The Battle of the V-Weapons 1944-45* (London: Hodder and Stoughton, 1964); P Cooksley, *Flying Bomb* (London: Hale, 2006); W Dornberger, *V-2* (New York: Bantam Books, 1979); J Garliński, *Hitler's Last Weapons: The Underground War against the V-1 and V-2* (New York: Times Books, 1978); F H Hinsley, et al, *British Intelligence in the Second World War* Vol 3 pt 1, 357-455; R.V.Jones,

However, from 4 to 10 June 1944 no reconnaissance was flown for *Crossbow*, only for *Overlord*.<sup>442</sup> There was also an overall priority given to *Overlord* above all other work which was issued by Headquarters 106 Group to Medmenham on 28 May 1944 and then produced as an ACIU Memorandum No. 39, "Emergency Measures for Coming Operations" which stated in its first paragraph 'all work not connected with coming operations may be temporarily suspended if this in any way interferes with the production of photographic intelligence for the operations'. This gave Medmenham the authority to stop work on other tasks including *Crossbow* if necessary, to support *Overlord*. The memorandum then section by section ordered the suspension of routine work and directed them to concentrate on targets for *Overlord*.<sup>443</sup>

RAF Medmenham had learnt from how the North Africa Central Interpretation Unit (NACIU) and Middle East Central Interpretation Unit (MECIU) supported land operations during the Eighth Army North Africa campaign and the initial stages of the Italian Campaign with the formation of the MECIU and the NACIU.<sup>444</sup> This experience helped with the planning for photographic interpretation support to *Overlord*, the support being split between Medmenham staff and deployed staff at the airfields and Army headquarters as well as deployed APIS for brigade, divisional, and army-level. The APIS both at Medmenham and deployed specialised by using Army trained photographic interpreters to provide ground focused photographic

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*Most Secret War*, 424-444, 523-580; Powys-Lybbe, *The Eye of Intelligence*, 188-212; T Downing, *Spies in the Sky*, 276-310; M Neufeld, *The Rocket and the Reich: Peenemünde and the Coming of the Ballistic Missile Era* (New York: Free Press, 1995); R Stanley, *V Weapons Hunt* (Barnsley: Pen & Sword, 2010); A Williams, *Operation Crossbow*, 101-296; S Zaloga, *Operation Crossbow 1944: Hunting Hitler's V-Weapons* (Oxford: Bloomsbury Publishing, 2018).

<sup>442</sup> A Brookes, *Photo Reconnaissance* (London: Ian Allan, 1975) 199.

<sup>443</sup> TNA AIR 40/1170, *Procedure Memorandum No. 39 dated 28 May 1944*.

<sup>444</sup> For more details of the intelligence support to these operations and the challenges of centralising reconnaissance and interpretation in the Western Desert see: B W Gladman, *Intelligence and Anglo-American Air Support in World War Two: The Western Desert and Tunisia, 1940-43* (Basingstoke: Palgrave Macmillan, 2009). Note: The decision to form a Middle East Central Interpretation Unit was taken in November 1941 and it covered Malta, The Levant, Iraq, Egypt and the Western Desert. The North African Central Interpretation Unit was formed on 23 Feb 1943. These were formed as it was realised that due to distance, Medmenham could not meet the operational needs for reconnaissance interpretation and a local Central Interpretation Unit was required for these campaigns. The initial photographic interpretation staff were usually from Medmenham. TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, p 47 – 70.



interpretation for the use in army operations. They had deployable and mobile photographic interpretation and photographic processing facilities in vehicles to reproduce photographs for distribution with the intelligence reports to the army in the field.<sup>445</sup>

The Army had established APIS at Army GHQ Home Forces and at Medmenham with the CIU. The Army expanded the APIS organisation to support the Allied invasion of Europe with APIS units to support 21st Army Group. The 21st Army Group main constituent parts were the British 2nd Army and the 1st Canadian Army. The 21st Army Group reported to SHAEF under General Eisenhower. All these formations had their own embedded intelligence staff. The 21st Army Group Photographic Interpretation Unit (AGPIU<sup>446</sup>) moved forward to France in early August 1944.<sup>447</sup> However, individual Army photographic interpreters had started to arrive in France from 13 June 1944. These initial APIS members grew in number quickly during June, attached at Brigade, Division and Army level and would provide expert advice on photographic reports and photographs. The APIS units attached to the ALGs had both photographic printing cabins and interpretation cabins. These were mobile to keep up with the advance of the Allied forces as they moved across France and Germany. They produced First Phase intelligence reports, many annotated prints which were one of the preferred products, mosaic prints and topographic maps.<sup>448</sup> The first photographic intelligence reports produced from APIS in France using photography from forward based 2 TAF aircraft were produced in early July and rapidly gathered pace. The APIS units in France were key to providing tactical photographic intelligence to the Allied invasion forces from July until the end of the war.<sup>449</sup> However, as the reconnaissance aircraft were not yet based in France,

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<sup>445</sup> See MA Aqn No 5741 APIS Soldiers with Stereo & MA Aqn No 18626 Report on APIS SHAEF p 39 – 65.

<sup>446</sup> AGPIU was a HQ APIS, MA Acc no: 3717, APIS Soldiers With Stereo.

<sup>447</sup> MA Acc no: 3717, APIS Soldiers With Stereo.

<sup>448</sup> MA Acc no: 3717, APIS Soldiers With Stereo & TNA WO 171/179, 21<sup>st</sup> Army Group APIS. The APIS bulk distribution of prints for Brigade level was set at 50 prints, with copies available for every Company within the Brigade. The APIS system was scaled to provide this support at Brigade, Division and Army level.

<sup>449</sup> MA Acc no: 3717, APIS Soldiers With Stereo; MA Acc no: 3343, Report on the Work of APIS 21 Army Group 1943-45; TNA WO 171/179, 21<sup>st</sup> Army Group APIS.

APIS was also in the UK. Therefore, all photographic interpretation reports for *Epsom* were provided from the UK.

*Overlord* was the focus of much of Medmenham efforts in 1944, but Medmenham also had other priorities and had to focus on supporting the strategic bombing campaign against the German war industries, especially oil and the V weapon hunt under *Crossbow*. The Bombing Targets Priorities Committee and the Joint Photographic Reconnaissance Committee (JPRC) directed that oil targets had a priority 'second only to *Crossbow*, taking precedence over all else' by the end of June 1944. The V weapon hunt was a high priority before any V weapons were launched, but after the 13 June 1944, when the first V1's were launched against London they became a priority for many in government and significant effort was expended in defending against them. Medmenham to support this priority produced internal processes to rapidly report on all *Crossbow* targets.<sup>450</sup>

The photographic reconnaissance effort for *Overlord* consisted of the four strategic RAF photographic reconnaissance squadrons based in Britain and those of 2nd Tactical Air Force (2 TAF), flying from their UK bases.<sup>451</sup> The strategic photographic reconnaissance squadrons had other tasks as well as supporting *Overlord*. However, all the 2 TAF aircraft were dedicated to supporting 21st Army Group and that included 180 dedicated photographic reconnaissance aircraft. These were in three reconnaissance wings, each of three squadrons.<sup>452</sup> The aircraft types flying these reconnaissance sorties were now not only Spitfires, but also the Mosquitos and

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<sup>450</sup> A Danchev & D Todman, eds, *War Diaries 1939-1945: Field Marshal Lord Alanbrooke* (London: Weidenfeld & Nicolson, 2001) 558-565; TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 68 dated 23 June 1944; TNA AIR 29/338 Minutes of Meeting of Bombing Targets Priorities Committee dated 27 June 1944.

<sup>451</sup> The RAF strategic reconnaissance squadrons in 1944 were in No 106 (PR) Wing and consisted of 540, 541, 542 & 544 Squadron equipped with Spitfire PR XI or Mosquito PR IX aircraft. The US photoreconnaissance was commanded by Col Elliot Roosevelt and was the 325 Reconnaissance Wing. The Joint Photographic Reconnaissance Committee deconflicted strategic reconnaissance sorties between the US and RAF squadrons. The US tactical reconnaissance squadrons were part of the Allied Expeditionary Air Force. See R Nesbit, *Eyes of the RAF*, 179-197; TNA AIR 41/7, RAF Draft Narrative Photographic Reconnaissance Vol 2, 78-80.

<sup>452</sup> The three wings were No 34 Wing, comprising 16,69 and 140 Squadrons, 35 Wing, comprising 2,4 and 268 Squadrons, and 39 Wing, comprising 169, 400, 414 and 430 Squadrons.

Mustangs.<sup>453</sup> It was the dedication of these 180-reconnaissance aircraft to 21st Army Group that allowed them to task reconnaissance sorties to best serve their needs for tactical photographic reconnaissance. All these squadrons were based in Britain for the duration of *Epsom*, with the first squadron, 400 Squadron, deploying to ALG B.8 in France on 1 July 1944 and ground crew arriving on 2 July.<sup>454</sup>

The 2 TAF reconnaissance squadrons were expected to process film at the ALGs, using the RAF Mobile Field Photographic Sections (MFPS). These MFPS had vehicles that contained continuous film processors, multiprinters and photographic enlargers and all the ancillary equipment needed to develop and print the films. At each ALG with a MFPS the RAF also had photographic interpreters to provide quick First Phase interpretation reports on the film being processed by the MFPS. There were seven MFPS available for the 2 TAF squadrons, but the first MFPS did not deploy to France until 2 July 1944.<sup>455</sup> The MFPS and the photographic interpreters' cabins had been successfully used in North Africa and they were further developed for use during *Overlord*.<sup>456</sup> The larger Type A MFPS contained a fast multiprinter that was capable of producing up to 24,000 prints per day. However, it was hoped that the photographic interpretation report, without accompanying prints would answer many questions and reduce the requirement for extra prints.<sup>457</sup> However, all photographic intelligence support for *Epsom* was provided from the UK mainland.

Medmenham experienced a surge in reconnaissance sorties received and demands for photographic interpretation reports and prints during the first few months of 1944. The number of reconnaissance sorties received between January and May 1944

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<sup>453</sup> C G Jefford, *R A F Squadrons*; TNA AIR 27/20, 2 Squadron ORB; AIR 27/49, 4 Squadron ORB; AIR 27/223, 16 Squadron ORB; AIR 27/609, 69 Squadron ORB; AIR 27/967, 140 Squadron ORB; AIR 27/1093/11, 168 Squadron ORB; AIR 29/1543, 262 Squadron ORB; AIR 27/1770, 400 Squadron ORB; AIR 27/1809, 414 Squadron ORB; AIR 27/1856, 430 Squadron ORB.

<sup>454</sup> TNA AIR 27/1770/47 400 Squadron Operational Record Book. ALG B.8 was located near Bayeux.

<sup>455</sup> R Nesbit, *Eyes of the RAF*, 192-197; MA Acc no: 1105, *History of No 7 Mobile Field Processing Section*.

<sup>456</sup> B W Gladman, *Intelligence and Anglo-American Air Support in World War Two*, 131-178.

<sup>457</sup> MA Acc no: 1105, *History of No 7 Mobile Field Processing Section*; TNA AIR 41/7, *Draft RAF Narrative Photographic Reconnaissance Vol 2*, 54, 64-65, Appendix F.

more than quadrupled, providing Medmenham with a wealth of photographs to analyse. This growth in reconnaissance sorties also caused the number of photographic interpretation reports produced per month to double between January and May 1944 and the number of prints almost tripled over the same period. The number of people at Medmenham continued to expand, but only grew by about a sixth over the same time. The manning, reports, print and sortie statistics for Medmenham can be seen in Graphs 1 to 6.

Therefore, to deal with this greatly increased workload, that they expected to grow further as demands of supporting *Overlord* after D-Day arrived, changes were made to the organisation of Medmenham. There was a change in prioritisation of detailed long term Third Phase reporting to allow the allocation of more staff to support the analysis and reporting required by the Second Phase interpretation teams to meet the demands of supporting the invasion.<sup>458</sup> This was the most important change to handle the increased work load. An analysis of RAF photographic interpreter numbers for May 1944 shows that just over a fifth of them were already working for the Army B Section by the end of May.<sup>459</sup> That provided B Section with 55 RAF photographic interpreters as well as the Army photographic interpreters who already worked in the section. The Army had 121 staff at Medmenham in May 1944, not all will have been photographic interpreters and not all will have worked in B Section, but a reasonable assumption is that most Army photographic interpreters were working in B Section, so they would have had a significant number of staff.<sup>460</sup> Then as already mentioned Medmenham was given the directive to suspend all routine work for a short period to support the work on *Overlord*.<sup>461</sup>

Medmenham also realised that it would need to deal with an increase in tasks from external organisations, to support the ongoing operations. To achieve this, they placed the Duty Intelligence Office on 24/7 operations to accept incoming tasks, with

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<sup>458</sup> TNA AIR 29/337 A.C.I.U. Operational Memorandum No. 1 dated 20 June 1944. This memorandum also had an appendix naming twenty-two reinforcement teams to assist the Second Phase sections.

<sup>459</sup> TNA AIR 29/329, RAF Medmenham Monthly Return of Officers May 1944 dated 31 May 1944.

<sup>460</sup> See Annex I for Medmenham Personnel numbers.

<sup>461</sup> TNA AIR 40/1170 A.C.I.U. Technical Control – Procedure Memorandum No. 39 dated 28 May 1944

the priority being support to operations.<sup>462</sup> They also changed and streamlined the procedures for ordering photographs by external organisations and issued a new procedure to be followed. This may seem an odd area to change, until you realise that ACIU produced and dispatched over ¾ million prints in June 1944 as shown in Graph 3.<sup>463</sup> ACIU also noticed that they would pick up during Second Phase and Third Phase interpretation information of immediate tactical value that had not been previously reported. They set up a procedure to telephone this immediate tactical information to the Tactical Air Force Reconnaissance Centre and then record on a form the phone call.<sup>464</sup> From D-Day until 11 June, ACIU had been reporting both Allied activity and German activity in its reports. Then after the 11 June it was decided that the reporting of Allied activity in areas already occupied by the Allies in Medmenham reports was to be discontinued, this would save photographic interpretation time and possible confusion to the users.<sup>465</sup> The reporting of all signs of enemy military activity was a top priority and a new special procedure was developed to rapidly pass any enemy military activity seen on rail or road by phone to 21st Army Group and a follow up written copy to APIS 21st Army Group.<sup>466</sup>

Medmenham was also experiencing an increase in visitors turning up to visit and see what was going on, including senior military officers. Medmenham ACIU Technical Control Memorandum No 45, introduced strict visiting procedures for British and American visitors, requiring prior authorisation.<sup>467</sup> The increase in senior visitors can be partially accounted for because Medmenham was working on both *Overlord* and *Crossbow*, two of the top priority operations for the Allies. It could also be an indication of the growing importance and recognition Medmenham and photographic intelligence was gaining amongst senior staff, as well as being easily accessible from London. They would have been able to view the stereo photographs and see the models for both *Overlord* and *Crossbow* as well as results of the combined bomber

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<sup>462</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 47 dated 5 June 1944.

<sup>463</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 48 dated 5 June 1944 & MA RAF Medmenham F540 entry for June 30<sup>th</sup> 1944. See Annex I and Graph 2 and 3 for Medmenham Manning and Production Figures from Dec 1942 to May 1945.

<sup>464</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 57 dated 11 June 1944.

<sup>465</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 58 dated 11 June 1944.

<sup>466</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 64 dated 17 June 1944.

<sup>467</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 45 dated 20 June 1944.

offensive. It would have made an easily justifiable visit for senior staff and an opportunity to escape the pressures of London for a few hours. There was also the advantage of being able to visit Medmenham without the special clearances and induction needed for Bletchley Park.

Table 19 Total Reports by Medmenham, 24 June 1944<sup>468</sup>

Report Type	Number	Comment
Daily Airfield Report	1	
Daily Railway Report	1	
Daily Army Report	1	Army daily report B916 was issued on 24 June 1944 but was not recorded in Information Summary 1093.
A Section	1	Naval report
D Section	1	Oil industry report
G Section	1	Wireless report
K Section	37	Damage Assessment reports (including K,KS and SA series damage assessment reports usually sent within 24 hours and 143 copies of K series reports and 229 copies of each SA report)
N Section	6	Night photography damage assessment reports
Z Section	5	Detailed Third Phase reports
<b>Total</b>	<b>53</b>	

Medmenham provided 21 Army Group with multiple types of interpretation reports each day. The greatest numbers of reports produced on a daily basis were the standard damage assessment series of reports that multiple times a day reported out on damage seen to enemy targets. There were numerous other special reports produced by Medmenham, which can be seen from the summary Table 19 and in detail in the transcribed Medmenham daily Information Summary No 1093 at Appendix 3.<sup>469</sup> These information summary reports from Medmenham provided details on every sortie received by Medmenham and all reports that they had issued in the last twenty-four hours. The transcribed information summary at Appendix 3, shows the details of over 100 reconnaissance sorties and twenty-three damage assessment reports that day, which is typical.

<sup>468</sup> See Transcribed Information Summary No. 1093 dated 25 June 1944 at Appendix 3.

<sup>469</sup> See Appendix 3 Information Summary 1093 dated 25 June 1944.

However, the cornerstone of the photographic intelligence feed to 21 Army Group were the three types of daily Medmenham reports that covered airfields, railways, and enemy army activity, the first three entries in Table 19. These reports could each be up to thirty pages long and cover up to seventy targets per report, with each target reported out to show what could be interpreted from the photographs. The daily army, airfield and railway reports for the duration of *Epsom* have been examined in detail and extracted to a database for further analysis and selected examples of each are transcribed at Appendix 3. They include hundreds of targets covered during the period of *Epsom*. This analysed data has then been tabulated by French region, see Map 2, and the regions grouped together in four bands, radiating out from Normandy.<sup>470</sup> The addition of banding to the regional map allows further analysis of the data and is used in the following tables on the daily army, airfield and railway report target analysis.

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<sup>470</sup> The French region map used shows Normandy divided into Haute and Basse Normandy and they form band one. Band two contains Bretagne, Pays de Loire, Centre, Ile-de-France, Picardie and Nord Pas De Calais. Band three contains Poitou Charentes, Limousine, Auvergne, Bourgogne and Champagne Ardenne. Band four contains the rest of the regions, Aquitaine, Midi-Pyrenees, Languedoc Roussillon, Rhone Alpes, Franche Cornte, Alsace and the Provence Alpes Cote D'Azur. Alsace is shown as a French region as it was not formally annexed by Germany. However, the German Reich merged Alsace with Baden and conscripted men from Alsace into the German army from 1942. F Frohlig, 'Painful legacy of World War II: Nazi forced enlistment' (unpublished doctoral thesis, Stockholm University, 2013) 10-13; K Maier, H Rohde, B Stegemann, H Umbreit, *Germany and the Second World War: Volume II* (Oxford: Clarendon Press, 2015) 320.

## Map 2 French Map by Region



Table 20 shows the total number of targets reported on for the period of *Epsom* across the three types of daily Medmenham reports. The photography analysed will have covered an even larger area, but if no activity or item of note was seen, it would not make it into the report, so the figures below are of activity seen during the period, not total ground covered by the reconnaissance sorties. The table concentrates on the three types of daily Medmenham reports and does not include the coverage of the hundreds of individual Medmenham battle damage reports on individual targets. This is because the damage reported out in the individual reports is also consolidated into the daily reports, so would amount to double counting. However, the individual battle damage reports were sent out as soon as they were finished and would arrive with the intelligence customer faster than the daily reports. Bomber Command in particular would use the individual battle damage reports to assess the effectiveness of each mission.<sup>471</sup> This was done even on the targets that were part of Operation

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<sup>471</sup> See Chapter 4 for Bomber Command use of Medmenham damage assessment reports.



*Fortitude* where Bomber Command, as well as bombing targets for Operation *Overlord*, made sure that for every raid in Normandy at least one was carried out in the Pas de Calais area.<sup>472</sup> This continued after D-Day with Bomber Command continuing to bomb targets in the Calais area to keep up the deception that the Normandy landings were a diversion and the main attack would still come in the Calais area.<sup>473</sup> After D-Day Bomber Command moved from night time bombing to using strategic bombers for massed daylight support to the troops, preceding troop movements on the set piece operations by massed bombing raids, as in the prelude to Operations *Charnwood* and *Goodwood*.<sup>474</sup>

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<sup>472</sup> M Barbier, *Operation Fortitude and the Normandy Invasion*, 144.

<sup>473</sup> M Barbier, *Operation Fortitude and the Normandy Invasion*, 74-147;

<sup>474</sup> J Buckley, *Monty's Men*, 71-87. C Webster & N Frankland, *The Strategic Air Offensive Against Germany 1939-1945 Vol III*, 163-182.

Table 20 Total Targets Reported on by Medmenham in Daily Airfield, Daily Railway and Daily Army Report by French Region

Band	Region	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	Band Total
1	Basse Normandie	9		1	3		103
	Haute Normandie	8	3	36	36	7	
2	Bretagne	7	1	21	6	14	282
	Pays De La Loire	16	6	11	2	3	
	Centre	5	10		7	11	
	Ile De France	10	9		2	2	
	Picardie	14	8	14	9	20	
	Nord Pas De Calais	24	11	10	8	21	
	Poitou Charentes	12	2	2	4	5	
3	Limousin						72
	Auvergne		2				
	Bourgogne	4	4	1	4	4	
	Champagne						
	Ardenne	5	5	2	4	12	
4	Aquitaine	5				2	23
	Midi Pyrenees	4	2	2		3	
	Languedoc						
	Rousillon						
	Provence Alpes						
	Cote D'Azur						
	Rhone Alpes			2			
	Franche Comte						
	Lorraine					3	
	Alsace						
<b>Total Targets</b>		<b>123</b>	<b>63</b>	<b>102</b>	<b>85</b>	<b>107</b>	<b>480</b>

Table 20 shows the wide distribution of target coverage across France, and is organised into four bands radiating out from the Basse and Haute Normandie area, with as can be seen a concentration of targets in the band 1 and band 2 areas, and the highest target concentration in Haute Normandie. This is what would be expected with the focus on supporting the invasion, however the wider coverage was needed to show the status of German airfields in France and the activity and status of the French railway network.

To show how detailed and extensive the three types of daily Medmenham reports were, how these photographic interpretation reports were formatted and what they contained, an example of each of the reports from the *Epsom* period has been transcribed. The Daily Airfield Report DAR.754 from 28 June 1944, the Daily Army Report B.920 from 28 June 1944, the Daily Railway Report No 45 from 30 June/ 1 July are at Appendix 3. The Daily Railway Report also includes a map of the French

railway system, showing the status of the railway system and the map has been transcribed and is attached at the end of the report in Appendix 3 and in Annex R.<sup>475</sup> The complete set of the French railway system master maps used for reporting by Medmenham are transcribed in Appendix 4. The data in these transcribed reports along with those covering the period from 26 to 30 June 1944 are further analysed in the following tables and discussion.

## Daily Airfield Reports

The daily airfield reports allowed the intelligence staff to build up a picture of serviceability and activity at the airfields and to monitor the impact of bombing attacks against the airfields. The careful bombing campaign before Operation *Overlord* to destroy or seriously damage all the *Luftwaffe* airfields in France greatly reduced the ability of the *Luftwaffe* to bring in reinforcements and aircraft from Germany. They were forced to base aircraft at emergency airfields far to the east and well away from the invasion beaches. When these greater distances and severe lack of aviation fuel because of the successful Allied offensive against the synthetic oil industry were combined together with the lack of ground support aircraft, the *Luftwaffe* never proved to be a significant factor in the invasion battles. They were taking unsustainable losses in aircraft and pilots and German reconnaissance aircraft over the invasion areas became almost non-existent.<sup>476</sup> The Medmenham Daily Airfield Reports were a contributory factor in providing intelligence for the suppression of the German *Luftwaffe* for *Overlord*.

The Medmenham Daily Airfield Reports used all photographs available for the previous 24 hours.<sup>477</sup> The report detailed all the reconnaissance sorties that had

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<sup>475</sup> TNA 29/337, Daily Airfield Report No. DAR.754, 28.6.1944, Daily Army Report B.920, 28.6.1944 & Daily Railway Report No.45 covering 30.6.1944 to 1.7.1944.

<sup>476</sup> W Murray, *The Luftwaffe 1933-45*, 277-292; H Boog, G Krebs, D Vogel, *Germany and the Second World War: Volume VII*, 585-596.

<sup>477</sup> The Daily Airfield Reports normally covered a 24 hour period, but on occasion reports could be produced for shorter periods as seen in DAR.745 at Appendix 3, which covered 0001hrs to 1600hrs on 28 June 1944.

been used to compile the report. The report followed a standard format that would always report on how well covered the airfields were by the reconnaissance sortie, any aircraft seen and any activity as well as any defences. The airfield name and grid reference would also always be used at the start of the report on the airfield as well as the time of cover, altitude, scale of photographs and print numbers covering the airfield. They reported out on all airfields seen and could cover many countries. They always covered France, but could also cover Denmark, the Low Countries and Germany. They could cover over thirty airfields in one report and always reported on the serviceability of the airfield and any aircraft or aircraft activity seen, defensive positions, modifications or repairs made to the airfield. The Medmenham report would also include all airfields that had been reported on by First Phase immediate reports from 2 TAF aircraft, so the Medmenham Daily Airfield Report was a complete report on all enemy airfields covered during the reporting period, usually the previous twenty-four hours and an example can be seen in the transcript at Appendix 3 of DAR.754.

The transcribed report shows that the Germans created new landing strips for their aircraft to use as seen in the report on St. Dizier and continued trying to get the Allies to target unused airfields by placing dummy aircraft on them, but these were usually identified by the Medmenham reports as in the report on St Andre airfield, which clearly identifies eighteen dummy aircraft, but no other activity. The transcribed report is not a special case, but a standard example of the Daily Airfield Report and all the other DARs over this period follow the same format and detailed content. The reports would be produced and distributed by the end of the same day on a standard distribution list. The standard format and distribution of the report made it easier for Medmenham to send out and for recipients to assimilate, with the details being required for further collation and analysis by intelligence officers at higher formations.

Table 21 shows the number of airfield targets covered each day of the *Epsom* period across the French regions and divided in to four bands. The table shows the distribution across France of the eighty-four targets over the five days. The table also clearly identifies that the reports contained up to date information from sorties within

the last 24 hours. This time the main concentration of targets are in band 2, with the least number of targets in band 1. This is to be expected as with the Allied landings in the band 1 area, German aircraft would have been moved to safer bases further away from the front line.

Table 21 Coverage of Daily Airfield Reports on France during Operation *Epsom*<sup>478</sup>

Band	Region	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	Band Total
1	Basse Normandie	1					2
	Haute Normandie		1				
2	Bretagne						61
	Pays De La Loire		1		1		
	Centre	3	3		3	3	
	Ile De France	3	4			2	
	Picardie	2	3	2	5	9	
	Nord Pas De Calais	1	4	3	4	5	
3	Poitou Charentes		1			1	12
	Limousin						
	Auvergne						
	Bourgogne	1				2	
	Champagne						
Ardenne		2	1		4		
4	Aquitaine	1					9
	Midi Pyrenees		2			1	
	Languedoc						
	Rousillon						
	Provence Alpes						
	Cote D'Azur						
	Rhone Alpes			2			
	Franche Comte						
	Lorraine					3	
Alsace							
<b>Total</b>		<b>12</b>	<b>21</b>	<b>8</b>	<b>13</b>	<b>30</b>	<b>84</b>
<b>Report no</b>		<b>743</b>	<b>744</b>	<b>745</b>	<b>746</b>	<b>747</b>	
<b>Report date</b>		<b>26-Jun</b>	<b>27-Jun</b>	<b>28-Jun</b>	<b>29-Jun</b>	<b>30-Jun</b>	
<b>Dates reported on</b>		<b>25 &amp; 26</b>	<b>27</b>	<b>28</b>	<b>28 &amp; 29</b>	<b>29 &amp; 30 Jun</b>	

The stereo photographic coverage and comparative analysis with earlier photographs of the airfields and dummy airfields will have contributed to the ability of the photographic interpreters at Medmenham to identify the German attempts at deception. With the Allied air forces dominating the skies over France and constantly attacking the *Luftwaffe* in the air and on the ground, the *Luftwaffe* were not a threat to

<sup>478</sup> This table is derived from the Daily Airfield Reports 743 to 747. TNA AIR 29/336 and Air 29/337. The reports cover airfields in Norway, Belgium, Germany, Holland and France. Only the French targets are included in the table.

the Allies from the initial landings onward or during *Epsom*. The ACIU Daily Airfield Reports contributed to this battle against the German *Luftwaffe*, allowing attacks to be targeted against active airfields, whilst ignoring inactive or damaged and unserviceable airfields. The key factor is that the Allies had gained sufficient control of the air, to render the *Luftwaffe* an ineffectual force and of little consequence during *Epsom*.<sup>479</sup>

### **Daily Army Reports – B Series**

The daily army reports allowed the intelligence staff to build up a picture of enemy activity in the France not just in the immediate areas around the landing beaches and the impact that those movements might have on the *Overlord* forces. The Daily Army Reports in the B series from Medmenham were produced on a daily basis and used multiple sorties to produce the reports, for example report B920 which is transcribed at Appendix 3, used 19 reconnaissance sorties in the production of the report.<sup>480</sup> These Army reports contained great detail on all German army movements and locations including details on artillery positions, anti-tank positions, ammunition dumps and stores, tank positions and movement, minefields, trenches, troop and machine gun positions and any other defensive position. The stereo photographs used was of such quality that they frequently reported on the position of barbed wire and communication cable trenches.<sup>481</sup> Troop shelters were reported along roads and trackways in the Normandy area. The troop shelters reported in the daily army report B920 on the 28 June 1944 which is transcribed at Appendix 3, have been extracted and plotted. This gives an idea of the area covered and reported on in great detail in these daily army reports as shown on Map 3, where each red dot represents another individual troop shelter reported by Medmenham. The plotting of these troop shelters, the details of which are only available from the Medmenham reports, would

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<sup>479</sup> P O'Brien, *How the War was Won*, 316-373.

<sup>480</sup> See Appendix 3, Interpretation Report No. B.920 dated 28 June 1944, page 10 for sortie information.

<sup>481</sup> Stereo photographs or 3-D imagery in current parlance, were essential to be able to analyse and extract the most detail out of the photographs, it was the normal way for the PI's to work. The transcribed reports at Appendix 3 actually detail when they do not have stereo available as it precluded them giving a full report.

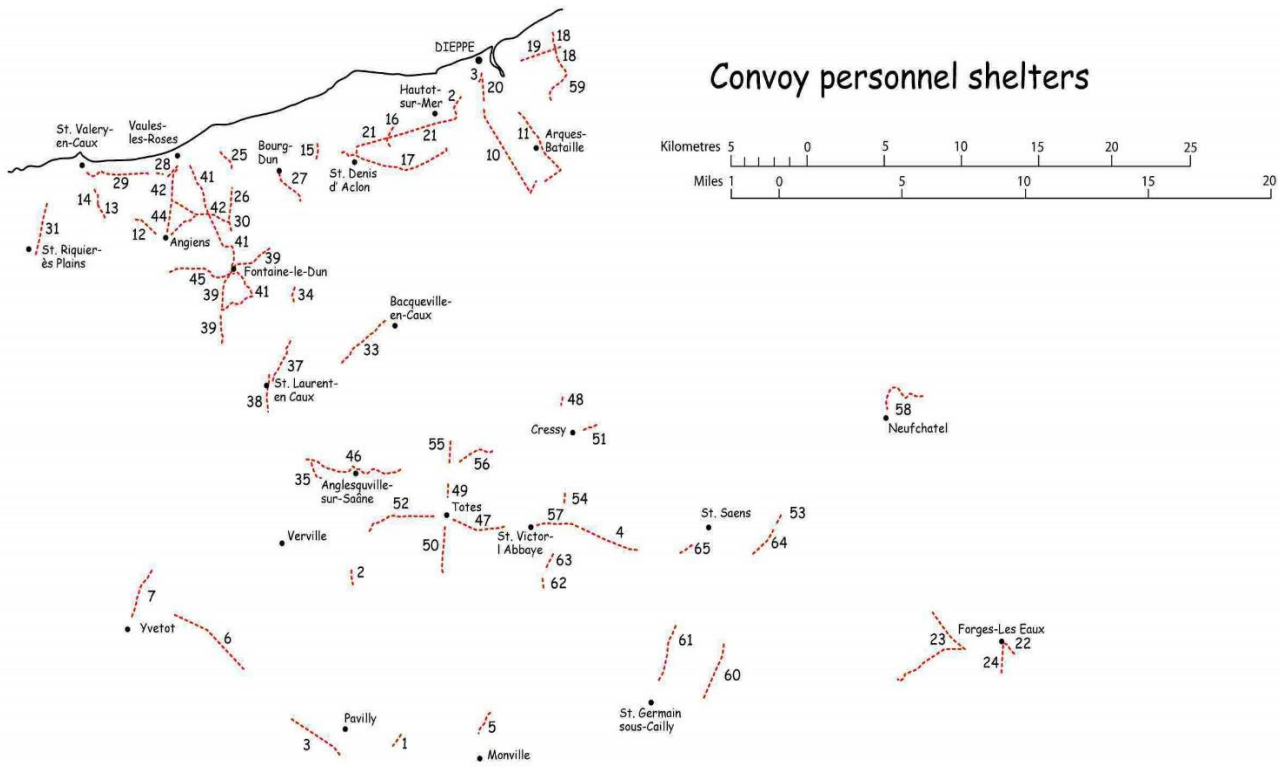
allow the army intelligence officers to build up a picture of what routes the German forces were using to bring in men and supplies under cover of darkness.

The report B920 is as mentioned transcribed at Appendix 3, with the troop shelter reporting starting on page 12 of the report. These troop shelters were often in the form of slit trenches on both sides of the road as well as larger convoy shelters. To report each one of these slit trenches would have been a painstaking task for the photographic interpreters in B Section at Medmenham. The exact coordinates of all the items reported were also included in the report. These reports were sent out on the standard Medmenham distribution list number 33 and 89 copies were sent each day.<sup>482</sup>

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<sup>482</sup> For full list of all Medmenham standard distribution lists see: TNA AIR 40/1173, CIU Distribution Lists. The B Series of reports went out on distribution list 33 to 23 external addresses which included 5 Army addresses, 2 in MI 14, multiple Air Intelligence and all reconnaissance stations including USAAF.

Map 3, Convoy Shelter Positions.<sup>483</sup>



The Medmenham Army B series reports have been analysed for the period of *Epsom* and the targets tabulated against the French Regions and grouped into four bands to show the areas covered and frequency of reporting.

<sup>483</sup> Plotted from coordinates in Medmenham Report B920, 28 June 1944. TNA AIR 34/111.



Table 22 Daily Army B Series Reports, Tabulated by French Region during *Epsom* Period <sup>484</sup>

Band	Date	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	Band Total
1	Basse Normandie	8		1	3	8	101
	Haute Normandie	3	1	36	36	5	
2	Bretagne	7		21	5	13	98
	Pays De La Loire			5	1	2	
	Centre		1		2	1	
	Ile De France						
	Picardie	4	1	9	1	1	
	Nord Pas De Calais	10	2	2		10	
3	Poitou Charentes	1			4		5
<b>Total</b>		<b>33</b>	<b>5</b>	<b>74</b>	<b>52</b>	<b>40</b>	<b>204</b>
Report no		B918	B919	B920	B921	B922	
Report date		26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	
Dates reported		12,15,20,21,22	20,22,24	15,20,21,22,23,24	20,22,24	8,20,22,23,24,25	

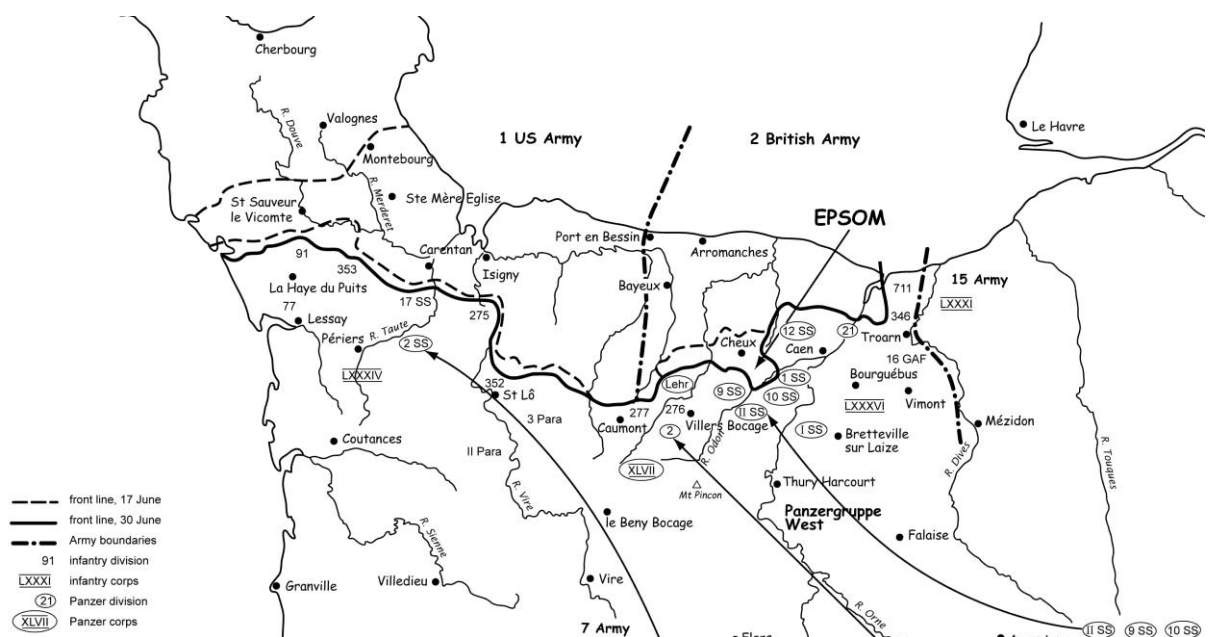
Table 22 shows that the greatest number of targets were in the band 1 area, then band 2 and only a few in band 3, but no targets at all in band 4 which has been excluded from the table. This is expected as the army reports will have concentrated on targets close to the Allied landing areas and then extended out from those to other targets of interest. The photography used for the reports has the most recent sorties used being three days old and the oldest twenty-two days. However, these are detailed Second Phase photographic intelligence reports and 21 Army Group would already have had First Phase tactical reports direct from the airfields within a couple of hours of the aircraft landing, that will have concentrated on any immediately actionable or targetable information seen.

These Medmenham B series reports will have provided great detail on the German army positions and defences, but not current activity in the last thirty-six hours. Therefore, of use for planning at the operational level, but not an up to date tactical picture. The 2 Army daily intelligence reports over the *Epsom* period and the weekly SHAEF G2 intelligence reports provide significant detail on German military

<sup>484</sup> The table data is based on reports B917 to B922 from TNA AIR 34/111. The reports also cover Denmark, The Low Countries and Germany, but only the reports on France are included in the table above.

dispositions and orders of battle. The ground situation and how it moved is shown between 17 and 30 June in Map 4. There is no conclusive proof that the Medmenham Daily Army reports contributed to these, as they are not explicitly mentioned. The 2 Army and SHAEF G2 reports will have contained intelligence from their own indigenous sources as they were in contact with the enemy and taking enemy prisoners who would have provided low level tactical intelligence through prisoner interrogation.<sup>485</sup> However, there are enough reports of tank and troop movements in the SHAEF and 2 Army reports, that the Medmenham reports probably contributed to these intelligence reports, especially as *Ultra* intelligence from Bletchley Park was sparse from 25 June to 30 June.<sup>486</sup>

Map 4 Ground Situation 17 June to 30 June 1944.<sup>487</sup>



The B series of reports over this period do not show the tasking of planning mosaics of Caen to 2 TAF, and it was 400 Squadron reconnaissance flights in the Normandy area that flew Caen unsuccessfully on the 8 and 10 June to try and capture photography to produce the mosaics of Caen. The Squadron successfully flew the

<sup>485</sup> See for discussions of tactical intelligence and its use: K Jones, 'Intelligence and Command at the Operational Level of War – The British Eighth Army's Experience during the Italian Campaign of the Second World War 1943-1945' (unpublished doctoral thesis, University College London, 2005) 46-60.

<sup>486</sup> R Bennett, *ULTRA in the West*, 69-95.

<sup>487</sup> See Annex Q for A4 expanded version of Map 4.

Caen mosaic tasks again on the 14, 15 and 20 June. They also successfully flew the 21 Army battle area on the 17 June. The mosaics produced from these missions would have provided important and up to date planning and briefing tools for the *Epsom* campaign.<sup>488</sup> From analysis of the Squadron Operational Record Books of the nine reconnaissance squadrons of 2 TAF, it was 400 Squadron that did the majority of the reconnaissance flights around the Caen area during the period post D-Day and up to the fall of Caen.<sup>489</sup> The 400 Squadron tasking during June 1944, also show multiple *Crossbow* targets, which were V1 launch sites.<sup>490</sup> The Squadron was still based at Odiham during this period and the films were sent to ACIU Medmenham for analysis and reporting. The sorties flown by the reconnaissance squadrons would cover multiple targets, tactical targets such as Caen and strategic targets for *Crossbow* and this multi-tasking of reconnaissance assets was a normal part of target planning for reconnaissance sorties.

The delay in producing the daily Army B series of reports as shown in Table 22 is at odds with the speed of reporting for the daily airfield and railway reports. The secondary sources are silent on this issue, however the Medmenham F540 entry for the 30 September 1944 highlights the work of B Section from April to September and casts some light on probable causes.<sup>491</sup> *Crossbow* reports were produced by the B.2 sub-section at Medmenham, who were also responsible for all reporting from the Belgian border to St. Malo on enemy activity along the coastal area. Therefore, it would appear that the priority and tight reporting timelines for *Crossbow* reporting had an impact on work to support *Overlord*. This sub-section was overloaded with tasking which was not identified until 23 June, when all responsibility for the coastal reporting was passed to another sub-section B.3 and B.2 concentrated just on *Crossbow* and was enhanced with more staff from the RAF and started reported directly to the TCO.<sup>492</sup> However, further analysis shows that this delay in reporting was still present in the Army B series of reports a month later in late July. Therefore, it

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<sup>488</sup> TNA AIR 27/1770/47 400 Squadron Operational Record Book, June 1944.

<sup>489</sup> 2 TAF Reconnaissance Squadrons were: 2, 4, 16, 69, 140, 168, 400, 414 and 430 Squadrons.

<sup>490</sup> The *Crossbow* targets were called NO BALL Targets and could include any target associated with the V Weapons. There are numerous mentions to NO BALL targets in the 400 Squadron Operational Record Book. See: TNA AIR 27/1770/47 400 Squadron Operational Record Book.

<sup>491</sup> MA RAF Medmenham F540 Operational Record Book 1942 – 1945, entry dated 30 September 1944.

<sup>492</sup> MA Medmenham F540 entry for 30 September 1944.

is possible that it was not the overloading of the B.2 sub-section that created the delay in reporting, but the fact it was far easier to see airfields and railways on photographs and to become familiar with them, and that the detailed Second Phase reporting of any German military ground activity seen was more time consuming and caused the time lag between the latest sorties used and the production of the reports. The ground reporting would also have had to examine every frame of film to produce the report, which would have been time consuming.

The Information Summary transcribed at Appendix 3 shows the 119 sorties that Medmenham received that day and that was normal during this period.<sup>493</sup> However, to report on a railway or airfield they could ignore any frames that did not have the distinctive outlines of railways or airfields. Tactical information requiring urgent action would already have been sent by in-flight radio of important tactical German movements seen by 2 TAF aircrew and following landing and film processing the First Phase photographic interpretation reports were sent by signal direct from the airfields. The fast, usually within a couple of hours of the aircraft landing, First Phase reporting from the airfields may well have filled the 36 hour time gap we see in the daily army reports from Medmenham.<sup>494</sup> However, as the First Phase tactical reports are very incomplete in the record, none surviving for the *Epsom* period, it has not been possible to give a definitive answer as to why the Daily Army B series daily reports were 72 or more hours behind the other reports.<sup>495</sup> The most likely reasons are the greater difficulty in detecting German army movements in the volume of sorties being received combined with a clash of priorities for Medmenham analytical staff between *Overlord* and *Crossbow*, in spite of actions to alleviate the tasking overload.

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<sup>493</sup> Appendix 3, Transcript of Information Summary 1093 from: TNA AIR 29/336.

<sup>494</sup> The first APIS reports found in the archives are from January 1945, TNA WO 171/3839.

<sup>495</sup> This reporting delay was not solved by removing the Operation Crossbow reporting and the reallocation of tasking to sub section B.3 as reporting in late July still shows a 72 hour or later delay from last sortie. TNA AIR 34/111 CIU Reports B900 to 969.

## Daily Railway Reports

To manage the workload in producing the Medmenham Daily Railway Report (DRR) some changes to other railway reporting and the separate railway damage assessment reports were made, which involved stopping the railway damage assessment reports and incorporated them into the DRR.<sup>496</sup> The DRRs usually covered the preceding 24 hour period, with a late afternoon cut off for sorties included. The reports would usually cover the French and German railway systems leading to France. The report would then be produced and distributed by the end of the same day on a standard distribution list with 116 reports distributed daily. The reports had a very set format, reporting out on any military train activity seen, bomb damage to railway infrastructure, total numbers of trains and wagons seen at every location, the serviceability of the trains and if they were in steam and any repair work seen or completed since the last report.<sup>497</sup> The reports also highlighted every rail line, siding and yard that was unserviceable and if the network and through lines were passable, damaged or blocked. Report DRR 41 for example from the 27 June reports on seeing a total of fifty-one military trains on the Toulouse to Avignon and Montauban line. Report DRR 45 from the 30 June reports seeing fifty locomotives that have been fired up and were all in steam ready to move at Dijon on the Sud-Est system, this report and its accompanying map are transcribed at Appendix 3. This report has been chosen for transcription as it is a good example of a DRR and the accompanying map survived with the report. These reports also frequently used comparative analysis to compare activity seen in previous reports with current observations as seen in the transcribed DRR 45, that refers to changes in activity from reports DRR 40, 41 and 42. The reports were also always sent out with a map of the railway network, showing its serviceability.<sup>498</sup> This daily reporting of serviceability of the French railway system from Medmenham and the thesis analysis of these reports provides new insights into the importance of the Medmenham DRR to the Normandy campaign.

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<sup>496</sup> TNA AIR 29/337 A.C.I.U. Technical Control – Procedure Memorandum No. 54 dated 9 June 1944.

<sup>497</sup> TNA AIR 29/329 A.C.I.U. Technical Control – Procedure Memorandum No. 25 Railway Reporting Policy dated 14 May 1944.

<sup>498</sup> TNA AIR 29/337 DRR 41 dated 27 June 44. Not all the maps accompanying the reports are in the National Archives, but the master maps are in AIR 34/79 and transcribed at Appendix 4.

The Medmenham French Railway maps break the French system down into six areas: Sud-Est, Sud-Ouest, Ouest, Nord, Est and the Paris area, with a numbered key of every railway station and these numbers were also used in the report.<sup>499</sup> This allowed anyone reading the report to quickly assimilate and visualise the extensive detail provided by these daily reports. This would have made it very easy to see where there was military activity on the railway system and where the through lines were blocked or cut as shown in the seventeen page very detailed DRR 45 and accompanying map transcribed at Appendix 3. The map accompanying DRR 45 is also at Annex R and demonstrates the ability of the map to clearly show key activity from the DRR, as the activity was detailed in red print against the black map. All the master maps have also been transcribed and are at Appendix 4.

The DRRs over the period of *Epsom* are tabulated by French region and band to show the activity reported across France. Table 23 also shows the speed with which the reports were produced, using missions from the last 24 hours. This extensive coverage of the French railways was the most comprehensive of the daily reports.

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<sup>499</sup> See Appendix 4 for transcripts of the TNA AIR 34/79 Medmenham French Railway System Master Maps.

Table 23 Daily Railway Reports, Tabulated by French Region during *Epsom* Period

Band	French Region	26-Jun	27-Jun	28-Jun	29-Jun	30-Jun	Band Total
1	Basse Normandie						8
	Haute Normandie	5	1			2	
2	Bretagne		1		1	1	123
	Pays De La Loire	16	5	6	0	1	
	Centre	2	6		2	7	
	Ile De France	7	5		2	0	
	Picardie	8	4	3	3	10	
	Nord Pas De Calais	13	5	5	4	6	
3	Poitou Charentes	11	1	2		4	55
	Limousin						
	Auvergne		2				
	Bourgogne	3	4	1	4	2	
	Champagne						
4	Ardenne	5	3	1	4	8	93
	Aquitaine	4				2	
	Midi Pyrenees	4		2		2	
	Languedoc						
	Rousillon	21		5			
	Provence Alpes						
	Cote D'Azur	5		5			
	Rhone Alpes	1		3		2	
	Franche Comte					5	
	Lorraine	2	8	9	1	6	
Alsace			2	1	3		
<b>Total</b>		<b>107</b>	<b>45</b>	<b>44</b>	<b>22</b>	<b>61</b>	<b>279</b>
Report no		40	41	42	43	45	
Report date		26-Jun	28-Jun	28-Jun	29-Jun	01-Jul	
Dates reported on		25 & 26	26 & 27	27 & 28	28 & 29	30 Jun & 1 Jul	

Table 23 shows that the most targets were covered in band 2 and only a handful in band 1. However, there are still a significant number of targets covered in band 3 and band 4. This is because the railway report was covering the whole of France and reporting any movements. To show how much detail Medmenham provided in each report, DRR 45 and its accompanying map are transcribed at Appendix 3.<sup>500</sup> DRR 45 for example shows that the Boulogne to St Omer main line has been cut by bomb craters in at least fifteen places over a length of a mile and half of track and was impassable. This information was crucial to 21 Army Group as it allowed them to assess the speed German reinforcements would arrive and forced the reinforcements off the faster train system onto the roads, where they would be

<sup>500</sup> The transcribed report DRR 45 was sent out on Medmenham standard distribution list No. 8 which had 21 external recipients which included 21 Army Group.

targeted by Allied bombers.<sup>501</sup> Part of the bombing campaign had been to ensure a firm rail seal around Normandy to stop the Germans moving reinforcements quickly by rail into the Normandy invasion area. The Medmenham DRR was one of the main sources that could confirm the status of the railway network and status of the seal. The DRR would show the current status of all the railway network seen that day, but it would not be able to give an accurate assessment of total rail traffic, that when available would have to come from other intelligence sources such as *Ultra* or agent reporting.

The rail seal worked so well that the Germans were forced to de-train considerable distances from Normandy. The Second Army Intelligence Summary of 30 June confirms that the Germans were detraining around Paris and then taking up to five days to move into the Caen area. One of the sources of this information has to be the Medmenham DRR.<sup>502</sup> The 21 Army Group Intelligence Summary of 28 June 1944, in a set of paragraphs on 'Rail Communications in the Battle Area' confirm the effectiveness of the rail seal around the battle area and the report includes a list of railway bridges damaged or destroyed by Allied attacks, with the dates of the last reconnaissance flights.<sup>503</sup> The 21 Army Group Intelligence Summary of 5 July confirms that with the attack on the 30 June of a single track emergency rail bridge on the lower Seine the 'rail seal along the Lower Seine has been closed again'.<sup>504</sup> The SHAEF G2 Weekly Intelligence Summary for the week ending 1 July, covering the *Epsom* period also has almost a page and a half on the effects of the French railway attacks, confirmed by air reconnaissance, on slowing down the German reinforcements.<sup>505</sup>

These reports give a clear indication that the Medmenham DRR were being used in the daily and weekly intelligence summaries and of the importance attached to

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<sup>501</sup> TNA AIR 29/337 DRR 45 dated 1 July 44. Transcript of this DRR shows the extent of Medmenham reporting on the French railway system. The report also shows activity on the German railway, but that part has not been transcribed.

<sup>502</sup> TNA WO 171/220 Second Army Intelligence Summary dated 30 June 1944.

<sup>503</sup> TNA WO 171/221 21 Army Group Intelligence Summary 138 dated 28 June 1944.

<sup>504</sup> TNA WO 171/131 21 Army Group Intelligence Summary 142 dated 5 July 1944.

<sup>505</sup> TNA WO 219/5166, Weekly SHAEF Intelligence Summary No 15 dated 1 July 1944.



maintaining the rail seal to reduce the flow of reinforcements into the battle area. The degradation of the railway system in France to a level where German reinforcements could not be delivered by train into Normandy was considered an essential prequel to invasion. The rail seal combined with the constant air attacks on moving convoys of troops and equipment during the day caused German divisions traveling from the south to leave the trains at the Loire and those from the east at Paris, with some troops and supplies being forced to travel by road from Germany.<sup>506</sup> This had a decisive impact on the German attempts to force the Allies back into the sea, because they were never able to build up sufficient forces to successfully oppose and neutralise the Allied landings and rapid build-up of forces.

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This case study has shown by concentrating on Medmenham reporting in June 1944, the significant quantities of reconnaissance and then analysis and reporting that Medmenham undertook to supply photographic intelligence to 21st Army Group. They had all the photographic intelligence reports, prints, maps and topographic models that had been provided for D-Day as well as the Medmenham Daily Army B Series reports, Daily Airfield reports and Daily Railway reports. As well as the Medmenham reports there was also the tactical photographic interpretation reports from 2 TAF and APIS, both still based back on the UK mainland. However, this thesis and case study concentrate on the reporting from Medmenham. Medmenham had built up significant expertise in reporting on German infrastructure, Bomber Command targets including damage assessment and on the hunt for the vengeance weapons. Therefore, the daily airfield and railway reporting can be considered to play to Medmenham strengths.

The Medmenham B Section daily reports on enemy army movements, defences and damage provided 21st Army Group with a detailed if not very timely picture of

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<sup>506</sup> See A Harris and S Cox, *Despatch on War Operations*, 23; R A Hart, 'Feeding Mars: The Role of Logistics in the German Defeat in Normandy', *War in History*, 3.4 (1996) 427-429; P O'Brien, *How the War was Won*, 369-371; W Murray, *The Luftwaffe 1933-45*, 271-272.

German activity in France.<sup>507</sup> It is probable that the direct wireless reporting from reconnaissance aircrew, followed by the First Phase photographic interpreters reports direct from the airfields by signal filled in the timeliness gap. However, due to a lack of the First Phase signals in the archive, this cannot be proved. This case study is the first to highlight the delay in the daily army reports from Medmenham compared with the speed of reporting in the airfield and railway reports. However, at an operational level these reports could also be used as a cover for the *Ultra* intelligence that provided many details of the tactical and operational level German troop movements and reinforcements. The *Ultra* intelligence provided Montgomery with the reassurance that he was succeeding in drawing all the major German armour against his front and stopping it being used to attack the American sector. It also reassured him that the deception plan, Operation *Fortitude*, that the main offensive would be against Pas du Calais, not Normandy was working and holding significant German forces in reserve waiting for that attack. However, *Ultra* intelligence was not available in any great quantity during Operation *Epsom*, but it did provide some tactical information. Possibly the most useful *Ultra* intelligence provided during Operation *Epsom* was of the counter attack planned for 1 July by 9 SS Panzer Division against Cheux, which was in the middle of the land gained during *Epsom*. The *Ultra* decode was available four hours after the German initial signal and well in advance of the attack, allowing the massive Allied artillery barrage which stopped the counter attack.<sup>508</sup> It is interesting to note that the Allies included Land Line Systems as targets for Bomber Command to try to force German communications away from disrupted land lines to wireless and therefore *Enigma* encoded communications. In the Caen Tactical Targets Book, land line systems were included as a target category, with the important repeater station at Caen being identified as a target in the Post Office Building.<sup>509</sup>

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<sup>507</sup> The latest photography used in the reports was usually 72 hours prior to distribution of the report. The Medmenham B Section reports were detailed Third Phase reports and therefore had a time delay between the date of the last used photographs and the date the report was sent out. This delay as it was a Third Phase report does not appear to have raised any comments because of the constant stream of tactical wireless and First Phase reports from photographic reconnaissance being sent daily to 21 Army Group, so the intelligence summaries of 21 Army Group contained up to date German movements.

<sup>508</sup> R Bennett, *ULTRA in the West*, 86.

<sup>509</sup> J Buckley, *British Armour*, 27-29; R Bennett, *ULTRA in the West*, 80-87; TNAADM 199/1608, Caen Tactical Targets page 78 to 81.

The Medmenham daily reporting on German and French airfields provided a good picture of the *Luftwaffe* dispositions and actual status of all the airfields in Normandy. The success of the Allied attacks against the German airfields in Normandy, forced the *Luftwaffe* to retreat to airfields in South East France, denying them easy access to the Normandy battlefield. All these daily special reports, combined with the numerous Medmenham reports on bombing attacks against tactical targets as well as more strategic targets helped the Allies plan the future direction of the campaign without any significant interference from the *Luftwaffe*.<sup>510</sup>

The Medmenham daily reporting on the French railway system, provided intelligence on the German troop and equipment movements. They identified military trains so that they could be targeted. The reports provided a daily update on the serviceability of the French railway system and on all the lines into Normandy, identifying all through lines that had been cut. This daily stream of intelligence with the attached maps of the railway system, would have been very easy and quick to assimilate. The attacks against the railway system were key to hindering the German resupply and reinforcement plans, where in the invasion month of June, the transport backlog because of Allied attacks against the railway system was reported as seventeen hundred trainloads, with fuel supply being reduced by thirty three percent.<sup>511</sup> This case study has highlighted and provided new insights that shown for the first time that the Medmenham reporting had a crucial role to play in achieving and maintaining the rail seal.<sup>512</sup>

The Medmenham photographic intelligence was not on its own decisive, but it covered Normandy multiple times per day and provided a significant source of

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<sup>510</sup> W Murray, *The Luftwaffe 1933-45*, 277-292. H Boog, G Krebs, D Vogel, *Germany and the Second World War: Volume VII*, 585-596.

<sup>511</sup> H Boog, G Krebs, D Vogel, *Germany and the Second World War* (Oxford: Clarendon Press, 2015) *Volume VII*, 527.

<sup>512</sup> R A Hart, 'Feeding Mars', 427-429; J Stubbington, *Kept in the Dark*, S Cox, *The Strategic Air War against Germany 1939-1945*; A Mierzejewski, *The Collapse of the German War Economy: Allied Air Power and the German National Railway 1944-1945* (USA: University of North Carolina, 2007); R Overy, *The Bombing War*, 573-576.

intelligence on German movements. It also provided important products for the Allies to use for the planning and execution of future operations and campaigns. Operation *Epsom* benefited from significant photographic intelligence work and products produced for D-Day by Medmenham. Medmenham then provided daily updates via the B Section Army reports, Daily Railway reports and Daily Airfield reports. This was all provided at the same time as support continued for the Bomber Command strategic bombing campaign and the high priority Operation *Crossbow V1/V2* campaign. The case study analysis also leads to the conclusion that out of the Medmenham series of daily reports, it is not the Daily Army B reports or the airfield reports that were the most significant, but the extensive and detailed Daily Railway Reports. It was the railway report information that appeared in SHAEF and 21 Army Group reporting in easily recognised form and the railway seal was crucial to the success of the Normandy campaign. Therefore, this thesis has identified the crucial role that DRRs played in monitoring the rail seal around Normandy that significantly delayed the Axis forces from moving reinforcements into the battle area. This is a very significant finding for the importance of Medmenham and photographic intelligence during this critical phase of the Normandy campaign that alters our understanding of the whole campaign, not just Operation *Epsom*.

## Chapter 6

### Conclusion

This thesis has shown conclusively, and in detail, how RAF Medmenham and the CIU/ACIU grew from a small nucleus of experienced photographic interpreters working at the AOC to a large centralised complex for photographic interpretation at RAF Medmenham. The thesis has shown how effective this centralisation of staff and equipment were for Second and Third Phase photographic interpretation and the rapid distribution of the interpretation reports and accompanying prints. The thesis has also shown how the photographic intelligence produced by Medmenham has not been subjected to any detailed analysis within the existing historiography of the Second World War. This thesis further provides proof of the detail, quality and vast quantity of photographic intelligence Medmenham produced. Medmenham developed into a multi-sectioned factory for interpretation in 3-D, or stereo as it was known then, of all the missions flown by the Allies. This centralisation of resources, specialists and interpretation at Medmenham was one of the crucial factors in the Allies success with photographic intelligence. The thesis' analysis proves that this was achieved by developing the complex analytical procedures needed to extract the most intelligence possible from every photograph. They coupled this with the library systems needed for the indexing, storage and retrieval of thousands of intelligence reports and millions of photographs. These reports and photographs were then used for future research, comparative analysis and further detailed Second and Third Phase analysis and reporting.

The role of Medmenham and how it was organised has been compared with Bletchley Park. This has shown how both organisations benefited by centralising and consolidating at a single site to produce intelligence. This had advantages for specialist staff being able to benefit from the presence of other specialists on the same site. For example, Medmenham staff in K Section working on damage assessment reports were able to draw on the specialist knowledge from other sections, such as D Section for industrial specialists. This centralisation also benefited the specialist equipment employed, with Medmenham using the *Wild A5*

stereo autograph machine, specialist high speed film processing equipment and multi-printers for the millions of prints produced. These specialist machines can be seen to be the Medmenham equivalents of the Bletchley Park Bombes. However, though initially there were some similarities in the recruitment of key staff into Bletchley Park and Medmenham, because the latter was a RAF station, more normal military recruitment and posting regimes became the norm. This meant Medmenham did not suffer from the civilian / military tensions that at times existed at Bletchley Park. There was also a clear difference in the classification of the reports produced by Medmenham, compared with Bletchley Park. The Medmenham reports were at a lower classification and did not require the special handling or suffer from the limited distribution of the Bletchley Park product, so were more easily available and usable as an intelligence product. This organisational analysis and detailed comparison with Bletchley Park has not been undertaken previously and provides a more nuanced understanding than before.

Chapter 3 explained how the PIU, already a central interpretation centre, developed during 1940 from producing very simple reports, that were little more than photo reading of what could be seen on that print, to by the end of September 1940 producing more complex analytical reports utilising and producing the early examples of comparative analysis in interpretation reports. The detailed analysis of every reconnaissance sortie during the invasion period and correlation of those with every one of the interpretation reports has highlighted significant gaps in coverage of the invasion ports, not previously identified within the literature. The new analysis in this thesis has shown that this was caused by a combination of scarce reconnaissance Spitfires to fly the missions and also periods of bad weather and not by any shortage of staff at the PIU. These are new insights into the photographic intelligence and reconnaissance capacities, during this phase of the war. However, the PIU reports did allow the build-up of invasion barges to be correctly identified by the CIC and to allow the correct identification of the peak threat of invasion. This was clearly shown by the research methodology used in this thesis, examining in detail every photographic interpretation report and then abstracting that intelligence in the tables of data on the barge counts. This is the first time such an exhaustive and detailed examination of all the photographic interpretation reports from the PIU has been

undertaken and that analysis has provided a new perspective on what photographic intelligence contributed to the wider intelligence picture.

Chapter 4 compared the support from Medmenham to Bomber Command over an area bombing target and then against a precision target. These case studies clearly showed the importance of Medmenham damage assessment reports to Bomber Command and the comparative analysis used to identify the damage caused by specific raids. The detailed analysis of all the Medmenham reports on Cologne in early 1942 also clearly identified for the first time that no special tasking of Medmenham was required to launch Operation *Millennium*, the first 1,000 bomber raid of the war. This was in contrast to the significance of the Medmenham reports for the planning and execution of Operation *Chastise*, the dams raid. Medmenham reports prior to the operation were used by Barnes Wallis and the scientific community to ensure the water levels were high enough for the new weapon to work. The photographs were also used to prepare models of the three dams for briefing of the aircrews. This detailed examination of all the photographic interpretation reports for these two case studies has not been done before and contribute to a more nuanced understanding of the support Medmenham provided to Bomber Command and the importance of that intelligence to them.

Chapter 4 also allowed an examination of how Medmenham had developed between 1942 and 1943 and it was a large complex organisation capable of dealing with substantial numbers of sorties and produce large numbers of interpretation reports and prints. This was a phase of industrialisation of the production process at Medmenham. The PIU produced simple interpretation reports, but Medmenham by 1942 was producing detailed Second Phase reports and Third Phase reports from the 19 specialist interpretation sections. The analysis and comparison of the early PIU reports with those from 1942 to 1944, show a clear development of analytical techniques across the sections, with inter-section collaboration and a wider more diverse set of consumers for the interpretation reports. This changed aerial photography and photographic interpretation, professionalising both so they would never be the same again.

Chapter 5 covered the period after the integration of the Americans into Medmenham and the formal change of name from the Central Interpretation Unit to the Allied Central Interpretation Unit in May 1944. This formally acknowledged the arrival of the Americans into Medmenham, at the working level and at the command level in sections and the TCO. Operation *Overlord* was the top priority for Medmenham, with the fight against the 'V' weapons a close second. This thesis has shown how there was a conflict of priorities and has for the first time highlighted the overloading of the Army B-2 sub section at Medmenham. This overloading of B-2 was not addressed until late in June 1944 and had an adverse effect on the output from that section, working on both the daily B series ground report and the hunt for V weapons. The fact that the most recent photography used in any of the daily B series reports during June and July including was at least 72 hours old, is a significant new finding and alters our understanding of the photographic intelligence support to the Normandy campaign. The conclusion from that finding is that these reports were not used for planning of the next day's tactical battle. The reports, because of the great detail of German defensive locations and equipment and troop movements, would still have been useful for longer term planning by Montgomery and his staff for future set piece operations.

The daily airfield and railway reports in June and July 1944 were by comparison with the Army reports, very timely using photographs from sorties in the last 24 hours for the compilation of the reports. The daily reporting on airfields allowed the Allies to build up a good picture of the actual *Luftwaffe* dispersion and confirmed the adverse impact bombing of the airfields was having on *Luftwaffe* operations. However, the equally timely railway reporting is the reporting that has been seen echoed in the SHAEF and 21 Army Group reports. This thesis detailed analysis of the Medmenham daily railway reporting has for the first time highlighted the important role Medmenham played in monitoring the railway seal around Normandy. They had developed detailed reporting of all activity seen on the railway network, on a daily basis and augmented the long reports with easy to assimilate detailed maps of the railway system, highlighting where lines were impassable. They also monitored and



reported on German repair activity in these daily railway reports, allowing the Allies to re-attack before the railway seal was broken. The identification of the role Medmenham played in the constant monitoring of the rail seal around Normandy is a significant new insight provided by this thesis. However, for this period the Medmenham photographic intelligence was not decisive, but it did provide a consolidated intelligence view of German movements.

From an organisational perspective, the decision to fully integrate the US photographic interpreters and other staff into Medmenham and the official change of the name to the ACIU, can be seen as far more than a simple public relations exercise between the British and US allies. This willingness, like at Bletchley Park, to share the technological advances, practices and procedures developed at Medmenham as well as sharing all the aerial photography and intelligence reports with the US can be seen as one of the foundation stones of the now long-standing intelligence special relationship that exists with the USA. The special relationship on intelligence is often referred to as that between GCHQ and NSA, but this thesis has shown that photographic interpretation and the strong integration of US personnel at Medmenham that still exists to this day, is also part of the enduring special relationship.<sup>513</sup>

Ferris has warned against 'Bloomsbury syndrome' with a 'focus on anecdote instead of analysis' in many historical studies of intelligence.<sup>514</sup> This thesis has avoided that trap with a methodology, used for the first time on Medmenham photographic interpretation reports, of detailed analysis of all of the Medmenham interpretation reports in each of the four case studies. This has clearly shown the wealth of intelligence produced at Medmenham. This is further illustrated by the carefully selected transcribed interpretation reports in the three appendixes. This wealth of very detailed intelligence is a source that has not previously been exploited in any

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<sup>513</sup> D Brugioni, *Eyes in the Sky* (USA: Naval Institute Press, 2010) 1-64; The heritage of the UK special relationship on imagery can be clearly seen to have originated at Medmenham, and still exist today as shown by the induction of Constance Babington Smith into the Hall of Fame of the US National Geospatial Intelligence Centre on 27 May 2015.

<sup>514</sup> J Ferris, *Intelligence and Strategy*, 99-105.

depth within the literature and can provide contemporaneous reports of events during the Second World War, which would provide another set of original documents to allow further research and analysis into tactical and operational military events during that period. This thesis has therefore highlighted both the existence of large and under researched sources of photographic intelligence and a fresh methodology and analytical techniques to exploit that source.

Looking to future research, the methodology of this thesis could be applied to other aspects of Medmenham's work. For example, *Crossbow*, which is dominant in the folklore of Medmenham would be a good candidate for further research. *Crossbow* has a core of 1,089 Medmenham B Section reports in TNA and this thesis has analysed that order of individual reports, therefore such a research project, though large is achievable. This methodology could be extended to look at Medmenham support for smaller operations such as the RAF attacks on naval units for example Tirpitz, or the RAF campaign against the U-boat construction and harbour facilities. There are several other operations in the Strategic Bombing Campaign that these techniques would work well with such as the attacks against Dresden and Hamburg or, using a thematic view, an analysis of the synthetic oil bombing campaign. Then, thematically the support Medmenham provided across the scientific war with Germany could be investigated. Looking outside the Second and Third Phase environments of Medmenham there is future research investigating the RAF tactical photographic interpretation sections and APIS that deployed and supported those in mainland Europe after July 1944.

There are also unanswered questions about the Medmenham personnel dimension, which with the imminent availability of service records in the 2020s, would provide a significant avenue for research. The personnel dimension could encompass the British core of Medmenham, as well as the gradual build up of the American contingent, whilst also including the far fewer numbers of French, Canadian, Czech and Norwegian. The personnel dimension could lead into a detailed analysis of the role of the women at Medmenham, who ranged from Section leaders to clerical

support. There is also the role of the overseas versions of Medmenham, that would make an interesting research project in its own right.

This thesis is the first to analyse the development of photographic interpretation and the intelligence it provided during the Second World War through the vehicle of the textual photographic interpretation reports. This has allowed the thesis to prove that Medmenham provided a vast flow of photographic intelligence that has been under-reported in the historiography. The quantity and quality of this intelligence provided by Medmenham have been shown in the thesis to have provided the Allies with a significant source of easily used and assimilated photographic intelligence that has not had the academic study or recognition in the historiography of the Second World War that this vast source of intelligence archival material deserves. Therefore, this thesis makes an original contribution to the intelligence historiography of the Second World War by placing photographic intelligence firmly as one of the most significant sources of intelligence available to the Allies.

**List of CIU and ACIU Sections**<sup>515</sup>

Section	Function	Date Formed	Date Closed
A	Naval	November 1940	April 1946
B	Army & HQ Element	July 1940	September 1946
B1	FLAK Defences	Aug 1942	June 1946
B2	Army 'CROSSBOW'	June 1944	June 1946
B3	Army SIEGFRIED LINE	June 1940	June 1946
B4	U.S.A.A.F. S. Germany and Austria	Not known	June 1946
B5	Far East	October 1944	June 1946
B6	Crossbow Underground Factories	November 1943	June 1946
C	Airfields	August 1940	June 1946
D	Industries	May 1941	June 1946
E	Camouflage	April 1941	November 1945
F	Communications and Transportation	April 1941	June 1946
G	Wireless	January 1941	May 1945
H1	Control Commission	September 1944	May 1945
H2	Control Commission Military	July 1944	September 1945
J	Press and Publicity	May 1940	June 1945
K	Bomber Command PI Section	September 1939	September 1941
	Damage Assessment	September 1941	December 1945
L	Aircraft and Aircraft Industry	March 1941	January 1945
M	British Photography	December 1941	After April 1945
N	Night Photography	November 1940	May 1945
O	Overseas	September 1944	Not known
P	Plotting	1940	Continued post war
Q	Decoys	July 1941	June 1944
R1/R2	Combined Operations	March 1942	September 1944
S	Signals Intelligence	December 1941	Merged with G early 1942
S	Shipbuilding	July 1942	November 1943 merged with A.
S	Survey Liaison	August 1945	Not known
GI	Ground Intelligence	June 1941	September 1942
T	Target	September 1941	September 1942
GI & T	Combined Targets and Ground Intelligence	September 1942	July 1945
V	Model Making	May 1941	1998
W	Wild or Photogrammetric	September 1939	July 1948
Z	Second Phase	January 1940	Not known
X	Navigation Aids	Not known	August 1945
TCO	Technical Control Office	April 1944	April 1946
	Progress	March 1942	June 1946
DIO	Duty Intelligence Office	Not recorded	April 1946
	Coversearch	February 1944	Continued post war
	Print and Map Library	January 1940	Continued post war
	PI School	1940	Continued post war
Photographic	Film Development, Duplication and Printing	1940	Continued post war
Clerical	Central registry, Typing Pool, Signals, Telephone exchange	Not Known	Continued post war

<sup>515</sup> List compiled from TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 31-41; MA Acc no:4891, List of CIU/ACIU Sections. Note: The formation of B1 Sub-Section is not recorded but it was in existence by August 1942. See MA Acc no:4894, B Section, 7; The Model Makers had been initially established in 1940 at the Royal Aeronautical Establishment, Farnborough before moving to Medmenham in May 1941. See: A Pearson, 'Allied Military Model Making during World War II', *Cartographic and Geographic Information Science*, 29.3 (2002) 227-242; The Model Section continued after Medmenham, moved to JARIC but as a lodger at RAF Wyton closing at Wyton in 1993 with the rump moving to JARIC at RAF Brampton and was finally closed at JARIC in 1998 under MoD savings measures. Group Captain Nigel Pearson, Email to author about his time as OC JARIC, 1996-1998, 3 February 2018; The *Wild* A5 machine was owned by the AOC in 1938, but no section was formed until the *Wild* move to Medmenham in January 1941, but for the purposes of the table September 1939 is used; MA, [unaccessioned] file draft: *Air Ministry History of ACIU*, 12-16; MA Acc no: 40 & 47 *House with the Tudor Chimneys*.

## Medmenham Sections<sup>516</sup>

### Section A – Naval

This section was formed at Wembley in late 1940. When formed it had 2 staff growing to a peak of 16 during 1944. The majority of the staff were from the RAF and WAAF. The work of this Section in the early days was almost entirely for the Admiralty. The section produced detailed intelligence reports covering port facilities, minesweeping, wrecks, convoys, ship repair and ship building as well as German naval dispositions. They provided reports on German U-boat construction, from daily analysis of photographs of the construction ports. They produced pictures in tabular format of the month by month German U-boat production. They also keep a detailed log of all major German naval vessels, detailing sightings, movements and attacks against the vessels. A significant intelligence failure and lesson was learnt by the Section and Medmenham when in early April 1940 the inexperienced photographic interpreters, without earlier comparative cover did not point out the large concentration of German shipping at Kiel, preparing for the invasion of Norway. The lesson about the value of comparative cover was painfully brought home to Medmenham and A Section. The scale of photography improved from on average scales of 1:50,000 to 1:60,000 in 1940 to 1:25,000 by the end of 1941 and 1:8,000 to 1:10,000 by 1944. The section produced a total of 989 reports, with the six and twelve-monthly compendium reports on naval and merchant shipbuilding standing out as exceptional strategic reports.<sup>517</sup>

### Section B – Army

This section was formed in the middle of 1940. The section's full name was the Army Photographic Interpretation Section (APIS). When formed it had an establishment of

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<sup>516</sup> Note: The task to officially record the work of individual CIU/ACIU sections at the end of the war was only issued on 9 September 1945 to the heads of each section, but initial work had started in late July (MDM/S.2802/6/Org dated 9 Sep 45), with the intention of producing a single History of ACIU. The task was not completed and the quality of the input from each section varied in quality and quantity. The drafts for this task are held in the MA, [unaccessioned] file draft: *Air Ministry History of ACIU*. The file does not have continuous page numbers, but is in section order.

<sup>517</sup> MA, Air Ministry, 'History of ACIU' (Air Ministry, 1945), pt. 1, MA, Acc no:4893, A Section; MA Acc no:14897, A Section – Naval.

23 officers, reaching a maximum of 116 in 1945.<sup>518</sup> The army members were not on the RAF Medmenham manning, but were part of GHQ Home Forces. During May 1942 the section split with many of the army staff departing to GHQ Home Forces forming APIS GHQ. The APIS GHQ had responsibility for providing photographic interpretation of minor defences with APIS CIU responsible for artillery and anti-aircraft defences as well as any other strategic work. APIS tended to work on a system of master maps and dossier system. The master map was kept up to date with all relevant detail and the dossier recorded all previous reports and sightings. The remaining army section produced detailed intelligence reports covering general military installations and troop positions as well as FLAK reports on the location of FLAK batteries.<sup>519</sup> The standard procedures for the sections were to produce general military and FLAK reports within forty-eight hours after the sortie. The section was reorganised as needed during the war, with specialist sub-Sections being created for special analysis projects. B3, Section was formed in June 1940 for analysis of the Siegfried Line, B2 in June 1944 stopped its normal work on the coastline from St Malo up to the Belgian border to concentrate as the *Bodyline/Crossbow* Section to provide detailed analysis of the V1 and V2 weapons.<sup>520</sup>

### **Section C - Airfields**

This section was formed at the CIU in the middle of 1940. When formed it comprised 6 interpreters, raising to a peak of 15 during 1942 to 1943. The Section produced detailed reports, with the Air Ministry as the main customer, on the location, construction and developments on airfields, landing grounds, and seaplane bases. This section when formed at Wembley was commanded by Flight Officer Hammerton WAAF and Flight Officer Constance Babington Smith, the author of *Evidence in Camera*, commanded the section after its move to Medmenham.<sup>521</sup> They produced three main types of reports, the C series of routine reports at four monthly intervals, CR series reports on special topics and limited distributions and the CS series of

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<sup>518</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no:4894, B Section; MA Acc no:14899, B Section – Army.

<sup>519</sup> FLAK was the name given to Anti-aircraft artillery fire.

<sup>520</sup> Other B Section specialist sub-Sections are listed in Annex A.

<sup>521</sup> Note: Flight Officer in the WAAF equated to Flight Lieutenant as an RAF rank.

research reports.<sup>522</sup>

### **Section D - Industries**

This section was formed in mid 1941 and when formed it comprised 2 analysts, but grew to a peak of 25 analysts by the end of 1942. The Section examined all coverage to find the location of enemy industrial complexes. They then formed teams specialising in each industrial area as outlined in the table below.

Table 24 Industries Section Specialist Teams

Team 1	Iron	Steel	Nonferrous metals	Electrical equipment
Team 2	Engineering works	Ball-bearings	Textiles	Military vehicle works
Team 3	Oil	Coke	Gas	
Team 4	Electrical power	Dam construction		
Team 5	Chemicals	Explosives	Synthetic rubber	Plastics

These five teams analysed all cover of the sites and produced detailed reports and plans that identified individual buildings and functions within each complex. The electrical power team produced from photographs the whole of the power grid for France, a task that had absorbed considerable effort, only to find in March 1943 that maps of the French power grid already existed. However, the section worked successfully on detailed plans for the Joint Target Committee, with oil and armament targets making up the bulk of those targets, where after attacks on the targets they would provide an estimate of the damage done to the production capability of the target and the time until it would be repaired. Those reports were important for the Combined Bombing Offensive and Bomber Command as they reduced the need to revisit and re-bomb targets unnecessarily. They also produced reports for Operation *Chastise* as covered in detail in chapter four.<sup>523</sup>

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<sup>522</sup> Air Ministry; MA Acc no: 4895, C Section; MA Acc no: 14904, C Section – Airfield Section.

<sup>523</sup> MA, Air Ministry, *History of ACIU*, 30-34; MA Acc no: 4896, D Section History; MA Acc no: 14905, D Section – Industries Section.

### **Section E – Camouflage**

This section was formed in early 1941 and when formed it had one analyst growing to seven in 1944.<sup>524</sup> The Section not only reported on German military camouflage and new developments, but also checked the Allies camouflage and reported on both. The section also produced reports on German camouflage of industrial sites, including details of camouflage that simulated bomb damage. From 1942 they also reported on German smoke camouflage, decoy and dummy sites.<sup>525</sup>

### **Section F – Communications and Transportation**

This section was formed in early 1941 and when the section formed it had an initial establishment of 7, growing to 20 by 1943. The major work of the section was to cover road, rail and waterway transport systems in Germany and occupied Europe. The scale of the effort needed to cover road transportation was beyond the effort available in the section, so roads were moved to the Army in B section in the summer of 1941. The section recruited a railway specialist direct from LNER and three from the Royal Engineer railway depot at Longmoor to provide the section with expertise in railway transport systems.<sup>526</sup> The section provided detailed intelligence reports on all rail and canal systems under Axis control in Europe until June 1944. The focus then changed to providing daily tactical reports to SHAEF from special reconnaissance flights over railway and waterway communication lines, producing the daily railway reports with Z Section as discussed in chapter five.<sup>527</sup>

### **Section G – Wireless**

This section was formed in January 1941 and closed in May 1945. When formed it had an establishment of 2 but by 1942 had 9 staff, which included two WAAF officers who had been radio location operators, before transferring to photographic interpretation. They worked with the scientific community on both radar and navigation Beam Stations that helped German bombers find the targets in the UK.<sup>528</sup>

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<sup>524</sup>The numbers were made up of 3 WAAF, 3 RAF and 1 USAAF Officer.

<sup>525</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4897, E Section History; MA Acc no: 14908, E Section – Camouflage Section.

<sup>526</sup> MA Acc no: 4898, F Section History, Mr R J Moody of LNER arrived at CIU 14 April 1941.

<sup>527</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4898, F Section History; also see chapter five for details of the daily railway reports during Operation Epsom and transcribed daily railway report no 45 and map at Appendix 3; MA Acc no: 14902, F Section – Communications Section.

<sup>528</sup> R.V.Jones, *Most Secret War*, 134-185.



The Section expanded to cover enemy signals organisations, radar and radar guided search lights, navigational beam, wireless, point-to-point stations and land lines. The major systems they produced reports on included the Knickebein, Wurzburg and Freya systems.<sup>529</sup>

### **Section H – Control Commission**

This section was formed in mid-1944 and when formed it comprised 7 analysts and a peak of 13, but numbers dwindled as work moved to other sections. The work of the Section was GAF military installations and Wehrmacht military installations as well as Defences and Fortifications and Storage installations. With the establishment of Control Commission advance parties in Germany in May 1945 all the H Section reports for the Control Commission were sent to APIS 21 Army Group who then assumed responsibility for the commitment from ACIU.<sup>530</sup> There are also H reports in the archive that are FLAK reports, so at least during 1943, H Section existed as a section to produce FLAK reports.<sup>531</sup>

### **Section J – Press and Publicity**

This section was formed in mid-1940 and when formed it had an establishment of 2, growing to 6. The Section was tasked with providing press, publicity and propaganda photographs. However, the major task from July 1942 to March 1945 was the production of first weekly editions of *Evidence in Camera* and then fortnightly editions. A total of 114 issues of *Evidence in Camera* were produced and the MA have the original masters which make up an eight-volume set complete with sortie information added to each illustration, which was not included on the published versions.<sup>532</sup>

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<sup>529</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4899, G Section History; MA Acc no: 14903, G Section – Wireless Section.

<sup>530</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4900, H Section History; MA Acc no: 14901, H Section.

<sup>531</sup> MA Loc C1.3, The RAF Medmenham F540 entry for May 1943, p80.

<sup>532</sup> *Evidence in Camera* was a service magazine containing interesting and instructive photographs from the previous week or fortnight showing a wide selection of targets and including some stereo pairs for instructional use on units. They produced 114 issues across eight volumes that were distributed to all major units and HQ's. *Evidence in Camera* ensured that the capabilities of Medmenham was known about as widely as possible during the war. MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4901, J Section History; MA Acc no: 223 to 230, Vol 1 – 8: *Evidence in Camera*; MA Acc no: 14917, J Section; HMSO, *Evidence in Camera: Special Edition on Photographic Reconnaissance and Photographic Intelligence, March 1945: Restricted for Official use Only* (Cambridge: Geoinformation Group, 2003).

### **Section K – Bomber Command PI Section, Damage Assessment**

The section was formed at HQ Bomber Command based near High Wycombe, on the 3<sup>rd</sup> September 1939, and moved to the CIU in September 1941, renamed Damage Assessment and when formed it had 9 interpreters, and had 54 at its peak in 1944. The Section was tasked mainly with identifying and assessing the damage from Bomber Command attacks and extended to include USAAF attacks under the CBO. These reports were a crucial part of the Bomber Command damage assessment and re-attack planning process.<sup>533</sup> The K series of damage assessment reports were usually accompanied by illustrated photographs and damage map plots as well as bomb fall plots; transcribed examples can be seen in Appendix 2. The reports included comparative analysis to differentiate previous damage from the latest attacks. The final recorded tasks for the section were to conduct damage assessments on Hiroshima and Nagasaki in May 1945.<sup>534</sup>

### **Section L – Aircraft and Aircraft Industry**

The section was first formed at Wembley in early 1941, moved to Medmenham in April 1941 and when formed it had 4 analysts, and was a sub-section of D Section only becoming L Section in August 1943, growing to 11 in 1944. The Section specialised in reporting on aircraft, especially new aircraft and aircraft factories. They also provided from examining the factories, German aircraft production estimates. The reporting and identification of aircraft factories became very important with the German dispersal of them from 1943 onwards. The section also worked with B2 on the *Crossbow* investigations and monitored German jet engine production as well as normal aircraft production.<sup>535</sup>

### **Section M – British Photography**

There is no record so far found of when the section was formed its establishment or when it was disbanded. It was probably formed in early 1940, but it was definitely in

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<sup>533</sup> F.H. Hinsley, *British Intelligence in the Second World War*, Vol 1, 102.

<sup>534</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4902, K Section History; MA Acc no: 14910, K Section; MA Acc no: 19924, Hiroshima damage assessment plot; MA Acc no: 4455, Report K 4350 Hiroshima.

<sup>535</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4903, L Section History; MA Acc no: 7418, L Section Log Book 1 June 1942 – 13 May 1945; MA Acc no: 7413, Introduction to L Section; MA Acc no: 14906, L Section.

existence in December 1941 and still in existence in April 1945. The section does not appear in the photographic record of the sections at Medmenham. It only appears in organisation charts of Medmenham. A reasonable assessment of the section's role, would be to look at photography over the UK to aid with planning of military exercises and bases. However, further research has shown that the section had a secret task, working on key point targets in the UK to be attacked or demolished in advance of any German invasion, using the list of key points from the Ministry of Home Security. Medmenham were expressly forbidden to brief visitors or show them around this section without the express permission of ACAS (I) or ADI (Photo).<sup>536</sup>

### **Section N – Night Photography**

The section was formed in early 1942 and when formed it had an establishment of 6 personnel, growing to over 23 in 1944. Prior to the formation of N Section, the work on night photography was undertaken by K Section. The section worked on all aspects of night photography and produced plots for Bomber Command of bomb fall over targets and then detailed reports on the raids and the operation of enemy defences and flak. The night photography also contributed to analysis of aircraft evasion tactics and weapon effectiveness. There is an example night report and plot transcribed at Appendix 2. The section also had an important role to play in the analysis and development of the target indicators that the Pathfinder force used and the interpretation of colour film to identify the target indicators.<sup>537</sup>

### **Section O – Overseas**

There is conflicting evidence about this section. Initially its functions were performed within the Progress Section, but by September 1944, O Section had been formed. The section was called O Section – Overseas Library and the details of the section library tasks were detailed in ACIU procedure memorandums 35 and 53.<sup>538</sup>

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<sup>536</sup> Note: The Pathfinder force were a special target locating and marking set of aircraft sent out at the front of the raids to locate and mark the targets for the following bombers. Overy, *The Bombing War*, 291-292; MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4904, M Section History; MA Acc no: 14907, M Section; TNA AIR 40/1174, Most Secret Memo – Targets in the United Kingdom from ADI (Photo) to RAF Medmenham dated 11 December 1941.

<sup>537</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4905, History of N Section; MA Acc no: 14911, N Section – Night Photography Section.

<sup>538</sup> MA Acc no: 14924, O – Overseas Section.

### **Section P – Plotting**

This section was formed at Heston in mid-1940, moved to Medmenham and when formed it had 10 staff and grew to 23 by April 1944 with a workload of between 150 and 170 sorties per week plotted.<sup>539</sup> These sorties were plotted frame by frame on to a master sortie map, so that all the ground covered by the sortie could be easily seen on the master map. With the plotting workload building up on the approach of D Day, 68 staff were relocated from other Medmenham Sections so the staff rose temporarily to 90. They had to deal with up to 358 sorties per week during the build up to D Day. The plotting of sorties was a fundamental part of being able to go back and find photographs for photographic interpretation and comparative analysis. They developed a sophisticated card index and master plot and overlay system to be able to record and find any sortie and exact frame that covered any location.<sup>540</sup>

### **Section Q – Decoys**

This section was formed in late 1941 and when formed it had 3 analysts, growing to 8 in June 1942. The Section was tasked with identifying enemy decoys on photographs, this included decoy equipment, decoy installations, airfields and decoy night target identifiers. The problem of decoy night target identifiers became more of a focus when the German decoy sites were able to react and show decoy target identifiers of the same colour as those used by the Pathfinder Force. The report Q 53 in late November 1943 was a report by the section on the German introduction of new target indicator decoy devices. The N section report and map on Cologne in the transcribed report at Appendix 2, shows examples of the location of decoy sites around Cologne. These details were provided in Q section reports Q 3 and Q 9. There was a close cooperation between Q Section and N Section, with Q section dedicating an officer to that role.<sup>541</sup>

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<sup>539</sup> The Plotting Section continued operations and moved from Medmenham to RAF Brampton. Also: A sortie is a single operational flight by a single aircraft. The aircraft would have up to 250 photographs per camera per sortie.

<sup>540</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 14918, P – Plotting Section.

<sup>541</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4906, Q Section; MA Acc no: 14909, Q Section – Enemy Decoys; MA Acc no: 8465, Decoy Report Q3; MA Acc no: 8481, Decoy Report Q9.

## **Section R – Combined Operations**

This section was formed in early 1942 and when formed it had 2 staff and grew to a maximum of 16 staff. The Section was initially tasked with sensitive work on future operations, starting with Operation *Torch* and working on combined operations until it disbanded.<sup>542</sup> The reports covered all defences, rail, road, ports and industries. These reports were fully illustrated with photographs and maps and were amongst the largest reports produced by Medmenham. R Section report XY 48 on the Mediterranean area of France ran to 373 pages, with 20 railway plans and 16 port plans and was completed in two weeks by a team of twelve officers.<sup>543</sup>

## **Section S – Signals Intelligence / Shipbuilding / Survey Liaison**

This section was formed in late 1941 and was formed to analyse the land line, point to point wireless and IDF wireless communications. The section merged with G Section in early 1942. The section reformed from part of A Section as the Shipbuilding section in July 1942 until November 1943 when it re-merged back in to A Section. However, shipbuilding and U-boat construction reports continued to be produced under the S prefix after the reabsorption back into A Section. The section again reformed in August 45 as the Survey liaison section.<sup>544</sup>

## **Section GI – Ground Intelligence**

This section was formed in mid-1941 and had an establishment of 7 officers. The section also had a card index system of all intelligence held in the intelligence library. The library included maps, charts, town plans and gazetteers, guide books, topographic reference books, recognition material, trade and industrial directories. The section also held POW interrogation reports. The section merged with Targets in September 1942.<sup>545</sup>

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<sup>542</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4907, R Section History; MA Acc no: 14900, R Section – Combined Operations.

<sup>543</sup> Of note: Sarah Churchill worked in this section on Operation *Torch* and when visiting her father at Chequers kept quiet about Operation *Torch*. It is reported that when at Chequers on 8 November 1942 early in the morning Winston Churchill announced to Sarah Churchill that 643 ships were landing in North Africa, she corrected him with 644 ships. She had not mentioned to him before that she was working on the operation at Medmenham, because it was Secret. See: C Babington Smith, *Evidence in Camera*, 152-154.

<sup>544</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4908, S Section; MA Acc no: 14898, S Section – Shipbuilding.

<sup>545</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4913, GI Section; MA Acc no: 14915, GI Section – Ground Intelligence.

### **Section T - Target**

This section was formed in late 1941 and was renamed the Combined Targets and Ground Intelligence section in September 1942. The section was formed with 11 staff in 1941 growing to 21 during 1943 and early 1944. The ground intelligence part of the Section was responsible for the receipt, analysis and reporting to all other Sections at Medmenham of all reports from any ground intelligence source, such as interrogation reports from prisoners. The targets part of the Section used the information from ground intelligence as well as intelligence from other Sections at Medmenham, in particular A, B, C, D and Q Sections, to produce target folders and target information sheets to a target list and prioritisation provided by the Air Ministry intelligence department AI3(c)1. The responsibility to produce target information sheets passed from Medmenham to AI3(c)1 in early 1944 and three Medmenham officers moved to AI3(c)1.<sup>546</sup> The Section provided the target folders to AI3(c)1 who then checked them and distributed to Bomber Command.<sup>547</sup>

### **Section GI & T – Combined Targets and Ground Intelligence**

See GI and T Section above.

### **Section V – Model Making**

This section was formed at the Royal Aircraft Establishment Farnborough in mid-1940 and when the section formed it had 9 staff assigned and grew to 36 staff by mid-1941. Their task was to produce operational models. They developed a new technique to make topographic models from stereo photographs and developed ways to work with new materials to make the models and rubber model copies. They produced over 1400 models during the war and for D-Day 109 models and 250 copies.<sup>548</sup>

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<sup>546</sup> Note: On the 27 August 1944 a V1 landed on AI3(c)1 killing four previous members of T Section. See MA Acc no: 4909, T Section.

<sup>547</sup> A Price, *Targeting The Reich*; C Babington Smith, 88-111. MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4909, T Section; MA Acc no: 14914, T Section – Target Section.

<sup>548</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 14920, V Section – Model Section; L Abrams, *Our Secret Little War*, 13-60; MA [unaccessioned] Master Model Section task register; MA [unaccessioned] Model Section Daily Log Book. Also see Chapter 5.

### **Section W – Wild or Photogrammetric**

This section was formed from the pre-existing *Wild* office at the AOC, moving in January 1941 to Medmenham. The *Wild* Autograph A5 stereo photogrammetric machine was moved from the AOC at Wembley to Medmenham at the same time. The team of five personnel at the AOC who worked in the *Wild* room, on the *Wild* A5, on moving to Medmenham were all made RAF personnel. The *Wild* allowed Medmenham to make up to date maps of occupied countries and keep up to date maps and plans of enemy installations. It also allowed very accurate measurements to be made of any item seen, such as new aircraft types' wing spans. This was from high-altitude small-scale photography.<sup>549</sup> The *Wild* was also used to compile the PI Air Publication 1396, which was a publication of Photogrammetric tables for PIs.<sup>550</sup> See Annex G for more detail on the *Wild*.

### **Section X – Navigation Aids and Landmarks**

The formation of the section is not recorded and it produced two series of reports, the XS1 to XS3 series on vegetation types in north west Europe and the Mediterranean, and the XS4 to XS13 series of topographic reports on European regions. The reports were used by Bomber Command for aircrew training and landmark identification. No further details on establishment or staffing are available.<sup>551</sup>

### **Section Z – Second Phase**

The Section was formed in early 1940 and when formed it had 19 staff and grew to 123 staff during 1944 and 1945, which included up to 50 US staff, 3 Czech, 4 Norwegian, 9 Polish and single free French officer for a short period. The Section reported on every sortie received by Medmenham on all enemy activity on a daily basis using a three-watch system to cover the full twenty-four-hour day. These reports were initially timely readouts of activity within the first 24 hours, not the detailed Third Phase reports more normal for other Medmenham sections, but in more detail than the very quick, usually within two to three hour, First Phase form

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<sup>549</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 14919, W Section – Photogrammetric Section.

<sup>550</sup> TNA AIR 10/2759, AP 1936, Photogrammetric Tables for Intelligence Officers Employed on Interpretation of Air Photographs 1st Edition dated February 1942.

<sup>551</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4910, X Section; MA Acc no: 14916, X Section.

white reports from the airfields. They also ran a sub-section that provided Coversearch facilities for the rest of Z Section and other sections. The experience Z Section had in timely reporting meant that it was teams within Z Section that produced the Daily Railway Reports and Daily Airfield Reports discussed in Chapter 5 and transcribed examples of these reports can be found at Appendix 3.<sup>552</sup>

### **Section TCO – Technical Control Office**

The Technical Control Office (TCO) was formed in early 1944 and when formed it had 4 intelligence staff and clerical support. The TCO was responsible for all day to day operational planning issues, operational procedures and technical quality control. They would reach agreement on the competing priorities for the tasking of the ACIU. The main competing priorities and bulk of tasking were from US originating units, Army and RAF originators. Tasking from the Admiralty and other agencies was equally important, but tended to be of a scale that the unit could meet without detracting from other work. The formation of this section was a result of the formation at 106 Group Headquarters of the JPRC to take on the previous tasking responsibilities of ADI (Photo) in the Air Ministry. However, unlike ADI (Photo), the JPRC gave the majority of external tasking agencies authority to place demands directly with ACIU for tasks that did not require new reconnaissance sorties to be flown. This direct contact between tasker and ACIU provided a far more efficient and streamlined tasking system, but it did require ACIU to create the TCO Office as the single point of contact. The TCO office, which was a joint British and US staffed office, would then prioritise and task the relevant sections of ACIU to work on the tasks.<sup>553</sup>

### **Progress Section**

Progress Section was formed in early 1942 and when formed it had 14 staff, which grew to 28 staff by June 1944, which by then included 12 Americans. The Section was under the direct control of the Technical Control Officer and his section. However, Progress was responsible for all photographic orders placed upon

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<sup>552</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 4911, Z Section; MA Acc no: 14893, Z Second Phase.

<sup>553</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 40, The Chalk House with the Tudor Chimneys; MA Acc no: 14892, TCO Section – Technical Control Office.



Medmenham and prioritised all photographic reproduction undertaken at Medmenham. They were also responsible for the receipt of all reconnaissance sorties and negatives and the tracking of them until all photographic interpretation was complete. The sorties were then passed to the Library for storage as historic coverage. They, of course, could be recalled from the library by any Section at Medmenham for use in comparative studies or to answer new intelligence questions.<sup>554</sup> The Section was also responsible for copying all the Medmenham work to Washington.

### **Section DIO – Duty Intelligence Office**

The date of establishment of the Section is not known, but it was in existence soon after the creation of CIU at Medmenham and continued to April 1946. The Duty Intelligence Office (DIO) worked for the TCO on task management and tracking. The DIO also tracked all tasks that required new sorties that were approved by the JPRC and tracked them through ACIU. The office was manned around the clock and acted as an intelligence library, including external intelligence reports and documents. However, an essential function of the office was to keep an up to date card index of all CIU/ACIU Interpretation reports.<sup>555</sup>

### **Sub-Section – Cover-search**

This section was established as a stand-alone Section in early 1944. However, cover search had been an essential part of the working processes of Medmenham since the beginning, but had been done by Z Section until the formation of a special sub-section. Cover-search worked on the output from P Section, the plotting Section to see if Medmenham had cover of an area and demand for cover-search requests and new print jobs from the cover-search results reached a peak after D-Day. The demand remained high until the end of the war and the section was manned around the clock.<sup>556</sup>

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<sup>554</sup> U. Powys-Lybbe. 39-45. MA, [unaccessioned] file draft: Air Ministry History of ACIU.

<sup>555</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU, MA Acc no: 14913, Intelligence Office.

<sup>556</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 14925, Cover-search Section.

### **Sub-Section – Print and Map Library**

This section was established in early 1940, and the establishment of the Section is not recorded until March 1943, when it had an establishment of 32 and a strength of 29. It had a small increase in establishment to 37 by May 1944. However, its strength grew to 50 personnel by November 1944 and 106 in September 1945. The Section had four distinct sub Sections within it: The Print Library, Map Section, Tracing Section and finally the Mosaic Section. The Print Library received the sortie and there it was registered and added to the sortie index. The map sub section held over 250 different series of maps as well as town plans for cities world-wide. The tracing sub section created linen trace plots from the master sortie plot and it was these linen cover traces, which held all sortie details covering an area that allowed quick cover searches to be made. Once a linen cover trace plot sheet was full, a continuation linen cover trace sheet was started for the next sorties. Therefore, to cover-search an area multiple cover trace sheets would be examined. However, it proved to be a very quick way to see what photography Medmenham held on an area.<sup>557</sup>

### **Sub-Section – PI School**

A school for photographic interpreters was formed at Wembley in 1940. It ran three-week courses for 20 students, and with the requirement for PIs growing, within the RAF and in the other services both at Medmenham and at numerous stations and overseas locations, Medmenham did not have the space for the number of students. Nuneham Park was selected as a suitable site for the PI school and as a full backup site for Medmenham, should it be destroyed. The acquisition and setting up was delayed and it was January 1942 before the school moved to Nuneham Park. With the growth of Medmenham the school had an interim moved to RAF Benson in September 1941, to free up space at Medmenham. When the school finally moved to Nuneham Park, the course expanded to five weeks. The size of the courses also expanded, now able to take between 40 and 50 students per course, a significant

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<sup>557</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 14921, Print Library.

uplift from Medmenham and Benson. The school trained 1395 students from August 1940 to the end of the war.<sup>558</sup>

### **Photographic Section**

The photographic section was formed in Wembley in 1940 and the section had an average of 275 staff during the last half of the war, split between the main Medmenham site and its satellite site at Nuneham Park. They developed and copied films on state-of-the-art continuous film processing machines capable of developing aerial film at four feet per minute, film duplicating machines and with specially developed automatic Print Multiprinter capable of producing 1,000 photographic prints per hour from aerial film.<sup>559</sup> The film processor and multiprinter are shown in Pictures 4 and 5. They also produced special prints for mosaics and almost any type of print enlargement. The section also contained an in-house lithographic printing capability. It is interesting to note that aerial film processing had been performed manually on up to 500 frame rolls of film, using manual bench processing equipment prior to the arrival of the first Kodak developed continuous film processing machines in 1941.

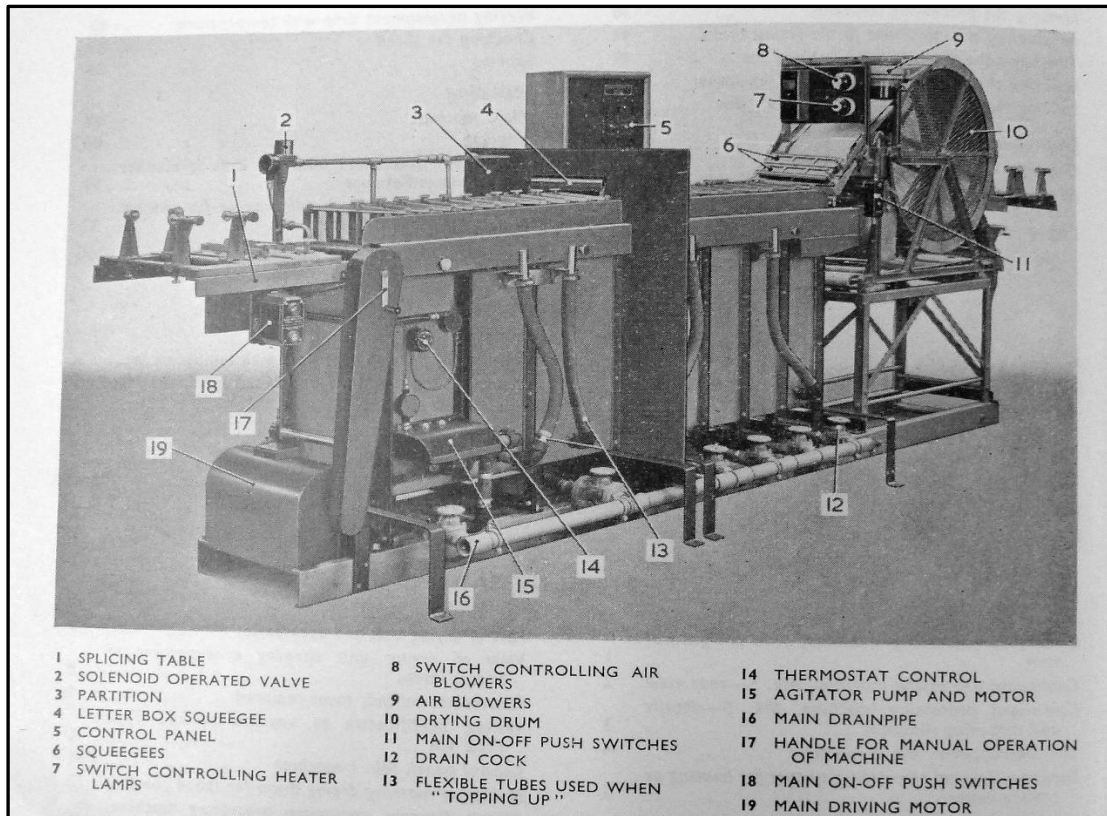
### **Clerical Support Sections**

The clerical sections existed at the PIU in some embryonic form, but expanded at Medmenham. They included the Central Registry, typing pool, telephonists, signals and teleprinter operators as well as a dispatch section. These clerical support workers were essential to the smooth running of Medmenham.

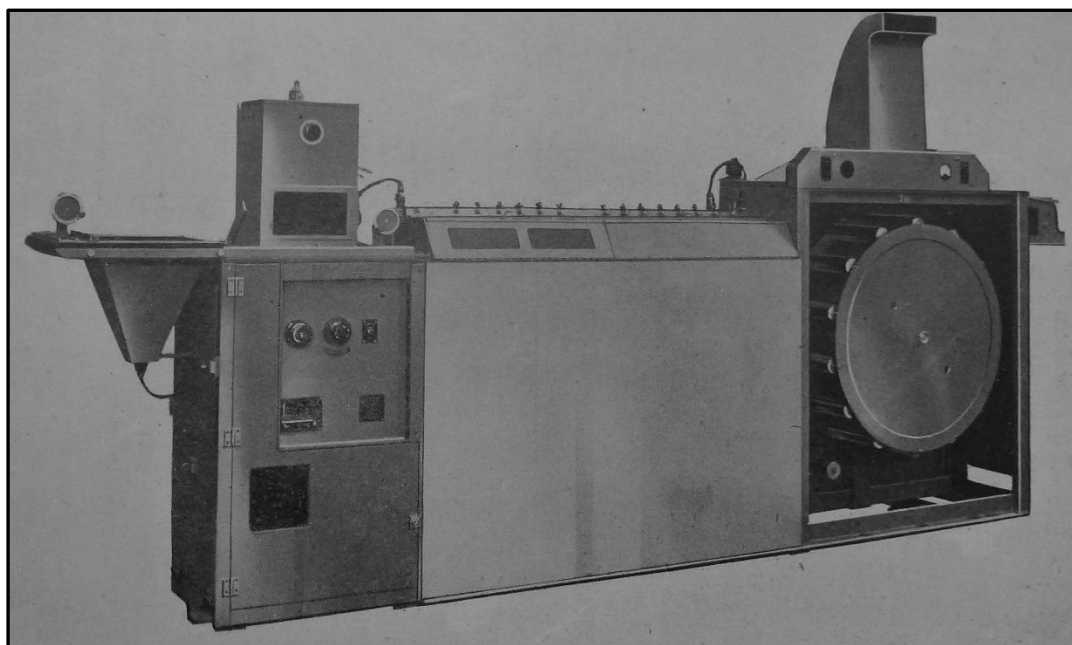
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<sup>558</sup> MA, [unaccessioned] file draft: Air Ministry History of ACIU; MA Acc no: 44, PI Course Training Programmes April – July 1945 at Nuneham Park; MA Acc no: 1856, Historical Narrative File – Nuneham Park, March 1945; TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 2, 39-40.

<sup>559</sup> RAFMA, T520746, Air Publication 1355G Vol 1, *Processing printing and Duplicating Machines*.



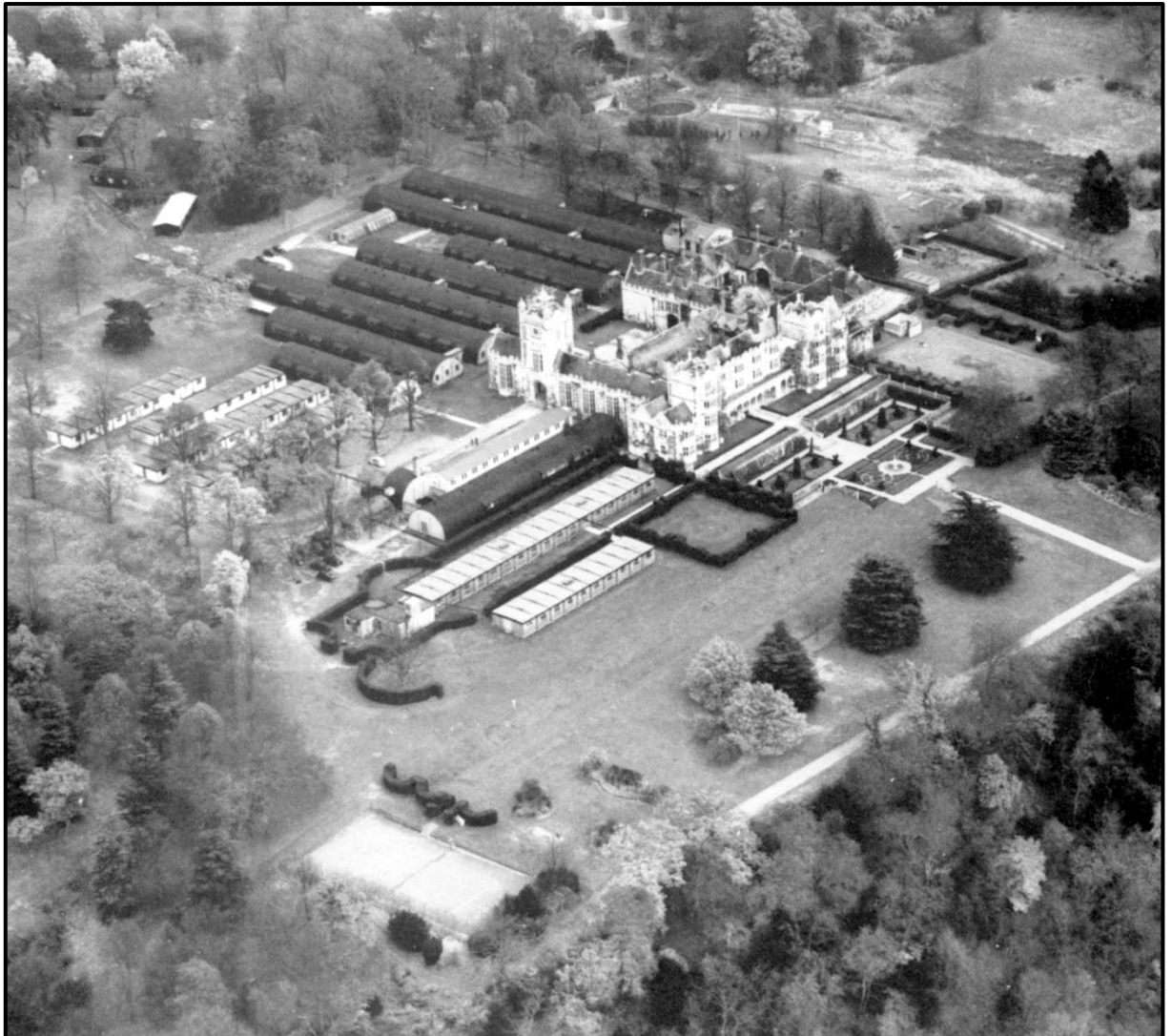
Picture 4. Continuous Film Processor<sup>560</sup>



Picture 5. Multi-Printer<sup>561</sup>

<sup>560</sup> RAFMA, T520746, Air Publication 1355G Vol 1, *Processing printing and Duplicating Machines.*

<sup>561</sup> RAFMA, T520746, Air Publication 1355G Vol 1, *Processing printing and Duplicating Machines.*



**Danesfield House - Medmenham circa 1941**

Picture 6. RAF Medmenham<sup>562</sup>

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<sup>562</sup> MA, Photograph of RAF Medmenham showing Danesfield House and huts in the grounds. [unaccessioned].

**British – American – German Reconnaissance Organisation**<sup>563</sup>**RAF – Reconnaissance**Table 25 RAF Photographic Reconnaissance Units and Squadrons, November 1940 to May 1945<sup>564</sup>

Squadron / Unit	Aircraft Type	Aircraft Type	Date
1 PRU	Spitfire PR Blenheim IV Mosquito PR	Hudson I Maryland I	November 1940 to October 1942
2 PRU	Spitfire PR		March 1941 to February 1943
3 PRU	Spitfire PR		November 1940 to 21 August 1941
4 PRU	Spitfire PR		September 1942 to February 1943
540 (PR) Sqn	Mosquito PR IV to PR 34		October 1942 to May 1945
541 (PR) Sqn	Spitfire PR IX to XIX		October 1942 to May 1945
542 (PR) Sqn	Spitfire PR IV to XIX		October 1942 to May 1945
543 (PR) Sqn	Spitfire PR IV to IX		October 1942 to October 1943
544 (PR) Sqn	Wellington Mk IV Mosquito PR IV to XVI	Spitfire PR IV to XI	October 1942 to May 1945
680 (PR) Sqn	Spitfire PR IV to XI Mosquito PR IX to XVI	Hurricane	October 1942 to May 1945
681 (PR) Sqn	B-25 Mitchell Spitfire PR IV to XIX	Hurricane Mosquito PR VI to IX	January 1943 to August 1945
682 (PR) Sqn	Spitfire PR IV to XIX		February 1943 to May 1945
683 (PR) Sqn	Spitfire PR IV to XIX	Mosquito PR IV	February 1943 to August 1945
684 (PR) Sqn	B-25 Mitchell	Mosquito PR II to 34	September 1943 to August 1945

The description of the build-up of RAF Reconnaissance is shown in chapter two, with the table of reconnaissance units and aircraft shown in Table 25. The two historic memorandums from Maurice Longbottom and Sydney Cotton that started the RAF

<sup>563</sup> All tables and data compiled from: R Nesbit, *Eyes of the RAF*; D Kahn, *Hitler's Spies*; E Leaf, *Above All Unseen*; R Stanley, *World War II Photo Intelligence* (New York: Scribner, 1981); TNA AIR 41/6 & TNA AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 1 & 2.

<sup>564</sup> Note: The minor units 431 Flight, Intelligence Photographic Flight, 1437 Flight 60 (SAAF) Squadron, 200 PR Flight, 128 PR Detachment & 160 Squadron (Ceylon) are not shown in the table. more details on these see: R Nesbit, *Eyes of the RAF*, 326-328; also note: 1 PRU became No 540, 541, 542, 543 & 544 Squadrons on 19 October 1942; 2 PRU became 680 Squadron in February 1943; 4 PRU became 682 Squadron in February 1943.

trial and acquisition of high-altitude unarmed Spitfires for specialist reconnaissance work are also transcribed at Annex E and F.

### **US Army Air Force - Reconnaissance**<sup>565</sup>

The main USAAF reconnaissance organisation in the UK from 1944 on, was the 8th Air Force, 325 Photographic Reconnaissance Wing, based at Mount Farm and it also conducted first and Second Phase photographic interpretation work.<sup>566</sup> The USAAF concentrated its reconnaissance on a few aircraft types, using the F-5 Lightning and F-6 Mustang, though they did fly some reconnaissance Spitfires and Mosquitos as well.

Table 26 US Army Air Force Reconnaissance

8 Air Force + 9 Air Force	
325 Reconnaissance Wing	
13 PRS	F-5 Lightning F-6 Mustang
14 PRS	
22 PRS	
27 PRS	

**Key:**

PRS – Photo Reconnaissance Squadron

### **German – Luftwaffe Reconnaissance**

The German photographic reconnaissance and interpretation organisations consisted of 53 dedicated reconnaissance squadrons at the start of the war.<sup>567</sup> These

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<sup>565</sup> For more details on USAAF Reconnaissance see: J Kreis, *Piercing the Fog*, 80-94; AFHSO IRISNUM 00216944, United States Strategic Air Forces in Europe: History of Directorate of Intelligence, 1 January 1944 to 1 May 1945; R Stanley, *World War II: Photo Intelligence*, 133-186.

<sup>566</sup> See Map showing Medmenham in relation to Mount Farm at Annex H.

<sup>567</sup> Note: It is of tangential interest that Germany had an equivalent of Sydney Cotton and the MI5 secret flights in Colonel Theodor Rowehl and his Squadron for Special Purposes, later the Reconnaissance Group. His aircraft provided targeting intelligence on Czechoslovakia, England, France, Norway, Poland, Soviet Union, and providing photographs direct to Reichsmarschall Goring. See: J Caddell, 'Seeing Things Differently' 78-94, p 83; A Claasen, 'The German Invasion of Norway, 1940: The Operational Intelligence Dimension', *Journal of Strategic Studies*, 27.1 (2004) 114-135; D Kahn, *Hitler's Spies*, 114-129;

reconnaissance squadrons were established for twelve aircraft each and in total had 342 aircraft in 30 squadrons for short range reconnaissance to support tactical reconnaissance. They had 260 aircraft in 23 long range reconnaissance squadrons for long range operational reconnaissance. They were widely dispersed to serve the Army, but they also had a central photographic centre in Berlin but it was not an equivalent of Medmenham. They also suffered from using standard fighters and bombers for reconnaissance and from the middle of 1942 were virtually unable to fly reconnaissance missions over the UK. This only changed late in the war when the Arado 234 jet was used for reconnaissance. The German reconnaissance system did not improve the cameras or film during the war, believing it was good enough.<sup>568</sup>

Table 27 *Luftwaffe* Reconnaissance Squadrons

Short Range	Long Range
30 Squadrons – 342 aircraft	23 Squadrons – 260 aircraft
Henschel 126 Focke Wulf 189A Messerschmidt 109 Arado 234	Dornier 17 F Junkers Ju 88D

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<sup>568</sup> R Overy, *The Air War*, 199-200; D Kahn, *Hitler's Spies*, 114-135.



**British – American – German Aerial Cameras**<sup>569</sup>**R A F Aerial Camera Development**

The development of RAF aerial cameras during the war, is shown in the table below.

Table 28 Camera Development in the RAF 1939 to 1945<sup>570</sup>

Camera	Date in Service	Lens focal length inches	Comments
F 8	Since 1919	6 to 20	7 inch square film, 100 magazine, survey camera
F 24	Since 1924	5 to 20	5 inch square film, 125 magazine
F 52	January 1942	10 to 40	8 ½ by 7 inch film, 250 or 500 magazine
F 63	1943	Same as F52	Same as F 52 but with image movement compensation.

The RAF used the F 8 survey cameras and F 24 cameras as shown in Table 28. The F 24 camera though already an old camera was very flexible in its use as it could be mounted vertically, obliquely or even used as a hand-held camera. It was the workhorse camera for the RAF at the start of Second World War. The first new camera of the war, the F 52, did not enter service until early 1942, but with its longer focal length, increased film format and larger film magazine provided the photographic interpreters with more and better photographs for interpretation.<sup>571</sup> Then in 1943 to compensate for blurred images on low level fast flying Spitfire missions a derivative of the F 52 was introduced, the F 63, that allowed the film to continuously move as the picture was taken to compensate for the aircraft movement. The ground area covered by each frame of film was important for the photographic interpreters, and this area changed depending on the focal length of the camera used as can be seen in Table 29.

<sup>569</sup> All tables and data compiled from: R Nesbit, *Eyes of the RAF*; D Kahn, *Hitler's Spies*; E Leaf, *Above All Unseen*; R Stanley, *World War II Photo Intelligence*; TNA AIR 41/6 & AIR 41/7, Draft RAF Narrative Photographic Reconnaissance Vol 1 & 2; RAF Air Publications for each camera see: MA Acc no: 5836 Air Publication 1403 Instruction Handbook for F.24 Air Camera; MA Acc no: 23832 Air Publication 112P-0021-1 Aircraft Camera Type F52; MA Acc no: 23803 A.P. 1355A+C; MA Acc no: 23832 Air Publication 112P-0021-1 Aircraft Camera Type F52.

<sup>570</sup> R Nesbit, *Eyes of the RAF*; R Stanley, *World War II Photo Intelligence*, 165-171; MA Acc no: 5836 Air Publication 1403 Instruction Handbook for F.24 Air Camera; MA Acc no: 23832 Air Publication 112P-0021-1 Aircraft Camera Type F52; MA Acc no: 23803 A.P. 1355A+C.

<sup>571</sup> MA Acc no: 23832 Air Publication 112P-0021-1 Aircraft Camera Type F52.

Table 29 Camera Ground Coverage<sup>572</sup>

Height Feet	F 24 Camera Ground Covered Per Frame (5x5) in Yards					
	Focal Length of Lens in inches					
	5	8	14	20	36	40
1000	333	208	119	83	46	42
5000	1666	1041	595	416	231	208
10000	3333	2083	1190	833	555	416
20000	6666	4166	2380	1666	1111	833
30000	10000	6259	3571	2500	1389	1250
Height Feet	F 52 Camera Ground Coverage Per Frame (7 x 7) in Yards					
	Focal Length of Lens in inches					
	5	8	14	20	36	40
1000	466	291	166	116	65	58
5000	2333	1458	833	583	324	291
10000	4666	2906	1666	1166	648	583
20000	9333	5813	3333	2333	1296	1166
30000	13999	8710	4999	3499	1944	1749

Table 29, shows the area on the ground that each frame of film in the F 24 and F 52 camera covers at altitudes between 1,000 and 30,000 feet and the camera lens being used. The F 24 was the work horse camera until 1942, when the F 52 entered service and as can be seen from the ground coverage a larger area was covered on each frame. The detail that could be seen on each frame increased depending on the focal length of the lens. The longer the lens the more details the photographic interpreters were able to see on each frame, but the area that could be covered per film reduced. The area covered at 30,000 foot by a 40-inch lens on the F 52 was an area of 1749 yards and with a good resolution for the photographic interpreters to work. However, using a 5-inch lens an area eight times greater could be covered per aircraft sortie, but less detail could be seen on each frame of film. The art was to task the reconnaissance mission to carry the best focal length lens for the type of intelligence required to allow the photographic interpreters the best chance of analysis.

<sup>572</sup> MA Acc No: 193, Table 29 compiled from: The Interpretation of Air Photographs, 1943, Appendix 1.

## USAAF Aerial Cameras

The workhorse camera of the US Army Air Force was the Kodak K-17 and its derivative the K-18, used as the standard reconnaissance camera from mid 1940. It was a completely automatic, electrically controlled and with an independently powered magazine. It could take a range of different lenses from six inch up to 14 inch to allow it to produce high resolution photographs from different altitudes on to film that was nine inches square and the magazine could hold up to 500 frames of film. The K-17 with a six inch lens and one hundred and ninety frames was capable of covering an area of 5,500 square miles at survey standard in a single sortie.<sup>573</sup> The US also used the K-24, an adaptation of the British F 24 camera, especially on bomber aircraft for bomb damage assessment. The cameras are shown in Table 30 below.

Table 30 USAAF Aerial Cameras

Camera	Lens focal length inches	Comments
K-17	6 to 14	9 inch square film, 500 magazine, general purpose camera
K-18	24	9 by 18 inch film, 260 magazine, high altitude camera
K-24	3 to 14	5 inch square film, 125 or 250 magazine, general purpose camera

## German Aerial Cameras

The three main German reconnaissance cameras, well-built and with excellent Zeiss optical lenses served through the war without any improvements or development and are shown in Table 31.

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<sup>573</sup> R Stanley, *World War II*, 133-186.

Table 31 *Luftwaffe* Aerial Cameras

<b>Camera</b>	<b>Lens focal length centimetres</b>	<b>Comments</b>
Rb 20/30	20	30 cm square film, 260 magazine, general purpose camera
Rb 50/30	50	30 cm square film, 260 magazine, general purpose camera
Rb 75/30	75 to 150	30 cm square film, 260 magazine, general purpose camera and the main camera used

**Transcript of Flying Officer Maurice Longbottom Memorandum<sup>574</sup>**

SECRET

August 1939

PHOTOGRAPHIC RECONNAISSANCE OF ENEMY TERRITORY IN WAR  
(MEMORANDUM BY F/O. M.V. LONGBOTTOM)

## GENERAL:

Air reconnaissance of enemy territory in war may be broadly divided into two types; reconnaissance of the immediate vicinity of the front lines of the opposing forces, and reconnaissance of all other parts of the enemy's territory behind the lines. Near the front lines reconnaissance will probably be made possible by the maintenance of local air superiority. Enemy A.A. guns may be temporarily partly put out of action by gunfire or bombing, and the remainder risked for short periods, or they may be avoided by keeping a distance from them, and taking oblique photographs with long focus lenses from considerable heights. From behind the enemy both strategical and tactical information will be required about important areas, which may extend to any distance into the enemy territory, and will include accurate information on the results of night bombing raids, which obviously cannot be obtained by taking the photographs from the raiding aircraft, as would be done in day raids.

Reconnaissance aircraft endeavouring to obtain this information run all the risks that raiding bomber aircraft run. It is not possible to have air superiority over enemy territory. The A.A. guns cannot be silenced by bombardment. Important areas, which are the ones over which it will be necessary to fly, will probably be defended by elaborate fixed defences, in addition to mobile ones. The reconnaissance aircraft will be over enemy territory for a considerable time – certainly long enough for the defensive fighter organisation to be brought into operation, and even if they get to their objectives they may still be intercepted and destroyed on the return journey. Furthermore, heavy bombers are well armed, and move in large numbers in formation, giving good protection against fighter attack, which would not be an economical method of reconnaissance. Also, bombers which have got to their target and dropped their bombs have still achieved their main object even if they are shot down on the return trip, whilst the reconnaissance aircraft must get back with his information in order to achieve his object at all, as to use his radio would only be to increase his own chances of interception and destruction, and in any case his most valuable information would be in the form of photographs, which

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<sup>574</sup> TNA AIR 41/6 Draft RAF Narrative Photographic Reconnaissance Vol 1, Appendix XIV.

are the only really reliable and worth-while form of reconnaissance in this type of work.

Clearly, therefore, this type of reconnaissance must be done in such a manner as to avoid the enemy fighters and A.A. defences as completely as possible. The best method of doing this appears to be the use of a single small machine, relying solely on its speed, climb, and ceiling to avoid destruction. A machine such as a single seater fighter could fly high enough to be well above the balloon barrages and A.A. fire, and could rely on sheer speed and height to get away from enemy fighters. It would have no use for its armament or radio, and these could be removed, to provide extra available weight for more fuel, in order to get the necessary range, which a fighter does not normally have. As most fighters have a very good take off, due to their great reserve of engine power, they could be considerably overloaded, for this purpose, with further fuel, giving even greater range.

In clear weather the aircraft would fly at a great height all the time it was over enemy territory, and would be too high to be heard or seen with the unaided ear or eye. If detected by sound locators it would still be out of range of the guns, and with its great speed and advantage of height it could almost certainly elude fighters coming up to

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intercept it from the ground, particularly as it would be a very small machine, painted in the manner which would reduce its visibility against the sky as much as possible. In cloudy weather it would fly in or above the cloud, if possible only emerging below for long enough to take the photographs required, intermittently, not giving the waiting gunners below time to open effective fire, and certainly not giving fighters any opening or opportunity to approach it.

Equipment

Aircraft:

The fastest of the fighters in service at present is the 'Spitfire' and as speed is one of the most important characteristics, it will be assumed that the Spitfire will be used.

The weights for the Spitfire I, with Merlin II engine, and V.P. aircrew are as follows:-

Tare weight	4598	lbs.
Service load	658	"
84 gals. fuel	630	"
Oil	49	"
Total	<u>5935</u>	<u>lbs.</u>

About 450 lbs of the Service load (in the form of guns, ammunition etc.) can be dispensed with. The weight to be added consists of extra tanks, fuel and cameras, and will be approximately as below:-

Tare weight (including extra tanks)	4650	lbs.
Service load (pilot, cameras, etc.)	268	"
Oil	60	"
240 gals. fuel	1880	"
	<hr/>	
Total	6858	lbs.

This represents an increase of 923 lbs. (about 15%) over the all-up weight as a fighter.

With the extra 240 gals. of fuel, allowing 20 gals. for warming, take-off, and extra used on climb, the range is 1500 miles (1200 miles safe) at 300 mph., or 1800 miles (1400 miles safe) at 250 mph.

Allowing one hour flying at full throttle (367 mph) the range is reduced to 1270 miles (1000 miles safe) if the rest of the trip is flown at 300 mph., or to 1450 miles (1150 miles safe) if the rest of the trip is flown at 250 mph.

With two hours flying at 320 mph., the range is reduced to 1380 miles (1100 miles safe) doing the rest at 300 mph., or to 1520 miles (1200 miles safe) doing the rest at 250 mph.

Starting with 6858 lbs. all-up weight the service ceiling should be about 30000 ft., so the aircraft could climb to, say, 25000 ft. over friendly territory, and then gradually climb to about 30000 ft. over a considerable period. After about two hours flying including take-off and climb, about 100 gals., i.e. 800 lbs., of fuel would have been used, and the service ceiling should be about 34000 ft., so that it should be easy to maintain 30000 ft. for the rest of the trip. During the later stages of the trip, if necessary, the machine could climb to over 35000 ft.

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NOTE: These figures are for 15000 ft. (except the top speed of 367, which is for 18500 ft.) but are all for the Spitfire with Merlin II engine. In practice it is proposed that the Merlin XX with the two speed supercharger, or the Merlin RM2M with 100 octane fuel and two speed supercharger should be used, either of which would give a better performance at a greater height, and a very considerably increased ceiling. Also, the machine itself could probably be cleaned up slightly, as the special high speed Spitfire has been. However, the figures given above are the only ones available now, so they will be used for the present, on the assumption that they could be improved in practice.

As a good a good deal of flying may be done over the sea, it would be an advantage if parts of the aircraft, such as section of the wings, could be made watertight, and jettison valves fitted on the tanks, which could be used for extra buoyancy, in the event of a forced landing in the sea.

#### Equipment

##### Cameras, etc:

Owing to the limitations of space and weight available the standard R.A.F. F24 camera cannot conveniently be used.

Because of the great height from which the photographs will normally be taken it is necessary to use lenses of quite long focal length in order to get the resultant prints on a scale which will be sufficiently large to be useful. Generally speaking, the scale of the print should not be smaller than about 3 inches to one mile, or 1/21120. To get the scale of a print from 30000' with the F24 camera it would be necessary to use 8" lenses, and in order to cover a sufficiently wide band on the ground it would be necessary to use three cameras – one vertical, and the other two inclined to either side, with a slight overlap with the central one. Obviously, three F24 camera, with the necessary motors and controls, would be far too heavy and would take up too much space in a very small machine such as the Spitfire, and would probably entail cutting too large a hole in the bottom of the stressed skin fuselage.

It is suggested therefore, that 3 Leitz Leica 250 cameras be used. These cameras hold a length of 35 mm. cine film long enough for 250 exposures, size 24 mm. by 36 mm. As the lenses are computed and made for a circle of confusion of 1/800 inch, the negatives can be enlarged 8 times without visible loss of definition, as opposed to the maximum of 2½ times for the F24 negatives. If the 5 cm. F 2 lenses were used, from 30000 ft., the scale of the 8 times enlarged print would be 1:22500 for the centre camera. The two other cameras would be inclined 33½ degrees from vertical to either side, giving 6 degrees overlap with the centre camera, and the same scale as the centre one on the inside edges of the print, decreasing slightly outwards from this edge (as they would be steep oblique views). The three cameras would cover a band 15 miles wide from 30000 ft. They would all be driven from one gear box, on a similar principle to the F 24 gear box, and one F24 motor, controlled by a Type 35 automatic electrical control. The Type 35 control would be set in a suitable position near the pilot, and the cameras, gear box and motor in the position in the bottom of the fuselage selected as being the best from the point of view of space, accessibility, and convenience for cutting a hole in the fuselage for the lenses. This hole would be covered by a sliding panel controlled by the pilot, and would only be opened when the photographs were being taken, in order to exclude dirt, oil, etc. from the lenses as far as possible. It would only have to be a small hole, and would be unlikely to require much stiffening around it.

With a 60% fore and after overlap the 250 exposures would cover a band of 15 miles wide and 280 miles long from 30000 ft., and would run for 55 minutes continuously at 300 mph. From 20000 ft. the 250 exposures would



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cover a band 10 miles wide and 190 miles long, running for 38 minutes continuously at 300 mph. This would be ample for the requirements of a single flight, so that no reloading of the cameras would be required – an essential point, as they would be inaccessible to the pilot.

The large aperture of F 2 would permit the use of a medium speed pan film (1bout 27 Scheiner) with a very fine grain, and red filters, such as the Ilford Tri-colour Red filter, known in the R.A.F. as the Type 5 filter. This filter should give ample haze penetration from 30000 ft. or more. A very good lens hood would be essential, as there would be at times a considerable amount of strong extraneous light from below, particularly when there was any cloud lower than the aircraft.

The films would be developed with the usual cine apparatus, in a good very fine grain developer, preferably a paraphenylenediamine developer, with a hardening stop bath, and an acid hardening fixer. Before any prints were taken off the film it should be treated with some form of scratch proofing. 8 times enlargements could be made with a proper 35 mm enlarger at least as quickly as contact prints with a standard F 24 contact printer from a F 24 film.

#### Camouflage

As all armament is being removed, and, to avoid detection or interception, the machine is relying on its speed, climb, and ceiling, and on its small size, every effort should be made to make it as difficult to see as possible. It is assumed that the question of it being seen from above will not arise, as it would always be above its opponents, except when it is necessary to fly lower because of cloud, when escape into the clouds will be possible.

Probably the best camouflage would be to paint the entire machine a very pale blue, with a dull surface, to avoid reflections. An alternative would be parts in the pale blue, and parts in a pale cream, with dull surface, or part pale blue and part green.

There must be no bright metal parts at all, so that the only part of the aircraft from which there could be a reflection would be the windshield and the Perspex cockpit covering.

Experiments could be made with the machine painted in various colours, and flying at a height such that it was just visible from the ground, to determine the best colour scheme. During the experiments the machine should also be observed from another machine in the air, from about 5000 ft. lower, and from various distances.

Experiments might be made with a redesigned exhaust system on the engine, with a view to reducing engine noise.

#### Tactics

The aircraft will normally leave on its flight from the nearest suitable aerodrome to the objective. The fuel taken on will be such that it will give a safe

margin, allowing for periods of full throttle flying, and some zig-zagging, but no more, so that the weight will always be kept as low as possible, to give the best possible climb and ceiling.

In clear weather the aircraft should climb to at least 25000 ft. before approaching enemy territory, and preferably 30000 ft. In any case, 30000 ft. should be reached as soon as possible, and once reached should be held. In the later stages of the trip it will probably be possible to fly considerably higher, and at all times the greatest height consistent with a good high cruising speed should be used.

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At these heights there should be no danger from any A.A. fire at all. The Germans claim that their 8.8 cm. gun is effective up to about 25000 ft. This gun is the normal German heavy A.A. armament, and has been well tried in the Spanish war, where it proved quite effective. Batteries of them will be found near all important objectives. But at 25000 ft. the effectiveness of any A.A. gun against a small aircraft flying at speeds in the region of 300 mph. is doubtful. It would be invisible to the naked eye, and, owing to the varying winds over the great difference in height, sound locators would tend to be inaccurate, as also would height finders, and the shell fuses. The length of time between the aircraft being detected or coming into range of the guns and passing out of range again would be very small indeed. No one gun would be able to fire more than three shots during that time. The German 10.5 cm. gun, used for fixed A.A. defences around important areas, and perhaps as mobile guns in some cases, would probably reach higher than the 8.8 cm. gun, but would, of course, be subject to the same inaccuracies at great heights. In general, 25000 ft. should be out of effective A.A. fire for an aircraft flying at speeds near or above 300 mph., and provide no real danger for such a machine. 30000 ft. should be out of range, and even if the 10.5 cm. guns could actually reach that height, the chance of being hit would be negligible.

The German experiments at kite and balloon barrage are not believed to have resulted as yet in anything over 160000 (sic) ft., so they would not constitute any danger on a clear day when it was possible to fly high.

Over enemy territory a slightly zig-zag course should be flown, with fairly long legs, to confuse anyone who might be endeavouring to plot the track, and to make interception difficult. The return trip should not normally be made by the same route as was used to get to the objective.

The German policy for fighter aircraft is believed to be to keep them on the ground until a warning is received of the approach of hostile aircraft, and not to operate fighter patrols.

Even if fighter patrols were up, they would not be as high as 30000 ft., but would be at a more suitable height to intercept bomber aircraft, such as about 20000 ft., and a small, suitably painted, high speed aircraft, about 10000 ft. higher, would have to pass very close to be noticed. If noticed, he could not be caught unless the

enemy fighters had at least as good a ceiling and a considerably higher speed, as they would have to climb while pursuing, thus reducing their speed. Even a fighter at the same height would have to have a reasonable margin of speed to catch up in level flight, and if his ceiling was not so good as the reconnaissance machine he could be avoided by climbing.

If the machine was detected by sound locators or other method, and an attempt made to plot his track and intercept him, it would be necessary, for the interception to have any chance of success, for his height to be computed fairly accurately, for his track to be accurately known, and also his speed, all of which are unlikely, particularly as he would be zig-zagging on a large scale. Also, the fighters would have to have climbed to at least the same height as the reconnaissance machine by the time they were due to intercept, and would even then have to be considerably faster than their quarry.

Of the German fighters at present known to be in service, even the fastest of them, the Messerschmidt 109, series E.1., could not catch the modified Spitfire. The only German fighter which is probably faster than it, would be the Messerschmidt 112 U, which is a new machine, probably not yet in service. But the Spitfire, cleaned up, without armament, and with the Rolls Royce RM2M engine with two speed supercharger and 100 octane fuel, could probably equal or better the speed of the Me 112 U, particularly at great heights, and would almost certainly have a better ceiling.

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## 6.

Reconnaissance of an area such as the Ruhr would be a comparatively simple matter, as the distance travelled over enemy territory would be small. In the case of places such as Bremen, Hamburg, and Kiel, the machine could fly from somewhere in Norfolk, keeping over the sea to just off the coast near these places, and would then have only a short distance to go over enemy territory. The same applies to Heligoland and the adjacent islands.

For a distance objective, such as Berlin, the machine would fly over the sea to a point just south of Heligoland, and then turn towards Berlin. The total distance would be considerably greater than going in a more or less straight line, but it would give the minimum time over hostile territory, and whilst over the sea the machine could be flown at its most economical speed and height, climbing to about 30000 ft. before crossing the coast line.

When there is cloud in the region of the objective the tactics employed will have to be arranged to suit the particular type and amount of cloud. In the case of high cloud, above about 18000 ft., i.e. cirrus, cirro-stratus, cirro-cumulus, high alto-stratus, and high alto-cumulus, if it is below about 30000 ft., the aircraft should fly mainly above it whilst over enemy territory, only descending below when necessary for navigational purposes and to take photographs, and then only for the shortest possible time. In the case of cloud below 18000 ft., if it is less than about 4/10, the photographs can probably be taken without descending below them, in which case

the tactics will be as given above. If it is more than about 4/10 it will be necessary to descend below them to get the photographs. This entails danger of running into balloon or kite barrages over important areas. For such areas it will have to be decided at the time whether the importance of the information required warrants taking the risks of probable barrages. If it does, the machine will have to endeavour to get through the barrages, if they exist. In this case, and in the case where the machine is forced to go low in regions where there are unlikely to be barrages, every possible advantage should be taken of the cloud as a means of concealment. For a large part of the trip it should be possible to fly over the cloud, which will be an advantage, as thick cloud tends to blanket the sound locators.

If chased by fighters above the cloud the machine can retire into the cloud, keeping on its course, and flying near the top of the cloud layer, to get maximum amount of cloud between it and the sound locators. When descending below the cloud for navigational purposes an area should be selected, if possible, which is likely to be free from A.A. guns. When descent below the clouds has to be made below about 25000 ft. in an area which is likely to be defended, as will probably be the case when the photographs are being taken, it should be done at a very high speed, and if A.A. fire is opened an irregular zig-zag course should be steered.

There will obviously be conditions of low cloud, such as low stratus and nimbo-stratus, under which it would be impracticable to attempt the reconnaissance at all, but these conditions would be unlikely to last for any very long period without a break. In general, it will hardly be worth while from the photographic point of view below about 5000 ft.

Owing to the large amount of cloud flying which might be done, it would probably be well worth while to fit the machine with some form of de-icing equipment.

One of the problems to be considered is that of navigation. In such a small machine the facilities for accurate navigation are few. The first essential is that the pilot should be a qualified navigator. He should have had ample practice at high altitude navigation in a small fast machine, and he should be able to fly accurately by instruments for long periods.

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It would obviously be a great advantage if the pilot knew the country over which he had to fly. Therefore, initially at any rate, the pilots should be taken from those who had been doing certain photographic reconnaissance of foreign territory in peace time.

Accurate forecasts of the upper winds would be a most important factor.

In clear weather, or when there was only high cloud, the navigation should be quite straightforward. In cases where there was medium or low cloud, the navigation would have to be done entirely by the met. forecasts of the upper winds, and from such checks on track and ground speed as could be obtained either through gaps in the clouds if they were not 10/10, or by descending below them for

short periods. The pilots should be given ample opportunity to practice this type of navigation, keeping the descents below the cloud down to a minimum.

#### Possible Future Developments

##### Aircraft:

There is a new fighter, of which the prototype has been made, which would be an improvement on the Spitfire. This is the Westland "Whirlwind", with two Rolls Royce Peregrine engines, which has a top speed between (sic) 370 mph. The weights as a fighter are as follows:-

Tare weight	6776 lbs.
Service load	952 lbs.
140 gals. fuel	1092 lbs.
Oil	85 lbs.
Total	<u>8905 lbs.</u>

Of this, about 650 lbs. of the service load, in the form of guns, ammunition, etc., could be dispensed with. It is suggested that the weights should then be made up as follows:-

Tare wt. (with extra tanks)	6850 lbs.
Service load (including pilot, cameras, etc.)	360 lbs.
Oil	100 lbs.
408 gals. fuel	3182 lbs.
Total	<u>10492 lbs.</u>

This an increase of 1587 lbs., i.e. about 17½%, over the weight as a fighter.

Allowing 30 gals of fuel for warming, take-off etc., the range would be 1800 miles (1400 miles safe) at 300 mph., or 2150 miles (1700 miles safe) at 250 mph.

With one hour at full throttle (say 380 mph.), the range would be reduced to 1480 miles (1200 miles safe) doing the rest of the trip at 300 mph., or to 1700 miles (1400 miles safe), doing the rest of the trip at 250 mph.

With more powerful engines, and two speed superchargers, the performance of this aircraft could probably be considerably improved.

Except for the added safety given when flying over the sea, it is very doubtful whether the two engines are any advantage for this type of work. If one engine were to fail whilst over enemy territory the greatly reduced speed and ceiling, combined with the absence of armament, would make this machine an easy

prey for the hostile fighters and A.A. guns. The ideal seems to be a single engine machine, of the single seater fighter type, with a two speed supercharger engine of about 1700 to 1800 max. B.H.P. It would have a top speed of 450 mph., a ceiling of 40000 ft., and a range of 1500 miles safe at 350 mph. If a machine were to be designed and built specially for this work it should be quite possible to get this performance, if a suitable engine were available.

#### Future Developments

##### Cameras

Although the use of the Leica 250 camera may be expected to give excellent results, it is not the ideal arrangement. Considerable research is needed to find the best apparatus for the work, and the best compromise between scale and area covered. A suitable might be to use three cameras, with film 2½ inches square, and 4 inch lenses. It might be possible to combine these in one unit. From 30000 ft. they would cover a band 12 miles wide, and if the lenses could be made with a circle of confusion of about 1/800 inch, the resultant 8 times enlargements, which would be possible, would have a scale of about 1/11200, which is about 5½ inches to one mile. The 2½ inch film could be used in lengths up to, say, 200 exposures or 250 exposures, which would be ample for all the requirements of a single flight.

There are also further improvements which might be made, such as the taking of both panchromatic film and infra-red simultaneously, or possible colour and pan or infra-red together.

(Sgd) M.F. LONGBOTTOM. F/O

August, 1939

**Transcript of Sydney Cotton Memorandum**

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S/2041/1A

MEMORANDUM BY F.S. COTTON. 21/9/39

HESTON FLIGHT

SECRET

Future Requirements for Photographic Aircraft

1st Stage: Long Range:

1. Aircraft must be small, to reduce visibility, and well camouflaged against sky.
2. Top speed of at least 370 m.p.h. attained at a height of 18,000 to 20,000 feet.
3. Range of at least 1,200 miles safe at a cruising speed of 300 m.p.h., including half an hour at full throttle.
4. Service ceiling of 30,000 feet climbing straight up from full load take-off, rising to 35,000 feet with decrease of load through fuel consumption.
5. At least one 5 inch F.24 camera with automatic electrical control.
6. No armament. Reliance is placed on speed, climb, ceiling, and invisibility of aircraft to escape attack.

Short Range

As above, except that range of safe 500 to 600 miles inly (sic) is required, for photography immediately behind front lines.

2nd Stage: Long Range:

1. Aircraft must be small, to reduce visibility, and well camouflaged against sky, and may be single or two seater.
2. Pilot's visibility towards the ground, immediately downwards, and ahead, must be good.
3. Top speed in the region of 450 m.p.h., attained at a height of about 25,000 feet, but engine must have a two speed turbocharger, so that high speed is also available lower down.

4. Range of 1,500 miles safe at 300 m.p.h., including half an hour at full throttle.
5. Service ceiling of at least 34,000 feet, climbing straight up from full load take-off.
6. At least 2 F.24 cameras, with automatic electrical control.
7. No armament. Reliance is placed on speed, climb, ceiling, and invisibility of aircraft, to escape attack.

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Short Range:

As above, but range need only be 500 to 600 miles safe, for photography immediately behind front lines, and general short range work.

In principle, the machine should always be slightly faster than the fastest fighters in use. This should always be possible, as the machine may always be a simplified and cleaned-up form of the fighters. The use of turbo-superchargers should make possible the desired performance.

(Sgd) F. SIDNEY COTTON.

21/10/39.



### The Wild A5 Stereo Autograph



Picture 7. *Wild A5 at Wembley 1939/1940*<sup>575</sup>

The *Wild A5* Stereo autograph was an analytical device for interpreting aerial or terrestrial stereo photographs. The *Wild A5* worked using dia-positive film of two consecutive pairs of aerial photographs, mounted in two adjustable camera boxes designed to replicate the exact azimuthal, tip and tilt at the moment of exposure. These images were transferred via a complicated series of high-quality optics to a binocular high magnification viewing eye piece. The image was seen as a three-

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<sup>575</sup> Photograph courtesy of the Medmenham Collection Archive – unaccessioned. The photograph is of the *Wild A5* serial number 50 in situ at the Aircraft Operating Company, Wembley. It has on it the 1938 International Society for Photogrammetry Rome Congress medal which is still has today. The *Wild A5* can be seen in the Medmenham Museum room at Joint Forces Command Chicksands.

dimensional (3D) image in space. Superimposed over this 3D image was a black floating mark. This black floating mark could be moved all over the 3D image by manipulating foot pedals and wheels. This allowed the *Wild* operator to trace the outline of all ground details seen and plotting contours of the terrain. Via a complicated gearing system all these movements were accurately transferred on to a plotting table where a pencil traced them onto a highly accurate map sheet. This could allow the fast creation of accurate new maps from photographs, or very accurate diagrams of new enemy equipment (e.g. aircraft, ships, harbour plans, V weapons). Due to the high-quality optics, magnification and stereo viewing it also allowed photographic interpretation of very small-scale high-altitude photographs that was not possible by normal instruments.<sup>576</sup>

The AOC before the war was a commercial company and used the *Wild* A5 to produce maps from stereo aerial photography in a cost efficient and fast method. They then moved on to also use it for photographic interpretation for the SIS and Sidney Cotton prior to the start of the Second World War. The AOC was eventually requisitioned for intelligence work in 1940.<sup>577</sup> The *Wild* A5 and staff then became part of the PIU and were moved to RAF Medmenham in 1941. The *Wild* A5 was used at Medmenham for producing detailed maps from stereo aerial photographs. These could be new maps of German occupied territory, or maps used by Bomber Command in the Strategic Bombing offensive. The *Wild* A5 was also used to provide the accurate dimensions needed when producing models, such as those used for the D-Day landings, or accurate dimensions to go into the intelligence reports Medmenham produced.<sup>578</sup>

The Ordnance Survey at Southampton in 1940 also had one *Wild* A5 to assist with map making from stereo photographs, however it was damaged beyond repair later that year. The damaged parts were repaired as far as possible as part of a ploy to

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<sup>576</sup> K A Whitaker, 'The *WILD* Heerbrugg A5 in Britain in 2014', 456-462.

<sup>577</sup> TNA, AIR 29/434 Enclosure 30A Letter dated 30 September 1940.

<sup>578</sup> For more discussion of what Medmenham used the *Wild* A5 for see: R Barker, *Aviator Extraordinary*, 168, 175, 177, 191; C Halsall, *Women of Intelligence*, 134; U Powys-Lybbe, *The Eye of Intelligence*, 54-59; MA Acc no: 901, *The Wild* Story, dated Mar 2013.

fool the Germans, made into a passable whole, but non-functioning A5 and transported out to Lisbon, to be sent back to *Wild* in Switzerland for servicing and repair. Via this cloak-and-dagger operation, *Wild* were able to send a brand new *Wild* A5 out to the 'Portuguese customer'.<sup>579</sup> This new *Wild* A5 was transported from Lisbon back to the UK on HMS Hood and then on to Medmenham. These extraordinary efforts that the UK went to in order to acquire additional *Wild* machines during the war, show the level of importance these machines had in the work at Medmenham and for the greater intelligence machinery of the British.

The workload soon exceeded what these two *Wild* A5 machines could do, even when they were worked on in 24 hour shifts. Via another clandestine operation two new *Wild* A6 machines were acquired via Stockholm and flown out on Mosquito aircraft, probably civilian BOAC Mosquitos, not a RAF reconnaissance Mosquito as was suggested by Ursula Powys-Lybbe.<sup>580</sup> A third *Wild* A5 was recorded as arriving at RAF Nuneham Park in 1943, having being acquired via Gibraltar. These were the five *Wilds* used for the rest of the war.<sup>581</sup> They were all used by W Section at Medmenham and its outstation W Section at Nuneham Park. They have been described as being almost as important to the war effort as were the Bombes at Bletchley Park. That is probably to exaggerate the importance of the *Wild* A5 and A6 machines at Medmenham and Nuneham Park, but what is certain is the important intelligence and mapping work they did at Medmenham for the war effort and the extraordinary lengths the UK went to acquire additional *Wilds* during the war.

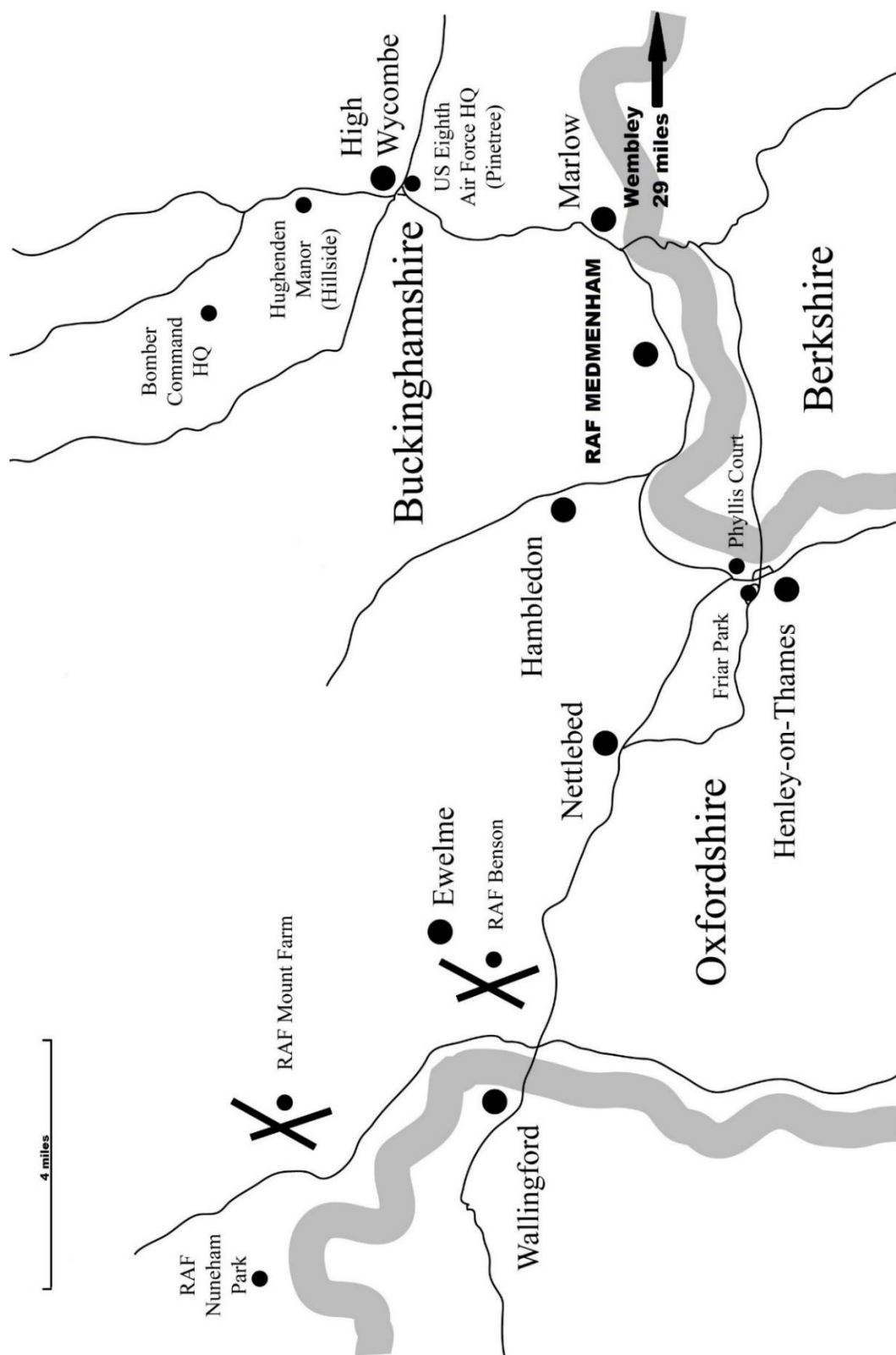
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<sup>579</sup> TNA, AIR29/434 Enclosure 13A, dated 15 February 1941.

<sup>580</sup> C Woodley, *BOAC: A History* (Stroud: The History Press, 2004) 12-13,20,29; U Powys-Lybbe, *The Eye of Intelligence*, 57-59

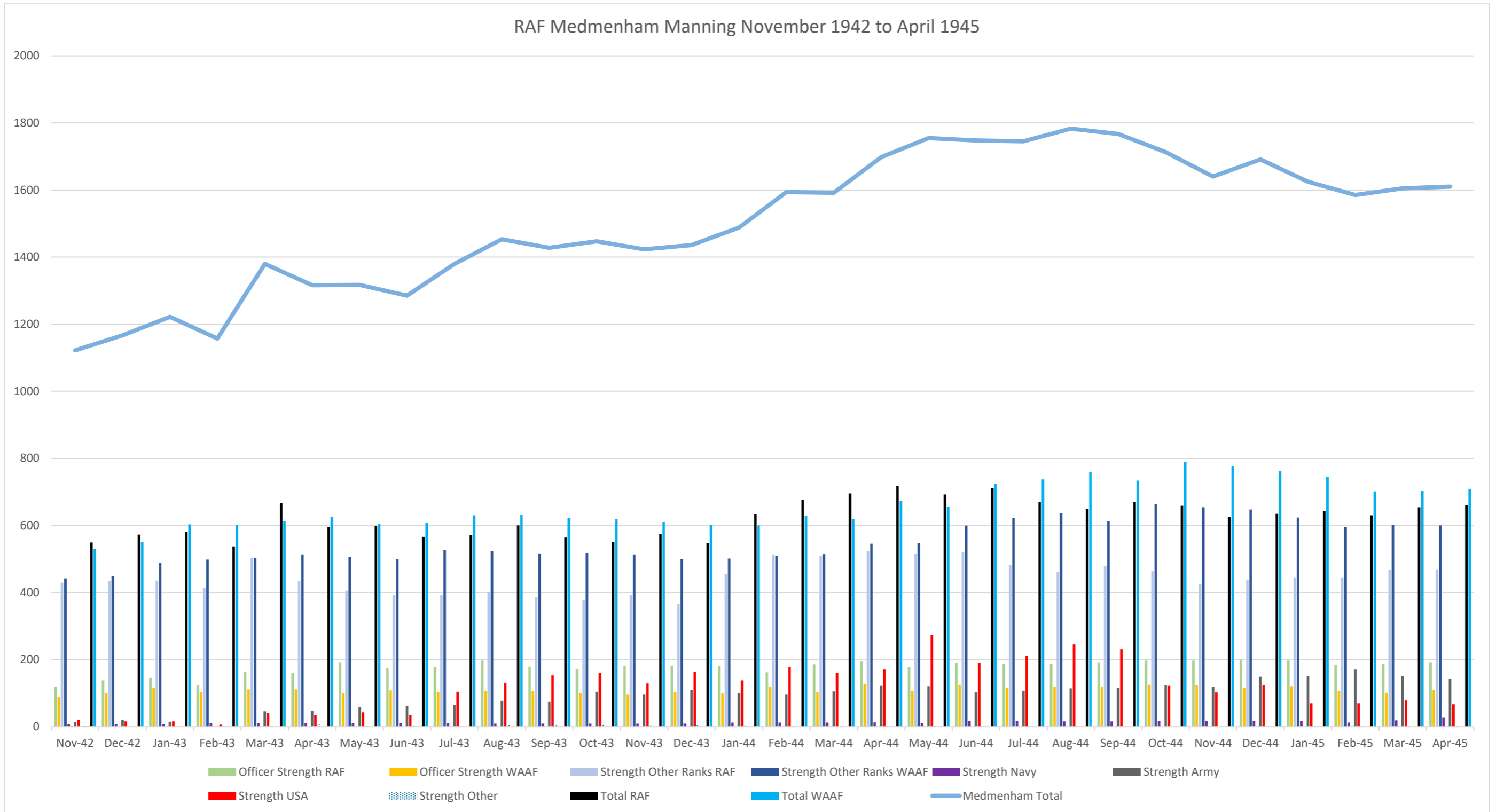
<sup>581</sup> U Powys-Lybbe, *The Eye of Intelligence*, 54-59; K A Whitaker, 'The *WILD* Heerbrugg A5 in Britain in 2014', 456-462; MA Acc no: 901, *The Wild* Story, dated 20 Jan 2006, pp. 1-6.

**Map 5 Medmenham and Associated Bases**<sup>582</sup>



<sup>582</sup> Adapted from A Williams, *Operation Crossbow*, Map 2.

**Medmenham Manning, Production & Sortie Figures**

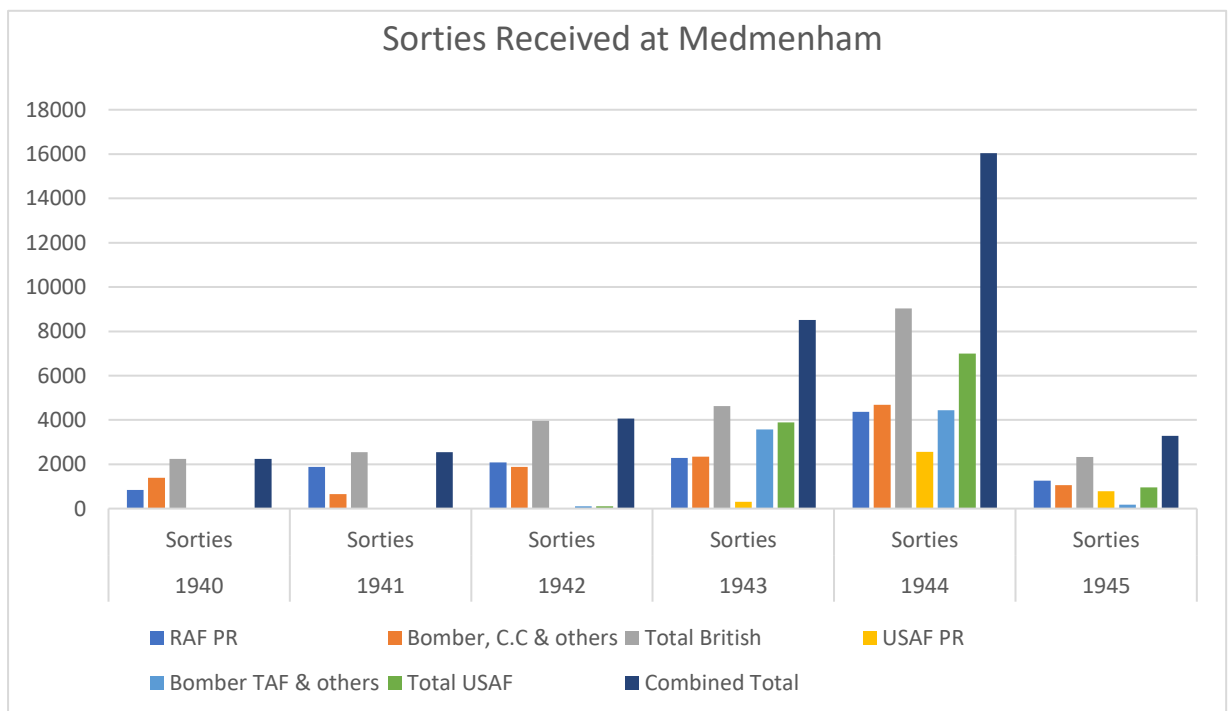


Graph 1.<sup>583</sup>

<sup>583</sup> Note: Naval strength includes the WRNS, which were at a high of 3 from Jan 1944 to May 1945, Strength Other includes the maximum of 3 Norwegian, 3 Canadian and 2 Czech.

The Medmenham manning figures in Graph 1 show that June to September 1944 were the peak manning figures for Medmenham.<sup>1</sup> It is interesting to note that the RAF contingent, which was the largest at ACIU, consisted in June 1944 of 699 RAF and 714 WAAF. This shows the significant contribution the WAAF made to ACIU, including commanding sections. The US are present in relatively small numbers from late 1942, but expand from mid-1943 reaching peak manpower in May 1944.<sup>584</sup>

The sorties and prints received at Medmenham are the raw material that the Medmenham photographic interpreters had to work with to produce the Medmenham intelligence reports and the prints they sent out. The interpretation reports produced by Wembley and Medmenham and the prints sent out are shown in the Graphs 2 and 3 in Chapter 2.

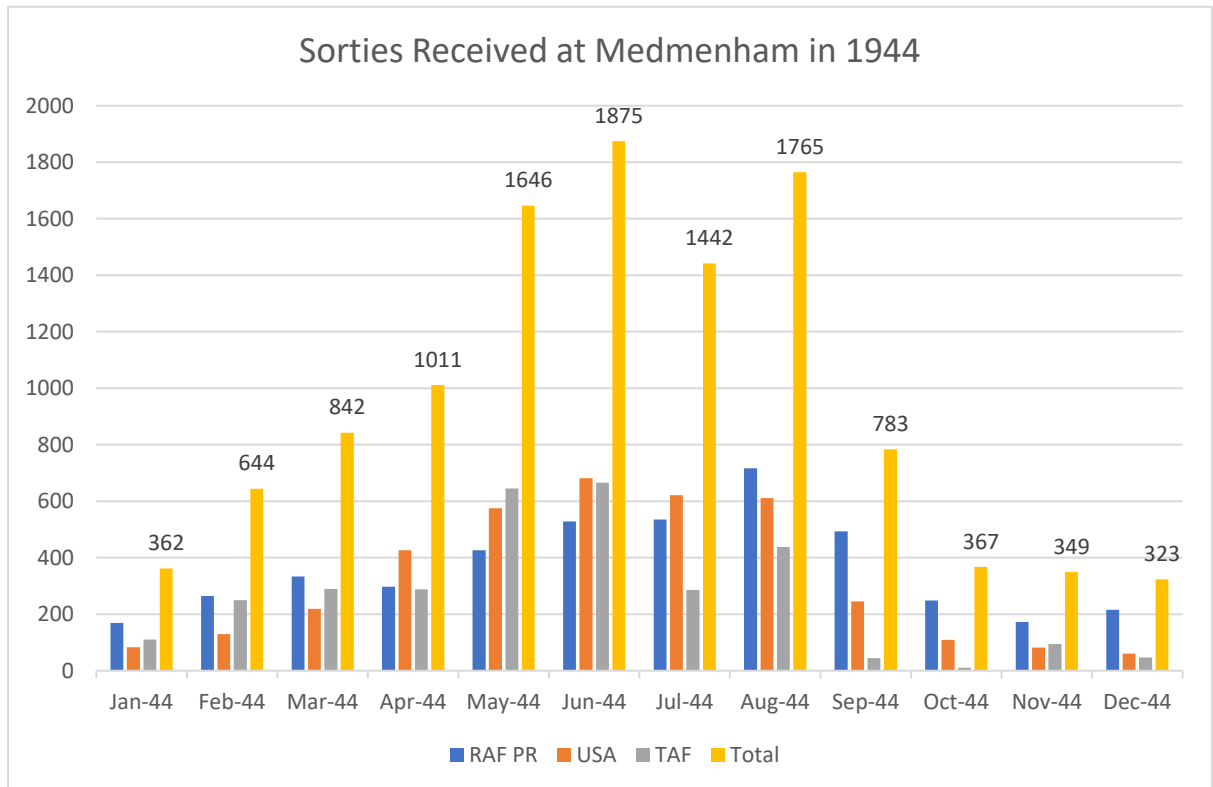


Graph 4.

The sorties and prints received by Wembley and then Medmenham can be seen from Graphs 4 to 6. There was a seven-fold increase in the number of reconnaissance sorties and sixteen-fold increase in prints received by Medmenham from 1940 to the

<sup>584</sup> The data in Graphs 1 to 3 is extracted from an analysis of the Medmenham Archive RAF Medmenham F540 from 1942 to 1945. The data for 1940/1941 is extracted from TNA AIR 41/7.

peak in 1944. When the chart of sorties received at Medmenham in 1944 is analysed it shows Medmenham had four and a half as many sorties to work on in May as it had in January 1944, but with only a small increase in manpower. Medmenham had increased in staff, developed new procedures and become more efficient to deliver enhanced intelligence reporting from a vast increase in photographic reconnaissance missions from 1940 to 1945.<sup>585</sup>

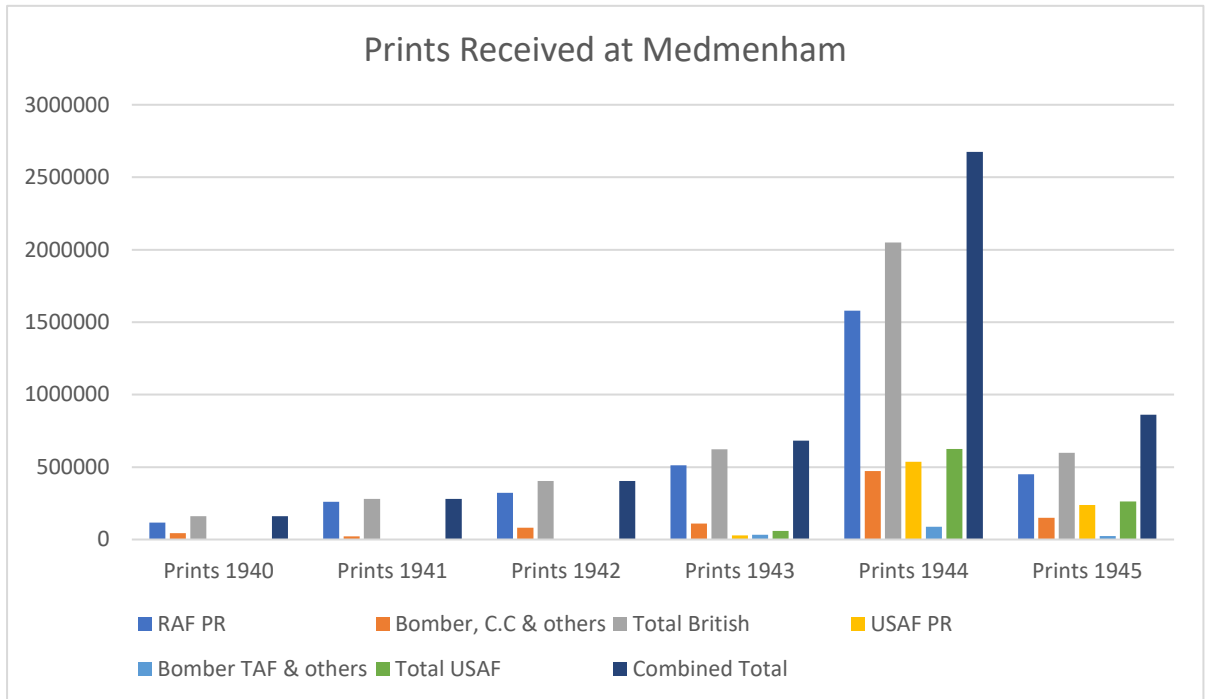


Graph 5.

Graph 5 above shows the total sorties received at Medmenham during 1944. This table clearly shows the increase in sorties from January through to the peak sorties received in June 1944 and then the rapid decline in sorties from August to December 1944. The build-up in sorties in the first half of the year is due to the increase in sorties gathering reconnaissance in preparation for Operation *Overlord*. This is achieved by combining the RAF PR and USAAF PR and Tactical Air Force reconnaissance aircraft, this wealth of reconnaissance aircraft to collect sorties allowed the significant uplift in sorties from January to June. Then after August to the

<sup>585</sup> Data in the 1940 to 1945 Sorties and Prints received tables extracted from MA Acc no: 5, History of Air Reconnaissance, Appendix C.1. Data for the 1944 monthly Sorties calculated by analysis of the RAF Medmenham F540 from the MA. RAF Medmenham F540 January to December 1944.

end of the year there is a drop of USA and TAF sorties as well as a decline in RAF PR sorties received at Medmenham, part of this decline is due to the movement of the TAF sorties to ALGs in France and being processed and analysed at the MFPSs which by the end of August 1944 were deployed to France.



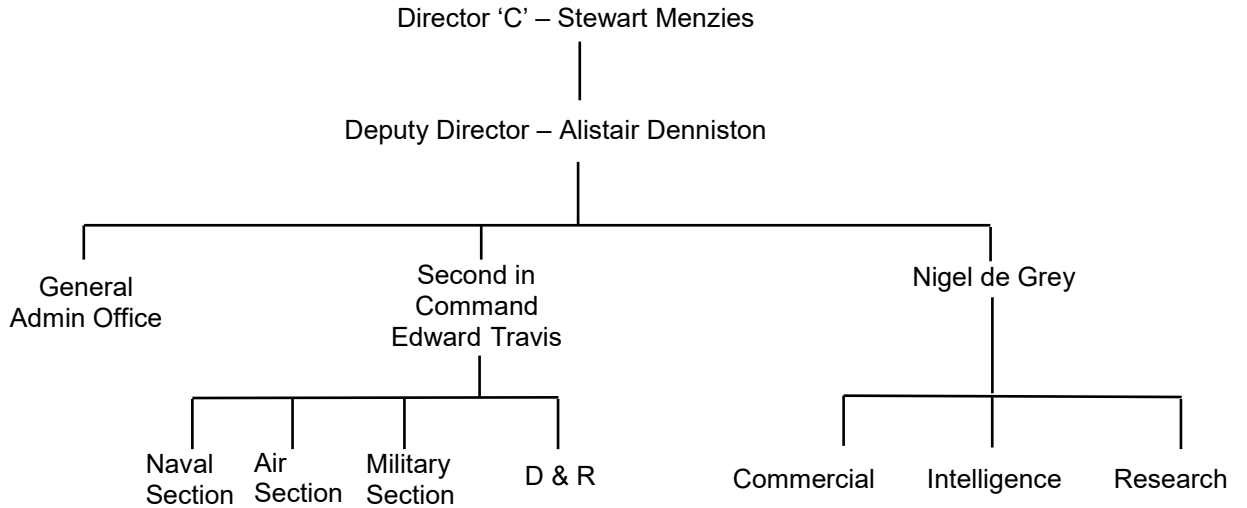
Graph 6.

Graph 6 shows the prints received at Medmenham and they are further categorised by RAF photographic reconnaissance aircraft, Bomber Command and other British aircraft, US photographic reconnaissance aircraft and the Tactical Air Force aircraft. These clearly show the significant increase in prints received in 1944 and the majority were from RAF PR aircraft.

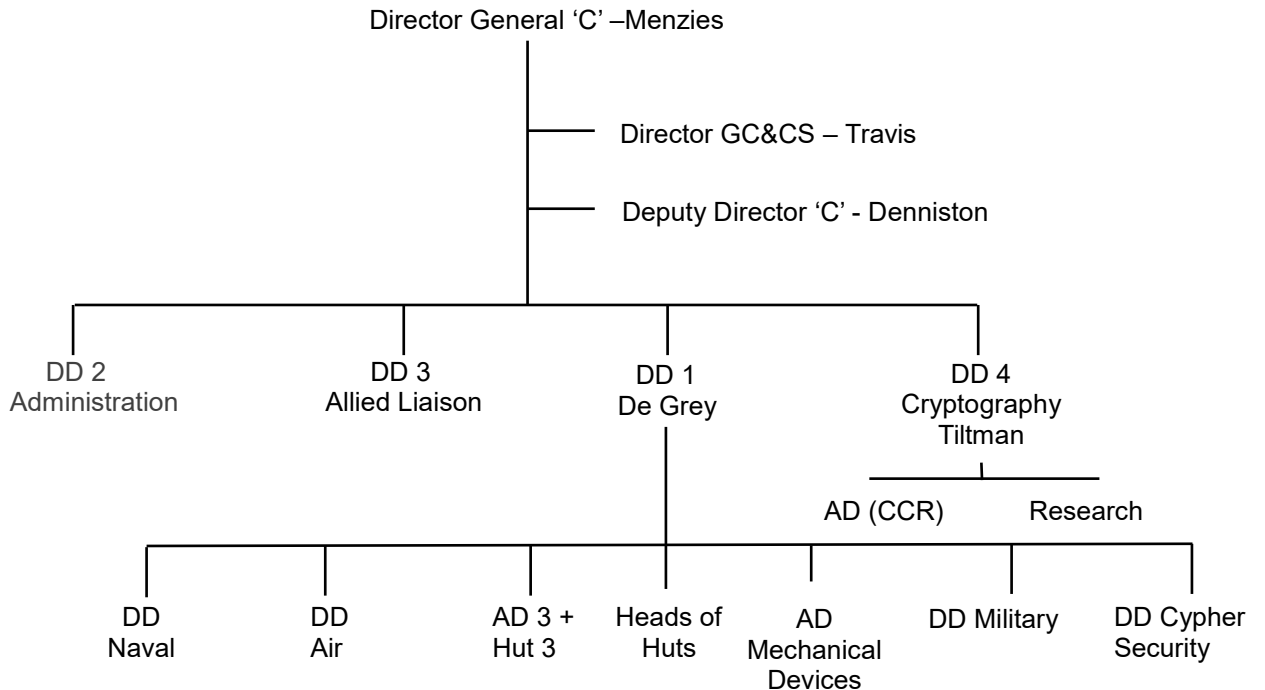


**Bletchley Park Organisation 1940 - 1944**<sup>586</sup>

**Bletchley Park Organisation – May 1940**



**Bletchley Park Organisation – November 1944**



<sup>586</sup> Note: adapted from C Grey, *Decoding Organization*, 286-288.

### Bletchley Park Processes and Huts

Bletchley Park was dependant on the 'Y' Service to get intercepted wireless traffic collected out of the ether and then had to find the daily changing security key, decrypt the message, translate it, analyse it and assess its intelligence value, before dispatching the intelligence to the select band of those cleared to receive it. The decoding of the encrypted communications could take from hours to days or weeks dependant on the code and quality of the messages received. The decoding of the messages was in general a slow manual process between 1939 and March 1940. The decoded messages could be between days and weeks old during this period. This improved slowly when the first prototype Bombe was delivered to Bletchley Park in April 1940, but even by August 1941 there were only six machines available. This caused bottlenecks for time on the Bombes between Huts at Bletchley Park and a backload of work. The numbers of Bombes grew to 40 three rotor Bombes by the end of 1942, 87 three rotor Bombes by the end of 1943 and 20 of the new four rotor versions for use against the new German Naval four-wheel *Enigma* machines. The speed of decryption and number of messages decrypted grew in line with the increase in the number of Bombes available.<sup>587</sup>

The *Luftwaffe* and Army *Enigma* codes were regularly broken, the *Luftwaffe* codes from early 1940 and the Army codes intermittently from later in 1940. The code breakers of Bletchley Park were often assisted by the poor signals intelligence discipline of rather under trained German *Enigma* operators, who in the *Luftwaffe* and Army were non-commissioned. The German Navy, had far better signals intelligence discipline in its use of *Enigma*. They had officers responsible for setting up the daily changing *Enigma* keys, developed a more secure Naval *Enigma* with one extra rotor, now four and a selection of eight rotors that could be used, and Naval general communications discipline was superior to the other two services. This is one of the reasons that Bletchley Park could not read Naval *Enigma* early in the war or later all

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<sup>587</sup> C Smith, 'How I Learned to Stop Worrying and Love the Bombe: Machine Research and Development and Bletchley Park', *History of Science*, 52.2 (2014) 200-222; M Smith, *Station X*, 7-54; R Erskine & M Smith, *The Bletchley Park Code-breakers*, 165-184.

the time and had extended periods of being locked out from the Naval *Enigma*, which caused problems during phases of the Battle of the Atlantic, when Bletchley Park was locked out of the German Naval codes.<sup>588</sup>

The Allies planned a raid on an isolated German weather ships north east of Iceland to capture *Enigma* material in May and June 1941 to provide Bletchley Park with the way in to more regular reading of German Naval U-boat *Enigma*. However, this initial break allowed Bletchley Park to read only six days of naval *Enigma* from 22 to 27 April 1940. They did not break back into naval *Enigma* until November 1940. The breaking of the six days traffic in April did not actually occur in April, it was 17 days before the first messages were passed to the Operational Intelligence Centre and 63 days to complete the last messages.<sup>589</sup> Bletchley Park in the early period of the war was not able to provide rapid decrypts of the German *Enigma* system. Then once again, through German changes in February 1942, Bletchley Park was locked out of naval *Enigma* until December 1942. This clearly demonstrated that Bletchley Park could not read all German messages at all times, and when Bletchley Park was locked out, it did have significant adverse impact on Allied operations.<sup>590</sup>

*Ultra* is said to have had little impact on the Allied conduct of the war until the spring of 1941. This is because Bletchley Park was only able to read regularly two German *Luftwaffe* keys and the Army key for the Norwegian campaign from spring 1940 until 1941.<sup>591</sup> The reports that Bletchley Park contributed to the successes in the Battle of Britain can now be dismissed, as other intelligence sources and the RAF fighter command superior aircraft and command and control systems including radar were the key factors.<sup>592</sup>

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<sup>588</sup> R Erskine & F Weierud, 'Naval *Enigma*: M4 and Its Rotors', *Cryptologia*, 11.4 (1987) 235-244; J Wright, 'The Turing Bombe Victory and the First Naval *Enigma* Decrypts', *Cryptologia*, 41.4 (2017) 295-328.

<sup>589</sup> J Wright, 'The Turing Bombe Victory and the First Naval *Enigma* Decrypts', 295-328; R Erskine, 'The First Naval *Enigma* Decrypts of World War II', *Cryptologia*, 21.1 (1997) 42-46.

<sup>590</sup> D Kahn, 'Intelligence in World War II', 1-20. & R A Ratcliff, 'Searching for security: The German investigations into *Enigma*'s security', *INS*, 14.1 (1999) 146-167.

<sup>591</sup> J Jackson, *Solving Enigma's Secrets*, 409-416.

<sup>592</sup> F H Hinsley & A Stripp, *Codebreakers*, 1-14.

There is no doubt that Bletchley Park provided excellent intelligence on German and Axis plans, intentions and dispositions. It was not however an infallible source of intelligence, because Bletchley Park could not always decode the messages, or in time to make use of them and also our Allied commanders did not always make best use of the intelligence. This could sometimes be because they were not cleared into *Ultra* and were instead given the gist of the intelligence, enough to act on, but told it came from agent reporting, often agent *Boniface* as Churchill liked to report it. Some of the Allied commanders who were not cleared distrusted Agent reporting, so ignored or gave less weight to the intelligence.<sup>593</sup>

Bletchley Park grew over time and this growth was not a simple response to demand for more signals intelligence but also a requirement to professionalise and industrialise the processes at Bletchley Park. They had to cope with the increased workload, a growing library of intelligence intercepts, industrialisation of the cryptographic processes with the introduction of *Bombes* and *Colossus*, all of which required an array of different staff to keep them running. There was also the need to keep absolute secrecy and security around the work of Bletchley Park and its *Ultra* intelligence, so a growth of security personnel dealt with the ever-increasing number of staff across the Allied military and governments who were cleared for *Ultra*. To facilitate the secure handling of *Ultra* intelligence Special Communication Units, usually Army staffed and Special Liaison Units usually RAF staffed were set up to provide this intelligence to overseas staff and commands. The *Ultra* intelligence was sent via wireless and tele-printer machines, encrypted with British cyphers. However, to guard against the chance that Germany was able to read any of these messages, they were not allowed to transmit raw intercepts from *Ultra*, only the derived intelligence.<sup>594</sup> This was to protect the source of the *Ultra* intelligence and stop Germany questioning the security of the *Enigma* machine and implementing significant upgrades or enhancements to *Enigma* that would lock Bletchley Park out of the codes. The Germans did instigate checks on security of *Enigma*, however they

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<sup>593</sup> D Stafford, *Churchill and Secret Service*, 59 - 85 & 189 - 205.

<sup>594</sup> F H Hinsley & A Stripp, *Codebreakers*; R Lewin, *Ultra Goes to War*; R Erskine & M Smith, *The Bletchley Park Codebreakers*.

never questioned its invulnerability, always ascribing any failure or setback during the war to other sources, for example spies, reconnaissance aircraft or British advanced direction finding. Even in the battle of the Atlantic, when the Germans were reading the Royal Navy signals and seeing the British and American messages to re-route our convoys away from the U-boat wolf packs, they did not believe *Enigma* was compromised.<sup>595</sup>

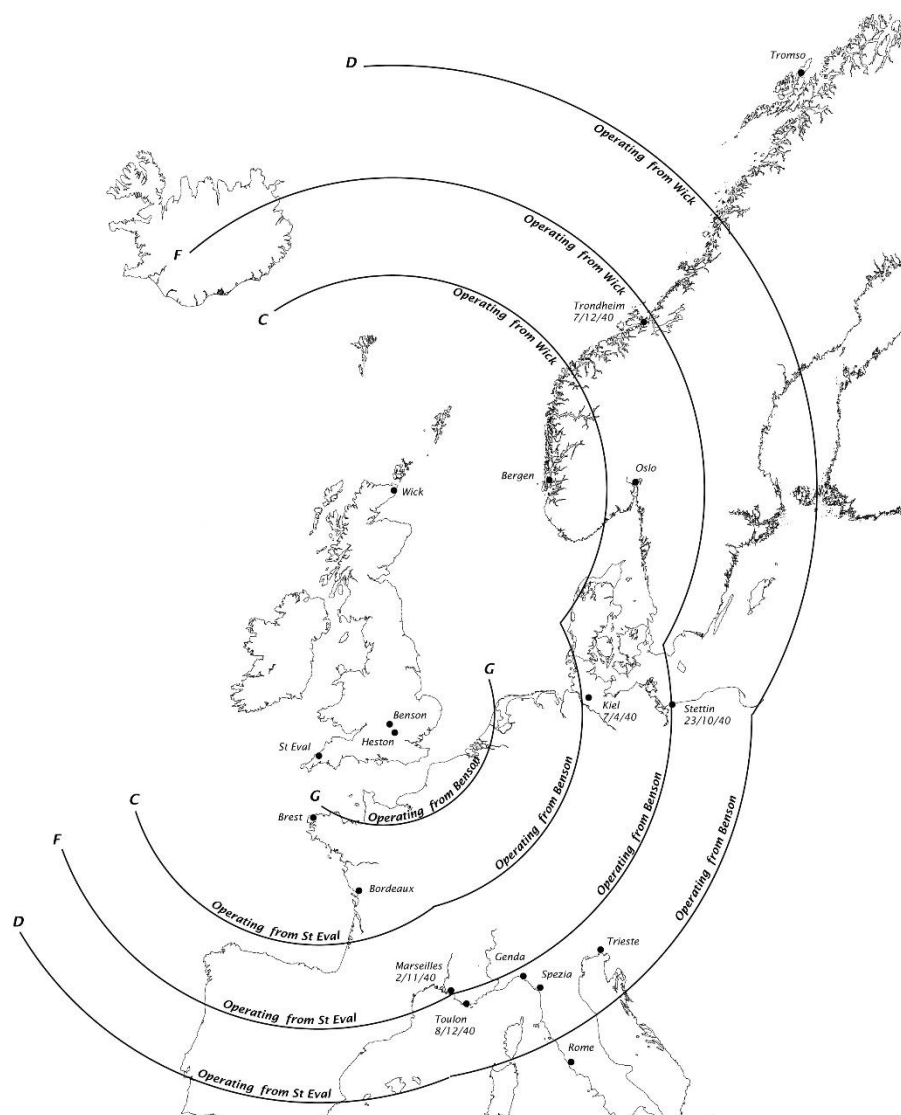
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<sup>595</sup> R A Ratcliff, 'Searching for security: The German investigations into *Enigma*'s security', 146-167.

## List of Bletchley Park Huts and Buildings with Functions<sup>596</sup>

Bletchley Park	
Building	Function
Main House	HQ and Administration
Hut 1	Wireless Station, Administration, first Bombe Hut
Hut 2	NAAFI Hut
Hut 3	Intelligence translation and analysis of Army and Air Force decrypts
Hut 4	Naval Intelligence
Hut 5	Military Intelligence
Hut 6	Army and Air Force <i>Enigma</i> Cryptanalysis
Hut 7	Japanese naval codes
Hut 8	Naval <i>Enigma</i>
Hut 9	Intelligence Section
Hut 10	SIS and Meteorological sections
Hut 11	Bombe Hut
Hut 14	Communications Centre
Hut 15	Signals Intelligence and Traffic Analysis
Hut 16	Intelligence Service – Abwehr
Hut 18	Intelligence Section
Hut 23	Engineering Section
Block A	Naval Intelligence
Block B	Italian Air and Naval section and Japanese
Block C	Registry of Punched cards (need to check further)
Block D	Extensions to Huts 3, 6 and 8 when they ran out of room in the Huts
Block E	Type X and radio communications
Block F	Japanese Section Newmanry (Colossus machine Section) and Testery under Maj R Tester hand broke the Tunny / Lorenz code
Block G	Traffic analysis
Block H	Tunny and Colossus machines

<sup>596</sup> GCHQ, *History of Bletchley Park Huts & Blocks 1939-45*; C Grey, *Decoding Organization*.

**Map 6 Spitfire Photographic Sortie Ranges**<sup>597</sup>**Key:**

- G: Range of Armed Spitfire with 30 extra gallons
- C: Range of Unarmed Spitfire with 60 extra gallons
- F: Range of Unarmed Spitfire with 90 extra gallons
- D: Range of Unarmed Spitfire with 145 extra gallons

<sup>597</sup> TNA AIR41/6 Draft RAF Narrative Photographic Reconnaissance Vol 1 Appendix XXXVI.

**Photographic Interpretation Reports 1 to 100**<sup>598</sup>

<b>Report No</b>	<b>Date of Report 1940</b>	<b>Sortie No</b>	<b>Date of Sortie 1940</b>	<b>Locality</b>	<b>Notes</b>	<b>Significant Activity</b>
1	14/05	HAA/018	14/05	Aachen - Helmond	Photography of small scale - considerable activity near Aachen. Helmond Bridges destroyed, Temp bridge over canal S.W.of Helmond.	Willems Canal Bridge and locks destroyed and many barges held up at 51-22N 50-44E
2	14/05	HNA/016	14/05	Dutch Friesian Islands Terschelling	Mainly over mud flats approaching Naval Base Helder - than cameras failed	
3	15/05	HAA/019	14/05	N. of Antwerp to N. of Maastricht	Report on New canal 8 miles N of Antwerp & Schelde Maastricht Canal	Multiple Bridges destroyed on both canals
4	16/05	IXFA/007	14/05	Bari	Shipping - No warships 7 other vessels, Bari Aerodrome No activity, Oil Refinery	Detailed paragraph on Oil Refinery
5	16/05	IXFA/001	12/05	Genoa and Parts Italian Riviera	Genoa Seaplane base work, Oil Depot and Shipping report	
6	16/05	IXFA/002	12/05	Livorno & Piza	Aerodrome, Oil Refinery, Wireless Station, Dock	Leghorn (Livorno) Refinery medium sized for distilling high grade fuel

<sup>598</sup> TNA AIR 34/290, Interpretation Reports 001 – 100.



Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
7	16/05	IXFA/006	12/05	Milan	4 Aerodromes covered	
8	16/05	IXFA/005	12/05	Turino Westwards	6 Aerodromes, 4 Barracks no significant activity	
9	12/05	IXFA/003 & 004	12/05	Italo-French Frontier	No sign of unusual activity	
10	17/05	HNA/017	17/05	Amsterdam to Ijmuiden	North Sea Canal no activity Ijmuiden blocked by vessel, Hook of Holland no boom defences seen	First two-page report
11	17/05	HNA/018	17/05	German and Dutch Friesian Islands	Aerodrome and Harbour activity reported - no significant activity	
12	18/05	HAA/022	18/05	Zutphen 52-8N 6-12E	Destroyed bridges at Zutphen, long column on road to SW Zelhem	
13	19/05	HAA/023	19/05	Buer Ickern Rotterdam	Krefeld Uerdingen Aerodrome 3 planes on ground and 3 in flight and new dispersal area started construction	Recce Spitfire catches 3 planes in air
14	20/05	HAA/024	19/05	????	Report too faded to read apart from no significant activity seen	
15	20/05	HAA/025	19/05	Flushing Rotterdam The Hague	Large Ship 655 X 75 feet probably a liner not military Rotterdam large 600 ft ship on	

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
					fire below bridge	
16	19/05	HNA/022	20/05	Langeoog, Wilhelmshaven, Bremerhafen	Langeoog Aerodrome construction work, Harbour 4 barges 20 smaller craft, Wilhelmshaven little activity incl barges	Langeoog Harbour 4 Barges
17	16/05	HAA/021	20/05	Bingen, Mainz, Frankfurt, Bad Nauheim	6 Aerodromes NSTR, but AA Batteries evident	
18	25/05	HAA/028	25/05	Schouwen - Rotterdam	Poor quality and small scale, but no changes in barges at Rotterdam seen	Rotterdam no changes in barge concentration
19	25/05	HAA/029	25/05	Boulogne - Etaples - Abbeville - Amiens - Albert - Arras	Small scale high altitude 1:47,000 , no barges or aircraft seen	
20	26/05	HNA/023	26/05	Zeebrugge - Bruges - Zeebrugge	Zeebrugge - All lock gates, bridges road and rail junctions intact	
21	28/05	HAA/030	27/05	Gravelines - St Omer - Aire - Menin - Ypres	Small scale 1:50,000 Bourbourg numerous barges stationary in canal - Ypres all bridges intact	Bourbourg numerous barges stationary in canal
22	28/05	HNA/024	27/05	Dunkirk - Calais - Boulogne - Bay D'Authie	Calais no ships in harbour	
23	28/05	HNA/025	28/05	Vlaardingen - Rotterdam	Vlaardingen Oil Depot damage report - no	

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
					change at Rotterdam	
24	01/06	IXFA/008	28/05	Italian Coast - Spexia and Genoa regions	Long report on naval sightings	
25	01/06	HNA/026	31/05	Den Helder	Den Helder Naval Base - no German warships seen	
26	01/06	HAA/032	31/05	Gravelines - Bergues - Nieuport	Canal west of Bourbourgville - barges used to try to bridge canal - failed and sunk	
27	29/05	IXFA/009	01/06	North Italy Turin - Cuneo	Report on aerodromes	
28	02/06	HNA/027	02/06	Rotterdam Coast north	NSTR	
29	02/06	IXFA/011	01/06	Turin and district	Report on aerodromes	
30	03/06	IXFA/010	31/05	Westward and Southward of Turin	Report on aerodromes	
31	03/06	NHA/028	02/06	Ijmuiden and North Sea Canal to Amsterdam	Ijmuiden - barge and small craft movements at higher levels than seen in any Dutch ports	Ijmuiden - barge and small craft movements at higher levels than seen in any Dutch ports
32	03/06	HNA/029	03/06	Wilhelmshaven	Significant cloud cover - but harbour covered	
33	04/06	FAA/026A	03/06	Valenciennes - Fumay	Scale: 1:50,000 - tanks/heavy vehicles noted	
34	04/06	IXFA/012	03/06	Italy -Genoa - Spezia	Scale 1:50,000	
35	04/06	IXFA/013	03/06	Italy - Menton North to Mount Viso	Scale 1:50,000	

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
36	04/06	IXFA/014	03/06	Aulxpinerele Argentera	Scale 1:50,000	
37	04/06	HAA/038	04/06	Flushing - Canal towards Brussels - Ghent Canal	Scale 1:50,000 Flushing Port no activity, 15 barges river west Scheldt, 150 barges in Ghent	150 barges in Ghent
38	04/06	HAA/039	04/06	15M West St.Omer to St.Quentin and Arras	Scale 1:47,000 Aerodromes, Aire, Nunco, Beauvoir, Dieval - construction work seen	
39	05/06	HNA/030	04/06	Zeebrugge - Flushing - Helder	Scale 1:50,00 No wrecks found in mined areas	
40	05/06	IXFA/015	04/06	Italy - Mondovi - Asti, Milan - Aosta	Scale: 1:50,000	
41	05/06	IXFA/016	04/06	Italy - Susa - Salbertrand - Aosta - Chatillon	Scale: 1:50,000	
42	05/06	HNA/031	05/06	Rotterdam - Hook - Hague - Ijmuiden - NSC - Amsterdam	Scale: 1:50,000 Rotterdam 60- 70 barges in Waalhaven have moved - Hook boom defences seen	Rotterdam 60-70 barges in Waalhaven have moved
43	06/06	HNA/032	05/06	Emden - Wilhelmshaven - Intervening Country	Scale: 1:60,000 Wilhelmshaven <i>Turpitz</i> at usual birth Admiral Scheer in No 5 dry dock - Emden barge numbers down	Wilhelmshav- en <i>Turpitz</i> at usual birth Admiral Scheer in No 5 dry dock - Emden barge numbers down
44	06/06	IXFA/017	05/06	Italy - Leghorn - Lucca - Pistoia - Florence	Scale: 1:50,000	
45	06/06	HNA/033	05/06	Calais - Dunkirk - Ostend	Scale: 1:50,000 No Activity	

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
46	07/06	HNA/035	06/06	Abbeville to coast to Calais	Scale: 1:50,000 Beached vessels near Calais	
47	07/06	HNA/034	06/06	Wilhelmshaven	Scale: 1:50,000 Long Naval report - barges at Emden	Barge movement at Emden
48	07/06	HAA/042	06/06	Rhine - Oudetonge - Nijmegen	Scale: 1:54,000 Gorinchem some barge activity	Gorinchem some barge activity
48A	07/06	HAA/044	06/06	Homburg - Basle - Waldshut	Scale: 1:50,000 Aerodromes no activity	
49	08/06	HAA/045	07/06	Escoeuilles - Dieval	Scale: 1:50,000 Cameras failed before main tgts but aerodrome under construction Bruay/Dieval	
49A	07/06	HNA/036	07/06	Holland and Germany	Scale: 1:60,000 Amsterdam Little movement of barges but 30 missing	Amsterdam Little movement of barges but 30 missing
50	08/06	IXFA/018	06/06	Northern Sardinia	Scale: 1:44,000	
51	09/06	HAA/046	08/06	Rheine - Amsterdam - Haarlem	Scale: 1:50,000 Camera faults caused 2 tgts to be missed EMS-Dortmund Canal barge movement reported	EMS-Dortmund Canal barge movement reported
52	09/06	IXFA/019	08/06	Italy - Naples - Gaeta	Scale: 1:20,000	
53	09/06	HAA/047	09/06	Ijmuiden	Scale: 1:60,000 Only Ijmuiden Naval covered and no activity seen	

<b>Report No</b>	<b>Date of Report 1940</b>	<b>Sortie No</b>	<b>Date of Sortie 1940</b>	<b>Locality</b>	<b>Notes</b>	<b>Significant Activity</b>
54	11/06	IXFA/020	08/06	Italy - Cagliari Naval Base	Scale: 1:50,000	
55	11/06	IXFA/021	10/06	Italy - Naples - Gaeta	Scale: 1:50,000	
56	11/06	IXFA/022	11/06	Italy - La Maddalena Base - Terranova - Cagliari - Alghero	Scale: 1:50,000	
57	12/06	IXFA/023	11/06	Italy - Leghorn - Mondovi	Scale: 1:50,000	
58	12/06	IXFA/024	11/06	Italy - Milan - Busto - Arsizio - Turin	Scale: 1:44,000	
59	14/06	HAA/048	14/06	Vernon - Les Andelys - Made - Louviers - St.Aubin	Scale: 1:7,500 Seine Railway Bridge at Vernon spans 5&6 destroyed & road bridge totally destroyed	New pontoon road bridge built
60	15/06	HNA/038	14/06	Dieppe - Le Havre - Seine - Etretat	Scale: 1:50,000 Sortie looking for invasion craft - poor quality due to bad Wx	Special sortie looking for invasion craft
61	18/06	IXFA/025	14/06	Italy - Spezia	Scale: 1:17,000 Cloud obscured tgts	
62	18/06	IXFA/026	13/06	Italy - Genoa	Scale: 1:20,000	
63	18/06	IXFA/027	15/06	Italy - Spezia - Genoa- Piza - Mondovi	Scale: 1:16,000	
64	18/06	HAA/049	18/06	Muenster Rheine - Amsterdam - Ijmuiden	Scale; 1:50,000 + 1:17,000 Muenster - lock gates intact and emergency gates at aqueduct & new aerodrome @ 52-16N 70-29E	New aerodrome

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
65	18/06	HNA/039	18/06	Havre - Dieppe - Boulogne - Gris NFZ	Scale: 1:50,000 Battery of guns moving N of Fort De La Creche	
66	19/06	HNA/040	18/06	Texel - Helder - Haarlem - NSC - Schipol	Scale: 1:60,000 Schipol Airport activity 25 small a/c & several large a/c	
67	19/06	HNA/041	18/06	Coast from Zeebrugge to 52-45	Scale: 1:50,000 Zeebrugge - Only two new small craft, no change at The Hague	
68	19/06	HNA/042	18/06	Gravelines - Dunkirk - Nieuport - Ostend - Ghent - Flushing	Scale: 1:50,000 Dunkirk only slight changes in naval shipping in harbour, Ostend - no shipping	
69	19/06	HNA/043	18/06	Boulogne - Calais	Scale: 1/50,000 Boulogne MTB departed Calais No shipping to report	
70	20/06	HAA/050	20/06	Emmerich - Nijmegen - Goringhem - Rotterdam - Hook	Scale: 1:55,000 & 1:18,000 Barges @ Goringhem and fair activity, Rotterdam 40 barges departed medium sized steamers and three tankers arrived	Barge activity at Rotterdam and Gorinchem
71	21/06	HNA/045	20/06	Boulogne - Calais - Dunkirk - Ostend - Zeebrugge - Antwerp	Scale: 1:50,000 Calais no activity, Dunkirk no change but activity to make vessels serviceable	

<b>Report No</b>	<b>Date of Report 1940</b>	<b>Sortie No</b>	<b>Date of Sortie 1940</b>	<b>Locality</b>	<b>Notes</b>	<b>Significant Activity</b>
72	21/06	HNA/046	20/06	Ijmuiden - NSC - Amsterdam	Scale: 1:50,000 Ijmuiden Naval - no change - NSC increase in barge traffic - Amsterdam increase in barge traffic	Barge activity on NSC and Amsterdam
73	21/06	HNA/047	20/06	Cherbourg - Le Havre	Scale: 1:60,000 Cherbourg no naval craft, Le Havre no naval craft	
73a	21/06	HNA/047	20/06	Cherbourg - coast to Le Havre	Scale: 1:60,000 Poor quality photographs no activity seen	
74	22/06	HAA/051	21/06	Cleves - Rheine - Schiphol - Haarlem	Scale: 1:55,000 Port camera failed no cover of Cleves	
75	22/06	HNA/048	21/06	Calais - coast to Le Havre	Scale: 1:50,000 Calais & Boulogne no shipping activity	
76	24/06	HAA/052	24/06	Asch-Maeseeyck	Scale: 1:50,000 Near Buchten on Juliana canal near dock 70 barges	70 barges - nil on 8/06/1940
77	24/06	HNA/049	24/06	Wilhelmshaven & North German Aerodromes	Scale: 1:50,000 Wilhelmshaven Tirpitz nearing completion, Admiral Scheer has left No 5 dry dock	Tirpitz nearing completion
78	25/06	HNA/050	24/06	Den Helder - Aurich	Scale: 1:50,000 No significant activity seen due to poor image quality and low sun	



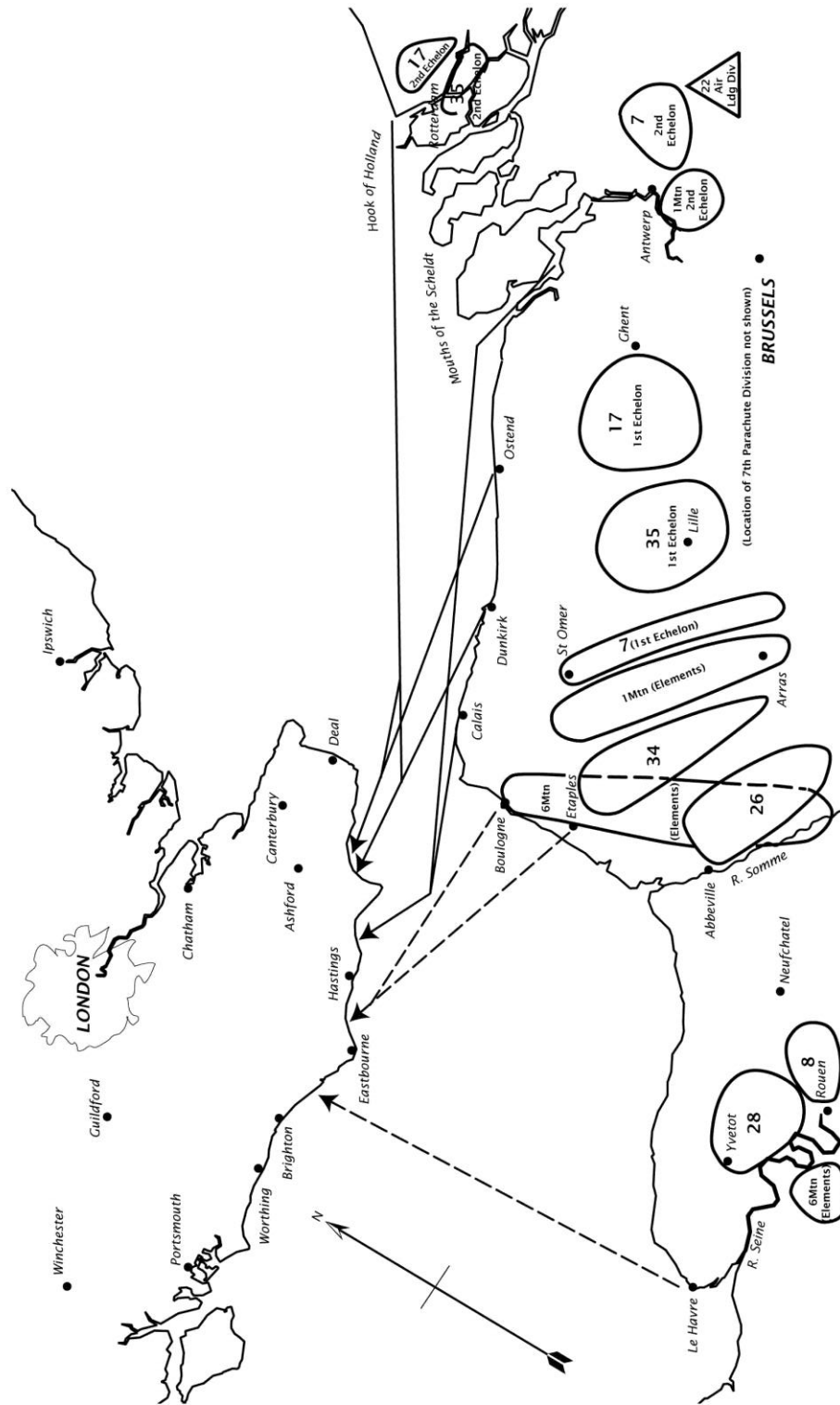
Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
79	25/06	HNA/051	25/06	Nieuport - Dunkirk - Calais - Boulogne	Scale: 1:50,000 30 barges at entrance to Passchendaele Canal, Furnes barge concentration, Dunkirk - Calais canals no change in barge concentrations	Barge concentrations at 3 Ports
80	26/06	HNA/053	26/06	Abbeville	Scale: 1:55,000 AA Defences seen at aerodrome	
81	26/06	HNA/052	26/06	Zeebrugge - Dunkirk - Calais - Boulogne	Scale: 1:55,000 Bad cloud cover - & barges moved at Furnes Canal - Nieuport - no change at Dunkirk	Small movement of barges at Furnes Canal - Nieuport
82	27/06	HNA/054	27/06	Calais - Cape Gris NEZ	Scale: 1:55,000 & 1:17,000 Group of batteries seen at Cape Blanc NFZ	
83	28/06	HAA/053	27/06	Bruges - Zeebrugge - S. Beveland Canal - Belsele Aerodrome	Scale: 1:55,000 Sortie to investigate concentration of barges - no new barges seen in S.Beveland Canal, 7 up to 12 barges at West Schelt	Special sortie to look at barges on S.Beveland Canal
84	28/06	HAA/054	28/06	Rotterdam - Schiphol - Amsterdam - NSC - IJmuiden - Helder	Scale: 1:50,000 Rotterdam - 60 barges have departed, Amsterdam barge movements active	Barge movements

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
85	29/06	HAA/055	29/06	Dieppe - Etrepagny	Scale: 1:50,000 Dieppe no new shipping seen	
86	29/06	HAA/056	29/06	Ghent - Lille - Roubaix	Scale: 1:50,000 New Military Aerodrome near Wevelchem 50-49.5 N 03-12E	New Military aerodrome
87	30/06	HNA/055	29/06	Kiel - Kiel Canal - Brunsbuettel - Cuxhaven	Scale: F.24 1:50,000 F.8 1:20,000 Kiel Battleship <i>Scharnhorst</i> @ floating dock numerous other naval vessels - barges on Kiel Canal	<i>Scharnhorst</i> and barge movement
88	30/06	HNA/056	29/06	Iles de Chausey - Avranches - Granville - Cherbourg	Scale: 1:50,000 Granville large number of small pleasure craft in outer harbour	
89	29/06	HNA/057	29/06	Bensersiel - Ardorf - Wilhelmshaven	Scale: 1:50,000 Wilmelmshaven - <i>Tirpitz</i> no movement, 3 destroyers, 4 torpedo boats 3 submarines	<i>Tirpitz</i> no movement
90	30/06	HAA/057	30/06	Hook of Holland - Rotterdam - Nijmegen	Scale: 1:55,000 Rotterdam 5 new possible barges with modified front and backs - River Ley 100 new barges	New style barges and 100 barges 5 miles north Rotterdam on R.Lek
91	30/06	HNA/058	30/06	Helder - Schiphol - Rotterdam - Flushing - Knocke	Scale: 1:55,000 NSC - barges as previously reported	
92	01/07	HAA/058	30/06	Brussels - St.Quentin - Dunkirk	Scale: 1:50,000 German style runways under construction Evere - Dunkirk	Dunkirk - no change in barges since 25.6.40

Report No	Date of Report 1940	Sortie No	Date of Sortie 1940	Locality	Notes	Significant Activity
					no change in barges	
93	01/07	HAA/060	01/07	Morlaix - Brest - Cherbourg	Scale: F.24 1/50,000 Eagle 1:18,000 Lanveoc 8 vessels poss dispersed from Brest	
94	01/07	HAA/059	01/07	Le Bourget - Aerodromes to S.Paris	Scale: 1:50,000 Le Bourget HE.111 X 7, 280 barges La Roquette - Rouen	280 barges La Roquette
95	02/0	HNA/059	01/07	Cherbourg	Scale; F.24 1:50,000 Eagle 1:21,000 no change in Cherbourg harbour	
96	02/07	HNN/001	30/06	Norway Haugesund	Scale: 1:12,000 No signs of special activity	
97	02/07	HNA/060	01/07	Le Havre - Deauville	Scale: 1:500,000??? Tgt oil dept Le Havre 30% of Oil tanks still intact, large number barges Honfleur	Large number barges Honfleur
98	02/07	HAA/061	02/07	Antwerp - Munster Canal - Ruhr Valley	Scale f.24 1:55,000 F.8 1:20,000 Runway construction work at Eindhoven - Dortmund EMS Canal damaged so no barge movement	Munster Locks new barges and S.Munster more barge activity
99	03/07	HNA/061	02/07	Knocke - Flushing - H.of.Holland - Rotterdam	Scale: 1:50,000 Flushing harbour no activity,	Rotterdam most barge

<b>Report No</b>	<b>Date of Report 1940</b>	<b>Sortie No</b>	<b>Date of Sortie 1940</b>	<b>Locality</b>	<b>Notes</b>	<b>Significant Activity</b>
					Maasluis No change in barges - Rotterdam slight change in barges	activity on this sortie
100	03/07	W/1	02/07	Crozon - Brest - Ploufscat	Scale 1:50,000 le Longue 90 small fishing boats, 4 naval vessels in Brest	90 small fishing vessels

**Map 7 Invasion Ports and Sealion Plan**



Sealion Plan September 1940<sup>599</sup>

<sup>599</sup> Adapted from R Wheatley, *Operation Sea Lion*, Map 3.

### Analysis of the Cologne Reports

Table 32 Medmenham Reports, covering Cologne from 23 March to 10 August 1942, with Area Covered.

No	CIU Report No	Locality	Date of Photographs/Sortie	Date of Report	Ref
1	Interpretation Report 3190	Duiseberg, Essen, Cologne, Bergheim	23 March A/433	24 March	AIR 34/318
2	Interpretation Report K.S.3	Cologne	From 12 March 1941 to 13 October 1941 using 12 Sorties	2 April	AIR 24/242
3	Interpretation Report 3393	Antwerp, Cologne, Dusseldorf	15 April 1942 A/591	16 April	AIR 34/320
4	Night Photography Plotting Report N.31	Cologne, Le Havre	22 April	24 April	AIR 24/242
5	Interpretation Report 3475	Cologne, Antwerp	25 April A/647	26 April	AIR 34/321
6	Interpretation Report NS. 11	Cologne	22/23 April & 27/28 April	19 May	AIR 24/243
7	Interpretation Report K.1309	Cologne	15.4.42 A/591	27 April	AIR 24/242
8	Interpretation Report 3497	Cologne, Frankfurt-am-Main	28 April A/672	29 April	AIR 34/321
9	Interpretation Report 3508	Cologne	29 April A/675	30 April	AIR 34/322
10	Interpretation Report K.1315	Cologne	29 April A/675	30 April	AIR 24/242
11	Interpretation Report K.1319	Cologne	25/29 April A/647 & A/675	3 May	AIR 24/242
12	Interpretation Report 3573	Cologne, Antwerp	6 May A/726	7 May	AIR 34/322
13	Immediate Damage Report K.1323	Cologne	6 May A/726	7 May	AIR 24/243
14	Interpretation Report K.1325	Cologne	6 May A/726	9 May	AIR 24/243
Cologne Raid Night of 30/31 May 1942					
15	Immediate Interpretation Report K1333	Cologne	1 June A/840, A/844, A/849	2 June	AIR 24/243
16	Interpretation Report 3718	Cologne, The Ruhr, Duisburg, (Undecipherable- but probably Saarbrucken), Frankfurt-am-Main	2 June	3 June	AIR 34/324
17	Interpretation Report K1333	Cologne	1 June & 5 June A/840, A/844, A/849, A/856, A/867, A/885, M.N.105	8 June	AIR 24/243
18	Interpretation Report 3731	Cologne, Duisburg, Essen, Aachen, Saarbucken	3 June & 4 June	5 June	AIR 34/324
19	Interpretation Report 3743	Cologne, The Ruhr, Essen	5 June	6 June	AIR 34/324
20	Supplement to Interpretation Report K1333	Environs of Cologne	1 June & 2 June A/840, A/844, A/849, A/856,	14 June	AIR 24/243
21	Interpretation Report K1345	Cologne	20 June A/942	25.6.42	AIR 24/244
22	Interpretation Report N.S.18	Cologne	30/31 May	1 July	MA Acc 11480
23	Interpretation Report N.26	Cologne	Multiple	10 August	MA Acc 11486

The first report on Cologne within the planning window of three months is CIU Interpretation Report 3190 from a Spitfire flight on the 23 March 1942. The report covers the airfield at Duisberg, the town of Essen and the Krupp works as well as Bergheim and the electric power plant at Fortuna and is a very short half page report.<sup>600</sup> Cologne is also well covered by the Spitfire sortie, and the flight provides complete good quality cover of the whole city. However, that is all the report provides on Cologne, just the fact that the whole city is covered. The interpretation report does not provide any details of defences, military targets or any details at all about Cologne. This is an unusually bland and content-free report on Cologne, which implies that Cologne was not tasked as a special target for photographic reconnaissance, but just another target to get some library cover of the city to be used to update photographic cover already held. The actual text from the report covering Cologne reads: 'The town is well covered.'

The second report on Cologne is the CIU K Section Report K.S.3 a very detailed damage summary report on the city and is four pages long. The report uses photographs from twelve sorties covering the period from March 1941 to the middle of October 1941 and covers damage to the city from December 1940 to October 1941. The report covers the defensive systems around Cologne, which include nearly 500 FLAK guns and thirteen decoy sites outside the city which are reported to have been heavily bombed.<sup>601</sup> The report included a paragraph on the inadequate provision of air raid shelters in the city for factory workers. The report also covered the very limited damage to the railways. The damage to industrial works including the engine works of Humboldt Deutz A.G., who produced engines for aircraft and submarines and was only minor. The report even mentions that the damage to municipal buildings and residential property was more extensive than the damage to the heavy industry. The report then details the damage to these properties month by month over the period covered. The report also details the minor damage seen to public utilities and concludes with a detailed report on where the over 1,000 craters

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<sup>600</sup> See Appendix 2 for transcribed Interpretation Report No. 3190. TNA, Air 34/318.

<sup>601</sup> Note: The Medmenham reports from Q Section detail all known Decoy sites, but the damage assessment report shows how they still attract bombers. This was in part due to the difficulty of accurately finding the target at night and been diverted to the fires from the decoy site rather than the city/target.

can be seen, the main concentrations of craters being around actual targets, searchlight batteries and the decoy sites. This report again will not have been specially commissioned for the attack on Cologne, but would provide a good baseline for any future attacks and tracking the new damage.

The third report to cover Cologne is again a standard Second Phase report number 3393 from a Spitfire sortie on 15 April 1942. The report covers Antwerp, Cologne and Dusseldorf. The report is four pages long with a three page detailed annexe on Antwerp shipping. The Cologne part of the report is just over half a page and again covers shipping movements on the Rhine for half a page and then reports cover of two aerodromes and a dummy aerodrome around Cologne. The report also states that the city is well covered by the sortie. This report is obviously a normal Second Phase section Medmenham report reading out on this particular sortie and not a detailed report for Operation *Millennium*.

The fourth report to cover Cologne is a very short report on Night Photography Plotting Report N.31.<sup>602</sup> The report covers the location of night photographs over Cologne and Le Havre on 22/23 April 1942. The report on the Cologne night photographs reports that the first photograph was within 1½ miles of the target aim point. This report was produced from images taken by the Cologne raid on the night of the 22/23 April. This raid on Cologne was an important experimental raid by 69 aircraft, all equipped with the new 'GEE' blind bombing system.<sup>603</sup>

The fifth report on Cologne is CIU Interpretation Report 3475 from a Spitfire flight on the 25 April 1942. The report covers Antwerp and Cologne, and this report does provide some more detail, but only on shipping seen on the river between Bonn and Cologne, reports on activity at two Cologne aerodromes and a dummy aerodrome as well as the location of four barrage balloons. This type of reporting is the normal Second Phase report system and again shows that this was not specially tasked to

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<sup>602</sup> See transcribed report N.31 in Appendix 2.

<sup>603</sup> TNA AIR 24/242 CIU Report N.31 and M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 259 and for more on the Gee Bombing system see R Jones, *Most Secret War*, 284-289.



get target, and defensive details on Cologne as any special report would have been far more detailed and longer than the half page on Cologne which used only thirteen frames/photographs from the sortie to produce the report.<sup>604</sup>

The sixth report on Cologne is a short Night Photography Report N.S.11 from cameras on the Bomber Command aircraft on the experimental GEE raid on the 23/24 April. The report required significant work by Medmenham and was not completed until 19 May 1942. The report provides details of where the bombs and incendiaries are burning. It also provides details about two FLAK batteries of four and five guns. The report has also confirmed actual damage by comparing fires seen on this night photography with later day time reconnaissance photography. The report does not detail the daytime sorties used. Again, this report provides little for Operation *Millennium* but did provide more information on the effects and accuracy of the GEE raid.

The seventh report is another CIU K Section Report K.1309 from a Spitfire sortie A/591 on 15 April 1942 and the report issued on 27 April 1942. This is a detailed two-page damage assessment report that covers at medium scale the majority of the city, but misses three small areas. The report covers damage on the east bank of the city to warehouses and gutted tenement housing, and the destruction on the west bank of the signals box in the freight yard and adjoining buildings. This two-page report updates the damage to Cologne from the damage inflicted by the raid against the city on the 5/6 April 42 by 263 aircraft. The aircrew claimed good bombing results, but the actual bomb fall missed the target of the Humboldt works and hit only one industrial target, a mill and the rest of the bombs fell across the city destroying 90 houses.<sup>605</sup> Again this is a standard damage assessment report, so of use for Operation *Millennium* only for the building up of what was already destroyed and damaged.

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<sup>604</sup> Note: If Bomber Command had commissioned special reconnaissance flights against Cologne for attack planning, a large number of frames would have been used and several passes made over the city.

<sup>605</sup> TNA AIR 24/242 CIU Report K.1309 and M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 254.

The eighth report 3497 was again a normal Second Phase Medmenham report from a Spitfire reconnaissance mission on 28 April 1942. The targets covered were Cologne and Frankfurt-am-Main. The interpretation report confirms most of Cologne is covered, but by hazy photographs. The movement of barges on the Rhine is covered by three photographs and reported as being normal activity. The report also covered part of an aerodrome on a single photograph and reports the aircraft seen. The whole report is less than half a page and not of much use for Operation *Millennium*.

The ninth report is again a Second Phase Medmenham report 3508 from a Spitfire sortie on the 29 April 1942. Medmenham produced the report on the 30 of April and the only target for the sortie is Cologne. The report is again less than one page and reports that the 25 invasion type barges seen on the 15 April can no longer be seen, but barge activity is normal. Two aerodromes are covered, with reports of the six aircraft seen and then reports on two dummy aerodromes. Again, this is a very short report of not much tactical value for Operation *Millennium*.

The tenth report is a K Section damage assessment Report K.1315 from a Spitfire sortie A/675 on the 29 April 1942. This reports out on damage seen from the Bomber Command raid against Cologne on 27/28 April by 97 aircraft.<sup>606</sup> The report covers the major damage inflicted in the central city area, which is reported as being caused by fire damage and then in detail lists ten areas with damage inflicted.

The eleventh report is another K Section damage assessment Report K.1319 and is a more detailed report using the same sortie as K.1315 and also an earlier sortie for comparison.<sup>607</sup> This is a far more detailed damage assessment report running to three pages and expands upon the reporting in K.1315, but also mentions that although the photographs are of good quality, the stereo is poor. The poor stereo

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<sup>606</sup> M Middlebrook & C Everitt, *The Bomber Command War Diaries*, 261.

<sup>607</sup> See Transcribed report K.1319 in Appendix 2.

hampers detailed photographic interpretation of the damage. The report expands upon the detail of the damage to the central city area and the three suburban districts on the west bank. The report then provides an annex that gives the details of the annotations marked on the photographs distributed with the report.<sup>608</sup>

The twelfth report is again another Medmenham Second Phase report 3573 from a Spitfire sortie on 6 May 1942 that covered Cologne and Antwerp. The Cologne report is less than half a page and covers normal activity from the barges, but only part of the port is covered. The report mentions seeing balloons, but they are on the ground and no locations are given. Cologne aerodrome Ostheim is covered and seven aircraft are seen on two photographs. Again, a short report and not of much use for Operation *Millennium*.

The thirteenth report is another CIU K Section Report K.1323. This is again a Spitfire sortie A/726 on the 6 May 1942. The report is a very short immediate damage report and the city is covered by good quality photographs, apart from a narrow strip about one mile north of the city and another strip half a mile south of the city centre. The report covers damage under two headings, industrial and residential. The industrial part covers the damage to the Citroen Motor works, where two large work shops have been destroyed by fire and the Humboldt Deutz Motor Works where part of a large work shop has been destroyed by fire. The residential damage reports 15 to 18 houses damaged.

The final report before the Operation *Millennium* raid is another CIU K Section Report K.1325 from a Spitfire sortie on the 6 May 1942. This report uses the same Spitfire sortie as report K.1323 above, but provides more detail. The last bombing raid against Cologne was on 27/28 April and that would be the last raid until the Operation *Millennium* raid on 30/31 May. Therefore this is the last damage assessment and in fact the last Medmenham report on Cologne before the 1,000 bomber raid. This

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<sup>608</sup> Note: No photographs from this report were in the National Archive file Air 24/242, This is quite normal, most report provide details of the photographs used, but they were not included with the reports.

detailed damage report includes details of the fire damage inflicted on the Citroen Motor Works of over 35,000 square yards of fire ravaged buildings. The report includes more details on residential damage on thirteen houses. It also mentions that the Henmar decoy site to the South East of the city has only attracted one bomb since the 29 April sortie. This is not because Bomber Command is getting better at missing the decoy sites, but because no bombing missions have taken place since the 29 April sortie and the bomb crater was not seen on the previous report.

Reports after the Operation Millennium raid.

The Medmenham Immediate Interpretation Report K.1333 was the first damage assessment report from the Cologne raid and issued on 2 June 1942 and used three Spitfire sorties flown on 1 June 1942 to compile the report. The weather was poor and cloudy on two of the sorties, better on the third sortie, but that sortie only covered parts of the city. The report records heavy and widespread damage that is over the whole 'town' with most of the damage caused by fire. The report then lists the damage seen over eight areas of the city, with very severe damage in the old city area.<sup>609</sup>

The first Medmenham K Section interpretation report that lists in great detail the damage to the city was Interpretation Report K.1333 which used seven reconnaissance sorties from 1 & 5 June 1942.<sup>610</sup> The report summarises the extensive damage to the city before going into detail area by area across the city and surrounding areas. It reports that over 300 acres in the city centre have been destroyed or had significant damage inflicted. The report also includes a count of the number of factory buildings destroyed or damaged, and they are over 250 factory buildings. The report includes the damage on the east and west bank areas as well as the damage seen and disruption to the railway network. The report was also sent out with a Medmenham mosaic created from the photographs showing the damage

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<sup>609</sup> TNA AIR 24/243 Medmenham Immediate Interpretation Report K.1333 dated 2.6.42.

<sup>610</sup> See transcription of Report K.1333 in Appendix 2.

to the central city area and east bank area.<sup>611</sup> This report contains substantially more intelligence and interpretation than the very short immediate interpretation report of the same number but required extra reconnaissance sorties and more time to produce, and it was issued on 8 June 1942. This is the main report used for the base damage assessment in many of the Bomber Command intelligence reports of the operation.<sup>612</sup> The Bomber Command intelligence reports referenced, are almost exclusively derived from the Medmenham K series of reports. They have reformatted the information into the Bomber Command report format, but they have then précised the Medmenham report to concentrate on what they see as the most significant damage, leaving out the vast detail in the Medmenham reports. They do not comment on the undamaged areas reported by Medmenham.

Two weeks after the raid, a supplement was issued to report K1333. This report is where K Section have gone back over the images of Cologne from the four sorties and discovered damage around the periphery of the city that has not been previously reported from the 1,000 Bomber Raid. This supplemental report does illustrate one of the ways Medmenham worked. It was normal practice to produce 'Supplement' reports with the same number as previous reports, and these 'Supplement' reports could correct mistakes made in the main report or as in this case include additional detail missing from the original report. Keeping the same report number made tracking easier for the intelligence staffs at Medmenham and in Bomber Command and other headquarters.

Three weeks after the raid report K1345 is a Medmenham K Section Second Phase report on the damage to Cologne from the 1,000 Bomber raid seen from a Spitfire sortie on 20 June 1942. The report starts by mentioning that the results of the bombing have been fully reported in K.1333. It points out that due to the poor quality of coverage in the Northwest of the city and an area in the South and West of the city were not covered by that report. This report fills in the gaps, by covering the severe

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<sup>611</sup> TNA AIR 24/243 Medmenham Interpretation Report K.1333 dated 8.6.42. This report is also transcribed at Appendix 2.

<sup>612</sup> For example, see these reports from Bomber Command in TNA AIR 24/244 Bomber Command Intelligence Reports 2505, 2514, 2568.

damage seen in those areas. Because it is now three weeks after the raid the report also covers the repair and clearance activity that has been achieved. It reports the repairs seen in detail, down to domestic houses that have had roof repairs. This level of detail was needed as repairs to housing would allow factory workers to return and was all analysed by Bomber Command staff to assess the impact on the German war economy.

Report N.S.18 dated 1 July 1942 is a Medmenham night photography report from N Section and is based upon night photographs taken by Bomber Command aircraft involved in the 1,000 Bomber raid on 30/31 May 1942. The report mentions that work on the night photographs has reached a stage that this preliminary report can be made. The report explains that the centre of the city is a '*confusing expanse of fires*'. The reason is that the fires change quickly between the photographs on one bomber and the next and smoke obscure much ground detail. The report also mentions that of the Marsdorf and Heumar decoy sites it could only detect bombing near the Marsdorf decoy site. The report also mentioned a photographic mosaic showing the fall of bombs and incendiaries.

Report N.26 dated 10 August 1942 is the final Medmenham night photography report for the 1,000 Bomber raid and is based on the Bomber Command aircraft involved in the raid. The report mentions the photographs were taken between just after midnight and quarter to three in the morning, but only those between a quarter to one and just after two thirty in the morning were able to provide successful photographs to track the raid. In fact, due to the success of the incendiaries and the number of extensive fires, they were not able to track individual aircraft bombing and could not detect any high explosive bomb craters due to the fires. The report is seven pages long, with an outline map detailing the fall of incendiaries, fires seen, searchlight batteries and other items in a map with concentric circles radiating out in one mile intervals from the Cathedral in the centre of Cologne.<sup>613</sup> The report then goes into detail about the fall of incendiary sticks up to 1, 2 and 3 miles from the Cathedral. The

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<sup>613</sup> See Appendix 2, MA Acc no: 11486 Koln Plan 30/31.5.42 for a transcript of the map that accompanies Report N26.

report also details locations of searchlights, including searchlights bombed during the operation and FLAK locations. The report also covers each of the Cologne decoy sites, and the fall of incendiaries attracted to the sites. The decoy sites did not appear to have attracted many incendiary sticks, and this could be down to the severe fires already burning in the city, therefore making finding the target more straightforward and more difficult to be deceived by the decoys. The report then details annotated prints that were distributed with the report at the time and described what can be interpreted from the photographs. The report also lists the aircraft it has been able to plot from the observed fires and gives the aircraft number, time over target and where the fires caused by that aircraft were recorded. It is not a surprise that it has taken Medmenham until 10 August to complete this detailed report and accompanying map, given the detail and number of aircraft photographs they had to analyse to produce the report. The report would be of considerable interest to the individual bomber crews, but also to Bomber Command to add to the statistics and operational analysis that they conducted on all bombing operations. The map accompanying the report makes assimilating the detailed report an easier task for the reader.<sup>614</sup>

The Medmenham Second Phase report 3718 from a Spitfire sortie A/856 on 2 June 1942 covers other targets as well as Cologne. It records four good quality photographs cover the city and records barge and paddle steamer movements but does not mention any damage. This whole report only mentions river traffic movements on all the targets covered and is of little to no use for assessing the impact of the 1,000 bomber raid.<sup>615</sup>

Report 3731 dated 5 June 1942 is a standard Medmenham Second Phase report covering Cologne, Duisburg, Essen, Achen and Saarbrucken and is two pages long. It does not mention any damage to Cologne but reports out on barges, and other river craft on the Rhine as well as a battery of four railway mounted heavy FLAK

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<sup>614</sup> MA Acc no: 11486, Medmenham Report N.26 dated 10.8.1942 and Map. Report and Map transcribed at Appendix 2.

<sup>615</sup> TNA AIR 34/321 Medmenham Report 3718 dated 3.6.42.

guns, south of the city. It is evident from this report that Medmenham procedures left K Section and N Section to report out on Bomber Command damage assessments and these were then not duplicated in other Medmenham reports.<sup>616</sup>

Report 3743 dated 6 June 1942 is again a standard Medmenham Second Phase report covering Cologne, The Ruhr and Essen and is two pages long. No mention of damage to Cologne is given, just reports of barge and river vessel movement and positions of three heavy rail mounted FLAK batteries, each comprising four guns. This increase in the number of FLAK batteries defending Cologne could be a response to the 1,000 bomber raid.<sup>617</sup>

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<sup>616</sup> TNA Air 34/324 Medmenham Report 3731 dated 5.6.42.

<sup>617</sup> TNA AIR 34/324 Medmenham Report 3743 dated 6.6.42.



**Analysis of Operation Chastise Reports.**

Table 33 Medmenham Chastise Reports, February to May 1943 with Locations

No	CIU Report No	Locality	Date of Photographs	Date of Report	Found in TNA Ref
1	No Reference but titled: 'Special Interpretation Report on Defences	Moehne	19 February	21 February	AIR 14/4797
2	D.240.A	Moehne Dam		27 February	Partial extract of report in AIR 14/2036, but accompanying plan missing.
3	D.244.A			5 March	Missing
4	D.264.A	Moehne Valley Barrage	4 April	5 April	AIR 20/4797
5	D.265.A	Moehne Valley Barrage	5 April	6 April	AIR 20/4797
6	D.281.A	Eder Dam & Sorpe dam	13 May	14 May	AIR 14/2068
7	D.282.A	Moehne Valley Barrage	15 May	16 May	AIR 34/609
<b>Operation Chastise</b>					
			May 1943	May 1943	
8	Interpretation Report 4962	Moehne Reservoir, Moehne and Ruhr Rivers, Sorpe Reservoir and Eder Reservoir and Eder River	17	18	AIR 29/275
9	Immediate Report No: K.1559	Moehne, Sorpe, Eder Dams	17	18	AIR 34/609 & AIR 19/383
10	Interpretation Report 4970	Moehne, Sorpe, Eder Dams	18	19	AIR 34/609
11	4979	Ruhr Valley – Sorpe Reservoir	17/19	20	AIR 29/275
12	Immediate Report K.1562	Moehne Eder	18	19	AIR 19/383
13	Immediate Report No: K.1564	Moehne, Sorpe, Eder Dams	19	20	AIR 19/383
14	K.S.85	Sorpe Dam	13/17/19	21	AIR 19/383
15	K.S.85A	All 3 dams	Not reported	22	AIR 2/8395
16	4993	Sorpe Dam	17/19/21	23	AIR 29/275
17	F.S.116	Weekly Report of Rail, Port and Inland Waterway Activity Observed (3 page report 14 page annex listing rail movements)	Sorties for week ending 15 May 43	20	AIR 29/276
18	F.S.117	German Railway and Other Communication Damage		25	AIR 29/276
19	F.S.118	Weekly Report of Rail, Port and Inland Waterway Activity Observed (5 page report 22 page annex listing movements)		27	AIR 29/276

This annex contains a close examination of each of the reports listed in Table 33.

The first Medmenham report produced specially for Operation *Chastise* was D.240.A, which concentrated on the Moehne dam.<sup>618</sup> This is one of the missing reports from the archive, but an extract of the report is in Air 14/2036. The extract is in a memorandum to the Senior Air Staff Officer at Headquarters, No 5 Group from the Bomber Command Chief Intelligence Officer and is dated 9 May 1943.<sup>619</sup> The memo covers the fact that forty target maps, twenty information sheets and seven, then 11 illustrations as well as another forty target maps have already been sent. Then the memo contains a page of the extract on dam defences seen at Moehne from the Medmenham report D.240.A dated 27 February 1943.

The defences listed in the extract from D.240.A cover the light anti-aircraft guns mounted on each of the two dam towers and a third light anti-aircraft platform on the dam parapet. A separate three gun FLAK battery is identified to the north of the compensating basin and each of these guns is protected by sandbag walls. The position of a searchlight is also identified as are the positions of the double line boom and protective barrage on the reservoir in front of the dam to protect it from torpedo attacks. The disrepair of the boom at the southern end is highlighted as are the fact many of the boom spreaders are missing. An unidentified 'dark straight line' is pointed out that leads from the eastern end of the dam to point 15 on the plan. The extract of the report explains that it has not been possible to identify what this mark is, but it could possibly be a drainage channel or a belt of wire. The report then confirm no other anti-aircraft or defensive installations have been seen on the dam or surrounding areas. The memo then mentions that reports on the other two targets will be sent as soon as successful reconnaissance missions have been achieved. The memo and extract of the report show that Medmenham had produced a detailed report that covered all the defences at the Moehne dam. An analysis of other reports in the series shows those on the Moehne dam followed a format of an introduction, a set of paragraphs titled Moehne Valley Barrage and a set of paragraphs titled

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<sup>618</sup> See transcription of the Memo with report extract in Appendix 2.

<sup>619</sup> TNA AIR 14/2036, Memo to SASO dated 9 May 1943.

Defences and were probably a standard format. We have the extract of the report that mentions the defences in full and a later report D.265.A dated 6.4.43 refers to the Moehne Valley Barrage and describes in detail four objects visible on the reservoir side of the dam wall. The report also mentions that they were also reported in place in report D.240.A and annotated on the plan distributed with D.240.A. Therefore, it is not unreasonable to deduce that the missing report D.240.A followed the same format, with a short one line introduction, giving the sortie number used in the report and its date, a set of paragraphs on the Moehne Valley Barrage, including the details we have seen in report D.265.A and a set of paragraphs under the heading Defences, and we have seen the extract of the defences part of the report.

The second report Medmenham produced was D.244.A dated 5.3.43 and has not been found to date in any National Archive file. There are no copies of the report in The Medmenham Archive at RAF Wyton or amongst the Barnes Wallis papers at the Science Museum Archive. However, the fact the report was produced is recorded in the Medmenham Operational Record Book entry for 17 May 1943 and in the introduction of Report D.282.A.<sup>620</sup> The Operational Book entry unfortunately does not give any detail of the report, except to state that it was very comprehensive and detailed as well as having an accompanying plan. However, the fact it is mentioned in Report D.282.A means it was a report on the Moehne dam and analysis of the three full D series Moehne dam reports and the extract of the fourth report, would suggest that this missing report would have followed the same format of an introduction, giving the sortie number, a set of reporting under the Moehne Valley Barrage heading and a Defences paragraph. We can deduce that this Moehne Valley Barrage reporting would have reported the current state of the dam and water level with the barrage as being an unkept state and not anchored on the southern end. This deduction is because the next report D.264.A on 5.4.43 reports that the barrage boom, which was 'rather untidy when last seen' has been repaired. As the previous report is the missing report D.244.A, it should have reported again the unkept and unanchored nature of the boom. It is also unlikely that the four and then eight objects seen on the reservoir side of the dam in reports D.265.A and D.282.A

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<sup>620</sup> MA unaccessioned, RAF Medmenham F540, entry for 17 May 1943, p 37-38 & TNA AIR 34/609 Interpretation Report D.282.A dated 16.5.43.

were reported in this report and they had not appeared in the next report. It is also likely that the report would have stated no changes to the defences around the dam as they do not change from the original report from February to the last report before the raid. Therefore, this missing report can be partially reconstructed by what is reported before and after its own date, as outlined above.

Report D.264.A was issued on 5.4.43 and produced from a single Spitfire sortie of the previous day and covered the Moehne dam and surrounding area.<sup>621</sup> The report states that it is an update from reports D.240.A and D.244.A and is divided into two sections. The first section covers the dam barrage and water height that is between one and two feet higher than previously seen. The height of the water in the dam is a critical factor in the timing of the dams raid. The *Upkeep* weapon required 30 foot of water pressure above it before detonating and needed to be in contact with the dam wall for best effect and a water height of five foot below the dam spill way was the optimal time to attack.<sup>622</sup> It was the water height and pressure above the weapon that contributed to the way it worked and ensuring that the majority of the pressure wave from the explosion was directed into the dam wall, not dissipated into the air in a large blast of water. This section of the report is only the second section of the report and is only five sentences long. The bulk of the report is on the dam defences. The report covers the boom defences mentioned in the extract from D.240.A and the fact that they have been repaired and appear to be in full working order. The rest of the defences part of the report provide the exact position of the three battery FLAK position and the light anti-aircraft guns on the dam towers and the end of the dam wall. The report is on a very restricted circulation of only Air Commodore Bufton, DB Ops in the Air Ministry, who received three copies.<sup>623</sup>

Report D.265.A was issued on the 6.4.43, and produced from a single Spitfire sortie on 5.4.43 and covered the Moehne dam and surrounding area. The report follows

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<sup>621</sup> See transcription of the report D.264.A in Appendix 2.

<sup>622</sup> J Sweetman, *The Dams Raid*, 96-97 & TSMA Barnes Wallis Papers D2/1, Paper on General Discussion of The Problem & TSMA Barnes Wallis Papers D2/1 Report of Meeting Held at Air Ministry in ACAS(Ops) Office on 5 May 1943 to Discuss "UPKEEP" dated 7 May 1943.

<sup>623</sup> TNA AIR 20/4797 Interpretation Report D.264.A dated 5.4.43.

the same format of reporting under three headings, Introduction, Moehne Valley Barrage and Defences. No change was seen in the defences, but work had continued on the four objects seen on the reservoir side of the dam wall on the South West end of the dam. The report also notes that the same four objects were reported in the first report D.240.A dated 27.2.43. Again, this report has a very restricted circulation of only Air Commodore Bufton, DB Ops in the Air Ministry, who received three copies.<sup>624</sup>

Report D.281.A was issued on the 14.5.43, and produced from a single Spitfire sortie flown on 13.5.43 and covered the Eder and Sorpe dams. The report covers each dam in turn both under the headings of 'The dam and water level' and Defences. The report on the Eder dam mentions the two power stations, thickness of the dam wall and distance between the two dam towers as well as the fact the water level is only six feet below the top of the dam. Under defences at the Eder dam, no boom defences are present and only an empty light anti-aircraft gun emplacement  $\frac{3}{4}$  of a mile South West of the dam. No FLAK defences were seen in the surrounding woods, but due to poor stereo coverage, the report could not guarantee that FLAK towers did not exist in the woods. The report on the Sorpe dam also mentioned the power station and the dam width at the top, as well as the fact the water level was sixteen and a half feet below the top of the dam. Again, under defences, there was no barrage in front of the dam and no anti-aircraft defences were seen at the dam or in the woods surrounding the dam. Again, poor stereo cover over the woods, did not allow the report to totally dismiss the presence of FLAK towers, but none were seen. This report did not include a distribution list, but is again likely to have been a very restricted distribution, but due to the proximity of the operation, wider than the previous reports.

Report D.282.A was issued on the 16.5.43, and produced from a single Spitfire sortie on 15.5.43 and covered the Moehne dam and surrounding area. The report followed the same format as previous Moehne dam reports and in the introduction lists all the

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<sup>624</sup> TNA AIR 20/4797 Interpretation Report D.265.A dated 6.4.43.

previous reports in this series on the Moehne dam and the dates of the reports. The report then follows the normal headings and under Moehne Valley Barrage that no significant activity has taken place at the barrage, but water levels have risen a further three or four feet since 19.2.43. The number of objects suspended on the reservoir side of the dam wall has risen from four to eight and are evenly spaced along the whole length of the dam wall. Also, at the centre of the dam, on the road are mounds of sand, gravel and probably cement, not previously seen. The report then proposed that the eight objects seen are actually working platforms suspended over the dam wall for construction work, with a possibility of closing off the overflow slots to increase the storage of the dam. The report also calculates that with the overflow slots closed, that would increase the dam storage by between four and five hundred thousand tons of water. The defences section of the report shows no change in the defences. This report has a short distribution list of DB Ops, HQ Bomber Command for Squadron Leader Fawsset and the Air Ministry ADI (Photo).<sup>625</sup>

There now follows a similar detailed analysis of the Medmenham reporting after the dams raid. This detailed investigation of the actual intelligence reports provides clear evidence of the quality of the work of the Medmenham photographic interpreters, working under great pressure to provide intelligence on a very high profile attack.<sup>626</sup>

Report K.1559 was an Immediate Report on the damage seen from Operation *Chastise* and a three man team had been sent to Benson to report out as soon as the post attack reconnaissance missions had landed.<sup>627</sup> The report is in the normal format of a Medmenham K Section report for Bomber Command and is three pages long.<sup>628</sup> The report was produced using three Spitfire sorties flown on 17.5.43.<sup>629</sup> The report provides an initial quick damage report, confirming breaches of the Moehne and Eder dams, even though the Eder dam is not covered by any of the three sorties

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<sup>625</sup> TNA AIR 34/609 Interpretation Report D.282.A dated 16.5.43.

<sup>626</sup> The attack was featured with photographs on page one of The Daily Telegraph, 18 May 1943 and the Medmenham Models mentioned in a Telegraph article on 22 May 1943.

<sup>627</sup> TNA AIR 34/609 & Air 19/383 Immediate Report K.1559, This report was distributed with annotated pre and post attack photographs of Moehne Dam, pre-attack photographs of the Eder Dam and post attack photographs of the Sorpe Dam.

<sup>628</sup> See transcription of the report K.1559 in Appendix 2.

<sup>629</sup> Note: The report was based on Sorties D578, D581 & D585 all flown on the 17.5.43 and at 0900, 109.45 and 1630 hrs respectively. They were all flown using 36 inch camera lenses and at an altitude of between 29,000 and 30,500 foot. TNA AIR 29/275 Interpretation Report 4962 dated 18.5.43.

used for the report. The damage to the Moehne dam is reported in great detail, including exact measurements of the width and depth of the breach in the dam wall. The destruction of the hydroelectric plant and flooding and destruction downstream is also covered in detail. The damage to the Sorpe dam is covered in detail, with the majority of the damage being to the parapet at the centre of the dam wall and a break of two hundred feet in the road that ran along the dam wall. They confirm that the water level in the reservoir behind the dam is unchanged, which as the dam was not breached is to be expected. The report then has one line on the Eder dam, that is not covered by the sortie, but they confirm that due to the level of flooding down the Eder valley the dam must have been breached.<sup>630</sup> The report and accompanying annotated photographs were given a standard Medmenham wide distribution list, with additional copies for ADI (Photo) and a copy to the Secretary of State.<sup>631</sup>

Report 4962 is the second report Medmenham produced after the raid and it covered the three dams, Moehne, Eder and Sorpe. The report was produced using three Spitfire sorties flown on 17.5.43.<sup>632</sup> The report states that it is reporting out on the attack made by Lancaster aircraft of Bomber Command using 'special mines'. The introduction mentions the extensive flooding and destruction of bridges seen downstream of the Moehne and Eder dams that were successfully attacked. The more minor damage to the Sorpe dam is reported as well. The report then goes into detail starting with the Moehne dam and reports the size and extent of the breach to the dam and the fact water was still rushing through the breach and the level of water remaining. The total destruction of the main Hydroelectric power station is also reported. The extensive flooding in the Ruhr and Moehne valleys is reported, including the damage to road and rail infrastructure. Then the Sorpe dam is covered and the first five words are 'The dam is not breached'. The report then covers the damage seen and discolouring of water in the lower compensating basin below the dam. The report then covers the Eder dam and reports that the water level is very low at 09:00 hrs with up to three hundred yards of mud flats being visible at the

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<sup>630</sup> TNA AIR 19/383 Immediate Report K.1559 dated 18.5.43.

<sup>631</sup> Sir Archibald Sinclair was the Secretary of State for Air in 1943.

<sup>632</sup> Note: The report was based on Sorties D578, D581 & D585 all flown on the 17.5.43 and at 0900, 109.45 and 1630 hrs respectively. They were all flown using 36 inch camera lenses and at an altitude of between 29,000 and 30,500 foot. TNA AIR 29/275 Interpretation Report 4962 dated 18.5.43.

shore. The actual dam wall was not covered by the three sorties, so the report stated that the dam must have been breached, but it has not been photographed. The report then covers the flooding of the Eder river, which is reported to extend sixteen miles downstream by 1045 hrs. This report was given a large distribution list from the normal Medmenham set of distribution lists, rather than the pre operation very limited distribution.

Report 4970 dated 19.5.43 from a Spitfire sortie on 18.5.43 covers the Rhur Valley, Eder dam and Valley, Lister dam and Ennepo dams.<sup>633</sup> This report is the first to have photographic evidence of the breach in the Eder dam and reports on the extensive damage and flooding down the Ruhr valley, Eder Valley for twenty two miles and the breach in the Eder dam wall, with water still flowing out. The report also covers the Moehne dam, reporting seven barrage balloons are now positioned to fly above the damaged gap in the dam wall. Only the southern end of the Sorpe Reservoir is covered and no change has been seen. This report also covered the two alternative dam targets of the Lister and Ennepe dams and no sign of damage is reported at either dam. The report has a normal Medmenham distribution list and the report was sent with two flood maps, showing the extent of the flooding in the Eder and Ruhr Valleys.<sup>634</sup>

Report 4979 dated 20.5.43 from Spitfire sorties of 17 and 19.5.43 covers the areas of the Ruhr Valley, Duisburg and Sorpe Reservoir. The report shows flooding has extended thirty-nine miles down to Duisburg. The report then details the damage seen to bridges, railways, factories, water works, marshalling yards and houses from the dams raid. The report also counts the number of barges seen on the Rhine, and reports they are considerably less than is normal. The damage to the top of the Sorpe dam is again reported, and confirms no drop in water level and the

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<sup>633</sup> Note: The Lister, Ennepe dams were alternate targets for 617 Sqn should the Moehne and Eder dams already be breached by earlier aircraft from Operation *Chastise*. The Diemal Dam was the third alternate target for Operation *Chastise*. Only the Ennepe dam was attacked, but the bomb reportedly exploded short of the dam wall causing no damage. There is a view that the Bever dam was actually attacked by mistake instead of the Ennepe Dam, but if so no damage was done to the Bever Dam. See J Sweetman, *Operation Chastise*, 159-160.

<sup>634</sup> TNA AIR 34/609 Eder Valley Flood Map & Ruhr Valley Flood Map for Int Rep 4970.



discolouration seen in the compensating basin has now cleared. However, twenty balloons for defence of dam are seen for the first time, with thirteen already flying at medium altitude. Balloon support vehicles are seen around the area. The report is distributed on a normal Medmenham distribution.<sup>635</sup>

Immediate Report K.1562 is a Medmenham K Section damage assessment report dated 19.5.43 from a Spitfire sortie of 18.5.43. The report covers the area of the Moehne and Eder dams and surrounding flooded areas. The report also covers the alternate dam targets of the Lister and Ennepe dams. This is the first report to give the exact measurements of the breach in the Eder dam and reports water is still flooding through the breach. It also reports the hydroelectric plants at each end of the dam are still intact, but sever damage has been done to the external embankments and channels for water to leave the plants. The level of water left in the reservoir is also reported and assessed to be one eighth of normal storage capacity. The damage to the Moehne dam is now clearly seen and the breach in the dam wall is reported to have reached to the foundations of the dam. The Ennepe and Lister dams are reported as showing no damage. The report then details all the damage seen in the Eder, Fulda Moehne and Ruhr valleys. The report is distributed on a standard Medmenham distribution list, with photographs of the Eder dam breach and flooding at Kassel.

Report K.1564 is a Medmenham K Section damage assessment report dated 20.5.43 from a Spitfire sortie of 19.5.43. The report covers the Sorpe dam and Ruhr Valley. The report shows significant repair activity is taking place on top of the Sorpe dam where damage to the road and crown were previously seen. The report then details all the flood damage seen down the Ruhr Valley and is distributed with an annotated photograph of the flooding and damage to the railway viaduct near Herdecke. Again, the report is distributed on a standard Medmenham distribution list.<sup>636</sup>

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<sup>635</sup> TNA AIR 29/275 Interpretation Report No 4979 dated 20.5.43.

<sup>636</sup> TNA AIR 29/276 Immediate Interpretation Report K.1564 & Photograph dated 19.5.43.

Report K.S.85 is a Medmenham K Section damage assessment follow up report dated 20.5.43 from report K.1559 on the Sorpe dam. The report uses spitfire sorties from the 13.5.43, 17.5.43 and 19.5.43. The report details the damage seen to the dam road and top of the dam wall, including the damage exposing the concrete dam core over a distance of thirty five feet. The report includes details of the lack of hydroelectric generation being seen, but significant repair work is already underway on the damaged dam wall road and dam concrete core. The report was distributed on a standard Medmenham distribution list with two Medmenham plans of the Sorpe dam wall showing the extend of the damage and area of the exposed concrete core.<sup>637</sup>

Report K.S. 85A is a Medmenham K Section damage assessment report on the Moehne, Eder and Sorpe dams dated 22.5.43. No sorties later than 19.5.43 were used in the report. The report clearly identifies the damage to all three dams and confirms that the Sorpe dam is the only one still operating. The report details the repair work been undertaken at the Sorpe dam. It also identified the large areas affected by flooding in the Moehne and Ruhr valleys. It details the residential and Industrial areas and the damage inflicted on those, communications, road, rail, canal and river damage and the damage to public utilities and agriculture. The report confirms the damage to the Eder dam and lists new damage to the Eder and Fulda valleys. The damage to the Sorpe dam is also covered including the ongoing repair work. No distribution list is seen on this report, but it can be expected to be similar to that on report KS85.<sup>638</sup>

Report 4993 is a normal Medmenham Second Phase report dated 23.5.43 and covers the area of the Sorpe Reservoir, Lunen, Wilhelmshaven, Emden and Heligoland. The report refers back to the Sorpe dam report 4979 and provides a more detailed interpretation of the stains seen on the Sorpe dam face, concluding they were caused by water and sediments thrown up by the blasts. No seepage is

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<sup>637</sup> TNA AIR 29/276 Interpretation Report KS 85 dated 20.5.43.

<sup>638</sup> TNA AIR 2/8395 Interpretation Report K.S.85A dated 22.5.43.

seen and the dam wall is reported as intact. The Sorpe part of the report is only seven lines long. The rest of the targets are of no concern to this study.<sup>639</sup>

Report F.S.116 is a normal weekly Medmenham F Section report on Rail, Port and Inland Waterway Activity dated 20.5.43. The report details on its first page the damage inflicted on the railways downstream of the Moehne and Eder dams as well as the bridges destroyed or damaged.<sup>640</sup> The report also mentions the delays rerouting rail traffic will impose on the network, whilst repairs and rebuilding take place. The report was distributed on a normal Medmenham distribution list.

Report F.S.117 is a Special Medmenham F Section report on damage caused to Rail, Road and Inland Waterways after the breaching of the Moehne and Eder dams dated 25.5.43. The report details all the damage inflicted in the Ruhr valley and Eder valley to railway infrastructure and the trains and railway coaches damaged as well as damage inflicted on the inland waterways. The report concludes with an analysis of the impact on rail traffic and the diversions that will have to be made until major repairs are completed. The Ruhr valley rail infrastructure suffered the most damage in the floods. The report is in great detail and covers all rail infrastructure over the area and runs to eight pages. The report was distributed on a normal Medmenham distribution list. This was the last Medmenham report on the damage caused by Operation *Chastise*, though further reports over the areas affected reported on the progress of restoration and repairs.<sup>641</sup>

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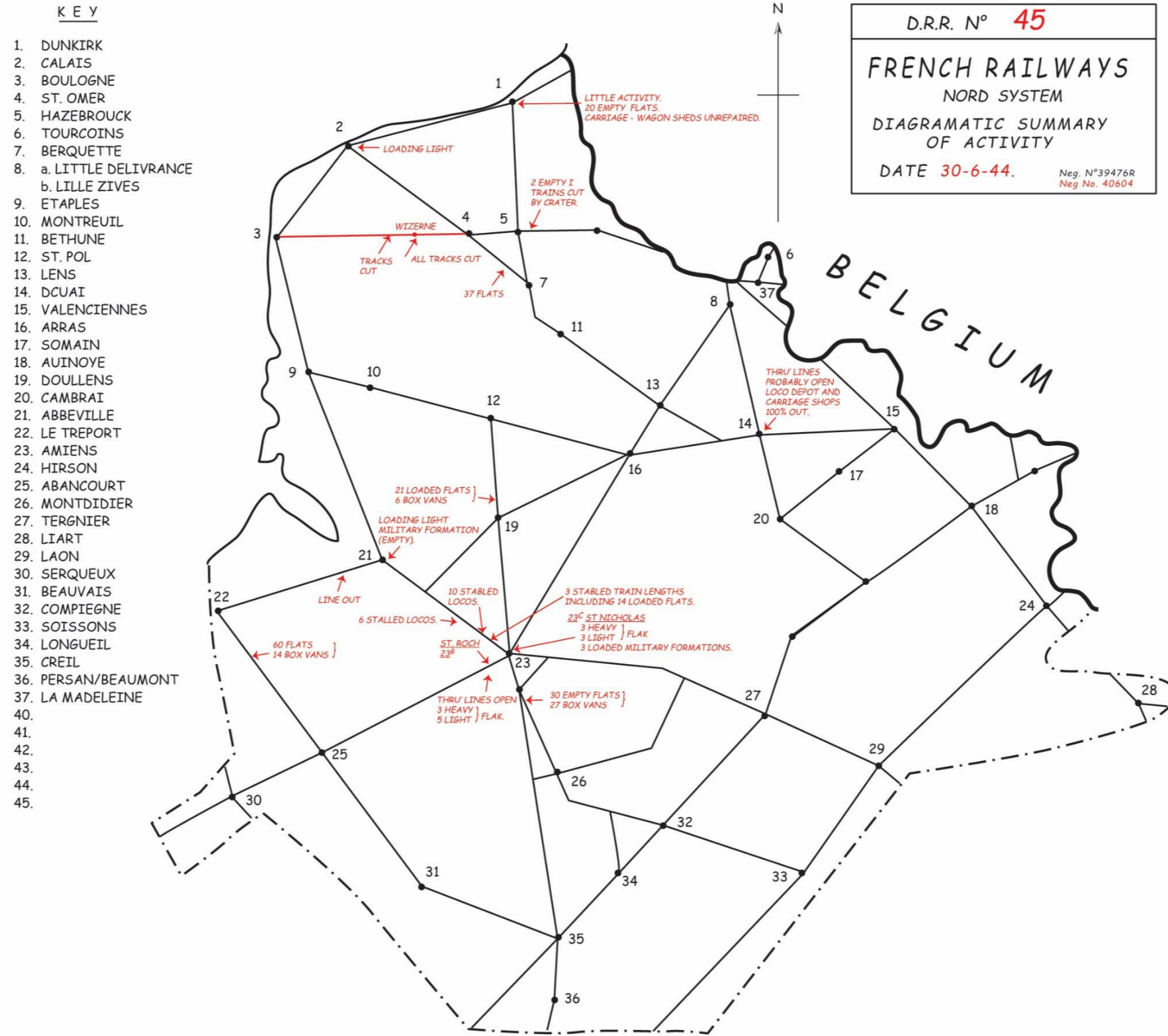
<sup>639</sup> TNA AIR 29/275 Interpretation Report 4993 dated 23.5.43.

<sup>640</sup> F Section at Medmenham reported on Communications and Transportation. TNA AIR 29/276 Report F.S.116 dated 20.5.43.

<sup>641</sup> TNA AIR 29/276 Report F.S.117 dated 25.5.43.



Map 9 Daily Railway Report 45, Map of NORD System with Original Annotations<sup>642</sup>



<sup>642</sup> Transcribed Map of daily Railway Report No 45. For original see TNA AIR 29/329.

### Stereoscopes

The interpretation of aerial photographs using stereo viewers was an essential photographic interpretation technique at Medmenham during the Second World War. However, the stereoscope in use by all photographic interpreters were the very basic Type B as shown in Picture 8.



Picture 8. Type B Stereoscope<sup>643</sup>

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<sup>643</sup> MA Acc No 17828, Type D Stereoscope in original wooden case.



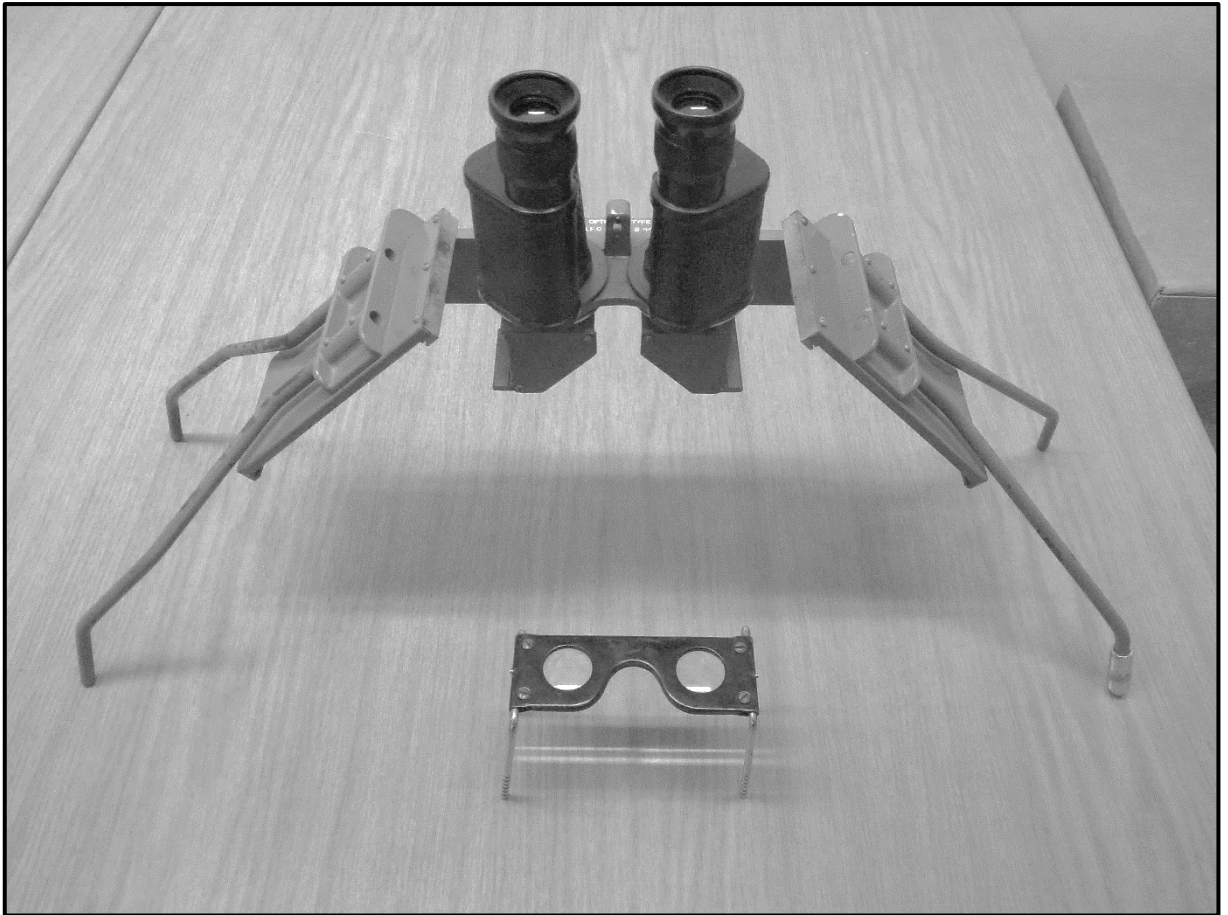
Picture 9. Stereoscope Universal Type SV-3.<sup>644</sup>

Picture 9, shows the SV-3 stereoscope which was a larger and more cumbersome device for viewing stereo photographs and it did not view the photographs directly. It had a four times magnification binocular viewing lens system, that used two prisms to view mirrors on the two sides. The mirrors were angled to reflect the image of the photograph into the prisms. This stereoscope with the four times magnification allowed the photographic interpreters to interpret finer detail in the photographs. They were not widely available in Medmenham until late 1942. The SV-3 is shown with a stereo pair of photographs of Calais showing invasion barges on the 18 September 1940 and 255 barges can be counted as shown in Chapter 3, Table 12. The American Fairchild F-71 mirrored stereoscope was similar to the SV-3.<sup>645</sup>

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<sup>644</sup> MA Acc No 3598, Stereoscope Universal, Type SV-3. The SV-3 stereoscope is shown with a stereo pair of Calais on 18 September 1940 and 255 barges can be counted, MA Acc No 1152, Invasion Barges in Calais.

<sup>645</sup> MA Acc No3032, Fairchild F-71 Magnifying Stereoscope Handbook.



Picture 10. Size Comparison Type B and SV-3 Stereoscopes

Picture 10, shows the comparative size of the two stereoscopes. The small Type B was the most used stereoscope and was very compact and robust, if very basic.