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**CONSIDERED POLICY OR HAPHAZARD
EVOLUTION?**

NO. 617 SQUADRON RAF 1943-45

ROBERT MALCOLM OWEN

A thesis submitted to the University of Huddersfield in partial fulfilment of the requirements for the degree of Doctor of Philosophy

The University of Huddersfield
(in collaboration with the Royal Air Force Museum)

OCTOBER 2014

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ABSTRACT

Following their breaching of German dams in May 1943, No. 617 Squadron, Royal Air Force, was maintained as a specialist precision bombing unit. For the remainder of the Second World War the Squadron carried out precision attacks using new and unconventional weapons, culminating with Barnes Wallis's deep penetration bombs, TALLBOY and GRAND SLAM.

This thesis will show that the numerous accounts of the Squadron's history have failed to take account of many factors that determined its role. By concentrating on the operational record and weapons, both popular historians and scholars have given a distorted and interpretatively incomplete description of the Squadron's development. This in turn has led to an incomplete perception of the Squadron's Development and a misconception of its full contribution to the bomber offensive.

This thesis identifies policy and decision making bodies and examines their role in selecting weapons and targets for the Squadron. It explores the issues which determined the role played by the Squadron: changes in Air Staff policy for Bomber Command, choice of targets, the development and production of weapons, and tactical requirements. Comparison is made between the planners' original intentions and the final operational record.

Many of the Squadron's operations emerged from an inability to follow through from initial planning. Such failure resulted from factors that included unrealistic expectations of weapon performance, delays in the development of new weapons, and political intervention. Alternative targets were selected not only to take advantage of the Squadron's existing capabilities but also to address specific issues that were often imposed on the planners by outside agencies which would have otherwise diverted Bomber Command from the main offensive. In other instances the Squadron was used to supplement existing operations carried out by main force.

The gestation time for new weapons was such that when a weapon emerged its originally intended targets were no often longer relevant. Accordingly, new targets had to be found. The Squadron's role in the development and assessment of weapons, equipment and new techniques for the Command is revealed to be greater than previously recognised.

This new approach to the Squadron's wartime role examines the policy and planning backstory to the Squadron's operations. It reveals a hitherto unrecognised complexity in the evolution of the Squadron's role, and demonstrates how haphazard delays and set-backs were transformed into new policy to meet ever changing requirements.

Acknowledgements

The origins of this thesis lie in informal discussions with Sebastian Cox, Head of Air Historical Branch, RAF Northolt. Not only has he been a sounding board for the development of ideas, but asked many thought provoking questions stimulating new avenues of research. His advice, encouragement and assistance over the years have been beyond compare. Thank you too, all those members of the Branch who have contributed in no small measure to my research over the years.

Peter Elliott and the staff of the Royal Air Force Museum, Hendon, have been unstinting in their assistance, answering numerous questions and making available a range of material, often at short notice.

I acknowledge the help given by staff providing a vital and usually anonymous service, both front of house and in the archives at the following institutions:

National Archives, Kew; the Science Museum Library, Swindon; The Archive Centre, Leonard Cheshire Disability, Netherseal; Imperial War Museum, London; Churchill College, Cambridge.

My thanks go to the University of Huddersfield, the Royal Air Force Museum and to the Royal Air Force Historical Society for their generous financial support for my research.

The Committee and Members of the No. 617 Squadron Association and members of Sir Barnes Wallis's family have provided a personal link to personalities and events featured in this research. For your fellowship over the years, thank you.

Friends and fellow researchers have been generous with their support: Clive Richards, who inspired me to embark on this project, Dr John Sweetman, James Holland and Patrick Bishop.

Finally, my greatest debt is to my supervisors, Professor Richard Morris and Reverend Paul Wilcock of the University of Huddersfield Arms and Armour Research Institute. Their guidance, encouragement and advice have been invaluable, and without them this would be a lesser work.

Glossary

12,000lb HC bomb	High Capacity blast bomb used primarily for attacks on industrial targets
ABC	AIRBORNE CIGAR: Transmissions to interfere with German fighter control instructions
ANVIL	Use of radio controlled war weary bombers for attacks against large V-weapon sites
ANVIL (Operation)	Original codename for Allied amphibious landings in the South of France (later Operation DRAGOON)
APRHRODITE	Use of radio controlled war weary bombers for attacks against large V-weapon sites
Base	The parent administrative unit of a group of (usually) three bomber airfields
Battle of the Ruhr	Bomber Command's attacks on German industry March-July 1943
BLACKMAIL	Operation to persuade French factory management to cooperate with SOE sabotage
BODYLINE	Operations against German secret weapon (renamed CROSSBOW from 15 November 1943)
CASABLANCA	Directive issued to British and American Air Force commanders, February 1943 – April 1944
CATECHISM	Attack on <i>Tirpitz</i> 12 November 1944
CIU	Central Interpretation Unit
CROSSBOW	Operations against the V-weapon launching sites (formerly BODYLINE)
D-Day	Allied invasion of Europe, 6 June 1944
E-boat	High speed German motor torpedo boat
FLASHLAMP	Attack on coastal gun batteries 5/6 June 1944
FORTITUDE	Pre-D-Day deception plan to mislead the Germans as to the location of the Allied landings in north-west Europe
GEE	Radar aid to navigation
GRAND SLAM	22,000 lb Medium Capacity Deep Penetration bomb - See TALLBOY (L)
H2S	Ground mapping airborne radar used for navigation
H2X	American version of H2S

High Capacity (HC)	Thin cased blast bombs with a high (80%) charge/weight ratio for blast effect
HIGHBALL	A smaller version of Wallis's 'bouncing bomb' carried by Mosquitos (see UPKEEP)
INFATUATE	Allied Landings on Walcheren October 1944
'J' Bomb	Liquid filled incendiary bomb (first used 22 April 1944)
JOCKEY	Committee analysing the German aircraft industry to recommend targets for POINTBLANK
JOHNNY WALKER	400-500lb anti-ship bomb
Kriegsmarine	Germany Navy
LULU	Tail warning radar trialled by Squadron's Lancasters
Medium Capacity (MC)	Thicker cased bombs than HC, with approx. 40% charge/weight ratio
MANDREL	Airborne radar jamming device
MONICA	Tail warning radar carried by Lancasters
OBOE	Blind bombing aid and marking device used by PFF Mosquitos
OBVIATE	Attack on <i>Tirpitz</i> 29 October 1944
Ordensburg	National Socialist Party educational training camps
OVERLORD	The Allied invasion of France, 6 June 1944
PARAVANE	Attack on <i>Tirpitz</i> 15 September 1944
POINTBLANK	Directive issued for the Combined Bomber Offensive, June 1943
QUEEN	US Army advance to the River Roer, Nov- Dec 1944
R-boat	Räumboote (German navy minesweeper)
SHINGLE	Allied amphibious landings at Anzio
Shuttle raids	Attacks from the UK against Italian targets, landing in North African bases
Special Operations Executive	Organisation controlling Allied agents in occupied territories
Spot Fire	Brightly coloured incendiary bomb used for target marking
TALLBOY	Wallis's design for a deep penetration ('earthquake') bomb
TALLBOY (L)	Original designation of 22,000lb Medium Capacity deep penetration bomb, GRAND SLAM
TALLBOY (M)	The operational 12,000 lb MC deep penetration bomb
TALLBOY (S)	4,000lb ballistic trials version of TALLBOY
TAXABLE	D-Day deception operation executed by No. 617 Sqn dropping WINDOW to simulate an invasion convoy

TIGER FORCE	Bomber Command's projected contribution to the war in the Pacific post V-E Day
Torpex	High Explosive (abbreviated: <i>Torpedo Explosive</i>) used for TALLBOY and GRAND SLAM
U-boat	Unterseeboot (German submarine)
ULTRA	Information obtained from decrypted enemy sources
UPKEEP	Rotating mine used to breach Möhne and Eder Dams (the 'bouncing bomb')
VISUAL	Radar monitoring of bomber force over enemy territory to provide warning of possible fighter interception
Wastage	Loss of equipment due to enemy action or accident
WINDOW	Metal foil strips to disrupt enemy radar reception

Abbreviations

AAEE	Aeroplane and Armament Experimental Establishment, Boscombe Down
ACAS	Assistant Chief of Air Staff
ACAS (Ops)	Assistant Chief of Air Staff (Operations)
ACAS (P)	Assistant Chief of Air Staff (Policy)
ACAS (TR)	Assistant Chief of Air Staff (Technical Requirements)
A/Cdre	Air Commodore
ACM	Air Chief Marshal
ADGB	Air Defence of Great Britain
ADI (Ph)	Assistant Director of Intelligence (Photography)
AEAF	Allied Expeditionary Air Force
AI	Airborne Interception
Air C-in-C	Air Commander-in-Chief
AM	Air Marshal
AOC	Air Officer Commanding
AOC-in-C	Air Officer Commanding -in-Chief
ASWDU	Air-Sea Warfare Development Unit
AVM	Air Vice-Marshal
BAC	British Air Commission, Washington DC
CAS	Chief of the Air Staff
CCC	Churchill College, Cambridge (Bufton Papers)
CCO	Christ Church Oxford (Portal Papers)
CCOS	Combined Chiefs of Staff
C-in-C	Commander-in-Chief
CIO	Chief Intelligence Officer
COS	Chiefs of Staff
CP	Concrete Piercing (bomb)
CSTC	Combined Strategic Targets Committee
DA	Delay Action (fuze)
DAT	Director of Air Tactics
D Arm R	Director of Armament (Research)

DBO	Directorate of Bomber Operations
D B Ops	Director of Bomber Operations
DCAS	Deputy Chief of the Air Staff
D C-in-C	Deputy Commander-in-Chief
D/C RD	Deputy Chief Research and Development
DD B Ops	Deputy Director of Bomber Operations
DD of Ops (A)	Deputy Director of Operations (Administration)
D Inst P	Director of Instruments (Production)
D of I	Director of Intelligence
D of I (O)	Director of Intelligence (Operations)
D of Ops (Tact)	Director of Operations (Tactics)
Flg Off	Flying Officer
Flt Sgt	Flight Sergeant
Gp Capt	Group Captain
Gp Capt Ops	Group Captain, Operations
HC	High Capacity
HL	High level
HQ	Headquarters
HQBC	Headquarters Bomber Command
IFF	Identification Friend or Foe
JPS	Joint Planning Staff
LCA	Leonard Cheshire Disability Archive Collection, Netherseal
LL	Low level
MAAF	Mediterranean Allied Air Forces
MAC	Mediterranean Air Command
MAP	Ministry of Aircraft Production
MC	Medium Capacity
MEW	Ministry of Economic Warfare
NAVSTAR	Naval Targets (List)
ORS	Operations Research Section
PFF	Pathfinder Force (No. 8 Group)
RAFDEL	Royal Air Force Delegation
RAFM	Royal Air Force Museum
RCM	Radio Countermeasures
RE (8)	Ministry of Home Security Research and Experiments Department 8
RRL	Road Research Laboratories, Harmondsworth
SABS	Stabilised Automatic Bomb Sight
SASO	Senior Air Staff Officer

SCAEF	Supreme Commander Allied Expeditionary Force (Gen. Eisenhower)
Sgt	Sergeant
SHAEF	Supreme Headquarters Allied Expeditionary Force
SIS	Secret Intelligence Service (MI6)
SM	Science Museum Library, Wroughton
SOE	Special Operations Executive
Sqn Ldr	Squadron Leader
TNA	The National Archives, Kew
USAAF	United States Army Air Force
USAF	United States Air Force
USStAFE	United States Strategic Air Forces in Europe
VCAS	Vice-Chief of the Air Staff
VHF	Very High Frequency (Radio communication by direct speech)
VLR	Very Long Range bomber operations
W/T	Wireless Telegraphy (radio communication by Morse code)
Wg Cdr	Wing Commander

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INTRODUCTION

No. 617 Squadron Royal Air Force was formed as a specialist unit specifically for the Dams Raid (Operation CHASTISE), using Barnes Wallis's unique 'bouncing bomb'. It was retained as a specialist Squadron within Bomber Command using other weapons, inter alia, developed by Wallis for precision attacks against atypical targets regarded as being beyond the scope of the Command's main force.

Existing histories of the Squadron concentrate on the development of these specialist weapons and the operations in which they were used. These accounts have created an impression that the Squadron's role developed in a linear way, important targets coincidentally presenting themselves to specialised weapons suited for their destruction. The overall process is seen as part of a carefully orchestrated strategy in which each stage led to the next. However, if the Squadron's wartime history is examined in a broader context, its development is by no means so clear cut. This thesis investigates the actual nature of the process.

"I gather this Squadron will either make history or be wiped out."¹ These words were attributed by Paul Brickhill to Wg Cdr Guy Gibson speaking to his adjutant when No. 617 Squadron was formed. The Squadron certainly did make history.

Brickhill's account was written in 1951. It was the first in a succession of writings about the Squadron and its wartime operations that continues to this day and shows no sign of abating.² Without doubt more will appear in the future. The sheer volume of this material has created the impression that there is surely no more of significance to be said. Examination of existing accounts reveals that while authors have been very interested in the men, machines, technology and targets, they have given much less attention to the many contextual factors that influenced and determined the Squadron's operational role.

The epic nature of the Dams Raid and the Squadron's subsequent operations have generated a very long line of narratives. Brickhill's account was the first; most of those

¹ Paul Brickhill, *The Dam Busters* (London: Evans, 1951), p 56. Such is the appeal of this work that it has never been out of print since 1951. It was the first Pan paperback to sell over a million copies and was included in the first UK edition of the Reader's Digest Condensed Book in 1954.

² See Bibliography pp 252-258.

that followed were in some respects based on his.³ Brickhill in turn relied considerably for his account of the Dams Raid on *Enemy Coast Ahead*, the wartime autobiography of Wg Cdr Gibson, completed in August 1944 and published in 1946. Brickhill continued the story of the Squadron's wartime exploits, using information provided largely by Squadron wartime members.⁴ Although his book was a commercial venture, it was intended that it would stimulate interest and serve as a recruiting vehicle for the Royal Air Force.⁵ However, it was not an official history, and Brickhill was not granted access to official records which at the time were still closed. Notwithstanding, he produced a strong narrative account, and given the constraints under which it was produced it was remarkably accurate. By today's standards it is lacking in detail and referenced research, but these shortcomings are compensated by its ability to communicate the mood of the time. Brickhill's style is very much that of the 1950's war story, of which he was perhaps the master. He had been a pilot before being taken prisoner of war in 1943 and as a professional journalist was well able to communicate RAF life and ethos. His popularity was furthered by *The Dam Busters'* translation into the epitome of the 1950s British war film with its representation of wartime courage and triumph against uneven odds.⁶

Brickhill's work remained unchallenged as an overview of the Squadron's wartime record until two volumes produced by Alan Cooper, *The Men Who Breached the Dams* and *Beyond the Dams to the Tirpitz*.⁷ Cooper had the benefit of access to many of the official records, together with the de-classification of UPKEEP. However, both books often rely on single sources, and make uncritical use of information obtained from former Squadron members who were recalling events of some 40 years before. The result is

³ Exceptions to this include John Sweetman (1982), *The Dambusters Raid*, and James Holland (2012), *Dam Busters – The Race to Smash the Dams*.

⁴ Paul Brickhill, letter to *Flight Magazine*, 20 Apr 50, p 508.

⁵ TNA Air 2/10147: Publications. History of No. 617 Squadron (Dam Busters): choice of author. Minute 15, J C Nerney to DST, 3 Oct 47.

⁶ *Enemy Coast Ahead* and *The Dam Busters* subsequently provided the core material for the playwright R. C. Sherriff who crafted the screenplay for director Michael Anderson's 1955 film taking its title from Brickhill's book. Associated British Films' *The Dam Busters* became the largest box office earner of 1955 and was one of the productions selected for Digital re-mastering for the British Film Institute's *Summer of British Film* in 2007. It featured amongst the top 60 films of the past 60 years in a poll published by the British Video Association in 2012. <http://www.bva.org.uk/news-press-releases/trainspotting-voted-best-british-film-in-past-60-years-hmv-s-national-survey-mark-d>. [Accessed 24 Feb 13]. It is regularly shown on television and has been the subject of studies in its own right. As this is being written a re-make is reputedly in production, Video Association in 2012. It is regularly shown on television and has been the subject of studies in its own right. As this is being written a re-make is reputedly in production, reputedly using 3-D technology, by New Zealand director, Peter Jackson.

⁷ Alan W. Cooper, *The Men Who Breached the Dams* (London: William Kimber, 1982); *Beyond the Dams to the Tirpitz* (London: William Kimber, 1983).

essentially a narrative account, which is clouded by the reliability of memory and occasionally inconsistent when cross-checked with primary sources.

Chris Ward, the author of a series of Squadron monographs based on unit Operations Record Books, has produced more recent works, *Dambusters – the Definitive History of No. 617 Squadron at War 1943-45* and *Dambusters the Forging of a Legend* that take up the mantle of Cooper.⁸ The second work is an expansion of the first, which was restricted in its text content on account of its heavily photographic format. The earlier work is very much an operational record. In the second work (2009), and unlike earlier authors, Ward has sought to position the Squadron within the broader context of the bomber offensive with reference to main force operations, although he does not tie these back to the broad base of overall policy and directives. Another area of strength of this work is the incorporation of archive material from sources in Germany and former occupied countries.

Alex Bateman's *Aviation Elite Units, No. 34. No. 617 'Dambusters' Squadron*, part of the Osprey portfolio provides a useful, comprehensive and concise account of the Squadron's history, and includes a number of aspects relating to training and equipment not covered by former works.⁹ While the format and brevity of this work restricts the overall amount of information available, it combines the basic narrative with new and lesser known material.

Sam Olsen's studies, *The Dambusters Vol 1- The Rise of Precision Bombing* and *Vol 2 - Bombing for Victory*, are like Cooper, a two-part work.¹⁰ Much of the text (and photographs) are quarried from works by previous authors. It contributes little beyond what has already been written.

Nigel Press, *Into Thin Air: The story of a bomber station at war*, offers a variation on the operational narrative in his history of RAF Woodhall Spa.¹¹ Press, an amateur local historian, addresses events on and around the airfield that was the Squadron's home

⁸ Chris Ward, Andy Lee and Andreas Wachtel, *Dambusters – The Definitive History of 617 Squadron at War 1943-45* (Walton on Thames: Red Kite, 2003); *Dambusters: The Forging of a Legend* (Barnsley: Pen and Sword, 2009).

⁹ Alex Bateman, *No. 617 'Dambusters' Squadron* (Botley: Osprey, 2009).

¹⁰ Olsen, Sam, *The Dambusters Vol 1 The rise of Precision Bombing March 1943-May 1944* (Manchester: Leandoer & Ekholm (Crécy), 2010); *The Dambusters Vol 2: Bombing for Victory June 1944-VE Day 1945* (Manchester: Leandoer & Ekholm (Crécy), 2012).

¹¹ Nigel Press, *Into Thin Air. The story of a bomber station at war. RAF Woodhall Spa 1941-45.* (Heighington: Tucann, 2001).

between January 1944 and July 1945. It is based largely on the Station's Operations Record Book.¹²

Each of the works listed above reflects the style and approach of the period in which it was written. To an extent they also resemble each other in that each follows a formula combining a general operational narrative, expositions of weapons used and results obtained, and aspects of the personal side of Squadron life. Brickhill adopts a journalistic, story-telling style of the immediate post-war period, addressing an audience who were perhaps only too familiar with the aspects of war and life in the Services. Ward writes in a heavily researched manner for a more factual and data-conscious readership seeking specific detail, rather than simply a stirring narrative.

Two works set the Squadron's role in the context of the activities of No. 5 Group, the larger organisational formation (part of Bomber Command) of which the Squadron was part: W J Lawrence, *No. 5 Bomber Group RAF*¹³ and Chris Ward, *No. 5 Group Bomber Command – An Operational Record*.¹⁴ Wg Cdr Lawrence, ACM Harris's former Press Officer, provides a useful and easily readable narrative of the Group's operations. In addition to recording No. 617 Squadron's unique role in terms of weaponry and successful attacks, it pays tribute to its contribution through the development of precision target marking later adopted by the Group. Ward's account, following the format of his other works on Nos. 3 and 6 Groups, combines a brief narrative history with a subsequent statistical section detailing units, aircraft and operations, much of the latter, as the author acknowledges, being taken from the opus magnum of military historians Martin Middlebrook and Chris Everitt, *Bomber Command War Diaries*.¹⁵ Unlike Lawrence, Ward's work is "not intended to serve as a comprehensive history of the Group or squadrons" but serves better as a reference work and data source.¹⁶

There is no shortage of works to record and analyse the overall bomber offensive. For greater detail and analysis, Charles Webster and Noble Frankland's, *Strategic Air Offensive Against Germany*, Vols II -IV provide an essential starting point.¹⁷ As part of

¹² TNA Air 28/2128: No. 617 Squadron: Operations Record Book 1943 Apr -1945 May.

¹³ W J Lawrence, *No. 5 Bomber Group RAF* (London: Faber and Faber, 1951).

¹⁴ Chris Ward, *No. 5 Group Bomber Command, an Operational Record* (Barnsley: Pen and Sword, 2007).

¹⁵ Martin Middlebrook and Chris Everitt, *The Bomber Command War Diaries* (London: Viking, 1985).

¹⁶ Ward, *No. 5 Group*, General Notes, p viii.

¹⁷ Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Vols I-IV (Uckfield: Naval and Military Press, 2006). (Originally published London: HMSO, 1961).

the official history of military campaigns these address issues of both policy and execution, covering aspects beyond those of basic planning and operations, including the introduction of equipment, development of tactics and, to a degree, the effects upon Germany. The authors, both academic historians (Frankland had also served as a navigator with Bomber Command), were given access to official documents, both Allied and German, some of which are reproduced in full in the final volume. The scale of this work and its sole focus on the bomber offensive permit greater detail and analysis than that in the former work. The Squadron's major operations, notably CHASTISE and the attacks against *Tirpitz*, are covered in considerable detail. Of special significance is the analysis of the issues and results of the debate of the results of selective and precision bombing that lay at the heart of 617 Squadron's existence.¹⁸ This is the first major work to adopt a broader perspective on the Squadron's operations. It not only examines the pattern of operations but looks also at the ramifications of these for other policies, notably those relating to the development and production of weapons. By doing so it took the first steps to prompt deeper investigation of the range of factors and their inter-relationships that form the basis for this thesis.

The title of Webster and Frankland - *Strategic Air Offensive Against Germany* - at first sight appears to exclude operations against targets in areas occupied Europe. The subject is, however, addressed at two levels: The first concerns the political and military issues as put forward by Eisenhower, Churchill, Tedder, Spaatz and Harris culminating in Harris's reluctant participation in the Transportation Plan during the prelude to OVERLORD.¹⁹ It was during this period that the Squadron fine-tuned its marking technique, mainly against French targets, to the point that it could be adopted and further developed for use by a specialist force for No. 5 Group as a whole. By incorporating this new development into a chapter dealing with the overall development of precision bombing at night, the authors demonstrated that this was but one of a range of methods being tried to achieve this objective. It is noticeable that while acknowledging the Squadron's (and subsequently No. 5 Group's) success, they make light of the issues that emerged during its development, notably those of logistics, assignment of priorities and the political dissention between the Group Commanders, refereed by Harris.²⁰

¹⁸ Webster and Frankland, *Strategic Air Offensive*, Vol II, pp 269-300.

¹⁹ Ibid. pp 10-41.

²⁰ Ibid. pp 141-162. This in particular emerged with the transfer of three squadrons from No. 8 (PFF) Group to No. 5 Group in April 1944, see pp 127 and 131-132.

Hilary St George Saunders was a wartime chronicler and uncredited author of a number of wartime publications by HMSO relating to the RAF.²¹ The three volumes produced in co-authorship with historian Denis Richards, *Royal Air Force 1939-1945*, cover a history of RAF operations 1943-45 and the policy governing them.²² Although not among the full-length official histories they were however, officially commissioned and based throughout on official documents.²³ They provide a considered, but of necessity condensed, overview of the bomber offensive. While the Squadron's key operations are referred to within the context of the main offensive, there is no reference to the Squadron's operations against the V-1 launch sites or the development of their marking technique, other than its use in the April 1944 attack on Munich.²⁴

Other works covering the overall bomber offensive do so at a level similar to that of Richards and Saunders. These are also able to cover issues that Webster and Frankland were unable or unwilling to address. In his preface to *The Bomber Offensive*, Anthony Verrier raises issues of the impersonal representation of the Commander's manifest in the Official Narrative and is politely critical of the lack of a personal element relating to the aircrews.²⁵ Verrier, a journalist and one time defence correspondent for *The Observer* and *New Statesman*, is one of the early exponents of a more challenging approach to the established view of bomber operations. He addresses these issues, not least in respect of No. 617 Squadron. In his account of No. 5 Group marking technique subsequent to the Squadron's developmental period, Verrier highlights the conflict between the commanders of Nos. 5 and 8 (PFF) Groups and questions the validity of the former's sole claim to the technique.²⁶

Denis Richards, *RAF Bomber Command in the Second World War* provides a further account of the bomber offensive in a later work, combining an outline of overall policy with operational narrative.²⁷ This devotes nearly six pages to the Dams Raid, and three to the sinking of *Tirpitz*, but there are few other references to the Squadron's operations. There is no acknowledgement of the overall contribution made to target marking and

²¹ Saunders, H. St. G. (various): (1941) *The Battle of Britain*; (1941) *Bomber Command*; (1941) *Coastal Command*.

²² Of these, the final two volumes are relevant to the period covered by this thesis. Denis Richards, and Hilary St. G. Saunders, *Royal Air Force 1939-45: Vol 2, The Fight Avails* and Vol 3, *The Fight is Won* (London: HMSO, 1953). (Re-printed London: HMSO, 1974)

²³ Saunders, *Royal Air Force 1939-45, Vol 1 The Fight at Odds*, (1974), p ix.

²⁴ For the development of marking technique against these sites, see pp 92-94.

²⁵ Anthony Verrier, *The Bomber Offensive* (London: Batsford, 1968), pp 2-7.

²⁶ Ibid. pp 225-229.

²⁷ Denis Richards, *RAF Bomber Command in the Second World War* (London: Penguin Books, 2001).

bombing technique. It is a clear example of a few key operations continuing to skew the public understanding of the Squadron's contribution to the bomber offensive.

More recent authors have chosen to include personal recollections from former aircrew, an aspect lacking in the earlier 'official' and narrative histories of the bomber offensive. These include Alistair Revie, *The Lost Command*²⁸ and Robin Neillands, *The Bomber War*.²⁹ Kevin Wilson's volumes *Men of Air; Bomber Boys* and *Journey's End* expand on this use of veterans, thus embodying the assessment of those who participated, looking back over 50 years.³⁰ Nevertheless, the narrative content still remains largely similar to earlier works. Max Hastings, *Bomber Command* adopts an approach segmenting the offensive and examining each time period through the eyes of an individual Squadron, linked by narrative of policy. For the period of 1944, he selects No. 97 Squadron, which was part of the marker force operating with No. 617 Squadron.³¹

These works confirm the continuing popularity of the subject and its public appeal. They have also served to create market interest for a number of more detailed studies of specific operations and the technology used in their execution. The above works place No. 617 Squadron in the broad context of the bomber offensive, except for Squadron specific narratives and, to an extent, the Group histories which take a narrower perspective of the offensive.

For more detailed analysis it is necessary to look at works addressing specific campaigns. These cover only certain of the Squadron's operations, notably the Dams Raid, attacks against the V-weapons, the development of precision bombing and target marking and attacks using deep penetration bombs against E-and U-boat pens and the battleship *Tirpitz*.

²⁸ Alistair Revie, *The Lost Command* (London: Corgi Books, 1972).

²⁹ Robin Neillands, *The Bomber War, Arthur Harris and the Allied Bomber Offensive 1939-1945* (London: Cassell, 2001).

³⁰ Kevin Wilson, *Bomber Boys: The RAF Offensive of 1943: The Ruhr, the Dambusters and Bloody Berlin* (Bomber War Trilogy 1) (London: Weidenfeld & Nicholson, 2006); *Men of Air: The Doomed Youth of Bomber Command* (Bomber War Trilogy 2) (London: Weidenfeld & Nicholson, 2008) and *Journey's End: Bomber Command's Battle from Arnhem to Dresden and Beyond* (Bomber War Trilogy 3) (London: Weidenfeld & Nicholson, 2011).

³¹ Max Hastings, *Bomber Command* (London: Pan Paperbacks, 1981), pp 332- 362, part of which relates to operations with No. 617 Squadron.

Starting with Operation CHASTISE, the paramount study remains John Sweetman's *Operation Chastise – the Dams Raid, Epic or Myth?*³² Formerly former head of Defence and International Affairs at the Royal Military Academy Sandhurst, Sweetman established a benchmark approach, combining strategy with technical and operational detail. His is a strong narrative based on a combination of comprehensive archive research and personal recollection. To date this is the definitive work on this operation. There are some errors, but they are few and do not detract from the scholarship of the work. Established historian and television documentary maker James Holland in *Dam Busters – the Race to Smash the Dams 1943* approaches the subject in a similar but less technically detailed manner, in the first part concentrating on the politics and interplay of events, including the parallel development of both UPKEEP (the dams weapon) and HIGHBALL (for anti-shipping use).³³ By doing so, Holland re-contextualizes the development of the 'bouncing bomb' emphasising the influence of the Admiralty and inter-service rivalry. The accounts of the operation are similar, although Holland introduces the hypothesis that the operation was nearly jeopardised by inaccurate meteorological forecasting. In conclusion both Sweetman and Holland promote the validity and efficacy of the operation and counter the claims of revisionists who maintain that the operation was an expensive sideshow that had little impact on German industrial production or the course of the war.

Unlike Sweetman, who included personal recollections in a detached manner, Holland engages the reader in the lives of individual aircrew, recreating their lives through their letters and recollections of their families. W.B. Bartlett, *The Dam Busters in the Words of the Bomber Crews*, might be expected to expand this approach, but the title is a misnomer.³⁴ There are few personal quotes from the aircrew, although paradoxically there are interesting insights from German witnesses and survivors. The bibliography suggests a heavy reliance on previously published works and the primary archival sources cited in the footnotes indicate that those consulted are well known. Overall Bartlett's work brings little new in terms of information or analysis.

Personal accounts are better exploited by prolific oral historian Max Arthur, *Dambusters – a Landmark Oral History* that better justifies Bartlett's subtitle.³⁵ Arthur uses recorded

³² John Sweetman, *Operation Chastise, The Dams Raid, Epic or Myth?* (London: Janes, 1982). Subsequently retitled and republished: *The Dambusters Raid*, London: Arms and Armour Press, 1990).

³³ James Holland, *Dam Busters: The Race to Smash the Dams 1943* (London: Bantam Press, 2012).

³⁴ W.B. Bartlett, *The Dam Busters - in the Words of the Bomber Crews* (Stroud: Amberley, 2012).

³⁵ Max Arthur, *Dambusters: A Landmark Oral History* (London: Virgin, 2008).

material from the Imperial War Museum, earlier television documentaries, private papers and extracts from previously published works to reconstruct the operation from a mosaic of individual personal perspectives. The result has appealing immediacy. Inevitably, such a work cannot tell the full story – there are aspects of the operation for which no suitable quotes can be found.

The above works focus on the Squadron's first operation, but do not examine the foundations for its future role. These are to be found in works looking at themes or campaigns within the overall bomber offensive.

These will be taken in chronological order of operations, beginning post-CHASTISE. Stephen Darlow's *Sledgehammers for Tin Tacks* examines Bomber Command's contribution to combat the emerging threat posed by German secret weapons.³⁶ The Squadron's initial attacks against flying bomb launch sites during the winter of 1943-44 are detailed and placed within the context of operations against these sites. The Squadron's own requirements and the specific reasons for its involvement at this stage of the campaign are not examined. The Squadron's use of TALLBOY against the later hardened and underground sites is likewise addressed, with useful narrative of the night operation against St Leu d'Esserent in July 1944, providing insight into the main operation within which No. 617 Squadron's activities were part.³⁷ The later TALLBOY attacks against the rocket launching sites and storage facilities are covered in narrative form, but again, the planning and logistical aspects of these operations are not covered. For an exposition of these large sites, Roland Hautefeuille's *Constructions Speciales* provides by far the most detailed account of the development of these sites and their discovery by reconnaissance.³⁸ Attacks against them and their results are recorded from the perspective of the individual sites. Hautefeuille does not address technical and operational planning issues with regard to the RAF. The sites and background to their purpose are also detailed in 'After the Battle, then and now' a periodical series edited by Winston Ramsay. *After the Battle No. 6, The V-Weapons* – provides a succinct narrative on their construction and fate.³⁹ In *Hitler's Rocket Sites*, Philip Henshall likewise examines the sites' physical construction and likely purpose.⁴⁰ These sites were never used operationally and Hautefeuille, *After the Battle* and Henshall offer varying

³⁶ Stephen Darlow, *Sledgehammers for Tintacks* (London: Grub Street, 2002).

³⁷ Ibid. pp 100-118.

³⁸ Roland Hautefeuille, *Constructions Speciales* (Paris: R. Hautefeuille, 1985).

³⁹ Winston Ramsay (ed), *The V-Weapons - After the Battle Magazine, No. 6* (Harlow: After the Battle, 1974).

⁴⁰ Philip Henshall, *Hitler's Rocket Sites* (London: Robert Hale, 1985).

interpretation as to how they might have been used. These authors are nevertheless consistent in acknowledging the effectiveness of the Squadron's attacks.

The Squadron's operations pioneering low level marking techniques against targets during the spring of 1944 do not feature as a separate individual study. They are touched upon in works dealing overall with attacks against targets in occupied territory, such as Darlow.⁴¹ Lionel Lacey-Johnson *Pointblank and Beyond* provides a well-researched and analytical study of the pre-invasion bombing campaign and contains a chapter outlining the Squadron's role in the development of precision bombing and target marking and an appendix provides a concise summary of marking techniques.⁴² Since the focus of this work is policy, operations and results relating to the transportation plan it only touches other aspects of operations against French targets, such as flying bombs, French industry and rocket sites. Its selective use of attacks as case studies surprisingly makes no mention of those against the Paris marshalling yards, which were key in the transition of the Squadron's marking role from 'self-marking' to marking for main force.⁴³

D-Day Bombers: The Veterans' Story by Stephen Darlow rectifies this omission with an account of the attack on the marshalling yards at Juvisy, drawing on the unpublished memoirs of Squadron pilot John Pryor, combined with a French eyewitness account.⁴⁴ *D-Day Bombers* provides an overview of the pre- and post-OVERLORD bombing strategy, but is primarily concerned with accounts of operations and the experience of individual aircrew.

Lionel Lacey-Johnson's *Pointblank and Beyond* also devotes a chapter to the attack on the important tank training depot at Mailly-le-Camp, marked in part by No. 617 Squadron's Mosquitos.⁴⁵ This controversial attack is also the subject of two further books: Jack Currie, *Battle under the Moon*⁴⁶ and Molly Burkett and Geoff Gilbert, *Not Just Another Milk Run*.⁴⁷ The former provides a dispassionate account of the operation and counters the oft reported criticism of Wg Cdr Cheshire's control and the marking

⁴¹ Darlow, *Sledgehammers for Tintacks*, pp 25-26 and 29-37.

⁴² Lionel Lacey-Johnson, *Pointblank and Beyond* (Shrewsbury: Airline, 1999).

⁴³ See pp 127-128.

⁴⁴ Stephen Darlow, *D-Day bombers: The Veterans' Story. RAF Bomber Command and the US Eighth Air Force support to the Normandy invasion, 1944* (London: Grub Street, 2004), pp 78-83.

⁴⁵ Lacey-Johnson, *Pointblank and Beyond*, pp 112-121. The attack on Mailly cost the life of Lacey-Johnson's brother.

⁴⁶ Jack Currie, *Battle under the Moon* (Wilmslow: Air Data, 1995).

⁴⁷ Mary Burkett, and Geoff Gilbert, *Not Just Another Milk Run: The Maily-le-Camp bomber raid* (Grantham: Barney Books, 2004).

element. Frustratingly, lack of references makes referral to primary material difficult. The latter work, written for the general reader, is largely a collection of personal reminiscences by participants, some gathered fifty years or more after the event and is more of a memoir than precise study of the operation.

Recent years have seen research to assess the effect of the bomber campaign against targets in occupied countries and the experience of those bombed. The foremost published studies are those by Claudia Baldoli & Andrew Knapp, *Forgotten Blitzes*,⁴⁸ Baldoli et al, *Bombing States and Peoples*⁴⁹ and Richard Overy, *The Bombing War*.⁵⁰ Overy, whose research covers the social, political and industrial effects of Allied bombing, is the pre-eminent authority on bombing as a means of war. These works cover a broad spectrum and as a result barely touch upon the specific policies connected with the operations executed by the Squadron against factories and communications. Nevertheless, they do highlight the importance of the Squadron's almost surgical ability to destroy key installations and the value of this in both political and propaganda terms in addition to its economic worth.

Operations through the summer of 1944 concentrated on the large V-sites, discussed above, and the impregnable E and U-boat pens of the Atlantic coasts. *E-boat Alert* by US Military historian and academic James Tent provides a detailed analysis and contextualised account of the strategy and execution of the attacks on those at Le Havre and Boulogne.⁵¹ Jean Pallud in Ramsay (ed), *After the Battle No. 55 – U-boat bases*,⁵² Jack Mallmann Showell,⁵³ *Hitler's U-boat Bases* and Gordon Williamson, *U-boat Bases and Bunkers*⁵⁴ offer detailed descriptions of the construction and operation of these pens. A useful overview of German naval operations and the effects resulting from these attacks is provided by naval historian V. E. Tarrant in *The Last Year of the Kriegsmarine*.⁵⁵ This account of the German Navy also chronicles the significance of German naval power as a background to operations to sink the battleship *Tirpitz*.

⁴⁸ Claudia Baldoli and Andrew Knapp, *Forgotten Blitzes* (London: Continuum, 2012).

⁴⁹ Claudia Baldoli, Andrew Knapp and Richard Overy, *Bombing States and Peoples in Western Europe 1940-45* (London: Continuum, 2011).

⁵⁰ Richard Overy, *The Bombing War* (London: Allen Lane, 2013).

⁵¹ James F. Tent, *E-boat Alert: Defending the Normandy invasion fleet* (Annapolis: Naval Institute Press, 1996).

⁵² Jean P. Pallud, *U-boat bases in France - After the Battle Magazine, No. 55* (Winston Ramsay (ed.) (Harlow: After the Battle, 1987).

⁵³ Jack. P. Mallman Showell, *Hitler's U-boat bases* (Stroud: Sutton Publishing, 2002).

⁵⁴ Gordon Williamson, *U-boat bases and bunkers 1941-45* (Botley: Osprey Publishing, 2003).

⁵⁵ V.E. Tarrant, *The last year of the Kriegsmarine* (London: Arms and Armour Press, 1994).

The German battleship *Tirpitz* moored in a Norwegian fjord posed a latent threat to allied convoys to Russia and in the North Atlantic. Many authors have chronicled the varied attempts to despatch this potent vessel. A number have taken into account the German perspective, thus providing a two sided view of events. David Woodward's *The Tirpitz*,⁵⁶ in journalistic style, is very much a narrative of its period and contributed no more than Brickhill to a record of the autumn 1944 attacks by the Squadron. Jochen Brennecke, *The Lone Queen of the North*⁵⁷ and Léonce Peillard, *Sink the Tirpitz*⁵⁸ provide greater insight by drawing more heavily on German accounts, while David Brown, *Tirpitz – the Floating Fortress*⁵⁹ and Ludovic Kennedy, *Menace: The Life and Death of the Tirpitz*⁶⁰ concentrate on the naval aspects of the offensive against this vessel, reducing the three TALLBOY attacks, which ultimately sank her, to a few pages. John Sweetman's, *Tirpitz, Hunting the Beast* drew on primary sources and personal interviews to produce a detailed account of the ship's career in keeping with recent readership and market trends.⁶¹ As with this author's earlier work on Operation CHASTISE, technical achievement strategy and tactics feature heavily. Although primary sources are referenced in the bibliography of both works there are no footnotes to facilitate direct archival follow up. This omission is addressed in Patrick Bishop's *Target Tirpitz*⁶² whose narrative treatment, drawing upon personal papers and recollections resulted in a more human and emotionally engaging account, thereby complementing Sweetman's more intensive technical work.

For accounts of operations beyond *Tirpitz* up to the V-E Day, it is generally necessary to revert, at least in English language, to the broader campaign narratives and Squadron histories. The attacks on railway viaducts to isolate the Ruhr pocket during the spring of 1945 are described and analysed in German works by Axel Frick, *Als in Schildersche die Erde Bebt*⁶³ and Werner Bühner, *Bomben auf Arnsberg*.⁶⁴ These were for local history societies ('Heimatbund') and look at the effect of attacks within their locality. Inevitably these works concentrate on the effects on the ground, rather than strategic or operational detail, but supplement and provide useful correlation of information

⁵⁶ David Woodward, *The Tirpitz* (London: William Kimber, 1953).

⁵⁷ Jochen Brennecke, *The Tirpitz. The Drama of the 'Lone Queen of the North'* (translated by Frederick Holt) (London: Robert Hale, 1963).

⁵⁸ Léonce Peillard, *Sink the Tirpitz* (translated by O. Coburn) (London: Jonathan Cape, 1968).

⁵⁹ David Brown, *Tirpitz: The Floating Fortress* (London: Arms and Armour Press, 1977).

⁶⁰ Ludovic Kennedy, *Menace: The life and death of the Tirpitz* (London: Sidgwick and Jackson, 1979).

⁶¹ John Sweetman, *Tirpitz: Hunting the Beast* (Stroud: Sutton Publishing, 2000).

⁶² Patrick Bishop, *Target Tirpitz* (London: Harper Press, 2012).

⁶³ Axel Frick, *Als in Schildersche die Erde bebte* (Leopoldshöhe: Heinz Kamieier, 1985).

⁶⁴ Werner Bühner, *Bomben auf Arnsberg 1940-45* (Arnsberg: Verlag F W Becker, 1995).

obtainable from Allied sources in the form of the United States Strategic Bombing Surveys and other Intelligence documentation.⁶⁵ Winston Ramsay, *After the Battle No. 79, The Bielefeld Viaduct* contains an account of operations against this target in the magazine's standard format – providing a useful and accurate, if necessarily abbreviated record of the operation.⁶⁶

Aside from its operations much of the appeal of No. 617 Squadron lies in its unique arsenal of weapons. Study of their development and use in turn provides a further perspective on the Squadron's history which has traditionally been tied into the commonly understood narrative of events. Three works examine the technology and engineering behind the weapons and equipment used by the Squadron: Stephen Flower, *A Hell of a Bomb – How the Bombs of Barnes Wallis helped win the Second World War*⁶⁷ and Iain Murray, *Bouncing Bomb Man. The Science of Barnes Wallis*⁶⁸ and also *Dambusters 1943 Onwards (All marks and models)*.⁶⁹

While the development of UPKEEP is well recorded by Sweetman (1982), *Operation Chastise*, Flower balances this with equal emphasis on the protracted development of the (ultimately never used) HIGHBALL. The development of TALLBOY, superficially covered by Brickhill, is described with detail taken from primary documents. Flower effectively integrates scientific and engineering aspects, both in the development of weapons and the modifications to aircraft to carry them, with the operational record – although in the latter aspect, a lack of cross-referencing perpetuates errors contained in the Squadron Operations Record Book and other documentation. Nevertheless the work demonstrates a considerable amount of research and skill in combining a multiplicity of sources into a comprehensive account of the development and use of Wallis's weapons. In respect of TALLBOY the work becomes an operational record of both Nos. 9 and 617 Squadrons,

⁶⁵ TNA Air 48/119: United States Strategic Bombing Survey: *Reports. Physical Damage Division Reports. Germany. No.59: Arnsberg, railway viaduct* and TNA Air 48/121: United States Strategic Bombing Survey: *Reports. Physical Damage Division Reports. Germany. Bielefeld, railway viaduct.*

⁶⁶ Winston Ramsay (ed), *The Bielefeld Viaduct - After the Battle Magazine, No. 79* (Harlow: After the Battle, 1993).

⁶⁷ Stephen Flower, *A Hell of a Bomb. How the Bombs of Barnes Wallis helped win the Second World War* (Stroud: Tempus, 2002). (Reprinted and re-titled as *Barnes Wallis's Bombs – Dam Buster, Tallboy and Grand Slam*, (Stroud, Amberley, 2010); and again in revised form, retitled as *The Dam Busters: An Operational History of Barnes Wallis's Bombs* (Stroud: Amberley, 2013).

⁶⁸ Iain R. Murray, *Bouncing Bomb Man. The Science of Sir Barnes Wallis* (Yeovil: Haynes, 2009).

⁶⁹ Iain R. Murray, *Dam Busters: 1943 onwards (all marks and models)* (Yeovil: Haynes, 2011).

thus permitting comparisons to be made between the two units beyond those usually drawn on the basis of the *Tirpitz* operations alone.

Murray's *Bouncing Bomb Man* provides a comprehensive overview of Wallis's engineering projects, covering similar ground, with greater emphasis on the technology. Whereas Flower draws heavily on restating primary sources, Murray's scientific background permits greater insight into the engineering and technical aspects, with clear and concise explanation of key aspects and informative appendices. This is the only work to discuss the technical issues relating to the Rothensee ship lift – a target which will become highly significant later in this thesis.⁷⁰ Murray's *Dam Busters 1943 onwards* goes into greater detail the technical aspects of Wallis's weapons and the ancillary equipment and modifications to aircraft required to carry and aim them. He also clarifies the common misapprehension that all No. 617 Squadron's weapons were developed by Wallis.⁷¹ In this respect he covers the design and operation of the 12,000lb HC bomb and JOHNNY WALKER bomb. Sample targets and operations are also considered. The author's skill in distilling a large amount of research down to salient points combined with the book's design (echoing the publisher's range of vehicle workshop manuals) results in a basic, easy-to-access appreciation of the technical aspects and theory. Since the work is intended to appeal to a broad readership it is, of necessity, simplified and stylised, but that does not reduce its value as a useful aide memoire for more serious research.

The role and work of the Squadron is recounted in biographies of some of the major players who formulated policy or were in positions of command. Key within the Air Ministry, was Gp Capt Sydney Bufton, Director of Bomber Operations (DB Ops). Bufton's biographer Hugh Melinsky, *Forming the Pathfinders*, provided an overview of the issues concerning the future of the Squadron and further use of UPKEEP post-CHASTISE, but in the main this rather slim work concentrates on Bufton's establishment of the Pathfinder Force and then addresses major operations and campaigns.⁷² It omits nearly all Bufton's involvement with the Squadron's operations during 1944 – a period during which he exerted as great, if not greater influence than for Operation CHASTISE and then touches again on the well-known facts regarding the protracted development of GRAND SLAM. The deficit is addressed to some extent by Rex Cording's doctoral thesis, *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*

⁷⁰ Murray, *Bouncing Bomb Man*, pp 141-143.

⁷¹ Ibid. p 60. The Squadron operated for nearly a year using the 12,000lb HC bomb, a weapon developed by Service channels.

⁷² Hugh R. Melinsky, *Forming the Pathfinders. The Career of Air Vice-Marshal Sydney Bufton* (Stroud: The History Press, 2010).

Bomber Offensive.⁷³ This highly detailed and analytical work describes Bufton's key conflicts with Harris, illustrating the former's independent thinking and his ability to promote his views amongst senior officers. Taken in the context of this thesis, it also serves to underline the complexity of Bufton's role as DB Ops and the multiple challenges that he faced.

At Command level, Dudley Saward, *Bomber Harris*⁷⁴ and Henry Probert, *Bomber Harris – His Life and Times* both offer biographies of Air Chief Marshal Harris.⁷⁵ Saward knew and worked with Harris (as his Senior Radar Officer) and was immersed in the atmosphere of high command. His work is also the 'authorised' biography, written during Harris's lifetime. These factors can be seen as double-edged, the benefit of inside knowledge being tempered by loyalty to a colleague and friend, plus personal involvement in some of the events and decisions recounted. Saward's work accordingly requires source-critical care, to guard against views that could be self-serving or indicate bias. Probert's work used Harris's papers, and is the more searching, written at greater time and distance from both events and the individual by a former Head of Air Historical Branch. While both works provide insight into the political and strategic issues faced by Harris, Probert makes greater reference to Squadron's role and Harris's consideration of the requirement for specialist units.⁷⁶

There is a dearth of published work on the key personality at No. 5 Group, AVM the Hon Sir Ralph Cochrane. As is the case with nearly all the Group Commanders (other than AVM Donald Bennett of No. 8 (PFF) Group) there is no biography and he left no deposited collection of his papers. Perversely, an appreciation of Cochrane can be found in Bennett's *Pathfinder*.⁷⁷ Denying any personal animosity between himself and Cochrane, Bennett pays tribute to the latter. If there is animosity in this respect it is directed at Harris's implied favouritism towards Cochrane.⁷⁸ Even so, Bennett is forthright in his criticism of Cheshire's low level marking technique – justifying this by reference to the fact that it was never used against Berlin, but ignoring its other

⁷³ Rex F. 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 PhD Thesis, Canterbury, New Zealand, 2006). http://ir.canterbury.ac.nz/bitstream/10092/915/1/thesis_fulltext.pdf

⁷⁴ Dudley Saward, *Bomber Harris* (London: Sphere Books, 1984).

⁷⁵ Henry Probert, *Bomber Harris – His Life and Times* (London, Greenhill Books, 2001).

⁷⁶ Ibid. pp 255-6, 313 and 402.

⁷⁷ Donald Bennett, *Pathfinder* (London: Panther Books, 1960).

⁷⁸ Ibid. p 155.

successes.⁷⁹ Otherwise, from published sources, insight into this commander, such as it is, has to be obtained through other works referenced above.

As with the history of the Squadron itself, there is no shortage of work concerning two of its three major commanders. Wg Cdr Guy Gibson provided a semi-autobiographical account, *Enemy Coast Ahead*, which concluded with his own account of the Dams Raid.⁸⁰ Edmund Burke, *Guy Gibson VC* produced a largely a third person rendering of Gibson's own work. The approach of the sixtieth anniversaries of the Dams Raid and Gibson's death brought forth a number of works: Alan Cooper's *Born Leader*,⁸¹ Susan Ottaway's *Dambuster*⁸² and Richard Morris's *Guy Gibson*.⁸³ Cooper offered a fundamental, (at times not always accurate) narrative; Ottaway included interesting family material; Morris painted a fuller, rounded picture of the Squadron's first Commanding Officer. Morris also provided passing insight into Gibson's successor, Sqn Ldr George Holden. The study of the Squadron's commanders was furthered by Morris with *Cheshire*, his biography of Wg Cdr Leonard Cheshire⁸⁴. Morris's studies provide perceptive insight not only into the subjects' character but also their influence on the Squadron's achievements. Earlier biographies of Cheshire by Russell Braddon, *Cheshire VC*⁸⁵ and Andrew Boyle, *No Passing Glory*,⁸⁶ provide snapshots of the Squadron, and occasionally personalities, complementing the ground already laid by Brickhill, but add little more by way of insight into Squadron policy. There are no biographies of the Squadron's later commanders, Wg Cdr James 'Willie' Tait and Gp Capt John Fauquier, although useful pen portraits of Tait are found in Morris's *Cheshire* and Bishop's *Target Tirpitz*.⁸⁷

Other works written by or relating to aircrew members of the Squadron almost all focus on social and operational aspects. Tom Bennett (1986), *The Dambusters at War*, focuses on incidents or operations involving individual members of the Squadron. Bennett was a former Squadron Navigation Leader who devoted much of his life in retirement to ensuring the accurate recording of the Squadron's wartime achievements. Well researched and drawing on both official and personal sources together with

⁷⁹ Ibid. p 156.

⁸⁰ Guy P. Gibson, *Enemy Coast Ahead* (London: Michael Joseph, 1946).

⁸¹ Alan W. Cooper, *Born Leader. The Story of Guy Gibson, VC* (Bromley, Independent Books: 1993).

⁸² Susan Ottaway, *Dambuster. A life of Guy Gibson VC* (London: Leo Cooper, 1994).

⁸³ Richard K. Morris, *Guy Gibson* (London: Viking, 1994).

⁸⁴ Richard K. Morris, *Cheshire. The biography of Leonard Cheshire, VC, OM* (London: Viking, 2000).

⁸⁵ Russell Braddon, *Cheshire VC. A Story of War and Peace* (London: Evans Brothers, 1954).

⁸⁶ Andrew Boyle, *No Passing Glory. The Full and Authentic Biography of Group Captain Cheshire VC, DSO, DFC* (London: Collins, 1955).

⁸⁷ Morris, *Cheshire*, pp 99-100 and Bishop, *Target Tirpitz*, pp 323-328.

information from German records, this work captures well the spirit of life on the Squadron. Of other crew members' recollections, *Lower than Low* by Australian air gunner Tom Simpson is based on diaries he kept throughout the war,⁸⁸ while 'Chan' Chandler, *Tail Gunner – 98 Raids in World War II* is the posthumously published memoirs of another rear gunner.⁸⁹ Harry Humphries was the Squadron Adjutant from 1943 to early 1945 and during that period built up his own collection of material with the intention of writing the Squadron history post-war. Leonard Cheshire persuaded him to make this available to Brickhill who was researching for *The Dam Busters*. Humphries's own subsequent work, *Living with Heroes*, makes an interesting comparison.⁹⁰ A book of several parts, it starts in reasonable narrative format and then progresses increasingly to scrapbook and note form. It is in the latter sections that there real interest lies for here, unedited, lie raw observations of life and minor personalities.⁹¹ *Australia's Dambusters* by Colin Burgess is a collection of pen portraits of Australian aircrew who served with the Squadron.⁹² A combination of personal recollection and archival research, this work again contributes to an understanding of the cosmopolitan nature of the Squadron, as does David Birrell's *Big Joe McCarthy*, a biography of an American serving with the Squadron.⁹³ These works are however, biographical and do not analyse policy, strategy or tactics.

To these works a multitude of magazine articles and lesser works may be added. Although numerous, those in the popular consumer press and covering a wide range of topics generally provide little new analysis. Few articles in academic journals focus specifically on the Squadron; those that do concentrate on aspects of Operation CHASTISE from the perspectives of weapons development, tactics or effectiveness.⁹⁴ Academic study in general favours the broader issues of the bomber offensive: Harris

⁸⁸ Thomas D. Simpson, *Lower than Low* (Sandy Bay, Tasmania: Libra Books Pty Ltd, 1995).

⁸⁹ Edmund B. Chandler, *Tail Gunner - 98 Raids in World War II* (Shrewsbury: Airline, 1999).

⁹⁰ Harry R. Humphries, *Living with Heroes. The Dambusters* (Norwich: The Erskine Press, 2003).

⁹¹ *Ibid.* pp 91-104.

⁹² Colin Burgess, *Australia's Dambusters* (Loftus, Australia: Australian Military History Publications, 2003).

⁹³ David Birrell, *Big Joe McCarthy, the RCAF's American Dambuster* (Walton on Thames: Wing Leader Publishing, 2012).

⁹⁴ John Sweetman, *Barnes Wallis's other Bouncing Bomb*, *Air Power Review*, Summer 2002, 5 (2), pp 105-121 and Autumn 2002, 5 (3), pp 47-55; Tim Webster, *The Dam Busters Raid*, *Air Power Review*, Spring 2004, 7 (1), pp 59-75; M. Gilligan, *Does the Dambusters Raid Deserve its Growing Reputation as Operationally Daring but Strategically Flawed?* *Air Power Review*, Spring 2006, 9 (1), pp 27-48; Charles S. Cockell, *The Science and Scientific Legacy of Operation Chastise*, *Interdisciplinary Science Reviews*, 2002, 27 (4), pp 278 – 286.

and his leadership, or aspects of the overall strategic bomber offensive.⁹⁵ The question of area versus precision attack, relevant to an examination of the Squadron's work, is inevitably focused on comparison between the night attacks by Bomber Command and the so-called precision daylight operations by the USAAF.⁹⁶ Others address the socio-political aspects of campaigns.⁹⁷ The Squadron's role in relation to bombing policy and strategy, and how this was planned and the components co-ordinated has remained unexplored.

To return to the initial question: "Is there any more to say?" It cannot be an exaggeration to say that no other Royal Air Force Squadron has received such an amount of study and attention. The operational narrative has been well covered. It is easy to produce, the framework lies in contemporary documents notably the Operations Record Book (RAF Forms 540 and 541).⁹⁸ Narrative derived from this can be expanded by reference to the No. 5 Group Records and personal recollections from published and unpublished sources.⁹⁹ It can be placed in the overall context both of Bomber Command's operations or No. 5 Group's operations by reference to works described earlier.

More recent works have developed a further approach to the analysis and understanding of the bomber offensive. *Targeting the Reich* by Robert Ehlers¹⁰⁰ and Randall Wakelam's *The Science of Bombing*¹⁰¹ address the use of Intelligence and Operational Research for the planning and assessment of the offensive. Ehlers, professor of military history at the USAF's School of Advanced Air and Space Studies at Maxwell Air Force Base, examines

⁹⁵ Sebastian Cox, *Sir Arthur Harris and some Myths and Controversies of the Bomber Offensive*. RAF Historical Society Journal, 2010, 47, pp 11-12.

⁹⁶ Randall T. Wakelam, *Bomber Harris and Precision Bombing – No Oxymoron Here*.

Journal of Military and Strategic Studies, 2012, 14 (1). Available at:

<http://www.jmss.org/jmss/index.php/jmss/article/view/446/445>

W. Hays Parks, 'Precision' and 'area' bombing: Who did which, and when?

Journal of Strategic Studies, 1995, 18, (1), Special Issue: Air Power Theory and Practice. pp 145-174.

Tami Davis Biddle, *British and American approaches to strategic bombing: Their origins and implementation in the World War II combined bomber offensive*. Journal of Strategic Studies, 1995, 18, (1), Special Issue: Air Power Theory and Practice, pages 91-144.

⁹⁷ Lindsay Dodd and Andrew Knapp, 'How many Frenchmen did you kill?' French History (2008), 22 (4), pp 469-492.

⁹⁸ TNA Air 27/2128: No. 617 Squadron: Operations Record Book 1943 Apr-1945 May.

⁹⁹ TNA Air 25/109A: No. 5 Group Operations Record Book 1937 Sept - 1943 Dec and Air 25/110: No. 5 Group Operations Record Book 1944 Jan - 1945 Dec.

¹⁰⁰ Robert S. Ehlers Jr, *Targeting the Reich. Air Intelligence and the Allied bombing campaigns* (Kansas: University Press of Kansas, 2009).

¹⁰¹ Randall T. Wakelam, *The Science of Bombing. Operational Research in RAF Bomber Command* (Toronto: University of Toronto Press, 2009).

the execution of more effective operations through the use of increased and more accurate intelligence, enabling more sophisticated planning and the allocation of appropriate resources to targets. He makes the case that the entry of the US Eighth Air Force into the European theatre demonstrated the potential of effective daylight precision bombing by heavy bombers and furthered the desire of the RAF to achieve similar results at night using the new technology entering service.¹⁰² In the face of Portal and Bufton's growing support for this strategy, Harris was still reluctant to divert Bomber Command from city targets to what he remained convinced were 'panacea' targets of limited worth. Eulers examines the development of the debate between Portal and Harris, from the planning of the pre-OVERLORD transportation campaign through to the oil campaign during the winter/spring of 1944/45. Eulers attributes Bomber Command's increasing accuracy to new equipment and the Pathfinder Force, enabling more concentrated attacks on city targets and the decisive attacks on French railway targets. No specific mention is made to the innovations developed by No. 617 Squadron and No. 5 Group, or the key part played by them in the Ruhr transportation plan of spring 1945.

Wakelam, assistant professor for Defence Studies with the Royal Military College, attributes Bomber Command's increasing accuracy not only to technology, but also the development of technique and paints a much more shaded picture of the debate. He points out that Harris was not totally against accurate, pin-point attacks, but that he considered that they were only possible by small numbers of aircraft.¹⁰³ In addition he was prepared to use such operations in conjunction with main force operations.¹⁰⁴ By doing so Wakelam opens a path for further discussion of the role of No. 617 Squadron.

John Stubbington, *Kept in the Dark* also compared the use of intelligence and technology by Bomber Command and the US Eighth Air Force to achieve decisive effects.¹⁰⁵ Stubbington, a retired Wing Commander, formerly working in Intelligence, postulated a mis-match between both the USAAF and USSTAF which had access to ULTRA material and Bomber Command, which was denied it (other than in disguised form).¹⁰⁶ Portal's inability to reveal the source and significance of information which shaped policy, combined with Harris's mis-trust of Intelligence and the imprecise wording of the Bomber directives allowed Harris the latitude to continue with his policy of area

¹⁰² Ehlers, *Targeting the Reich*, pp 139-140.

¹⁰³ Wakelam, *The Science of Bombing*, p 185.

¹⁰⁴ Ibid. p 195.

¹⁰⁵ John 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).

¹⁰⁶ Ibid. pp 271-2.

bombing. Stubbington examined the relative Bomber Command and USAAF definitions of 'precision bombing'. He concurred that after 1943 (and thus post-CHASTISE) Bomber Command should have been able to mount considerably more effective precision operations against selective targets, executed by smaller forces.¹⁰⁷ Like Ehlers, the 'transportation vs oil' debate, is examined, but again in the light of main force's ability to make precision attacks.¹⁰⁸ No. 617 Squadron's accuracy and destructive capabilities are discussed, but are noted as being atypical requiring not only specialist equipment and specialist aircrew, but also good visibility. This could not be guaranteed for main force attacks and such precision could not be achieved using blind bombing equipment or sky marking.

The substance and emphasis in works about this subject has evolved in style over time. Such changes have in part been influenced by the background and expertise of the authors and the audience for whom they are writing. Another major factor has been the nature and availability of source material.

Early works were written by former serving officers, either as personal memoirs or as accounts of units with which they served.¹⁰⁹ Some had been collecting material for such an eventuality during their service careers, so permitting them unofficial access to official material. In general they were senior figures, who were writing for a public eager to read of the story from those in command. The popular authors of the 1950s were journalists by trade. Many were themselves former servicemen. They lacked access to official records and relied heavily on personal interviews and recollections.¹¹⁰ Their works were action-packed, page-turning narratives, written for and read by an audience who had been through the conflict and were keen to see a portrayal of the bomber offensive in a chivalric style. This was also the period of the classic British war film, of which *The Dam Busters* is the most popular and revered.¹¹¹ These books and the film have produced the popular image of Bomber Command that has persisted for three generations of post-war Britons.

The early 1960s introduced academic analysis in a manner not previously seen.¹¹² The gradual release of official material permitted access to primary sources although most of those who first read them were practising historians and the journalists who reported

¹⁰⁷ Ibid. p 237.

¹⁰⁸ Ibid. pp 296-299.

¹⁰⁹ Gibson, *Enemy Coast Ahead*; Harris, *Bomber Offensive*; Lawrence No. 5 Bomber Group RAF.

¹¹⁰ Brickhill, *The Dam Busters*, Braddon Cheshire VC, and Boyle *No Passing Glory*.

¹¹¹ See fn 6, p 20.

¹¹² Webster and Frankland, *Strategic Air Offensive*.

their conclusions did not always get the story straight.¹¹³ The opening of official sources was accompanied by relaxation of secrecy surrounding the working of the dams bomb UPKEEP, which stimulated further interest in the operation and the Squadron that carried it out.¹¹⁴

In the next decade a new study combined interviews with Barnes Wallis and other eye witnesses with research in both British and German archives.¹¹⁵ Serialised in a popular Sunday newspaper this account of the Dams Raid brought academic research in this subject to a new audience and ploughed the ground in preparation for a new generation of authors.

The further opening of official archives triggered a host of works. Authors across a spectrum from academic historians to an emerging breed of amateur aviation historian quarried the archives seeking new material. The result was a plethora of works whose diversity serves to illustrate differences in treatment afforded by professional historian and untrained researcher using largely material from the same sources.¹¹⁶

The past twenty years have seen an increase in the number of veterans' accounts providing social and personal aspects, or personal narrative.¹¹⁷ These are valuable but need to be treated with caution especially when they have been developed after the event from personal diaries or individual recollections. Oral historians have skilfully managed to edit taped and personal interviews to exclude inaccurate or false memory; however there remains the need to cross reference the oral and documentary record.¹¹⁸ For the purist such a work may be thought to lack academic rigor, but if so this is a weakness of the source material, not necessarily of the author.

As the number of survivors dwindles a new generation of historians seeks to quarry their letters and memoirs. Those who can combine scholarship and human interest with

¹¹³ Verrier, *Bomber Offensive*.

¹¹⁴ Bruce Robertson, *Lancaster – The Story of a Famous Bomber* (Letchworth: Harleyford, 1964), p 4.

¹¹⁵ David Irving, *The Night the Dams Burst* (1973) Available at: <http://www.fpp.co.uk/bookchapters/articles/dambusters/1.html> [Accessed 11 Feb 14]. First published in the *Sunday Express*, May 1973. During this period David Irving pioneered new research, accessing new sources and offering new interpretations. He talked to Wallis and his language skills permitted access to unexplored German sources. When writing *The Dam Busters*, Brickhill had written to Wallis who declined to be interviewed.

¹¹⁶ Sweetman, *Operation Chastise* and Cooper, *Men who Breached the Dams*.

¹¹⁷ Simpson, *Lower than Low*; Chandler, *Tail Gunner*.

¹¹⁸ Arthur, *Dambusters*.

pacey writing produce a page turning style akin to Brickhill. The wheel has turned full circle, but in doing so has become factually more robust.¹¹⁹

Over the last thirty years, an increasingly technology-literate audience has emerged that is as interested in the 'How?' as the 'What?' or 'When?' of events. The result has been a genre of works examining the science and engineering behind the weapons produced for Bomber Command, and, more recently, those used by the Squadron.¹²⁰ Such research has attracted authors from scientific and engineering backgrounds who have brought new perspectives and methods of investigation. These in turn have led to the re-examination of existing archives with a focus on technology and production. In many cases the records are incomplete and unsatisfactory.¹²¹ The adoption of a scientific approach now uses practical research to establish empirical data, thereby filling gaps in the archival record, or validating that which survives.¹²²

It is over fifty years since Webster and Frankland addressed the strategic aspects of the bomber offensive. More recently authors and publishers have become aware of a growing interest in the more esoteric areas of planning such as Intelligence and Operational Research and logistics.¹²³ These have broken new ground in relation to the overall strategy and conduct of the broad bomber offensive. There is now scope to apply their approach to a new assessment of the activities of individual units. This is the basis for the approach taken by the thesis.

Despite extensive writing, there has been no comprehensive study of the factors that determined the Squadron's activity. The absence of these creates the impression that, having created a precision bombing squadron, Harris kept it for use whenever such attack by heavy bombers was required. As large bombs were developed the Squadron dropped them with unprecedented accuracy sufficient to destroy any specific target

¹¹⁹ Holland, *Race to Smash the Dams*.

¹²⁰ John A. MacBean and Arthur S. Hogben *Bombs Gone. The Development of British Air Dropped Weapons from 1912 to the Present Day* (Wellingborough: Patrick Stephens Ltd, 1990) cover bombs in general. Murray, *Bouncing Bomb Man and Dambusters 1943 Onwards (All marks and models)* focus on technology for the Squadron.

¹²¹ Only partial documentation for the development of UPKEEP survives. The impression gained is that much evolved during development without being formally recorded.

¹²² This has been prompted largely by the opportunity for the production of television documentaries recording the progress of such experimentation: QinetiQ: *Dambusters* (Tigress Productions for Channel 4, May 2003); Dr Hugh Hunt of Cambridge University Engineering Dept: *Dambusters – Building the Bouncing Bomb* (Windfall Films for Channel 4, 2011). To date this approach has been confined to the development of UPKEEP.

¹²³ Ehlers, *Targeting the Reich; Stubbington, Kept in the Dark; Wakelam, The Science of Bombing* and Roy Irons *The Relentless Offensive. War and Bomber Command, 1939-1945* (Barnsley: Pen & Sword, 2009).

almost at will. A self-fulfilling prophecy has been created. The reality was more complex.

By adopting a new approach, this thesis establishes the means and motives behind the Squadron's wartime role. Instead of looking retrospectively at decisions made, targets attacked and bombs dropped it reveals the influencers and influences behind the operations. Critically, it also shines light on operations that were proposed but never executed - a study of what might have been a parallel universe. Such unfulfilled projects shed light on intentions. Uniquely, they also reveal the degree to which the planners' intentions never came to fruition. Hence the thesis is as much an examination of things that did not happen as those that did. In comparing those two worlds, it is not only essential to identify the differences, but also to understand why they occurred; a combination of factors, strategic, tactical and technical. As a result a new picture emerges of the methods used by the Air Ministry and Bomber Command to manage, facilitate and employ this unique élite unit, and the determinants of its role and capability.

Harris's decision to maintain the Squadron for special duties created a new scenario for the planners and policy makers. Unlike an 'ordinary' new squadron how would it conform to existing main force policy and planning? A squadron operating only on an ad hoc basis when special targets demanded was not an economic use of resource, nor was it good for morale. How were targets selected, and what did they entail with regard to equipment and weapons? When new weapons were required, how were these developed and supplied? Additional targets needed to maintain operational momentum had to be appropriate for the Squadron's existing weapons and equipment and unsuited to attack by main force.

The objectives of this thesis are to trace the detail and dynamics of the interplay between policy and personalities, targets and target selection, weapons and equipment and techniques and role. Previous histories have concentrated on the operational aspects and/or weapons development.¹²⁴ To fully understand the Squadron's role it is necessary not only to place its operations in the context of the bomber offensive in general, but also to appreciate how decisions were made, by whom and for what reasons. It is also important to appreciate the mutual influences between weapons development, delivery methods and targets; political and industrial implications of the Squadron's work; and the organisation and logistics required to equip, man and manage the Squadron.¹²⁵

¹²⁴ Operational narratives by Brickhill, Cooper and Ward; weapons development by Flower and Murray.

¹²⁵ See Appendix 2, p 242.

Placing the Squadron's operations into the broader context of the bomber offensive, to what extent did they reflect Air Staff policy for Bomber Command? Bomber Command was a strategic weapon. However, the nature of the Squadron's operations and their apparent disconnect from main force activity has created the impression that both the Air Staff and Headquarters Bomber Command saw No. 617 Squadron as a tactical tool within the overall strategic remit. Closer examination of the directives issued to Harris reveals that far from operating independently and outside the bombing policy as perceived for the main bomber force, the Squadron was used to extend the Command's reach and attack prescribed target sectors that were beyond the scope of main force.

Since overall bombing policy was determined by the directives issued to Harris, how and by whom were operational requirements for the Squadron determined and appropriate targets selected? The traditional view established by Brickhill and echoed by subsequent narrative writers suggests that these decisions were primarily the remit of Harris, aided by Cochrane, with Wallis providing technical advice. As will be seen, this view is not only over-simplistic, but fails to acknowledge a significant element of the planning chain that was also instrumental in the development of overall policy, the Directorate of Bomber Operations. Study of the Directorate's role reveals the influence of other agencies, such as the Ministry of Economic Warfare, and the political factors in addition to the strategic and tactical considerations involved in target allocation. Also considered are the changes in the Directorate's involvement and emphasis during the period running up to OVERLORD and in the subsequent months, when the Command was tasked to support the invasion, and later when the determination of targets reverted to the Combined Strategic Target Committee. What were the effects of these changes on both the Squadron's deployment and Harris's involvement in decisions for its use?

The Squadron's specialist and unconventional weapons were not the only determinants of targets and policy. The weapons required modified aircraft to carry them and special equipment and techniques to ensure their accurate aim. Existing weapons required additional appropriate targets for their continued utilisation. Plans for operations requiring new weapons not only had to address strategic considerations and the development of tactics. Operational planning had to take into account the time necessary for the development and production of both weapons and aircraft. Resources had to be allocated and the required production quantities determined, taking into account wartime shortages of material and labour. How were these and other considerations affecting the introduction and use of weapons co-ordinated and what impact did they have on the Squadron's role?

Delays in decision making and the late introduction of new weapons had significant impact on both target selection and the execution of operations. What were the reasons for such delays and how did they affect target selection and other aspects of the Squadron's operations?

Examination of the planning process also reveals ways in which the Squadron was used to develop equipment and techniques to benefit other parts of the Command. While the development of the low level marking technique is well-known, its origins and manner of development are mis-represented by extant works. The extent to which the Squadron was used for other development trials and that such trials extended into operational use has hitherto been largely ignored, yet they are further indicators of the way in which the Squadron was viewed.

In order to explore the relationships, influences and links between the various layers of planning the years covered have been broken down into appropriate periods to accommodate the multiple influences acting at any one time. These timescales have been determined by key phases of Squadron activity; the phases are not always synchronous with those of the planners. They are:

- June –September 1943: attempts to find new targets for the Squadron leading to the attack on the Dortmund Ems Canal 16 September 1943.
- September 1943 – January 1944: a switch of role and accommodating the delay caused by the slow development of new weapons.
- February - May 1944: exploiting the Squadron's accurate marking ability and addressing demands placed on the planners by the impending invasion.
- June – August 1944: finding new uses for a weapon whose planned purpose was no longer apposite.
- September 1944 – January 1945: consolidation of the Squadron's role to address key requirements not appropriate for main force.¹²⁶
- February – April 1945: attempts to broaden the Squadron's role and address its immediate future following V-E Day.

Each chapter examines the nature of changing circumstances and influences faced by the planners, the way in which existing policy was modified to accommodate them and the effect of this on the way the Squadron was equipped and used. By adopting a multi-

¹²⁶ In this sense 'main force' refers to standard Squadrons comprising the main striking force of Bomber Command.

layered approach a new picture emerges. This is the first time that such a technique has been used to analyse the Squadron's wartime role.

CHAPTER 1 June – September 1943

The Dams Raid was undertaken by No. 617 Squadron, specially formed with hand-picked aircrew, who had trained specifically for this operation. The Squadron had been equipped with the unique back spun 'bouncing bomb' (UPKEEP) designed specifically to breach dams, which necessitated specially modified aircraft to carry it. Air Chief Marshal Sir Arthur Harris, Commander in Chief (C-in-C) of Bomber Command had had little faith in the concept.¹ No. 617 Squadron was formed only after an instruction from Air Chief Marshal Sir Charles Portal, the Chief of the Air Staff (CAS), who supported the idea.²

The success of the operation in breaching the Möhne and Eder Dams, together with contemporary perceptions of the damage caused by the resulting floods proved the validity of the weapon. Decisions were now required as to whether UPKEEP should be deployed again, whether the Squadron should be regarded as an addition to the main force and, if not, how best it might be employed.

This chapter sets out to examine three linked themes in this area of process: first, to establish the relationships between Bomber Command and the planners who determined the Squadron's future; second, to ascertain the planners' ability to adapt their policies to meet changing requirements, and their readiness to invest in new concepts; and third, to identify and examine the factors that informed the decisions that maintained the Squadron as a separate specialist unit. In exploring these, the chapter will reveal for the first time in detail the considerable number of options that were under consideration, the extent of efforts to find further targets for UPKEEP, and the growing realisation of the need for a new weapon. As these developed into two distinct strategies, neither of which was capable of immediate fulfilment but which would be a major influence on policy for the next twelve months, it will be found that a third, interim, option emerged. This resulted in an attack that hitherto has been regarded in the operational record as a logical evolution of CHASTISE. However, as this chapter will show, this was a compromise in both weapon and target.

¹ TNA Air 14/842: UPKEEP: Progress reports. Annotation by Harris to loose Minute Saundby to Harris, 14 Jan 43.

² TNA Air 8/1234: Operations UPKEEP & HIGHBALL. Note Portal to Harris, 19 Feb 43.

Decisions as to the Squadron's future were not purely in Harris's gift. The direction, policy and targeting for Bomber Command were the result of an entwined chain of command.

Ultimate responsibility for the general direction of the War rested with Winston Churchill and the War Cabinet. As Prime Minister, Churchill also appointed himself as Minister of Defence, which accorded him the additional role of supervision and direction of the Chiefs of Staff (COS) committee.³ This sub-committee of the War Cabinet, comprising the head of each of the three Services, with General Sir Hastings Ismay, as its secretary, was responsible for the overall conduct of the British military contribution component of the war effort.⁴

From the Royal Air Force perspective, the head of command at the Air Ministry was ACM (later Marshal of the Royal Air Force) Sir Charles Portal, Chief of the Air Staff. In addition to his position on the COS Committee, Portal also attended Cabinet and Defence Committees. Portal reported through the under-Secretary of State for Air to the Secretary of State for Air, Sir Archibald Sinclair. Although not a member of the War Cabinet, Sinclair was President of the Air Council and had access to Churchill and was invited to selected Cabinet meetings. Portal was responsible for strategic decisions for the entire Royal Air Force. This necessitated the delegation of many responsibilities to his immediate subordinates. Below Portal were the Vice-Chief of the Air Staff (VCAS) Air Marshal Sir Douglas Evill and the Assistant Chief of the Air Staff (ACAS) Air Vice-Marshal (shortly to become Air Marshal and Deputy Chief of the Air Staff (DCAS)) Norman Bottomley. Four Assistant Chiefs of the Air Staff (ACAS) reported to Bottomley. Each of these was responsible for their own portfolio: Policy (P), Intelligence (Int), Operational Requirements (OR) and Tactics (T). Bottomley himself was ACAS Operations (Ops).

Matters of policy were analysed and refined by the Air Staff before being taken by Portal to the COS for discussion. After further refining they would be referred to the War Cabinet, at which point Churchill would have the final decision. The process provided opportunity for input from departments other than the Services who might make contributions, or raise objections influencing the final outcome. Approved policy was

³ Winston S. Churchill, *The Second World War*, Vol II, *Their Finest Hour* (London: Cassell, 1952), p 15.

⁴ Matters requiring Anglo-American decision were discussed between COS Members (or their representatives from the British Joint Staff Mission in Washington) and their American counterparts, this joint body taking the title of Combined Chiefs of Staff (CCOS).

then communicated to Commanders in Chief of the relevant Commands by means of periodic directives issued by The Air Staff. The Directives were technically issued by the Air Staff and thus in theory by Portal. However, in practical terms they were usually issued by Bottomley on Portal's behalf.⁵ Directives to Harris defined the strategic objectives for the bomber offensive and prioritised target groups to be attacked. The identification and selection of targets relevant to agreed policy was the responsibility of a separate body, the Targets Committee, part of the Directorate of Bomber Operations (DBO).

The Air Ministry was divided into a number of Departments and Directorates. The Directorate of Bomber Operations had been established in 1940 by Harris who at the time was DCAS.⁶ The DBO had a diverse range of responsibilities. At one level it advised the Air Staff on organisation and composition of Bomber Command, including aspects of operational policy, equipment and weapons. As part of this remit, the Directorate played a key part in briefing the Air Staff when devising strategy and assisting in the drafting of directives prior to their being issued to Harris.

The Directorate's other role was to interface directly with Bomber Command. In this respect they acted as a representative in Whitehall, lobbied Ministries and various Government bodies on the Command's behalf and fought its corner against competing demands from the Army and Admiralty. Gp Capt Sydney Bufton, the Director of Bombing Operations (DB Ops), head of the DBO, was essential as a conduit and facilitator, enabling the Air Ministry and Command to work in concert with each other and other Departments. He was assisted by three subordinate Wing Commanders each with discrete areas of responsibility: operational planning and the selection of targets; current operations, Air Staff policy relating to the organisation of Bomber Command, and the provision of night navigational aids and Air Staff policy regarding the development and provisioning of aircraft, armament and weapons.⁷ Bufton was thus in a position to advise and exert exercise influence on officers above his rank, in respect of both policy and operational matters.

Harris's intent had been to create an organisation that would assist Bomber Command in achieving the objectives laid out in the directives. The Directorate would appreciate the Command's abilities and limitations when advising the Air Staff on policy. Likewise, once a directive had been issued the Directorate could assist Command by providing suitable

⁵ Cording, *The Other Bomber Battle*, p 55.

⁶ Probert, *Bomber Harris*, p 110.

⁷ Cording, *The Other Bomber Battle*, pp 5-7.

target lists and ensuring the provision of appropriate equipment. This would have worked well had it not been for a growing divergence of views between the Air Staff policy and Harris's belief that Bomber Command was best suited to area attacks. The situation was not helped by the fact that the directives were issued by Bottomley, who was junior in rank to Harris, although his position as ACAS (Ops) afforded him greater authority. An even greater bone of contention lay with the fact that DB Ops, who advised the Air Staff, drafted most of the directives and policed the policy in addition to chairing the Committee that provided Harris with his targets, was only a Group Captain. Harris resented what he considered to be interference in the operational running of his Command. He considered that "the Air Staff were there to provide policy guidance and help him when necessary, but not - as 'junior officers' - to tell him how to do his job."⁸

Buften had joined the Air Ministry as Deputy Director of Bomber Operations (DD B Ops) in November 1941.⁹ He succeeded to the post of Director in March 1943.¹⁰ He was a former bomber pilot and Squadron Commander who also had a solid grounding in engineering. He brought with him personal operational experience at a time when most senior officers in the Air Ministry and at Bomber Command were too old to have participated in the current conflict.¹¹ This stood him in good stead with Portal who at times sought Buften's advice as to the determination of policy, and even Churchill who valued Buften's ability to voice his (sometimes controversial) views in the presence of senior officers. His standing with Churchill was such that the latter referred to him as 'the little Air Commodore'.¹²

Buften believed that given the right organisation, equipment and opportunities Bomber Command could become a more precise instrument of war. During the summer of 1942 there had been a major confrontation with Harris. Harris had believed that each Group should have its own 'Target Finders', but Buften had also been promoting his own idea to the Air Staff, for a separate elite force to find and accurately mark targets for the entire main force. Portal supported Buften's idea and instructed Harris to implement it, resulting in the formation of the Pathfinder Force. Harris had no alternative but to

⁸ Probert, *Bomber Harris*, p 135.

⁹ Cording, *The Other Bomber Battle*, p 5.

¹⁰ *Ibid.* p 53.

¹¹ For details of Buften's operational career as Officer Commanding Nos. 10 and 76 Sqns (1940-41) and Station Commander, Pocklington, see Melinsky, *Forming the Pathfinders*, pp 25-36.

¹² Humphrey Wynn, 'Buften, Sydney Osborne (1908-1993)', *Oxford Dictionary of National Biography*, (Oxford University Press, 2004).

comply, believing that Bufton had achieved his aims by underhand means.¹³ The tension remained for the rest of the war, resurfacing again during April 1944.¹⁴

Bufton's role in planning policy for main force and his conflict with Harris are well documented by Rex Cording and Hugh Melinsky.¹⁵ However, his influence on policy and targeting specifically for the Squadron has remained largely unrecognised. This is in part due to popular belief that the Squadron operated largely independently of main force, and also the impression implied by Brickhill that the Squadron's operations and policy were determined by Harris and Cochrane, rather than implemented by them.

Operational command of the Bomber Force was delegated to Headquarters Bomber Command. From his Headquarters at High Wycombe Harris, as Commander in Chief assisted by his Deputy, AVM Robert Saundby, was responsible for achieving the objectives set out in the current directive. Each morning Harris would determine the coming night's operations. Targets were selected from a prioritised list drawn up by the DBO based upon factors that included the number of available aircraft and crews, weather conditions and enemy defences. Instructions detailing the outline plan and key information essential for all units would then be issued by teleprinter to the regional bomber Groups. The Groups in turn would add information in respect of their Squadrons' own requirements and pass them on to Stations and Squadrons.

By the summer of 1943 Bomber Command comprised six Bomber Groups, each covering an area of eastern England.¹⁶ No. 5 Group, the parent Group for No. 617 Squadron, with its Headquarters at Grantham, was commanded by AVM Sir Ralph Cochrane.¹⁷ Cochrane had previously served alongside Saundby in Iraq in 1922, when both airmen were part of No. 45 Squadron, commanded by (then) Sqn Ldr Arthur Harris. Cochrane was a strict but innovative commander, receptive to new ideas from both Command and Squadron level, a trait that was recognised and exploited by Harris. The chain of command then ran from Group Headquarters to Base Headquarters (a Base being the 'parent' for three airfields) and then to the individual Stations and Squadrons.

The three months following Operation CHASTISE saw decisions that would cast the die for much of the Squadron's war. First it is necessary to place the period in context.

¹³ For full discussion of the conflict triggered by creation of the Pathfinders see Webster & Frankland, *Strategic Air Offensive*, Vol. 1, pp 418–436. See also Probert, *Bomber Harris*, pp 225-227.

¹⁴ Probert, *Bomber Harris*, pp 267-70.

¹⁵ Cording, *The Other Bomber Battle*, Hugh R. Melinsky, *Forming the Pathfinders*.

¹⁶ A seventh Group, No. 2 Group, transferred to 2nd Tactical Air Force in May 1943.

¹⁷ From November 1943 No. 5 Group Headquarters would transfer to Swinderby.

The CASABLANCA directive issued in February 1943 defined Bomber Command's primary objective as: "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."¹⁸ Harris interpreted this as affirmation to pursue his policy of attacking major German cities.¹⁹ A month later on the night of 5/6 March, he commenced Bomber Command's offensive against Germany's industrial heartland. By 27 May, ten days after CHASTISE Harris had decided to switch his offensive from the Ruhr to other German cities, notably Hamburg.²⁰ The final attack of what became to be known as 'The Battle of the Ruhr' was mounted against Gelsenkirchen on 9/10 July.²¹ Additionally, following the Allied invasion of Sicily increasing demands were also being made for attacks against Italian targets to disrupt the supply of *matériel* and undermine morale.

The process during this period to determine the future of the Squadron has hitherto been little recognised or discussed.²² Standard narrative works concentrate on the operations.²³ Understandably they focus on the eventual outcome, an attack on the Dortmund Ems Canal. However, there are no explanations as to the origins of this operation, or probing of the extensive debate which preceded its execution. Similarly there has been only narrow appreciation of the time, effort and resources spent in seeking new targets for this UPKEEP.

Future policy for the Squadron evolved in several places and to a degree independently. Both the Air Ministry and Bomber Command realised that the existence of a specialist Squadron provided an additional and valuable resource. While there was common agreement that the Squadron should remain in existence there was there was no immediate consensus as to how it might be employed. The DBO was keen to pursue a weapons-led policy to exploit the advantages of UPKEEP, utilising the trained crews and specialist equipment that already existed for its delivery. While Harris and Bomber

¹⁸ Directive (xxviii), 21 January 1943, reproduced in Webster and Frankland, *Strategic Air Offensive*, Vol IV, p 153.

¹⁹ Webster and Frankland, *Strategic Air Offensive*, Vol II, p 15.

²⁰ Bomber Command Operations Record Book Appendices, 27 May 43 (Copy held by AHB).

²¹ Middlebrook and Everitt, *Bomber Command War Diaries*, p 406.

²² Original research by the author into the search for further targets for UPKEEP and efforts to develop the weapon was first published in Owen, R.M: *Raids the never were*, in Morris, R.K. and Owen, R.M, *Breaching the German Dams - Flying into History* (London: Newsdesk Publications, 2008), pp 64-72. This was a preliminary examination limited by the nature of the publication.

²³ Cooper, *Beyond the Dams*, pp 13-30 and Ward, *The Definitive History and Forging of a Legend*, pp 87-122.

Command saw the justification for this policy they were looking at a broader picture. By harnessing the experience and skill of the aircrew, rather than simply exploiting the potential of UPKEEP, the Squadron could be developed into a multi-purpose unit capable of being tasked for a wide variety of roles that might require special training or involve the use of specialist equipment. Thus Harris would have at his disposal a unit capable of addressing tasks that might otherwise require the depletion of Main Force in order to equip and train for bespoke operations. At the same time he would also be retaining for operational use some of his most experienced aircrew, who would otherwise have been transferred to non-operational roles.

Harris appears to have taken the decision to retain the Squadron as a specialist unit within days of CHASTISE.²⁴ By the beginning of June he had formulated a policy. It would not be used for ordinary operations, but would undertake tasks that required special training or special equipment that called for experienced and skilled aircrew. The operations would not be particularly hazardous and the Squadron would operate only infrequently, probably only once a month.²⁵ Bomber Command's priority must lie with the offensive against large industrial towns. There must be no diversion from this. Attacks on targets of importance requiring special training must be the sole prerogative of No. 617 Squadron.²⁶

Despite the wider implications, Bufton interpreted this as relating primarily to further operations with UPKEEP. However this illustrates something which will recur; a tendency for some of the protagonists to talk past each other or to misunderstand what other parties were saying. In reality Harris and Cochrane were looking at wider horizons.

Both approaches required the recruitment of further experienced aircrew to make good the losses of CHASTISE and bring the Squadron back to sufficient strength to execute a further attack with UPKEEP as soon as possible. To meet Harris's intent, he decreed that the Squadron would also train for high altitude bombing.²⁷ Neither of these tasks could be completed quickly and achieve these objectives the Squadron was made non-

²⁴ Possibly strongly influenced by the Air Staff – see TNA Air 20/995: Operations HIGHBALL and UPKEEP operational planning. Note ACAS (Ops) to D B Ops 20 May 43 - stating that it had been agreed to retain the remaining UPKEEP aircraft until a decision was made regarding future UPKEEP attacks.

²⁵ RAFM, Harris Papers, H 49: Letter Harris to Group Commanders, 3 Jun 43.

²⁶ TNA Air 14/717: 617 and 619 Squadron's: Operations. Oxland to HQ No. 5 Group, 11 Aug 43.

²⁷ RAFM, Harris Papers, H 60: Letter Cochrane to Harris, 2 Jun 43.

operational for two months.²⁸ This also gave Bufton time to refine his policy and find new targets for UPKEEP.

Within hours of the Dams Raid administrative machinery was automatically engaged to make good the losses incurred on the Dams Raid. Harris stipulated that aircrew should have completed two tours.²⁹ He was optimistic that there would be no shortage of volunteers.³⁰ In fact a trawl of No. 5 Group in following days produced only two crews; ten more were still needed to bring the Squadron to full strength. The Squadron's formation had already taken many of the Group's best crews and taking more might seriously deplete the main force or deny training units new instructors.³¹ The situation was exacerbated by a continued demand for crews by No. 8 (Pathfinder Force) Group, together with the creation of new Lancaster units within No. 5 Group itself.

Extending the search to other Groups was slow to bear fruit.³² Many second tour-expired crews were simply too tired to carry on.³³ Crews coming from outside No. 5 Group, though veterans of the Short Stirling or Handley Page Halifax, did not have Lancaster experience. Hence, replacement would have to take place over a longer period, or less experienced crews would have to be accepted. Sufficient crews existed for the surviving UPKEEP aircraft, but if the next operation was to involve high level bombing Cochrane suggested it might be better to train another Squadron.

Given little alternative, Harris and Cochrane were forced to pace the Squadron's growth. With barely a dozen crews it was half the size of a normal Squadron. As a result, after Wg Cdr Gibson's departure in August his successor as commanding officer would hold only the rank of Squadron Leader, despite having previously served as Acting Wing Commander commanding No. 102 Squadron (a Halifax unit).

Training and practice were fundamental to precision bombing. But with no definite operations planned, for what should the Squadron train? The search for further targets for UPKEEP necessitated the maintenance of low level expertise, but possible targets requiring precise high level bombing were also emerging. Crews already trained with

²⁸ TNA Air 14/3287: Air Officer Administration Conference: notes. Meeting, 4 Jun 43.

²⁹ RAFM, Harris Papers, H 60: Letter Cochrane to Harris, 2 Jun 43.

³⁰ RAFM, Harris Papers, H 49: Letter Harris to Group Commanders, 3 Jun 43.

³¹ RAFM, Harris Papers, H 60: Letter Cochrane to Harris, 2 Jun 43.

³² Ibid. and RAFM, Harris Papers, H 59 Cochrane to Harris, 22 Jun 43.

³³ TNA Air 20/2859: Aircrew, Operational Tours. Air Ministry Letter, 8 May 43. Two tours equated to a first tour of 30 operations, a six month spell instructing at a training unit and then a further 20 operations.

UPKEEP could be switched to high level bombing immediately. Arriving crews would first need to become proficient in low level flying and navigation.

Training was dependent upon availability of aircraft and equipment. Low level experience could be conducted in any aircraft and was given added purpose by using the Squadron to evaluate defence schemes against possible German reprisal attack of British reservoirs. Further practice was gained investigating the ability of UPKEEP to run overland.³⁴ High level bombing could only be practised once aircraft were equipped with a suitable bomb sight. This took time, and ceased almost as soon as it started as emphasis switched back to low level flying in preparation for the Squadron's next operation.

While Cochrane concentrated on finding replacement crews and training policy, the DBO, headed by Bufton, was searching for suitable targets requiring precision attack.

UPKEEP represented a tremendous investment in resources. Operation CHASTISE had proved its effectiveness. New targets were needed if its full potential was to be exploited while aircraft, crews and weapons were still available.

Early work regarding the Service aspects of UPKEEP development had been steered by Bottomley.³⁵ The highly secret nature of the weapon had necessitated that co-ordination of planning and development was undertaken by a small committee which he chaired. The committee's role is described in Sweetman, who also summarises its continued involvement immediately post-Chastise.³⁶ However, what has not previously been examined in detail is the extent to which the committee was involved in planning which not only determined the Squadron's next major operation but also initiated development of the weapon that would determine its future.

Contrary to Melinsky's assertion that D B Ops was not influential in planning CHASTISE he was already a significant player.³⁷ Bufton had become increasingly involved in UPKEEP, including the operational aspects, following his appointment as DB Ops in March 1943. It was on his recommendation that the weapon's initial use was directed against the Möhne and Eder Dams³⁸ and he had been instrumental in discussions resulting in the

³⁴ See pp 61-62.

³⁵ TNA Air 2/5944: Air attacks on Dams – tactical aspects. Minutes of meeting, 16 Feb 43.

³⁶ Sweetman, *Operation Chastise*, pp 187-188.

³⁷ Melinsky, *Forming the Pathfinders*, p 104.

³⁸ TNA Air 20/4821: HIGHBALL and UPKEEP: policy. Bufton to Bottomley, 13 Mar 43.

Squadron's formation.³⁹ Within days of CHASTISE Bufton was already considering new targets for UPKEEP. His information came from a number of sources. The Ministry of Economic Warfare (MEW) provided assessments of potential targets' economic worth and the effect of disruption. Air Intelligence provided material from official sources and organised requests for photographic reconnaissance. In addition Bufton consulted relevant experts, including Wallis, for their assessment of the practicality and likely effects of any attack. Bufton's search examined a number of possibilities that had been considered during the early stages of CHASTISE and also extended into new areas, including the use of UPKEEP with forward spin to travel over ground. Although Sweetman and Ward make passing reference to these further applications the full extent of Bufton's search has not been explored.⁴⁰ It is worthy of further investigation.

The most obvious objectives for further UPKEEP attacks were other important dams in Axis and occupied territory. However detailed examination of such targets revealed that few were suitable. Within two days of CHASTISE the MEW suggested several new dams to Bufton, including two supplying water for the Wuppertal area.⁴¹ The suggestion was discounted. The defences of other dams in Germany were being strengthened; the risk was now too great. With the element of surprise gone, and the enemy fully aware of the tactics employed against these targets, further attacks would inevitably result in heavy losses.

Italian dams had been considered as targets during the planning of CHASTISE as it was believed that they provided electricity to power the railway network.⁴² Investigation revealed that these were not strategically viable; only part of the Italian rail network was electrified and an efficient distribution grid meant that a large number of targets would have to be breached to disrupt supply.⁴³ To achieve any great effect conventional attacks would also have to be made on the switching stations, which were small, difficult to identify and even harder to hit. Flooding was unlikely to have much effect on industrial output in Italy. Dams were generally located away from centres of industry and flooding would only be disruptive to communications and small settlements, although there might be a general effect on morale. The breaching of the Bissorte Dam, west of Modane

³⁹ TNA Air 20/4821: HIGHBALL and UPKEEP: policy. Bufton to Bottomley, 17 Mar 43.

⁴⁰ Sweetman, *Operation Chastise*, p 187 and Ward, *Forging of a Legend*, p 98.

⁴¹ TNA Air 40/1815: Germany: bombing policy: miscellaneous reports and correspondence between Air Ministry and Ministry of Economic Warfare. Letter MEW to Bufton, 19 May 43.

⁴² TNA Air20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note Air Intelligence 3c to B Ops 1, 27 Mar 43.

⁴³ TNA Air20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note Collier to Bufton, 28 Mar 43.

would disrupt rail communications on the Mont Cernis route, but its location on the Franco-Italian border made it a political issue. An attack on the dam would put French lives at risk and the route could be disrupted equally well by an area attack on the Modane marshalling yards. It would only be attacked in extreme circumstances.⁴⁴ However, the Italian dams were not completely discounted; they remained as possible tactical targets in support of an Allied invasion and the Squadron would need to retain its UPKEEP capability until a firm decision was made.

Wallis examined the Janiskoski Dam at Petsamo, Finland, which provided power for the nickel mines and smelter at Kirkenes.⁴⁵ Bufton prepared an assessment for a potential operation; the power house was a suitable target but any operation would be challenging and would have to be mounted from either a north Scottish airfield or a Russian base – the latter placing the aircraft at additional risk of attack on the ground, and perhaps forcing revelation of full details of UPKEEP to the Soviet Union.⁴⁶ Following information that destruction of this dam would not put the mines out of action the proposal was dropped.⁴⁷

A further target set was brought to Bufton's attention. MEW emphasised the importance of the German inland waterway system.⁴⁸ Canals and rivers transported an estimated 25 per cent of freight, including industrial and bulk materials, allowing the overstretched railway network to carry military traffic. Disruption to these would necessitate a re-ordering of priorities for all traffic and a number of vulnerable points were assessed. More vulnerable and seemingly suited to UPKEEP were embanked stretches carrying canals over low lying ground. Breaching the embankments would drain the stretches between lock gates, interrupting traffic until the water course could be restored. Repair time would be relatively fast, but could be lengthened by multiple breaches stretching demand on limited manpower and equipment. Subsequent examination of other principal waterways of Axis Europe including those in Northern France and Benelux and the Kiel Canal confirmed the key importance of the Dortmund Ems and Mittelland Canal systems.

⁴⁴ TNA Air 20/164: Proposed bombing of Bissorte Dam. An appreciation of the effects of the destruction of the Bissorte Dam, 23 Aug 43.

⁴⁵ TNA Air 9/186: Bombing of Janiskoski Dam, Finland: planning. Wallis to Bufton, 30 Jul 43.

⁴⁶ TNA Air 9/186: Bombing of Janiskoski Dam, Finland: planning Bufton to Director of Plans, 30 Jul 43.

⁴⁷ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Letter Ritchie to Page, 14 Aug 43.

⁴⁸ TNA Air 40/1815: Germany: bombing policy: miscellaneous reports and correspondence between Air Ministry and Ministry of Economic Warfare. Letter MEW to Bufton, 19 May 43.

Bufton received a further report from MEW's Railway Research Section.⁴⁹ Breaching canals would place additional strain on the rail network and if the key rail routes could also be severed it might be possible to paralyse all bulk transport routes between the Ruhr and much of Germany. UPKEEP run overland might be used to demolish the piers of railway viaducts; of four key Ruhr routes identified three had vulnerable viaducts, one of which had been severed already by floods from CHASTISE. The two serviceable routes offered three suitable targets: the viaducts at Bielefeld, Altenbeken and Neuenbeken. The remaining line without a viaduct could be dealt with by area attack on marshalling yards. Bufton was receptive to MEW's report and soon began to formulate a transportation plan to isolate the Ruhr.

Although Harris initially opposed the entire concept of UPKEEP the result of Chastise tempered his views.⁵⁰ He too considered rail communications a possible future target. He was not only prepared to support further operations, but encouraged the search for new targets.⁵¹ At his instigation the Air Ministry Intelligence Branch conducted a survey of German and Italian railway tunnels.⁵² Harris was keen to look at tunnels in the Alps, although he knew that topography might make attacks impossible.⁵³ The investigation showed there was little potential. There were few suitable tunnels in Germany that could not be by-passed; in any case, Germany's problem was shortage of engines and rolling stock, rather than lack of track capacity. In Italy, with the exception of the Brenner Pass, multiple tunnels would also need to be blocked.⁵⁴ Examination of the subject continued until the autumn, by which time they had been dismissed as a target for UPKEEP.⁵⁵

Since UPKEEP was in effect a large mine or depth charge, further consideration was given to other water-related targets. The upper reaches of major rivers such as the Rhine and Danube relied on barrages to maintain navigable conditions. Breaching the barrages would strand vessels upstream, forcing transshipment of goods to other transport networks, while repairs might take several months. Cochrane believed that of

⁴⁹ TNA Air 20/5832: Operation TALLBOY: operations subsequent to operation CHASTISE. Effect of attack on communications to the east of the Ruhr area, 17 Jun 43.

⁵⁰ Air 14/842: UPKEEP: Progress reports. Harris note, 14 Feb 43. "This is tripe of the wildest description... ..there is not the smallest chance of it working."

⁵¹ RAFM, Harris Papers, H 60: Letter Harris to Cochrane, 4 Jun 43. See also p 51.

⁵² TNA Air 14/1221: German and Italian Railway Tunnels. Minute 7, Marwood-Elton to SASO.

⁵³ RAFM, Harris Papers, H 60: Letter Harris to Cochrane, 4 Jun 43. This letter refers to "rolling some UPKEEPS down the big rabbit holes... ..between Germany and Italy," and "blowing some of the waterways".

⁵⁴ TNA Air 14/1221: German and Italian Railway Tunnels. Minute 8, Sqn Ldr Fawsett to CIO, 6 Jun 43.

⁵⁵ TNA Air 14/1221: German and Italian Railway Tunnels. Letter HQBC to Air Intelligence, 24 Oct 43.

all the options these offered the best prospects for attack by UPKEEP.⁵⁶ The Kembs barrage on the upper Rhine was identified but discounted.⁵⁷ Two barrages on the Danube were singled out for further examination.⁵⁸ This revealed that the river carried less traffic than originally thought and was therefore of no great economic significance.⁵⁹ At best they might be used as an interim target to provide UPKEEP crews with operational experience. Against this was the risk that losses might reduce the force to an unacceptably low number, thereby curtailing higher priority operations, such as those potentially against Italian dams.

Barrages were important for maintaining the navigable depth of key rivers; locks performed a similar purpose for canals. The use of UPKEEP to destroy these might offer a means of halting traffic on canals that lacked vulnerable embanked sections. In this respect MEW emphasised the economic importance of the Kiel Canal which could only be drained by the destruction of lock gates.⁶⁰ Although there were numerous locks on this and other canals the gates were small targets and not very vulnerable, often having multiple chambers; moreover, damaged gates could be easily repaired.⁶¹ Attacks could be made with ordinary weapons and, since they were usually heavily defended, attack with UPKEEP was undesirable. Aqueducts also presented equally vulnerable waterway objectives. However, they were small, difficult to hit and would be well defended, as had been demonstrated by attacks against the Munster aqueducts on the Dortmund Ems Canal in 1940.⁶²

The weight and destructive power of UPKEEP also appeared to provide an effective method with which to attack a further key component of German inland water transport system, ship lifts. MEW's analysis had identified three such potential targets. Of these, the most important was at Rothensee on the Mittelland Canal which allowed traffic between the Ruhr and Berlin and also linked the canal to the River Elbe, providing access from Hamburg to the River Danube and Prague. MEW estimated that destruction of the ship lifts, together with lock gates, would produce even greater economic consequences than the destruction of the dams. The lifts might take up to a year to repair. However,

⁵⁶ RAFM, Harris Papers, H 59: Letter Cochrane to Harris, 9 Jun 43.

⁵⁷ TNA Air 20/6110: Directives to Bomber Command, Vol V. MEW Report: Inland Water Transport in Axis Europe, 17 Jun 43. The Kembs Dam would emerge again, for different reason in October 1944, see p 186.

⁵⁸ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note Bufton to ADI (Ph), 12 Jun 43 and letter HQBC to No. 5 Group, 13 Jun 43.

⁵⁹ TNA Air 20/6110: Directives to Bomber Command, Vol V. MEW Report: Inland Water Transport in Axis Europe, 17 Jun 43.

⁶⁰ Ibid.

⁶¹ Ibid.

⁶² Middlebrook and Everitt, *Bomber Command War Diaries*, pp 72-73.

since these were substantial structures they might need heavy weapons to destroy them.⁶³ An assessment made earlier in the year had recommended the use of bombs in excess of 2,000 lb for any attack.⁶⁴ The Rothensee ship lift was identified as the most vulnerable point in the system and, as will be seen, became the focus of attention for future planning.

One further potential use for UPKEEP emerged from these considerations.

The Chiefs of Staff (COS) Committee considered that UPKEEP might also be suitable for breaching anti-tank walls to facilitate amphibious landings and requested trials.⁶⁵ Bufton investigated and reported to the Air Staff. The weapon would have to transit water and beach, posing the question of forward or back spin, multiple hits might be necessary, and its relatively short range might bring a Lancaster dangerously close to heavy defences. The smaller HIGHBALL – the anti-shipping version of UPKEEP carried by Mosquitos – might be a better option, dropped by a faster aircraft, or rocket projectiles.⁶⁶ Portal agreed that trials could proceed, but there could be no guarantee to undertake such an operation.⁶⁷ Data were collected during other over ground trials but the project progressed no further.

Investigation of these varied target sets continued for several months. Bufton favoured canals from the outset and raised the possibility of destroying the ship lift and canal embankments with Wallis who agreed that these were suitable targets for UPKEEP.⁶⁸ Wallis discussed these with Cochrane, who reported back favourably to Headquarters Bomber Command (HQBC).⁶⁹ Saundby suggested to Bottomley that the proposal should be considered in more detail.⁷⁰ Bottomley then issued a Directed Letter

⁶³ TNA Air 40/1815: Germany: bombing policy: miscellaneous reports and correspondence between Air Ministry and Ministry of Economic Warfare. Letter MEW to Bufton, 19 May 43.

⁶⁴ TNA Air 14/1204: Dortmund-Ems and Mittelland Canals. Letter Halcrow to Verity, 13 May 43.

⁶⁵ TNA Air 8/1101: Bombing: effect on beach defences COS Committee. Memorandum, Breaching of anti-tank walls, 30 Jul 43.

⁶⁶ TNA Air 20/4797: Operation HIGHBALL and use of UPKEEP bombs against enemy ships, dock gates etc. Note Bufton to ASP 1. Breaching of anti-tank walls, 30 Jul 43 and TNA Air 8/1101: Bombing: effect on beach defences COS Committee. Note ACAS (P) Breaching of anti-tank walls, 4 Aug 43.

⁶⁷ TNA Air 20/2617: Breaching of anti-tank walls. Part Minutes of Meeting, 5 Aug 43.

⁶⁸ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Bufton to Bottomley, 26 May 43.

⁶⁹ TNA Air 20/5833: Operation TALLBOY: operations subsequent to operation CHASTISE. Note Bufton to ACAS Ops, 26 May 43.

⁷⁰ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Saundby to ACAS Ops, 1 Jun 43.

authorising the formation of a committee to discuss targets and operational tactics.⁷¹ As for the planning of CHASTISE the committee was chaired by Bottomley and included Bufton and Wallis along with representatives from the Directorate of Armament, Air Intelligence and No. 5 Group.⁷²

After studying a further appreciation of the German canal system by MEW, the first meeting of the committee agreed on the prioritisation of targets: the Rothensee ship lift, embanked stretches of the Dortmund Ems Canal and similar on the Mittelland Canal. Future targets for consideration could include river barrages on the Danube and railway targets including tunnels and viaducts; final selection would be made after intelligence had been gathered and assessments made.⁷³ Meanwhile technical issues were to be addressed. Many of the proposals would require UPKEEP to run over ground instead of water; trials were needed to assess its performance. Was UPKEEP an appropriate weapon, or were there better alternatives from either a destructive or tactical point of view?

Despite his original assurance to Bufton, Wallis was the first to waiver with regard to the use of UPKEEP against the ship lift. The latter's topography might not be suitable for such an attack and an attack using HIGHBALL dropped to run along the canal might be better. Cochrane was not in favour of an overland attack, considering its only advantage might be to negate some of the target's defences, instead pilots would prefer to release UPKEEP directly into the canal. Subsequently Cochrane exhibited further doubts about the viability of this weapon with a suggestion of replacing it by the 12,000lb HC blast bomb for this purpose.⁷⁴ This raised a new set of issues: the weapon was still under development and its capabilities were not fully explored.

Having eliminated the possibility of a low level attack against the ship lift, high altitude attack using 4,000lb bombs was discussed.⁷⁵ This proved to be a pivotal point in the discussion, and one which would have far reaching consequences for the future of the Squadron. While this form of attack appeared to be more practical, the bombs suggested were unlikely to cause major damage to the target.⁷⁶

⁷¹ TNA Air 14/480: Operation CHASTISE. Directed Letter Bottomley to Harris, 3 Jun 43.

⁷² TNA Air 14/480: Operation CHASTISE. Minutes of meeting, 8 Jun 43.

⁷³ Ibid.

⁷⁴ Ibid.

⁷⁵ Ibid.

⁷⁶ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. 18 Jun 43. The limitations of the 4,000 lb bomb were subsequently confirmed by a report by the Ministry of Home Security. See CCC, Bufton Papers, BUFT 3/40: Letter W.M. Thomas to Sqn Ldr Dewdney, 18 Jun 43.

Agreement that an attack from high level was potentially viable provided Cochrane with a good opportunity to introduce Wallis's concept for the development of a deep penetration bomb.⁷⁷

This weapon had been first proposed by Wallis in 1940. Wallis envisaged that a large, 10 ton bomb might be used against installations critical to an enemy's economy: petrol and oil storage tanks, coal fields, oilfields, dams, docks and lock gates, and surface transport. Dropped from a great height it would penetrate deep into the ground alongside such targets before detonating. The resulting shock wave, transmitted through the earth, would damage the structure in a similar manner to an earthquake.⁷⁸

Such a weapon might cause significant damage to the underground structure of the ship lift, making repair an extremely difficult and lengthy process. It was agreed that Wallis should further investigate his idea's potential. This decision was to have far reaching consequences for the Squadron's long term policy and operations. Despite its significance in this respect extant narratives have ignored the value of Rothensee ship lift both as means of drawing attention to the importance of the canal network and as a catalyst for the development of Wallis's large bomb.⁷⁹ As will be seen, the weapon – target combination of TALLBOY and the ship lift became the key reason for the Squadron's continued existence and switch to high level precision attack.⁸⁰

Further assessment by MEW of inland water transport in Axis Europe reaffirmed the pre-eminence of the Dortmund Ems and Mittelland Canals. Disruption of these would force shipping to the North Sea coastal route to the Scheldt estuary where it would be exposed to attack, and would impose additional burden on the over-stretched rail network.⁸¹ A companion assessment identified that the additional cutting of the four rail links (p 56) between the Ruhr and Central and North Eastern Germany would result in "catastrophic dislocation" of traffic and confirmed that long term damage could be achieved by the destruction of key viaducts on three of the routes (one of which had

⁷⁷ TNA Air 14/480: Operation CHASTISE. Minutes of meeting, 8 Jun 43. Wallis Family Archive: Barnes Wallis *A Note on a Method of Attacking the Axis Powers (1940)*.

⁷⁸ Wallis Family Archive: Barnes Wallis, *A Note on a Method of Attacking the Axis Powers (1940)*.

⁷⁹ See p 70 and also Chapters 3 and 5.

⁸⁰ Flower, *A Hell of a Bomb*, p 90 and Melinsky, *Forming the Pathfinders*, pp 104-105 discuss Bufton's suggestion for attacks the ship lift, canals and viaducts, but do not elaborate on the subsequent debate and decisions made.

⁸¹ TNA Air 20/6110: Directives to Bomber Command, Vol V. MEW Report: Inland Water Transport in Axis Europe, 17 Jun 43.

already been broken by the floods from CHASTISE) and area attacks to close the fourth.⁸²

A reassessment of targets was forced by Wallis's further assessment that UPKEEP would not damage the ship lift. However, the DBO still sought to use UPKEEP and now proposed its use for a simultaneous attack of canal embankments and viaducts.⁸³ This would require additional aircraft but in the meantime UPKEEP attacks might be conducted against Italian dams or barrages on the Danube or Rhine.

Dissention arose. Cochrane was not keen on further use of UPKEEP but was supportive of the proposal to attack the ship lift; he suggested that Harris request that the Air Ministry ask Wallis to develop his deep penetration bomb. Cochrane considered that the 12,000lb HC bomb, preferable to UPKEEP on the embankments and viaducts and the Danube barrages, would only be a distraction.⁸⁴ Harris agreed to the development of the deep penetration bomb.⁸⁵ He was "not interested" in the viaducts but wanted to consider dropping UPKEEP unrotated straight into the canals⁸⁶ and was prepared to wait for Wallis's assessment regarding the use of UPKEEP against the Danube barrages.⁸⁷

Over the next two months comparative trials were conducted at Bufton's request to evaluate the effectiveness of both UPKEEP and the 12,000lb HC bomb against canal embankments and viaducts.⁸⁸ Despite Harris's reservations, both were both still under consideration. Each weapon was evaluated by the Directorate of Armament Development and other departments to assess the best one for the task: the key issues for UPKEEP were the determination of its over ground performance, its effects on striking a hard target, and detonation trials to confirm that it was sufficient to breach an embankment or demolish a viaduct pier.

The UPKEEP trials had to be undertaken by the Squadron; it had all the modified aircraft. Initial drops using a forward spin showed no serious issues, other than respect for the

⁸² TNA Air 20/6110: Directives to Bomber Command, Vol V. MEW Report: Effect of Attack on Communications to the East of the Ruhr Area, 17 Jun 43.

⁸³ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Suggested outline plan for cutting the water and rail communications between the Ruhr and Central-North-Eastern Germany.

⁸⁴ RAFM, Harris Papers H 59: Letter Cochrane to Harris, 22 Jun 43.

⁸⁵ TNA Air 20/4813: Bombs and flares: development and production. Letter Oxland to ACAS Ops, 30 Jun 43.

⁸⁶ RAFM, Harris Papers H 59: Harris's annotation to letter Cochrane to Harris, 22 Jun 43.

⁸⁷ TNA Air 14/717: 617 and 619 Squadron's operations. Letter Harris to Cochrane, 28 Jun 43.

⁸⁸ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Bufton to Harris, 27 Jun 43 and Bufton to ACAS (TR), 27 Jun 43.

minimum dropping height owing to debris thrown up by the bomb's first impact.⁸⁹ Subsequent trials were carried out against dummy viaduct piers despite Harris's objection to these objectives and a large concrete target was used to determine the behaviour of UPKEEP on impact with a solid object.⁹⁰ These results were less favourable. Range was dependent on terrain. There was a chance that UPKEEP might pass through the arches, and on impact it was more likely to bounce off rather than remain in contact with a pier. Tests were also required to determine the vulnerability of viaduct piers to contact and near miss detonations. The Road Research Laboratories (RRL) confirmed that piers of the Bielefeld viaduct might be demolished by a close explosion, but those of the other targets would not.⁹¹ A greater challenge was the development of a fuze that could distinguish between impacts during initial travel to the target and yet activate on contact with a pier.⁹² This seemingly impossible problem was fortuitously resolved by the decision to attack only canals.

The 12,000lb HC bomb was a new and untried weapon. Although writers such as Brickhill⁹³ and Ward⁹⁴ acknowledge this, the urgency of its final development and the issues associated with producing sufficient quantity have largely been ignored. In many respects this paralleled the race for final approval of UPKEEP.

Dropping trials of the 12,000lb HC bomb were conducted by the Aeroplane and Armament Experimental Establishment (AAEE). The weapon's poor ballistics made the bomb unsuitable for use against a viaduct but it would withstand impact with water from low level.⁹⁵ Initial trials conducted by RRL to confirm that the weapon would breach an embankment were inconclusive.⁹⁶ Comparative model tests with the 12,000lb HC bomb and UPKEEP showed that neither was likely to breach a canal bank, even if up to three were detonated in the same place.⁹⁷ To do so was asking for exceptional aiming (or a great deal of good fortune) to place a bomb in exactly the right position. Larger scale trials confirmed that a 12,000lb bomb placed at the junction of the canal bed and

⁸⁹ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Wynter-Morgan to CRD, 5 Jun 43.

⁹⁰ TNA Air 14/2060: Further trials with UPKEEP. Note by Whitworth, Most Secret, UPKEEP, 8 Aug 43.

⁹¹ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Letter RRL to MAP, 1 Sept 43.

⁹² TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Bufton note UPKEEP, 20 Aug 43.

⁹³ Brickhill, *Dam Busters*, p 117.

⁹⁴ Ward, *Forging of a Legend*, p 103.

⁹⁵ TNA Air 14/2060: Further trials with UPKEEP. Minutes of meeting, 1 Jul 43.

⁹⁶ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note DD Arm R to DDOR and DB Ops, 20 Aug 43.

⁹⁷ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note B Ops 1 to DB Ops, 20 Aug 43.

embankment slope would cause a breach, but Torpex filling was essential.⁹⁸ This created a further issue. Priority for Torpex had been allocated for the production of underwater weapons and 4,000lb bombs.⁹⁹ The Directorate of Armament arranged suitable dispensation allowing supplies to be allocated for the production of sufficient 12,000lb bombs. Initially 25 were ordered, being given priority over other types at the filling factory.¹⁰⁰ This was later increased to 35.¹⁰¹ The first weapons were delivered a week before the operation.¹⁰² The provision of explosive was not the only difficulty to be overcome. A low level attack necessitated delay action fuzing to allow time for the dropping aircraft to get clear before detonation. Development of a suitable fuze was put in hand, but such were the complexities that final trials of the new fuze took place only days before the operation was mounted.¹⁰³

While investigations progressed to determine the most effective weapon for each target set firm there was still no consensus on whether these should be attacked. Despite Harris's objections to viaducts, Bufton continued to champion simultaneous attacks on both target sets. Accepting this strategy, Bottomley issued a Directed Letter to Harris requesting his views on the proposal for cutting both embanked sections of the Dortmund Ems and Mittelland Canals and the three remaining rail routes from the Ruhr to Central and Eastern Germany. The operation was to be mounted as soon as possible using either UPKEEP or the 12,000lb HC bomb, dependent on the outcome of trials that were just being concluded. Harris was reminded that any use of UPKEEP would require approval by the COS.¹⁰⁴ The request was duly passed to No. 5 Group inviting their views on the tactical considerations.¹⁰⁵

⁹⁸ TNA Air 20/4813: Bombs and flares: development and production. Note C.F.S. Fraser to DDOR II and DB Ops, 24 Aug 43.

⁹⁹ TNA Air 20/4813: Bombs and flares: development and production. Note Bufton to DDE 12, 12 Aug 43.

¹⁰⁰ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. CFS Fraser to DB Ops, 21 Aug 43.

¹⁰¹ TNA Air 14/717: 617 and 619 Squadron's operations. 12,000lb bombs for special operation. Note Morley to Marwood-Elton, 27 Aug 43.

¹⁰² TNA Air 14/2169: Bomb HC 12,000 lb introduction. Minute 1, 8 Sept 43.

¹⁰³ TNA Air 14/2169: Bomb HC 12,000 lb introduction. RDM4 MAP to HQ 5 Group, 2 Sept 43. Such was the speed of development that no trial installation had been carried out to ensure that the bomb would fit into the Squadron aircraft. For this purpose an empty bomb case was despatched to Coningsby along with eight heavy duty bomb trolleys.

¹⁰⁴ TNA Air 14/2059: Attacks on canal targets: operational directives. Letter Bottomley to Harris, 31 Jul 43.

¹⁰⁵ TNA Air 14/717: 617 and 619 Squadron's operations. Minute Note 6, Marwood-Elton to Saundby, 1 Aug 43.

What then transpired epitomised the internal politics and policy debates that frequently surrounded precision attacks and policy for the Squadron. Harris discussed the proposal with Sinclair who then wrote to Bottomley asking about the likelihood of success of the operation, its forecast effects, likely cost and the wisdom of its timing.¹⁰⁶ Sinclair's letter was passed to the DBO who believed that Sinclair was implying that area attacks were the only effective use for Bomber Command. The Directorate asked MEW for information to support a reply endorsing precision attacks on key selected targets.¹⁰⁷ Bufton also consulted Bottomley. Recent conversations between the Directorate and SASO HQ Bomber Command suggested that Harris was still opposed to the formation of specialist units, and against the combined rail and canal plan.¹⁰⁸ Bufton drafted a reply to Sinclair. The proposal had been developed in full consultation with MEW, Bomber Command and No. 5 Group. The attack would hinder recovery of the Ruhr from the effect of recent area attacks and the use of No. 617 Squadron would mean no diversion from the rest of the Command's effort. Previous attempts to empty the canals had failed due to lack of specialised equipment but weapons now available should provide "a level of success at least comparable to that achieved in the Möhne attack." Tactical surprise and targeting lesser defended points would reduce the risk of high casualties. To emphasise the value of such precision attacks and the need for a specialist unit to carry them out, Bufton concluded that the success of the projected operation, together with the results of CHASTISE, more than justified the diversion of men and equipment from main operations. In case there might be any thought of disbanding the Squadron after this operation Bufton added that planning was already underway to use it in a further precision operation against communications in Northern Italy.¹⁰⁹

Bufton's assertion that both Bomber Command and No. 5 Group were in full agreement was no longer true; Harris had already made his views known. The same day as Bottomley replied to Sinclair, Cochrane submitted his opinion to Bomber Command. Trials with UPKEEP demonstrated that the plan to sever all communications was too ambitious for the small force of aircraft available. Even the entire Squadron might be insufficient to destroy the viaducts which were bound to be well defended, and would result in heavy losses. Cochrane, however, supported an attack on the Dortmund Ems

¹⁰⁶ TNA Air 40/1815: Germany: bombing policy: miscellaneous reports and correspondence between Air Ministry and Ministry of Economic Warfare. Copy of letter to ACAS Ops, 11 Aug 43.

¹⁰⁷ TNA Air 40/1815: Germany: bombing policy: miscellaneous reports and correspondence between Air Ministry and Ministry of Economic Warfare. Letter Morley to Lawrence, 13 Aug 43.

¹⁰⁸ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Letter Bufton to DCAS, 15 Aug 43.

¹⁰⁹ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe Draft reply to Sinclair, 15 Aug 43.

and Mittelland Canal embankments using the 12,000lb HC bomb, provided the results of trials showed it to be effective against such targets; such attacks would not be decisive, but would create short term disruption. He was prepared to mount an operation at a later date, should the viaducts be deemed essential and UPKEEP considered a viable weapon. An operation of this nature would need a larger force and potentially high losses were to be expected.¹¹⁰

Gp Capt Operations at Bomber Command went one stage further. Following discussion with Saundby he advised that the entire plan outlined in Bottomley's Directed Letter should be rejected. The Squadron should relinquish its UPKEEP aircraft and concentrate on training for a high level attack on the ship lift once Wallis's deep penetration bomb was ready. If an attack on the Bissorte Dam to disrupt north Italian rail communications was decided, then the Squadron should retain one flight of UPKEEP aircraft.¹¹¹ This view was challenged by the Command's Chief Intelligence Officer (CIO) who emphasised that the canals were important and should be attacked. Harris concurred and the DBO was notified: attacks would be made against stretches of the Dortmund Ems and Mittelland Canals using the 12,000lb HC bomb.¹¹²

No. 5 Group was asked for a detailed operational plan.¹¹³ Their proposal required 12 Lancasters each carrying a 12,000lb HC bomb. Six would make low level attacks against embankments on the Dortmund Ems Canal at Greven (Ladbergen) the remainder would target embankments on the Mittelland Canal at Rothensee.¹¹⁴ Further discussion between Harris and Cochrane resulted in a reassessment; only the Dortmund Ems embankment was to be attacked.¹¹⁵

By the time this plan was drafted CASABLANCA had been superseded by a new directive, known as POINTBLANK.¹¹⁶ In this the overall objective of the strategic bomber offensive remained "the progressive destruction of the German military, industrial and economic

¹¹⁰ TNA Air 14/2059: Attacks on canal targets: operational directives. Letter Cochrane to SASO HQBC, 16 Aug 43.

¹¹¹ TNA Air 14/717: 617 and 619 Squadron's operations. Minute Note 12. Gp Capt Marwood-Elton to SASO HQBC, 18 Aug 43.

¹¹² TNA Air 14/717: 617 and 619 Squadron's operations Letter Harris to B Ops 1, 26 Aug 43.

¹¹³ TNA Air 14/717: 617 and 619 Squadron's operations SASO HQBC to HQ No. 5 Group, 26 Aug 43.

¹¹⁴ TNA Air 14/2038: Operation Garlic. Draft operation order, 28 Aug 43.

¹¹⁵ TNA Air 14/717: 617 and 619 Squadron's operations. Gp Capt Marwood-Elton. Note of Action, 7 Sept 43.

¹¹⁶ The POINTBLANK directive 10 Jun 43. Webster and Frankland, *Strategic Air Offensive*, Vol IV, Appendix 23, pp 273- 283 and Harris, A.T. (1947), *Despatch on War Operations*, 23 February 1943 – 8 May 1945 (London: Frank Cass, 1995), p 197.

system, and the undermining of the morale of the German people..." However, transportation no longer ranked among the target groupings. Attacks on primary objectives were now calculated to reduce German fighter strength and submarine capability, along with ball bearing and oil production. That said, the canal and railway targets under examination were brought back into the fold by an additional clause: "the forces of Bomber Command will be employed in accordance with their main aim in the disorganisation of German industry..."¹¹⁷ There was no doubt that Ruhr industry would suffer without the canal and rail network for the transport of raw materials and manufactured *matériel*. Successful attacks on the canals and key rail links would therefore qualify under this clause of the directive; they would also serve to extend the disruption caused by the Battle of the Ruhr and undermine morale just as the Germans were feeling that were overcoming the effects of the bombing.

A further appraisal by MEW dispelled any remaining doubt as to the validity of the operation.¹¹⁸ The importance of the canals had been grossly under-estimated; traffic in 1943 was three times that of 1937. Such was the importance of these targets that more aircraft were needed in order to guarantee success. Suggestions were made within the DBO to increase the number of attacking aircraft by using the UPKEEP Lancasters and Bufton was to discuss the issue with Harris personally; there could not be any more important objectives.¹¹⁹ With UPKEEP aircraft still earmarked for attacks on Italian dams (p 64) and the Squadron lacking crews, Bufton's letter to Harris only emphasised the importance of both canals, without requesting an increase in the attacking force. A revised operation order was prepared, but this time the numbers were reduced to nine aircraft, the number of modified aircraft immediately available.¹²⁰

The Dortmund Ems Canal operation was first attempted on the night of 14/15 September 1943, but was aborted en route due to poor weather over the target.¹²¹ Following the loss of one aircraft during this attempt only eight aircraft were available for the following night.¹²² A combination of bad weather, and active defences, and an over-elaborate plan based on that developed for CHASTISE combined to turn the operation

¹¹⁷ The POINTBLANK directive 10 Jun 43. Webster and Frankland, *Strategic Air Offensive*, Vol IV, Appendix 23, pp 273- 283.

¹¹⁸ TNA Air 14/2059: Attacks on canal targets: operational directives. Letter Bufton to Cochrane 2 Sept 43 and Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. MEW Report: Current traffic on the Dortmund Ems and Mittelland Canals, 4 Sept 43.

¹¹⁹ Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note Strachey to Bufton, 8 Sept 43.

¹²⁰ TNA Air 14/2083: Operation Garlic. Draft Operation Order, undated, Enclosure 4A..

¹²¹ This abortive operation is not recorded in TNA Air 27/2128: No. 617 Sqn ORB.

¹²² TNA Air 27/2128: No. 617 Squadron, Operations Record Book, 15 Sept 43.

into a disaster.¹²³ Five aircraft were lost, and none succeeded in placing a bomb in the canal.

Narrative accounts of the operation quite rightly measure the high cost of this operation in terms of both number of aircraft and aircrew lives.¹²⁴ In four months the Squadron had carried out five operations, four against minor targets. In operations against a single target it had lost 6 aircraft and 48 aircrew.¹²⁵ This hardly endorsed Harris's claim that the Squadron would conduct precision attacks and that the operations would not be unduly hazardous. Overlooked, however, is a factor that exercised an influence over the Squadron's deployment throughout the war, namely their use of non-standard aircraft and equipment which was difficult to replace. The unique nature of the UPKEEP aircraft is visibly apparent and the difficulty of their conversion is well recorded.¹²⁶ Less obvious and receiving little mention are the issues relating to those aircraft to carry the 12,000lb bomb. Though the modifications were of a lesser scale they were no less a problem when it came to the supply of aircraft.

Only 23 UPKEEP aircraft had been built. Following CHASTISE only 14 serviceable aircraft remained and there were 37 live UPKEEPS in the bomb dump at Scampton.¹²⁷ Since possible future operations against other targets were possible, these aircraft needed to be carefully conserved. The UPKEEP aircraft could not carry any other bomb load and a request by Bomber Command to convert the aircraft back to standard was rejected.¹²⁸ No new UPKEEP aircraft were planned but the jigs for modification sets were to be stored for possible future use.¹²⁹

Although the Lancasters lost on CHASTISE had initially been replaced by standard aircraft the decision to use the 12,000lb HC bomb necessitated the provision of aircraft embodying a strengthened bomb bay together with larger bomb doors, fitted only to the Lancaster II. Not previously recognised is that consideration was given to using Lancaster IIs from No. 115 Squadron, under the control of 5 Group. This, however, was

¹²³ For accounts of this operation see Ward, *The Definitive History*, pp 102-116.

¹²⁴ Brickhill, *The Dam Busters*, pp 117-126; Ward et al, *Dambusters: The Forging of a Legend*, pp 102-122 and Cooper, *Beyond the Dams*, pp 21-29.

¹²⁵ Each aircraft attacking the Dortmund Ems Canal carried a crew of eight. Forty one men were killed.

¹²⁶ Sweetman, (1982), *Operation Chastise*, pp 49-53.

¹²⁷ TNA Avia 15/3933: Spherical bomb: proposal by Barnes Wallis. UPKEEP and HIGHBALL, 26 May 43.

¹²⁸ TNA Air 14/717: 617 and 619 Squadron's operations. SASO HQBC to HQ No. 5 Group, 26 Aug 43.

¹²⁹ SM Wallis Papers: D/2/10 Letter Ministry of Aircraft Production to Wallis, 30 Aug 43.

impractical.¹³⁰ Instead, a policy change was required to provide these large doors for the Squadron's standard aircraft.¹³¹ This modification fortunately also permitted the carriage of Wallis's deep penetration bomb; in addition these aircraft could still carry ordinary bomb loads and were thus more adaptable than the UPKEEP aircraft. Operational changes reduced the requirement to 12 aircraft, but only nine were available on the day of the operation. The demand for these specially modified aircraft, unique to the Squadron, came at a time when Harris was particularly concerned over the shortage of Lancasters.¹³²

A further concern was that the Squadron's aircraft also had to be modified with the Stabilised Automatic Bomb Sight (SABS) ready for an operation proposed for October using the deep penetration bomb.¹³³ The Squadron's switch to high level bombing is generally associated with the introduction of SABS.¹³⁴ However, the decision to train the Squadron in precision high level bombing was taken in early June - that is even *before* that to progress with Wallis's deep penetration bomb.¹³⁵ In retaining the Squadron for special duties, Harris realised that they would need to be capable of bombing from both high and low level. Although Harris was prepared to entertain further use of UPKEEP he retained his belief that low level attack was not a profitable employment for heavy bombers. An initial decision to use the Mk XIV bombsight was soon superseded by the installation of the limited production SABS, the switch being prompted by the increased accuracy attainable with the latter sight.¹³⁶

The SABS itself was in short supply and only allocated in small quantities to a few squadrons. The latest version was not yet in full production. Twenty-five sights were required in eight weeks.¹³⁷ To meet this and future demand equipment was withdrawn from other Squadrons and earlier models of the sight were returned to the manufacturer

¹³⁰ TNA Air 14/717: 617 and 619 Squadron's operations. Minute 5, 21 Jul 43.

¹³¹ TNA Air 14/717: 617 and 619 Squadron's operations. Harris to Cochrane, 28 Jun 43 and Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Bufton to ACAS (TR), 12 Jul 43.

¹³² RAFM, Harris Papers H 59: Harris to Cochrane, 11 Aug 43.

¹³³ The Stabilised Automatic Bomb Sight permitted precision high altitude bombing with greater accuracy than normally achieved using the Command's standard Mk XIV sight.

¹³⁴ Brickhill, *Dam Busters*, p 131; Ward, *Forging of a Legend*, p 139.

¹³⁵ RAFM, Harris Papers H 60. Letter Cochrane to Harris, 2 Jun 43.

¹³⁶ No. 617 Squadron Collection: *Bombing Leader's Notebook*, entry for 9 Jun 43 and TNA Air 14/717: 617 and 619 Squadron's operations. Cochrane to Saundby, 9 Jul 43 and Saundby to Cochrane, 12 Jul 43.

¹³⁷ TNA Air 14/2022: Provision of Stabilised Automatic Bomb Sight for No. 617 Squadron. Loose Minute, 21 Jul 43.

for upgrading, in addition to new orders being placed.¹³⁸ As with CHASTISE the Squadron was receiving equipment and resources at the expense of main force. Installation of the sight necessitated further alterations to the Squadron's Lancasters: a larger bomb aimer's nose blister to accommodate the sight and more efficient engine powered compressors to drive the gyroscopes controlling the sight.¹³⁹ While the unique nature of the aircraft modified to carry UPKEEP has long been understood, the significance of the less apparent modifications required for aircraft fitted with SABS and equipped to carry the large 12,000lb bomb has hitherto gone unrecognised. With the Squadron's extensively modified aircraft and sights now impossible to replace at short notice losses needed to be kept to a minimum. Despite every precaution one UPKEEP Lancaster and one 12,000lb aircraft were lost in flying accidents.¹⁴⁰ Of greater significance, five 12,000lb aircraft (fortunately without the actual SABS sights) would be lost attacking the Dortmund Ems Canal.¹⁴¹ These losses emphasised the need to take greater efforts to minimise the risks to the remaining aircraft and their replacements. Such was the concern that this became a significant influence on target selection for the next six months.¹⁴²

Nevertheless, consolidation of the sights into a single squadron brought considerable advantages. Servicing and the holding of spares were simplified, not only for the sights themselves, but also for the modified aircraft. Training could be undertaken more efficiently and ground instructional facilities were required only at the Squadron's base and the ground training building at Scampton, and later Coningsby, was modified accordingly.¹⁴³

With limited operations, No. 617 Squadron now had the necessary time to practice and perfect the essential teamwork between pilot, navigator and bomb aimer. The end result was a specialist force of squadron strength uniquely capable of mounting a heavyweight precision attack and already a new weapon was under consideration for its armoury.

¹³⁸ TNA Air 2/2031: Stabilised automatic bombsight Mark II: trials. RD Inst 7 to E 27, 28 Aug 43.

¹³⁹ TNA Air 2/2032: Stabilised automatic bombsight Mark II: trials, Lancaster III aircraft. Preparation to special requirements of Bomber Command, G.H. Miles, 21 Aug 43.

¹⁴⁰ RAFM, Accident Cards: Avro Lancasters ED765, 5 Aug 43 and JA894, 10 Sept 43.

¹⁴¹ TNA Air 27/2128: No. 617 Squadron, Operations Record Book, 15 Sept 43.

¹⁴² See Chapter 3.

¹⁴³ TNA Air 14/2022: Provision of Stabilised Automatic Bomb Sight for No. 617 Squadron. Loose Minute, 21 July 43.

Wallis's deep penetration bomb was first envisaged in 1940 as a weapon to destroy the enemy's sources of power.¹⁴⁴ The idea was rejected for a number of reasons, and continued discussion resulted in the new concept of UPKEEP for an assault on dams. In June 1943 realisation that UPKEEP was unlikely to cause significant damage to the Rothensee ship lift caused Wallis to return to his deep penetration concept.¹⁴⁵ Unofficially he had already begun to progress the design.¹⁴⁶ Prompted by Cochrane, Harris requested official sanction for the project from the Air Ministry.¹⁴⁷ Bufton informed Bottomley that he was convinced of the merits of such a weapon and also asked that it be made an urgent operational requirement.¹⁴⁸

Here confusion arose. Three versions of his weapon, given the generic name TALLBOY, were envisaged: 4,000lb (Small - essentially a trials weapon), 12,000lb (Medium) and 10 tons (Large).¹⁴⁹ Wallis discussed Large with Sir Wilfred Freeman, Chief Executive of the Ministry of Aircraft Production, saying that he could develop it within four months. Following an official requirement for 12 of the Small version, Freeman placed his own separate order for 100 each of the Medium and Large bombs. Wallis had earlier claimed to have almost finished design of the weapon and predicted production at 40 Medium bombs per week by September.¹⁵⁰ This led ACAS (TR) to request 60 of these to be ready within two months for a special operation.¹⁵¹ Bufton expressed concern that development of the bigger weapons might result in insufficient of either type to mount an operation; revised figures showed that even by concentrating on one type the best estimate was 32 by the end of December 1943.¹⁵² By September the British Air Commission in Washington had secured superior American production facilities under Lend-Lease.¹⁵³ Despite these, an immediate attack on the ship lift with TALLBOY was out of the question.

¹⁴⁴ Wallis Family Archive: Barnes Wallis *A Note on a Method of Attacking the Axis Powers (1940)*.

¹⁴⁵ TNA Air 14/480: Operation CHASTISE. Minutes of meeting, 8 Jun 43.

¹⁴⁶ SM Wallis Papers: File D2/21. Wallis to Bufton, 26 Jun 43.

¹⁴⁷ RAFM, Harris Papers H 59: Letter Cochrane to Harris, 22 Jun 43.

¹⁴⁸ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Minute Bufton to DCAS, 20 Aug 43.

¹⁴⁹ The 12,000 lb TALLBOY (Medium) will generally be referred to subsequently simply as TALLBOY. To avoid confusion the term TALLBOY (M) will be used when it is being discussed in conjunction with the smaller and larger versions, TALLBOY (S) and TALLBOY (L) respectively.

¹⁵⁰ TNA Air 20/1793: TALLBOY bombs. Cited in Letter ACAS (TR) to CRD, 18 Jul 43.

¹⁵¹ TNA Air 14/2060: Further trials with UPKEEP Minutes of Meeting, 1 Jul 43 and Air 20/1793: TALLBOY bombs. ACAS (TR) to CRD, 18 Jul 43.

¹⁵² TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Note D Arm D to ACAS (TR), 2 Sept 43.

¹⁵³ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Freeman to Evill, 14 Sept 43.

Meanwhile, the Squadron needed to maintain its operational edge until future precision operations were decided, but the unit had only a small number of standard aircraft and suitable targets were limited. No. 5 Group was developing other techniques to improve accuracy against area targets.¹⁵⁴ Harris and Cochrane contemplated using the Squadron for these but it had not yet perfected a high level technique and it was considered unjustified to risk crews against targets that did not provide beneficial experience.¹⁵⁵

Small, relatively undefended targets were needed. This ruled out Germany, and French targets; not yet on the agenda for No. 5 Group, although they were being attacked by others Groups.¹⁵⁶ Italian targets had returned to Bomber Command's objectives in June when aircraft returning from Friedrichshafen bombed La Spezia – the first of the so called 'shuttle' raids - landing in North Africa and bombing Italy en route back to the UK. These operations involved relatively small forces, but the targets themselves were relatively undefended and routeing could be taken away from the night fighter belt, however accurate bombing was desirable to obtain maximum results. Attacks against Italian targets earlier in the year appeared to be successful in creating antipathy towards the Fascist Government without causing strong feeling against the Allies.¹⁵⁷

This prompted Harris to re-submit a plan from six months earlier for a low level precision attack aimed directly at Mussolini.¹⁵⁸ Portal referred this to Churchill who consulted Eden.¹⁵⁹ It was rejected. Rome's historic and religious nature made it a contentious target and the chances of killing Mussolini were slim and failure might rally support for him at a time when it was believed to be crumbling.¹⁶⁰

Transport and communications were reconsidered: electrical transformer and switching stations were small targets, the location of which required precise navigation and could be attacked from reasonably low level. Owing to the number of these objectives, the Squadron joined others for a 'shuttle' operation, the type that might be required for

¹⁵⁴ Although they were main force attacks, those by 5 Group on Friedrichshafen 20 Jun 43 and Peenemunde 17 Aug 43, involved precision techniques.

¹⁵⁵ RAFM, Harris Papers, H 60: Letter Harris to Cochrane, 4 Jun 43 discusses the use of the Squadron against "south-eastern" targets – possibly Friedrichshafen.

¹⁵⁶ Middlebrook and Everitt, *Bomber Command War Diaries*. Le Creusot 17-18 Jun and Montbeliard, 15-16 Jul 43.

¹⁵⁷ Badoli and Knapp, *Forgotten Blitzes*, pp 21-22; Roger Beaumont, *The Bomber Offensive as a Second Front: Journal of Contemporary History*, Vol. 22, No. 1 (Jan., 1987), pp 14-15.

¹⁵⁸ TNA Air 8/437: Bombing of Rome. Harris to Portal, 11 Jul 43.

¹⁵⁹ TNA Air 8/437: Bombing of Rome. Portal to Churchill, 13 Jul 43.

¹⁶⁰ TNA Air 8/437: Bombing of Rome. Eden to Churchill, 14 Jul 43.

operations against Italian dams. Shortage of aircraft was solved by borrowing standard Lancasters from other Squadrons.¹⁶¹ The results were uninspiring; other than providing experience in navigation and locating small targets these operations were seen by the Squadron to be of limited benefit.

The original search for targets had been instigated under the CASABLANCA directive. In this, transportation targets, such as canals and railways, had been third in priority, preceded by submarine construction yards and the German aircraft industry.

"Objectives in northern Italy in connection with amphibious operations" were listed as those that might be requested "on demand" in relation to specific military operations. Attacks on key dams might serve to assist the advance of the Allied armies at critical times. An up to date assessment was necessary to determine those suitable for attack. Six dams were selected.¹⁶² Wallis was consulted on the technical aspects and Squadron pilots on the flying requirements. Key issues were the construction of the dam, water levels, defences, surrounding topography, and the probable effects of breaching. Only three dams (two in Sardinia) surveyed in July were sufficiently full for attack.¹⁶³

Eisenhower was consulted as to the plan's tactical importance.¹⁶⁴ Dams were currently not important and plans were put on hold, waiting for the lakes to fill while further intelligence was gathered. By late August the Bissorte Dam was reported at maximum capacity.¹⁶⁵ Wallis believed that six or eight UPKEEPS might be required to breach it.¹⁶⁶ Bufton was still enthusiastic about the operation, but Harris was now raising objections.¹⁶⁷ In his opinion tactical and political difficulties ruled it out, and time would be needed for training.¹⁶⁸ Portal accepted this view and agreed to withhold an attack unless it was urgently required.¹⁶⁹

¹⁶¹ TNA Air 27/2128: No. 617 Squadron, Operations Record Book, 15 Jul 43 and 24 Jul 43.

¹⁶² TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note on projected operations. B Ops 1 to DB Ops, 8 Jul 43.

¹⁶³ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. The attack of Italian dams with the UPKEEP weapon, 14 Jul 43.

¹⁶⁴ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. DB Ops to ACAS (Ops), 13 Jul 43.

¹⁶⁵ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Letter Collier to Wallis, 21 Aug 43.

¹⁶⁶ TNA Air 20/164: Proposed bombing of Bissorte Dam. Letter Wallis to Morley, 31 Aug 43.

¹⁶⁷ TNA Air 20/3233: Bombing attacks on Italian railways. Minute Whitworth to VCAS, 12 Sept 43.

¹⁶⁸ TNA Air 20/3233: Bombing attacks on Italian railways. Minute Bottomley to VCAS, 14 Sept 43.

¹⁶⁹ Ibid.

Meanwhile Bufton was working on other plans for Bomber Command to disrupt six rail routes into northern Italy, in conjunction with attacks by Mediterranean Air Command (MAC). In addition to the possible attack on the Bissorte Dam, precision moonlight attacks might be made against key viaducts, using 4,000lb bombs.¹⁷⁰ Harris received a Directed Letter to prepare for operations during the September moon period.¹⁷¹ Cochrane was instructed to plan attacks for the Squadron against two viaducts on the Brenner and Riviera routes. The issue of the Bissorte Dam was still undecided. The Mont Cernis route would be blocked by an attack on Modane by other units.¹⁷² If possible the attacks should be carried out simultaneously. The intention was for 617 Squadron to conduct attacks the Antheor viaduct with three aircraft and the Avisio viaduct with twelve.¹⁷³

The heavy losses on the Dortmund Ems Canal meant that only a small force could be deployed against the Antheor viaduct, boosted by aircraft from No. 619 Squadron. It was unsuccessful.¹⁷⁴ The same night 340 aircraft of Nos. 3, 4, 6 and 8 Groups attacked the marshalling yards at Modane. It was a successful operation. For the time being the Mont Cernis route was disabled, obviating the need for further consideration of the Bissorte Dam. The Squadron was to carry out two further operations against the Antheor viaduct.¹⁷⁵ The tendency for existing narratives to record these attacks in isolation reinforces the impression that the Squadron was being sent to these targets because they were suitable for destruction by a small force rather than as part of the concerted campaign against the Italian railways.¹⁷⁶

Hitherto the Squadron's operations against Italian targets have been seen as a stop gap to maintain an operational edge and an expedient way to supplement Bomber Command's effort at a time when Harris was reluctant to divert no more of his force than was necessary against Italian targets. In fact, the considerable discussion of Italian targets, including Harris's own proposal for the attack on Rome, indicates for the first time that Harris saw the Squadron as a means of delivering effective blows in this theatre, yet at minimum cost to his main offensive against Germany. In modern

¹⁷⁰ TNA Air 20/3233: Bombing attacks on Italian railways. Bufton to DCAS, 19 Aug 43 and Air 14/730: Bombing of strategic railways in Northern Italy. Letter Bufton to Saundby, 31 Aug 43.

¹⁷¹ TNA Air 20/3233: Bombing attacks on Italian railways Coryton to Harris, 5 Sept 43.

¹⁷² TNA Air 14/2039: Operation 'Puff'. HQBC to HQ Nos. 3 and 5 Groups, 8 Sept 43.

¹⁷³ TNA Air 14/2039: Operation 'Puff'. HQ No. 5 Group to HQBC, 12 Sept 43.

¹⁷⁴ TNA Air 27/2128: No. 617 Squadron Operations Record Book and Air 27/2131: No. 619 Squadron Operations Record Book, 16 Sept 43.

¹⁷⁵ TNA Air 27/2128: No. 617 Squadron Operations Record Book, 11 Nov 43 and 2 Feb 44.

¹⁷⁶ See also p. 101-102.

terminology the Squadron would become a 'force multiplier'. This policy continued for a further six months, but with a switch of emphasis to targets in occupied territories.

In the months that followed Chastise the foundations for the Squadron's future were determined. It would continue to operate as an independent unit, and would be used only periodically to attack targets suitable for attack by a small force, but possibly requiring special weapons and a high level of precision. Targets would conform to the requirements as defined by the current policy directive issued to Harris by the Air Staff, potentially addressing secondary or tertiary priorities. While these would be selected to take advantage of the Squadron's existing skills and equipment, new weapons and equipment would be considered and if necessary developed to enable other important targets to be attacked. As with the planning for CHASTISE targets were still discussed by a select committee, necessitated by secrecy and the unique requirements of UPKEEP, combining input from both the Directorate of Bomber Operations and Bomber Command.

The retention of UPKEEP, addition of the 12,000lb HC bomb and planned introduction of TALLBOY and SABS established the Squadron as a flexible, independent unit capable of a variety of applications. Already further considerations were identified, a requirement to balance a training and operations regular basis in order to maintain morale and efficiency, and the need to conserve specialist aircraft and crews, neither of which could be easily replaced.

Four associated issues are emerging that together will become a recurring theme: the selection of existing weapons, and the adaption of these for uses other than those originally intended, the provision of aircraft to carry them and the identification of alternative targets while new weapons were developed.

CHAPTER 2 September 1943 – January 1944

During autumn 1943 Bomber Command continued its area offensive against city targets. Longer nights allowed deeper penetration into Germany which would culminate during the ensuing winter in what was to become known as 'the Battle of Berlin'.

The losses incurred on the attack on the Dortmund Ems Canal placed the Squadron in a worse position than following CHASTISE. It now had only six crews out of its allotted strength of twenty. However the earlier decisions to retain the Squadron for specialist operations, including the use of UPKEEP, together with the intention to attack the Rothensee ship lift ensured its continued existence. This chapter examines the issues that emerged while the Squadron was re-constructed and practised for its new high level precision role. Contrary to the perception that this was a period of limited activity, examination of the planners' intentions and the Squadron's non-operational activity reveals a much more complicated picture than previous accounts portray.¹ Not only did planning continue for the proposed attack against the ship lift but Bufton sought to maintain the Squadron's support for the Italian campaign with proposals for further attacks with UPKEEP and attacks against the Antheor viaduct.

A significant and hitherto seemingly unnoticed development at this time was Bufton's increasing concern that Harris would transfer the Squadron to main force, and thereby bring immediate hopes of further precision attacks to an end.² To counter this Bufton developed a proposal for the Squadron to undertake a significant campaign against key industrial targets in occupied territories, which would complement other activity by the Command. This was proposed to Bottomley who accordingly asked Harris for his views.³ Although operations never materialised in the form that Bufton envisaged his proposal nonetheless merits examination as it shaped the basis for future policy during the spring of 1944.

¹ c.f. Brickhill, *Dam Busters*, pp130-143; Cooper, *Beyond the Dams*, pp 31-40; Ward *Forging of a Legend*, p 139.

² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: The present position of No. 617 Specialist Squadron, 27 Oct 43.

³ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Directed letter Bottomley to Harris, 11 Nov 43.

With all this noted, when the Squadron re-started operations during December it was employed on none of the foregoing proposals; instead it was detailed for attacks against a number of small construction works in northern France believed to be launching sites for a small pilotless aircraft – a flying bomb – targeted at London.⁴ Contrary to the impression given by most narratives, these operations were not simply meeting a tactical requirement and providing employment for the Squadron. Closer examination shows that they were in fact a progression of training – and in effect they were operational trials.

Coincident with this activity was the continuing debate about the development of TALLBOY. The parallel development of three versions of this weapon placed heavy demands on both Wallis and production resources. A solution was needed that would ensure development and production of sufficient quantities to permit an attack on the Rothensee ship lift together with other emerging targets.

The heavy losses suffered on the Dortmund Ems attack demanded immediate consideration of the Squadron's future. Cochrane was decisive. Writing to Harris within a day of the operation, he recommended that it should continue as a specialist precision bombing unit. Such a force would be more efficient and cost-effective than the USAAF's heavy day bombers against small precision targets.⁵

The Squadron had demonstrated that it was capable of accurate low level attack against lightly defended targets. Similar results could be achieved for high level attack given sufficient training with SABS. Efficient target marking was required, but Cochrane believed that this could be achieved by the Pathfinders, using OBOE - a radio precision bombing aid. OBOE was limited to a range of some 270 miles, enabling targets as far as the Ruhr to be marked. Cochrane realised that alternative marking methods were required beyond this distance, but these could evolve as the Squadron developed its technique.⁶

Cochrane and Harris were broadly in agreement over this basic policy but differed in their views as to the experience of crews to be selected and frequency of operations undertaken.⁷ Harris considered that one operation a month would be likely to be the

⁴ Christy Campbell, *Target London – under attack from the V-weapons during WW II*, (London: Abacus, 2013), p.187.

⁵ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Cochrane to Harris, 17 Sept 43.

⁶ Ibid.

⁷ See p 51 for Harris's intention.

norm and that the Squadron should comprise crews who had completed two tours of operations (i.e. at least 50 trips). Cochrane took a more pragmatic approach. Experience post CHASTISE showed that few experienced crews met Harris's criterion, and of those that did only one or two were prepared to volunteer for further operations. (Cochrane also may have suspected that there were likely to be even fewer following the losses incurred against the Dortmund Ems Canal).⁸ For the interim Cochrane was prepared to recruit those who were of suitable calibre who had completed, or were nearing completion of their first tour. Likewise, continual training without the satisfaction of successful operations would be detrimental to efficiency and morale. Cochrane suggested that three or four operations a month would be realistic, a third of those normally completed by a main force squadron.⁹

At the same time that Cochrane raised the issue of recruiting for No. 617 Squadron, Harris received a letter of protest from AVM Donald Bennett, AOC No. 8 (PFF) Group. According to Bennett, the Pathfinders were not getting the best crews or equipment. Bennett requested that his Group must be able to select from second tour crews returning to duty.¹⁰ In effect, Cochrane and Bennett were competing for the same crews. This is further reflected in Harris's responses to both Group Commanders. To Bennett: that he would "write again to main force Group Commanders and draw their attention to the importance of doing everything possible to ensure their best crews are sent to the Pathfinders."¹¹ To Cochrane: "make sure that any tour expired crews who would like to join 617 Squadron are given the opportunity of doing so. If you think it desirable I will have an official letter written to all AOCs bringing this to their notice."¹²

These were not the only demands. At a time when he was seeking to bolster his force for the impending winter offensive, Harris was also fighting a request for the repatriation of Australian Air Force crews who had completed one operational and one non-operational tour and the grant of extended leave to Canadian crews in a similar position.¹³ Harris accepted Cochrane's view that recruitment of non-tour-expired crews

⁸ Many main force aircrew now considered No. 617 to be a suicide Squadron. One of the additional gunners attached to the Squadron for the canal raid, Flt Sgt Clifford Morley, commented on the high loss rate in a letter to his mother when he returned to his parent unit: "...believe you me, I'll never do another trip with them." (Author's collection).

⁹ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Cochrane to Harris, 17 Sept 43.

¹⁰ RAFM, Harris Papers, H 57: Letter Bennett to Harris, 25 Sept 43. This complaint would re-emerge under a different guise in April 1944. See p 127.

¹¹ RAFM, Harris Papers, H 57: Letter Harris to Bennett, 1 Oct 43.

¹² TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Harris to Cochrane, 1 Oct 43.

¹³ RAFM, Harris Papers, H 79: Letter Harris to Sinclair, 8 Oct 43.

was expedient as a temporary measure. Less experienced crews would be replaced as those who were tour expired became available. He also agreed that the Squadron should concentrate on precision high level bombing using SABS.¹⁴

The appointment of Gp Capt Cheshire in November as replacement for Sqn Ldr Holden marked a turning point.¹⁵ Like a number of the crews, Cheshire came from outside No. 5 Group and had no previous Lancaster experience. His qualities of quiet, persuasive leadership were a marked change from the style of his predecessors, but his skill and innovation were key to the Squadron's future. This was a period of limited operations, as predicted by Harris and Cochrane but, contrary to the former's view, some crews felt frustrated. They had volunteered to undertake "difficult and important operations...of such importance to materially affect the course of the war," but felt underused.¹⁶ Two captains requested and obtained transfers from the Squadron.¹⁷ Conversely there were those who knew of Cheshire and respected him sufficiently to write, volunteering their services.¹⁸ Cochrane was able to recruit half a dozen crews between September 1943 and the end of the year. Three were lost on operations within a few months, but the remainder emerged as the backbone of the Squadron during 1944.

There was also the question of aircraft and equipment. The Squadron retained 13 UPKEEP aircraft against the possibility of a further attack being mounted using this weapon. The six aircraft modified to carry the 12,000lb bomb that had been lost during the month needed to be replaced and additional aircraft were acquired to bring the Squadron up to its nominal strength of twenty aircraft. Each of these required the fitting of large bomb doors and improved compressors and fittings for the installation of SABS. Further modification was required once Wallis's deep penetration bomb was available.

By the beginning of October only four standard aircraft were equipped with SABS, so restricting the amount of training that could be undertaken.¹⁹ No new standard aircraft were allocated to the Squadron and authority was issued to convert six of the UPKEEP aircraft for the installation of SABS while retaining the capability to carry UPKEEP.²⁰

¹⁴ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Harris to Cochrane, 1 Oct 43.

¹⁵ Cheshire relinquished rank to take over the Squadron, becoming Wing Commander.

¹⁶ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Johnson to Evans Evans, 30 Jan 44.

¹⁷ W H Kellaway, personal correspondence with author.

¹⁸ LCAC: Andrew Boyle papers. Letter McLean to Cheshire, 31 Jan 44.

¹⁹ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Cochrane to Harris, 3 Oct 43.

²⁰ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Harris to Cochrane, 7 Oct 43.

However, the instruction was misinterpreted by the Squadron engineers who partly restored the aircraft to standard configuration and removed much of their UPKEEP equipment.

A question now emerged: was the Squadron to retain its UPKEEP aircraft and receive additional new aircraft to carry TALLBOY, or might the UPKEEP aircraft be converted to carry it? If the latter option was chosen, could the aircraft be re-converted to UPKEEP standard or would new aircraft need to be manufactured? Converting the UPKEEP aircraft to full current operational standard would be a major and time consuming task. Any new UPKEEP aircraft would have to be produced by A V Roe, using the special equipment removed from the original aircraft. This would take 14 weeks to produce 11 new aircraft, thus precluding the mounting of any future UPKEEP operation at short notice.²¹ Meanwhile, demand for Lancasters was ever increasing.²²

Bomber Command saw Bufton's retention of the UPKEEP aircraft and the allocation of additional TALLBOY aircraft as unjustifiable extravagance. Nonetheless, their request to convert all the UPKEEP aircraft to meet the Squadron's need for aircraft to carry TALLBOY was rejected.²³ Further UPKEEP targets were under consideration and an operation might be required at short notice.²⁴

Delays in the development of TALLBOY eased any immediate requirement for TALLBOY aircraft. By the start of November seven standard aircraft were fitted with SABS; these being used heavily for training and bombing trials (p 81).²⁵ A new programme of re-equipment was drawn up. Twenty-four new aircraft were to be modified to carry SABS and 12,000lb HC or the proposed TALLBOY and delivered at the rate of three a week from the middle of November.²⁶ It was anticipated that these would be sufficient to mount an attack on the ship lift once TALLBOY deliveries began.

²¹ TNA Avia 15/3934: Bombs and Bombing: Trials and development: Special purpose spinning bomb: UPKEEP, HIGHBALL, 'Golf mine'. Re-conversion of UPKEEP aircraft to standard. D/C RD to ACAS (TR), 15 Oct 43.

²² RAFM, Harris Papers, H 79: Letter Harris to Sinclair, 27 Oct 43: In addition to making good losses, Harris wanted to replace the Short Stirlings of No. 3 Group and the last remaining Halifax squadron in No. 8 (PFF) Group. Lancasters were being withdrawn from training units to meet operational demand.

²³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute: 617 Squadron, B Ops 1 to DB Ops, 28 Oct 43.

²⁴ See p 104.

²⁵ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Minute sheet, DOR to DB Ops, 9 Nov 43.

²⁶ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note DDO (A) to MAP and DB Ops, 16 Nov 43.

Planning thus far had been on the basis that the UPKEEP aircraft were not used for any other operations and that TALLBOY aircraft were first used against the ship lift. However, changes to policy and the need for the Squadron to gain operational experience exposed the aircraft to the risk of loss. Such changes occurred during December as the Squadron began operations against targets in northern France and Belgium. The loss of a SABS / 12,000lb aircraft highlighted the risks and the fact that losses were difficult to replace. The delivery date for TALLBOY now made an attack on the ship lift unlikely before April, but under present policy the Squadron continued to conduct operations against other targets in the interim. As a result provision was made for sufficient sets of modification items to enable the production of a further 14 TALLBOY aircraft.²⁷ The Squadron had 25 SABS and 15 more were in store, barely sufficient to meet this demand. An attempt to stop SABS production for three months was blocked and production continued at the rate of 10 a month to complete the original order for 400 sights.²⁸

The realisation that no further UPKEEP operations would be possible until the spring of 1944 also led to a recommendation that the UPKEEP aircraft be converted to standard.²⁹ Two of the re-converted UPKEEP aircraft were lost during SOE operations over France in December 1943;³⁰ after this, instructions were issued to Bomber Command to store the remaining UPKEEP aircraft pending reappraisal in April 1944.³¹ This created accommodation problems. The TALLBOY and UPKEEP aircraft increased establishment to 34 aircraft which, with the 20 aircraft of No. 61 Squadron also based at Coningsby, exceeded the number of hardstandings available.³² The solution was to transfer the Squadron to become the sole occupants at Woodhall Spa.³³

²⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute DOR to DB Ops, 30 Jan 44.

²⁸ TNA Air 20/4748: Bomb sights, policy. Required output of SABS, Wilkin to MAP, 22 Jan 44.

²⁹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Report: Reconversion of UPKEEP aircraft, 13 Nov 43 and Air 20/4795: Proposed attacks on dams and other targets in Europe, ACAS (Ops) to DCAS, 5 Dec 43.

³⁰ See discussion pp 90-91.

³¹ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Letter Coryton to Harris, 30 Dec 43.

³² TNA Air 14/2062: Operational role of No. 617 Squadron. Minute 10. SOA to AOC No. 5 Group, 19 Dec 43.

³³ TNA Air 27/2128: No. 617 Squadron Operations Record Book, January 1944 Summary, 9 Jan 44.

Progress with TALLBOY underlined the need for the Squadron to perfect high level precision bombing using SABS. This required teamwork of the highest order between pilot, navigator and bomb aimer. After ground instruction crews began intensive training, using a number of bombing ranges in different locations to maximise weather opportunities. As has been shown (p 78) shortage of aircraft restricted training until approval was given to fit SABS to six of the UPKEEP aircraft.

The Squadron's practice and increasing accuracy was put to practical use from October, completing a series of trials to evaluate the ability of standard bombs to withstand impact. The trials involved dropping explosive filled bombs (but unprimed, so that they would not detonate) on a unique factory target at Braid Fell, near Stranraer.³⁴ The trials provided useful practice by day, but the Squadron obtained limited practice by night.³⁵ By late October crews obtained an average error with SABS of 80 yards from 10,000', nearly half that achieved by main force using the standard Mk XIV sight.³⁶ Further night bombing practice was undertaken in November; it was less successful. For accurate aim at night the SABS required a single spot of light, rather than the current Pathfinder marker that comprised a large shower of burning candles.³⁷ This problem would not be satisfactorily resolved until the Squadron began operations.³⁸

Meanwhile, crews unable to practise with SABS because of the shortage of aircraft carried out low level and navigational training by day. Newly arrived crews in particular were coached in low level flying to enable them to operate with UPKEEP.³⁹ Once again some of this practice was put to productive use, in this case by carrying out anti-aircraft co-operation exercises to help position defences to protect key British reservoirs.⁴⁰

By late October the Squadron was becoming proficient with SABS ready for the arrival of Wallis's deep penetration bomb and the attack on the ship lift. The problem was that TALLBOY was not ready. It was originally scheduled for October, but development and

³⁴ TNA Air 14/717: Bomber Command trials at Braid Fell target. This target comprised sections of different construction, each being typical of continental factories. The Squadron was to score hits on each section with each type of weapon which could then be examined to see how well each bomb had stood up to impact.

³⁵ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute DDB Ops to DB Ops, 31 Oct 43.

³⁶ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. Note DDB ops to ACAS (Ops), 26 Oct 43.

³⁷ Ibid.

³⁸ TNA Air 14/2010: Target indicators for use on small targets. Report on Red Spot Fire, G/C Johnson to HQ No. 5 Group, 2 Feb 44. See also p 93.

³⁹ Confirmed by flying log book entries.

⁴⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, October 1943 Summary, 19 Oct 43.

production were proving more problematical than envisaged and the weapon was now expected by February 1944.⁴¹

As seen (p 79), the DBO was concerned that once Harris heard of the delay to TALLBOY, and with no immediate operations in sight, he might attempt to curtail the Squadron's specialist status. In a memo to Bufton, B Ops 1 (whose responsibilities included operational planning and the selection of targets) emphasised the need for a directive to define the Squadron's future tasks. Failure to do so might lead to "further demands on the part of Bomber Command that it should be re-absorbed into main force."⁴² This action would immediately place the modified aircraft and experienced crews at risk, since Bomber Command was bound to request conversion of the modified UPKEEP aircraft back to standard, thus at least jeopardising, if not precluding, any future UPKEEP operations. Such a transfer would also mean that the Squadron would have less time to practice and perfect precision high level bombing, thereby negating its effort and attainment to date.⁴³ This in turn would call into question the use of TALLBOY. By now TALLBOY was not only earmarked for the ship lift but was also being considered as possibly the only weapon capable of damaging the large concrete structures that were being constructed in the Pas de Calais and believed to be connected with the emerging threat of the German rocket.⁴⁴

Prompt action was accordingly needed to find an operational role for the Squadron, both to maintain it as a separate force until TALLBOY was available and to use and develop the high level bombing skills that were now being acquired. This introduced a further set of criteria. Targets needed to be carefully selected to provide maximum experience with minimum risk to aircraft and crews. They also had to be economically significant, within OBOE range and require a greater bomb load than could be carried by Mosquitos. Ideally targets should be outside the main night fighter belt, although it might be possible to operate against objectives in the Ruhr on nights when operations by main force would draw off the fighters.⁴⁵

⁴¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note DDB Ops to DB Ops, 28 Oct 43. This issue is discussed in greater detail, pp 99-101.

⁴² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: The present position of No. 617 Specialist Squadron, 27 Oct 43.

⁴³ Ibid.

⁴⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. DDB Ops to DB Ops, 28 Oct 43.

⁴⁵ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: The present position of No. 617 Specialist Squadron, 27 Oct 43.

Thus far, target selection and planning for the Squadron had been restricted to a select number of individuals from the Air Ministry, HQBC and No. 5 Group, all co-ordinated by Bufton. As DB Ops he was also chairman of the Bombing Target Committee. This was made up of members from both Operational and Intelligence staffs with representatives from Bomber, Fighter and Coastal Commands, the USAAF, War Office, Admiralty and MEW. It was an advisory body responsible for examining potential targets, assessing them in terms of their economic and strategic importance and relevance to current directives. Suitable targets were then recommended to Bomber Command who examined them from a tactical and operational point of view. Those that passed this examination were added to the target list.

Drawing on this experience, Bufton initially considered a suggestion of key target groups: ball bearing factories in Paris, special steel plants in Belgium and electricity generating and switching stations in the Ruhr.⁴⁶ The latter two were rapidly discounted on grounds of expected night fighter activity.⁴⁷ Accordingly Bufton drafted a Directed Letter laying out Air Ministry policy for the Squadron. This informed Harris that deliveries of TALLBOY were not expected until January 1944 and confirmed that UPKEEP might still be used against dams situated along rail communications between Axis Europe and Italy. As a result, aircraft modified for UPKEEP should not be converted to standard. The Squadron should continue to equip with SABS and aircraft modified to carry TALLBOY and train for high level precision bombing. However, BODYLINE firing points were now identified as the principal target for TALLBOY, with no reference to the ship lift.⁴⁸ With no immediate major targets for the Squadron, it was "suggested" that it should be tasked to attack "important targets in occupied territory" using the ground marking and high level bombing.⁴⁹ A list of half a dozen factories in the Paris area engaged in work for the German Air Force (and therefore appropriate to the POINTBLANK directive) was attached to the letter. The selection of targets situated within urban areas of occupied territory introduced important new considerations. Precision attacks were essential to maximise the amount of damage that a small force

⁴⁶ Ibid.

⁴⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: The present position of No. 617 Specialist Squadron, Bufton's comments to draft, 28 Oct 43.

⁴⁸ BODYLINE was the code word for activity for operations to counter the German secret weapon/rocket programme. It was changed to CROSSBOW on 15 November 1943.

⁴⁹ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Directed Letter Coryton to Harris, 11 Nov 43.

could do to the target. In occupied territory these would also minimise political repercussions in the event of civilian casualties.⁵⁰

The repercussions of bombing targets in occupied territory had exercised the War Cabinet since 1940. Following the Fall of France Churchill considered the French to be recent allies who might still be able to assist in the liberation of Europe. It was important to maintain their belief in Allied victory, in addition to avoiding civilian casualties. As a result approval for daylight attacks on factories in the occupied zone was only granted in June 1941.⁵¹ These were to be undertaken only in daylight, thereby in theory reducing the risks of collateral damage, and were initially limited to shallow penetration targets. The following year saw the start of a progressive relaxation of constraints. Attacks were seen as boosting French morale and would also serve as a deterrent to Frenchmen working in German controlled factories.⁵² Approval for night attacks followed in 1942, after representations from Sinclair.⁵³ This opened the way for Bomber Command to attack industrial concerns in urban areas, the first being the Renault works at Billancourt on the outskirts of Paris. Although conducted from a lower level than usual in an attempt to achieve accuracy French civilian casualties were high.⁵⁴ Such night attacks continued, but were limited in number until January 1943, when bowing to pressure from the Admiralty, the War Cabinet sanctioned area attacks on the Atlantic U-boat bases.⁵⁵ Three months of intense bombing resulted in a heavy loss of French lives before the campaign ended. In an attempt to reduce casualties attacks on French targets reverted to daylight and were allocated to the US 8th Air Force. Their preference for high level attacks combined with inexperience, failed to produce the desired results.⁵⁶

By the autumn of 1943 the Air Staff were prepared to consider further night attacks by Bomber Command on a limited scale. However, strict rules of engagement restricted attacks to "military objectives", which included "shipyards, factories and other establishments engaged in the manufacture, assembly or repair of military material and equipment or spares..." Attacks must be carried out by experienced crews, in

⁵⁰ For discussion of this subject see Dodd and Knapp, *How many Frenchmen did you kill?* French History (2008), 22 (4), pp 469-492.

⁵¹ Overy, *The Bombing War*, p 552.

⁵² Dodd and Knapp *How many Frenchmen did you kill?* French History (2008), 22 (4): 469-492.

⁵³ Baldoli and Knapp, *Forgotten Blitzes*, p 35.

⁵⁴ Middlebrook and Everett, *Bomber Command War Diaries*, pp 244-245. Billancourt, 3/4 Mar 42.

⁵⁵ Overy, *The Bombing War*, p 558.

⁵⁶ Overy, *The Bombing War*, p 559-61.

favourable weather conditions and only after positive identification of the target.⁵⁷ Night attacks required moonlight and clear conditions - perfect conditions for night fighters. By November 1943 additional precautions were taken to minimise civilian casualties: repeated warnings by wireless and leaflets, special briefings for crews and the use of long delay fuzes with appropriate warnings to the local population.⁵⁸

The Bois-Colombes ball bearing plant in Paris produced ball bearings for use by the German Air Force. Bufton's suggestion for an attack against this target was an extension of an on-going campaign waged with the Air Staff and Harris since May 1943. Ball bearings fell within the objectives of both CASABLANCA and POINTBLANK. MEW had identified the importance of this target set, and Bufton pressed both Bottomley and his successor Coryton (as ACAS Ops) to instruct Harris to participate in a joint campaign against the major production centre at Schweinfurt.⁵⁹ His efforts were unsuccessful. Harris resisted all requests by the Air Staff. Schweinfurt was left to the Americans.

The Bois-Colombes plant's importance increased following an 8th USAAF attack on Schweinfurt in August. A daylight attack by the Americans on the Paris plant on 15 September achieved limited effect.⁶⁰ It was estimated that even one hit from a very heavy calibre bomb dropped by No. 617 Squadron would result in a far longer interruption of production.⁶¹ A second USAAF attack on Schweinfurt in October further increased Bois-Colombes' importance and Harris was asked to detail No. 617 Sqn for an attack. He thought otherwise and maintained that with only seven crews available the Squadron would have to be supported by hand-picked Stirling crews. Delay action bombs would be used, but even with OBOE marking many of these would fall outside the target area.⁶² Bottomley was against the whole operation, advising Portal that not only

⁵⁷ TNA Air 20/4383: Sabotage and bomber attacks on French factories. Minute 100, ACAS (Ops) to VCAS, 19 May 43.

⁵⁸ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Aerial Bombing of French Territory, 4 Nov 43.

⁵⁹ For details of Bufton's campaign to promote attacks on the German ball bearing industry see Cording, *The Other Bomber Battle*, Ch 5, pp 156-191.

⁶⁰ Only three hits had been scored with 500lb bombs (thereby refuting the American's claims for precision daylight attacks) but these were estimated to have cost one month's output.

⁶¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: Undated draft of Directed Letter to AOC-in-C Bomber Command (sent 11 Nov) and reply by AVM Oxland 17 Nov 43.

⁶² TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Note B Ops 1 to DB Ops, 11 Nov 43.

would there be civilian casualties, but also the delay action bombs would either break up or penetrate too deeply to be effective. Such attacks were best carried out by daylight.⁶³

Concerns about the danger of damage to civilian property had been recently voiced in a note prepared by the Air Staff regarding the attack of targets in occupied territory. Emphasising that: "Especial care is inevitably taken to minimise in every possible way the asualtlers to the civilian population which may be caused by attacks on objectives in France" it stated that, in order to minimise the risk to civil life, whenever possible repeated warnings were given by radio and leaflet and crews were specially briefed to take the utmost possible care. Targets in populated areas were avoided unless of paramount military or economic importance and that delay action bombs were used in certain instances, with appropriate warnings to the local populace.⁶⁴

Heeding this advice, and conscious of Churchill's concerns regarding French casualties, Portal ruled that the target should be offered first to the USAAF. If they were unable to carry out an attack then the War Cabinet would be asked to approve an operation by Bomber Command during the December full moon.⁶⁵ The views of Portal and Bottomley prevailed.⁶⁶

The issue of how to conduct attacks on military objectives in urban areas proved divisive. Harris maintained that if such targets were left untouched the Germans would realise this and exploit it. He suggested that 50 potential targets be named and warnings issued to the local populations, allowing these targets to be attacked if necessary.⁶⁷ Portal also subscribed to this view, but believed that such Bomber Command attacks should only be carried out by No. 617 Squadron. He instructed that warning leaflets be prepared and distributed as soon as possible.⁶⁸ Bottomley remained against such attacks, maintaining that the warnings would go unheeded. Such targets

⁶³ TNA Air 20/2797: Bombing: policy against occupied territories. Note DCAS to CAS, 13 Nov. 43.

⁶⁴ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Note, Aerial Bombing of French Territory, 4 Nov 43.

⁶⁵ TNA Air 20/3248: Bombing policy for enemy occupied territory. Note DCAS to ACAS (Ops), 14 Nov 43.

⁶⁶ The Bois-Colombes plant was attacked again by the USAAF on 31 December 1943.

⁶⁷ TNA Air 20/2797: Bombing: policy against occupied territories. Note DCAS to CAS, 13 Nov 43.

⁶⁸ TNA Air 20/3248: Bombing policy for enemy occupied territory. Note DCAS to ACAS (Ops), 14 Nov 43 and Air 20/8142: Draft of Warning Leaflet AVIS 19.

should remain daylight targets and might be dealt with more effectively and with less risk by sabotage by SOE operatives.⁶⁹

Portal's concern for civilian casualties was tempered by a degree of pragmatism. He believed that much German steel production lost as a result of attacks on the Ruhr had been balanced by production from France, Belgium and Luxembourg. To counter this, production in occupied territory should be targeted by medium bombers of the Tactical Air Force and Ninth USAAF. A propaganda campaign would emphasise that the Allies would not hesitate to bomb factories working for the German war economy. He predicted that "when a few thousands of [workers] had been killed [it] might have a very salutary effect."⁷⁰ Further investigation revealed that it was better to continue attacks against Ruhr steelworks, although attacks might be valid against certain targets producing more specialist steel in occupied territories.⁷¹

In a further effort to select suitable OBOE marked targets for attack by No. 617 Squadron, Bomber Command supplied No. 5 Group with a list of industrial plants in the Ruhr. These included major plants in Bochum, Dusseldorf and Essen, plus others producing special steels in other areas of the region, giving details of their vulnerable points and defences. A final grouping included chemical and ball bearing works, and two electrical supply targets.⁷²

At the same time, the Air Ministry provided Bomber Command with a similar list of steel plants, electrical power targets and other industrial concerns for small scale OBOE attacks by Mosquitos.⁷³ Marwood-Elton, Gp Capt Operations at HQBC was unhappy with an Air Ministry request that the Mosquito attacks should concentrate on a single industry group and suggested that this should be taken as the basis for finding targets for No. 617 Squadron.⁷⁴ By using OBOE Mosquitos to mark the targets and the Squadron to bomb them the two requirements could be addressed in one attack.

⁶⁹ TNA Air 20/2797: Bombing: policy against occupied territories. Note DCAS to CAS, 13 Nov 43. See also p 81-82 for further details of SOE's campaign.

⁷⁰ TNA Air 20/3248: Bombing policy for enemy occupied territory. Note Portal to ACAS (I), 9 Nov 43.

⁷¹ TNA Air 20/3248: Bombing policy for enemy occupied territory. Report on German Use of Steel Production Facilities of Occupied Countries, 13 Nov 43.

⁷² TNA Air 14/2009: Special targets for attack by No. 617 Squadron. Postagram HQBC to HQ No. 5 Group, 24 Nov 43.

⁷³ TNA Air 14/779: Air Ministry Directives, Vol V. Directed Letter Bufton to Harris, 25 Nov 43.

⁷⁴ TNA Air 14/779: Air Ministry Directives, Vol V. Minute 108, Marwood-Elton to SASO HQBC, 24 Nov 43.

Such targets were contentious. An earlier suggestion had been rejected on the grounds that they were within the Ruhr defences and in an area of strong night fighter activity.⁷⁵ Nevertheless the idea prompted a re-examination of the steel industry as a potential target group with the hope of finding plants in lesser defended areas. The results were not encouraging. A MEW report confirmed that bombing had caused the transfer of output to occupied territories this but was predominantly basic steel not in short supply. However, five other plants produced special steel and were considered to be worthwhile targets for daylight attack by USAAF medium bombers.⁷⁶

The need to find a suitable target was so pressing that Bufton took a chance. He selected the most important of the special steel plants, the Cockerill steel works at Liege and authorised it for attack by the Squadron with OBOE marking. He specified aiming points furthest from the built up area.⁷⁷ It turned out to be a flawed decision, or at least flawed in execution. An attack was mounted on 20/21 December: the target was covered by cloud, the OBOE aircraft failed to mark the target and only one Lancaster bombed, making a timed run from a route marker to do so. One aircraft failed to return. This was hardly the precision required, or expected.⁷⁸ Nevertheless, Bufton's proposal for a campaign against steel production demonstrated an ability to create opportunity out of apparent setback. The significance of this attack and has hitherto escaped the attention of previous historians and is recorded as merely a one-off attack to keep the Squadron occupied rather than part of what was planned as a series of attacks for the Squadron designed to target a specific industry.⁷⁹

Attacks on factories in occupied territory were much under discussion during this period. SABS and accurate marking would have permitted precise bombing and also reduced the risk of civilian casualties. However, it was not to be. The Special Operations Executive (SOE) was pressing strongly for sabotage as an alternative to bombing.⁸⁰ The Air Staff

⁷⁵ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1: The present position of No. 617 Specialist Squadron, Bufton's comments to draft, 28 Oct 43.

⁷⁶ TNA Air 20/3248: Bombing policy for enemy occupied territory. Minute Sheet, ACAS (I) to CAS, 17 Nov 43.

⁷⁷ TNA Air 14/757: Nos. 1 and 5 Groups: targets. Message Form, HQBC to HQ 5 Group, 1 Dec 43.

⁷⁸ To make matters worse, one Lancaster was shot down by a night fighter during this attack despite a synchronous main force attack on Frankfurt. This was not only an aircraft equipped for the 12,000lb bomb and SABS, it was captained by Flt Lt Rice, one of the five remaining participants of CHASTISE.

⁷⁹ Ward, *Forging of a Legend*, pp 143-144. Ward describes the target as the Fabrique Nationale Gun Factory.

⁸⁰ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Air Staff Policy in relation to the suspension of bombing attacks against targets

were initially in favour. Attractions of the proposal included less bomber effort, precise targeting in built up areas, and obliging the Germans to deploy anti-sabotage teams for numerous potential targets. It was wondered if factory management could be persuaded that sabotage was preferable to major damage by bombing.⁸¹ However, further consideration revealed disbenefits. Bombing could target the major manufacturers of key products and put them all out of action in a short space of time and a short notice, whereas SOE had limited resources and could attack relatively few targets. SOE operations took time to organise and could not be timed with such independence. Anti-sabotage activity would increase and the French would become increasingly reluctant to destroy their livelihoods. The results of bombing could be immediately assessed through reconnaissance, whereas discrete sabotage damage inside a factory could not be so detected. SOE attacks were considered unreliable, inexact and difficult to verify. Until they could be more exact the Air Staff wanted freedom to bomb any justifiable target.⁸²

The apparent success of SOE operations called for reconsideration of policy at the end of November.⁸³ A new sub-committee chaired by Bufton, but directed and authorised by Coryton, comprising representatives from SOE, Bomber Command and the United States Eighth Air Force determined the allocation of targets and co-ordination between SOE and the bombers.⁸⁴ The targets were initially taken from a list of approved objectives, selection often being prompted by information from the field. The target was then allocated either for bombing or attack by SOE based on practical criteria including the practicability of either form of attack or the urgency with which an attack was required. An attack by SOE usually required a month to prepare and execute. If SOE's negotiations with management for sabotage broke down it was deemed desirable that the target should be bombed as soon as possible. Once the allocation had been decided a copy of the target list and allocations was passed by Bufton to Harris, with others going to the C-in-C AEF, Commanding General UStAFE and SOE to Bottomley (DCAS) via Coryton (ACAS Ops). To preserve security knowledge of target allocation was kept to a select

selected for attack by SOE, 21 Nov 43. For an overall account of the Blackmail campaign see Bernard O'Connor, *Blackmail Sabotage – Attacks on French Industries in WW 2* (Lulu.com, 2014).

⁸¹ TNA Air 4382: Bombing policy for enemy occupied territory. Note ACAS (Ops) to DCAS, 12 Nov 43.

⁸² TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Air Staff policy in relation to the suspension of attacks against targets selected for attack by SOE, 21 Nov 43.

⁸³ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Letter Brig Mockler-Ferryman to DB Ops, 27 Nov 43.

⁸⁴ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Minutes of Meeting, 20 Dec 43.

few. Bottomley would then issue a directed letter to Harris instructing him to attack selected targets on the list as required.

Harris would occasionally refute the choice with Bottomley, questioning why he was not permitted to attack what appeared to be an ideal target, or refusing to use delay action fuzing. In such cases Bufton would advise Bottomley.⁸⁵ More immediate liaison was conducted between B Ops 1 and G/C Plans at HQBC. MEW would assess the results of attacks using information and photographic evidence provided by Air Intelligence or SOE. In the case of the latter this could take several weeks. Once a target was confirmed as successfully attacked it would be removed from the list, with all parties being informed by signal and a revised list would be issued following the next co-ordination meeting. New targets would be added following recommendation by SOE and/or MEW. A few targets had no immunity from air attack, but the majority would be immune from bombing until 1 March (or an earlier date agreed with SOE) but subject to sabotage operations.⁸⁶ The decision was duly communicated to Bomber Command.⁸⁷ As far as they were concerned it was a positive outcome, leaving main force free to concentrate on German cities.

Bufton's targeting of industry in occupied territories was commensurate with his belief that Bomber Command was capable of delivering attacks of greater precision. It also showed his realisation that the Squadron could be used against objectives hitherto designated only to small forces of medium bombers, thereby increasing the striking power of Bomber Command and thus establishes for the first time the true origins of the later attacks by the Squadron on French factory targets. The attack on Liege has never previously been recognised as a fragment of this plan.⁸⁸ Indeed, the entire plan has been overlooked, while until now its emergence as an alternative to the ship lift due to the delay with TALLBOY has been ignored completely.

Meanwhile Harris was dealing with another issue arising from SOE. Bomber Command was responsible for the aircraft supplying SOE operatives in the field, a task regarded by Harris as unwanted and thankless.⁸⁹ During full moon main force aircraft were used to supplement the Halifaxes of SOE's supply squadrons.⁹⁰ To minimise cost to the main

⁸⁵ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Note Bufton to Bottomley, 13 Jan 44.

⁸⁶ TNA HS/6/343: Blackmail and Sabotage. Minutes of sub-committee, 23 Dec 43.

⁸⁷ TNA HS/6/343: Blackmail and Sabotage. Directed Letter Coryton to Harris, 7 Jan 44.

⁸⁸ TNA Air 27/2128: No 617 Squadron Operations Record Book, Liege 20 Dec 43.

⁸⁹ RAFM, Harris Papers H 59: Letter Harris to DCAS, 30 Nov 43.

⁹⁰ Nos. 138 and 161 Squadrons.

offensive Stirlings were usually used.⁹¹ The transfer of four Halifaxes from the supply squadrons to the Mediterranean resulted in a further shortfall and to replace them, four of 617's Lancasters were used for drops in December. The thinking, no doubt, was that they were not being used for other operations, and the Squadron's crews were well versed in low level moonlight navigation necessary to locate the dropping zones.

The four aircraft were despatched to France on 10/11 December. Two failed to return, shot down by light flak over France; both former UPKEEP aircraft, re-modelled to carry the 12,000lb bomb. Ten nights later four more similar sorties were flown. All returned safely, but it was neither a profitable nor satisfactory use of their skills.⁹²

These events might have left Bufton still searching for suitable targets, but for the emergence of a new and near-ideal target set: CROSSBOW.

The increasingly longer nights of November 1943 provided the opportunity for the bomber force to hit targets further into Germany. As Harris opened the 'Battle of Berlin' Bufton's attention focused on a new set of targets that potentially threatened the continuation of this campaign. Unusual construction activity at forty-nine sites in Northern France was identified as being possible launch sites connected with the German pilotless aircraft and rocket programme (CROSSBOW).⁹³ More locations were being discovered each week.⁹⁴ Limited attacks were made on them but their number and approaching completion now demanded more intensive counter-measures. Bufton proposed a series of raids on selected sites by differing forces to determine the most effective weapons and weight of attack.⁹⁵ The sites were small, in rural locations, lightly defended, outside the fighter belt and within OBOE range. They would make ideal training targets for the Squadron, which could use varying types of bomb including the 12,000lb HC. Cochrane was keen, but Harris considered that such attacks, if successful, would again create demands to divert his force from German targets.⁹⁶ However, he had

⁹¹ The Stirling was being phased out from main force and relegated to mining duties. For this reason Stirlings equipped with the G-H electronic bombing aid were also being used at this time in the experimental attacks against the CROSSBOW sites.

⁹² TNA Air 27/2128: No 617 Squadron Operations Record Book, 10 Dec 43 and 20 Dec 43

⁹³ Codenamed originally BODYLINE by the Allies, this was changed to CROSSBOW on 15 November 1943.

⁹⁴ TNA Air 20/8138: V Weapons: Rockets: German long range rocket (Bodyline) and flying bomb (CROSSBOW): detection and attacks on launching sites. Undated draft note by CAS: CROSSBOW.

⁹⁵ TNA Air 40/1884: Attacks on CROSSBOW (rocket projectiles) sites and miscellaneous correspondence. Note Bufton to DCAS, CROSSBOW, 27 Nov 1943.

⁹⁶ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers: Note Bufton to ACAS (Ops), 1 Dec 43.

little option. No other economic targets could be found for the Squadron and the attacks would "assist the development of the other counter-measures being taken." Three targets had been quarantined specifically for the Squadron to attack.⁹⁷ It was hoped to prove that the diversion of large numbers of heavy bombers to destroy such sites would be unnecessary.

The Chiefs of Staff gave approval for attacks on 3 December.⁹⁸ The campaign opened on 16 December when nine aircraft each carrying a 12,000lb HC bomb were despatched to a site at Flixecourt. They were aiming at red OBOE markers bursting on the ground to create an area of burning candles, some 100 yards in diameter. These were not the perfect markers for SABS, which ideally required a single pinpoint of light against which to align the graticule. Photographs showed that it was an accurate attack with the Bombing Mean Point of Impact 50 yards from the markers.⁹⁹ No bomb was more than 130 yards from a marker, and two were as close as 30 yards. The problem was that the markers were 350 yards from the centre of the target, which remained untouched. Already Harris was re-iterating his reticence to be part of the flying bomb campaign. In a Minute to his commander, Saundby stated: "the wedge is being driven in quite fast". Harris added, "Only when we have nothing better to do and then only Stirlings and 617 Squadron."¹⁰⁰

An attack against Freval, (Ibis) on 21/22 December, using 1,000 pounders was aborted. There was cloud over the target and no markers were seen, although subsequent reports state that these probably failed through technical error.¹⁰¹ Fighter flares were seen, re-iterating the risk to a small force in moonlight, although no fighters were encountered. On seeing the results Portal commented: "The bombing was quite good, but it looks as though 24 times the number of 500lb bombs would have done more damage."¹⁰² As a result Bufton issued instructions that the Squadron's load should comprise these bombs,

⁹⁷ TNA Air 2/8415: Operations: France & Low Countries: Location of and attack on rocket and flying-bomb sites. Directed Letter Coryton to Harris, 2 Dec 43.

⁹⁸ TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Cypher Message. Air Ministry to Bomber Command, 3 Dec 43.

⁹⁹ TNA Air 14/3411: Operational Research Section: final reports on operations, night raids, Nos. 416-620 Vol. IV. Night Raid Report No. 489. Bomber Command Report on Night Operations 16/17 Dec 43.

¹⁰⁰ TNA Air 14/743: Operation Crossbow. Minute note, 17 Dec 43.

¹⁰¹ TNA Air 14/3411: Operational Research Section: final reports on operations, night raids, Nos. 416-620 Vol. IV. Night Raid Report No. 493. Bomber Command Report on Night Operations 22/23 Dec 43. Individual CROSSBOW V-1 sites were given bird codenames.

¹⁰² TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Minute Portal to DCAS, 23 Dec 43.

or 1,000 pounders when this would not reduce the number of bombs carried.¹⁰³ On a dispersed site, and when accurate marking could not be guaranteed, quantity, rather than weight was deemed to be the key factor. This ignored the fact that stick bombing diluted the accuracy of SABS. Additionally, in view of the recent failures through weather, marking would be carried out using air burst, rather than ground markers.¹⁰⁴ Given this revised method, precision bombing using SABS seemed an even more remote possibility. Realising that the value of such operations to the Squadron was diminishing, Bomber Command made representations to ACAS (Ops) who consented to 12,000lb bombs being reinstated for operations in order to assess the Squadron's (and SABS) accuracy and determine the effectiveness of the bombs against such targets.¹⁰⁵ An attack against Flixecourt (Thrush) on 30/31 December highlighted the flaws in the technique. Once again the Squadron was aiming at cascading TIs and these were found to be 280 yards short and 350 yards beyond the target. Once again the bombing had been accurate, four bombs around each marker, all but one within 120 yards, yet the target remained untouched.¹⁰⁶ The same story prevailed on 4/5 January when high winds were said to be responsible for the OBOE markers falling $\frac{3}{4}$ mile and a startling $3\frac{1}{4}$ miles from the target at Freval.

Harris continued to rebel against the policy. With considerable misgiving he had accepted three targets as an experiment; these had then been increased to eight. He was certain that no more could be accepted. Even when OBOE was working well, its average error was some 400 yards. He was prepared to continue to use No. 617 Squadron and the Stirlings (for which he had little other use), but retained strong doubts that this type of operation could ever fulfil the hopes of those, like Bufton, who proscribed it. "I do not, in fact, regard bombing of a pinpoint target by heavy bombers as a reasonable operation of war."¹⁰⁷

The Squadron developed its own technique. After using the OBOE markers to identify the target area, selected Squadron crews dropped flares to illuminate the ground while Cheshire identified the target visually from 8,000' and released a Red Spot Fire. This was better suited to the SABS graticule since it burst as a single point of light on the ground.¹⁰⁸ The remaining crews bombed after its accuracy had been assessed and any

¹⁰³ TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Letter Bufton to Harris, 24 Dec 43.

¹⁰⁴ TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Letter Oxland to Bufton, 27 Dec 43.

¹⁰⁵ TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Note Coryton to CAS, 30 Dec 43.

¹⁰⁶ AHB. Operational Research Section (BC) Report No. S 117. Attack on Special Military Target on 30/31 Dec 43.

¹⁰⁷ TNA Air 14/743: Operation Crossbow. Letter Harris to Bottomley, 11 Jan 44.

¹⁰⁸ For details of the Red Spot Fire see TNA Air 10/2593: *Special Marker Equipment, Air Publication 1661H*, Vol 1, Section 5, Chapter 8.

necessary corrections given by VHF. This method was first used at Flixecourt on the 21/22 January with spectacular results. Four nights later the process was repeated at Freval, proving that the technique was reliable. The Squadron could now demonstrably conduct precision attacks against lightly defended targets in occupied territory.

Harris's opposition to the use of his heavy bombers against Crossbow targets continued. He first argued that the markers became obscured by smoke so bombing wandered – then changed his argument to say simply that OBOE was inaccurate.¹⁰⁹ His view was not shared by Portal who still believed that heavy bombers could contribute to the attacks on these sites. Portal considered that if the attacks were made on moonlight nights (i.e. when main force was unable to go to Germany) there should be no difficulty in picking up the target on easily identifiable sites if OBOE were used as proximity marker. If No. 617 Squadron could do this there was no reason that it could not also be done by Stirlings.¹¹⁰ The latter statement suggests that the Chief of the Air Staff was unaware, or did not appreciate, the increased precision afforded by SABS (with which Stirlings were not equipped) nor the considerable amount of training required to perfect the required accuracy. Portal went on to say that if night attack by heavy bombers was proven ineffective Portal conceded that he was prepared to make the case to the Chiefs of Staff for these operations to cease. General Carl Spaatz, the newly appointed Commander of the US Strategic Air Forces in Europe (USStAFE) was keen to carry out daylight operations against these sites, although as Portal indicated: "then it would probably be necessary to take American heavy bombers off the bombing off Germany."¹¹¹ Accordingly Bottomley instructed Harris to step up his attacks on these trial targets.¹¹²

The attacks continued until 25 January when the trial was considered complete. The use of smaller bombs, combined with a growing number of sites then transferred the main thrust of operations to the USAAF assisted by the 2nd Tactical Air Force. A small number of night attacks were conducted by Bomber Command but only using Mosquitos. RAF heavy bombers would not return to these targets until after the invasion.¹¹³

The Squadron's attacks had demonstrated that Bomber Command's night operations were capable of accuracy similar to that of high level daylight bombing by the USAAF. Given better marking, they had the potential of even better results. Accepting the fact that No. 617 Squadron was a specialist unit, this gave lie to Harris's claim that precision attacks against small targets were inappropriate.

There were also important political ramifications. As predicted by Churchill, increasing numbers of civilian casualties caused by Allied bombing, and now in particular USAAF

¹⁰⁹ TNA Air 2/8415: Location of and attack on rocket and flying-bomb sites. Minute Portal to Bottomley, 13 Jan 44.

¹¹⁰ Ibid.

¹¹¹ Ibid.

¹¹² TNA Air 14/743: Operation Crossbow. Letter Bottomley to Harris, 14 Jan 44.

¹¹³ Darlow, *Sledgehammers for Tin Tacks*. pp 36-37.

attacks, were eroding “the friendly feelings of the entire French population towards the Allies”.¹¹⁴ New techniques were required. The switch of targets to CROSSBOW sites for No. 617 Squadron was fortunate. It meant that inaccurate marking resulted in cratering the fields and woodland of rural France, rather than destroying civilian homes adjacent to urban targets. Had Bufton’s original, heavily defended, ball bearing factory target prevailed, the experiment may not have progressed to permit the evolution of the low level marking technique, at least at this juncture. Paradoxically, failure would have provided Harris with further support for his belief that his force should concentrate on area attacks on German targets. Although Harris does not appear to have voiced a view at the time, it is possible that he viewed this apparent set-back as an emerging opportunity to re-dress the pre-eminence of the Pathfinder Force. On this occasion, even equipped with the latest bombing aid, PFF Mosquitos had failed, while his ‘heavies’ had developed a more accurate technique, albeit by a specialised force. This further allowed No. 617 Sqn to address tasks that might otherwise divert aircraft and crews from main force. It also created the conditions allowing Harris to develop his earlier concept of a marker force for individual Bomber Groups.

Bufton’s acceptance of the requirement to attack the CROSSBOW sites provides new insight and perspective on policy for the Squadron. Brickhill was in error when he reported that the Squadron took over attacks on these sites because daylight attacks were proving too costly.¹¹⁵ Darlow correctly records that the attacks were used to explore the effect of different types of bombs.¹¹⁶ However, when the CROSSBOW operations are placed in context as they have been by this chapter, it can now be seen that they were also an operational continuation of the Squadron’s work during the Braid Fell trials. They thus support an emerging theme; in addition to its operational role, the Squadron was being used, in effect, as an operational bombing development unit. Further examples of this will be seen later.¹¹⁷ Such sites also provided rural targets where overshoots (against inaccurate OBOE markers) caused little collateral damage. Condemnation that might have resulted from an attack against the Paris factory was thus avoided. Had this not been so, any further attacks would have been extremely difficult for the War Cabinet to sanction.

The operations against the CROSSBOW sites demonstrated that a small independent force could operate over lightly defended targets without loss. However, the loss of one of the Squadron’s aircraft while attacking a Belgian industrial target in December (p 88) further reinforced earlier concerns about the Squadron’s vulnerability to night fighters. With uncertainty over the Squadron’s future targets, steps were taken to provide as

¹¹⁴ TNA ADM 199/2467: NID, French Division “France: Reaction to the Paris and Anvers Raids, 18 Apr 43.” See also Overy, *The Bombing War*, pp 556 -562.

¹¹⁵ Brickhill, *Dam Busters*, p 144.

¹¹⁶ Darlow, *Sledgehammers for Tintacks*, p 18.

¹¹⁷ See pp 147 and 230.

much assistance and protection as possible. Two bespoke measures, Operation VISUAL – utilising long-range ground based radar, and LULU – an aircraft mounted fighter detection radar, were instigated. These have gone unexplored by other researchers, despite passing references in an early biography of Leonard Cheshire and aircrew log books.¹¹⁸

Operation VISUAL, enlisted the use of radar equipped fighter control stations on the south coast of England to monitor the progress of the Squadron's attacks and the airspace through which they were flying over Northern France. The origins of the proposal for the Squadron's use are obscure. Cheshire's biographer Andrew Boyle suggests it may have been another example of Cheshire's creativity and unorthodox methods.¹¹⁹ Type 16 radar stations on the Kent and Sussex coast, used to control fighter sweeps over Northern France, were able to detect aircraft flying high over France at a range of over 180 miles and could provide cover over the CROSSBOW sites. If the Squadron was in radio contact with the radar station timely warning could be given of approaching fighters. The Type 16 could also home the bombers to within half a mile of their target, or back to base if necessary. After discussion between No. 5 Group and Bomber Command the Squadron was given approval to contact Air Defence of Great Britain (ADGB).¹²⁰ The system was far from infallible. The Type 16's resolution was best suited to monitoring formations of aircraft and single fighters might not always be detected. The radar could not read the bombers' Identification Friend or Foe (IFF) signals and could only identify them if they flew pre-arranged routes and heights.¹²¹ Communication between the aircraft and ground station was by VHF radio telephony (R/T). Unlike most bomber aircraft at this time, the Squadron's aircraft were fitted with this equipment (a legacy of CHASTISE), but it was discovered that German early warning radar (Freya) caused interference on the Squadron's allotted operating frequency.¹²² The problem was overcome by the allocation of a new frequency.¹²³ The system was first employed on 21 January 1944 when Cheshire was able to direct an attack reassured

¹¹⁸ Boyle *No Passing Glory* (Reprint Society edition, 1957, pp 210-211) refers to VISUAL – though without using its name. Various aircrew logbooks (copies in author's collection) refer to installation tests for LULU.

¹¹⁹ Boyle, *No Passing Glory*, p 211.

¹²⁰ TNA Air 14/2040: Operation CROSSBOW. Note Co-operation with ADGB Fighter Control Stations and No. 617 Squadron when attacking CROSSBOW Targets. No. 5 Group to HQBC, 8 Jan 44 and HQBC to HQ No. 5 Group, 10 Jan 44.

¹²¹ TNA Air 14/2040: Operation CROSSBOW. Note HQBC to HQ No. 5 Group, 10 Jan 44.

¹²² TNA Air 14/1983: Use of Type 16 Stations. Notes, HQ 5 Group to HQBC, 18 Jan 44 and 23 Jan 44.

¹²³ TNA Air 14/1983: Use of Type 16 Stations. Note: Use of Type 16 Stations for 617 Squadron sorties. HQ No. 5 Group to HQ No. 54 Base, 29 Jan 44.

by the knowledge that no enemy fighters were in the area.¹²⁴ The system proved beneficial for future operations and was adopted for use by other forces.

Operations involving deeper penetration attacks required a self-contained system carried by the aircraft. The Squadron was already equipped with a rearward looking radar known as MONICA, but this only provided information regarding the range and bearing of the approaching fighter. No. 5 Group again came up with a proposal: replace MONICA with AI Mark IV, an improved radar used by British night fighters. This provided increased detection range and permitted a three dimensional interpretation of the position (relative range, bearing and height) of the approaching fighter.¹²⁵ Two aircraft were fitted with a trial installation before additional sets were installed in Squadron aircraft.¹²⁶ Known as LULU by the Squadron, the new equipment was subsequently given the official designation 'Monica V'.¹²⁷ Gradually the equipment would be adopted initially by other No. 5 Group Squadrons and then by other Groups as further AI Mk IV sets became available as RAF night fighters upgraded to more advanced equipment.¹²⁸

Both examples illustrate how the Squadron was afforded other resources in addition to aircrew, aircraft and weapons. Although sometimes instigated (particularly by Cheshire) on an ad hoc basis or through unofficial channels, these embodiments were tacitly, if not always officially, endorsed by both Cochrane and Harris. Such preferential treatment contributed to AVM Donald Bennett's growing resentment of Harris's perceived favouritism towards AVM Cochrane's No. 5 Group at the expense of the Pathfinders.¹²⁹ The proposed attack on the Rothensee Ship Lift had been instrumental in the retention and direction of the development of the Squadron. However, further consideration of this target was deferred during the autumn of 1943, pending the development of TALLBOY. Despite delays in the weapon's development, sufficient deliveries of bombs and aircraft to carry them were scheduled for the end of January 1944.¹³⁰ By mid-December 1943 Headquarters No. 5 Group were considering tactical aspects of the

¹²⁴ TNA Air 14/1983: Use of Type 16 Stations. Report by Wg Cdr Cheshire on co-operation with Type 16 control station, 30 Jan 44.

¹²⁵ TNA Air 14/2096: Monica Mk IV & Mk V AI in Stirling and Lancaster aircraft: policy. Note HQ No. 5 Group to HQBS, 9 Jan 44.

¹²⁶ TNA Air 14/2096: Monica Mk IV & Mk V AI in Stirling and Lancaster aircraft: policy Note HQBC to HQ No. 5 Group, 26 Jan 44.

¹²⁷ TNA Air 14/2096: Monica Mk IV & Mk V AI in Stirling and Lancaster aircraft: policy Note HQ No. 5 Group to HQ 54 Base et al, 15 Jan 44.

¹²⁸ TNA Air 14/1885: Losses and interceptions of specially equipped aircraft. Minute, 19 Aug 44.

¹²⁹ See pp 127 and 131-132.

¹³⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets. Draft letter to Harris, attached to Bufton note to Bottomley, 4 Nov 44.

proposed operation. Immediate issues for consideration included the method of marking the target and ensuring the availability of sufficient crews and aircraft.¹³¹

A request to Bomber Command for a provisional date for the operation triggered a review. Further delays with TALLBOY suggested that sufficient weapons might not be available until March.¹³² In any case, winter freezing restricted barge traffic on Germany's canal network, reducing the importance of the ship lift until the thaw: April now appeared to be the earliest date for any attack to ensure maximum disruption to traffic.¹³³

Buften's proposals for an attack with TALLBOY on the Rothensee ship lift in December, with the subsequent possibility of further attacks against Italian dams, do not feature in Squadron narratives. In other works they are given only brief mention and then without analysis and since neither of these proposals came to fruition they have been largely ignored.¹³⁴ As a result their influence and significance on the Squadron's future has not been fully recognised. The UPKEEP proposal has been noticed by previous chroniclers (owing the loss of an aircraft during training) but the full extent of the projected operations has only been brought to light in recent years by the author.¹³⁵

The CROSSBOW sites had demonstrated that accurate target marking was essential. Cheshire believed that the new method currently being developed for these targets might be used against the ship lift.

Mosquito fighter bombers would accompany the force to suppress the target's defences. If this tactic failed, (as had occurred over the Dortmund Ems Canal in September 1943), and Cheshire's Lancaster was unable to make a medium level marking run, the Mosquitos would drop markers from very low level (a precursor to what became

¹³¹ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. Note High level bombing attack, Target GH673. HQ No. 5 Group to HQBC, 18 Dec 43.

¹³² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets. Minute ACAS (TR) to ACAS (Ops), 17 Jan 44.

¹³³ TNA Air 14/1204: Dortmund-Ems and Mittelland Canals. Loose Minute Sqn Ldr Fawssett to Gp Capt Ops, 21 Dec 43 and Air 14/717: Gp Capt Ops to SASO HQBC, 21 Dec 43.

¹³⁴ Flower, *A Hell of a Bomb*, pp 90-91 and Melinsky, *Forming the Pathfinders*, p 104.

¹³⁵ See Owen in Morris and Owen, *Breaching the German Dams*, pp 69-72. See also fn p 50. This work was unreferenced and of restricted length owing to the nature of the publication.

Cheshire's later technique).¹³⁶ Further embellishments were added: the Mosquitos might release a HIGHBALL (the smaller, anti-shipping version of UPKEEP) specially filled with an incendiary mixture to burn in water or on land from outside the defences to run along the canal. Night fighter activity had increased considerably since the operation was originally proposed, making a moonlit attack out of the question; the operation would now have to take place on a dark night, with additional protection gained from a diversionary attack by other aircraft on a nearby target.¹³⁷

Once again, the legacy of CHASTISE and the Dortmund Ems Canal can be seen. Innovation brought with it complication and the attendant risk of failure. The marking procedure was simplified following a meeting between Cochrane, Cheshire and AVM Bennett. The use of HIGHBALL (which was having its own development problems) was dismissed in favour of Cheshire's new technique of placing markers by the light of flares, using SABS after the Pathfinders had dropped proximity markers. Further attacks on CROSSBOW sites would provide training and experience in the technique. The attack would not take place until April, the actual date being at Cochrane's discretion in order to coincide with a suitable main force operation.¹³⁸ The important question was why were there delays to TALLBOY and could they be resolved to meet the new schedule?

Wallis's original estimate for the design and production of his deep penetration bomb proved to be extremely optimistic. Though his three differing sizes of weapon (TALLBOY Small, Medium and Large) were similar it was not simply a question of scaling up from the smallest. Manufacturing capacity was another issue: of the original order, placed in July 1943, the 100 Large casings were to be cast by two foundries, those for the 100 Medium by two further companies and the 18 Small by Firth Brown (who were also producing 50 of the Large) and Vickers-Armstrongs. After casting the casings had to be machined by subcontractors before filling, but manufacturers were already stretched and materials were in short supply; capacity at the filling factories was also at a premium and further delays seemed inevitable.¹³⁹

By September 1943, the Air Staff viewed the simultaneous production of three different weapons with considerable concern. They had an operational requirement for the

¹³⁶ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. High Level Bombing Attack, OC RAF Station Coningsby to HQ No. 5 Group, 29 Dec 43.

¹³⁷ TNA Air 14/717: 617 and 619 Squadrons: Operations. Notes on operation against Target GH673, 17 Jan 44.

¹³⁸ TNA Air 14/2702: Pathfinder Force: Special Targets. Minutes of meeting, 18 Jan 44.

¹³⁹ For details of the TALLBOY design and production stages see Murray, *Bouncing Bomb Man*, pp 124-128.

Medium version, and could accept that the smaller version would be used for development trials. Freeman had placed the order for the Large version without consulting the Air Staff, who now were concerned that production of the Large weapon (for which they currently had no use) might cause the production of the Medium weapon to suffer. Further, the Large version could be carried only by a substantially modified aircraft that would be unable to carry a standard bomb load (a repeat of the UPKEEP scenario). Such a machine would have limited range and was unlikely to reach the required height to achieve ideal penetration; at best it might be possible to use it against the larger construction sites in northern France believed to be connected with the German rocket programme. Until the weapon was proven it was better to have more of the Medium version which could be used against a wider range of targets, including the possible rocket sites.¹⁴⁰ Portal took the issue to Churchill who agreed to the cancellation of TALLBOY (L).¹⁴¹

Freeman, meanwhile, a strong supporter of Wallis's weapon, had already found a means to accelerate production of TALLBOY. By placing greater reliance on American manufacture 100 casings for the Medium version could be produced within two months.¹⁴² An additional 25 were requested on the highest priority.¹⁴³ With British production this brought the total to 325.

This created new issues. Portal had instructed that no further orders should be placed until trials of TALLBOY (S) had proved the concept.¹⁴⁴ These had originally been scheduled for October 1943, but did not take place until December. Yet to obtain production capacity and material any further American orders had to be placed by mid-December, failure to do so would almost certainly result in the loss of all immediate American production. American bombs would be delivered as empty cases and uncertainly over delivery dates meant that provision had yet to be made with British factories for filling any of the weapons. Production of the tail units by Short Brothers would necessitate the probable loss of two Stirling bombers a month.¹⁴⁵

¹⁴⁰ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Note DCAS to CAS, 25 Sept 43.

¹⁴¹ TNA CAB 79/65/6: War Cabinet and Cabinet: Minutes of meetings (O) Meeting COS (43) 232nd Meeting, 1 Oct 43. Also: Air 20/1793: TALLBOY bombs. CAS to Prime Minister, 27 Sept 43.

¹⁴² TNA Air 20/1793: TALLBOY bombs: Note ACAS(TR) to ACAS (Ops), 16 Sept 43.

¹⁴³ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Cypher Message Air Ministry to RAFDEL Washington, 23 Oct 43.

¹⁴⁴ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Note DCAS to CAS, 25 Sept 43.

¹⁴⁵ Each TALLBOY tail unit had to be aerodynamically perfect to ensure accurate aim.

Production of bombs was the major concern; it would be relatively easy to convert the aircraft to carry them.¹⁴⁶ Guaranteed future supplies of TALLBOY were essential - it was needed for the ship lift and there would be other uses, including the rocket launching sites. Production and filling must be assured since the weapons were needed as soon as possible. In mid-January the first twenty Medium weapons were expected by the beginning of March. Delivery then would continue at the rate of 30 a month for the next three months.¹⁴⁷

The truth was that Bufton had little on which to base his argument. His main support was that TALLBOY had been ordered against an Air Staff operational requirement.¹⁴⁸ It was needed for the proposed attack on the Rothensee Ship Lift and, if suitable, for attacks on BODYLINE targets and concrete coastal batteries. He also cited experimental attacks against built up areas where it might cause more damage than the 12,000lb HC bomb, although no such use had been considered by Wallis.¹⁴⁹ However, until trials were complete TALLBOY performance was an unknown quantity. Unforeseen problems might further delay delivery. His decision was a great leap of faith - in Wallis's ability as an engineer, in the Squadron's ability with SABS and in the belief that further targets would quickly emerge once the weapon had demonstrated its effectiveness. Although this did much to progress the production of TALLBOY, sufficient uncertainty still remained and precluded it a part in the planning for OVERLORD.¹⁵⁰

Meanwhile, the search continued for additional targets suitable for UPKEEP. Despite initial political concerns that attacks on Italian dams might be counter-productive information on 13 potential targets was being collated.¹⁵¹ The Chiefs of Staff had confirmed the strategic importance of the Italian rail system.¹⁵² Attacks on dams were now seen as part of the integrated campaign being mounted against communications between Axis Europe and Italy, the suitability of targets being determined by both their

¹⁴⁶ TNA Air 20/1793: TALLBOY bombs. VCAS to ACAS (TR), 21 Nov 43 and DB Ops to ACAS (TR), 22 Nov 43.

¹⁴⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. ACAS (TR) to ACAS (Ops), 17 Jan 44.

¹⁴⁸ TNA Air 20/1793: TALLBOY bombs. Bottomley to Portal, 25 Sept 43.

¹⁴⁹ TNA Air 20/1793: TALLBOY bombs. Minute, Bufton to ACAS (TR), 22 Nov 43.

¹⁵⁰ This was fortuitous and enabled to Squadron to be used for another key role in the invasion, see pp 134-136.

¹⁵¹ TNA Air 20/3233: Bombing attacks on Italian railways. Note ACAS (I) to CAS and attachment, 1 Oct 43.

¹⁵² TNA CAB 79/64/13: War Cabinet and Cabinet: Minutes of meetings (O) Meeting COS (43) 232nd Meeting, 1 Oct 43.

vulnerability to UPKEEP attack and the net effects resulting from their destruction.¹⁵³ Breaching the Bissorte Dam would block the Mont Cernis Pass and attention now turned to potential targets to block the Brenner Pass.

For reasons already examined any UPKEEP operation was subject to considerable constraints. The Squadron had only 12 UPKEEP aircraft. It was unlikely that all of them would reach their target or make successful attacks. By late autumn many of the reservoir levels were low, precluding attacks, and would not refill until the spring. Any operation would be difficult to plan and require considerable resources. Once a suitable target had been identified and approved time was needed to train crews to deliver UPKEEP, but of the thirteen original crews that had survived CHASTISE, losses and postings meant that only six remained on the Squadron. As new crews were recruited they were given basic training in the necessary skills; nevertheless if an operation was called intensive practice would be needed. Further, water levels had to be re-assessed immediately before any operation was mounted to establish that conditions were still favourable, and after this there might be additional delay until the COS approved the operation.

Meanwhile other measures were being used to disrupt all the rail routes into Northern Italy. Attacks on marshalling yards such as those at Modane and Miramas caused significant disruption. Other marshalling yards, bridges and viaducts were targeted by both heavy and medium bombers, and fighter bombers, of the Mediterranean Air Forces.¹⁵⁴ Patriot groups carried out sabotage attacks and during the winter period snow and rock falls added their contribution. Effective dislocation could best be achieved by simultaneously cutting lines at several points or inflicting major damage that would take a long time to repair. Appreciation of this fully integrated campaign using aircraft from multiple Commands further establishes the true significance of the planning of further UPKEEP attacks and the Squadron's three attacks on the Antheor viaduct.¹⁵⁵

Without this knowledge, the Squadron's attacks against the Antheor viaduct appear an expedient measure, exploiting the Squadron's accuracy and the 12,000lb HC bomb. Placed in context it can be seen that they were originally intended as part of a much broader strategy. Not only were they complimentary to main force attacks on

¹⁵³ TNA Air 20/3233: Bombing attacks on Italian railways. Minute DB Ops to DCAS, 4 Oct 43.

¹⁵⁴ Alun Grandfield, *Bombers over Sand and Snow* (Barnsley: Pen and Sword, 2011). Chapters 8 and 9 discuss these operations in greater detail.

¹⁵⁵ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Attacks on the Antheor viaduct, 16 Sept 43, 11 Nov 43 and 12 Feb 44.

marshalling yards, but the attacks on other viaducts formed a comprehensive effort to prevent supplies entering Italy. This in turn links with the proposed attack on the Bissorte Dam, thereby making UPKEEP and the 12,000 pounder complementary weapons, as had been Bufton's intent when planning the original attack against the Ruhr communications network. Viewed in connection with the July attacks carried out against Italian railway and port targets and Harris's projected attack against Mussolini a new picture emerges. The Squadron can accordingly be seen as a potential major contributor to Bomber Command's support for the Italian campaign.

Despite this integrated campaign, by September the Bissorte Dam remained the only potential target for UPKEEP. Political objections had been overruled, Air Marshal Tedder (Air C-in-C Mediterranean Air Forces) confirmed its importance as a target and Bomber Command agreed that an attack "would be a reasonable operation of war".¹⁵⁶ The target had then been downgraded by VCAS, suggesting that any attack be withheld until disruption of the route became more critical.¹⁵⁷ A further review in December was prompted by continued concern that, with no operation in sight, the remaining UPKEEP Lancasters were a wasted resource and should be converted back to standard.¹⁵⁸ The War Office now considered that rail capacity in Italy met German requirements and unless all routes could be disrupted simultaneously, attacks should concentrate on the Brenner in preference to Mont Cernis or Riviera routes.¹⁵⁹ Already three out of five dams on the Brenner route had been ruled out for attack and a request by HQ North-West African Air Forces to attack the Fortezza Dam rejected on the grounds that it was tactically too difficult and held too little water to cause meaningful damage to the railway.¹⁶⁰ Destruction of the Bissorte would be of greater use at a later date during the Allied invasion of the South of France (Operation ANVIL), then scheduled for April 1944. Accordingly a decision was taken to instruct Bomber Command to store the UPKEEP aircraft.¹⁶¹

¹⁵⁶ TNA Air 20/164: Proposed bombing of the Bissorte Dam. A C Kett to DB Ops, 15 Sept 43 and 20 Sept 43.

¹⁵⁷ TNA Air 20/3233: Bombing attacks on Italian railways. DCAS to ACS (Ops), 20 Oct 43. See pp 54-55 for earlier discussion of this subject.

¹⁵⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. ACAS (Ops) to Harris and Tedder, 1 Dec 43. See p 79 for earlier discussion of this subject.

¹⁵⁹ TNA Air 20/164: Proposed bombing of the Bissorte Dam. Director of Air to DB Ops, 24 Nov 43.

¹⁶⁰ TNA Air 40/1706: Fortezza. B Ops 1 to AI 3(c), 14 Dec 43.

¹⁶¹ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. DCAS to VCAS, 15 Dec 43.

Before action could be taken the situation changed. Advice was requested on the possible destruction of the Salto and Turano Dams, north-east of Rome, to coincide with the Anzio landings (Operation SHINGLE) during the final week of January.¹⁶² Initial examination showed that UPKEEP was the only suitable weapon but new reconnaissance was required before any commitment could be made; no operation was possible before the February moon and needed COS approval in view of the certainty of civilian casualties. A firm decision would be made once all information was available.¹⁶³ Plans for any Army ground operations should not automatically assume the attack would be mounted.

The Army had not yet estimated the likely effects of an attack, Wallis had made no final assessment and there was no approval from the COS. If sanctioned the operation was to be launched from Blida, Algeria, and aircraft had to be positioned there ahead of the agreed date.¹⁶⁴ Time was of the essence and Bufton instructed the Squadron to commence training.¹⁶⁵ Three nights later, one of the irreplaceable UPKEEP aircraft was lost when it flew into the ground during practice.¹⁶⁶ Two days later reconnaissance revealed that low water levels would make an attack on the Salto impracticable. The Turano was marginal, but well defended; casualties would be high and the number of successful attacks might be small.¹⁶⁷ Wallis concurred and the operation was cancelled.¹⁶⁸ This did not bring to a close consideration of targets for UPKEEP. There was still a possibility that the weapon might be resurrected in the late spring in support of the invasion of Southern France.

Bufton's decision to seek new targets for UPKEEP was sound despite its failure to result in any further operations. The Squadron had aircraft, weapons and trained crews. Following the success of CHASTISE, his enthusiasm for the weapon was understandable but was excessive and misplaced. There was still the element of surprise for targets

¹⁶² TNA Air 20/3233: Bombing attacks on Italian railways. MAAF Advanced to Air Ministry, 7 Jan 44.

¹⁶³ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Examination of the possibility of breaching the Turano and Salto Dams, 9 Jan 44.

¹⁶⁴ TNA Air 20/4556: Operation HIGHBALL: bombing operations against enemy ships, dock gates etc. Air Ministry to HQBC, 17 Jan 44.

¹⁶⁵ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note of Action, D B Ops, 17 Jan 44.

¹⁶⁶ RAFM, Aircraft Accident Card: Lancaster ED918, 20 Jan 44. For a narrative account of the incident see Tom Bennett, *617 Squadron: the Dambusters at War* (Wellingborough: Patrick Stephens, 1986), pp 16-21.

¹⁶⁷ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. DB Ops to ACAS (Ops), 22 Jan 44.

¹⁶⁸ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Wallis to Bufton, 23 Jan 44 and TNA Air 20/4556: Operation HIGHBALL: bombing operations against enemy ships, dock gates, etc. Air Ministry to HQBC, 24 Jan 44.

outside Germany and development of the weapon to run over ground would increase possibilities for its use. UPKEEP had been designed for one particular task, and its adaptation was too difficult to achieve within the time and resources available. Moreover, other weapons were emerging that could deliver better results and Bufton's reluctance to sanction the production of further modified aircraft was understandable. However, this demanded conservation of the existing UPKEEP aircraft and so restricted opportunity to targets that could be successfully attacked by a very small force. His identification of Italian dams supported the requirement that Bomber Command should aid the Italian campaign by disrupting rail reinforcement of the German front line but the concept was then frustrated by political concerns about collateral damage. Subsequent considerations to support the Army's advance turned UPKEEP from a strategic into a tactical weapon. This contemporary realisation of the potential use of water as a weapon in support of action by ground forces has not been discussed by earlier authors although basis of this thinking re-emerged as a contributory factor in decisions to mount pre-emptive attacks against dams in advance of the Allied advance in the autumn of 1944.¹⁶⁹ It also created a further set of timing and command problems. Bufton's determination to find further targets aroused the interest of those who had little knowledge of the weapons requirements and limitations. Time and effort had to be expended dispelling unrealistic expectations, while at the same time clutching at slender opportunity. Had these not continued to keep the project alive then an earlier decision might have been taken to convert the modified aircraft back to standard. Instead fourteen Lancasters were effectively removed from the strength of Bomber Command for operations that never materialised.

The period October to December 1943 has been portrayed in the past largely as the Squadron concentrating on re-building and working up with SABS in order to perfect its high level bombing ability. Since the standard narratives make no reference to the delayed delivery of TALLBOY the impression has been created that the SABS training was simply to switch attacks with the 12,000lb HC bomb from low level to high level, thereby resulting in the attacks against the emerging V-sites. A quite different picture is constructed from this research. The training with SABS was not simply a work up period. It served an additional purpose to assist in the development of weapons for main force. The Squadron's skills were being used to maximum effect even as they were being learned. Furthermore, Bufton's continued influence remained crucial to the Squadron's future. Not only did his alternative targeting proposals use existing skills and techniques but provided for them to be further developed.

¹⁶⁹ See pp 186-188.

CHAPTER 3 February 1944 - May 1944

The decision to invade North-West Europe (Operation OVERLORD) during the spring of 1944 was taken by Churchill, Stalin and Roosevelt at Tehran in December 1943.¹ General Eisenhower was appointed as Supreme Commander Allied Expeditionary Force (SCAEF) with ACM Sir Arthur Tedder as his Deputy Air Commander in Chief, and ACM Sir Trafford Leigh-Mallory became Commander in Chief of the Allied Expeditionary Air Force (AEAF). Leigh-Mallory reported to Tedder and also headed the Joint Planning Staff (JPS), comprising Admiral Sir Bertram Ramsay and General Sir Bernard Montgomery. The JPS was tasked with preparing the plans for the initial phase of the invasion.

The consolidation of a beachhead was crucial for any invasion; for this to succeed once the landings had begun it was essential to disrupt the movement of reinforcements to the battle area. To this end AEAF planners proposed creating a 'railway desert' by severing rail links within 150 miles of Caen.² Prof Solly Zuckerman, scientific advisor to Leigh-Mallory and who had been responsible under Tedder for a similar plan to support the Italian campaign, refined and expanded the proposal. Rather than severing rail tracks that could be quickly repaired (with attacks dependent on weather, limited to shortly before the invasion and running the risk of indicating its timing and location) Zuckerman advocated targeting rail centres which would destroy locomotives and rolling stock – already in short supply, along with repair facilities. Damage would take longer to repair and attacks could be carried out over a longer period, with cumulative effect. The plan was shown to Eisenhower, who gave it his tacit approval.

Such proposals were counter to Harris's philosophy of area attacks against German targets. Portal reassured Harris that the principles outlined by the POINTBLANK Directive would remain until the invasion, after which his force would be called to support OVERLORD, although not necessarily with direct tactical support.³ While Harris accepted that OVERLORD was an inescapable commitment it was now his task to ensure that his force was used to its best advantage.⁴ He informed Portal that the only effective deployment for his Command was to target German cities; small targets, such as rail

¹ Winston S. Churchill, *The Second World War*, Vol 5, *Closing the Ring* (London: Cassell, 1952), p 357.

² Lacey-Johnson, *Pointblank and Beyond*, p 46.

³ CCO, Portal Papers: Letter Portal to Harris, 3 Jan 44.

⁴ TNA Air 20/3223: Harris, Employment of Night Bomber Force in connection with the Continent, 13 Jan 44.

installations, gun emplacements, or ammunition dumps were beyond the capability of his crews.⁵ Furthermore lack of training and defensive armament meant that his that his crews could only operate at night. Short notice tactical operations were precluded owing to the time taken to prepare aircraft and brief crews.⁶ Subsequent events demonstrated that these statements understated his crews' ability, not least in the in the case of No. 617 Squadron. Harris was further exercised at the possibility of the plan continuing for up to nine months following the invasion. This period of respite from area attacks would permit repair of much of the damage already inflicted on German industry.⁷

Harris found an ally in General Spaatz who was also a firm advocate of POINTBLANK and the continued bombing of Germany.⁸ The Transportation Plan would not meet the POINTBLANK objective of depleting German fighter strength.

The DBO were concerned on a number of counts. Bufton informed Portal that he did not believe that Harris's insistence in the continuation of POINTBLANK would be in the best interests of OVERLORD. He was also concerned that once again Harris was trying to overrule Air Staff decisions.⁹ Equally the Transportation Plan was considered to be built on a false assumption. DBO did not believe that the Germans could draw on large numbers of reserves in France. The attacks might be unnecessary. MEW did not consider marshalling yards to be economic targets, besides which they were located in urban areas which again raised the spectre of potentially heavy civilian casualties.

Spaatz believed the Transportation Plan would take too long to produce results and proposed a primary campaign against oil targets, with secondary attacks targeting German fighter production. Transportation would provide targets of last resort. This coincided with a new development of the Transportation Plan, now targeting over 70 marshalling yards and rail centres across North-West France, Belgium and Germany. Tedder, Coryton and Bufton discussed the merits of both plans at a meeting in the middle of March.¹⁰

Bufton had no confidence in either proposal and produced one of his own. To achieve air superiority he proposed targeting aircraft repair depots, factory airfields, aircraft storage areas, airfields and their personnel. These targets were largely in rural areas and

⁵ Ibid.

⁶ Ibid.

⁷ TNA Air 14/739A: Conduct of Strategic Bomber Offensive before Preparatory Stage of OVERLORD, 17 Jan 44.

⁸ Donald L Miller, *Eighth Air Force*, (London: Aurum Press, 2007) p 244.

⁹ CCA, Bufton Papers, 3/31: Letter, Bufton to Bottomley, 24 Jan 44.

¹⁰ CCA, Bufton Papers 3/44: Letter Bottomley to Portal, 14 Mar 1944.

reduced the risk of civilian casualties. Bufton also agreed with Spaatz on the importance of oil and recommended 27 such targets in Germany.¹¹

Support for Transportation Plan was waning. Bufton was convinced that it would have little effect on events during the critical five weeks immediately following the invasion. The War Office believed that the primary effort should be to reduce Luftwaffe strength and that any spare effort should be directed against recommendations made by SHAEF and JIC. Oil, tank production and depots, ordnance depots, motor transport parks and radar systems were suggested.¹² Spaatz was still against the plan, proposing Luftwaffe and oil targets while Harris, perhaps the most consistent, continued to demand greater freedom to select targets in Germany.¹³

Bottomley, disagreed with Bufton's proposal. He believed that transportation targets offered the most immediate benefits to OVERLORD. Such attacks would also mean that Harris could continue attacks against German industrial centres.¹⁴ Tedder likewise, supported the Transportation Plan. It was consistent with POINTBLANK and attacks on rail targets in Germany would contribute to both OVERLORD and the depletion of the enemy's general war effort. He proposed a new joint POINTBLANK/OVERLORD directive to address Luftwaffe targets and selected rail objectives in western France and Germany.¹⁵ Part of this change in view must be attributed to a series of trial operations conducted against suitable rail targets while these plans were under development. These demonstrated that while collateral damage was inevitable crews were capable of inflicting severe damage on these targets, sufficient to justify the continuance of such operations.¹⁶

The leading protagonists presented their proposals to Portal, Eisenhower and Tedder on 25 March. Following evidence from MEW (who were now less confident in the bomber offensive) that the Oil Plan would take four or five months to take effect owing to large stocks, Eisenhower selected the Transportation Plan, despite continued concern about potential civilian casualties.¹⁷

¹¹ CCA, Bufton Papers, 3/44: Air Staff Paper, 19 Mar 1944.

¹² CCA, Bufton Papers, 3/44: War Office Note OVERLORD Air Policy, 24 Mar 44.

¹³ RAFM, Harris Papers: H 83: Letter Harris to Portal, 24 Mar 44.

¹⁴ TNA Air 8/1188: Operation OVERLORD policy for bombing attacks. Letter Bottomley to Portal 24 Mar 44.

¹⁵ TNA Air 41/66: Minutes of Meeting held by Chief of Staff to Discuss the Preparatory Bombing Plan for OVERLORD, 25 Mar 1944.

¹⁶ For details and analysis of these operations see Lacey-Johnson, *Pointblank and beyond*, Ch 7 et al.

¹⁷ TNA 41/66: Tedder Paper, *Employment of Allied Air Forces in Support of OVERLORD*, 24 Mar 1944.

The Transportation Plan was put to Churchill at a meeting of the War Defence Committee on 5 April. Portal and Tedder supported the plan, the former now suggesting that French casualty projections of 80,000 – 160,000 Frenchmen might be over-estimated. Bufton was in attendance. Invited to present his own views, he did so candidly criticising the Transportation Plan on the grounds that it would have no effect on the initial five weeks of OVERLORD and promoting his own alternative. It was to no avail. Churchill asked Portal and Tedder to re-examine the plan with a view to minimising casualties and authorised continued attacks against targets where this risk was small.¹⁸

Bufton continued to lobby against the plan, proposing attacks on Luftwaffe installations in France, Belgium and Holland, along with military targets including camps, ammunition dumps and ordnance depots. Twenty-six road and rail bridges were also included which he claimed would restrict traffic more effectively than the proposed attacks on marshalling yards and train centres. It would also minimise civilian casualties.¹⁹

On 12 April Portal re-presented the Transportation Plan, modified to reduce casualties and calculated to cause progressive dislocation to the enemy railway system. This was agreed and the following day Eisenhower was advised that he was to assume command of all Air Forces operating from England. He designated Tedder to be responsible for all air operations connected with POINTBLANK and OVERLORD. One of SHAEF's first actions was to issue a directive on the furtherance of the bomber offensive in support of the forthcoming invasion. In this the strategical air forces were tasked "to destroy and disrupt the enemy's rail communications, particularly those affecting the enemy's movement towards the OVERLORD lodgement area."²⁰ Spaatz and Harris were notified accordingly.²¹

While the Transportation Plan was debated Bufton and the Target Committee continued to consider industrial targets in occupied territories. The ability to attack small targets, as demonstrated by No. 617 Squadron and latterly by No. 5 Group contradicted Harris's earlier assertion that his crews were unable to conduct such operations (pp 106-107). It

¹⁸ Lacey-Johnson, *Pointblank and Beyond*, p.54.

¹⁹ CCA Bufton Papers 3/46: Plan for the Employment of the Strategic Bomber Forces Prior to OVERLORD, 10 Apr 1944.

²⁰ TNA Air 37/746: Operation OVERLORD: employment of bomber forces. Directive of the Supreme Commander to USStAF and Bomber Command for support of OVERLORD during the preparatory period, 17 Apr 44.

²¹ For a further appreciation of the Transportation Plan and concerns about French casualties see: Stephen Bourque: *Rouen-La Semaine Rouge*, Journal of Military and Strategic Studies (2012), 14, (3) and (4) pp 16-22.

also enabled Bufton to implement certain aspects of his rejected OVERLORD policy in respect of attacks on aircraft repair depots, factory airfields, tank depots, ordnance depots and motor transport parks. These operations made new demands on both aircrews and the planners as they sought to achieve the most effective attacks with the minimum risk to civilians.

Debates over the Transportation Plan brought a sharp focus on the issue of collateral damage. An analysis of this subject by Lindsay Dodd shows that during this pre-invasion period political concerns were overtaken by military necessity. The French were not averse to precision attacks by small numbers of aircraft on targets that they understood to be of military or industrial importance and they understood on these operations civilian casualties might accrue. A climate of toleration was created by the RAF's obvious efforts to achieve accuracy (for example by bombing from low level) and minimise casualties (by giving sufficient time for the target to be evacuated and workers to take shelter). Associated with this was French recognition of the additional risks incurred by the crews. Conversely the American high level daylight attacks were seen as indiscriminate. During the pre-invasion period, the switch to French targets of main force crews previously engaged in the bombing of German cities inevitably reduced the accuracy of attacks (though to not as great an extent as perhaps feared) and the larger scale of the attacks inevitably created the (erroneous) impression that the RAF was now area bombing. The use of delay action bombs, favoured by the Air Staff as a means of reducing casualties, was condemned by the French. Many were killed returning after an attack had ended unaware of the presence of such weapons. Inevitably civilian casualties increased but ultimately '...political concerns... .. were invariably trumped when vital military interests were seen as at stake'.²²

Until April the Squadron operated as a separate entity. Targets were specially selected to develop its high level bombing accuracy and hone techniques required to conduct precision attacks with TALLBOY. During April this capability would be exploited to improve the quality of main force attacks. Gradually a new role began to evolve, the effects of which had repercussions for No. 5 Group as a whole for the rest of the war.

This was a complex period for the Squadron. Marking techniques switched from the Lancaster to the more agile Mosquito for defended targets and were evolved hand in hand with attacks against a variety of targets in occupied territory, culminating with a move to targets in Germany. For the purpose of this analysis these two strands have

²² Dodd and Knapp *How many Frenchmen did you kill?* French History (2008), 22 (4). pp 23-24.

been separated. As a result the development of target marking and the selection of targets cover the same period, but are viewed through a different prism. By adopting this approach the established view of the development of target marking and its culmination with the Squadron established by Brickhill and echoed by Cooper and other narratives - i.e. initially Lancasters marking undefended factory targets, then Mosquitos against lightly defended French targets progressing to the more heavily defended Paris marshalling yards and culminating in attacks on Brunswick and Munich - can be seen to be founded on false premise and that its origins and evolution lie elsewhere.²³

The impending arrival of TALLBOY added a further strand: the Squadron's role was about to change, but not in the way that had originally been intended.²⁴ Plans for its use were continually reconsidered, resulting in the emergence of new targets.

It has been shown that the development of precision high level bombing marking techniques were geared to requirements for the proposed attack on the Rothensee ship lift. Operations against specific targets were very much of a bespoke nature.

The decision to despatch Bomber Command against lightly defended targets in occupied territories during moonlight periods brought the Squadron into the main stream of policy. The key difference was that whereas main force attacks were conducted by aircraft from a number of squadrons using PFF / OBOE marking if required, the Squadron continued to operate as a self-contained unit that conducted its own marking. Targets allocated to the Squadron were usually factories in built up areas, susceptible to destruction by a small force and requiring greater accuracy than could be achieved by main force attacks.

This policy changed in mid-April 1944 when it was realised that the Squadron's marking technique could be exploited to improve the accuracy of main force attacks on area targets that required a larger force. The Squadron switched briefly from being an autonomous unit to become target markers for No. 5 Group operations. Increased bombing accuracy was achieved by marking the target, assessing the accuracy of the markers then directing the bombing and backing up the original markers as required. This resulted in a greater weight of the attack falling on the target. However, while such use of the Squadron to address main force targets was effective, it was incompatible with the long term objective of maintaining it as a separate, specialist unit. As a result a separate No. 54 Base Marker Force was created so releasing the Squadron at the end of

²³ See pp 123-126.

²⁴ See pp 87-90.

April to revert to its original role as a unit for the attack of targets requiring specialist training, weapons and equipment.

At first sight the changes during this period were at odds with Harris's original plan. The crews posted to the Squadron in February were at the end of their first operational tour, rather than a second. Six further crews introduced in early April to provide the Squadron with its own integral flare force had not even completed their first tour. Harris's intention had been for the Squadron to operate once or twice a month yet during March it mounted ten attacks, in April a further six. When, looked at from a different perspective, however, the key elements were still in place. The Squadron was still composed of experienced crews and its flare force was now better equipped and more capable for this specialist role. Beyond this, most attacks were still conducted as a self-contained force. Above all, the Squadron retained its specialist equipment and capability, and all its operations still demanded the two key skills of marking and accurate high level bombing using SABS. Taken together these things would enable a return to specialist precision attacks as soon as conditions demanded.

By the beginning of February the Squadron was up to strength with its full complement of 20 Lancasters fitted with SABS and modified with large bomb doors to carry either the 12,000lb HC bomb or Wallis's TALLBOY.²⁵ Other equipment, spares and replacement aircraft remained in short supply. By the end of March there were only seven SABS in reserve, prompting Bomber Command to request an increase in production to 10 per month to ensure sufficient stock for the Squadron.²⁶ By mid-April the Air Staff lodged an urgent requirement for the production of 20 sights a month to maintain two squadrons.²⁷

Increased use of the 12,000lb HC bomb resulted in a shortage during March. To date sections of the bombs had been supplied in small batches, without ensuring sufficient for

²⁵ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note Bufton to DCAS et al, 8 Mar 44. These aircraft were not yet fully modified. TALLBOY carriage and release mechanism would be installed during late April and early May; in their present state the aircraft could carry the 12,000lb HC bomb or other standard smaller weapons. The 11 UPKEEP aircraft were now held under storage conditions. Repairing damage or lost aircraft would not be easy. There were few sets of spare large bomb doors, modification kits to install SABS were now out of production with few in stock and production of engine mounted compressors (to provide compressed air to power the SABS) was temporarily at reduced level.

²⁶ TNA Air 2/2032: Stabilised automatic bombsight Mark II: trials. Note Stabilised Automatic Bombsight Mk IIA D Arm R to D Inst P, 31 Mar 44.

²⁷ TNA Air 20/4748: Bomb sights: policy. Note Stabilised Automatic Bombsights Mk IIA. DDE 5 to D Inst P and DB Ops, 19 Apr 44. This suggests that a further squadron may already have been envisaged.

complete weapons.²⁸ A regular order of 24 a month was now placed.²⁹ Even so, shortages and tactical considerations continued to curtail use of the 12,000lb HC after the middle of April.³⁰

For reasons already mentioned (pp 98-99) and discussed in more detail below (pp 123-126) the Squadron's use of the de Havilland Mosquito resulted from the need for a smaller, faster and more agile aircraft to mark defended targets. At the end of March two unarmed bomber variants of this aircraft were loaned to the Squadron for a month. At the beginning of April these were supplemented by two fighter bomber marks, replaced in turn the following month by similar aircraft capable of carrying rocket projectiles.³¹

The 11 UPKEEP aircraft had now been consigned to store but were flown occasionally on training flights to maintain serviceability. Most were transferred to RAF Metheringham in April, making room for the arrival of another squadron at Woodhall Spa.³² At the beginning of May, Bomber Command sought a final decision from SHAEF regarding the possible operation against the Bissorte Dam, however the project was vetoed on the grounds that civilian casualties could not be justified. Nevertheless, the possibility of other Italian targets remained open and it was accordingly decided that the aircraft should be retained in store.³³

Additional crews recruited during the autumn had done much to revitalise the Squadron but more were still required. Although Cochrane was still influential, Cheshire was also active in gathering new crews. A letter from Headquarters No. 4 Group (Cheshire's former Group) shows that he remained in indirect contact, no doubt networking and using his old contacts.³⁴ Cheshire's reputation also attracted volunteers and several unsolicited letters arrived from individual aircrew who wanted to serve under his command.³⁵ In several cases he had to decline the offers unless the individuals were

²⁸ The 12,000 lb HC Bomb comprised three separate sections and a tail unit. TNA Air 14/2169: Bomb HC 12,000 lb introduction. Note of Action, Sqn Ldr Goodman, 3 Mar 44.

²⁹ TNA Air 14/1666: Bomb design: 12,000 lb HE (HC) bombs. Minute Gp Capt Bilney to Gp Capt Plans, 7 Mar 44.

³⁰ TNA Air 27/2127: No. 617 Squadron Operations Record Book, Bergerac 18-19 April 44.

³¹ See pp 123-126.

³² See p 127.

³³ TNA Air 14/4795: Proposed attacks on dams and other targets in Europe. Note Bufton to ACAS (Ops), 6 May 44 and Bufton to Harris, 7 May 44.

³⁴ LCA: Letter HQ No. 4 Group to Cheshire, 6 Feb 44. The response was negative; No. 4 Group was expanding and needed their experienced crews, but he should contact them again if further crews were needed.

³⁵ LCA: Letters from Flg Off Lawrence, 2 Feb 44 and Flg Off Stutt, 3 Feb 44.

able to bring a complete crew with them.³⁶ In others he made an exception: replying to an ex-No. 4 Group gunner who had a solid reputation (and several night fighters to his credit) he said that he would try to meet the request.³⁷ True to his word the gunner was soon posted to the Squadron.³⁸

To summarise, in contrast to circumstances in autumn 1943 there was now no difficulty in finding full crews willing to join the Squadron. Mid-February saw a further influx of 11 crews, all but one recruited from within No. 5 Group and with experience gained during the Battle of Berlin. To meet new developments in marking technique a further eight crews were posted to the Squadron during April, making a total of 30. The Squadron settled to a period of stability.³⁹

Prior to attacks against the CROSSBOW sites, Bufton had proposed that the Squadron carry out precision operations against specific industrial targets in occupied territory. The intention was to provide operational experience with SABS and high level bombing. CROSSBOW sites had demonstrated that the proposed OBOE method of marking was unsuitable for the task. An accurate marking technique had been developed, but the Squadron now needed targets better suited to precision attack at night with large bombs. The search for suitable targets was accordingly combined with the need for moonlight targets for Bomber Command as a whole.

By the beginning of February several targets were potentially available for attack. MEW had identified five major French powder factories situated away from urban areas and although constructed to resist explosion and fire they were considered viable moonlight targets.⁴⁰ One had already been sabotaged but the remaining plants at Toulouse, Angouleme, Bergerac and St Medard were recommended for attack by main force.⁴¹ After further consideration these were allocated to No. 617 Squadron but Bomber Command's request for clearance to attack was turned down by the Air Ministry.⁴² St Medard was seen as unsuitable for attack and SOE had been given the first option for

³⁶ LCA: Letter Cheshire to Flg Off Stutt, 3 Feb 44.

³⁷ LCA: Letter Cheshire to MacLean, 10 Feb 44.

³⁸ TNA Air 27/2128: No. 617 Squadron Operations Record Book. Sgt C [sic] MacLean, 3 Mar 44.

³⁹ Between February and May 1944 the Squadron lost one crew in a flying accident, one on operations, and two were posted out, tour expired.

⁴⁰ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Letter AI 3(c) Air Ministry to Wg Cdr Morley, 8 Jan 44 and undated MEW Report: French Powder Factories.

⁴¹ TNA Air 20/5607: Target Committee: meetings and minutes. Meeting 11 Feb 44.

⁴² TNA Air 14/1206: Intelligence on directif [sic] targets. Message HQBC to Air Ministry, 28 Feb 44 and Air 14/780: Air Ministry Directives, Vol VI. Cypher message, Air Ministry to HQBC, 29 Feb 44.

sabotage at Toulouse.⁴³ These decisions undermined the value of this target group because the plants were under-used and destruction needed to be simultaneous to prevent the transfer of lost production to undamaged plants.⁴⁴ Clearance was not obtained until the April moon period.

The management of the Michelin tyre plant at Clermont Ferrand had for a time resisted collaboration and its output for the Germans had been limited. By the end of 1943, many of its management had been replaced by pro-German sympathisers and production for the Germans increased.⁴⁵ Attempts at co-operation for sabotage were rejected and a message was passed back to London requesting air attack.⁴⁶ Since the factory was in a heavily built up area MEW had rejected it as a target for a massed bomber attack, but recommended instead an accurate moonlight attack, possibly by Mosquitos.⁴⁷ The DBO had a different idea: an attack by a small force of heavies using delay action bombs and incendiaries (the only weapons currently approved for such urban targets) might not only destroy an important part of the factory, but would send out a clear signal to the management of other companies who were reluctant to permit sabotage. Bomber Command was duly advised that if they wanted to mount a small scale operation Bufton would endorse such action.

The Directorate also suggested other targets for attack during the forthcoming moon period. Amongst them was the Antheor railway viaduct, attacked previously by the Squadron in September and November, together with targets which would assist the POINTBLANK directive: two aero engine factories, at Woippy and Limoges and industrial concerns including aircraft and radar plants at Friedrichshafen.⁴⁸ In addition the four French gunpowder factories were still under consideration.⁴⁹ At this stage the onus was on Bomber Command to select the individual targets and the attacking force and the

⁴³ TNA Air 14/1206: Intelligence on directif [sic] targets Minute Sqn Ldr (Int 1) to Gp Capt Plans, HQBC, 26 Feb 44.

⁴⁴ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Letter AI 3(c) Air Ministry to Wg Cdr Morley, 8 Jan 44 and undated MEW Report: French Powder Factories.

⁴⁵ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. MEW to Wg Cdr Collier, Michelin Clermont Ferrand, 1 Feb 44.

⁴⁶ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Spinks (SOE) to Collier (HQBC), 31 Jan 44.

⁴⁷ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Minute Collier to Bufton, 1 Feb 44.

⁴⁸ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Letter Collier to Inness, 3 Feb 44.

⁴⁹ See p 114.

Directorate made no specific reference to any of the attacks being carried out by No. 617 Squadron.⁵⁰

The selection process was complex and to understand the context in which targets were allocated to No. 617 Squadron its interconnected steps must be analysed. The selection not only involved the targets under discussion with SOE, but also others under assessment by the Target Committee together with those already cleared and on target lists held by Bomber Command. The Directorate's recommendations were passed to Group Captain Plans at HQBC, who after consideration referred them with his comments to the Senior Air Staff Officer for discussion with Harris.⁵¹ Harris's modified selection was finally passed back to Group Captain Plans for further discussion and ratification with the Directorate.⁵² Included in the discussion were requests that some of the targets be cleared for attack with 12,000lb HC bombs and that two further CROSSBOW targets should be allocated for No. 617 Squadron. (The latter had been broached by No. 5 Group as an insurance should none of the industrial targets be suitable).⁵³ After some debate targets for main force during the February moon period were agreed as Limoges, Woippy, Clermont Ferrand, Antheor, Miramas marshalling yards, Friedrichshafen and the four powder works. At Saundby's suggestion the first four, together with the Cockerill Steel Works at Liege were also cleared for attack by No. 617 Squadron alone.⁵⁴ Two further CROSSBOW sites, 'Nightjar' and 'Crossbill' were confirmed later.⁵⁵

Approval came with clear stipulations. Each of the targets must be visually identified in clear conditions, apart from Liege, which was to be marked by the Pathfinders using OBOE. The Squadron could use 12,000 pounders on all its allotted targets, except Clermont Ferrand, where incendiaries or delay action bombs were to be used and every precaution taken to minimise civilian casualties.

Final decision as to the date and time of attacks was agreed between HQBC and No. 5 Group, dependent on weather conditions, availability of crews, bombs or other determining factors. SOE, MEW and Bufton all emphasised that that Clermont Ferrand

⁵⁰ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Letter Collier to Inness, 3 Feb 44.

⁵¹ TNA Air 14/780: Air Ministry Directives, Vol VI. Minute Gp Capt Ops to SASO, 5 Feb 44.

⁵² TNA Air 14/1220: Targets, Policy. Message HQBC to Air Ministry, 7 Feb 44.

⁵³ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. Minute 9. SASO No. 5 Group to Cochrane, 4 Feb 44.

⁵⁴ TNA Air 20/8142: Industrial targets in occupied countries: selection for moonlight attack. Cypher Message Air Ministry to HQBC, 8 Feb 44.

⁵⁵ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. Cypher Message HQBC to HQ No. 5 Group, 9 Feb 44.

should be attacked as soon as possible to underline the veracity of the BLACKMAIL campaign. Nevertheless the first target to be attacked, most probably on account of weather conditions, was the Gnome Rhone factory at Limoges,⁵⁶ the only other objective for the Squadron during this moon period being the Antheor viaduct.⁵⁷

The attack on Limoges in February 1944 is generally regarded by narrative accounts as the beginning of precision attacks on French factory targets; such objectives have been seen as unique to No. 617 Squadron.⁵⁸ The popular perception is that Bomber Command had not previously attacked such targets at night for fear of civilian casualties. In that context it seems logical to assume that following its perfection of marking technique against the CROSSBOW sites No. 617 Squadron should have been assigned to French factories.

However, extensive evidence has been presented to show that such attacks against French factories were not simply a spontaneous reaction to the Squadron's ability to mark accurately from low level. In fact, the Squadron was being directed back to the original strategy of attacks against industrial targets that Bufton had proposed in December before the CROSSBOW campaign, but now with the added focus of the POINTBLANK directive and SOE's BLACKMAIL requirement. Moreover, the Squadron was not unique in attacking such factories at this time a minor campaign was already being undertaken by Bomber Command.⁵⁹

The Target List and clearances were confirmed at the next Target Committee Meeting on 11 February. Already changes were being made to accommodate SOE who wanted to sabotage the Toulouse powder factory. Larger and more rural factories - the armament works at Le Creusot and Peugeot factory at Montbéliard - were sought for main force while the smaller Phillips radio valve works at Eindhoven was discussed as a potential target for the Squadron. The Admiralty raised the issue of early attack of the E/R-boat shelters under construction at IJmuiden before they were completed - a request

⁵⁶ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Limoges 8-9 Feb 44.

⁵⁷ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Antheor 12-13 Feb 44. Note the Battle Order omits Sqn Ldr Martin (Deputy Leader) whose aircraft was badly damaged by flak while carrying out a low level marking run. (See also pp 102-103).

⁵⁸ Brickhill, *Dam Busters*; Cooper, *Beyond the Dams* and Ward *Forging of a Legend*. The subject is addressed taking in the broader context by Dodd and Knapp (2008) *How many Frenchmen did you kill?* After noting that the attack on the Renault works in March 1942 killed more civilians than any attack on a German target, the authors state: "Periodic raids on French industry... ..were reinforced under the POINTBLANK directive of June 1943. Accuracy improved in 1944, and that was marked by a number of daring precision raids on French industrial targets." However, the extent and reasons for this improvement are neither examined nor explained.

⁵⁹ Montbéliard in July 1943 and Montluçon, September 1943.

reflecting the inter-service and international nature of the Committee – and it was agreed that these would be referred to the AEF and United States Strategic Bomber Force. At this point there was no suggestion that they might be suitable targets for the heavy bombers of Bomber Command. Friedrichshafen was again discussed in the light of its importance for tank manufacture revealed in a recent MEW report.⁶⁰ Harris had already referred it to No. 5 Group as a potential target for the Squadron but Cochrane was strongly against the suggestion because the target was heavily defended and wholly unsuited to attack by a small force.⁶¹

By the end of February, attacks were being scaled: for main force, limited force and/or No. 617 Squadron. New target sets had emerged in addition to the powder plants, echoing Bufton's earlier proposals (p 108). There was increased emphasis on French aircraft plants and experimental targets were being planned for main force in relation to OVERLORD: rail yards, airfields and ammunition dumps. The Squadron's target list was now composed of previous outstanding targets with further aircraft and engine plants as new additions. Despite Cochrane's protests about Friedrichshafen, this target was now recommended for a main force attack with the Squadron being allocated its own sub-target – the CROSSBOW experimental station at Oberaderach.⁶²

Harris and Cochrane were both keen to find further targets for No. 5 Group and the Squadron. Harris considered that there would be no shortage of targets in France and Benelux. Most would be within OBOE range, whereas to exploit the new marking technique more distant targets would be needed.⁶³ Cochrane proposed a list of 24 targets in France of which he felt 18 were practical for moonlight attack.⁶⁴ These were passed to Bufton for consideration.

Bufton outlined his own target selection.⁶⁵ There were no individual targets of major economic importance in France; a number of factories had been allocated to main force to work up crews during the moon periods and a number of smaller targets were given to No. 617 Squadron.⁶⁶ Bufton favoured targets whose destruction would be detrimental

⁶⁰ TNA Air 20/5607: Target Committee: meetings and minutes. Minutes of Meeting 11 Feb 44.

⁶¹ RAFM, Harris Papers H 59: Letter Cochrane to Harris, 10 Feb 44.

⁶² TNA Air 14/1206: Intelligence on directif [sic] targets. Suggested targets for No. 617 Squadron, 18 Feb 44 and undated target list (Enclosure 35A).

⁶³ RAFM, Harris Papers, H 59: Letter Harris to Cochrane, 25 Feb 44.

⁶⁴ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. Enclosure 4a, Targets in France for small scale attack, (undated).

⁶⁵ TNA Air 20/8142: Bombing: Industrial targets in occupied countries: selection for moonlight attack. Notes on Conference held in DCAS Office, 28 Feb 44.

⁶⁶ These included the powder plants.

to the German Air Force, notably aero engine factories and rubber plants. He again suggested experimental attacks against suitable test targets including an airfield, ammunition dump and a marshalling yard, proposals which echoed his earlier rejected plans during the Transportation Plan debate. These were embodied in a directive letter .to Harris that outlined eight targets for main force, four OVERLORD test targets and seven targets for main force attacks by less than 50 aircraft along with 13 targets allocated to No. 617 Squadron.⁶⁷ The importance of Friedrichshafen was re-iterated to Harris and Oberaderach was again added to this list.⁶⁸

Meanwhile Bufton continued to press for attacks against German ball bearing industry (p 85). The Air Staff believed that the enemy's supply of bearings was reaching a serious state and every effort should be made to curtail supply. In a note to Portal on 10 February 1944, AVM Coryton, reported: "Apart from the large scale attacks on the major factories at Schweinfurt, we have completed very successful attacks on the minor factories at Turin, Villa Perosa, and the CAM works in Paris. The SRC works at Annecy have been put out of action by SOE. These attacks on the smaller factories are extremely important now that the enemy is in this critical position."⁶⁹

Contrary to the impression given by Coryton, the attacks in August and October 1943 had been conducted by the Americans, who suffered heavy losses. Bufton had been trying unsuccessfully for seven months to get Bomber Command to mount attacks against Schweinfurt. Direct approaches to Harris had failed as had further efforts through Bottomley. Harris viewed Schweinfurt as another panacea target; production was certain to have been dispersed and any attack would be a diversion from his main thrust against the German capital.⁷⁰ It was a totally impractical target for Bomber Command. It was too small, could not be marked with sufficient accuracy and would have to be attacked in moonlight, risking high losses.⁷¹ Frustrated by Harris's intransigence Bottomley demanded that Harris attack Schweinfurt "at the first suitable opportunity."⁷² Harris did not despatch his force until 24/25 February 1944.

⁶⁷ TNA Air 20/8142: Bombing: Industrial targets in occupied countries: selection for moonlight attack. Targets for attack by Bomber Command in moonlight periods prior to OVERLORD, 1 Mar 44.

⁶⁸ TNA Air 14/780: Air Ministry Directives, Vol VI. Directed Letter Coryton to Harris, 4 Mar 44.

⁶⁹ TNA Air 20/2796: Bombing: policy, Part 2. ACAS (Ops) to CAS, 10 Feb 44.

⁷⁰ TNA Air 2/4477: Planning: Germany Air offensive against Germany. Harris to Bottomley, 20 Dec 43.

⁷¹ TNA Air 2/4477: Planning: Germany Air offensive against Germany. Harris to Under Secretary of State for Air and Bottomley, 9 Jan 44.

⁷² TNA Air 20/5835: Attacks on ball bearing factories. Bottomley to Harris, 14 Jan 44.

Coryton's note went on to cite a report by MEW, stating that there was only one bearing factory left in France worthy of attack - the Nadella needle bearing plant at St Etienne. The plant had been allocated for sabotage by SOE. However, contact with the agent detailed to sabotage the Nadella needle bearing plant at St Etienne had been lost and SOE accordingly requested that this plant be bombed.⁷³ It was a small target, set in the middle of a residential area. As with Limoges, the first suggestion was for a Mosquito attack by AEF. However, AEF were heavily engaged with POINTBLANK and CROSSBOW targets and the target was instead added to the Squadron's list.⁷⁴

This episode again demonstrated Bufton's continuing determination to progress his preference for individual target sets against Harris's area attacks, enlisting the support of the Air Staff. At the same time, with hindsight, it also provides support for Harris's suspicion of the validity of MEW input which Bufton frequently used to support his recommendations.⁷⁵ Post-war investigation by the British Bombing Survey Unit concluded that MEW had under-estimated the resources of German industry and over-estimated the effects of attacks against centres of production and individual industry target sets.⁷⁶

By now, the success of the Squadron's attacks was acknowledged. In detailing the targets for No. 5 Group it was noted that clearance had to be obtained from Bomber Command for any attack, with the exception of operations by No. 617 Squadron. Cochrane thought these moonlight operations were a great incentive and now allocated specific targets to the Bases of No. 5 Group. All operations were planned along the lines of the new technique - medium level marking and assessment followed by controlled visual bombing.⁷⁷ Even without the refinement of SABS Cochrane believed that by following the Squadron's example bombing accuracy and concentration would be improved.⁷⁸

⁷³ TNA Air 20/2796: Bombing: policy, Part 2. ACAS (Ops) to CAS, 10 Feb 44.

⁷⁴ The Squadron successfully attacked the Nadella plant on 10-11 Mar 44, following an abortive attempt due to poor visibility 2-3 Mar 44.

⁷⁵ For full analysis of the issues relating to Bomber Command attacks against the German ball bearing industry see Cording (2006), Ch. 5.

⁷⁶ Solly Zuckerman, *The Strategic Air War against Germany 1939-1945 : Report Of the British Bombing Survey Unit*, (London: 1946), p 83.

⁷⁷ For an example of the technique in use see Air 14/2054: Operations from East Kirkby: reports. Report on bombing attack on airfield and buildings at Clermont Ferrand, 10-11 Mar 44.

⁷⁸ TNA Air 14/757: Nos. 1 and 5 Groups, targets. Letter Cochrane to Saundby, 5 Mar 44.

Target lists became increasingly fluid as this transpired and more targets were found. Objectives outside France were now considered for the Squadron, such as the Phillips valve factories at Venlo and Eindhoven, and Ford at Antwerp.⁷⁹ Some such as the Caudron Renault works in Paris were seen as too difficult even for the Squadron;⁸⁰ others were dismissed as unsuitable or no longer significant.⁸¹ SOE brought more pressure to bear for an attack on the Michelin works at Clermont Ferrand since the BLACKMAIL campaign had no purchase until this was undertaken and the operation was eventually mounted on 16 March 1944.⁸² The success of this and the other attacks restored the credibility of the campaign.⁸³ Clermont Ferrand was quickly followed by successful attacks on the powder works at Bergerac and Angouleme which had finally been cleared.⁸⁴ The other two powder plants were left to main force.⁸⁵

Unsuccessful attacks on the Berliet works at Lyons at the end of March were the catalyst for a further refinement to the marking technique.⁸⁶ This resulted in the re-creation of the Squadron with its own flare force and Mosquito markers, and the initial target list for April suggests the intention was for the Squadron to continue to operate independently. Moonlight targets were now being issued to both Nos. 1 and 5 Groups and still mainly comprised aircraft and engine plants, with rail centres as a build up to the Transportation Campaign. Targets for the Squadron were more eclectic; a mix of aircraft plants, steelworks, electronics factories and pre-OVERLORD objectives while geographical boundaries were extended to encompass Belgium, Holland and Norway.⁸⁷ However, during April a change in policy would result with the Squadron acting mainly as the

⁷⁹ TNA Air 14/3475: Target Committee: reports of meetings Nos. 58-110. Meeting, 10 Mar 44.

⁸⁰ TNA Air 20/8171: Operations France and Low Countries, SOE: coordination of bombing attacks. Note Caudron – Renault, 12 Mar 44.

⁸¹ TNA Air 14/780: Air Ministry Directives, Vol VI. Minute 44, Gp Capt Plans to SASO HQBC, 6 Mar 44. Oberaderach was one such target deleted.

⁸² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note DDB Ops to ACAS (Ops), 24 Feb 44. One reason for delay was dissent about the bomb load to be used. Bomber Command considered delay action bombs unreliable. TNA Air 20/5607: Target Committee: meetings and minutes. Minutes of Meeting, 25 Feb 44. On the evidence of recent attacks approval was given for the use of 12,000lb HC bombs providing low level marking was employed.

⁸³ TNA HS 6/43: Blackmail and sabotage. Minutes of third meeting of sub-committee, 17 Mar 44. Without extra manpower in the field SOE were finding it difficult to cope with the number of targets and some of their targets were transferred to Bomber Command.

⁸⁴ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Bergerac 18-19 Mar 44 and Angouleme 20-21 Mar 44.

⁸⁵ Middlebrook and Everitt, *Bomber Command War Diaries*. St Medard 28-29 Apr 44 and 29-30 Apr 44 and Toulouse 1-2 May 44, pp 501-503.

⁸⁶ These failed partly due to poor illumination, see p 124.

⁸⁷ TNA Air 14/757: Nos. 1 and 5 Groups: targets. Minute 11 and target list (Encl 20A), 2 Apr 44.

markers for No. 5 Group's main force with the consequence that a number of the Squadron's designated targets were reallocated to other squadrons or Bases.⁸⁸

Only three of the targets attacked during this period were directly related to the BLACKMAIL campaign. Many of the others selected for attack (Limoges, Albert, St Etienne and Woippy) produced aircraft or engine components and therefore contributed to POINTBLANK. Nevertheless, each operation served to reinforce the message (promoted by further leaflets dropped showing the results of some of these attacks) that the RAF was capable of precision attacks by night, and that the greatest care was being taken to avoid civilian casualties.⁸⁹ The evidence supports the belief that the Squadron was allocated the more difficult or sensitive targets. The fact that some of these were later transferred to main force shows that the latter was also becoming a more accurate instrument. A tendency hitherto by historians writing about the Squadron to treat it as a disembodied entity has obscured the context in which its activities were planned and masked the full extent and number of these targets. Such de-contextualisation has also obscured the fact that had the Squadron continued this campaign, comparable targets outside France would have been attacked, and that Cochrane was already entertaining the possibility of similar attacks on small German industrial objectives. This latter consideration is particularly telling since to date the universal perception has been that the Squadron's tactics were only to be used against area targets in Germany.

The Squadron's ability to mark difficult targets strongly influenced target allocation. Examination and analysis of the evolution of the Squadron's marking technique reveals evidence that challenges the established view that it was simply an evolutionary process driven purely by operational experience.

The attacks on the CROSSBOW sites established the use of medium level marking, dropping Red Spot Fires as an aiming point for SABS. A meeting held at HQBC in January to discuss target marking for the attack on the Rothensee ship lift proposed two methods of target marking. Markers dropped by OBOE or H2S were preferred to identify the general target area.⁹⁰ The main marker aircraft would identify the target visually and release a stick of Red Spot Fires across it from medium altitude after which the main force would be directed to aim at the marker in the stick nearest the target. A second

⁸⁸ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. HQBC to HQ No. 5 Group. Target list, 2 Apr 44.

⁸⁹ These photographs also appeared in the Allied press, and cine camera footage of many of these operations filmed by the Bomber Command Film Production Unit was used in newsreels to communicate the same message to Allied audiences.

⁹⁰ H2S was a ground mapping radar fitted to some aircraft that could be used for blind bombing.

suggested method was to use flares dropped by H2S aircraft to illuminate the target for individual bomb aimers who each made a visual attack on the target.⁹¹ The former technique had worked well over the CROSSBOW sites, where OBOE-dropped proximity markers enabled Cheshire to mark the target visually. The Red Spot Fire was an ideal marker: its size and intensity suited the SABS graticule and the burning time of 15-20 minutes was sufficient for a small force to complete the attack.

For attacks against French factory targets the Squadron dispensed with the proximity marker dropped by OBOE. Immediate visual identification of the target was made by moonlight, or by the light of flares if natural light was insufficient. This in itself was not a new idea, AVM Bennett, advocated a similar method.⁹² However, French factory targets were generally undefended, or lightly defended, and Cheshire made extremely low level marking runs to ensure accurate placement of the markers. The method worked perfectly for the attack on Limoges in clear conditions, where the markers were released from 50 feet.⁹³ At Albert marking was carried out successfully by the light of flares from 6,000 feet. However, against a defended target the risks were only too apparent: during an attack on the Antheor viaduct the Deputy Marker's aircraft was hit and badly damaged, killing his bomb aimer.

The technique brought other problems. Marking aircraft needed to arrive in advance of the main attack to mark the target at precisely the allotted time, just ahead of the arrival of the main force. Late marking meant that the bombers were forced to orbit the target, thus increasing the risks of flak, night fighter attack or collision. If flares were used there was a danger that they might dazzle the marker aircraft. More than this, the enemy was getting wise to the technique and previously unprotected targets were now being furnished with defences. The SABS required a long and steady run up to the target: in addition to the risks of being shot down, flak bursts could prevent an accurate run and searchlights might blind the pilot. Flak gunners were now aware of the importance of the low flying marker aircraft but the use of other aircraft from the main force to act as a decoy was risky and uneconomical.⁹⁴

⁹¹ TNA 14/2702: Pathfinder Force: special targets. Minutes of meeting held at HQBC, 18 Jan 44.

⁹² RAFM, Harris Papers H 57: Letter Bennett to Harris, 19 Apr 43.

⁹³ On this attack Cheshire initially released incendiaries, which were then backed up by Red Spot Fires.

⁹⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Memorandum on the future development of precision bombing by No. 617 Squadron, 9 Mar 44.

The use of the Squadron to drop flares, however, diverted them from their main task of ensuring an accurate bombing run. After a difficult attack on St Etienne on 10 March future operations used a small formation of aircraft from No. 106 Squadron as a flare force, implementing an improved method of flare dropping.⁹⁵ Despite this, a new marking technique was needed if the method was to remain viable. This should be totally independent of the main Squadron, allowing tactical flexibility with a short bombing run so as to be relatively immune from the defences.

Following on from earlier discussion regarding the ship lift, Cheshire suggested the use of a Mosquito. From the same discussion came the idea of 'stand-off' marking.⁹⁶ It might also be worth considering the development of rocket projectile markers. These would enable the aircraft to mark the target from a greater distance and could also be aimed and fired after only a brief glimpse of the objective. The new concept was supported by Cochrane, who submitted it to Harris, pointing out that it was impossible to fit rockets to a Lancaster and recommending that two Mosquitos be allocated for this form of marking, and that rocket marker trials should be conducted as soon as possible "on ranges in this country and against targets in France".⁹⁷

Cochrane was thinking about the practicalities of marking the ship lift. Harris had further ideas. If the method was successful it would allow the Squadron to make precision attacks against lightly defended targets in Germany (p 132). He also envisaged using the Mosquito to place markers for use by the PFF as a datum for starting their marking run.⁹⁸ The Squadron was provided with two Mosquitos on loan at the end of March to ascertain if the technique was viable. These aircraft were B XVI bombers, which were equipped for high altitude work and could not carry rockets.⁹⁹ This was not what No. 5 Group had in mind: they wanted to experiment with rocket projectiles before attempting low level marking.¹⁰⁰ However, Mosquito VIs capable of

⁹⁵ TNA Air 27/834: No. 106 Squadron Operations Record Book. March 1944 Summary, 15 Mar 44 and Air 14/2062: Operational role of No. 617 Squadron. Record of conference to consider recent combined operations of Nos. 617 and 106 Squadrons, 26 Mar 44.

⁹⁶ For earlier discussion of the use of the Mosquito and stand-off marking see p 99.

⁹⁷ TNA Air 14/2062: Operational role of No. 617 Squadron. Note: Future policy on precision bombing by No. 617 Squadron, 18 Mar 44.

⁹⁸ TNA Air 14/2062: Operational role of No. 617 Squadron. Note: HQBC to HQ No. 5 Group, 26 Mar 44. This again reflects Harris's continued efforts to maintain his force's offensive against Germany.

⁹⁹ The loan of the two Mosquitos from No. 109 Sqn, a No. 8 (PFF) Group unit, was almost certainly sanctioned at HQBC level with Harris's approval.

¹⁰⁰ No. 617 Squadron Archive: HQ No. 5 Group to HQBC, Employment of Mosquito aircraft for target marking, 30 Mar 44. The desire to trial rocket marking with Mosquitos from the outset reverses the sequence which has been assumed by a few other

carrying rocket projectiles were in short supply and as yet no projectile marker had been developed. The Squadron thus pursued low level and dive attack with spot fires instead.

Further refinements in technique were soon in hand. Operations using No. 106 Squadron as the flare force had proved difficult to co-ordinate.¹⁰¹ Consideration was first given to the use of aircraft from yet another squadron before deciding to integrate the flare force as part of No. 617 Squadron and controlled by the Marker Leader using VHF.¹⁰² However, this flare force required aircraft equipped with H2S and at this point such machines were in short supply. During the first week of April six such aircraft and crews experienced in the use of this equipment and flare dropping were accordingly loaned to the Squadron from various units.¹⁰³ Even before these became operational the Squadron carried out two successful operations using the Mosquitos against moderately defended targets already on the moonlight list, an aircraft factory at Toulouse and an Air Stores Park at St Cyr, within the outer defences of Paris.¹⁰⁴ These proved the technique to be practical without undue risk. Two more Mosquitos, this time Mark VIs, arrived on 11 April.¹⁰⁵ The Squadron was now a self-contained force capable of locating the target, illuminating it, marking it and carrying out precision bombing.

Meanwhile HQBC asked Cochrane to forward a list of German targets suitable for attack using the new technique¹⁰⁶ and two days later, Harris authorised Cochrane to use the Squadron to mark and control No 5 Group attacks against targets in Germany.¹⁰⁷ This extension of the Squadron's marking role is highly significant. Previous writers have attributed the switch to German targets as being the logical progression from the attacks against the Paris marshalling yards (pp 128-129), a gradual scaling up of the technique in respect of the intensity of the defences. However, this evidence clearly shows for the first time that Harris confirmed his decision to apply the Squadron's low level marking

historians, whereby the rocket experiments were seen as an evolution from the delivery of spot fires.

¹⁰¹ TNA Air 14/2062: Operational role of No. 617 Squadron. Record of conference to consider recent combined operations of Nos. 617 and 106 Squadrons, 26 Mar 44.

¹⁰² TNA Air 14/2063: Control of operations at the target. Minutes of conference held to discuss methods of marking and controlling attacks of Group targets, 8 Apr 44.

¹⁰³ TNA Air 27/2128: No. 617 Squadron Operations Record Book, 6 Apr 44.

¹⁰⁴ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Toulouse 5-6 Apr 44 and St Cyr 10-11 Apr 44.

¹⁰⁵ RAFM, Aircraft Movement Cards. Mosquitos NS992 and NS993 were not equipped to carry rocket projectiles. They were replaced in May by aircraft fitted with the appropriate equipment.

¹⁰⁶ AHB HQBC Operations Record Book: The use of No. 5 Group as a separate force, 6 Apr 44.

¹⁰⁷ TNA Air 14/2063: Control of operations at the target. Minutes of conference held to discuss methods of marking and controlling attacks of Group targets, 8 Apr 44.

technique to German targets much earlier, after the Squadron had completed only one operation using the Mosquito.¹⁰⁸

This evidence demands a re-consideration of the evolution of the marking of targets for Bomber Command. Previous accounts have seen the increased defences of the Antheor viaduct as the catalyst for the switch to a more manoeuvrable aircraft for marking. However, the research presented here has shown that the idea had been under consideration since December 1943 for the Rothensee ship lift. The two key determinants of the Squadron's future, TALLBOY and accurate low level marking of defended targets, are thus found to have been instigated by preparations for an attack against the ship lift. Yet until now other accounts have either ignored the pivotal significance of this target or passed it over in few words.

On 14 April control of the Strategic Bomber Forces transferred to SHAEF; Harris and General Spaatz now reported to Eisenhower through his Deputy, Tedder. From now on the Air Staff had to place targeting through SHAEF and the Bombing Target Committee was replaced by regular meetings of the Air Commanders in Chief at which target selection and priorities were decided.¹⁰⁹ This revised procedure would continue for the next five months, after which Bufton would regain control as joint chairman of the Combined Strategic Target Committee.¹¹⁰ The effect of the transfer of target selection from the DBO to SHAEF has been ignored by works that concentrate on the operational record. It not only reduced Bufton's ability to decide the Squadron's individual targets, but it increased Harris's involvement. However, it did not bring an end to Bufton's influence over the Squadron, or its future. He now turned his attention to ensuring that TALLBOY was available in sufficient quantity and assessing its performance against various types of targets as a guide to potential future use.

TALLBOY was soon to become available for Squadron use: final ballistic and detonation trials were about to commence and once TALLBOY was cleared for service the Squadron would again be targeting objectives as a single unit. Since this was incompatible with the Group marking role recently devised the only solution would be to train another unit, or units, in the techniques and assign No. 617 Squadron's role to them. As there were no

¹⁰⁸ These targets were in addition to the ship lift that had been considered earlier.

¹⁰⁹ These conferences were conducted weekly at first and then almost daily following D-Day, and attended regularly by Harris or his representative.

¹¹⁰ See p 170. Harris considered this period under SHAEF direction to be the only period of his command when he was not "harassed and confused by confused and conflicting directives." Harris, *Bomber Command*, p 214, cited in Peter Gray, *The Leadership, Direction and Legitimacy of the RAF Bomber Offensive from Inception to 1945*, (London, Continuum, 2012) p 244.

other Mosquitos in No. 5 Group, and flare dropping was a specialist task, Harris's solution was to look to the Pathfinders. He ordered No. 627 Squadron (a Mosquito marker squadron) and Nos. 83 and 97 Lancaster Squadrons (both of which had been in No. 5 Group prior to the formation of the Pathfinders) to be detached temporarily to No. 5 Group to fulfil the role. They were to occupy No. 54 Base (No. 627 Squadron at Woodhall Spa with 617, and the Lancaster squadrons at Coningsby) under the operational and administrative command of No. 5 Group.

It was a pragmatic solution, but it was not well received by Bennett who saw it as a further example of Harris's perceived favouritism of Cochrane and undermining of the Pathfinders.¹¹¹ Indeed, the transfer of the three PFF squadrons had ramifications beyond No. 5 Group and with the potential to spread across the whole Command. Bufton, too, expressed concern. He was uncertain that the low level Mosquito technique would work against defended targets; it might prove unsustainably costly. If successful, the transfer might become permanent and lead to the breaking up of Pathfinders. This, he cautioned, would be contrary to Air Staff policy.¹¹²

The Squadron played a limited role in the execution of the Transportation Plan. Its precision was better directed at French factories and other targets that did not require a large force. At the beginning of April their target list contained only one rail target, the marshalling yard at Vaires.¹¹³ By this date the Plan had identified 69 rail centres as being suitable for attack by day or night and heavy or medium bombers.¹¹⁴ Most problematical in this respect were two marshalling yards at Juvisy and La Chapelle, both within the Paris defences and surrounded by housing. Such targets had been excluded from Portal's list on 12 April on account of the risk to civilians.¹¹⁵ These two targets, however, were ideal for No. 5 Group and the new technique, where the advantages of being able to mark a strongly defended target could be maximised by despatching a large force rather than a single squadron. The benefits outweighed potential risks. A week later the Squadron marked both of these targets for main force attacks.

¹¹¹ Bennett, (1960), pp 154-156.

¹¹² TNA Air 20/778: Pathfinder Force: formation, organisation and equipment. Bufton to ACAS (Ops), 17 Apr 44.

¹¹³ TNA Air 14/2009: Special targets for attack by No. 617 Squadron, HQBC to HQ No. 5 Group. Target list, 2 Apr 44.

¹¹⁴ TNA Air 37/746: Operation OVERLORD: employment of bomber forces Note: Attacks on railway targets in connection with Operation OVERLORD, undated and List of railway targets cleared for attack, B Ops 1, 3 Apr 44.

¹¹⁵ TNA Air 41/66: *The Liberation of NW Europe: Vol I The Planning and Preparation of the Allied Expeditionary Air Force for the Landings in Normandy 1942-1944*, p.160.

Both operations were concentrated and successful despite inevitable stray bombs from the main force aircraft. The Mosquitos were able to mark a defended urban target and despite limited communications between the Controller and bombing force it was possible to control the main attack. The two targets provided a useful interim demonstration before the technique was put to the ultimate test over Germany. French reports indicated that 400 French had been killed in Paris on the night of 18/19 April when Juvisy was attacked.¹¹⁶ This was in contrast to a main force attack against Sotteville marshalling yards on the same night, using OBOE marking, when over 2,200 buildings in Sotteville and Rouen were destroyed by bombs falling outside the target area, resulting in over 900 casualties.¹¹⁷

The attacks on Paris were intended to demonstrate not only that main force bombing was sufficiently accurate to benefit from precise marking, but also that the Mosquitos could mark a target within a defended area.¹¹⁸ Defences on the Juvisy operation were described as slight flak and few fighters.¹¹⁹ Flak was more intense over La Chapelle, and a number of main force crews remarked that the reduced bombing height (to improve accuracy) was "quite low enough from a flak point of view."¹²⁰ In neither case, however, was the marker force hindered by the defences.

It is generally assumed that the success of these operations led to the next stage of adopting the technique to mark German targets. This was not so. As already seen, this decision had been made on 8 April.¹²¹ However, Harris may have been further influenced by discussions leading to a tactical decision taken the following day that stemmed from Bomber Command's scheme to reduce losses by attacking multiple targets on the same night and the decision to use No. 5 Group as a separate force.¹²²

¹¹⁶ TNA Air 20/2798: Bombing Policy in Occupied Countries, Part 2, Annex A: 24 hours to 1330 hrs 19 April. Report by Paris radio.

¹¹⁷ Stephen Bourque: *Rouen-La Semaine Rouge*, Journal of Military and Strategic Studies (2012), 14, (3) and (4) pp 24-26.

¹¹⁸ Dodd and Knapp (2008) *How many Frenchmen did you kill?* notes that Harris had originally claimed that: "Bomber Command would not achieve sufficient accuracy" against rail targets but that his predictions "were confounded by experimental raids... at Trappes and Le Mans early in March." This refers to ordinary main force attacks. Precision marking as exploited by No. 5 Group improved upon this original result.

¹¹⁹ TNA Air 14/3411: Operational Research Section: final reports on operations, night raids, Vol. IV. Report No. 581, Juvisy, 18-19 Apr 44.

¹²⁰ TNA Air 27/1921: No. 463 Squadron Operations Record Book. Lancaster LL247, La Chapelle, 19-20 Apr 44.

¹²¹ See p 125.

¹²² TNA Air 14/1212: Control of operations at the target. Minutes of Meeting of Bomber Command Tactical Planning Committee, 9 Apr 44.

Main force had experienced heavy losses on recent operations.¹²³ To reduce these it was decided that if conditions permitted two targets should be attacked on the same night and that No. 5 Group would simultaneously attack a third target using this new marking technique. Careful selection of targets and routes was called for to split the defences.¹²⁴ The first such multi-target operation to be proposed embraced an OBOE attack on Essen, a PFF blind bombing attack on Brunswick and a No. 5 Group attack on Munich.¹²⁵ If implemented these plans would establish the Squadron firmly at the centre of large operations by No. 5 Group, rather than operating independently as a small force against specialist targets.¹²⁶

The proposed simultaneous operations against three targets did not materialise. Attacks on multiple German targets commenced on 22 April when the Squadron and the No. 54 Base Marker Force led 215 main force aircraft (including 10 from No. 1 Group) to Brunswick, while 596 aircraft from other Groups carried out a PFF marked attack on Dusseldorf.¹²⁷ The defences over Brunswick were relatively light, but the operation was only a partial success.¹²⁸ Although the Squadron's initial marking was accurate, initial flare dropping was poor and some of the backing up was inaccurate.¹²⁹

Cochrane was undeterred and sufficiently confident to despatch No. 5 Group, led by No. 54 Base, to Munich on 24/25 April, while aircraft from PFF and other Groups attacked Karlsruhe. The defences over the Bavarian capital were intense, but again Cheshire demonstrated that the technique could still be used effectively without loss to the Mosquito markers.¹³⁰ Two nights later, the technique was used again. While PFF and

¹²³ Notably the attack on Nuremberg, 30-31 Mar 44. See Middlebrook and Everitt, *Bomber Command War Diaries*, pp 486-488.

¹²⁴ TNA Air 14/1212: Control of operations at the target. Minutes of Meeting of Bomber Command Tactical Planning Committee, 9 Apr 44.

¹²⁵ *Ibid.*

¹²⁶ The idea that individual Groups might each have their own marker force was not new. This had been Harris's original concept for what had become PFF, overridden by Bufton's single Group concept on Portal's instruction in 1942, see p 48.

¹²⁷ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Brunswick 22-23 Apr 44. TNA Air 27/2148: No. 627 Squadron Operations Record Book, Brunswick 22-23 Apr 44. The Brunswick attack was the first No. 5 Group operation to involve Mosquitos of No. 627 Squadron, who provided weather reconnaissance, dropped WINDOW (strips of metal foil to disrupt enemy radar) and carried out reconnaissance after the attack.

¹²⁸ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Brunswick 22-23 Apr 44 and Air 14/3411: Operational Research Section: final reports on operations, night raids, Vol. IV. Report No. 584, Brunswick, 22-23 Apr 44.

¹²⁹ These factors, combined with poor visibility and poor communications resulted in only fifty per cent of the force's bomb load being concentrated on Brunswick.

¹³⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Munich 24-25 Apr 44, and Air 14/3411: Operational Research Section: final reports on operations, night raids, Vol. IV. Report No. 586, Munich, 24-25 Apr 44.

other Groups attacked Essen, No. 627 Squadron operated alone to mark a No. 5 Group attack on Schweinfurt where the main force bombing was less accurate and many bombs fell off target.¹³¹ The key problem that emerged was not that of marking the target, but control of the subsequent bombing and any re-marking of the target that might be required. At the root of this was the fact that while the marker force was in VHF contact with the Marker Leader, main force aircraft were not equipped with VHF radio. Instead one of the marker Lancasters had to act as a link aircraft re-broadcasting the Controller's instructions by W/T.¹³² It was a slow and inexact method. Cochrane immediately requested that all No. 5 Group aircraft be equipped with VHF sets. With this he believed that he could improve the Group's results by fifty per cent.¹³³ It was an issue already identified by Bomber Command.¹³⁴ The installation was eventually agreed, but the equipment was in short supply¹³⁵ and a solution was only found by the provision of comparable equipment produced by the Americans.¹³⁶ Meanwhile the shortcomings of the existing system were confirmed by the catastrophic attack against Mailly le Camp on the night of 3/4 May, 1944.¹³⁷

This throws new light on the evolution of thinking about target marking across Bomber Command. Use of the Squadron to mark the Paris rail yards for No. 5 Group was a pragmatic decision taken for both political and operational reasons. It was a tactical insertion into Harris's existing plans for the Squadron to mark German targets for No. 5 Group. SHAEF were benefiting from an existing decision, rather than helping to evolve the thinking that led to attacks on Brunswick and Munich. Nevertheless, taken in a broader context, each of these defended targets provided opportune test targets to

¹³¹ Middlebrook and Everitt, *Bomber Command War Diaries*. Schweinfurt 26-27 Apr 44. p 500. TNA Air 27/2148: No. 627 Squadron Operations Record Book, Schweinfurt 26-27 Apr 44.

¹³² Instructions received by the link aircraft VHF (direct speech) would be re-broadcast to the rest of the force by wireless telegraphy (Morse code) using pre-arranged code words to communicate required action.

¹³³ TNA Air 14/1255: Installation of VHF equipment in bomber aircraft: policy. Letter Cochrane to Harris 28 Apr 44.

¹³⁴ TNA Air 14/1255: Installation of VHF equipment in bomber aircraft: policy. Minute Note 29, Gp Capt Constantine, 19 Apr 44.

¹³⁵ TNA Air 14/1255: Installation of VHF equipment in bomber aircraft: policy. HQBC to HQ No. 5 Group 26 May 44.

¹³⁶ TNA Air 14/1255: Installation of VHF equipment in bomber aircraft: policy. Coryton to Harris, 12 May 44.

¹³⁷ RAFM, Bomber Command Night Raid Report No. 595: 3-4 May 1944, Mailly le Camp. The Mailly attack was marked by Cheshire and the three other No. 617 Squadron Mosquito crews. Delays in marking and confused control resulted in the main force having to orbit in moonlight waiting for instructions. Despite Cheshire's attempts to establish contact directly with the main force he was unable to do so. Night fighters were extremely active and 42 of the attacking force of 346 Lancasters were lost.

develop a technique that may have been the only means of marking the ship lift for TALLBOY in the absence of rocket projectiles.

However, such use of the Squadron to mark for No. 5 Group was always seen as temporary, and it was not the result of a need to release the Squadron for Operation TAXABLE - the D-Day deception - and TALLBOY. Harris made no effort to conceal his intentions: "My alternative was then, has always been, and still is, to form a Pathfinder element in each Group". Although Harris maintained that the idea was "an experiment" and could be revoked at 48 hours' notice he thought it would be a success. Further, he believed that the approach might be extended to other Groups in the future.¹³⁸ Since the need for additional marking effort arose from the decision for main force to attack more than one target per night, Harris saw an opportunity to re-structure the marker force along the individual Group model he had preferred in 1942 (p 48). The assumption that the Squadron would be relinquishing Group marking duties with the arrival of TALLBOY may not have been the only factor. Cochrane's plans for No. 617 Squadron to operate as an independent force following the Munich attack clearly suggest that an early replacement for the Squadron as Group markers was required by May 1944 regardless of the impending arrival of TALLBOY.

Cochrane's apparent ability to obtain whatever specialist equipment he required further added fuel to the fire as far as AVM Bennett was concerned. A strident letter to Harris at the end of April detailed the difficulties arising from the transfer of the three squadrons to No. 5 Group.¹³⁹ A further letter sent at the end of May echoed this, requesting that the squadrons be returned for the benefit of the Command. Bennett considered the No. 5 Group technique to be little different from the Pathfinders' method and the results obtained were no better than those of the rest of the Command. Cochrane was getting his own way because "it has always been his policy to shout the loudest in order to get what he wants".¹⁴⁰ Bennett's protests were in vain. Communications issues aside, Cheshire, Cochrane and Harris were satisfied that the technique was effective. The three Squadrons would remain with No. 5 Group for the remainder of the war and their use to continue the attacks against German targets allowed No. 617 Squadron to revert to its role as a self-marking, precision bombing unit.¹⁴¹

¹³⁸ RAFM, Harris Papers, H 83: Letter Harris to Portal, 14 Apr 44.

¹³⁹ RAFM, Harris Papers, H 57: Letter Bennett to Harris, 30 Apr 44.

¹⁴⁰ RAFM, Harris Papers, H 57: Letter Bennett to Harris, 31 May 44. See also p 71.

¹⁴¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. TALLBOY Report, B Ops 1 to DB Ops, 27 Apr 44.

Bennett's statement that the No. 5 Group technique was little different from that of PFF has given rise to suggestions that Harris was only able to implement his concept of target finding squadrons within each Group because he transferred crews already trained by the PFF.¹⁴² This is only partially correct. Much of the PFF marking was carried out from high level in order to extend the range of OBOE.¹⁴³ While the concept of proximity markers and a preceding flare force conformed to PFF practice the placing of the spot fires by Mosquitos from low level was a new concept. On arrival at No. 54 Base the No. 627 Squadron crews had to embark on a programme of shallow dive bombing in order to become proficient with the technique.¹⁴⁴

The debate about the future of the Squadron's own marking capability after Munich has never previously been examined in detail. In standard narratives the requirement simply became progressively less important.¹⁴⁵ Nevertheless investigation reveals the divergence of views held by Command, Group and Base on how best to employ the Squadron. It has already been noted (pp 124 -125) that Harris and Cochrane planned use the Squadron for independent attacks against German industrial targets. Cochrane was confident that the low level marking technique was viable against well defended targets. He submitted a list of 21 targets in the Ruhr to Harris, covering three categories of target, chemicals, power and steel that could be attacked during the summer months, using the new marking technique. In addition the Squadron was to continue making independent attacks on targets from the moonlight lists, including the ball bearing plant at Annecy and the Phillips works at Venlo and Eindhoven. In Cochrane's opinion there would never be any shortage of targets for them.¹⁴⁶

For these it needed its own permanent marker force of Mosquitos and H2S equipped Lancasters, rather than rely on equipment on loan. However, the B XVIIs were returned by the beginning of May, leaving the Squadron with only two FB VIIs and the six borrowed H2S Lancasters for flare dropping.¹⁴⁷ This was insufficient and Cochrane

¹⁴² Sebastian Cox, *Sir Arthur Harris and some Myths and Controversies of the Bomber Offensive*. RAF Historical Society Journal, 47 (2010), pp 11-12.

¹⁴³ Brian Bond, *Britain's two World Wars against Germany - Myth, Memory and the Distortions of Hindsight* (Cambridge: Cambridge University Press, 2014), p 108.

¹⁴⁴ William DeBoos, *Skylarks to Quail* in Alan Webb (ed.), *At First Sight*, (London Colney: Mosquito Museum, 1991), pp 45-47.

¹⁴⁵ With the advent of TALLBOY most operations were carried out in daylight and required only occasional marking.

¹⁴⁶ TNA Air 14/1206: Intelligence on directif [sic] targets. Letter, Cochrane to Harris, 2 May 44.

¹⁴⁷ RAFM: Aircraft Movement Cards: Mosquitos ML975, ML976, NS992, NS993, NT202 and NT205.

recommended a permanent establishment of four Mosquitos and six H2S Lancasters.¹⁴⁸ Harris disagreed. An alternative solution to attach No. 627 Squadron crews to No. 617 Squadron for operations was also rejected.

No. 54 Base wanted to mark for No. 617 Squadron in the same manner as they did for the rest of No. 5 Group, rather than detaching crews.¹⁴⁹ This would mean that No. 617 Squadron no longer operated as a self-contained independent unit or needed the Mosquitos and the H2S Lancasters. The idea foundered when No. 54 Base acknowledged the difficulties of marking two separate targets for No. 5 Group on a single night, plus a third for 617. No. 54 Base Commander also proposed a second, more radical option. This ignored No. 617 Squadron's role as a specialist precision bombing unit and re-created the Squadron solely as a marking and control squadron. To do so necessitated re-equipping it with 12 Mosquitos for marking and 12 Lancasters as backers up.¹⁵⁰ This was not considered a realistic possibility and in the end Harris's original decision prevailed. The Squadron would have to supplement their marker force with aircraft from No. 54 Base as necessary.¹⁵¹

As it transpired even this option never came to fruition. Cochrane's proposal for further factory attacks by the Squadron was never implemented and the whole episode has been by-passed by narrative accounts - the historical record has been effectively concealed.

The evidence suggests that although Harris realised the benefits of having a specialist precision unit, there were limits to the extent to which he would permit them exclusive use of scarce resources. The transfer of the three PFF Squadrons to No. 54 Base had provided No. 5 Group with its own marking Force, thereby negating the need for No. 617 Squadron to mark for them. This was in keeping with Harris's original intent for each Group to have its own marking force and supports Cording's assertion:

¹⁴⁸ TNA Air 14/2062: Operational role of No. 617 Squadron. Cochrane to HQBC, 5 May 44. No. 617 Squadron had been used as a 'three-in-one' unit, illuminating the target using their six borrowed H2S aircraft, marking it with their Mosquitos with their remaining Lancasters then backing up the marking with red spot fires. The new method now utilised three Squadrons to perform the same task.

¹⁴⁹ TNA Air 14/2062: Operational role of No. 617 Squadron. HQ No. 54 Base to HQ No. 5 Group, 29 May 44.

¹⁵⁰ Ibid. Presumably such a role would have used Nos. 83 and 97 Squadrons as illuminators.

¹⁵¹ TNA Air 14/2062: Operational role of No. 617 Squadron. HQBC to HQ No. 5 Group, 17 May 44.

"...tapes made in 1972 by Dudley Saward in extended interviews with Harris... ...are self-incriminating. Harris's admission that from the day of its inception he worked against the Pathfinder Force in order to fulfil his own plan of a Pathfinder Force in every Group, had it been known, should have required his instant dismissal. In interview, Harris may have indulged in exaggeration and hyperbole, but surely there was no reason for him to have been anything less than truthful, and the veracity of the tapes is borne out by the fact that they provide confirmation of the actions that he took during the war."¹⁵²

Uncertainty over the delivery of TALLBOY resulted in a lack of firm commitment for the Squadron in respect of OVERLORD.¹⁵³ Had circumstances not intervened the Squadron may have been included as a late addition in a precision bombing attack, possibly as part of Operation FLASHLAMP, the bombing of 10 gun batteries defending the Seine Bay.¹⁵⁴ An attack using TALLBOY may not have been totally out of the question; the first weapons were delivered to the Squadron on 1 June. By this time, however, the Squadron was already committed to a specialist role the importance of which eclipsed any call on it for bomber operations - Operation TAXABLE.

An element of the planning for OVERLORD required the provision of radio countermeasures (RCM) to cover both the approach to the beaches and the landings. A large part of this task was devolved to Bomber Command, the only organisation to have both the necessary equipment and experience for such a task. On this basis it would be logical to assume that the entire requirement would be given to Bomber Command's specialists in this field, No. 100 Group.

Details of the RCM operation's requirements were put to Bomber Command in mid-April.¹⁵⁵ The most challenging task was to drop WINDOW to create the impression on enemy radar of approaching naval forces. These spoof convoys would approach landing areas well away from the main beachhead and were intended to cause confusion as to the location of the main landing.¹⁵⁶

¹⁵² Cording (2006), *The Other Bomber Battle*, p 18.

¹⁵³ See p 101.

¹⁵⁴ Michael J F Bowyer, *Aircraft for the Many – a detailed survey of the RAF's aircraft in June 1944* (Yeovil: Patrick Stephens, 1995), p 24.

¹⁵⁵ TNA Air 37/1240: Allied Expeditionary Air Force: WINDOW and RCM. McCloughry to Leigh-Mallory, 17 Apr 44.

¹⁵⁶ These spoof landings were an extension of the elaborate deception plan, Operation FORTITUDE.

The idea had been conceived earlier in the year, with the intention of using crews from training units.¹⁵⁷ Wellingtons from Operational Training Units were considered but they were unable to carry the required quantities of Window. Only heavy bomber aircraft had both sufficient capacity to carry the quantity of WINDOW required and the electronic navigational aids necessary to execute the operation. No. 100 Group only had three Squadrons equipped with such aircraft; these were fitted with specialised jamming equipment and required for other precise tasks.¹⁵⁸ Bomber Command was ill-disposed to divert additional aircraft from other tasks.¹⁵⁹ By early May the situation was unresolved and Harris continued to maintain that his force was unable to undertake the deception.¹⁶⁰ As with the support for SOE (pp 90-91) he was prepared to concede obsolescent Stirlings, but the task properly required Lancasters equipped with the latest GEE navigational aid. Under increasing pressure, Harris was forced to reconsider his stance.

It was fortuitous that the Squadron was not otherwise committed for OVERLORD. Once again it provided Harris with a sufficiently adaptable resource to undertake an unusual and specialist commitment which otherwise would have depleted main stream effort. The task required specialist navigation and precise flying of the highest order, well suited to the Squadron's crews. After due consideration an order was issued to stand the Squadron down from operations for a period in order to perfect the necessary techniques.¹⁶¹ Although technical difficulties with the Gee network resulted in the Squadron being used for only one simulation, this operation was carried out flawlessly with the desired result.¹⁶²

The eventual delivery of TALLBOY brought to a head an issue that had been on-going since the beginning of the year. Although the bomb had been developed primarily for an attack on the Rothensee ship lift, development and production delays had brought this

¹⁵⁷ TNA Air 37/1240: Allied Expeditionary Air Force: WINDOW and RCM Loose Minute A/Cdre Air Signals Officer in Chief to A/Cdre Ops, 2 Feb 44.

¹⁵⁸ Michael J.F. Bowyer, *Aircraft for the Many*, pp 88-90. Stirlings were to use their special equipment (MANDREL) to create a jamming screen through which radar would be unable to detect activity while ABC equipped Fortresses disrupted Luftwaffe fighter control transmissions.

¹⁵⁹ TNA Air 37/1240: Allied Expeditionary Air Force: WINDOW and RCM Saundby to DCAS, 17 Mar 44.

¹⁶⁰ TNA Air 37/1125: Employment of strategic bombers in support of OVERLORD. Notes on visit to HQ Bomber Command, Air Marshal Robb, 2 May 44.

¹⁶¹ TNA Air 14/2062: Operational role of No. 617 Squadron. Cypher Message, from HQBC to HQ No. 5 Group, 7 May 44.

¹⁶² TNA Air 27/2128: No. 617 Squadron Operations Record Book, Special Operation, 5-6 Jun 44. Also RAFM, Saundby Papers: "*The War in the Ether, Europe 1939-45 - Radio Communications in Bomber Command*" - Signals Branch HQBC October 1945, Appendix "E". LCA: Note P. Bellringer to Cheshire, 6 Jun 44.

purpose into question. While analysis and discussion redefined the bomb's capabilities the changing war situation brought forth potential new targets. By June 1944 the planners found themselves considering a quite different use for the weapon.

The meeting held in mid-January 1944 to discuss target marking for the ship lift had agreed that the earliest date for any operation would be April (p 98).¹⁶³ At the beginning of February Bufton and Bomber Command still anticipated that there would be at least 20 TALLBOYS available within a month.¹⁶⁴ Only two days later reports of further development delays made this date look optimistic.¹⁶⁵ No. 5 Group had been tasked with the operation's tactical planning and the new delay posed a dilemma. After the middle of May nights would be too short, and if the attack was to be carried out without a moon, to reduce the risk from fighters, the deadline could be no later than the end of April.¹⁶⁶ Group had also reassessed the number of aircraft required. In July 1943, when the operation had first been mooted, twenty had been suggested. The figure had been expedient, on the assumption that the operation would take place during the autumn and that no greater number would be possible in the time available. Now, with a more realistic assessment of likely losses, together with knowledge of bombing accuracy based on both practice and operational data, No. 5 Group considered that the operation might require 40 aircraft. Since the standard two flight squadron comprised 20 aircraft, this meant equipping and training a second squadron: to do this further aircraft would have to be modified, additional SABS produced to equip them and crews trained. As this was quite out of the question No. 5 Group settled for a minimum of 20, ideally 25 aircraft, and pressed for additional CROSSBOW targets to provide more operational practice with SABS.¹⁶⁷

The ship lift operation acquired greater significance following a further report by MEW. The destruction of this target would be a major factor in severing water communications between the Ruhr, eastern Germany and the River Elbe and the Ruhr would be starved of vital raw materials for production and food for its workers. Given Germany's current economic situation, MEW assessed that a successful operation "would be greater than the effects of the attacks on the Ruhr dams." The greatest effects would be felt during

¹⁶³ TNA Air 14/2702: Pathfinder Force: special targets. Minutes of meeting held at HQBC, 18 Jan 44.

¹⁶⁴ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Bufton to Harris, 1 Feb 44.

¹⁶⁵ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. HQBC to HQ No. 5 Group, 3 Feb 44.

¹⁶⁶ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. Minute Satterly to Cochrane, 4 Feb 44.

¹⁶⁷ Ibid. See p 116 for the intention to provide CROSSBOW targets for practice.

the autumn when traffic flows were swelled by harvest produce and even greater if they coincided with other attacks on the German transport system, or periods of large scale German troop movements.¹⁶⁸

Much depended on the destruction that would be caused by any attack. Wrecking the superstructure would put the lift out of action for at least six months; damage to its substructure could take a year to resolve. Taking the least damage scenario, the best time for an attack would be during the spring.¹⁶⁹ This would benefit OVERLORD, and disruption would still affect the period of heaviest traffic flow in the autumn. A later attack would mean reduced returns since traffic levels fell over winter. Bomber Command sought Wallis's opinion.¹⁷⁰ His reply was disturbing and caused a major re-think of the operation.

Once again confusion had arisen from the allocation of the generic name TALLBOY to each of Wallis's deep penetration bombs. The Air Ministry and Bomber Command had been working on the basis that an attack would be carried out on the Rothensee lift using TALLBOY (M) – the 12,000lb bomb. However, Wallis had calculated that any such attack would be made using TALLBOY (L) - the ten ton version - and since development of this had been cancelled (see pp 99 -101 for the decision and context) he assumed that plans for any immediate attack had been shelved. Asked about the likely effect of TALLBOY (M) he advised that it was unlikely to penetrate the concrete apron surrounding the lift or damage the critical flotation chamber shafts, but suggested that further interim investigation might provide an alternative solution.¹⁷¹ Accordingly the Road Research Laboratories were briefed to undertake further experimentation and provide a better indication of the underground power of TALLBOY (M).¹⁷² At present, though, if an attack was to be made, Wallis still advocated the use of TALLBOY (L).¹⁷³

The protracted issue of the ship lift and TALLBOY development illustrates a large difficulty for planners who were working with an unconventional squadron and atypical targets. A weapon commissioned for the destruction of a target identified as a priority at one time could take so long to develop that the target might recede in importance by the

¹⁶⁸ TNA Air 20/5832: Operation TALLBOY: operations subsequent to Operation CHASTISE. MEW report, from H D B Wood to Wg Cdr Verity, 11 Feb 44.

¹⁶⁹ TNA Air 14/1204: Dortmund-Ems and Mittelland Canals. Note from Wg Cdr Verity to A/Cdre Paynter, HQBC, 29 Feb 44.

¹⁷⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Collier to Wallis, 5 Mar 44.

¹⁷¹ SM Wallis Papers: File D2/21. Wallis to Collier, 9 Mar 44.

¹⁷² TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. Minutes of Meeting held at Air Ministry, 22 Mar 44.

¹⁷³ SM Wallis Papers: File D2/21. Wallis to Bufton, 17 Mar 44.

time the weapon became available. The task of balancing aims and means was made more difficult by optimistic and at times over-enthusiastic claims, not only regarding the performance of a weapon, but its likely gestation time and the resources needed to produce it. From this period onwards such multi-faceted, mutually influencing factors intensified as ever-accelerating change in target priorities necessitated alternative uses for existing weapons, rather than the development of new ones.

Two issues now faced Bufton and Bomber Command. The Squadron had been kept in being, and re-equipped to carry and drop TALLBOY (M) primarily for the purpose of attacking the Rothensee ship lift. Although this weapon had been delayed, it had been under protracted development, at substantial cost to many different kinds of resource, and deliveries were now expected during the following months. Now with exposure of the unsuitability of TALLBOY for the principal intended objective there were no immediate targets for it.

Dropping trials of TALLBOY (M) did not begin until April when initial trials of inert bombs showed that earlier problems of instability and case fracture on impact had been resolved. Further tests of live bombs confirmed that the weapon met expectations. A second stage of trials involved Squadron crews releasing live weapons against the large concrete target at Ashley Walk bombing range in the New Forest and provided an indication of the effectiveness of the bomb against such a structure together with its likely accuracy on operations.¹⁷⁴ The results were sufficient to clear the weapon for service and by mid-April filling commenced of forty-one casings of British manufacture plus three from the USA.¹⁷⁵ TALLBOY was now being completed at a rate of 10 per week and it was estimated that 50 should be available by the end of May.¹⁷⁶

Coastal gun positions and suspected rocket sites had already been suggested as possible targets for TALLBOY. In early January Wallis met to discuss railway targets with Dr Jacob Bronowski, a mathematician working for Bomber Command's Operations Research

¹⁷⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. TALLBOY Report, B Ops 1 to DB Ops, 27 Apr 44. The trials were only a partial success. Aiming errors suggested that more research was required into the bomb's ballistic data and settings for the bomb sight. Incomplete detonation was experienced, raising questions as to the optimum fuzing required. This latter issue and questions as to the bomb's penetrative capability would continue into the early months of its operational life. (See Ch 5).

¹⁷⁵ TNA Air 20/1793: TALLBOY bombs. Minute D Arm R to ACAS (TR), 18 Apr 44.

¹⁷⁶ TNA Air 40/1885: TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Undated draft letter, possibly Bufton to SHAEF, circa late April 1944.

Section (ORS), and submarine pens with the Director of Armament Development.¹⁷⁷

With the invasion in mind, Wallis was provided with details of coastal defences, including gun batteries, personnel shelters and ammunition dumps.¹⁷⁸ The probability of a direct hit on these was remote, but a near miss and earth shock could burst thin floors, or tilt the structure sufficiently out of alignment to render sensitive gun laying equipment useless.¹⁷⁹ When the possibility of using TALLBOY against coastal defences became a firmer proposition after the successful trials of April requests were made for details of potential targets in order to develop suitable tactics, and the delivery of weapons was set at 100 by the end of May. With such stock the Squadron might be able to undertake one or two operations at short notice.¹⁸⁰

TALLBOY was now being recommended as a weapon for the attacks on the largest concrete structures.¹⁸¹ It had not been conceived for this purpose, but there was no other suitable weapon. A specific rocket powered Concrete Piercing (CP) bomb was under consideration, designed for use against U-boat and E-boat pens, but there were deep doubts about its efficacy and the time and resources needed for its development.¹⁸² This reinforced the belief that there would be no shortage of opportunities of employment for TALLBOY once it came into service.¹⁸³ Bufton had already suggested a possible use against the large CROSSBOW sites¹⁸⁴ and Sinclair championed its potential against U-boat pens.¹⁸⁵

The Squadron's attacks on factories and the use of target marking technique can now be viewed in a broader context. This challenges a number of hitherto accepted perceptions which have resulted from history written from an operational rather than a planning standpoint. Instead a new interpretation emerges interpolating intention and execution, which shows an earlier intention to attack German targets and also suggests that this

¹⁷⁷ Wallis Family Archive: Wallis diary entries, 9 Jan 44.

¹⁷⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter on German beach defences, Collier to Wallis, 17 Feb 44.

¹⁷⁹ Ibid. Letter on German beach defences, Wallis to Collier, 18 Apr 44.

¹⁸⁰ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Bufton to A/Cdre Kingston McCloughry, 6 May 44.

¹⁸¹ TNA Air 20/4813: Bombs and flares: development and production. AEF Weapons Committee, Summary of Recommendations, 13 May 44.

¹⁸² See p 143.

¹⁸³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Cochrane to Bufton, 4 Apr 44.

¹⁸⁴ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Bufton to A/Cdre Kingston McCloughry, 6 May 44.

¹⁸⁵ TNA Air 20/3315: Concrete-piercing bombs: development. Extract of 5th Meeting of the Defence Committee (Supply), 18 May 44. Note to ACAS (Ops) 19 May 44.

policy was deliberately facilitated by Harris and Cochrane in order to engineer a separate marker force for No. 5 Group. For the past six months policy had focused on finding effective uses for the Squadron until the arrival of TALLBOY. Now, with TALLBOY ready, but with the Rothsee ship lift no longer a current priority, the task became one of finding alternative targets for the new weapon.

CHAPTER 4 June - August 1944

The need for continued disruption of communications and German troop movements following the invasion was a much debated issue during the development of the Transportation Plan. Additional tasks now shouldered by the Allied Air Commanders included the support of ground forces and the continued protection of shipping and reinforcements. By the middle of June Harris was eager to return to striking at Germany but SHAEF and HQ AEF disagreed; targeting must remain tactical, decided at short notice by the situation on the ground.¹ The launch of the flying bomb offensive on 12 June brought an additional focus to operations as Bomber Command was directed against CROSSBOW launch sites and supply dumps ensuring that main force did not return to cities in Germany until July.

A new set of issues also faced the Squadron and its planners during the three months following the invasion. The arrival of a new weapon along with the transfer of responsibility for target marking to No. 54 Base demanded a reconsideration of the Squadron's role and mode of operation. This in turn raised questions regarding its manpower and equipment requirements. Targets too, posed a problem: were SHAEF's key targets appropriate for attack with TALLBOY or better dealt with by other weapons? New methods of assessing target suitability were required.

The long awaited arrival of TALLBOY marked a sea change for No. 617 Squadron. After a month without any significant bombing training the Squadron was again tasked with precision attacks. Although still operating outside main force, its targets were part of the same overall strategy as for the rest of the Command. The Squadron was initially tasked to target rail communications to disrupt German reinforcement of Normandy; it was then switched to the eradication of German naval forces threatening the invasion support convoys and after that turned its attention to disruption of the CROSSBOW sites. With added striking power now afforded by TALLBOY its targets were the larger reinforced concrete structures impervious to conventional bombing attacks. During July the CROSSBOW emphasis was switched to storage facilities, a number of these occupied underground workings, again highly suitable targets for TALLBOY. As the Allied forces progressed inland, the naval supply routes became increasingly stretched and critical and in August, the Squadron's attention responded to Admiralty requests and reverted to

¹ TNA Air 37/746: Operation OVERLORD: employment of bomber forces. Letter AVM Wigglesworth to Harris, 19 Jun 44.

naval targets – specifically U-boat pens. The supply of TALLBOY was at times hard pressed to keep pace with the increased tempo of operations, on occasion forcing the selection of 'softer' targets such as block ships, which were attacked using smaller, conventional bombs.

The other major change later in this period was the switch of operations from night to day. The Squadron now relied on fighter escort to protect crews from Luftwaffe interference; for defence against flak, presented with a perfect target during the final straight and level bombing run dictated by SABS, the Squadron adopted an open 'gaggle' with aircraft staggered at varying heights. Despite the increased risk, the Squadron lost only three aircraft on operations during this period.²

The realisation that the Rothensee ship lift would not be attacked until at least autumn 1944, and that TALLBOY would not be available for 'D-Day', had fuelled the search for other targets. Cochrane was not unduly concerned; there were likely to be many targets once the weapon became operational.³ Back in April, picking one of Wallis's original concepts, he had raised the possibility of targeting coal mines in the Ruhr; he also thought that manufacturers of welding carbons might prove worthwhile. MEW examined both industries. There was only one mine in the Ruhr that produced special coal suitable for carbon welding electrodes, the Langenbrahm pit. Reducing supply would affect the output of specialist metal fabrication. Electrode producers in Germany could not produce without carbon, while those in Italy and occupied territory were scheduled for the attention of SOE.⁴

Buften too was considering targets.⁵ An underground factory at Houilles, in the north-west suburbs of Paris, originally built to manufacture Hispano-Suiza aero engines, was believed to be producing torpedoes for the German navy, although information was limited. Despite initial optimism none of these installations was confirmed as a suitable target for TALLBOY. It was perhaps a missed opportunity. During April 1944 Speer chose Houilles as a case study to investigate the potential for dispersed underground

² All were lost over the target, two to flak, the other being hit by bombs from an aircraft above. TNA Air 27/2128: No. 617 Squadron Operations Record Book, Wizernes 24 Jun 44, Rilly 31 Jul 44 and Brest 5 Aug 44. RAFM, Bomber Command Loss Cards: Lancasters DV402 (flak), ME559 (bombs) and JB139 (flak).

³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Cochrane to Buften, 4 Apr 44.

⁴ Ibid. Letter Cochrane to Buften, 2 Apr 44 and note Noton to Collier 30 Mar 44.

⁵ Ibid. Note Whitehead to Buften, 12 May 44.

production and the design and construction of underground factories.⁶ A successful attack on this factory may have influenced future German production planning.

The difficulty in determining such targets stemmed from a number of factors: The original pre-occupation with the Rothensee ship lift and the perceived efficacy of the weapon against reinforced concrete appear to have focussed attention on these types of objectives. The assumption appears to have been that TALLBOY would be used initially against targets in northern France since these were likely to come to increasing pre-eminence post-invasion. However, realisation that much of the bomber offensive post-D-Day would be tactical in support of the ground situation precluded planning for specific targets. With limited supplies of TALLBOY, it needed to be used sparingly and against selected targets invulnerable to smaller weapons.

By the end of 1943 the Admiralty was becoming concerned by the completion of large reinforced concrete shelters suitable for the in-port protection of E, R and U-boats. Requests to bomb the pens during construction before thick concrete roofs made them impregnable to ordinary bombs had gone relatively unheeded. Meanwhile the Admiralty had pursued the development of its own weapon against such an eventuality. Known as the Concrete Piercing (CP) bomb (later the Disney bomb), this was a rocket powered bomb, weighing 4,500 lb, capable of penetrating 20 feet of concrete. Its dimensions precluded carriage by RAF aircraft without considerable modification; it was accordingly intended for the existing external bomb racks of B-17 Flying Fortresses. The project might take up to two years to come to fruition and was initially assigned low priority.⁷ The Admiralty believed that the weapon would be highly effective; the Air Ministry expressed concerns over the weapon's accuracy and considered that the destructive power of its 500lb warhead which might call for a disproportionate number of sorties in order to achieve the required destruction. Furthermore, production of the weapon was likely to interfere with other important projects.⁸ By April 1944 it was apparent that the technical difficulties were greater than anticipated.

In April the issue was brought before the Defence Committee (Supply). The ensuing discussion exposed the level of friction between the Admiralty and the Air Staff and MAP. The Admiralty appeared unjustifiably optimistic about the weapon's development, date of introduction and effectiveness. They claimed that destruction of the U and E-boat pens

⁶ Webster and Frankland, *Strategic Air Offensive*, Vol IV, p 319.

⁷ TNA Air 19/261: Bombs: requirements and production. Letter Admiral Cunningham to Stafford Cripps, 25 Jan 44.

⁸ TNA Air 20/3315: Concrete-piercing bombs: development. Note Development of rocket assisted concrete piercing bomb, 12 Apr 44.

was essential to remove the threat of these vessels to OVERLORD and pressed for greater priority. The Air Staff and MAP were unconvinced that either ballistic issues or other technical concerns regarding the rocket motors would be easily resolved. The operational value of the bomb might be jeopardised by smoke screens, increasing the thickness of the roofs, or other measures designed to cause premature detonation. Sinclair believed that TALLBOY, now about to enter service, might be a viable alternative, thereby obviating the need for development of the CP bomb and releasing key production resources for OVERLORD related projects. TALLBOY had less penetrative power but contained sixteen times the explosive content of the CP bomb. A hit by TALLBOY, even if it burst within the concrete rather than penetrating, might be sufficient to cause severe damage leading to collapse. Unconvinced, the Admiralty stressed the urgent need for resolution and called for an immediate trial of TALLBOY against a pen.⁹

The planners now faced a new range of interrelated issues. No. 617 Squadron was equipped to carry and aim TALLBOY with the required precision. However, their commitment to TAXABLE appeared to preclude any such attack in the near future. Furthermore TALLBOY had not been designed to penetrate concrete and its capabilities in this respect were still only theoretical. It was not known whether TALLBOY would break up on impact, or penetrate into the concrete before detonation.¹⁰ There were operational issues. Working on the assumption that the pens had to be attacked at night, how could they be marked? Were there sufficient bombs and aircraft to guarantee a hit?

Twenty-four TALLBOYs had already been delivered and 20 aircraft were available to carry them.¹¹ There was no shortage of pens, but it would be most productive to attack those that presented immediate operational needs. To this effect the Admiralty issued a coincident High Priority request to attack "at early date" E-boats and destroyers at Cherbourg and E-boats at Boulogne.¹² This went unheeded. Instead the DBO considered the pens at IJmuiden which been the subject of repeated requests at meetings of the Target Committee. By doing so they were keeping their options open. There were two sets of pens at IJmuiden, of differing size and construction. Bomber

⁹ TNA Air 20/3315: Concrete-piercing bombs: development. Note 19 May 44, to ACAS Ops circulating extract from the minutes of 5th Meeting of the Defence Committee, 18 May 44.

¹⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute Sheet, Bufton to D B Ops 1, 20 May 44 and appendix, B N Wallis: Note of Attack on U and E boat pens.

¹¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note B Ops 1 to Wg Cdr Collier, 21 May 44.

¹² TNA Air 20/5607: Target Committee: meetings and minutes. Cypher Message, Admiralty to ANCXF, 20 May 44.

Command ORS calculated the likely marking error and the probability of scoring a hit on each of the pens, but the Directorate of Armament was reluctant to predict whether penetration might be achieved on account of insufficient information regarding the roof's thickness.¹³ Consideration was then given to a daylight attack. This would significantly increase the chances of a hit, but strong defences increased the risks of visual marking (if this was required), and fighter escort might be needed, something with which neither fighters nor the bombers had practised.¹⁴ Wallis's appreciation that more than one hit would probably be necessary (to weaken or destroy the roof, before demolishing supporting walls) added to the uncertainty. The Directorate sent plans of the U-boat pens at St Nazaire and La Pallice to help him refine his assessment.¹⁵

Bomber Command refused to sanction any interference with the Squadron's preparations for TAXABLE, after which at least one week's training was considered necessary to ensure the required bombing accuracy.¹⁶ SHAEF, too, endorsed the embargo on operations pre-TAXABLE but approved attack on the pens as soon as this commitment had been met.¹⁷ By the end of May No. 5 Group was informed. The IJmuiden pens remained high priority. Despite considerable uncertainty an optimistic target list was issued detailing nine E and R-boat pens (from Heligoland to Le Havre, including IJmuiden) and nine U-boat pens (from Trondheim to Bordeaux) together with U-boat construction pens at Hamburg and Kiel.

However, as events were to transpire, despite the Admiralty's priority, and this preparation, a second target set requiring concrete penetrating weapons was soon to emerge. The opening of the long anticipated V-1 offensive began on the night of 12/13 June brought a diversion of emphasis for the heavy bombers. The offensive triggered further concerns as to the preparedness of the large concrete construction sites, whose precise purpose was still unclear, but which were assumed to be part of the V-weapon campaign. It was clear that TALLBOY and the CP bomb were the only two weapons likely to be effective against such targets. There was still little clear evidence in respect of the concrete penetrating performance of TALLBOY and the Admiralty saw this new and urgent requirement as a further opportunity to demand increased priority for the CP

¹³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note B Ops 1 to Wg Cdr Collier, 21 May 44.

¹⁴ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note on the employment of the TALLBOY Medium bomb against E- and U-boat pens, 22 May 44.

¹⁵ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Whitehead to Wallis, 24 May 44.

¹⁶ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note on the employment of the TALLBOY Medium bomb against E- and U-boat pens, 22 May 44.

¹⁷ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. Note Bottomley to Tedder, 23 May 44.

bomb.¹⁸ The First Sea Lord emphasised that sufficient material was now available for the production of 2,000 casings and that bomb bodies could be manufactured by unused shell factories. Adequate numbers should be possible “within a short space of time”.¹⁹

Support was also forthcoming from General Spaatz. Examination of captured large concrete fortifications such as the Merville Battery in Normandy clearly showed that little damage had been caused by normal bombing. Citing the CP bomb’s apparent potential against “the large CROSSBOW installation” (presumably that at Watten) Spaatz requested the production of 15,000 CP bombs as soon as possible.²⁰ Perhaps more surprising in this context was a championing of the weapon by members of the Air Staff (ACAS TR, Ops and P) who concluded that the CP bomb “seems the only promising weapon for use against the targets suggested” (i.e. the large CROSSBOW sites) and increasing the priority for the weapon’s development in order that it might enter service as soon as possible.²¹ A recommendation was made that the Admiralty should produce an experimental batch of 200 bombs to be ready for October, 1944. These were the precursor to a main order for 2,000 to be completed at a rate of 600 per month.²² This was far in excess of the anticipated production for TALLBOY. In reality the CP bomb was nowhere near ready for full-scale production, or operational use; it is for this reason that this weapon’s synchronicity with TALLBOY has not previously been explored.²³

The large CROSSBOW sites posed an imminent threat. Conventional bombing would not damage them, although it might crater the surrounding area, temporarily disrupting road and rail access, thereby preventing their use. Chairman of the Chiefs of Staff Committee and Churchill’s principal military advisor, General Sir Alan Brooke suggested that UPKEEP or HIGHBALL might be a suitable weapon. This was rejected by Bottomley, presumably thinking of the lessons learned when UPKEEP was being considered for attacks against railway viaducts, not to mention the risk of trying to deliver the weapon at low level against such targets. Each had been examined, but considered impractical. For the time

¹⁸ For further discussion of this point see pp 165-166.

¹⁹ TNA CAB 80/84/99: Concrete-piercing Bomb: development. War Cabinet, Chiefs of Staff Committee. Suggested use of the Concrete Piercing Bomb against the large CROSSBOW rocket sites, 25 Jun 44.

²⁰ TNA Air 20/3315: Concrete-piercing bombs: development. Note Spaatz to D Arm D, Air Ministry, 27 Jun 44.

²¹ TNA CAB 79/76/21: COS(44)(O)211th Meeting, Suggested use of the Concrete Piercing Bomb against the large CROSSBOW rocket sites, 27 Jun 44.

²² TNA CAB 79/76/26: War Cabinet, COS(44)(O)216th Meeting. CROSSBOW – use of Concrete Piercing bomb against large sites, 29 Jun 44.

²³ Roger Freeman, *The Mighty Eighth War Manual*, (London: Janes, 1984), p 228. The CP Bomb did not enter operational service until 14 March, 1945, the same day as TALLBOY (L).

being TALLBOY was the only weapon capable of making any major impact on the large CROSSBOW sites.

Attacks on E-boat pens were commensurate with the bombing priorities prior to OVERLORD issued in March 1944.²⁴ However, attacks by the Ninth Air Force and Second Tactical Air Force had demonstrated that the 1,000 lb bombs then available were insufficient to penetrate the roofs. Accordingly further attacks had been cancelled by HQ AEF.²⁵

Despite Admiralty pressure and the need to establish the performance of TALLBOY against a reinforced concrete target, the Squadron's first operation with this weapon was against the Saumur railway tunnel two nights after TAXABLE. Saumur had been identified as one of three important rail centres and crossing points of the River Loire across which the Germans would bring reinforcements to counter the OVERLORD landings. Accordingly an earlier attack had been made on the night of 31 May / 1 June; this had damaged the rail centre but left the bridge across the river intact. At the Air Commanders' meeting on 8 June ACM Leigh Mallory emphasised the urgent need to sever the Loire crossings.²⁶

The Squadron had already been detailed for an operation that night.²⁷ The intended target is unrecorded, but may have been the IJmuiden pens. In the light of the Air Commanders' Conference it appears that Harris made a late decision to switch the target to Saumur.²⁸ His decision may have been influenced by the fact that after crossing the river at Saumur the railway entered a tunnel which emerged into a cutting. This tunnel exit provided an excellent test of both the cratering ability of TALLBOY (the rail lines) and its earth shock effect (either causing landslides in the cutting or causing collapse inside the tunnel). The operation was an unqualified success, not least on account of one bomb which struck directly above the tunnel entrance and penetrated into the hillside before detonating, causing the tunnel beneath to collapse. The capability of TALLBOY as an "earthquake bomb" had been proven.

²⁴ TNA Air 37/746: Air Commander in Chief, AEF, ACM Leigh-Mallory: Operation OVERLORD employment of bomber forces. COS Committee, Bombing priorities prior to OVERLORD, 25 Mar 44.

²⁵ TNA Air 37/522: Allied Expeditionary Air Force: Bombing enemy occupied territory: policy. Brig Gen Strickland to D of Ops (Tac), 3 Apr 44.

²⁶ TNA Air 37/522: Allied Expeditionary Air Force: Bombing enemy occupied territory: policy. Eighth Air Commanders' Meeting, 8 Jun 44.

²⁷ IWM: Leonard Cheshire Collection, Briefing notes and narrative, Saumur, 8 Jun 44.

²⁸ TNA Air 25/122: No. 5 Group Operations Record Book, Appendices. Form B, 8 Jun 44.

The bomb's first trial against concrete came on 14 June when an attack was mounted against the E-boat pens at Le Havre.²⁹ The Admiralty had pressed the DBO for an attack on IJmuiden on 11 June.³⁰ The Squadron had been briefed for a TALLBOY operation on 12 June which may have been these pens, but the operation was cancelled.³¹ At the following day's Commanders' meeting the Naval Liaison Officer made a request for the air bombardment of Le Havre. This was approved. By coincidence poor weather that evening resulted in a greater than normal concentration of E-boats in the port, revealed by reconnaissance and radio intercepts. A successful TALLBOY attack was mounted at dusk, followed up by main force on the rest of the port. The attacks resulted in the sinking of some 66 vessels including three torpedo boats and 14 E-boats. Only one E-boat remained serviceable in the port. At the following day's Air Commanders' Conference a further attack was requested on either Cherbourg or Boulogne. The latter was selected.³² This attack was hampered by poor visibility, nevertheless 11 TALLBOYS were dropped and 26 light vessels sunk, including seven R-boats.³³ This resulted in a significant reduction in E-boat activity against the OVERLORD convoys.³⁴

SHAEF's direction to use TALLBOY against the E-boat pens was more than tactical expediency. This picked up on Wallis's investigations in January and May 1944 and later requests from the CP bomb Committee for the early attack of such targets.³⁵ It brought what was originally a trials requirement to operational fruition. Had it not been for Harris's decision to target the Saumur tunnel, TALLBOY may well have entered service as an "anti-concrete" weapon.

Bomber Command tasked the Squadron almost immediately to make further TALLBOY attacks. Despite concerns about the ability of TALLBOY to penetrate concrete, and the possibility of the bomb either breaking up on impact or premature detonation, the targets designated were large substantial concrete structures - the U-boat pens at Brest, together with the four large V-sites: Watten, Wizernes, Siracourt and Mimoyecques. Two

²⁹ A comprehensive account of this operation can be found in Tent, *E-boat Alert*, Ch 9 and 10, pp 146-182.

³⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1 Note Employment of TALLBOY Medium, 11 Jun 44.

³¹ RAFM, No. 617 Squadron Historical Collection: Bombing Leader's Notebook, 12 Jun 44. Details for this day refer to 'Amsterdam'.

³² TNA Air 37/563: Allied Air Commanders' Conferences. Minutes, Conference No. 15, 15 Jun 44.

³³ Tarrant, *Last year of the Kriegsmarine*, pp 69-70.

³⁴ TNA Air 19/261: Bombs: requirements and production. Minute DoI to PS to Secretary of State, 29 Jun 44. The success of these operations was also confirmed by photographic reconnaissance and ULTRA decrypts of German signals.

³⁵ See pp 139 and 144-145.

other targets included the lock gates on the Kiel Canal and aqueducts on the Dortmund Ems Canal.³⁶ The instruction came a day after Churchill and Eisenhower had agreed that the CROSSBOW sites should take priority over everything other than the immediate support of OVERLORD forces. Watten was the first to be targeted, inaugurating over a month of concentrated TALLBOY attacks against the large V-sites.³⁷ The precise function of the sites was still unconfirmed but there was strong evidence to connect them with impending CROSSBOW activity and it was considered essential to prevent their completion and use. Smaller in size than the pens, there was less concern regarding the issues of perforation resulting from a direct hit. Wizernes and Mimoyecques comprised underground tunnels and chambers driven into the local topography which might be collapsed by seismic shock. In the case of the large blockhouse structure at Watten, near misses might either damage side walls or undermine foundations. Severe shock might disrupt sensitive equipment inside.

A reappraisal of operations took place at the end of July. A new Committee made a new appreciation of CROSSBOW targets to prioritise targets and ensure effective allocation of bomber resources. Bufton was co-opted to this committee, thus potentially bringing him back into a position whereby he might more directly influence TALLBOY targeting. At the Committee's first meeting it was agreed that the large sites were to be excluded from attack apart from experimental attack through the USSAFE APHRODITE plan.³⁸ Key supply dumps now became equal First Priority along with production facilities. Launching sites were to receive only harassing attacks using large numbers of delay action bombs.³⁹ Despite this ruling the Squadron carried out an attack against the large site at Watten before targeting the supply depot at Rilly la Montagne.⁴⁰

The switch to attacks against the launching sites and the attack of storage sites marked the end of the Squadron's campaign against the V-weapons. Continued Admiralty pressure turned attention to the Atlantic U-boat bases. Requests were generally submitted at the daily Air Commanders' meetings via the Naval Liaison Officer in

³⁶ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. HQBC to HQ No. 5 Group: Following List of targets to be taken by No. 617 Squadron at first opportunity, 17 Jun 44.

³⁷ TNA Air 14/2128: No. 617 Squadron Operations Record Book, Watten, 19 Jun 44 and subsequent attacks until the end of July 1944.

³⁸ APHRODITE and ANVIL attacks commenced in August 1944. They involved the use of war weary B-17s (Flying Fortresses) and PB4Y-4 (Liberators) fitted with radio control and packed with explosives, to be directed as guided missiles to crash onto their targets.

³⁹ TNA Air 20/4754: Joint CROSSBOW Target Priorities Committee: meetings. Minutes, 21 Jul 44.

⁴⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Watten 25 Jul 44 and Rilly la Montagne 31 Jul 44.

conjunction with the Coastal Command representative. Targets were then cleared by the Supreme Commander and passed to Harris for action.⁴¹

These early attacks immediately highlighted a number of issues regarding the new weapon. The attack on Saumur had proven the effectiveness of TALLBOY to penetrate and cause large craters as Wallis had predicted. This was exactly the purpose for which it had been designed. The attack on Le Havre was less conclusive. Although marks on the roof indicated hits there was only one area of definite damage, displacing a corner. At Boulogne there were three possible hits on the roof, but no absolute evidence of penetration.⁴²

Whether TALLBOY would penetrate the roofs of the pens and the effect of such penetration were major concerns. The DBO had already expressed doubts about the worth of such attacks.⁴³ The first question was whether the bomb would withstand direct impact with thick concrete. Model tests had shown, not surprisingly, that penetration depended not only on the thickness of the roof, but also on the nature of any internal reinforcement. After looking at drawings of the pens at St Nazaire Wallis had confirmed that their overall dimensions indicated that they were large enough to be able to achieve a good proportion of hits on the roof, but declined to state how many would be needed to destroy it. He then added, disconcertingly, that it required one effective hit *per dock* [author's emphasis] to put them out of action. St Nazaire had 16 such docks.⁴⁴ This made the destruction of such structures far more problematical. Not only would a greater number of bombs be needed, but it required, in theory at least, far greater accuracy (or rather luck) to hit individual internal docks, whose position would be impossible for bomb aimers to determine.

Fuzing was another issue. Instructions had been issued to No. 5 Group detailing the fuzing to be used dependent upon the type of effect required: maximum earth disturbance on dry land, maximum cratering, maximum earth disturbance under water and maximum damage on a very hard target.⁴⁵ Wallis had calculated that for the latter

⁴¹ TNA Air 37/564: Allied Air Commanders' Conferences: minutes. Minutes of 67 Allied Air Commanders' Conference, 9 Aug 44.

⁴² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Paper TALLBOY, 26 Jun 44.

⁴³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. B Ops 1 Note Employment of TALLBOY Medium, 11 Jun 44.

⁴⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Wallis to Collier, 12 Jun 44.

⁴⁵ TNA Air 14/2189: TALLBOY bombs: fuzing suspension and aiming. HQBC to HQ No. 5 Group, 20 Jun 44.

TALLBOY would require fuzing of 0.01 seconds. Concerned that TALLBOY would not penetrate the roofs he believed that this timing would cause the bomb to detonate at the point of maximum penetration. Any greater delay and the bomb might break up, or bounce off the roof. This presented another difficulty. For the present the shortest fuzing available was 0.025 seconds, although a suitable fuze was under development.⁴⁶ The issue of whether or not TALLBOY had penetrated the Le Havre pens would continue for several months. The large V-sites were smaller targets than the pens and the chances of a direct hit were considered slight. To cope with the likelihood of a near miss in earth, a longer fuzing of 11 seconds was used initially; later a half-hour delay was developed.⁴⁷

The Ministry of Home Security Research and Experiments Department 8 (RE 8) produced a report to guide those selecting targets on the potential use of TALLBOY. The weapon's primary function of deep penetration and cratering did not preclude its use to achieve other effects including "direct hits on large and substantial buildings". Best used against bridges, viaducts and rail tracks it could also be used to displace small concrete structures. However, if the weapon was used against large and heavy concrete a shorter fuze must be used. Even so, said the document, the results of using it this way might be disappointing".⁴⁸ The report also countered a suggestion that TALLBOY might be useful for area attacks. While TALLBOY craters might disrupt transport infrastructure for longer periods, or damage utilities, an equal weight of smaller bombs would create greater damage by inflicting more cuts over a wider area.

More data were required to gauge the effect of TALLBOY on large concrete structures to ensure that the bombs were being used effectively. Wallis and RE 8 were both working on the problem but even after five operations there was frustratingly little evidence and conflicting views.⁴⁹ After examining reconnaissance photographs Wallis told Bufton at the end of June that he could not be certain that penetration had occurred at Le Havre.⁵⁰ On the same day, however, the Director of Intelligence (Operations) wrote to the

⁴⁶ TNA Air 14/2008: High level night bombing attacks on small targets by No. 617 Squadron. Letter Collier to Satterly, 13 Jun 44.

⁴⁷ TNA Air 14/2189: TALLBOY bombs: fuzing suspension and aiming. Postagram Wg Cdr Richardson to HQBC: TALLBOY No. 47 Pistol, 10 Aug 44 and Minute 9, ORS to Armament I, 10 Aug 44.

⁴⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Ministry of Home Security Research and Experiments Department. Notes on the use of TALLBOY (M), 17 Jun 44.

⁴⁹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Report, TALLBOY, 26 Jun 44.

⁵⁰ TNA Air 19/261: Bombs: requirements and production. Letter Wallis to Bufton, 29 Jun 44.

Secretary of State recording that "one of the most noteworthy features... [was] ...at Le Havre the concrete E-boat pens were pierced."⁵¹ RE 8 were having little success. Post raid photographic cover only showed the effects of direct hits when the bomb detonated properly and gave no indication of bombs that might have broken up on impact. Their conclusion was that there had been at least two TALLBOY hits on the roof, one of which had detonated at sufficient depth to cause the underside of the roof to burst inwards bringing material down into the pen. A second bomb appeared only to have caused a crater in the roof, possibly on account of it striking immediately above an internal dividing wall. An alternative explanation was that it may have been the result of an incomplete detonation. This assessment was at variance with an earlier interpretation report that had claimed there had been two perforations of the roof. RE 8 also concurred with Wallis's earlier assertion that since the pens were divided internally into individual docks it might be necessary to hit each subdivision to achieve adequate destruction. The report pessimistically concluded that total destruction of the target, allowing for misses, premature detonation and hits on dividing walls, might require up to three times the number of TALLBOY as there were individual docks in the pen.⁵²

It will be recalled that the Road Research Laboratories were to undertake further experiments relating to the ship lift (p 137). These showed that TALLBOY would cause "lethal" damage to the shafts.⁵³ Wallis offered this alternative solution, now supported by operational evidence, but felt that Bomber Command might still be unconvinced. No attack would be possible until the darker nights of late autumn, by which time TALLBOY (L) should be available. Since the Americans were beginning to take an interest in TALLBOY (L) to be carried by the Boeing B-29 Superfortress (which had a greater range than the Lancaster) it might be better to leave this target to them.⁵⁴

The question of perforation was re-opened in July when A/Cdre Bilney, Bomber Command's Chief Armament Officer, wrote to Wallis saying that there was now definite information that two weeks after the attack on Le Havre a number of torpedo warheads had detonated inside the pens. It was this that had caused collapse of the roof and not TALLBOY. Wallis responded with a technical treatise. Such a detonation would not cause that degree of damage. A more likely cause was that damage caused by the semi-

⁵¹ TNA Air 19/261: Bombs: requirements and production. Minute D of I (O) to PS to Secretary of State, 29 Jun 44.

⁵² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Report, RE 8, Ministry of Home Security to B Ops 1, Air Ministry, 30 Jun 44.

⁵³ TNA DSIR 27/47/MAP120: Further tests on the destruction of model under-ground shafts by explosives. By A.R. Collins, June 1944.

⁵⁴ SM Wallis Papers, D2/21. Letter Wallis to Bufton, 4 Aug 44.

perforation had resulted in the roof finally failing after a period and setting off the warheads.⁵⁵ Keen that full credit should be given to TALLBOY Wallis wrote to Bufton confirming that it was clear that two TALLBOYs penetrated Le Havre.⁵⁶ Even so the Air Staff were not convinced.⁵⁷ Their view was justified. Under interrogation, a captured German naval rating who had been in the Le Havre pens confirmed that only one TALLBOY had penetrated during the attack. The later roof collapse had been triggered by the detonation of the torpedo warheads.⁵⁸ More tellingly, in August Bletchley Park decrypted a message from the Sea Defence Commandant, Brittany, stating: "At Le Havre considerable destruction caused by the detonation of three [sic] torpedo warheads."⁵⁹

The issue of penetration emerged again in August after the Squadron turned to the U-boat pens. The first attack, against the pens at Brest took place on 5 August; two days after Wallis had asserted that TALLBOY had penetrated the roof at Le Havre. These targets were more substantial than the E-boat pens. Their roofs were not only thicker, but had a series of concrete beams ('Frangrost') creating an air space over the main roof that, acting as a "bomb trap", the intention was to cause bombs to detonate on them before impacting the main roof structure. To combat this No. 5 Group unilaterally decided to use a 0.5 second fuze. This went against the views of the Command Armament Officer who believed that a short delay fuze was needed. After due consideration, however, he conceded that a longer delay fuze would enable any near misses to produce effective earth shock. In his view TALLBOY would not penetrate more than 10 feet of concrete and a hit on the roof would probably break up or self-initiate on impact regardless of fuzing. In effect they had achieved self-selective fuzing. He also believed that where penetration had occurred it was as a result of the roof having been softened up by previous hits.⁶⁰ This further reinforced an earlier view by the Air Staff as to the cumulative effect of repeat TALLBOY attacks.⁶¹

⁵⁵ TNA Air 40/1885: Letter Wallis to Bilney, 26 Jul 44.

⁵⁶ SM Wallis Papers, D2/21: Letter Wallis to Bufton, 3 Aug 44 and TNA Air 40/1885: Letter to Wallis, 11 Aug 44.

⁵⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Bufton to S.6 (Copy to ACAS), 3 Aug 44.

⁵⁸ AHB: ADI (K) Reports. Report No. 501/1944, dated 31 Aug 44.

⁵⁹ TNA Air 14/2020: TALLBOY, GRAND SLAM and 'J' bomb results. Reports and photographs giving details of damage. Note D of I (O) to DCAS, 14 Aug 44 and attached Top Secret U[ltra] report, 14 Aug 44.

⁶⁰ TNA Air 14/2189: TALLBOY bombs: fuzing suspension and aiming. Letter A/Cdre Bilney to Wg Cdr Richardson, 25 Aug 44.

⁶¹ TNA Air 40/2020: TALLBOY, GRAND SLAM and 'J' bomb results. Reports and photographs giving details of damage. Telex, D of I (O) to Joint Photographic Reconnaissance Centre, 14 Jul 44.

The question of whether bombs were shattering or self-initiating on impact was also monitored by photographs taken during the attack. Each aircraft was equipped with a strike camera, and for many attacks cine footage was shot from an accompanying Mosquito. Analysis proved difficult but the general consensus was that most bombs were detonating correctly.⁶²

Shortage of bombs restricted the attacks that could be made. Production planning had not anticipated such rapid demand for TALLBOY. In three of the four attacks mounted against the La Pallice pens 2,000 lb AP bombs were used to make up for shortage of TALLBOY.⁶³ On other occasions when TALLBOY was unavailable, the Squadron was detailed to attack softer targets, such as potential block ships, and it was forced to use 1,000 pounders against a railway bridge at Etaples, a target better suited to TALLBOY.⁶⁴

Once again ULTRA decrypts provided an indication of the effectiveness of TALLBOY.⁶⁵ In the majority of cases TALLBOY failed to penetrate the roof and in only one instance, at Lorient, had three docks been put out of commission. The decrypts were used to verify the findings of photographic interpretation.⁶⁶ Assessments of these targets produced after the liberation of the pens by Allied forces continue to record the fact that TALLBOY was not designed for concrete penetration but that it was hoped that near misses would cause earth shock damage and displacement of walls.⁶⁷ The Squadron made three attacks on the pens at Brest, dropping 26 TALLBOYs. Nine of these struck the roof, four of them causing perforation. Disconcertingly, there was also evidence of bombs breaking up before detonation. Despite concerns and criticism there really was no other option other than to use TALLBOY. Although the U-boat pens were never destroyed in the manner Wallis had envisaged, with multiple hits, the attacks continued to harry a fleet that was coming under pressure from all sides.

⁶² TNA Air 14/2189: TALLBOY bombs: fuzing suspension and aiming. Letter Wg Cdr Richardson to A/Cdre Huskinson, 24 Aug 44.

⁶³ TNA Air 27/2128: No. 617 Squadron Operations Record Book, La Pallice 9 Aug 44, 11 Aug 44, 16 Aug 44 and 18 Aug 44.

⁶⁴ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Etaples 4 Aug 44.

⁶⁵ TNA Air 14/2020: TALLBOY, GRAND SLAM and 'J' bomb results. Reports and photographs giving details of damage. Note D of I (O) to DCAS, 14 Aug 44 and attached Top Secret U[ltra] report, 14 Aug 44.

⁶⁶ The above report (fn 65) was issued by CIO to DCAS. According to Stubbington, *Kept in the Dark*, Harris would not have been party to this report but may have received the information in sanitised form.

⁶⁷ TNA ADM 199/240: Bombing of Biscay U-Boat bases. Report on Bombing of the U-Boat Shelters at Brest, 12 Oct 44.

Where earth shock was a determining factor, notably against the rocket installations and supply sites, studies were put in hand to investigate local geology taking into account knowledge of existing underground workings which might have been adapted. This planning tool, which would help determine the optimum fuzing, had first been applied against the underground V-1 store at St Leu d'Esserent. Dr R V Jones, scientific adviser to MI 6, visited High Wycombe prior to the operation on 4 July to re-position the aiming points for TALLBOY over the most vulnerable underground workings.⁶⁸

By July there was growing reconnaissance evidence of the effectiveness of TALLBOY. The Central Interpretation Unit (CIU) had produced a bomb plotting sheet. This recorded the position of fall from the aiming point, the nature of the ground, dimensions of crater and notes on observed effects and damage, referenced against the photographic print from which the data had been taken. These sheets permitted CIU to produce a summary report of the 142 bombs dropped during the Squadron's first nine attacks. The report confirmed that near misses produced better results against large concrete structures. It determined crater size and a radius of damage and suggested that cumulative effects might result from more than one attack.⁶⁹ The report failed to come to any firm conclusions with regard to geological influences. Keith St Joseph of Bomber Command ORS had been preparing a survey of the geology relating to the four main large Crossbow sites based on maps from the French Geological Survey.⁷⁰ By the end of July his reports were suggesting improvements in the selection of aiming points and fuzing in order to obtain maximum effect for attacks on underground storage sites.⁷¹ His views were not universally accepted at Bomber Command.⁷² Nevertheless he continued with his analysis, and sought to apply it to the underlying strata on which U-boat pens were built.⁷³

Efforts by The Director of Intelligence (Operations) to improve information gathering and the assessment of results by briefing French agents met with little success. Bomber Command was reluctant to inform SIS of potential targets for security reasons. Two

⁶⁸ Christy Campbell *Target London. Under Attack from the V-Weapons during WW II* (London: Abacus, 2013), pp 280-281, and Reginald V. Jones *Most Secret War. British Scientific Intelligence 1939-1945* (London: Hamish Hamilton, 1978), pp 426-427.

⁶⁹ RAFM, 617 Squadron Historical Collection: Interpretation Report No. K 87 (R), 27 Jul 44.

⁷⁰ TNA Air 14/1907: Geological investigations. Geology of four large CROSSBOW targets, 13 Jul 44.

⁷¹ TNA Air 14/1907: Geological investigations. Report on CROSSBOW sites, 22 Jul 44.

⁷² TNA Air 14/1907: Geological investigations. Minute Note 3, Sqn Ldr Fawcett, 31 Jul 44.

⁷³ TNA Air 14/1907: Geological investigations. Note J.K. St. Joseph to Sqn Ldr Henderson, 31 Jul 44.

targets were notified, but both were V-2 sites where it was impossible to infiltrate agents at short notice. Additionally, Command had asked SIS for reports on the Saumur tunnel without being told that it had been a TALLBOY target. Seeking greater co-operation the Director requested from Bufton a full list of targets previously attacked with TALLBOY and asked for prior information about objectives scheduled for attack.⁷⁴ Bufton could only offer limited assistance, providing a list of targets attacked. He was not party to the immediate targeting process. Operations were instigated by the CROSSBOW Committee and agreed between AEAf and Bomber Command, often taking place with only a few hours' notice.⁷⁵

As previously stated, (pp 133-134) the new marker force for No. 5 Group was clearly intended to release No. 617 Squadron from this role, enabling it to revert to being a self-contained unit carrying out its own operations against pin-point targets. Nevertheless Cochrane was determined that the Squadron would continue to pioneer new marking techniques.⁷⁶

Although the Mosquito had demonstrated its effectiveness for the low level marking of heavily defended targets Cheshire believed that the dangers might be further reduced by the use of a single-seater fighter aircraft.⁷⁷ However, concern for survival against the defences had to be tempered by another consideration. Although the Americans were using P-51 Mustang's for deep penetration escort missions Cheshire was concerned that his navigational ability would restrict operations to short range targets. Cochrane was unconcerned, believing that it still would be possible to reach those as far as the Ruhr.⁷⁸ This confirms that Cochrane and Bufton's earlier proposals for the Squadron to revert to night attacks against lightly defended targets in Germany (p 125) were still under consideration.⁷⁹

Cochrane sought to retain the Squadron's independent marking capability by suggesting that it should be permitted to trial this idea using the Hawker Typhoon, Lockheed P-38

⁷⁴ TNA Air 40/2020: TALLBOY, GRAND SLAM and 'J' bomb results. Reports and photographs giving details of damage. Note D of I (O) to D B Ops, 10 Jul 44.

⁷⁵ TNA Air 40/2020: TALLBOY, GRAND SLAM and 'J' bomb results. Reports and photographs giving details of damage. Note D B Ops to D of I (O), 11 Jul 44.

⁷⁶ TNA Air 14/2062: Operational role of No. 617 Squadron. Letter Cochrane to HQ 54 Base, 6 Jun 44. See also p 116. The continuation of target marking might necessitate the borrowing of Mosquitos.

⁷⁷ While this may be so, it is possible that the shortage of Mosquitos and use of borrowed aircraft from No. 627 Squadron may have been a further factor.

⁷⁸ TNA Air 14/1206: Intelligence on Directif Targets: Doc. 62A. Letter Cochrane to Harris, 4 Jun 44.

⁷⁹ That these never came to fruition may have further contributed to the decision to dilute the Squadron's marking force.

Lightning and North American P-51 Mustang and asked Harris if it would be possible to obtain either of the American types (preferably the Mustang) on short-term loan for Cheshire's use. Cochrane may also have been considering the possible need to mark targets in daylight after D-Day.⁸⁰

The threatened withdrawal of the Squadron's Mosquitos also impacted on another continuing issue, the development of a rocket projectile marker for the ship lift. Since January progress had been slow; initial trials had been unsuccessful and showed that a new type of rocket was required.⁸¹ Such an item would require considerable long-term development at the expense of other important projects, but before this could be authorised the Squadron needed to confirm that it was satisfied of the practicality of rockets for marking.⁸² Bomber Command had no doubts: concerned that the Germans might develop effective countermeasures against the low level marking technique it confirmed that rockets were suitable and that their development was imperative.⁸³ As a result the Squadron's two FB VIs were retained and one was fitted with the necessary rocket rails ready for trials.⁸⁴ Although two armourers received instruction on these weapons and the Squadron was requested to undertake day and night firing trials no evidence has been found to confirm that the Squadron conducted any rocket firing.⁸⁵

Two Mustang IIIs were loaned to the Squadron at the end of June. Contrary to popular belief, they were not 'a gift of the Americans', but were from an RAF allocation, thus in effect depriving ADGB and the 2nd Tactical Air Force.⁸⁶ The Mustangs were used for only six operations and withdrawn in October.⁸⁷ Cheshire used them for three attacks, but, as Cochrane predicted, only one of these was at night owing to the difficulties of

⁸⁰ Ibid. If No. 617 Squadron's trial was successful Cochrane told Harris that he proposed to equip one flight of No. 627 Squadron with Mustangs for marking.

⁸¹ TNA Air 14/987: Rocket Projectiles target markers: No.617 Squadron. Letter A/Cdre Patch to Harris, 7 Jun 44.

⁸² Ibid. Letter A/Cdre Patch to Harris, 30 Jun 44.

⁸³ Ibid. Minute 8, A/Cdre Bilney to SASO HQBC, 3 Jul 44.

⁸⁴ Ibid. Letter AVM Walmsley to D Arm R, 11 Jul 44. This letter erroneously refers to a Mosquito of No. 627 Squadron being equipped to carry rockets. Also Air 14/987: Rocket Projectiles target markers: No.617 Squadron. Note HQBC to HQ No. 5 Group, 21 Jul 44. The modified Mosquito was destroyed in a flying accident at the beginning of August, (RAFM, Aircraft Accident Card: Mosquito FB VI, NT202, 7 Aug 44) after which the Squadron played no part in development trials.

⁸⁵ TNA Air 27/2128: No. 617 Squadron Operations Record Book, May 1944 Summary, 1 May 44. Also Air 14/987: Rocket Projectiles target markers: No.617 Squadron. Note A/Cdre Constantine HQBC to HQ No. 5 Group, 21 Jul 44.

⁸⁶ RAFM, Aircraft Movement Cards: Mustang III HB825 and HB837. Both of these were supplied from RAF sources and not by the Americans as recorded by Brickhill, *Dam Busters*, pp 206-207.

⁸⁷ TNA Air 14/2128: No. 617 Squadron Operations Record Book, Siracourt 25 Jun 44, St Leu d'Esserent 4 Jul 44, Mimoyecques 6 Jul 44.

navigation, but this was not of major concern since the introduction of TALLBOY saw a marked switch to daylight operations. More significant was the realisation that the Mustang and Mosquitos (the latter often borrowed from No. 627 Squadron) were rarely required to mark for daylight attacks.⁸⁸ Instead the Mosquitos were used primarily for weather reconnaissance and photographic purposes. Two Lightnings were borrowed from US sources but were never used by the Squadron, instead being attached to No. 54 Base.⁸⁹ Use of the Mosquito simplified maintenance and the holding of spares. For this reason, during August, Bomber Command's Chief Engineer Officer requested that the Squadron's two Mustangs be replaced by Spitfires.⁹⁰ However, by this time there was little requirement for a manoeuvrable marking aircraft and Cochrane declared that the Mustangs should be returned.⁹¹ While the allocation of these two aircraft may be seen to indicate a willingness on Harris's part to support Cochrane's wish that the Squadron should remain a self-sufficient force, the above evidence shows that they were in fact part of a larger review that might have resulted in the re-equipment of No. 627 Squadron (pp 156-157).

Aircrew, as well as aircraft, were also under review. By July 1944 Cheshire had been in command for eight months and was approaching his hundredth operation. Cochrane ordered that this would be the end of his tour and Cheshire had no option.⁹² At the same time the Squadron's three Flight Commanders, all of whom had been original members of the Squadron were also screened from operations. This was the end of an era; not only had the link with Gibson and the Dams Raid finally been severed, but it also concluded the period of development essential for the effective introduction of TALLBOY.

The official line was that Cochrane told Harris that 'the old guard' had asked to be given a rest.⁹³ Examination of more personal views now reveals a different picture. The decision was Cochrane's and it was resented by some of the aircrew. Cheshire had built the Squadron back up from the remnants following the heavy losses against the

⁸⁸ Only five night operations were completed between June and December 1944, only two of these were marked by the Squadron. By September 1944 daylight marking for the Squadron had all but ceased, although one Mosquito would remain on strength until February 1945.

⁸⁹ Three more aircraft were requested for use by No. 54 Base Controllers, but these were not forthcoming and Mosquitos remained the aircraft normally used for this purpose.

⁹⁰ TNA Air 14/868: No 5 Group: target marking procedure. Loose Minute C Eng O HQBC, 14 Aug 44. The Spitfire was unsuitable for marking and this was not done.

⁹¹ TNA Air 14/2318: P-38 aircraft introduction: comparison with Mosquito and Mustang for control purposes. Report, AVM Cochrane, 2 Sept 44.

⁹² Morris, *Cheshire*, pp 171-2.

⁹³ RAFM; Harris Papers, H 59: Letter Cochrane to Harris, 8 Jul 44.

Dortmund Ems Canal during the previous autumn. His reputation and personality had attracted new crews and instilled a bombing ethos and professionalism that was second to none, while his active and receptive mind encouraged thinking 'outside the box' in order to find solutions to technical and tactical problems.⁹⁴ Low losses and the Squadron's success had generated a high esprit de corps and the move was bound to be unpopular. Those posted viewed it with sadness, although there was the inevitable sense of relief, and for all there was a sense of loss. One Canadian later recorded that he sensed Cheshire felt "let down" by the removal of so many stalwarts of the Squadron.⁹⁵ Another pilot was more philosophical: "There was nothing sinister or anything like that. It just turned out that we were all tour-expired on the Bomber Command scale of 30 operations per tour, and we all came up at the same time. Maybe there was some thought about changing the character of the Squadron, but nothing was ever said or implied, as far as I was concerned, anyway."⁹⁶ Additionally, Cochrane may have noted that Cheshire was physically spent, but in denial. Asked about operational strain by a confidant who observed a nervous tic, Cheshire replied: "I never think about it, so there's no strain at all."⁹⁷

Harris cited operational reasons for the change. In a message read out at the party given for those leaving the Squadron he explained: "Alteration and intensification of the operational set up and commitments of 617 Squadron have inevitably necessitated some modification of the constitution of the Squadron."⁹⁸ The Squadron's operational requirements had changed. Daylight raids against large targets where a near miss with TALLBOY was sufficient had reduced the need for precision low level marking. The three PFF Squadrons transferred to No. 5 Group now satisfied the main force's marking needs. The Squadron required a different style of command. The emphasis was now on consolidation, rather than innovation.

Cochrane selected Wg Cdr James 'Willie' Tait as Cheshire's successor.⁹⁹ Cheshire and Tait had become friends while commanding Halifax squadrons but were quite different personalities and had distinct styles of command. Features that had encouraged a competitive team spirit, such as the monthly bombing ladder were discontinued, and there was a suspicion in some circles that experience now counted less than rank.¹⁰⁰

⁹⁴ See Bennett, *617 Squadron - The Dambusters at War*, pp 49-51.

⁹⁵ LCA: Letter Danny Walker to Andrew Boyle, 27 Oct 54.

⁹⁶ Author's collection: Letter R.S.D. Kearns to T. Bennett, 24 Sept 92.

⁹⁷ LCA: Letter Arthur Pollen (Intelligence Officer) to Andrew Boyle, 9 May 53.

⁹⁸ RAFM: Harris Papers, H 59: Letter Harris to Cochrane, 10 Jul 44.

⁹⁹ Tait was a Controller / Master Bomber with No. 53 Base, Waddington and had started his war as a former No. 4 Group Whitley pilot, as had Cheshire.

¹⁰⁰ Author's collection: Letter T Bennett, 27 Jul 86.

From the Squadron's formation it had always been policy to recruit experienced crews.¹⁰¹ Harris's 'two tours' criteria had proven largely unsustainable, but most crews had completed at least 25-30 bomber operations over Germany. With Cheshire's departure Cochrane instituted a new policy of posting in unblooded crews fresh from final training. Crews were chosen from those who had been rated 'Above average' at Operational Training Unit.¹⁰² Cochrane's thinking, perhaps prompted by a growing output of fresh aircrew, was that the Squadron's experienced crews would mentor the newcomers – in effect fast tracking them to attain the Squadron's high standards.

At first the old guard showed a degree of scepticism towards the new crews.¹⁰³ The first of the novice crews, Flt Lt Tony Iveson, believed that it was not the number of flying hours, or years of service that counted, it was experience of bomber operations. Iveson by no means lacked flying hours, having flown Spitfires in the Battle of Britain and then served as a flying instructor for two years in Rhodesia. He recounted being told on arrival that the experienced crews would 'have you for breakfast.'

Some of the longer serving Squadron members maintain that Cheshire would never have permitted this change of policy. Sqn Ldr Tom Bennett, an experienced navigator, maintained that "...Cheshire always insisted that he had no time to 'blood' sprog crews...he wanted 'TALLBOYS on targets, not scattered around the fields of Europe by crews endeavouring to get used to being under accurate ack-ack fire." Bennett's view is that this may have influenced Cochrane's decision to screen Cheshire.¹⁰⁴ If so, then it is strange that Cheshire's replacement had no objection to Cochrane's new policy. When Bufton had been establishing the Pathfinder Force, Tait had commented that a corps d'élite was a "good thing" and the best crews should be creamed off into such units. "Squadrons don't use their best crews to help others, except possibly for giving them dual at night."¹⁰⁵ Generally however, once the initial shock had worn off, new arrivals found themselves well received. In all only five such crews were posted in at this time and there was no reason to consider their performance lacking. Two were 'blooded' on operations against *Tirpitz*, three completed over 20 operations and Iveson was awarded the DFC for bringing his badly damaged aircraft back across the North Sea.

¹⁰¹ See p 77.

¹⁰² Author's collection: Flying log book, L.S. Goodman. Entry 26 May 44. Crews were chosen from those who had been rated 'Above average' at Operational Training Unit.

¹⁰³ T C Iveson to author, 16 May 93.

¹⁰⁴ Author's collection: Letter T. Bennett to H.R. Humphries (former 617 Squadron Adjutant), 11 Nov 2000.

¹⁰⁵ CCC, Bufton Papers, BUFT 3/17: Letter Wg Cdr Tait to Wg Cdr Smith, 5 Apr 42.

The Squadron veterans were not the only ones under consideration for replacement. Portal wanted to transfer Cochrane to his own staff as ACAS (Policy).¹⁰⁶ Harris rejected the request in the strongest terms and argued that such a move would have the most adverse effect on No. 5 Group, saying it would be detrimental to Cochrane, divorcing him from operational matters. Harris had other plans for Cochrane when Bomber Command turned its attention to the Pacific War.¹⁰⁷

The tempo of operations and demand for TALLBOY both increased as the new weapon's effectiveness became apparent. From the results of the attack on the Saumur Tunnel it immediately became apparent that the original order of 650 TALLBOY would be insufficient. Sixty bombs were immediately available and production was at a rate of 15 per week. The Ministry of Aircraft Production had issued an ad hoc order for 350 more to keep production going.¹⁰⁸ More would be required if stocks were to be built up for future use; Saundby wanted the order increased to 3,000 and the rate of production stepped up from the current 120 a month to 500. Shortage of capacity in the UK made this impossible unless Admiralty contracts were sacrificed. This meant that any significant increase had to come from the United States.¹⁰⁹ Until these came on stream, No. 5 Group was instructed that TALLBOY was only to be used if specifically instructed by HQBC.¹¹⁰

Freeman at MAP was keen to retain existing manufacturers if further bombs were to be produced in America. This would be easier than having to seek new facilities.¹¹¹ AVM Evill concurred. If the rate of production could be doubled to 240 per month the existing order would be increased to 2,000.¹¹² Production of bomb bodies was not the limiting factor. Rather it was a lack of filling capacity.¹¹³ It would take at least two or three months to find suitable buildings, lifting equipment and manpower to meet this new rate of production. Again the Americans came to the rescue. Robert Lovett (US secretary of Air) remarked to Portal that the British did not seem to be taking full advantage of American manufacturing resources. Questioned further Lovett confirmed that he thought

¹⁰⁶ RAFM, Harris Papers, H 83: Letter Portal to Harris, 23 Jun 44.

¹⁰⁷ Ibid. Letter Harris to Portal, 27 Jun 44.

¹⁰⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Bufton to ACAS Ops, 11 Jun 44.

¹⁰⁹ TNA Air 20/1793: TALLBOY bombs. Letter D Arm R to ACAS, 12 Jun 44.

¹¹⁰ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. HQBC to HQ No. 5 Group, 20 Jun 44.

¹¹¹ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Minutes of DCAS Conference, TALLBOY, 12 Jun 44.

¹¹² TNA Air 20/1793: TALLBOY bombs. Letter Evill to Freeman, 12 Jun 44.

¹¹³ TNA Air 20/1793: TALLBOY bombs. Letter D Arm R to ACAS, 12 Jun 44.

any number of TALLBOYS might be produced and filled by American industry.¹¹⁴ This prompted a multi-channel request. The Air Ministry contacted Lovett, via the RAF Delegation in Washington, instilling a sense of urgency by saying that more TALLBOYS were needed to combat the impending rocket threat.¹¹⁵ Portal would contact General Arnold direct if required.¹¹⁶ Freeman followed up via the British Air Commission in Washington.¹¹⁷

Results were soon forthcoming. The Americans assured production of 1,000 bombs as soon as possible.¹¹⁸ Empty bomb bodies would be despatched during July and August, in order not to disrupt the present arrangement.¹¹⁹ From September filled bombs would be delivered from the US Naval facility at Yorktown. Meanwhile, fuzing components, desensitizer and the filling formulation were to be sent to America by air.¹²⁰ The new arrangement would see joint Anglo-American production increase from 42 per month in August to 110 in September, rising to 245 in December.¹²¹ There was still additional capacity and Freeman was keen to initiate a further increase of 100 per month from American production to produce 340 per month during January and February 1945.¹²²

For the next two months an increasing number of targets and plans to equip a second squadron to use TALLBOY stretched this limited resource; careful husbanding of stocks was required. All TALLBOY production was to go to No. 617 Squadron until it exceeded the Squadron's expenditure rate.¹²³ From late August, as production increased and a second TALLBOY squadron, No. 9, was about to become operational, information regarding the next 24 hours' deliveries of TALLBOY was passed each day to HQBC. This was for Harris's information to aid planning and the allocation of targets.¹²⁴

¹¹⁴ RAFM, Harris Papers, H 83: Letter Portal to Harris, 27 Jun 44.

¹¹⁵ TNA Air 19/261: Bombs: requirements and production. Webber W 5480, Air Ministry to RAFDEL Washington, 4 Jul 44.

¹¹⁶ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Minute ACAS (Ops) to DCAS, 28 Jun 44.

¹¹⁷ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Cypher Message MAP to BSC Washington, 4 Jul 44.

¹¹⁸ RAFM, Harris Papers, H 83: Letter 8 Jul 44.

¹¹⁹ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Cypher Message MAP to BAC Washington, 4 Jul 44.

¹²⁰ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Message MAP to BAC Washington, 11 Jul 44.

¹²¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Scientific Equipment Progress Meeting 15(44), Notes on Item 4, TALLBOY, 16 Aug 44.

¹²² TNA Air 14/2173: TALLBOY: provisioning. Letter Freeman to Portal, 29 Aug 44.

¹²³ TNA Air 14/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter 'Lancaster aircraft for No. 9 Squadron', Bufton to CAS, 3 Jul 44.

¹²⁴ TNA Air 14/2173: TALLBOY: provisioning. Minute 2 Flt Lt Jarman, 29 Aug 44.

TALLBOY and SABS demonstrated that precision attacks were a practical proposition. The results achieved by TALLBOY and an anticipated increase in the bomb's production prompted the DBO to press for the formation of a second TALLBOY Squadron. In due course, it was suggested, perhaps each Group should have its own specialist Squadron to carry out similar attacks.¹²⁵ The idea found favour with Harris who instructed that another squadron be equipped with Lancasters with large bomb doors and SABS.¹²⁶

As earlier described (pp 67-69), this was a larger issue than simply the provision of bombs. Aircraft and bomb sights would be needed along with time to train the new squadron in the complexities of SABS. There had always been concern about the lack of large bomb doors. These were only fitted to aircraft on the Castle Bromwich production line destined for No. 3 Group and were due to be discontinued later in the year.¹²⁷ All other aircraft had to be retro-fitted, along with the necessary modifications for TALLBOY and SABS. Although the Squadron had lost only two aircraft in the first six months of 1944 (and would shortly lose a third) there were barely sufficient to meet their needs. There was no stock from which to draw to create a second unit.¹²⁸ Canadian-built Lancaster Xs were considered which were fitted with large bomb doors as standard, but did not have the fire-suppressant nitrogen tank system. These had US sourced instrumentation and electrics and were used only by the squadrons in No. 6 (RCAF) Group. Allocating these aircraft to another Group would pose considerable engineering problems. Could the second TALLBOY squadron be formed in this Group and based at Middleton St George?¹²⁹ The idea was discounted both in terms of practicality and on account of the low state of modification of the Canadian aircraft.¹³⁰

Instead another No. 5 Group unit, No. 9 Squadron was selected as the second squadron. Based at Bardney, Lincs, No. 9 had shown consistently good bombing results with the

¹²⁵ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute Morley to Bufton, 12 Jun 44.

¹²⁶ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute ACAS (Ops) to DCAS, 15 Jun 44.

¹²⁷ TNA Air 14/1144: Expansion and re-equipment: operational Groups. Minute 6, AVM Saunders to SASO Bomber Command, 19 Jun 44.

¹²⁸ RAFM, Aircraft Movement Cards: Avro Lancasters DV385, DV394 and DV402. TNA Air 27/2128: No. 617 Squadron Operations Record Book, 12 Feb 44, 24 Apr 44 and 24 Jun 44.

¹²⁹ TNA Air 14/1144: Expansion and re-equipment: operational Groups. Minute 6, AVM Saunders to SASO Bomber Command, 19 Jun 44.

¹³⁰ TNA Air 14/1144: Expansion and re-equipment: operational Groups. Postagram Wg Cdr Whitworth to HQBC, 22 Jun 44.

Mark XIV bomb sight, and is perhaps indicative of the narrowing of the divide between No. 617 Squadron and the main force. The decision was made together with the rejection of the Canadian Lancasters and confirmation that TALLBOY stocks would increase by September. This squadron would be taken off operations towards the end of August to prepare for TALLBOY.¹³¹ Its aircraft would be retrofitted with large bomb doors sourced from No. 6 Group.¹³² However, it would not be equipped with SABS.

The decision for No. 9 Squadron to retain the Mark XIV was expedient. It precluded time needed to train its crews on SABS to achieve the standard already attained with the Mark XIV. It also suggests that the planners were perhaps taking a small step towards the scenario proposed by Wallis in his paper of 1940 for large numbers of TALLBOY aircraft to attack area targets.¹³³ In effect No. 9 Squadron was a main force squadron that carried out attacks using specialist weapons, whereas No. 617 Squadron was a precision squadron that occasionally participated in non-specialist attacks. Although resources would never permit the large numbers of bombs Wallis had first envisaged, the introduction of a second squadron would double the size of the TALLBOY force that could be directed against a single target.¹³⁴

Although supplies of SABS were limited, proposals to increase aircraft provisioning and increased production for the sight were discussed and the option not totally discounted in case operational experience proved it to be essential.¹³⁵ There was also concern that the SABS settings could not accurately accommodate the high terminal velocity of TALLBOY.¹³⁶ Steps were in hand to rectify this problem, although there was still dispute as to the bomb's actual terminal velocity.¹³⁷ Aiming data from the development trials

¹³¹ TNA Air 14/1144: Expansion and re-equipment: operational Groups. Loose Minute Grp Capt Plans to AOT, 22 Jun 44.

¹³² TNA Air 20/4748: Bomb sights policy. Postagram Sqn Ldr Lister to MAP Overseer, A V Roe, 23 Jun 44.

¹³³ Wallis Family Archive: Wallis *A Note on a Method of Attacking the Axis Powers*, Figs 12 and 14. This involved the use of large numbers of aircraft equipped with deep penetration bombs in order to destroy large area targets such as underground oil storage tanks.

¹³⁴ This suggests the thinking was that No. 9 Squadron might only be used in the manner, and that No. 617 Squadron would be retained for precision attacks using SABS. The attacks on *Tirpitz* where it was realised that absolute precision was unlikely are also indicative of this concept.

¹³⁵ TNA Air 20/4748: Bomb sights policy. Postagram Sqn Ldr Lister to MAP Overseer, A V Roe, 23 Jun 44. See also p 162.

¹³⁶ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. RD Inst 7 to Sqn Ldr Brown, HQBC, 3 Jun 44.

¹³⁷ TNA Air 14/2057: Attack on Saumur by No 617 Squadron: report. Note of Action Sqn Ldr Richardson, 13 Jun 44.

were insufficient and needed refinement in the light of operational experience.¹³⁸ Even the smallest errors needed to be reduced. Reports recording attack data, including the SABS settings used and winds encountered were to be submitted after each attack.¹³⁹

The Squadron's use of SABS brought forth a further demand for its expertise. The Director of Air Tactics requested trials to ascertain SABS's suitability for use against moving ships for possible use in the Pacific War.¹⁴⁰ Such bombing trials normally fell within the remit of experimental establishments, such as the Bombing Development Unit, but Bomber Command maintained that this was already fully involved with other trials.¹⁴¹ Inter-Command politics also prompted the thought that the trials should be conducted by the Coastal Command Development Unit (CCDU) and the formation of an anti-ship bombing unit was also suggested. However none of these units had experience of SABS. The only sights in operational use at the time were those of No. 617 Squadron, and a few others employed by backer-ups with Nos. 83 and 97 Squadrons. All were fully committed with operational requirements and the projected trials necessitated the detachment of at least three aircraft and experienced crews for at least two months.¹⁴² The requirement remained unfulfilled until December, when three tour expired crews from No. 617 Squadron were detached to the CCDU (later designated the Air Sea Warfare Development Unit, ASWDU).

The success of TALLBOY reinforced support for its larger stable mate, the 22,000 lb TALLBOY (L). By July 1944 Harris was pressing for production of the latter, which he saw as a "killer weapon" against the large V-weapon sites. Once their threat was removed from London other targets "of a more profitable nature" could be addressed.¹⁴³

The introduction of TALLBOY (L) raised two key issues: that of manufacturing capacity, for both the bombs and the aircraft to carry them. Both sizes of bomb, Large and Medium, required the same manufacturing and filling processes which were already fully stretched coping with TALLBOY (M). MAP estimated that to obtain production of 10 Large per month the Medium bomb's production had to be halved. Harris was asking for 100 Large a month (from both UK and US producers) but at the expense of no more

¹³⁸ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. HQ No. 5 Group to HQ No. 54 Base, 25 Jun 44.

¹³⁹ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. HQ No. 5 Group to HQ No. 54 Base, 15 Jun 44.

¹⁴⁰ TNA Air 20/4748: Bomb sights policy. Letter A/Cdre Traill to Harris, 22 Jun 44.

¹⁴¹ TNA Air 20/4748: Bomb sights policy. Letter Saundby to DAT, 26 Jul 44.

¹⁴² TNA Air 14/201: Air tactics: attacks on warships and merchant vessels and trials of SABS Mark IIA. Letter AVM Walmsley to DCAS, 28 Aug 44 and Minute 28 Aug 44.

¹⁴³ RAFM, Harris Papers, H 85: Letter Harris to Freeman, 11 Jul 44.

than the same number of Medium.¹⁴⁴ Freeman then offered 25 Large at a cost of 30 Medium.¹⁴⁵ Any greater number of Large would be at the expense of Admiralty contracts. Harris insisted that a minimum of 50 Large a month would be needed to keep the large V-sites out of action. He was also convinced (correctly as it transpired) that if this were done, then the Germans would use other sites of a different type which might require an even greater quantity.¹⁴⁶ Portal shared Harris's view. However he was reluctant to sacrifice large numbers of Medium when quantities of Large were unlikely to become available until December at the earliest.¹⁴⁷

Furthermore, TALLBOY was competing with the CP bomb for production materials and resources, further underlining the problems of procurement and the difficulties of establishing priorities for equipment. Sufficient quantities of both TALLBOY (L) and (M) could be obtained only if the Admiralty co-operated. Portal discussed the matter with Admiral Cunningham, the First Sea Lord. The work that would be affected concerned the CP bomb, but Cunningham was prepared to assist.¹⁴⁸ After discussion Freeman was able to promise monthly supplies of 50 TALLBOY (L) by January 1945, while still guaranteeing 240 TALLBOY (M).¹⁴⁹ American production at a rate of 25 per month could start in November. If these were filled in the USA operations with (L) should be able to start in December.¹⁵⁰

The other factor was that TALLBOY (L) could only be carried by extensively modified Lancasters. Production of these would need to coincide with delivery of the first bombs. Rather than having two TALLBOY (M) squadrons (for what seemed to be a reduced number of this bomb) Portal advocated that the aircraft scheduled to be modified as TALLBOY (M) carriers for No. 9 Squadron should instead be modified to carry TALLBOY (L).¹⁵¹ This was anathema to Harris, who strongly disliked the prospect of specialist aircraft, writing to Freeman: "I have, as you have, a horror of specializing aircraft and if I had not fought that ground in season and for the last 2½ years we should have had about one bomber squadron left and the rest of the force would have been specialised

¹⁴⁴ Ibid.

¹⁴⁵ RAFM, Harris Papers, H 85: Letter Freeman to Harris, 14 Jul 44.

¹⁴⁶ RAFM, Harris Papers, H 85: Letter Harris to Freeman, 19 Jul 44.

¹⁴⁷ TNA Air 20/1793: Bombs: requirements and development. Letter Freeman to Portal, 14 Jul 44.

¹⁴⁸ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Extract from minutes of COS Meeting 15 Jul 44.

¹⁴⁹ TNA Air 20/5165: Bombs: requirements and development. Letter Freeman to Portal, 24 Jul 44.

¹⁵⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Arm 1 to ACAS, 16 Aug 44.

¹⁵¹ TNA Air 20/1793: Bombs: requirements and development. Letter Portal to Freeman, 17 Jul 44.

for every conceivable purpose from picking coconuts upwards and downwards.”¹⁵² For all Harris’s support of the Squadron as a specialised unit his views on uniquely modified aircraft had not changed. In this respect TALLBOY was a more acceptable weapon than GRAND SLAM. The original intention was to produce 52 TALLBOY (L) aircraft phased in gradually to keep pace with the delivery of bombs.¹⁵³ Although the TALLBOY (L) aircraft could also carry TALLBOY (M) as an alternative load, they were unable to carry smaller bombs. This restricted flexibility that might be required for other targets or during periods of shortage of the larger bombs. Harris’s disquiet about the limitations of the modified aircraft also echoed around the DBO, perhaps for slightly different reasons. To carry the ten ton bomb the aircraft’s fuel load restricted it to a range of a mere 500 miles. By the time that TALLBOY (L) was in operational use it appeared likely that the only target within range would be the E-boat pens at IJmuiden. A few other targets might emerge, but could the resources to produce aircraft and a weapon with such limited use be fully justified?¹⁵⁴ The issue remained unresolved for several months.¹⁵⁵

The dilemma of TALLBOY (M) was repeating itself. The long development process and lead time for production necessitated the allocation of resources in advance of knowing whether the weapon would be practical. MAP issued instructions to proceed with production of TALLBOY (L) in mid-July.¹⁵⁶ Having already been accused of foot-dragging with the introduction of TALLBOY (M) (and implicit in this the delay to TALLBOY (L) caused by this weapon’s start-stop inception in 1943) the Air Staff briefed the Secretary of State.¹⁵⁷ They cautioned there were still a large number of unknowns in both development and possible use and as a result the order for 600 placed was purely speculative.¹⁵⁸

From an operational perspective, the use of TALLBOY is well recorded in both the narrative histories and those recording the weapon’s development and use along with

¹⁵² RAFM, Harris Papers, H 85: Letter Harris to Freeman, 19 Jul 44.

¹⁵³ TNA Avia 15/1465: Aircraft: Manufacture and Production: Bombers: Lancaster bombers: production programme and policy. Notes of meeting, 16 Aug 44.

¹⁵⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Sqn Ldr Whitehead to DDB Ops 1, 22 Aug 44.

¹⁵⁵ See pp 192-196.

¹⁵⁶ Murray, *Bouncing Bomb Man*, p 132, and also Air 41/81: Armament, Bombs and Bombing Equipment Vol 1, SD 172, p 204.

¹⁵⁷ TNA Air 20/1793: Bombs: requirements and development. Note VCAS to Secretary of State, 28 Aug 44.

¹⁵⁸ TNA Air 20/1793: Bombs: requirements and development. Note ACAS (TR), 20 Aug 44.

specific works relating to targets.¹⁵⁹ Missing from these accounts is the relationship between the targets attacked during this period and earlier thinking. Had TALLBOY entered service as planned in late 1943 it would have been used against the large V-weapon sites at an earlier stage of their construction. They would also have been available for the U-boat pens requested by the Admiralty in February. Less attention has been paid to the organisational changes taking place at this time, triggered not only by the introduction of a new weapon, but also the change in targeting organisation and switch to daylight operations.

¹⁵⁹ Cooper, *Beyond the Dams*; Ward, *The Definitive History and Forging of a Legend*; Darlow, *Sledgehammers for Tintacks*; Flower, *A Hell of a Bomb*; Mallman Showell, *Hitler's U-boat bases* and Ramsay, *After the Battle* (1987 and 1993).

CHAPTER 5 September 1944 – January 1945

Throughout the summer the Strategic Bomber Forces had operated under the direction of SHAEF. Targets had been determined by a number of specialised committees (e.g. CROSSBOW, JOCKEY and 'Rail Targets'). Despite the objections voiced by Harris pre-OVERLORD to the switch of emphasis from attacks on German cities to targets in France he had accepted the task. His force was committed to attacks on communications, fuel and ammunition dumps, port installations and battlefield support, together with attacks on the CROSSBOW targets. During this time he built a warm relationship with Eisenhower and Tedder. Both praised his contribution to the invasion and subsequent operations: "[Harris] proved to be one of the most efficient and co-operative members of this team."¹ "Harris co-operates magnificently."² Despite this co-operation Harris still remained convinced his campaign against German cities should recommence as early as possible.

By August 1944 the critical phases of OVERLORD were complete; the Allies were firmly established. The V-1 sites had been overrun and ground forces were advancing through Holland to the Rhine. Portal proposed that it was now time for the strategic bomber forces to be removed from the control of SHAEF and revert to a primary role of targeting Germany.³ On 16 September executive control passed to Portal (CAS) and Arnold (Commanding General USAAF) exercised through Bottomley (DCAS) and Spaatz (Commanding General USStAFE).⁴

Once again the question of targets was to cause division. As part of the pre-invasion offensive the Americans had already targeted German oil production and the Air Staff were keen for Bomber Command to add their weight to the offensive. The subject had been broached by Bottomley in early June, much to Harris's annoyance. Not only did he consider oil a "panacea" target, but also regarded requests from the Air Staff as an unwarranted intrusion when he was under the direction of SHAEF. Nevertheless, with SHAEF intervention, Bomber Command began limited attacks against synthetic plants in the Ruhr.⁵ By August Intelligence reported that the combined effort of Bomber

¹ Probert, *Bomber Harris*, p 303. Letter Eisenhower to General Marshal, 25 Aug 44.

² Ibid. AM Tedder, diary entry, 14 Jun 44.

³ Richards, *Royal Air Force 1939-45*, Vol III, p 258.

⁴ AHB Narrative, *The RAF in the Bombing Offensive against Germany*, Vol IV, p 109.

⁵ Probert, *Bomber Harris*, p 307 and Ehlers, *Targeting the Reich*, pp 271-272.

Command and the USAAF on other production and transport targets (vital for the distribution of fuel) was creating serious fuel shortages for the Germans on both fronts.⁶

Portal and Bufton were both convinced of the importance of maintaining the offensive against oil, as was Spaatz. Tedder, however, favoured an extension of attacks against transport and communications into Germany. Harris remained obdurate; the bomber effort should be directed against city targets.

The immediate result was a compromise. On 25 September, on Portal's behalf, Bottomley, issued a directive that established revised objectives for the strategic bomber force.⁷ The oil industry was first priority, with rail and water transportation, tank and MT production plants and ordnance depots, as second. Provision was made for "counter air force activity" and direct support for land and sea operations. Attacks on important industrial areas were permitted when conditions prevented attack of the primary objectives.

By the middle of October 1944 a new committee, the Combined Strategic Target Committee (CSTC), had been established to focus and co-ordinate the efforts of both the British and American Strategic bomber forces and achieve the objectives set out in its first directive.⁸ The committee was established under the nominal joint chairmanship of Bottomley and Spaatz.⁹ Its role was to select and prioritise targets within the target sets of the current directive based on recommendations received from specialist working committees, including those on oil, communications and jet aircraft. CSTC monitored attacks and results and could recommend a change of emphasis or priority, the better to achieve objectives; they could also recommend new target systems relevant to existing or new directives. Should a marked change of policy be deemed necessary, Bufton submitted CSTC's recommendation via the Air Staff (Bottomley) to the COS. If they agreed, it would be discussed by the Combined Chiefs of Staff (CCOS). CSTC would also forward to Bottomley and Spaatz army support targets requested by bodies such as SHAEF. The Admiralty could request individual naval targets, or targets of opportunity via Coastal Command. Should sufficient naval targets emerge to warrant a target set this had to be approved by COS and CCOS. They could also send the Air Ministry weekly lists of important targets to be attacked if they fell within the current directive;

⁶ Erhlers, *Targeting the Reich*, pp 272-273.

⁷ TNA Air 14/718: Air Ministry Directives, Vol. 7. Bottomley to Harris, 25 Sept 44.

⁸ See Erhlers, *Targeting the Reich*, pp 275-276; Webster and Frankland, *Strategic Air Offensive*, Vol 3, pp 68-74.

⁹ Generally meetings were chaired alternately by their deputies, Bufton and Maxwell.

these would then complement those issued by CTSC for oil, communications and the aircraft industry.¹⁰

The September directive was superseded on 1 November. This new directive maintained oil as the primary target set, but modified the secondary priority by the deletion of the tank and MT production plants and ordnance depots, now concentrating solely on "German lines of communication with emphasis on the Ruhr."¹¹ Attacks on important industrial areas were given precedence over "counter air force activity" and as far as possible were, to be targeted against the two remaining key target sets. Provision was still made for the direct support of army and navy operations as necessary.

Both directives should have satisfied all parties. However, deteriorating weather conditions reduced the number of days of clear weather for visual attacks by the Americans on oil facilities. Their attention turned increasingly to attacks on rail installations in German cities, using H2X and blind bombing techniques which effectively transformed their precision attacks into area attacks. During this period the Bomber Command's main force accuracy by night often exceeded that of the USAAF by day.¹² At the same time Portal was concerned that Harris still failed to accept the significance of oil as a target set. Portal's attempts to persuade Harris of the validity of the policy resulted in a protracted, and at times acrimonious, exchange of correspondence described by one historian as "an eruption of the built up tension and exasperation that had accumulated over the years of the war."¹³

Portal set out to impress upon Harris the importance of oil, at the same time questioning the reasons for Bomber Command's apparently limited effort against such targets. Harris's views were coloured by his own beliefs, his mistrust of "experts", notably MEW, and his insistence, contrary to the results achieved since the pre-OVERLORD campaign, that his force was unsuited to precision attack.¹⁴ Portal's own suspicions may have been

¹⁰ TNA Air 40/1514: Combined Strategic Target Committee: Signals to and from Air Ministry. Air Ministry to HQBC, AX 157, 29 Dec 44.

¹¹ TNA Air 14/718: Air Ministry Directives, Vol. 7. Bottomley to Harris, 1 Nov 44.

¹² Tami Davis Biddle *British and American approaches to strategic bombing: Their origins and implementation in the World War II combined bomber offensive*. *Journal of Strategic Studies*, 1995, 18, (1) Special Issue: Air Power Theory and Practice, p 123. See also W. Hays Parks, 'Precision' and 'area' bombing: *Who did which, and when?* *Journal of Strategic Studies*, 1995, 18, (1), pp 160-161. Special Issue: Air Power Theory and Practice

¹³ Tami Davis Biddle, *Rhetoric and Reality in Air Warfare -The evolution of British and American Ideas about Strategic Bombing 1914-1945*, (Princeton: Princeton University Press, 2006) p 246.

¹⁴ A.C. Grayling, *Among the Dead Cities- Was the Allied Bombing of Civilians in WW II a necessity or a Crime?* (London: Bloomsbury, 2006), pp107-108.

influenced by this perception of Harris and his determination to attack oil targets; given the slightest opportunity by unfavourable weather forecasts, Harris was likely to select a city target in preference to oil. The exchange continued until January 1945 and has been the subject of continued debate by historians.¹⁵ Examination of the evidence suggests that both parties had their prejudices and assumptions. Oil plants were targeted when weather conditions permitted. On other occasions, the Ruhr city targets selected by Harris contained marshalling yards, and on occasion benzol plants. In these respects Harris's effort was in full accordance with the wording of the directives, and when this broader view of oil and transport targets is considered Bomber Command's contribution to the Oil Plan is seen to increase. Another indicator may be that by the end of November 1944 "all of the RAF's synthetic oil targets were suspended because they were no longer operating."¹⁶

The capture of the large V-weapon sites and supply dumps, and the withdrawal of the U-boat arm from French bases created a need for new targets for TALLBOY. This requirement was increased by the establishment of No. 9 Squadron as a second TALLBOY squadron, which doubled the Command's ability to deliver this weapon and in theory increased the number of targets required. Viewed from the operational perspective this period was a continuation of the Squadron's activity from August which progressed to targets further north to keep pace with the retreating U- and E-boat flotillas. From a planning perspective the Squadron played almost no part in the mainstream offensive against oil or transportation targets; neither (with the exception of canal embankments and the ship lift) was considered appropriate. Instead it once again extended the capability of Bomber Command and was used to address the secondary directive objectives of providing support for the advancing armies and dealing with targets of concern to the Admiralty. By doing so, the Squadron's role became more integrated into the Command's overall offensive with an increasingly consistent pattern of operations, only a few of which adopted unconventional tactics. Meanwhile, the development of TALLBOY (L) again raised issues concerning production priorities and quantities, the availability of suitable targets and resurrected concerns about the development of aircraft only capable of carrying specialised weapons.

The Squadron's first attack in the period was against the German battleship *Tirpitz*. This was undertaken before the change in command from SHAEF to Portal, or the formation

¹⁵ See Tami Davis Biddle, *Rhetoric and Reality in Air Warfare*, pp 246 – 252; Sebastian Cox, *Sir Arthur Harris and some Myths and Controversies* RAF Historical Society Journal, 47 (2010), pp 13-21 and Cording (2006), *The Other Bomber Battle*, pp 301-324.

¹⁶ Sebastian Cox, *Sir Arthur Harris and some Myths and Controversies of the Bomber Offensive*, RAF Historical Society Journal, 47 (2010), pp 18-19.

of CSTC. Operations against this vessel extended from September to November and therefore also transcended both the formation of CSTC and three directives. By doing so, they illustrate the potential for the diversion of resources into targets other than those prioritised by the directives. The attacks on *Tirpitz* were requested by the Admiralty, approved by SHAEF, and continued primarily when there were no demands for targets with higher priority. In effect *Tirpitz* was to be sunk in the Squadron's "spare time".¹⁷ The fact that the Squadron had such spare time was in part due to the strategic change of emphasis on targets.

During August, the Squadron had been directed against U-boat pens as part of a campaign to combat the threat to convoys bringing essential supplies to the Allied Armies in Europe.¹⁸ Additionally the battleship *Tirpitz* remained a potential threat. Although she had only made one brief foray to sea during her career her presence moored in Kaa Fiord, northern Norway, caused the Royal Navy to maintain a force in Scapa Flow in case she should venture into the North Atlantic. The Royal Navy, Fleet Air Arm and Coastal Command were increasingly stretched to provide the necessary convoy protection. Sinking *Tirpitz* would not only remove the threat but release assets for other essential duties.

A report by the Joint Planning Staff considered the possibility of mounting an attack on *Tirpitz* using Mosquitos and 2,000lb bombs.¹⁹ The Mosquito proposal was rejected.²⁰ Consideration was then given to an attack using TALLBOY. This weapon had not previously been envisaged as an anti-shipping weapon, but its size and penetrative power, combined with its charge weight ratio suggested that it might usefully serve as such. According to Harris, although he had previously recognised the importance of *Tirpitz*, and the possibilities of TALLBOY, he understood that the Admiralty's priority lay with the destruction of the U-boat threat.²¹ As a result, all available TALLBOYs had been expended on their protective pens. Now that these were no longer seen as priority

¹⁷ Quote attributed to Harris by Sqn Ldr Tony Iveson, 617 Squadron *Tirpitz* Dinner, RAF Lossiemouth, 12 Nov 44.

¹⁸ See pp 148-152. The convoys were not solely those plying between Britain and continental ports. Supplies were now being transported direct across the Atlantic from North America. The pens were now being neutralised by ground forces, but the source of the threat had migrated north as the U-boat fleet was pulled back to operating bases in Holland and Norway.

¹⁹ CAB 84/65/33: Attack on the *Tirpitz*. Report by J.P.S. Taken at COS Mtg. 286th(0), 23 Aug 1944.

²⁰ CAB 79/80/3: War Cabinet and Cabinet, Minutes of Meetings. COS(44) O 288th, 26 Aug 44.

²¹ RAFM, Harris Papers H 19: Harris to AVM Williams (ACAS (Ops), 4 Sept 44.

Harris believed that SHAEF would permit an operation be mounted.²² In order to maximise the chances of hitting the battleship, the attack against *Tirpitz* was to be made by a joint force of both TALLBOY squadrons. Kaa Fiord was beyond the range of Lancasters operating from UK bases so use of a Soviet base was required. This necessitated a major diplomatic and logistics exercise not only to obtain permission to use an airfield at Yagodnik, but also the necessary accommodation and supplies needed to sustain the force during its visit. The exercise was conducted in a remarkably short period with the assistance of the British Military Mission in Moscow and the Royal Naval Liaison Officer in Archangel working with Soviet Chief of Naval Air Staff.²³ Other organisations were involved, including Transport Command who provided two Liberators to transport ground crew, limited spares and additional food for the detachment. The fact that wheels were set in motion before official approval was received from SHAEF might be indicative of either Harris's confidence or rebellious nature.

Operation PARAVANE was carried out on 15 September using a mix of TALLBOY and JOHNNY WALKER anti-shipping bombs. Smoke screens hindered visibility and *Tirpitz* remaining afloat, although one TALLBOY struck her bow.²⁴ As a result the Germans moved her south to Tromso, bringing her within effective range of Lancasters operating from Scottish advanced bases.

Harris believed the existing damage to be sufficient to prevent her venturing to sea as an effective force. Cochrane, however, was keen for a further attack to ensure that she was out of action. During the middle of October he proposed a moonlight attack by 50 aircraft; the release of 500-600 JOHNNY WALKER bomb, either visually or by H2S, was expected to produce sufficient hits to cause substantial damage.²⁵ Cochrane was clearly thinking of this as a main force attack. Not only had he rejected TALLBOY but neither of the TALLBOY squadrons was equipped with H2S, and the force size exceeded that of the two squadrons combined. JOHNNY WALKER was an unusual choice. The weapon was not liked by the crews. Not only was it short supply, it was complicated for armourers to handle. It used a parachute to retard its fall and would drift with the wind, thus being virtually impossible to aim accurately from high level.²⁶ Harris disliked the weapon, and it is likely that he only forwarded the proposal to Portal because he saw it as a way of using a weapon that was useless against moving ships or those in harbour.²⁷

²² TNA Air 14/917: Operation PARAVANE. Note ACAS (Ops) to CAS, 31 Aug 44.

²³ TNA Air 20/799: PARAVANE. British Military Mission Moscow, Sept 44.

²⁴ TNA Air 20/2323: Operation PARAVANE: RAF reports.

²⁵ RAFM, Harris Papers, H 59: Cochrane to Harris, 14 Oct 44.

²⁶ TNA Air 14/2168: JW Bomb. Letter HQBC to AOC No. 5 Group. 1 Sept 44.

²⁷ RAFM, Harris Papers H 83: Harris to Portal, 17 Oct 44.

While Harris appeared willing to accept the task of sinking *Tirpitz* and continue with it for three attacks, this attitude was not reflected in a communication with Portal on 1 November. Arguing that diversions imposed on Bomber Command (notably in his view oil targets) were diluting the Bomber Offensive, Harris stated, "During the last few weeks every panacea monger and 'me too expert'has raised his head again. The *Tirpitz* has got within range and the Admiralty has resuscitated a U-boat threat. The ball-bearing experts have again become vocal . . ." Nevertheless this can also be interpreted as further evidence that Harris valued No. 617 Squadron as a means of assuaging such demands, as had been the case with the initial CROSSBOW attacks and requests from SOE.²⁸

In the meantime Cochrane reviewed the situation and decided that, rather than wait for JOHNNY WALKER production to restart, a further TALLBOY attack should be mounted.²⁹ This could be done within ten days if sufficient TALLBOYS could be obtained.³⁰ Harris concurred, giving Cochrane carte blanche with regard to aircraft loading and instructing no further use of TALLBOY until he had sufficient for the attack.³¹

This was an interesting decision. Harris was sanctioning an operation that was in effect the continuation of an attack on an agreed objective, and appears to have taken advantage of his recent communication to Portal to progress it, albeit more rapidly and with a different weapon. His decision to stockpile TALLBOY also suggests that he did not envisage any immediate requests for ground support operations, such as those that had occupied No. 617 Squadron at the beginning of October.

The second operation, OBVIATE, was mounted on 29 October. Again, this required considerable logistical planning. The aircraft of both Squadrons were fitted with more powerful engines, achieved by swapping engines with those from other No. 5 Group aircraft, and additional fuel tanks.³² Both Squadrons then had to be positioned at Lossiemouth and Kinloss, which necessitated the finding of accommodation and rations, and the involvement of Transport Command to ferry ground staff and equipment. Finally accurate meteorological forecasting was needed to ensure that the detachment was not unduly delayed by waiting for weather.

²⁸ CCO Portal Papers: File 10, 1944. Harris to Portal, 1 Nov 44.

²⁹ RAFM, Harris Papers H 59: Harris to Cochrane, 1 Nov 44. JOHNNY WALKER production did not re-start.

³⁰ RAFM, Harris Papers H 59: Cochrane to Harris, 19 Oct 44.

³¹ RAFM, Harris Papers H 59: Harris to Cochrane, 20 Oct 44.

³² A straight swap of aircraft was impossible owing to the modifications required to carry TALLBOY and in No. 617 Squadron's case, modifications for SABS.

The attack was unsuccessful. At the last minute cloud prevented the bomb aimers from getting a clear view of *Tirpitz*. A fortnight later Operation CATECHISM was repeated with no such hindrance. After three hits and several near misses *Tirpitz* capsized.

Despite the operational difficulties, the attacks had demonstrated that TALLBOY was an effective weapon against heavily armoured warships. The opportunity was not lost on Cochrane, who began to plan further anti-ship operations.

A day after the sinking of *Tirpitz* he proposed a night attack on the German fleet at Gdynia with the Squadron supporting main force. In an attempt to re-acquaint No. 617 Squadron with their old technique the targets would be marked from low level using Mosquitos. This would, however, require development of a new type of marker that could not be extinguished by the ship's crew. Cochrane also suggested action against the cruisers Köln and Emden, operating in Oslo Fiord.³³ Harris concurred, although noting that the Admiralty considered the U-boat pens at Bergen and Trondheim a higher priority (pp 188-192).³⁴ By choosing a naval target at greater range than some of the oil refineries, Harris was risking Portal's condemnation that he was again favouring other targets ahead of oil. The attack on Gdynia was delayed until mid-December, just as the debate on this issue came to a head.³⁵ In the event No. 617 Squadron did not participate. No marker had been developed. Instead, a few nights later the Squadron was despatched against the refinery at Pölitz. Köln and Emden had to wait until the last night of the year for No. 617 Squadron's attention. This was a strange and inconclusive operation; individual aircraft illuminated and attacking their own targets, although with no experience of hitting moving targets with SABS the Squadron was fortunate to score a near miss.³⁶

While these operations had no effect on the selection of targets from the two main priority groups, they did have implications for the Squadron's employment against other naval targets and opened up possibilities for anti-shipping work in the Pacific after the end of the European war. PARAVANE had additionally given insight into the deployment

³³ RAFM, Harris Papers H 59: Letter Cochrane to Harris, 13 Nov 44.

³⁴ RAFM, Harris Papers H 59: Letter Harris to Cochrane, 15 Nov 44.

³⁵ For the Portal-Harris debate on oil targets, see Ehlers, *Targeting the Reich*, pp 280-288.

³⁶ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Oslo Fiord 31 Dec 44 – 1 Jan 45.

of the squadrons to advanced bases, the level of resource required and the degree of self-sufficiency that could be expected from the aircrew themselves.³⁷

During the two months that it took for the Squadron finally to despatch *Tirpitz*, CSTC had defined its strategy and priorities: directives and target groupings were drawn up to encompass the entire joint Anglo-American strategic bomber force. Since there was no specific target set for TALLBOY targets were found from within each of the established categories. By its very nature TALLBOY was only appropriate for certain objectives and a degree of self-selection was inevitable.

Considering the CSTC target sets in order of priority: Oil remained pre-eminent, championed by Bottomley, Spaatz, Bufton and Maxwell. As discussed, although Harris viewed it with suspicion targeted it directly when conditions allowed and indirectly on other occasions. However, as far as TALLBOY was concerned, it had little relevance; of the heavier bombs, the 12,000 lb HC was a more effective weapon against oil production plants. Generally, these targets were more susceptible to smaller bombs that could smash and sever pipelines in numerous places; blast bombs could collapse refracting columns and storage tanks, and incendiary loads ignite their flammable contents.³⁸ As a result TALLBOY would only be used against oil production plants on two occasions, once by each squadron.³⁹

Underground storage depots had featured significantly in Wallis's original treatise of 1940 that argued for a deep penetration bomb.⁴⁰ In CSTC's strategic plan such storage dumps were seen as of limited importance compared to production facilities. They were well dispersed and difficult to locate and bomb accurately and experience showed that standard 1,000 pound bombs were effective against them.⁴¹ TALLBOY was used only once against such a target.⁴²

The Communications Plan supported by Tedder was devised by Solly Zuckerman and mirrored that employed in France the pre-Overlord. It envisaged dislocation of the

³⁷ TNA Air 14/1971: Operation PARAVANE. Report by G/C McMullen AFC on attack on *Tirpitz*, Sept- Oct 1944.

³⁸ TNA Air 2/8011: Combined Strategic Target Committee: minutes of meetings. Preliminary Conclusions on the effects of air bombardment on the Roumanian oil refineries, 8 Nov 44.

³⁹ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Pölitz 21 Dec 44 and TNA Air 27/129: No. 9 Squadron Operations Record Book, Lützkendorf 8 Apr 45.

⁴⁰ Wallis Family Archive: Barnes Wallis, *A Note on a Method of Attacking the Axis Powers*, (1940), pp 37-43 and Figs 9-14.

⁴¹ Ehlers, *Targeting the Reich*, p 271.

⁴² TNA Air 27/129: No. 9 Squadron Operations Record Book, Farge 27 Mar 45.

German war economy by the simultaneous targeting of the rail network and waterways. After initial opposition from those who favoured oil the plan gained approval.⁴³ With Tedder's backing Germany's canals were now added to the target mix.⁴⁴ By acknowledging the inter-relationship of rail and water as transport media, Zuckerman's proposal echoed that of MEW back in the summer of 1943 when new targets were being sought for the Squadron subsequent to CHASTISE. On that occasion, while still committed to area attacks, Harris had only limited resources at his disposal. Now, with a larger force and a directive instructing him to focus on rail and water communications, there seemed a greater possibility of success. The question was whether the oil protagonists would grant sufficient priority to permit the allocation of adequate aircraft to transportation targets.

The plan opened up additional possibilities. Wallis had already envisaged the use of TALLBOY to crater railway lines.⁴⁵ Saumur had confirmed this ability.⁴⁶ Its earth shock and cratering abilities indicated great potential against bridges, viaducts and embankments; likewise, embanked stretches of canal. More significantly, it again brought to the fore the target that had been the original catalyst for TALLBOY: the Rothensee ship lift. In terms of targets for TALLBOY this target set offered far greater potential than oil.

Two additional sub-sets of targets were acknowledged in the September directive, "direct support" and "counter air force action".⁴⁷ These were seen as on-going commitments to be attacked as necessity dictated.

As the advance towards Germany continued, operations in direct support of the army, and to a lesser extent the navy, were seen as a continuing commitment. These were often addressed by the medium bombers of the tactical air forces, but on occasion a heavier weight of attack might be required. Both Tedder and Portal were concerned that such requests for support by strategic bombers might dilute their contribution against priority targets.⁴⁸ Nevertheless it was acknowledged that there would be

⁴³ For discussion of the relative merits and effects of the two plans see Ehlers, *Targeting the Reich*, Chapter 11, pp 295-304.

⁴⁴ Webster and Frankland, *Strategic Air Offensive*, Vol IV, Appendix 25, Tedder Note: A view to rapid Defeat of Germany, 25 Oct 44, pp 290-292.

⁴⁵ Wallis Family Archive: Wallis, *A Note on a Method of Attacking the Axis Powers*, pp 49-50.

⁴⁶ Author's collection: The Saumur railway tunnel 8-9 Jun 44. Interpretation Report KS 1476, 12 Aug 44.

⁴⁷ Webster and Frankland, *Strategic Air Offensive*, Vol III, pp 172-173: Directive Bottomley and Spaatz to Harris and Maxwell, 25 Sept 44.

⁴⁸ Webster and Frankland, *Strategic Air Offensive*, Vol III, pp 68-69.

occasions when such support was warranted. Despite No. 617 Squadron's accuracy, TALLBOY could never be considered as a tactical close support weapon. Nevertheless, when apposite, it could be called upon for a pre-emptive strike against objectives that otherwise would pose major opposition for advancing armies.

Attacks against aircraft production and directly against the Luftwaffe had reduced German opposition to the bomber offensive and even less fighter activity was anticipated as the oil campaign reduced supplies of fuel and lubricants. With the concentration of effort on other priorities it was important to ensure that this advantage was not lost but at the same time it needed to divert as little resource as possible. When required, attacks in this category would be undertaken predominantly by the USAAF. However, there was growing evidence for the construction of underground production facilities; these were impregnable to the smaller American bombs but might become potential targets for TALLBOY.

Given this range of potential targets, how best might the limited numbers of TALLBOY be employed?

By the start of September, TALLBOY had been in operational service for three months. Up to the end of August deliveries had amounted to 300 out of the existing order of 2,325.⁴⁹ No. 617 Squadron had expended 235 on operations.⁵⁰ With the recent addition of No. 9 Squadron Bomber Command now had two squadrons equipped with a specialist bomb. Both were capable of making precision attacks against targets otherwise invulnerable to smaller weapons.

Sufficient data from interpretation reports and other sources for the DBO were now available to prepare a paper that identified potential uses for the weapon, and its effects in respect of crater size and depth, blast damage and the effects of various fuzing.⁵¹

Nine categories of target were proposed. At the time of preparation, hard evidence existed for the results against tunnels, railway tracks, E and U-boat pens, large rocket sites and underground stores. E-and U-boat pens were already established as Admiralty targets and were likely to continue under the new strategy, with the addition of capital

⁴⁹ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Freeman to Evill, 26 Sept 44.

⁵⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, and Flower, *A Hell of a Bomb*, Appendix, p 312.

⁵¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter to Wallis, 8 Sept 44 and attachment dated 2 Aug 44.

ships following the sinking of *Tirpitz*. TALLBOY had yet to be used against other key targets that were suggested in the paper and also featured in CSTC's objectives: bridges and viaducts, canals, and underground factories. For the time being further potential uses, against super heavy batteries and dams, appeared to be outside the current target priorities.

The decision for both for both SHAEF and Harris was how to use the two squadrons to maximise the benefits of TALLBOY? While it was intended to build TALLBOY deliveries up to 340 a month, the addition of a new squadron might curtail the number of targets attacked in the short term.⁵² This was inevitable if the squadrons were going to operate together as in the case of *Tirpitz*. Greater numbers of aircraft would split the ground defences; on the other hand, if TALLBOY was aimed accurately at a small target, large numbers would not be necessary. As events unfolded, at different times both squadrons found themselves operating either singly, together or as part of a main force attack, the configuration depending on the nature of the target.

There was also the need to ensure accuracy, but since SABS units were still in short supply and No. 9 Squadron had achieved consistently good results with the Mark XIV, No. 617 Squadron would remain the only squadron equipped with SABS.⁵³ As a result, while No. 9 Squadron continued to undertake main force operations in addition to their TALLBOY attacks, No. 617 Squadron remained dedicated to operations requiring TALLBOY, although this was not a foregone conclusion.

A survey of the thirteen targets attacked by No 617 Squadron during the period September 1944 –January 1945 shows that only two were from the priority target sets of oil and communications; four were direct support: seven, the majority, related to Admiralty requests related to shipping and E/U-boat bases. Since these posed a threat to supply lines they might also be considered to be an indirect form of battlefield support.

Closer examination of the process by which these targets were chosen reveals why they were allocated to No. 617 Squadron, and that there was both potential and willingness to expand the Squadron's remit.

⁵² TNA Air 14/688: GRAND SLAM and TALLBOY bombs, Operational policy. Minute Note Gp Capt Plans to Saundby, 13 Sept 44.

⁵³ See pp 164-165. The small number of SABS fitted to a number of Nos. 83 and 97 Squadron aircraft were removed, but kept in store, rather than used for No. 9 Squadron. TNA Air 14/2022: Provision of Stabilised Automatic Bomb Sight for No. 617 Squadron. Wg Cdr Howell to RM 7, 4 Oct 44 and supplementary note 6 Oct 44.

CSTC's emphasis ensured that majority of effort was directed against oil targets, for which TALLBOY was unsuited. If opportunity cost is taken into consideration, it can be seen that TALLBOY could be employed to better effect against other targets; with the weapon in short supply it was logical that a policy of conservation was adopted with the selection only of targets invulnerable to conventional bombs.

The question thus arises as to why, after several months of successful main force attacks against oil targets, the decision was taken to employ No. 617 Squadron against the Bergius synthetic oil plant at Pölitz (Police), near Stettin (Szczecin) on the night of 20/21 December 1944. During the previous month, Bomber Command had successfully focused its attacks on oil targets in the Ruhr. As winter days shortened, the scope for daylight attacks by the US 8th Air Force on oil plants in eastern Germany was curtailed. Portal urged Harris to turn his Command's attention to attacks on these plants that were by now key to the production of much of the aviation fuel required by the Luftwaffe.⁵⁴ By the end of November, Pölitz was Priority 1 on CSTC's oil target list.⁵⁵ The Americans had last attacked it in October but a major attack by Bomber Command, whose aircraft carried greater loads than the American bombers, might cause severe damage and put it out of action for an extended period.

Cochrane was equally keen to look at long range targets, his intention being to make full use of the additional tankage that had been fitted to Nos. 9 and 617 Squadrons for *Tirpitz*.⁵⁶ His preference was for industrial towns in eastern Germany, or Poland.⁵⁷ After a suggestion by Harris that he might look at Pölitz or Leuna Cochrane agreed to the former.⁵⁸ A Group strength attack including "some 12,000 pounders" (Cochrane did not specify whether HC blast bombs, or TALLBOY) should be sufficient to cause serious damage.

The combination of these factors brought Pölitz onto the Squadron's battle order. With a desire to mount as heavy an attack as could be achieved by a single Group, Cochrane mustered a force of 207 Lancasters. No. 9 Squadron participated but carried a standard

⁵⁴ TNA Air 8/1745: Bombing Policy. Letter Portal to Harris, 12 Nov 44.

⁵⁵ TNA Air 401514: Combined Strategic Target Committee: signals to and from Air Ministry. Air Ministry to HQBC, 23 Nov 44.

⁵⁶ This fact has escaped the attention of earlier researchers who have presumed that the extra tanks were only applicable to *Tirpitz* operations.

⁵⁷ TNA Air 14/731: Targets for No 5 Group operating as a separate force. Letter Cochrane to Harris, 14 Nov 44.

⁵⁸ TNA Air 14/731: Targets for No 5 Group operating as a separate force. Letter Cochrane to Harris, 20 Nov 44.

(non-TALLBOY) load. From the Squadron's point of view the operation was not a success. The marking was inaccurate, the illumination poor and a smoke screen partly covered the target. Five aircraft failed to bomb and one aircraft crashed owing to bad weather on return.

Transport targets were always the poor relation to the Oil Plan, despite Tedder's efforts to raise their importance. In theory they should have provided a number of significant targets for No. 617 Squadron during this period, it will be seen that despite the eventual appearance of rail and canal objectives on the target lists, the Squadron was given little chance to attack them during the autumn/winter of 1944. Many remained into the New Year and were only then successfully attacked by the Squadron in the spring of 1945.

The attack on transportation targets began within days of the September directive, and picked up on recommendations made by Bufton the previous June.⁵⁹ On 23/24 September No. 5 Group sent a force to attack an embanked section of the Dortmund Ems Canal at Ladbergen. The attack had its basis in the plans formulated a year earlier that led to the Squadron's disastrous attack, but now weapons and tactics had moved on. This was a main force attack, comprising 136 Lancasters, bombing from high level, supported by another No. 5 Group attack on a nearby airfield. All of No. 617 Squadron's aircraft carried TALLBOYS, but with TALLBOY stocks depleted following the *Tirpitz* operation only six of No. 9 Squadron were thus armed.⁶⁰ Bad weather and communications difficulties led to a confused attack, with five of the Squadron failing to receive a message not to bomb. It was fortuitous. Two of the TALLBOYS dropped breached a bank of each of the parallel canals at this section, causing a six mile section of both to be drained.

The attack began a continuing campaign. Over the next six months seven attacks were made on the Dortmund Ems and five against the Mittelland Canal. No sooner were repairs completed and the canal functioning a fresh attack would again drain a section. Despite the success of TALLBOY in the first attack it was not used again against a canal until February 1945. With both squadrons soon fully engaged in the further attacks on *Tirpitz* No. 5 Group learned how to wage a successful campaign without relying on TALLBOY, using small numbers of main force squadrons.

Throughout the autumn of 1944 CSTC continued to champion attacks on oil production. Though there was considerable support for this, there was also dissent, notably by

⁵⁹ TNA Air 20/4773: The attack of the Dortmund Ems and Mittelland Canals, 24 Jun 44.

⁶⁰ The remainder carried 1,000 lb bombs.

Tedder and Zuckerman who saw transportation as being complementary to oil. Following the new directive on 1 November (p 171) that still kept transport as a secondary target to oil, a CTSC Working Committee (Transportation) was established. A week later a new plan was proposed.⁶¹ Attacks on the Dortmund Ems and Mittelland Canals were sanctioned, along with the mining of the rivers Rhine and the Elbe. More importantly rail targets between the Rhine and 10 degrees east could be attacked on occasions when the weather precluded attacks on oil targets. This change of policy to formalise operations against these target groups provided the basis for the consideration of new TALLBOY targets. The inclusion of the Dortmund Ems and Mittelland Canals also took in the Rothensee ship lift. Prospective rail targets concentrated on marshalling yards in the Ruhr, but also included the Bielefeld and Paderborn (Altenbeken/Neuenbeken) railway viaducts.⁶²

Even before this, in keeping with projected planning from the previous summer No. 5 Group had been instructed to target the Bielefeld and Paderborn viaducts as soon as possible, together with the Sorpe Dam.⁶³ It was hoped that a successful attack on the Sorpe⁶⁴ would destroy the railway line running through the Ruhr Valley. The Ruhr rail network might then be isolated by the additional destruction of the Bielefeld and Paderborn viaducts. In the event, the Sorpe was attacked by No. 9 Squadron alone dropping TALLBOY.⁶⁵ It was unsuccessful. The dam and the viaducts were still on the list when the November directive was issued. Pressure to attack these targets mounted with a request from SHAEF who saw the curtailment of rail traffic as essential support for their advance up to the River Roer (Operation QUEEN).⁶⁶ Cochrane prepared to attack the viaducts as soon as weather conditions permitted.⁶⁷ First considering a daylight attack, he switched to night, but in discussion Tait maintained that, contrary to Cochrane's view, the viaducts would be a most difficult target to attack. For this, or other reasons, the attacks were never carried out. Following further assessment by Wallis the Sorpe was dropped as a target.⁶⁸ The viaducts, would remain a priority for

⁶¹ TNA Air 20/4819: CSTC Working Committee (Communications), 'Attack of German Transportation System', 7 Nov 44.

⁶² AHB: HQBC Operations Record Book, 1 Nov 44.

⁶³ AHB: HQBC Operations Record Book, 16 Oct 44.

⁶⁴ TNA Air 20/4795: Proposed attacks on dams and other targets in Europe. It was proposed to use both Squadrons against the Sorpe Dam.

⁶⁵ TNA Air 27/128: No. 9 Squadron Operations Record Book, Sorpe Dam 15 Oct 44.

⁶⁶ AHB, HQBC Operations Record Book, 11 Nov 44.

⁶⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Report on visit to No. 5 Group, 10 Nov 44.

⁶⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute Sheets Whitehead to DB Ops, 16 Oct 44 and Collier to DB Ops, 18 Oct 44.

the rest of the year, but responsibility for their destruction was allotted to the US 8th Air Force. Their limited attacks with medium weight bombs would be of little consequence.

The Ministry of Economic Warfare had already re-iterated the value of an attack on the Rothensee ship lift.⁶⁹ Wallis had reviewed the possibility of an attack and now believed that TALLBOY (M) would penetrate the concrete apron. There was always the chance that there might be a premature detonation on impact, as was believed to have occurred on the Brest pens, but if this happened it was still likely that the explosion would damage the superstructure.⁷⁰ Cochrane was keen to lay on an operation as soon as he could arrange a covering attack on Magdeburg. In case TALLBOY was insufficient to destroy the ship lift, and in view of the successes already achieved by No. 5 Group he proposed a simultaneous attack against the adjacent canal embankments, with the added measure of a Mosquito fighter bomber attack against neighbouring stop gates.⁷¹ Again there are echoes of previous planning, and what might have been a simple attack was now emerging as a complex plan requiring considerable co-ordination. There was no mention of the marking issue that had complicated the original planning.⁷² A few days later Cochrane suggested that an attack on Rothensee might serve to support an attack on the Leuna refinery.⁷³ Cochrane's keenness to attack the ship lift was increased by his enthusiasm for TALLBOY (L). Delays with the delivery of TALLBOY (pp 99-101) had prevented an attack on the ship lift during the previous winter. By the end of December 1944 Cochrane was again concerned about a similar situation emerging with TALLBOY (L) and wrote to Saundby emphasising his belief in "these big bombs" and urging that their development, and production of modified aircraft to carry them, be accelerated "in order to get some dropped as soon as possible."⁷⁴

⁶⁹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. MEW Report: Appreciation of German Inland Transport Position, 19 Oct 44.

⁷⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Wallis to Collier, 2 Oct 44 and Note B Ops 1 to D B Ops 2 Oct 44.

⁷¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Report on visit to No. 5 Group, 10 Nov 44.

⁷² It is likely that this would have been undertaken by No. 627 Squadron using spot fires.

⁷³ TNA Air 14/731: Targets for No 5 Group operating as a separate force. Letter Cochrane to Harris, 20 Nov 44.

⁷⁴ TNA Air 14/2011; TALLBOY and GRAND SLAM bombs: Trials and development. Letter Cochrane to Saundby, 30 Dec 44. Although ambiguous, the letter suggests that Cochrane was now considering an attack on the ship lift using TALLBOY (L) despite the fact that aircraft to carry this bomb would be stripped of night flying equipment, see p 198. Cochrane attributed the aircraft delay to Avro priority being given to development of the Lancaster's successor, the Lincoln.

Given the Squadron's capability with TALLBOY, why did it not come into its own at this time when main force began to target canals? In theory the conditions were now right for Bufton: he was once again influential in target planning and could now implement his earlier plan. The Squadron had the capability both to attack the ship lift, and destroy embanked stretches of canal; it also appeared to have the ability to destroy, or at least damage the key viaducts carrying rail links to the Ruhr. The additional contribution made by No. 9 Squadron overcame the issue of insufficient numbers that had handicapped the planners with regard to both UPKEEP and the 12,000lb HC aircraft the previous autumn. It would have been easy to modify the earlier plan to accommodate TALLBOY with simultaneous attacks against the canals either at Rothensee or the embanked sections nearer to the Ruhr. If necessary, main force could be used as cover, or to supplement the two squadrons' attacks with TALLBOY, but this did not happen; instead, with the exception of the attack on the Dortmund-Ems Canal in September, TALLBOY was excluded from this period's attacks against canals.

The answer can be found in the growing size and capability of the main force. There were now sufficient numbers of aircraft to mount large main force attacks against the canals and no need for the precision afforded by SABS and TALLBOY; the vast tonnage of smaller bombs dropped could drain large sections and those that did not breach the embankments were likely to churn up the surrounding countryside, making access difficult for repair teams. In short, there was no need to expend TALLBOY against canals when the weapon could be better used elsewhere. As for the viaducts, it seems strange that no advantage was taken of the opportunity to trial TALLBOY against such targets. The answer lies in the fact that more than enough targets were being requested by the Army and Admiralty, for which no other weapon than TALLBOY would do.⁷⁵

Beyond the directives' key priorities, the strategic bomber force was increasingly called on to provide support for the Allied armies advancing through Belgium towards the west bank of the Rhine. TALLBOY and SABS enabled the Squadron to take on targets beyond main force's capability, generally those that required concentrated firepower, either for precision or destructive effect, rather than the "bombs per acre" effect of "box bombing". The Squadron usually operated alone, but on occasion, as with the Dortmund Ems Canal and Pölitz, it combined with a main force operation, either to increase overall tonnage, or as an insurance policy should the smaller weapons be insufficient.

⁷⁵ With the exception of the CP bomb, but this was still under development and unavailable in quantity.

The ability of TALLBOY to move substantial structures gave the Squadron unparalleled striking power, especially when employed against man-made landscape features. TALLBOY had assumed the role that planners had potentially accorded to UPKEEP and in doing so it proved to be a more versatile and tactically expedient weapon. Its release conditions were far less stringent than those of UPKEEP, it exposed aircraft and crews to less risk from defences, and its behaviour was more predictable.

By October requests for TALLBOY attacks were coming in for a number of targets and, placing major demands on stocks that had been depleted by recent attacks on *Tirpitz* and the canal. By definition, ground support operations were tactical in nature and often called at short notice. Requests for such operations were originated from local commanders, were submitted to SHAEF and then, if approved, referred to the Air Commanders for acceptance by Command.

A request was made to bomb the sea wall dykes of Walcheren to weaken German resistance ahead of operation INFATUATE.⁷⁶ This was followed a few days later by the call for a pre-emptive attack on the Kembs Dam on the Upper Rhine to release water that might otherwise be used by the Germans to disrupt an Allied crossing of the river.⁷⁷ Coincident with this was an Admiralty request for a TALLBOY attack against U-boat installations at Bergen.⁷⁸ Harris dismissed the latter at an Air Commanders' Conference: TALLBOYS were not necessary to sink submarines.⁷⁹ At the same meeting Walcheren was established as having greater priority than Kembs. Bomber Command felt it unlikely that 4,000 pounders alone would be effective and Walcheren was planned as a joint "box" and TALLBOY attack, with the latter as an insurance policy.⁸⁰ The timing for Kembs had to wait until it was known how many TALLBOYS were needed for the sea wall. In the event Bomber Command's doubts were unfounded and the dyke was already breached by the time the Squadron arrived.⁸¹ The TALLBOYS were conserved, permitting an early attack on Kembs.⁸²

Requests for such operations required expert evaluation, both in terms of anticipated results and technical practicality. Predicted effects and economic assessments were

⁷⁶ TNA Air 20/4811: Requests for bombing attacks on specific targets. Air Ministry to HQBC, 22 Sept 44.

⁷⁷ TNA Air 14/731: Targets for No 5 Group operating as a separate force. Bomber Command Advanced Detachment, SHAEF, to HQBC, 28 Sept 44.

⁷⁸ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Note of Action, 2 Oct 44.

⁷⁹ TNA Air 37/564: Allied Air Commanders' Conferences. Minutes. Meeting, 3 Oct 44.

⁸⁰ Ibid.

⁸¹ TNA Air 27/2128: No. 617 Squadron Operations Record Book, West Kapelle 3 Oct 44.

⁸² TNA Air 27/2128: No. 617 Squadron Operations Record Book, Kembs 7 Oct 44.

undertaken by MEW and the Control Council (Military Section). Such was the intensity of requests that Wallis was advising simultaneously on projected attacks against the Sorpe Dam, Bielefeld and Paderborn viaducts and Rothensee ship lift.⁸³ For the Kembs operation Bomber Command advocated a low level attack for accuracy. Wallis preferred high level; it would avoid the risk of ricochet and also permit full tamping of the charge. He was also concerned that long delay fuzing might be affected by water penetration and that low level bombs might be dragged downstream, away from the target, by the river flow. Bomber Command settled for a high level attack to support a low level attack by a small force. Any hope that this might moderate losses amongst the latter was misplaced; although the attack was successful one third of the low level force failed to return.

Earlier it was described (p 155) how the planners called on the expertise of specialists to assess the potential vulnerability of targets to the Squadron's bombs. The process worked well on most occasions, but there were exceptions. When SHAEF requested an attack on the Urft and Schwammenauel Dams to pre-empt the release of water against approaching Allied forces, the planners first turned to eminent civil engineer Sir William Halcrow.⁸⁴ Halcrow assessed the effects of breaching the dams singly and simultaneously and also suggested that the Schwammenauel Dam might be breached by using TALLBOY to set off demolition charges placed by the Germans.⁸⁵ Wallis was not consulted until the beginning of December.⁸⁶ The targets were of differing construction; UPKEEP and TALLBOY were ruled out because local geography excluded the former and the water levels were too low for both. There was dissention between Harris and Cochrane as to the merits of any attack and only after much debate with Cochrane did Wallis reluctantly proposed a mixed main force and TALLBOY attack on the Urft Dam.⁸⁷ This was implemented, but without success.⁸⁸ Bombardment continued over several days, at Eisenhower's insistence, but only limited damage resulted. The attacks were finally halted by Tedder who became concerned at the diversion of effort from priority targets.

⁸³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Wallis to Collier, 2 Oct 44.

⁸⁴ TNA Air 14/1436: Operations against Roer (Rur) River and Urft River dams. Message 12th Army Group to SHAEF, 4 Nov 44; TNA Air 40/1885: Note, The Schamenauer [sic] and Urftalsperre Dams, 13 Nov 44.

⁸⁵ TNA Air 40/1885: Note the Schamenauer [sic] and Urftalsperre Dams, 13 Nov 44.

⁸⁶ SM Wallis Papers File D2/18, Note by Wallis, 2 Dec 44. Whether Halcrow's early involvement was influenced by Wallis's failure to predict the outcome of the attacks on the Sorpe, or simply pressure of other projects cannot be determined.

⁸⁷ TNA Air 14/1436: Operations against Roer (Rur) River and Urft River dams. Precis on the proposed attacks on the Roer River dams, 3 Dec 44.

⁸⁸ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Urft Dam 4 Dec 44.

The Squadron participated in operations against only three tactical targets, but such was the reputation of TALLBOY there were many suggestions and requests for others. A request to attack the Doornenburg dyke during the advance to the Rhine was accepted and plans made, only for the operation to be cancelled.⁸⁹ In January 1945 Wallis was approached to select the best aiming point on the Hohenzollern Bridge across the Rhine at Cologne, while No. 5 Group considered other river bridges for the Squadron.⁹⁰ Other demands were unrealistic. Among these was a flawed suggestion from the US consul in Barcelona to breach the Rhine banks near Ludwigshafen,⁹¹ destruction of the Seeleze aqueduct,⁹² and a request from SHAEF to attack the Schwartzbach Dam.⁹³ All were discarded after preliminary investigation.

As Harris had noted earlier in his exchange with Cochrane (p 176) the Admiralty continued to request support from the strategic bomber force as the remains of the U- and E-boat flotillas began to execute a renewed campaign against shipping in British coastal waters.⁹⁴ The pens at Bergen and Trondheim were now being improved and enlarged to provide protection for the vessels in port. The Admiralty called for attacks to destroy these before they were completed and became invulnerable.⁹⁵

The targets posed a number of problems which brought together a number of different considerations. They were an ideal target for TALLBOY but supplies were limited and stocks were being husbanded for the priority attack on the Kembs Dam.⁹⁶ The extreme range of Bergen and Trondheim made fighter escort difficult for daylight attacks and weather conditions for visual bombing were difficult to forecast. Any attacks were likely only to divert effort from more productive targets. For the time being these bases could not be targets for No. 617 Squadron. Under increased pressure, Harris was forced to

⁸⁹ TNA Air 20/4811: Requests for bombing attacks on specific targets. Bomber Command Advanced to HQBC, 17 Dec 44 and AHB HQBC Operations Record Book, 17 Dec 44.

⁹⁰ TNA Air 14/2068: Special briefing data, 23 Jan 45 and SM Wallis Papers File D2/18, 23 Jan 45.

⁹¹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter to Wg Cdr Carey-Foster, HQBC, 8 Oct 44.

⁹² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. P/W Interrogation Report, 16 Nov 44.

⁹³ TNA Air 14/1439: Schwartzbach Dam. HQ XII Air Command to Commanding General 1st Tactical Air Force, 24 Nov 44.

⁹⁴ For an account of this campaign see Tarrant, *Last year of the Kriegsmarine*, Ch 9, pp 155-170.

⁹⁵ TNA Air 14/781: Air Ministry Directives, Vol VII. Air Ministry to Bomber Command, 27 Sept 44.

⁹⁶ TNA Air 14/1428: Attack on Kembs Dam, and TNA Air 37/564: Allied Air Commanders' Conferences: minutes, 3 Oct 44.

mount main force attacks against the pens with smaller weapons. At best these would disrupt construction and damage port facilities. With insufficient pens to protect the U-boats, a few might even be sunk.⁹⁷ Admiralty pressure intensified during October. There was now growing evidence of increased U-boat production and the development of new improved types. Many assembly yards were now 'hardened' against air attack and a vast concrete assembly pen was under construction at Farge, near Bremen. These too were to be attacked as soon as possible.⁹⁸

The Air Staff were not convinced. From examination of the pens in France it was now apparent that TALLBOYS had not penetrated their roofs. At best their detonation in the concrete was sufficient to cause a large portion of the underside of the roof to detach and fall into the pens. This "scabbing" might create a hole giving the impression of perforation, but the explosive force was absorbed by the roof, and did not occur in the pen itself. Falling concrete might damage any submarine inside the dock, but the structure of the pen would remain largely intact. For pens over 10 feet thick it was recommended that TALLBOY (L) was required.⁹⁹ Additionally an Air Ministry Report believed that the Admiralty was over estimating the likely effect of strategic bombing on the construction of U-boats. With doubts about the effectiveness of TALLBOY against the pens, and with the Concrete Piercing bomb still under development there were no suitable weapons for such attacks. Consideration was again given to the denial of maintenance facilities at operating bases, but attacks against fuel oil supplies appeared a better option.¹⁰⁰

In the midst of this debate the Squadron was already engaged in preparations for a remarkable plan to attack U-boat operating bases. The Royal Marines had developed a new weapon. The Boom Patrol Boat was based on an Italian concept for a fast, explosive laden motor boat. It was to be dropped by parachute and then aimed at naval targets in harbour. Once the vessel was on course the Royal Marine helmsman would abandon the boat and swim ashore to effect his escape as best he could. Trials had been conducted by the Royal Aircraft Establishment. In September a party of Marines

⁹⁷ Middlebrook and Everitt, *Bomber Command War Diaries*. Attacks were mounted against Bergen on 4 Oct 44 and 29 Oct 44 and Trondheim on 22 Nov 44.

⁹⁸ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb). Loose Minute B Ops 1 to AI 3(c), 21 Oct 44.

⁹⁹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb). Report on visit to U-boat pens at Brest, 9 Oct 44.

¹⁰⁰ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Air Staff Note on Admiralty U-boat appreciation, 30 Oct 44. Also Webster and Frankland, *Strategic Air Offensive*, Vol IV, Appendix 26, para 15, p 296.

and boats were sent to Woodhall Spa. Six aircraft were each modified to carry a boat¹⁰¹ and plans prepared to mount an operation against U-boats, floating docks, U-boat depot ships at a number of Norwegian ports, including Bergen and Trondheim.¹⁰² Despite considerable preparation, a combination of operational commitments, intelligence reports and poor weather prevented the operation from being mounted and it was postponed to await more favourable conditions.¹⁰³ The Marines returned in January, but only to conduct further trials and six test drops off the Devon coast. The trials were successful, but increased defensive measures by the Germans curtailed further attempts to undertake this operation.¹⁰⁴

By the beginning of December E-boats were heavily active out of Rotterdam and IJmuiden, mining the coastal channels and approach routes to the Scheldt.¹⁰⁵ With minesweeping resources stretched to the limit, a request was made for air attack. Frustrated by ever increasing diversions from CSTC's primary objectives Bufton protested.¹⁰⁶ The pens at Rotterdam and the old pens at IJmuiden had roofs less than 10 feet thick. They were susceptible to TALLBOY, but destruction of all the docks in the pen would require unjustifiable effort. The new pens at IJmuiden had thicker roofs and were better suited to the CP bomb. Bufton believed that any attack on the pens would only serve to provoke the Germans into dispersing the E-boats around the docks, after which there would then be little chance of destroying them.¹⁰⁷

Bufton's views were not shared by SHAEF. His argument was not helped by Harris who maintained, perhaps strangely in view of the on-going attacks against the Urft Dam, that he had no targets for TALLBOY in the near future.¹⁰⁸ Tedder and Bottomley instructed that these pens should be designated as TALLBOY targets.¹⁰⁹ The old pens at IJmuiden were duly attacked and two TALLBOYS penetrated the pens.¹¹⁰ A similar

¹⁰¹ Air 10/4178, Descriptive notes, installation and instructions for servicing the SKYLARK (boom patrol boat) in the Lancaster Aircraft.

¹⁰² TNA Air 14/2042: Operation SKYLARK. No. 5 Group Operation Order B 421, 13 Oct 44.

¹⁰³ TNA ADM 1/16962: Combined Operations (47). Postponement of Operation SKYLARK. Capt. Slocum, Note 8 Dec 44 and TNA Air 14/2042: Operation SKYLARK. HQ No. 5 Group to HQ No. 54 Base, 18 Dec 44.

¹⁰⁴ TNA Air 14/2042: Operation SKYLARK. Taylor to Elworthy, 21 Mar 45. See also Ch 7.

¹⁰⁵ Tarrant, *Last year of the Kriegsmarine*, pp 172-181.

¹⁰⁶ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Air Ministry to HQBC, 3 Dec 44.

¹⁰⁷ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets. Draft note for ACAS (Ops) to Coastal Command, 4 Dec 44.

¹⁰⁸ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Bottomley to DCAS (Ops) and D B Ops, 6 Dec 44.

¹⁰⁹ Ibid.

¹¹⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, IJmuiden 15 Dec 44.

operation against Rotterdam was cancelled due to the weather, but already the lesson was learned. Bufton was vindicated as the remaining E-boats dispersed surviving to increase their activity over the Christmas period.¹¹¹ Despite the Air Ministry's assertion that the dispersed vessels might now be better suited to attack by Coastal Command strike aircraft, further bomber attacks were called for and the target list increased.¹¹²

By December the Air Staff determined that strategic bombers should be employed against construction yards. The war was now expected to end by May 1945 and new boats needed time to work up. Attacks were needed no later than mid-January if they were to have any appreciable impact. Targeting Bergen and Trondheim might force vessels into the Baltic, where they would be susceptible to mining as they passed through the Skagerrak.¹¹³ On 23 December a further directive was issued adding a number of U-boat objectives to the target mix, including key assembly and fitting out yards. These were to be attacked whenever possible, although without detriment to the key target groups of land battle, oil, transport, important industrial areas and the German Air Force.¹¹⁴ To keep pace with this growing activity and concern, Portal agreed with the First Sea Lord that henceforth lists of Naval targets (NAVSTAR) would be published on a weekly basis.¹¹⁵

SHAEF decreed that E and R-boat pens should rate in priority below battle area support, oil and transport targets. Nevertheless they were highly desirable and should be attacked by units not engaged against targets of higher priority.¹¹⁶ This effectively made them a priority for the TALLBOY units. In the first NAVSTAR, the E-pens at IJmuiden, Rotterdam and Den Helder ranked second to assembly yards at Hamburg and Farge.¹¹⁷ With the assembly yards being in heavily defended areas and unsuitable for a single Squadron, the Squadron despatched 16 aircraft to the Rotterdam pens, thereby completing the task started a fortnight earlier.¹¹⁸ This resulted in the removal of these

¹¹¹ Tarrant, *Last year of the Kriegsmarine*, p 176.

¹¹² TNA Air 20/3250: Bombing of U-boat and E-boat bases, Air Ministry to SHAEF Main and Admiralty, 27 Dec 44.

¹¹³ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Air Staff Note on Heavy Bomber Forces against the enemy U-boat organisation, 2 Dec 44 and Appreciation of the Potential Effectiveness, 3 Dec 44.

¹¹⁴ TNA Air 14/781: Air Ministry Directives, Vol 7. Bottomley to Harris, 23 Dec 44 and TNA Air 40/1514: Combined Strategic Target Committee: signals to and from Air Ministry. Air Ministry to HQBC, 29 Dec 44.

¹¹⁵ TNA Air 20/3328: Combined Strategic Target Committee. Portal to First Sea Lord, 21 Dec 44.

¹¹⁶ TNA Air 20/3250: Bombing of U-boat and E-boat bases. SHAEF to Air Ministry and Bomber Command, 29 Dec 44.

¹¹⁷ Ibid.

¹¹⁸ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Rotterdam 29 Dec 44.

pens from the NAVTAR list, but not discussion of their use as a target. The CP bomb was coming to fruition and the pens at Farge, IJmuiden and Rotterdam were sought for operational trials. The Admiralty, looking for the stiffest test, favoured the former while Bufton favoured the latter two; they were tactically more valuable and with thinner protection might yield better results.¹¹⁹ There was another motive. Success with the CP bomb could also reduce demand for TALLBOY and remove such targets from Bomber Command's lists, reducing the number of potential diversions from CSTC's primary objectives.

Assembly yards were still priority in the next NAVTAR, but the recently damaged E pens were removed and replaced by the midget submarine pens at Poorteshaven (p 209), ahead of the U-boat operating bases at Bergen and Trondheim which also appeared for the first time on the new listing.¹²⁰ On 12 January both TALLBOY squadrons finally made a daylight attack on Bergen, targeting both the pens and harbour installations. The operation was a mixed success.¹²¹ The difficulties of mounting attacks on these targets were not to be underestimated.

The effectiveness of TALLBOY had stimulated strong support for TALLBOY (L) during the late summer of 1944 (p 165), with a desire for the larger weapon to enter service as quickly as possible.¹²² However by the autumn of 1944 the climate had changed and there was once again a possibility that it might be cancelled; at the same time there appeared even more need for a weapon capable of penetrating increasingly thick concrete. The reasons behind the debate were many and further illustrate the problems faced by those trying to develop and produce new weapons for an ever more rapidly changing war situation.

By September 1944 preparations for the production of Wallis's 10 ton bomb were well under way. The extent of the debate about this and the Squadron's future in late autumn 1944 shows that lessons had been learned from its smaller stablemate. As with TALLBOY, manufacture would be split with 400 from the UK and 200 from the USA.¹²³ Deliveries would start in December increasing through the next two months and after

¹¹⁹ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets. Note Bufton to ACAS (Ops), 9 Jan 45.

¹²⁰ TNA Air 14/1514: Combined Strategic Target Committee: signals to and from Air Ministry, Air Ministry to HQBC, NAVTAR 25, 4 Jan 45.

¹²¹ Despite a Mustang fighter escort the Lancasters were badly mauled by enemy fighters. Three were shot down and a fourth limped back to the Shetlands, badly damaged.

¹²² From 16 Nov 44 TALLBOY Large was to be known as GRAND SLAM: SM Wallis Papers, 97N, 16 Nov 44. For simplification this name will be used throughout this work.

¹²³ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Bufton to Harris, 3 Sept 44.

some discussion, it had been agreed that No. 617 Squadron should be equipped with modified aircraft to carry this weapon and A V Roe worked with Wallis to produce an aircraft for trial installation.¹²⁴

When GRAND SLAM was first mooted in late 1943 it was envisaged that it would be required to attack relatively short range targets such as the rocket launching sites. Once again, delays in approvals and development meant that the war had advanced beyond the original requirement. By September 1944 many of these proposed targets no longer existed and other suitable targets might not be within modified aircraft's range. The inevitable questions were asked: was the weapon now needed, and if so against what targets would it be used, how many aircraft should be modified to carry it, and how many bombs should be produced? The situation was further complicated by a lack of co-ordination between the various agencies involved in the decision making and a muddying of the waters by independent decisions often made for practical rather than operational reasons or political expediency.

Operationally, range was the critical factor. The modified Lancaster B.I (Spec) was unable to carry anything other than GRAND SLAM or TALLBOY and was originally limited to a range of 500 miles. While this encompassed the large V-sites and some of the U-boat pens, most of these were now in Allied hands. Potential targets would be even more distant by December 1944 when GRAND SLAM was to enter service. For some in Bomber Command in September 1944 there seemed to be little use for this specialised and limited weapon combination. Events had overtaken its development.¹²⁵ Others looked at the weapon's potential against inland waterways, capital ships and city targets. Many targets only emerged after a new weapon had entered service.¹²⁶ The Air Ministry did not share their view. After the Ministry of Production cut UK production to release production capacity for other projects,¹²⁷ Bottomley investigated, and cancelled the entire project.¹²⁸

This might have had disastrous consequences. American production had involved delicate negotiations and cancellation might have major repercussions. The decision was

¹²⁴ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Bufton to Harris, 2 Sept 44.

¹²⁵ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. G/C Plans to SASO Bomber Command, 4 Sept 44.

¹²⁶ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Chief Armament Officer to SASO Bomber Command, 5 Sept 44.

¹²⁷ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Air Ministry to HQBC, 11 Sept 44.

¹²⁸ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. ACAS Ops to D of E (C), 19 Sept 44.

rescinded and modified. UK production was cut and total reliance placed on a reduced number from the US,¹²⁹ together with a drastically reduced number of modified aircraft.¹³⁰ New targets were still required. Bufton summarised a possible solution: range could be increased by operating from continental airfields so making possible a wide selection of targets.¹³¹ Another means of increasing the aircraft range emerged from operations against *Tirpitz*: with a lightened airframe additional fuel might be carried in extra tanks.¹³²

Once again new perspectives are gained by considering all the planning aspects and consequences. The technical and development issues connected with GRAND SLAM are covered by Flower.¹³³ While he also discusses the need for the weapon and the necessary aircraft modifications he omits the debate in respect of which squadron should be equipped, the issues of range and the protracted question of production and the trade off in quantities between TALLBOY and GRAND SLAM. The broader picture reveals dissent between the Air Staff, Bomber Command and the Ministry of Aircraft Production about whether it was desirable or necessary to progress with GRAND SLAM. Each party had its own practical or political agenda, and by this point post-war concerns were beginning to emerge. There were other reasons to continue with development: GRAND SLAM would demonstrate that Britain was the leader in bomb development, besides, the Treasury would never sanction such a budget in peacetime. Here was an opportunity to build up a post-war stock pile that could help shape Air Staff policy for years to come.¹³⁴

Throughout there had been a confusing exchange of correspondence between a plethora of bodies and individuals, each with their own agenda and *idées fixes*. These included: the Air Staff, the DBO; Bomber Command and No. 5 Group as end users and the Ministry of Aircraft Production who were responsible for UK production of bombs and aircraft and liaised, through the British Air Commission and RAF Delegation in Washington, with the American authorities, to obtain US production capacity. The situation was not helped by Freeman, who in October had unilaterally reinstated the original US order,¹³⁵ and

¹²⁹ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. RAFDEL Washington to Air Ministry, 29 Sept 44.

¹³⁰ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. ACAS (Ops) to ACAS (TR), 30 Sept 44.

¹³¹ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Note on the operational value of TALLBOY (Large), 17 Oct 44.

¹³² TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. DCAS to CAS, 20 Oct 44.

¹³³ Flower, *A Hell of a Bomb*, pp 239-248.

¹³⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets, DDB Ops to DB Ops, 12 Oct 44.

¹³⁵ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Freeman to Portal, 17 Oct 44.

correspondingly increased the production of aircraft back to 50 when Portal had assumed there would be 32.¹³⁶ The aircraft number was re-adjusted, but more debate followed about whether they should be produced as a batch, or incrementally.¹³⁷ Further confusion arose in November when a decision was taken to cut UK production to a nominal nine bombs (presumably those already in production) to facilitate production of TALLBOY (M) and expand US production to 600. Again it was a case of re-confirming the original order for 400 UK and 200 US, but reducing the delivery rate of the former to achieve required output of TALLBOY (M).¹³⁸

By December the major production issues were resolved. Approval of an additional increase in take-off weight added further range.¹³⁹ GRAND SLAM could now be carried to most of Germany. Further consideration suggested both TALLBOY(M) and GRAND SLAM might be used against cities and synthetic oil plants,¹⁴⁰ marshalling yards,¹⁴¹ the Rothensee ship lift, protective pens for naval vessels, underground factories, Ruhr coal mines and railway tunnels.¹⁴² As Cochrane had predicted, there was no shortage of potential targets.¹⁴³

Production aside, debates about allocation of GRAND SLAM and TALLBOY reveal changes in the way the Squadron was now perceived. It was not always certain No. 617 Squadron would be equipped with GRAND SLAM. No. 9 Squadron had been the original choice (p 166); by September preference had switched to No. 617 Squadron.¹⁴⁴ But other questions persisted: should all or only part of the Squadron be converted to the 'Specials' or should both be equipped or a new third Squadron formed?¹⁴⁵ Several factors contributed to the final choice of No. 617 Squadron. One was that this unit was the only one experienced with SABS; equipping part of each squadron meant doubling the

¹³⁶ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Freeman to Portal, 22 Oct 44.

¹³⁷ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Letter Portal to Freeman, 24 Oct 44.

¹³⁸ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Note of Action, SO to DCAS, 17 Nov 44.

¹³⁹ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. Letter Breakey to Cochrane, 10 Dec 44.

¹⁴⁰ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Bufton to ACAS (Ops), 24 Nov 44.

¹⁴¹ SM Wallis Papers, File 97N Letter Wallis to Cochrane, 8 Dec 44.

¹⁴² TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Loose Minute Wg Cdr Fawsett to G/C Ops, 23 Dec 44.

¹⁴³ See p 132. Although Cochrane had been referring then to targets pre-TALLBOY the same still held true.

¹⁴⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Letter Bufton to ACAS (Ops) 1 Sept 44.

¹⁴⁵ TNA Air 20/3370: TALLBOY and GRAND SLAM bombs. Bufton to ACAS Ops, 24 Nov 44.

provision of ground equipment and servicing. Cochrane originally wanted a homogenous squadron of three flights, making good any losses with TALLBOY aircraft.¹⁴⁶ A three flight squadron would be better protected on daylight operations. However, it became apparent that a greater range of weapons could be carried if the Squadron was a mix of Specials and TALLBOY carriers. Accordingly Cochrane and Harris agreed on two flights of GRAND SLAM and one of TALLBOY.¹⁴⁷ Throughout the entire process there is an atmosphere of confusion and compromise as various agencies tried to keep informed with both the development and potential use for the weapon.

The formation of a second specialist squadron to use TALLBOY replayed Wallis's original thinking. This was made possible by the growing availability of the weapon, although the timing was expedient, based on the need to attack a growing number of targets. The decision for No. 9 Squadron to retain the Mk XIV sight was partly due to the shortage of SABS but also that main force accuracy had continued to improve since April (p 122). In this respect Bufton was winning the debate about the validity of precision bombing. However, with TALLBOY the absolute precision being attained by No. 617 Squadron and SABS was no longer seen as essential: with an increased number of bombs, a near miss, or pattern of near misses was sufficient.¹⁴⁸

¹⁴⁶ TNA Air 14/688: GRAND SLAM and TALLBOY bombs. Operational policy. Letter Cochrane to Walmsley, 17 Dec 44.

¹⁴⁷ TNA Air 14/688: GRAND SLAM and TALLBOY bombs. Saundby to Harris, 13 Jan 45.

¹⁴⁸ Wallis, *A Note on a Method of Attacking the Axis Powers*, Figs 11 – 14. This also equates with Wallis's original paper showing in a number of aircraft "sweeping" for a field of oil storage tanks.

CHAPTER 6 February – April 1945

As the Allied armies crossed the Rhine and occupied the Ruhr, the strategic bomber offensive against oil and communications extended to include transport centres in eastern Germany in support of the Soviet advance. Meanwhile the Squadron continued to be tasked with targets requiring precision attack. Equipped with TALLBOY and later also GRAND SLAM it made a major contribution to the isolation of the Ruhr prior to its occupation by Allied forces, before again turning again to targets in support of the Navy.

Taken at face value this period did not appear to represent any significant departure from the policy prescribed by CSTC. Although the Squadron's target sets changed during this period, there was little modification with regard to policy for the Squadron or its operational contribution. However, the impression of continuity was a veneer; behind it was a more complicated picture. Not only were there subtle changes in strategy, but also potentially competing demands for the Squadron's resources and a number of constraining factors associated with the introduction of GRAND SLAM to service.

Issues that determined the Squadron's operations during this final phase will now be examined. Key factors concerned the re-equipping of the Squadron in preparation for the arrival of GRAND SLAM and provision of the weapon itself. Further efforts were made to extend the use of these weapons, with CSTC permitting the targeting of rail communications together with a continuation of attacks on naval targets while at the same time local initiatives were proposed for additional targets. Then, with the end of the European war in sight, plans were made for the Squadron's deployment to the Pacific.

To operate with GRAND SLAM, No. 617 Squadron had to be re-equipped with aircraft modified to carry it and supplies of the weapon had to be assured. Once again, with two different channels of provision for aircraft and weapon, plus input by other agencies, this was a major feat of co-ordination. Additionally No. 617 Squadron had to be expanded to three flights. This was normally achieved by the addition of ten more aircraft and crews posted in from other units; in this case, for reasons explained in the previous chapter, the Squadron was to acquire twenty new Lancasters capable of carrying GRAND SLAM, forming two flights while ten of the existing TALLBOY carrying aircraft were used to equip the third flight. Such increase in Squadron numbers came at a price elsewhere; Harris was restricted in the numerical strength of his Command so he effectively had to

lose the equivalent establishment from another unit.¹ The re-structuring was confirmed to No. 5 Group on 12 February.²

The first hitch came with the delivery of the aircraft. Bomber Command planned to have them all at Woodhall Spa by the end of February.³ The DBO was less optimistic. From a planning perspective they could not see the Squadron being ready to begin operations until the latter half of March; neither aircraft, nor GRAND SLAM had completed their trials, and re-equipment could not proceed until these had taken place.⁴

Problems arose when the aircraft arrived. The removal of certain equipment meant that the aircraft could no longer operate at night so the aircraft were to be finished in a scheme suitable for daylight operations. However, the first four aircraft arrived in standard night scheme before action could be taken for the remainder.⁵ Added to this operational equipment that should have been retained had been omitted to save weight and it would need to be re-installed.⁶ Manpower at Woodhall was stretched and a service working party had to be sent to the airfield to effect these modifications.⁷ However, the changes increased the aircraft weight and other non-essential equipment had to be removed, resulting in the decision to dispense with the bulky W/T transmitter/receiver (and the wireless operator).⁸ The aircraft arrived in three batches with the twenty fourth and final machine arriving on 15 March.

Their arrival created a problem akin to that caused by the additional UPKEEP Lancasters at Coningsby a year earlier. The presence of forty-four Lancasters at Woodhall Spa, together with the Mosquitos of No. 627 Squadron, meant that there were insufficient hardstandings on which to park the aircraft.⁹ Action was taken to reduce the Squadron's holdings to officially approved levels with the disposal of ten of the TALLBOY aircraft. A

¹ AHB: Secret Organisational Memorandum 247/45, 1 Feb 45. The adjustment was achieved by the by the reduction of one Flight of No. 51 Squadron.

² TNA AIR 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. Letter HQBC to HQ 5 Group, 12 Feb 45.

³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute B Ops 1 to DB Ops, 15 Feb 45.

⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute DDB Ops 1 to DB Ops, 15 Feb 45.

⁵ TNA Air 14/2011: TALLBOY and GRAND SLAM bombs: Trials and development. Minute note Wg Cdr Engineering to SASO, 15 Feb 45.

⁶ TNA Air 14/2257: Lancaster aircraft: special commitments. Minutes of meeting 25 Feb 45.

⁷ TNA Air 14/1336: Installation of VHF in Lancaster aircraft. HQBC to HQ No 5 Group 5 Mar 45.

⁸ TNA Air 14/2114: Signals and radar equipment in Lancaster type 'L' aircraft. Action note 25 Feb 45.

⁹ TNA Air 28/955: RAF Woodhall Spa Operations Record Book, February 1945 Summary.

simple solution to transfer them to No. 9 Squadron and increase its establishment to three flights had earlier been considered, but not adopted.¹⁰ Instead the aircraft were put into store ready to make up any "wastage" of TALLBOY aircraft in either Squadron.¹¹ After a survey of No. 617 Squadron's TALLBOY aircraft a compromise was reached: two were transferred to No. 9 Squadron, two were scrapped (one having completed 51 operations), five went for storage and the tenth to Avro for overhaul before re-issuing.¹²

In a further attempt to rationalise, the Squadron's last Mosquito was offered for disposal. The Squadron had not done any marking for six months, but there may have been a hope to re-instate this technique.¹³ A case was made for its retention, saying it was useful for co-ordinating operations against dispersed targets such as shipping; it was also ideal for weather reconnaissance ahead of the bombing force and essential for low level marking. The aircraft was given a reprieve for six months.¹⁴

The re-structuring of No. 617 Squadron had further implications: the two squadrons now only required 30 TALLBOY aircraft between them, and had thrown up spare aircraft, thus resolving the early shortage of aircraft with large bomb doors.¹⁵ Others currently in production were surplus to immediate requirements and within the month production was curtailed; surplus aircraft went into store or were allocated to squadrons within No. 3 Group.¹⁶

Uncertainties of weapon supply emerged even before deliveries of GRAND SLAM began. Until the bomb's effectiveness was established it was impossible to predict the Squadron's rate of usage. Demand would depend on the number of targets available and the tempo of operations, while the position of the front line would determine what targets lay within range.

¹⁰ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Minute Note 26, 14 Dec 44.

¹¹ "Wastage": a euphemism for losses, either due to enemy action or accidental damage.

¹² TNA Air 14/2557: Lancaster aircraft: special commitments. HQ 5 Group to HQBC. 18 Mar 45.

¹³ This may be evidenced by Satterly's proposals in February 1945, see pp 214-216.

¹⁴ TNA Air 14/893: 617 Squadron, Operational requirements, A/Cdre Elworthy HQ No.5 Group to HQBC, 27 Feb 45. TNA Air 27/2128: 617 Squadron Operations Record Book, 9 Mar 45: The Mosquito would only fly one further operation with No. 617 Squadron but was borrowed occasionally by No. 627 Squadron crews (TNA Air 27/2148: 627 Squadron Operations Record Book, 5 Mar 45).

¹⁵ By January 1945 these were now being produced by the Vickers Armstrong factory at Castle Bromwich, Birmingham.

¹⁶ TNA Air 14/1024: Formation and moves of squadrons: expansion and re-equipment programme. Command Development, 9 Apr 45.

Since TALLBOY and GRAND SLAM production were calling on the same finite resources for manufacturer and filling a degree of trade off was required. A contract for 600 GRAND SLAM had been issued.¹⁷ However, at the beginning of February the Ministry of Aircraft Production revealed that the original production target of 71 GRAND SLAMs and 253 TALLBOYS a month was no longer attainable; Bufton and Harris settled for a reduced figure of a minimum of 50 GRAND SLAM a month, with an increase of TALLBOY production to 290.¹⁸ Since the Lancaster B I (Spec) could carry either weapon this ensured that enough TALLBOYS were available to meet the requirements of both Squadrons even if GRAND SLAM supplies were insufficient.

Again familiar concerns emerged. Difficulties in allocating materials and resources affected production estimates. Inexact timings and uncertainty about targets precluded accurate determination of possible usage and hence quantities required. While Freeman addressed the former, Bufton attempted to define the latter. With an ever-changing state of affairs and inevitable time lag between planned production and final delivery, the projection of demand and supply became as much an art as a science.

GRAND SLAM deliveries began in February, together with the arrival of aircraft to carry them while smaller bombs, including live UPKEEPS were despatched to storage units to ensure that the Woodhall bomb dump did not exceed its capacity.¹⁹ It was anticipated that 15 bombs would be available by the end of the month, ready for operations subject to final clearance of both aircraft and weapon.²⁰ After this, careful employment of the weapon, together with increased production, would result the building up of reserves. By April, after expending 32 GRAND SLAMs on operations, a stock of 33 remained with a further 44 being scheduled for production that month.²¹ However, these figures could be deceptive; poor quality control (particularly in respect of American production) resulted in a number of damaged and unserviceable weapons: faulty exploder pockets and oversize bomb bodies necessitating the production of bespoke fairings and tail units.²²

¹⁷ TNA Air 19/261: Bombs: requirements and production. Letter Air Ministry to Ministry of Aircraft Production 22 Feb 45.

¹⁸ Ibid.

¹⁹ TNA Air 28/955: Woodhall Spa Operations Record Book, February 1945 Summary.

²⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute DB Ops 1 to DB Ops, 15 Feb 45.

²¹ TNA Air 20/803: Bomb supplies: Estimates of Production March – June 1945, 1 Apr 45.

²² TNA Air 14/2189: TALLBOY bombs: fuzing suspension and aiming. HQBC to HQ 5 Group 8 Feb 45 and HQBC to HQ 5 Group, 24 Mar 45. Tails, being made of thin alloy, were particularly susceptible to damage during loading and de-bombing operations.

In theory two thirds of the Squadron were capable of carrying GRAND SLAM on each attack, but this figure was never realised; by the end of hostilities only 42 had been expended on operations. Study of the figures shows the evolution of a policy whereby the number of weapons carried increased in stages as its effectiveness was proven. Generally, only one third of the potential GRAND SLAM force was so loaded. On occasion extreme thrift was exercised, as in the attack on 15 March against the Arnsberg viaduct, when two GRAND SLAMs were carried, but only one was dropped.²³ The greatest number employed in a single attack was 13.²⁴ Such frugality meant that no obvious deficit of GRAND SLAM arose although the agreed minimum production rate was not attained until June 1945.

By contrast, the two squadrons used 186 TALLBOYS during March. By now stocks had accrued; production was running at 128 a month but with only marginal increase forecast for the next two months. By 1 April a stock of 520 was available for use.²⁵

Since TALLBOY had performed well against hardened concrete targets, underground workings and Germany's most formidable battleship, there was every reason to think that the scaled up version would despatch such targets even more efficiently. However, as the Allied armies advanced the number of established target types suitable for attack was diminishing, while at the same time new targets such as bridges, viaducts and underground factories began to emerge.

Wallis had envisaged his big bomb for use against targets critical to an enemy's economy: petrol and oil storage tanks, coal fields, oilfields, dams, docks and lock gates, and surface transport.²⁶ However, by the beginning of 1945 when the Americans were beginning to show interest in the merits of large bombs, there are indications that there was a change in thinking about what they were for. General Spaatz enquired about the use of TALLBOY.²⁷ Wg Cdr Everitt (DBO) wrote in reply: "TALLBOY bombs were designed to achieve *deep penetration and large cratering*" [author's emphasis]. The implication seems to be that deep penetration and cratering, rather than earth shock were the prime

²³ TNA Air 27/2128: 617 Squadron Operations Record Book, Arnsberg 15 Mar 45.

²⁴ TNA Air 27/2128: 617 Squadron Operations Record Book, Farge 27 Mar 45. These were used against the U-boat construction pen at Farge.

²⁵ TNA Air 20/803: Bomb supplies. Bomb stocks 1 Apr 45.

²⁶ p 53, fn 56. Also Wallis Family Archive: Wallis, *A Note on a Method of Attacking the Axis Powers*, pp 37-51.

²⁷ TNA Air 40/1885, TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Message Spaatz to D Arm R, Air Ministry 12 Feb 45.

destructive elements. Everitt went on to explain that the great difficulty in filling such craters made railway tracks a highly profitable target.²⁸

Everitt confirmed that tunnels and heavy concrete structures were vulnerable targets. He also stated that TALLBOY (M) had been "*contemplated*" [author's emphasis] for use against underground factories and stores, large bridges, viaducts and aqueducts, E-boat and midget submarine pens, dams and capital ships. TALLBOY (L) (GRAND SLAM) had yet to be used, but it was intended to use it against similar targets to TALLBOY (M), "plus possibly attacks on U-boat pens etc." Everitt's choice of words is interesting. TALLBOY (M) had already been used against dams, E-boat and midget submarine pens and capital ships, but he made no mention of it targeting U-boat pens although he must have been aware of its use. The fact that U-boat pens now appeared to be the prerogative of TALLBOY (L) suggests that opinion as to the concrete piercing ability of Wallis's bombs remained divided.

The topic emerged again during a meeting held at No. 5 Group Headquarters to resolve details concerning the rectification of the newly delivered B I (Spec)s.²⁹ Discussion touched on a range of uses for GRAND SLAM, including the cutting of railways and canals. The idea was picked up by A/Cdre Satterly, No. 54 Base Commander who was keen to exploit the Squadron's potential as far as possible.³⁰ Given the growing importance of rail targets the concept was passed to Bomber Command for consideration.³¹ ORS reported that a TALLBOY crater took longer to fill than 12 x 1,000lb bombs. The craters caused by the latter were small and could be filled in a matter of hours, particularly if plant was available for work on several at a time. Refilling a TALLBOY crater, on the other hand would take at least a week, and the backfill then required considerably more consolidation before track could be re-laid. Making good a GRAND SLAM crater took up to three weeks. A GRAND SLAM or TALLBOY on a railway centre would thus cause great disruption.³² Despite this, experience against French rail

²⁸ TNA Air 40/1885, TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Cypher Message Wg Cdr Everitt, Air Ministry to USStAFE, 17 Feb 45.

²⁹ TNA Air 14/2257: Lancaster aircraft: special commitments. Minutes of Conference 25 Feb 45.

³⁰ TNA Air 14/2011: bombs: Trials and development. Letter Satterly to Elworthy, 26 Feb 45 and Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Letter Elworthy to Inness, 27 Feb 45.

³¹ TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Letter Elworthy to Inness, 27 Feb 45.

³² TNA Air 14/688: GRAND SLAM and TALLBOY bombs Operational policy. Minute Note ORS Bomber Command to G/C Plans, 3 Mar 45. SM Wallis Papers: 97N. Letter Wallis to Cochrane, 8 Dec 44. Wallis had discussed with the Chief Engineer of the Great Western Railway the relative effects of TALLBOY and GRAND SLAM craters on marshalling yards.

targets pre-OVERLORD had shown that 1,000 and 500lb bombs caused sufficient disruption with bomb densities as low as 3-4 hits per acre. In the view of Bomber Command, use of GRAND SLAM and TALLBOY was only justified against rail centres when there were no other worthwhile targets.³³ It was beginning to look as though TALLBOY and GRAND SLAM might not necessarily be the ultimate weapons in the Command's armoury.

Given the supply situation and limited number of aircraft available to carry them this was a realistic assessment.³⁴ An additional factor was their cost, although this is difficult to determine with exactitude since available figures are contradictory. Extant Vickers-Armstrong order books suggest that each TALLBOY cost approximately £1,050.00; GRAND SLAM £2,275.00 – excluding filling and transport. An Australian study of the economic costs of the Bomber Offensive cites significantly lower costs: £550.00 and £950.00 respectively.³⁵ This discrepancy between costs also occurs when considering the cost of a Lancaster: Leo McKinstry records the cost of a Lancaster as £42,000.³⁶ Sebastian Ritchie cites the cost of a Lancaster in 1944 as being £15,500.³⁷ The discrepancy here can be accounted for by the lower cost being the cost of the basic airframe and the larger the cost of the complete aircraft, with engines and full operational equipment. However, in the case of the bombs the discrepancy is more difficult to explain, other the lower cost being for empty cases the higher for filled examples. However, as Fahey's work records the cost of a 1,000lb MC bomb as £50.00 and a 4,000lb MC bomb as £135.00, his figures for TALLBOY and GRAND Slam may be an extrapolation based on average costs, and as such an under-estimate.³⁸ The size and complexity of manufacture and handling of these large bombs made them disproportionately expensive. To the costs of manufacturing TALLBOY and GRAND SLAM must also be added those of modifications to the aircraft to carry them, and other ancillary equipment such as modified bomb trolleys and cranes required to transport them from the bomb dump and load them onto the aircraft.

³³ Ibid. The discussion here concerned the cutting of railway lines and disruption of railway centres by cratering, rather than the specific destruction of railway viaducts.

³⁴ Brooklands Museum: TALLBOY/GRAND SLAM Order Book, HIS/VIC/001.

³⁵ John Fahey, *Britain 1939 – 1945: The Economic Cost of Strategic Bombing*, p 317. (Unpublished thesis, University of Sydney, 2004).
<http://ses.library.usyd.edu.au/bitstream/2123/664/2/adt-NU20050104.11440202whole.pdf>.

³⁶ Leo McKinstry: *Lancaster*, p 117.

³⁷ Sebastian Ritchie: *Industry and Air Power: The Expansion of British Aircraft Production, 1935-41* (Studies in Air Power), (Abingdon: Routledge, 1997), p 212.

³⁸ Fahey (p 316) notes that on average it cost the British Government £1.00 per 23.4 lb of HE bomb weight purchased.

The joint Admiralty/USAAF Concrete Piercing (CP) bomb now emerged as a rival to the pre-eminence of TALLBOY / GRAND SLAM. The Admiralty's weapon entered limited operational use against U-boat pens in February 1945.³⁹ Since its inception in May 1944 the Air Ministry had criticised the Admiralty's backing of the CP bomb on the grounds that the only point in its favour over the RAF's deep penetration bombs was its ability to pierce concrete; further, it contained too little explosive to cause serious damage to a large structure and could be employed only against a limited range of targets. Although the RAF bombs had not been designed to penetrate concrete, their larger charge and earth-shock ability made them effective against a greater range of targets.⁴⁰ The fact that No. 617 Squadron was achieving success against a far greater range of targets than the CP bomb could address, and that the latter weapon could not be carried by RAF aircraft, ensured the retention of TALLBOY and GRAND SLAM.

The choice of future targets beyond those already proven for TALLBOY and GRAND SLAM required yet further detailed consideration. A continuing aspect of the search for new targets was the role played by Keith St Joseph of Bomber Command's Operational Research Section. Following his work on the geology connected with the V-weapons sites and stores, he turned his attention to the German underground jet engine and rocket factory at Niedersachswerfen. St Joseph studied geological maps and other available data and visited the cratered remains of the RAF bomb store at Fauld, which was sited in a similar geological context to that of Niedersachswerfen.⁴¹ St Joseph's personal view, which he stressed was not that of Bomber Command, was that no attack was likely to result in the destruction of the underground galleries. The best option was to target surface facilities around the site with TALLBOY, in the hope that the tunnel entrances might collapse. Even this he conceded might be only temporary; the availability of a large on site labour force could probably restore rail facilities in a week or so, so facilitating further repair.⁴² His work, however, led Bomber Command to press for further experimentation using models to assess TALLBOY's penetration into different rock types.⁴³

³⁹ Roger Freeman, *The Mighty Eighth War Diary*, (London: Janes, 1981), p 437.

⁴⁰ TNA Air 20/3369: Bombs: supply. Bottomley to ACAS (Ops) 5 Mar 45.

⁴¹ This underground bomb store in an old gypsum mine experienced a catastrophic accidental explosion on 27 November 1944.

⁴² TNA Air 14/1907: Geological investigations. Letter and report J K St Joseph to Gp Capt Menzies for DB Ops, 15 Feb 45.

⁴³ TNA Air 14/1907: Geological investigations. Letter Gp Capt Bilney to D Arm R, 26 Mar 45. Earlier work had been conducted in the earlier stages of TALLBOY development. See: TNA DSIR 27/47/MAP132: Impact tests on concrete of 2-in. calibre model TALLBOY bombs, A.C. Whiffin and K.L.C. Freeborn, November 1944 and DSIR 27/48/MAP139: The penetration of model TALLBOY bombs into natural sandstone. A.C. Whiffin and K.L.C. Freeborn, January 1945.

While the Squadron, engineers and technicians worked to resolve technical and supply issues, the CTSC continued to progress the strategic plan instigated the previous autumn. As the Allies closed in on Germany a reassessment was made that provided the perfect targets for the Squadron's new weapon. Study of these reveals the true scope of targets that were under consideration during this period – a matter of importance for this discussion which cannot be inferred from the operational record alone.

At the beginning of February 1945 the COS were already reviewing the existing strategic bombing policy in the light the current war situation and the need to support the Russian advance. There was concern that a number of targets had been downgraded in priority in favour of the short term gains anticipated from attacks on oil and communications systems. All but four of the main oil producing plants had been knocked out, although continued monitoring and further attacks were required to maintain this reduction of output and attacks on communications targets were to continue, with emphasis on those east German centres used by both troop movements and refugees in order to assist the Eastern Front.⁴⁴

There was also a number of emerging target sets. Several of the major tank producers were situated in the area of major oil targets; these could be detailed for simultaneous attack without increasing the demand for fighter escort while other more dispersed tank factories required individual attack. Concern over the reduction in effort against the German aircraft industry was combined with the growing numbers of Me 262 jet fighters. Although these were not yet a major problem, it was agreed to target their production facilities to ensure that they did not become one. Finally and last in order of priority, increased action was requested against U-boat construction yards, notably those at Hamburg and Bremen.⁴⁵

How was No 617 to be used in relation to these priorities? By February 1945 the Squadron had played only a marginal role in the oil and communications offensive. Other attacks on the canals had come at a time where TALLBOY stocks were being husbanded for *Tirpitz*. TALLBOY was a poor choice for use against oil refineries (p 177) and Bomber Command had yet to mount attacks against any of the bridge targets that would eventually succumb to this weapon. TALLBOY had however proven successful against U-boat pens; in the light of continuing demands on Harris's resources, and as the

⁴⁴ See Erhlers, *Targeting the Reich*, p 320.

⁴⁵ TNA Air 20/2501: Bombing policy. Strategic Bombing in relation to the present bombing offensive. COS Committee, 1 Feb 45.

only weapon in Bomber Command's arsenal capable of success against these targets, it seemed logical that it would again be used to take on a task that otherwise diverted aircraft from main force.

The Squadron's operations during this final period of the war period clearly reflected the CSTC's policy, with only minor modification caused by tactical demands by the Admiralty. February saw concentration with communications targets, seen as the target of preference for TALLBOY, with two diversions for Admiralty requests for attacks against midget submarine and E-boat pens. After a break at the beginning of March, while the Squadron prepared itself for the arrival of GRAND SLAM, attacks continued against the recently prioritised viaducts in order to isolate the Ruhr. This strategic objective was achieved in no more than ten days, the Squadron destroying five viaducts and bridges, supplemented by two more by No. 9 Squadron.

The tightly focused nature of the communications plan, the relative ease with which key targets were dealt with, and the results obtained, all demonstrate the campaign's validity. Debate will continue as to its relative merits in relation to the oil plan⁴⁶ but as far as GRAND SLAM and TALLBOY are concerned there can be no doubt that they brought swift results. They also added to the cost-effectiveness of doing so by allowing the remainder of the Command time and resource for the attack of other objectives, including those connected with the oil campaign. With communications targets despatched the Squadron's tasks again became dominated by targets relating to the naval war.⁴⁷

These different types of target will now be examined individually. They formed two separate target sets, representing differing aspects of CSTC's strategy: the plan was modelled on Bufton's intention from a year earlier to isolate the Ruhr and a response to pressing demands from the Admiralty to counter the emerging U-boat menace and reduce the threat of surface vessels in the Baltic.

SHAEF's new plan for the isolation of the Ruhr split responsibility for targets between the tactical and strategic air forces.⁴⁸ The Bielefeld and Altenbeken/Neuenbeken railway viaducts had been on the CSTC target lists as first priority targets since the previous

⁴⁶ This debate is covered in detail in Ehlers, *Targeting the Reich*, Chapters 10-12.

⁴⁷ There appears to have been a division of labour, based on capability. No. 617 Squadron restricted to GRAND SLAM and TALLBOY concentrating on viaducts and bridges. No. 9 Squadron used TALLBOY against a more varied mix of targets and also operated as part of main force delivering 12,000lb HC bombs on targets including Essen.

⁴⁸ TNA Air14/1426: Isolation of Ruhr: attack on communications. SHAEF report: Isolation of the Ruhr, 17 Feb 45.

autumn.⁴⁹ The Arnsberg viaduct was subsequently added to these which had been recommended as suitable targets for No. 617 Squadron. These and four other viaducts were now elevated to "Communications targets of special importance."⁵⁰

The Squadron's initial four attacks against the Bielefeld viaduct met with limited results. After success with the first GRAND SLAM on their fifth attempt the Squadron's luck began to improve. Having the GRAND SLAM and SABS placed the Squadron at a distinct advantage. Two visits were required to destroy the Arnsberg viaduct but the remaining targets required only single attacks; the policy of earmarking targets for special attention with appropriate weapons was again proved cost-effective. Between November 1944 and March 1945 an estimated 2,875 tonnes had been aimed at the Bielefeld viaduct. In all probability only a fraction of the 89 tonnes dropped by No. 617 Squadron on 14 March had been required.⁵¹

Towards the end of February the Dortmund Ems and Mittelland Canals were also elevated to "Communications targets of special importance".⁵² The former had been cut almost continuously since September, but the latter still carried goods of importance such as Ruhr coal, coke, steel and manufactured goods to Berlin, and other industrial locations in the east, while imports of food and building materials went into the Ruhr. The equation that measured target value yielded changing results: while the loss of rail capability made the canals relatively more important, their volume of traffic was reduced as the availability of cargo diminished.⁵³

After an attack against the Mittelland canal on 1/2 January 1945, navigation on the canal was permanently halted at Gravenhorst. In early March other sections of the canal were still operating between Gravenhorst and Berlin, with links to the rivers Elbe and Weser. On this route the Rothensee ship lift remained a potential bottleneck, the destruction of which would have great effect.⁵⁴ Despite this, the CSTC decided that the ship lift was no longer relevant to the present communications plan; it was no longer a major interdiction objective and on 14 March it was downgraded to become the first of the

⁴⁹ AHB: HQBC Operations Record Book, 16 Oct 45.

⁵⁰ TNA Air 40/1514: Combined Strategic Target Committee: signals to and from Air Ministry. CSTC Communications targets priority signal 7/45, 22 Feb 45.

⁵¹ Tonnages from Friedhelm Golücke, *Der Zusammaenbruch Deutschlands-eine Transportfrage?* (Schernfeld, Germany: SH-Verlag, 1993), p 297.

⁵² TNA Air40/1514: Combined Strategic Target Committee: signals to and from Air Ministry. CSTC Communications targets priority signal 7/45, 22 Feb 45.

⁵³ TNA Air 14/1206: Intelligence on directif [sic] targets. Current target importance of the Rothensee ship lift, 11 Mar 45.

⁵⁴ Ibid.

“Alternative Weather and Filler” targets.⁵⁵ That same day the first GRAND SLAM - the weapon instigated to bring about the ship lift’s destruction - was dropped operationally.

Nevertheless, on 28 March No. 9 Squadron was detailed for a daylight attack on the ship lift with 15 TALLBOYS and on the same day operations were laid on for 20 aircraft from No. 617 Squadron against an unrecorded target but both operations were subsequently cancelled owing to weather.⁵⁶ This appears to be the first and the last time that an attempt was made to attack the target which had been the catalyst to transform Bomber Command’s approach to bombing accuracy.

The rapid severing of rail communications raises questions as to why GRAND SLAM was never used against the Rothensee ship lift. With the Lancaster B I (Spec) cleared for a heavier uplift, allowing a heavier fuel load, this target was now within range. No. 5 Group’s attacks against the canals were successful, but needed to be repeated at regular intervals after repairs to ensure a continued disruption of traffic; however, a projected attack on the Mittelland Canal on 20/21 February was aborted due to weather and the canal was never attacked again. Although the ship lift had been downgraded in priority, there was sufficient reason to plan the operation cancelled on 28 March. The fact that it was not re-scheduled may partly be indicative of further decline in canal traffic, but it equally reflected the greater priority that was attached to disruption of the resurgent U-boat activity. Timing may have been another factor. With the end of the war in sight, the ship lift’s destruction was considered counter-productive.⁵⁷ It was considered more beneficial to conserve it for use in the immediate post-war period. Continued attacks against the canal embankments would be sufficient.

With the Allied advance still heavily dependent on supplies brought in by sea through French and Belgian ports, increased U-boat operations were causing the Admiralty growing concern. In addition, new, improved types of boat under development had the potential to re-dress the balance of the sea war in both home waters and the North Atlantic. In December the Air Staff agreed begrudgingly to sanction attacks on construction yards, providing they did not divert resources from priority targets of oil and communications.⁵⁸ A further Admiralty request at the beginning of February

⁵⁵ CCA, Bufton Papers, BUFT 3/46: Minutes of the CSTC 14 Mar 45.

⁵⁶ TNA Air 27/2128: No 617 Squadron Operations Record Book, March 1945 Summary. Air 27/139. No. 9 Squadron Operations Record Book, March 1945 Summary.

⁵⁷ AHB Narrative, The RAF in the Bombing Offensive against Germany, Vol IV, p 232.

⁵⁸ Tarrant, *Last year of the Kriegsmarine*, p 183.

resulted in the COS directing Sir Douglas Evill to increase these attacks and those on surface vessels, together with a mining offensive in the Baltic U-boat training areas.⁵⁹

Harris's difficulty (and that of Spaatz, who had been similarly tasked) was that the strategic bomber force was already severely stretched by existing demands. Any operations in favour of Admiralty targets would inevitably mean a reduction of effort towards oil and communications, or be at the expense of the new priorities propounded by the COS.

The construction of new U-boats was not the only problem concerning the Admiralty. The Allied occupation of France and advance into Europe had resulted in the Kriegsmarine abandoning its French bases and withdrawing north. By February 1945 the U-boats were restricted to north German and Norwegian bases. Of equal import were the midget submarine operations of the K-Verband (Kleinkampfverbände der Kriegsmarine ('small battle units') and the S-boats (Schnellboot – ('fast boat') otherwise known to the Allies as E-boats). Operating out of Dutch ports, these vessels' minelaying and torpedo operations still posed a major threat to the Allied supply routes passing through the Scheldt estuary. These were dealt with on a tactical basis via the Admiralty weekly NAVTARs.⁶⁰ Targets requiring TALLBOY were issued to Nos. 9 and 617 Squadron.⁶¹

The NAVTARs dealt solely with U-boat construction and operating activities and listed targets in three Groups, in order of priority, which remained constant for the remaining months of the war.⁶² Construction and assembly yards were first priority in Group 1, with further construction yards and significant operating bases in Group 2 and, as a third group, the less important operating bases (and later, ports without pens but where concentrations of U-boats were gathering).

The operational pens at Bergen and Trondheim had already featured on the list of potential targets for the Squadron.⁶³ Despite further requests by the Admiralty no

⁵⁹ TNA Air 20/3250: Bombing of U-boat and E-boat bases. Signal, Argonaut to AMSSO (Air Ministry Special Signals Office), 4 Feb 45. Also undated draft and covering note Bottomley to Evill, 6 Feb 45.

⁶⁰ TNA Air 40/1514: Combined Strategic Target Committee: signals to and from Air Ministry, NAVTAR 29, 3 Feb 45.

⁶¹ TNA Air 25/125: Operations Record Book, Groups. No. 5 (Bomber) Group. Appendices. Forms B No. 509 3 Feb 45 and No. 514, 8 Feb 45.

⁶² TNA Air 2/8008; CSTC Attack of Naval Targets, 29 Dec 44 to 3 May 45.

⁶³ TNA Air 14/120: Intelligence on directif [sic] targets. Loose Minute Wg Cdr Int through SASO, 11 Feb 45.

further attacks were made and a further effort made to re-plan an attack on Bergen by the Boom Patrol Boats failed to materialise (p 171).⁶⁴

The U-boat pens and U-boat construction works at Farge and Hamburg first suggested in February were, in view of their enormous size, self-selecting targets.⁶⁵ Farge warranted 12 GRAND SLAMs (a 13th was jettisoned) in addition to TALLBOYS. IJmuiden was visited on two occasions (the first aborted due to poor visibility over the target) to sink a blockship before it could be positioned; Harris chose to use TALLBOY against this minor vessel to reduce the likelihood of collateral damage that might otherwise occur from using sticks of 1,000 lb bombs.⁶⁶

When Wallis conceived his deep penetration bomb he did not envisage its use against shipping. HIGHBALL, his smaller version of UPKEEP, was intended for that task. However the use of TALLBOY against *Tirpitz*, penetrating through the armour as well as damaging the softer parts of the vessel had established it as a potent weapon against shipping. A report produced at the end of March 1945 by the Admiralty's Department of Scientific Research concluded that even on the strength of near misses alone, TALLBOY could be classed as a Category I bomb for use against battleships.⁶⁷ This report was paralleled by other trials conducted by the Air-Sea Warfare Development Unit with ex-617 Squadron crews using SABS against moving targets.⁶⁸ With a proven track record and the Admiralty's endorsement it was logical that other key naval surface assets were hence targeted when opportunity presented.

The Kriegsmarine were now being forced to withdraw westwards ahead of the Soviet advance.⁶⁹ From February *Lützow*, *Admiral Scheer* and *Prinz Eugen* were running between eastern Baltic ports and the east Prussian coast where they bombarded Soviet

⁶⁴ TNA Air 14/2082: Operation SKYLARK. HQ No. 5 Group to No. 54 Base, 14 Mar 45 and undated operation order Encl. 37A circa 17 Mar 45.

⁶⁵ TNA Air 14/1206: Intelligence on directif [sic] targets. Loose Minute Wg Cdr Int through SASO, 11 Feb 45.

⁶⁶ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Bufton to APS, Secretary of State, 11 Apr 45.

⁶⁷ TNA Air 20/1199: Aircraft Weapons Sub-Committee: Attack on Battleships with High Capacity armour piercing bombs, March 1945. The title of the report was yet a further example of misunderstanding of the nature of TALLBOY. It was neither a High Capacity bomb nor, strictly speaking, armour piercing.

⁶⁸ TNA Air 14/201: Air tactics: attacks on warships and merchant vessels and trials of SABS Mark IIA and Mark XIVA Bombsights.

⁶⁹ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. HQ No. 54 Base to HQ No. 5 Group, 17 Feb 45.

land forces. On 8 April *Lützow* returned to Swinemünde (Swinoujście) to re-arm. Moored in the Kaiserfahrt Canal, along with *Prinz Eugen*, the ships were a sitting target. After two abortive attempts, on 16 April the Squadron despatched eighteen aircraft, fourteen carrying TALLBOYS.⁷⁰ The remaining four aircraft were loaded with 1,000 pounders.⁷¹ The battleship was damaged and settled on the bottom at its moorings. CSTC was also considering other target sets. Aircraft production from the weekly JOCKEY list was normally allocated to the US 8th Air Force to be attacked as 'filler' targets during attacks on oil installations. However, standard bomb loads and even the CP bomb would be totally ineffective against the underground assembly plant at Niedersachswerfen. Although Wallis's original paper never contemplated underground factories, in the second week of February TALLBOY's success against other underground structures led to discussion about its further potential. Following J K St Joseph's investigation Bomber Command decided that Niedersachswerfen was too tough a target for TALLBOY; GRAND SLAM might stand a better chance, although even that might not be sufficient.⁷² Bufton did not share this view and continued to promote the target to Bottomley.⁷³ Although five engine casting plants preceded Niedersachswerfen on the list it was the first engine producing plant and Bufton felt it warranted higher priority. He believed that a joint GRAND SLAM and TALLBOY attack would be effective; the tunnels might collapse even if the bombs failed to achieve full penetration. The Americans could then mount an immediate follow up attack on surface installations, including the workers camp and nearby power station. However, for the time being GRAND SLAM had not materialised and CSTC preferred not to divert effort from more pressing targets.⁷⁴ The list, omitting Niedersachswerfen, was duly sent to HQBC and hence to No. 5 Group as "targets for attack by 617 and 9 Squadrons as the opportunity offers."⁷⁵ Attacks might be carried out by day with fighter escort, or, if tactically possible, by moonlight, in an unusual reversion to night attack.

⁷⁰ TNA Air 27/2128: No. 617 Squadron Operations Record Book, Swinemünde, 16 Apr 45.

⁷¹ Since supplies of TALLBOY were now adequate, this suggests that these aircraft were the four remaining of those converted to carry the Boom Patrol Boats. If so, then the chances of their ever being used were further reduced, since one of these aircraft failed to return from this operation.

⁷² TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute Sheet, DDB Ops 1 to DB Ops, 8 Feb 45.

⁷³ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Note Bufton to ACAS Ops, 11 Feb 45.

⁷⁴ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. Minute Sheet DB ops to ACAS Ops, 9 Feb 45.

⁷⁵ TNA Air 14/731: Targets for No 5 Group operating as a separate force. HQBC to HQ No. 5 Group, 12 Feb 45.

At the beginning of 1944 Coastal batteries had been mooted as one of the first targets for TALLBOY, but discounted because of their small size and the accuracy required. By April 1945 the effectiveness of TALLBOY and the precision with which it could be aimed were beyond doubt. The extensively fortified island of Heligoland occupied a strategic position with its guns and naval base covering the approaches to Hamburg and Bremen. TALLBOY and GRAND SLAM were deemed the weapons to deal with this obstacle. A tactical operation mounted a week before the assault to take Bremen was the only time that TALLBOY was directed against this type of target.

Harris also had thoughts for further targets and proposed an attack on Hitler's Southern Redoubt at Berchtesgaden.⁷⁶ Tedder did not consider the Salzburg area a military objective, although it was an area of military and political organisation.⁷⁷ Harris, supported by Spaatz, won the day. The operation was executed as a No. 5 Group attack. Realistically neither of the Squadron's targets, the SS barracks and the 'Eagles Nest' could be considered to warrant TALLBOY; the project evoked a political mind set expounded earlier by Satterly's proposal to eradicate selected NS training camps.⁷⁸

No. 617 Squadron's operational war ended as the aircraft returned from Berchtesgaden. On the same day the eastern and western Allied armies met at Torgau and within a fortnight Germany had capitulated. Had events turned out differently, the planners were prepared: they had considered differing scenarios and allocated further targets for the Squadron to attack. These were envisaged as precision strikes to assist land and naval forces overcome pockets of strong resistance, such as heavy gun batteries while plans were also made for a continuation of attacks to counter the U-boat threat.

With German ground forces and the remains of its air force on the defensive, the Kriegsmarine would have continued its offensive against the Allies. However, the Allied advance and territorial gain would have forced the Kriegsmarine to continue its withdrawal north to Norwegian ports.⁷⁹ Already insufficient pen accommodation meant that concentrations of U-boats were reliant on other more open, but heavily defended ports. Bergen and Trondheim still had operational pens, and it is likely that these would have been subject to further attention. Plans made at the end of April for an attack on

⁷⁶ TNA Air 19/913: SHAEF Air Conferences: Bomber Command aspect. Minutes Air Commanders' Meeting 12 Apr 45.

⁷⁷ AHB Narrative, *The RAF in the Bombing Offensive against Germany*, Vol IV, p 238.

⁷⁸ See pp 215-216. Known as Ordensburg, these were considered the source of indoctrination for new Nazi officials.

⁷⁹ Tarrant, *Last year of the Kriegsmarine*, p 227. In April 1945 serviceable U-boats were ordered to move to Norwegian bases.

Narvik by both Nos. 9 and 617 Squadrons reveal that TALLBOY was now being considered for the attack of headquarters, repair and accommodation vessels.⁸⁰ Again, the conundrum presented itself. An operation against Narvik would require the aircraft to deploy to Scottish bases, with overload tanks, and then possibly wait for suitable weather conditions, thereby temporarily removing them from the theatre in which they could act against more tactical targets in support of the Army.⁸¹

The popular image of the deep penetration 'earthquake' bomb was of a weapon that could destroy almost any target; on its debut at Saumur TALLBOY had demonstrated its ability to excavate a hillside. Since the autumn of 1944 the Mediterranean Allied Air Forces had been targeting the Brenner Pass, seeking to sever the Germans' only supply route to Italy. By April 1945 the Air Ministry was considering a plan that might have been the inspiration for Frederick E Smith's novel *633 Squadron*.⁸² Could GRAND SLAM, the largest and most powerful bomb yet produced, be capable of moving mountains? MAAF had been considering the potential of creating landslides to block rail traffic using a force of Wellingtons carrying 4,000lb bombs: the proposal had been passed to the Air Ministry who suggested that TALLBOY carrying Lancasters might attack the Muhtahl tunnel. Wallis was consulted and recommended the stronger cased GRAND SLAM, but after due consideration the idea was shelved on the grounds that damage to the tunnel would be counter-productive to the Allies.

The DBO then reconsidered the idea, transferring the landslide concept to a different location where the strata were more suitable.⁸³ Here was an opportunity to develop a new use for the bomb and further explore the problem encountered on other similar targets where the casing had shattered after a glancing blow on the hillside.⁸⁴ Once again, events on the ground overtook the planners: the Allies were approaching Innsbruck and the operation was unnecessary.⁸⁵

SHAEF or its agents had prescribed the Squadron's targets since OVERLORD as part of the overall plan for the strategic bomber offensive. The departure of Cheshire, a keen

⁸⁰ TNA Air 40/1885: TALLBOY (12,000 lb deep penetration (earthquake) bomb): attacks on enemy targets and miscellaneous papers. DDB Ops to DB Ops, 26 Apr 45.

⁸¹ Ibid.

⁸² Frederick E. Smith, *633 Squadron*, (London: Hutchinson, 1959). A novel in which a fictitious Mosquito squadron destroys a German factory in Norway by bombing an overhanging mountain.

⁸³ TNA Air 20/4758: The Brenner Route as target. Letter Whitehead to Wallis, 28 Apr 45.

⁸⁴ TNA Air 20/4758: The Brenner Route as target. Wallis to Whitehead, 1 May 45.

⁸⁵ TNA Air 20/4758: The Brenner Route as target. Minute Note B Ops 1 to Bufton, 2 May 45.

innovator, combined with the extremely fluid war situation had further removed local initiative. Cochrane's subsequent departure in January 1945 was a further blow. The situation was redressed to an extent by the appointment of A/Cdre Satterly as Officer Commanding No. 54 Base in December 1944 with AVM Constantine replacing Cochrane.⁸⁶ Echoing the partnership of Cheshire and Cochrane, Satterly and Constantine explored ways of better using No. 617 Squadron's skill and accuracy.

Satterly was extremely aware that bad weather was curtailing opportunities for operations and practice bombing. By the middle of February the Squadron had operated only four times since the New Year.⁸⁷ Morale and efficiency would suffer if the situation continued. When weather conditions were insufficient for perfect visual bombing main force squadrons could switch to area targets or use blind bombing techniques. Under present policy with only one target, or several targets in the same area (a drawback of CSTC's targeting policy), the Squadron had to wait for clear conditions. Satterly advocated a wide range of geographically dispersed targets thus increasing the chances that at least one of them would have suitable conditions on any given day. Priority targets could be attacked when conditions were right but other worthwhile targets could be substituted if they were not. In this respect he was echoing the principles advocated by Tedder to Portal at the start of the oil/communications campaign.⁸⁸ This would allow more sorties and a greater tonnage dropped. It would also effectively increase the number of aircraft available to Harris on any one day.

Satterly proposed eighteen targets that fitted the CTSC strategic remit, including five in Norway and three of the high priority engine casting plants. His recommendation detailed whether the attack should be by day or night, the number of aircraft required and the optimum bomb load. In considering the latter he had not confined himself to current practice. Turning the clock back a year, for certain targets he advocated the use of 12,000lb HC bombs, with low level marking by a 617 [sic] Squadron Mosquito that would also act as Controller.⁸⁹ For Niedersachswerfen (which he still considered a viable

⁸⁶ As SASO No. 5 Group in 1943 A/Cdre Satterly had been responsible for drawing up the detailed operation order for the Dams Raid. A former Directorate of War Training and Tactics Staff Officer, he had become Base Commander, No. 54 Base in December 1944. Constantine replaced Cochrane on 16 January 1945.

⁸⁷ TNA Air 28/2128: No. 617 Squadron Operations Record Book, January and February 1945 Summaries.

⁸⁸ Webster and Frankland, *Strategic Air Offensive*, Vol IV, p 291-2. Note Tedder to Portal, Air Policy to be adopted with a view to rapid defeat of Germany, 25 Oct 44.

⁸⁹ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. HQ No. 54 Base to HQ No. 5 Group, 17 Feb 45. A number of the targets detail marking by a No. 617 [sic] Squadron Mosquito suggesting projected re-instatement of the Squadron's own marking capability.

target) he suggested a night attack. Picking up earlier thoughts for this target, and possibly influenced by the attack on the St Leu V-weapon store, marking would be by Mosquito with TALLBOYS aimed at the tunnel entrances with 12,000lb HC blast bombs targeting the labour camp.

Satterly's innovation did not stop there. Concerned about the lack of practice bombing, he suggested that the Squadron "should be allowed to go and do its practice bombing over Germany, especially on (communications targets in) some of the smaller targets in Southern Germany." A third suggestion was made; to target German naval units withdrawing westwards ahead of the Russian advance.⁹⁰ Bomber Command discounted most of Satterly's targets as unimportant but appreciated his initiative. They suggested he re-consider his proposal by taking further (non-TALLBOY) targets from the directive list: oil plants, tank and jet factories, other industrial concerns and ordnance depots. These should be capable of destruction by a small force.⁹¹

Satterly's proposals never came to fruition. Had they done so, implementation might have become an issue. The Squadron had not employed these tactics for over six months. None of the Mosquito marker force was still with the Squadron and the Squadron had only one Mosquito on strength. A possible solution, the use of No. 627 Squadron, would have re-opened an earlier debate.⁹²

Another facet of Satterly's planning was the psychological, propaganda and political value of precision attacks. His first listing included Hitler's Bavarian retreat at Berchtesgaden. Echoing earlier attitudes of colonial air policing, attacks on small south German towns "might provide an excellent education in the primary effects of bombing for post-war consideration... .. (by those who have who have seen) little of the raids on larger targets." Attacks on the German fleet might provide useful practice for the Pacific war, with political value at home and propaganda value in both Germany and Japan.⁹³

Satterly's socio-political outlook is further illustrated by his concurrent championing of a proposal for the Squadron to attack a number of Ordensburg being used to train Nazi

⁹⁰ Ibid.

⁹¹ TNA Air14/1206: Intelligence on directif [sic] targets. Letter HQBC to HQ 5 Group, 19 Feb 45.

⁹² TNA Air 14/2062: Special Targets for 617 Squadron. Woodhall Spa to HQ 54 Base, 25 May 45. See also p 133.

⁹³ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. HQ No. 54 Base to HQ No. 5 Group, 17 Feb 45.

officials.⁹⁴ As potential leaders of an underground resistance their students posed a threat to the peace of post-war Europe; here was an opportunity to eradicate them en masse.⁹⁵ Constantine concurred and HQ Bomber Command appears to have sanctioned the proposal.⁹⁶ However, the Ordensburg were overrun by ground troops before any attack could be mounted.⁹⁷

The unique nature of GRAND SLAM and TALLBOY and their relative scarcity called for considered judgement as to the targets selected for attack. CSTC's targeting policy made this partly self-selecting in terms of target grouping. The relatively small number of targets, prioritised within each group, simplified target selection; in many respects part of the intention behind the establishment of the CSTC. The system was now being run very much from the top down, as a fully integrated operation. Not only was there closer integration between the two Air Forces, but also with the overall war situation which introduced objectives hitherto seen as tactical into a more strategic remit, as demonstrated by naval targets. The price paid for this was the exclusion of creative planning at local level. Satterly had tried to re-invoke the degree of freedom that had been enjoyed pre-SHAEF, where independent ideas and "grass roots" creative thinking were encouraged. However, his attempt to exercise a degree of local freedom and build a peripheral set of targets, extending the scope of the Squadron's activity, was unwelcome. His suggestion that other weapons might be used to preserve TALLBOY and GRAND SLAM stocks for CSTC's priority targets applied only to No. 9 Squadron, which in turn still had to conform to the corporate policy.

Yet despite this centralisation, a degree of unconformity was permitted. The Squadron was allowed to progress the Boom Patrol Boat project, although it could be argued that this was acceptable since it was part of the anti-U-boat campaign and against an agreed objective. The proposed attack on the Brenner Pass, too, would have pushed the boundaries, but at a time by which the war was already decided. That said, it was nowhere near the freedom that the Squadron had previously enjoyed.

⁹⁴ National Socialist Party education camps. See also p 212 re the attack on Berchtesgaden.

⁹⁵ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. Letter Chadwick to Satterly, 26 Feb 45.

⁹⁶ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. SASO 5 Group to AOC 5 Group, 13 Mar 45 and AOC to SASO 16 Mar 45.

⁹⁷ TNA Air 14/2009: Special targets for attack by No. 617 Squadron. SASO HQBC to CIO HQBC, 16 Mar 45 and Note of Action by Chief Intelligence Officer, No. 5 Group, 17 Mar 45.

Even before the European war was over Bomber Command turned its attention to the offensive against Japan. Hitherto this had been the exclusive prerogative of USAAF long range bombers. With the war in Germany over, Bomber Command had the potential to supplement the USAAF effort, operating from Pacific island bases. By the spring of 1945 senior RAF officers, particularly those with operational experience, including Cheshire, were being asked to contribute to what in June 1945 was formally established as TIGER FORCE.⁹⁸

Bomber Command's intention was to use its night bombing expertise to complement the American daylight operations by B-29 Superfortresses. The Americans concurred, but the Air Ministry was only too aware of the American view that night bombing was inaccurate and did no vital damage. At best it could deliver area attacks, but the Americans had already demonstrated that they were more than capable of doing these themselves with their massive incendiary raids on Tokyo; necessitated by almost constant cloud cover that mitigated against accurate daylight attacks just as it had done over Europe during the latter part of 1944.⁹⁹ By comparison, Bomber Command's ten squadron contribution was seen as a small effort. TALLBOY, however, placed Bomber Command in a league of its own.¹⁰⁰

No. 5 Group considered it essential that full advantage be taken of the Squadron's precision bombing skills, both in terms of further developing the deep penetration bombs and precision bombing.¹⁰¹ The Squadron was already embarking on research and development work, pioneering a trial installation to link SABS to the autopilot to provide automatic input direct from the bomb aimer to the aircraft controls during the bombing run. The USAAF already had his capability with their Norden bombsight but earlier it was deemed technically too difficult and impractical to try to adopt the American technology

⁹⁸ LCA: Boyle Papers, Leonard Cheshire Paper: Future VLR Operations Bombing Technique, 1 Mar 45.

⁹⁹ Tami Davis Biddle, *British and American approaches to strategic bombing: Their origins and implementation in the World War II combined bomber offensive*. *Journal of Strategic Studies*, 1995, 18, (1), 1995. Special Issue: Air Power Theory and Practice, p 125.

¹⁰⁰ TNA Air 24/158: Flying Control; Operational Research; Meteorological; Defence. Loose Minute Air Marshal Lloyd to SASO TIGER FORCE, 7 Aug 45. There may also have been political points to be scored. If so, then Bomber Command, with TALLBOY and using the techniques pioneered by No. 617 Squadron in the spring of 1944 and further refined by No 54 Base Marker Squadrons was more than a match for the American bombers.

¹⁰¹ TNA Air 14/2188: Smoke marker trials: 617 Squadron. Letter No. 617 Squadron Policy. No. 5 Group to HQBC, 21 May 45.

while committed to operations.¹⁰² The Squadron had also been earmarked for bombing development trials using TALLBOY and GRAND SLAM against the former V-site at Watten. However, development of these projects would seriously interfere with preparations for the deployment of the Squadron to the Pacific.

Resolution of these competing demands was the converse of the arrangements employed when the Squadron acquired GRAND SLAM.¹⁰³ The Squadron would revert to two flights, retaining a TALLBOY capability while the third flight would be detached, and transferred to another Group.¹⁰⁴ Since range constraints meant that the Squadron could only use TALLBOY in the Pacific this it was an ideal solution.¹⁰⁵

Within weeks of VE-Day the future policy for No. 617 Squadron within TIGER FORCE had been defined. Generally the squadron would operate as part of a main force, but retain the skill and ability to conduct precision attacks using SABS and TALLBOY. The intention was for it to be one of the first to move out to the Pacific; in the meantime it also needed to re-equip and carry out intensive training to acquire essential long range navigational skills.

The two flights earmarked for TIGER FORCE, along with No. 9 Squadron, transferred to Waddington with a mix of TALLBOY and GRAND SLAM aircraft. This mongrel collection was expedient. Operations in the Pacific would require new Lancasters, tropicalized to cope with the climatic conditions and fitted with new equipment including the latest version of H2S, which was not carried by the Squadron's existing aircraft.¹⁰⁶ Although the Squadron had never been equipped with H2S (with the exception of a brief period during the spring of 1944) a number of crews had previously used it; nonetheless training and practice would be essential.¹⁰⁷

The intention was to use both squadrons to attack the many bridges and tunnels that were important for communications on the Japanese mainland, and also to provide a capability for dealing with permanent defences. It was also likely that TALLBOY would

¹⁰² The Norden bombsight was the USSAF's standard bombsight. Similar to SABS it was capable of great precision.

¹⁰³ See pp 197-198.

¹⁰⁴ TNA Air 14/2188: Smoke Marker Trials. Letter Policy 5 Gp to HQBC, 21 May 45.

¹⁰⁵ There were a number of crews, either deemed 'tour expired' or members of Commonwealth Air Forces now coming back under their own jurisdiction, who would be ideal for transfer to the high altitude bombing trials flight.

¹⁰⁶ TNA Air 24/1588: TIGER FORCE: Movements; Engineering; Equipment. Part III. Aircraft from the Technical Aspect. The tropicalized Lancasters were designated B VII.

¹⁰⁷ TNA Air 14/2211: TIGER FORCE: No. 5 Group participation. Notes on Conference held with AOC No. 5 Group, 26 Jul 45.

be used against naval forces, capitalising on the successes of *Tirpitz* and *Lützow*, together with the ASW DU trials carried out against moving vessels. A further two TALLBOY squadrons were mooted to expand the capability of TIGER FORCE, and this triggered a revision to the planning.¹⁰⁸ Not only could the two Squadrons achieve accuracy by day, and night if necessary (it was intended that No. 627 Squadron would also be attached to TIGER FORCE to act as precision markers if required), but for the time being the potency of TALLBOY could not be matched by the American bomb loads.¹⁰⁹ Might it not be better for Bomber Command to concentrate on precision day bombing? ORS disagreed; their experience showed that No. 5 Group night attacks on precise targets such as railway yards and the Dortmund Ems Canal targeting a single point of aim were marginally more accurate than day attacks conducted without marking.¹¹⁰

The debate lasted less than a fortnight. The Far East war was brought to a rapid close by daylight attacks on two major Japanese cities, each mounted by a single aircraft, carrying a bomb whose potency was beyond anything conceived by Barnes Wallis, and which did not require a precision attack. In a statement issued by the White House on 6 August 1945, President Truman announced the onset of the atomic era. In doing so, he made direct reference to the weapon that had become the apogee of the European bomber offensive:

That [atom] bomb had more power than twenty thousand tons of TNT. It had more than two thousand times the blast power of the British GRAND SLAM, which is the largest bomb ever yet used in the history of warfare.¹¹¹

The Squadron's war thus ended with what was largely a period of consolidation and evolution, with something of a hint of retrospection. In comparison to previous periods this final era might be seen as steady and routine, with none of the excitement of innovation or spectacular operations. In some respects the game had been played: Wallis's big bomb had finally come to fruition, but TALLBOY had already stolen much of the limelight. High level precision attack using the SABS was now routine; it was what the Squadron did, and because it did it superlatively well, the planners asked them to do more.

¹⁰⁸ Ibid.

¹⁰⁹ By June 1945 Boeing were conducting installation and carriage tests of TALLBOY in a B-29 Superfortress. USAAF. Report by USAAF Board, Orlando, Florida, *Test of TALLBOY bomb in B-29 airplane*, 30 Jun 45. <http://www.dtic.mil/dtic/tr/fulltext/u2/b972848.pdf>, [Accessed 3 Jan 14].

¹¹⁰ TNA Air 24/1587: Flying Control; Operational Research; Meteorological; Defence. Note ORS to SASO TIGER FORCE, 9 Aug 45.

¹¹¹ *The Times*, Tuesday, 7 Aug 45; pg. 4; Issue 50214; col C.

CHAPTER 7 CONCLUSIONS

This thesis began by reflecting that existing accounts of the Squadron's history have concentrated largely on operations, weapons and personalities. These have been written very much from the Squadron perspective – what its members did, how they did it and the results achieved. Less obvious is why they did it, or the rationale behind the tasks they were set to do.

With the exception of CHASTISE whose planning was analysed in detail by John Sweetman, and to a lesser degree the attacks against *Tirpitz*, again analysed by Sweetman and more recently by Patrick Bishop, writers have not explored the people and processes that led to the selection of targets.¹

In result the Squadron's continued existence and decisions on its employment have largely been ascribed to Harris (p 51). His strategy was subsequently delegated to Cochrane who oversaw the operational aspects. The development of tactics and other operational refinements is attributed to successive Squadron commanders, most notably Cheshire. As far as weapons are concerned, the Squadron existed solely to deliver Wallis's bombs. He was their armourer and it was "his" Squadron.²

The inference is that the targets were attacked for the self-evident reason that they were important to the German war machine, but were unsuited to main force attack (for instance because they were too difficult or unsuited to standard bomb loads). In result the Squadron has come to be seen as dealing with important targets that could not be otherwise be tackled.

Another impression, reinforced by those narratives that seek to contextualise the Squadron's operations by referring to contemporary main force operations, is that the Squadron carried out occasional precise attacks against small, high value targets, while main force carried out regular area attacks on city targets. In short, No. 617 Squadron was the antithesis of main force - an elite unit that conducted its own bespoke offensive apart from the rest of Bomber Command.

¹ Sweetman, *Operation Chastise* and *Tirpitz* and Bishop, *Target Tirpitz*.

² The sense of association ran deep. Post-war Wallis maintained close contact with former members of the Squadron. In 1977 they organised his 90th birthday party.

For a narrator there is a certain inevitability and logic in this interpretation: at intervals new, bigger and better bombs were developed and these were issued to the Squadron because it was a specialist unit. Suitable targets were then given to the Squadron to destroy. New tactics were devised to overcome operational problems and improve the effectiveness of attacks. These led to the allocation of further targets that made use of this improved capability. The process appears to be one of a simple evolution, marked by step changes as the Squadron received new equipment and then discovered the means to exploit its full potential.

In preceding chapters such views have been shown to be simplistic. Viewed in isolation of the overall bomber offensive, they ignore the issues of target selection, overall strategy and bombing policy and pay little attention to the problems of weapon development and provisioning. They assume that everything came to fruition as had been discussed and planned and that each stage evolved as a natural progression. This thesis has shown that this was not the case. It has demonstrated that plans were constantly evolving to meet strategic and tactical requirements, to accommodate technical developments and policy changes and to compensate for delays in production.

First of all it is important to appreciate that the Squadron's operations were not purely determined in response to isolated tactical requirements, or to exploit the striking power of a new weapon. To recapitulate: overall policy and strategy was determined by directives issued by the Air Ministry, embodying their policy for the bomber offensive. These defined Bomber Command's objectives in broad terms and established priorities. Target lists were also issued by a number of bodies that varied according to the period of the war - the Directorate of Bomber Operations, SHAEF and CSTC. It was from these that Harris made his final selection.

Standard accounts of the Squadron history may leave the reader with the impression that Harris was the prime mover of the Squadron's policy following CHASTISE. Harris's decision to maintain the Squadron as a special duties unit is considered the main factor that determined its future. This examination reveals that majority of key decisions in respect of both policy and targets were instigated by Bufton. It was these that determined the weapons used and the targets attacked for the remainder of the war. While Bufton's role as DB Ops (and his conflicts with Harris) are well documented, this significant aspect of his work has hitherto gone largely unnoticed.³

³ Webster and Frankland, *Strategic Air Offensive*, Vol I pp 419-42; Probert, *Bomber Harris – His Life and Times*, pp 226-228 and 267-269, and Melinsky, *Forming the Pathfinders*, pp 66-77.

Initially this targeting was conducted by a special committee headed by Bufton. Subsequently targets were determined by the same means applied to the rest of Bomber Command although on occasion special target sets would be produced for the Squadron. Hence, while it was Harris who determined that No. 617 Squadron should be retained as a specialist bombing unit, thereafter it was Bufton who determined how it should be employed and the equipment it would use.

Bufton was ideally placed and saw this as an ideal means of championing his cause for precision bombing by night. Not only did he help to draft the Air Staff directives, he project managed target allocation and other aspects essential to the Squadron's future, including weapons, equipment and aircraft. This made him the key player not only in shaping the Squadron's policy and targets, but also providing the means by which these might be achieved.⁴

Bufton exercised this control until preparations for OVERLORD resulted in a transfer of responsibility for targeting to SHAEF. This change came at a crucial time. The Squadron was on the eve of receiving TALLBOY, while its role became more tactical. Long term planning that had been instigated by Bufton was replaced by almost daily decisions to keep pace with the rapidly changing war situation. Harris was brought into closer contact with the planning process via the Air Commanders' Conferences. As such he was now subject to direction by SHAEF, but continued to make operational decisions as before and was now able to put across Bomber Command's (that is, his) views directly.⁵ He found that provided he gave priority to SHEAF's demands he was then able to exercise his own intentions with a greater freedom than had hitherto been possible.⁶ However, policy for the Squadron was, to a degree, self-determining since there was no alternative other than TALLBOY to address some of SHAEF's targets.⁷ As a result, Bufton's legacy continued to influence the Squadron's employment for the remainder of the war.

Bufton returned to the hub of policy making in October 1944 with the formation of CSTC.⁸ However, he did not revert to his pre-April 1944 control of direct policy making for the Squadron. If he had then so the Squadron might finally have carried out its long-intended attack on the Rothensee ship lift or simultaneous attacks on the Dortmund Ems

⁴ pp 47-49.

⁵ p 126.

⁶ Harris, *Bomber Offensive*, pp 214-216.

⁷ pp 145-150.

⁸ p 170.

Canal and the Ruhr railway viaducts, both of which had been proposed in August 1943. Both were possible and TALLBOY was ideal for all of them. Instead, Bufton's focus was now firmly on prosecution of the Oil Plan.⁹ Communications targets could also be addressed by main force. Hence from this point the Squadron was detailed for tasks for which only TALLBOY was suited. Only in the spring of 1945 were TALLBOY, and later GRAND SLAM directed against key bridges and viaducts – targets for which TALLBOY had earlier been intended.¹⁰

It is generally supposed that Harris was opposed to the formation of elite units. Portal's insistence that he implement Bufton's concept of the Pathfinder Force was a prime cause of the friction that arose between the two men.¹¹ However, when Harris was commanded by Portal to undertake the Dams Raid, Harris had opted to form a new specialist unit. By doing so Harris was being pragmatic. The creation of No. 617 Squadron avoided the diversion of an existing squadron and retained in an offensive role aircrew that would otherwise have been transferred to non-operational tasks. Despite friction between Harris and Bufton over issues concerning the conversion of the UPKEEP aircraft to standard and the value of MEW assessments there appears to have been relatively little disagreement about how the Squadron was to be used.¹²

Thereafter, Harris's decision to maintain the Squadron as a specialist unit was partly expedient. There were still aircraft, weapons and crews trained in the UPKEEP technique, and Bufton was looking for new targets. Despite the success of CHASTISE, Harris still appears to have seen UPKEEP as a weapon of limited application and instigated a switch to high level bombing, validated by the decision to proceed with TALLBOY. Nevertheless he did not directly oppose Bufton's intention for further use of UPKEEP, and encouraged Cochrane to search for suitable targets. Overall, however, it is clear from the start that Harris wanted an adaptable force, capable of varied forms of attack.

He saw the Squadron as a means of reducing the diversion of elements of main force from German targets: hence the units use for the experimental CROSSBOW attacks, and SOE supply drops in December 1943.¹³ By April 1944 he was formulating other plans to

⁹ pp 170-172.

¹⁰ pp 206-207.

¹¹ pp 48-49.

¹² p 79.

¹³ Ch 3.

harness the Squadron's marking expertise, leading to the formation of the No. 54 Base Marker Force which would use this for No. 5 Group's benefit.¹⁴

The arrival of TALLBOY enabled Harris to use the Squadron to take on the increasing number of "hardened" targets that might otherwise have had to be attacked (to less effect) by main force. The Squadron was now differentiated largely by the destructive capability of TALLBOY which determined the targets against which it was deployed. These increased as the weapon's potential was realised and increased production enabled more targets to be attacked. In doing so Harris was also able to make a point regarding the potency of air power over naval forces, culminating with the sinking of *Tirpitz*. Nevertheless despite his initial support for GRAND SLAM it is apparent that he retained some of his concerns about niche weapons (and more importantly the aircraft to carry them).¹⁵

Harris still recognised the Squadron's unique capabilities and championed them, but in many respects the unit had now become absorbed into the complex machine that was Bomber Command. In doing so the niche had become less of an exceptional position, even if it was still not the norm.

With regard to the introduction and use of weapons, Bufton was again focus of the process, working with the Director of Armament Development and MAP to develop weapons while he found targets for them. He and Wallis were both guilty of over-expectation with regard to the development of both UPKEEP and TALLBOY. Bufton's belief (supported by Wallis) that UPKEEP might be used against other targets led to a period of abortive development.¹⁶ Had the search for new targets revealed only unsuitable objectives, and had efforts not been made to get the weapon to perform over ground, then an earlier halt to UPKEEP might have been made. As it was, time had to be spent evaluating new targets and many were found wanting. The involvement of other parties, who for reasons of secrecy did not appreciate the weapon's requirements, further resulted in unrealistic expectations and demands. More fundamentally, Bufton's refusal to sanction the production of further UPKEEP aircraft resulted in a depleted force that was insufficient to mount an effective attack.¹⁷ The result was an expenditure of much time and effort on a project that failed to produce any operational result, while the possibility of further use of UPKEEP prevented conversion of the remaining aircraft to standard.

¹⁴ pp 128-132.

¹⁵ pp 166-167 and 193-194.

¹⁶ pp 61-62.

¹⁷ pp 65, 69 and 105.

New weapons had to be found for operations against the ship lift, canal embankments and railway viaducts, resulting in the Squadron's use of the 12,000lb HC bomb and TALLBOY. It was fortunate that the former was in final development and could be specially cleared for the Squadron's urgent use against the canal. This weapon then prompted a search for further suitable targets to keep the Squadron occupied until the arrival of TALLBOY. Its use necessitated further development to improve the blast bomb's high level ballistics, together with increased production to meet the new requirement. In this respect the weapon's construction, using sections of the existing 8,000lb bomb was a significant advantage.

Wallis was also excessively optimistic in his estimates of the time required to develop TALLBOY. This may have been influenced by the high priority given to UPKEEP for materials, production and trials facilities. No such priority was afforded TALLBOY. Approval of the larger weapon in addition to the small ballistic trials and medium versions meant that during the autumn of 1943 Wallis was working on three versions at once, each of which brought its own challenges as well as increasing the work load which was superimposed on other tasks.¹⁸

These difficulties had repercussions for the allocation of materials and production facilities which then affected final delivery schedules. Bufton and HQBC also faced difficulties in estimating the number of (as yet unproven) weapons that would be required; these in turn might depend in part on when the weapon entered service. The issue was yet further complicated by the desire to use American production facilities, while relying initially on British filling factories, operating with different capacities.¹⁹ Batch production created more problems. To guarantee continuity of supply, replenishment orders were required before the existing requirement had been fulfilled. Fortunately the weapon's success, together with a desire to ensure a post-war stockpile (funded by the war-budget) allowed Freeman to make unilateral, unofficial decisions that were later ratified. Such gambles were necessary in a fast-changing war in which there was fierce competition for resources. Also apparent is the amount of inter-service horse trading that was required to facilitate such deals.²⁰

Similar overlapping influences emerged with the production of GRAND SLAM. By the autumn of 1944 the Allied advance had reduced the number of targets within range until

¹⁸ These included further work on HIGHBALL, the Windsor bomber and defences against the V-1.

¹⁹ pp 99-100.

²⁰ pp 70 and 193-195.

A V Roe agreed to the restoration of the Lancaster's fuel load. Issues now centred on the relative proportions of TALLBOY and GRAND SLAM to be produced, allowing for the fact that there were two TALLBOY squadrons but only one that would be capable of carrying GRAND SLAM. Since production of both weapons involved fixed resources, a trade-off between the quantities of each type of bomb was required.²¹ Initially TALLBOY was considered the more flexible weapon, although final usage would demonstrate that this distinction was less marked in reality.

The long (and unpredictable) lead times for these weapons highlights another challenge for those involved in procurement. The tempo of the war was such that the targets envisaged at the start of development were not always relevant by the time the weapon entered service. In such cases a target driven aim was transformed into a weapons-driven outcome that resulted in a search for new targets to justify and use the weapon that had been provided. In the case of TALLBOY, where its destructive power surpassed all other weapons but supply was limited, the need was to find the most appropriate and cost-effective use.

Political concerns regarding collateral damage worked against the use of UPKEEP against French and Italian dams, and initially threatened to restrict the use of the 12,000 lb HC bomb against French factory targets in favour of smaller delay action bombs.²² Of similar concern was the avoidance of damage that might affect post-war reconstruction. While this factor played as an incentive in the SOE BLACKMAIL campaign, in other cases it led to the sparing of certain targets. It appears to have contributed to the removal of the Rothensee ship lift as a target and likewise curtailed plans for attacks on the Brenner Pass.

The thesis demonstrates that the use of these new and unconventional weapons was restricted by the lack of suitable intelligence on potential targets. This is evidenced by the efforts taken to evaluate Italian dams and is particularly noticeable in respect of TALLBOY. For the latter much effort was put into determining both its cratering (hence earth shock) effect and results against concrete structures. Despite this TALLBOY never attained its full potential against underground structures. Although underground factories were considered, lack of information regarding their layout and construction deterred the planners from committing to these targets. Moreover, by the New Year of 1945 there was no shortage of other suitable targets for TALLBOY and underground

²¹ p 166.

²² pp 85-86, 90, 110 and 116.

factories were passed over by planners in favour of other more certain and tactically significant objectives.²³

This thesis has drawn attention to the planning and provisioning complexities that arose from the need for specialised aircraft and equipment. Each of the weapons required modified aircraft to carry it. Those carrying UPKEEP and GRAND SLAM had to be built on the production line, which disrupted the output of standard aircraft and required forward allocation of resources to ensure synchronicity with the provision of weapons.²⁴ Aircraft carrying the 12,000lb HC and TALLBOY required large bomb doors which were only in limited production and priority had to be given to the Squadron. The SABS bombsight was always in short supply, despite attempts to increase production, and its installation required significant modifications to the aircraft.²⁵ The complexities of modifications and a shortage of equipment and spares made servicing and replacing losses difficult, and occasionally impossible. The use of varying types of aircraft necessitated a larger Squadron establishment that in turn required additional room on the Squadron's airfield.²⁶ The introduction of different types of marker aircraft necessitated the provision of spares and ground crew to maintain them, while the aircraft themselves were in short supply and high demand for other purposes.

Changes in the Squadron's capability with the introduction of TALLBOY and the nature of targets attacked are well recorded. That the weapon entered service nearly six months later than intended have been ignored, and the consequential effects of this delay have gone unrecognised. Protracted development twice deferred the proposed date for an attack on the ship lift. In the first instance new targets had to be found to occupy the Squadron until TALLBOY became available. After the second the nights were too short to permit an attack and light traffic reduced the target's importance. In any case, OVERLORD targets now took priority. Thereafter conditions were unsuitable for an attack until the autumn, by which time the target was no longer regarded as significant.

Each delay had multiple repercussions. Among them was a reconsideration of the modification of aircraft. Many of the modifications needed to carry TALLBOY had already been embodied for carrying the 12,000lb HC bomb. For the aircrew the same basic training procedures applied since both bombs were released from high level using SABS.

²³ p 211.

²⁴ This was less significant with TALLBOY, where a relatively simple retro-fit converted existing Squadron aircraft.

²⁵ pp 68-69.

²⁶ p 80.

More significant were changes to targeting policy. TALLBOY was intended for use against targets requiring earth shock and impervious to attack by other weapons. With the delay to TALLBOY a completely new set of targets was required. These needed to meet the requirements of the current directive and also provide operational training against small targets. Meanwhile experienced aircrews and specialist aircraft and equipment had to be conserved. This led in December 1943 to the selection of factory targets in occupied territory that were already under consideration for attack but unsuited to attention by main force.²⁷ The more urgent requirement of the Pas de Calais V-1 sites then intervened. Subsequent return to the industrial targets met the requirements of the POINTBLANK directive and the moonlight campaign and allowed Bufton to address SOE's BLACKMAIL requirements and the proposal to destroy key French explosives plants.²⁸

Had TALLBOY been introduced as planned in December 1943, then the ship lift might well have been attacked during the longer winter nights. This would also have permitted earlier attacks against the larger V-weapons sites at less advanced stages of construction and a response to the Admiralty's requests during the spring of 1944 for attacks against U-boat pens. In the process information relevant to the debate about the development of the Admiralty's rocket powered Concrete Piercing bomb could have been gathered. Whether or not the earlier introduction of TALLBOY would have resulted in an earlier emergence of GRAND SLAM cannot easily be determined. Had it been so, then extrapolation from Bufton's thoughts of December 1943 makes it likely that the larger weapon would have been employed against the large V-sites and U-boat pens.

Uncertainty as to whether TALLBOY would be in service in time for the invasion of Europe prevented the OVERLORD planners from allocating a D-Day role for the Squadron using this weapon. Had it been available it most likely would have been employed against coastal gun batteries, despite early concerns about the ability to mark these targets accurately. Instead this lack of role was to enable Harris to use the Squadron to fulfil Operation TAXABLE which would otherwise have required the diversion of another front line Squadron.

The second postponement of the Rothensee plan coincided with the transfer of targeting from Bufton to SHAEF and the commencement of Zuckerman's transportation plan. The attacks against the Paris rail yards at Juvisy and La Chapelle are represented in the

²⁷ This added weight and precision to the existing moonlight targeting campaign and hence is contrary to the general view that it was unique to the Squadron.

²⁸ pp 114-118.

standard narratives as the mid-point of the evolution of the Squadron's low level marking technique from its use against undefended or lightly defended areas to defended areas, culminating in the heavily defended German cities of Brunswick and Munich.²⁹

Policy following introduction of TALLBOY to service was largely determined by SHAEF and Harris, and responded to tactical requirements. Bufton's plans for an attack on the ship lift had been frustrated, but other aspects of his thinking for TALLBOY came to fruition. His proposals that TALLBOY might be used against the 'rocket projectors' under construction in northern France came to fruition in the attacks against the large V-weapon sites at Watten, Wizernes and Mimoyecques. The idea, arising from discussions regarding the development of the Concrete Piercing bomb, that TALLBOY should be evaluated against U-boat pens became an operational reality. In both cases the original concept had been little more than a proposal for further investigation. Instead, events of war had made them an essential expedient. TALLBOY had never been intended to pierce concrete, but was employed as such in the absence of any other suitable weapon.³⁰ While Bufton was no longer in a position to determine targets, he concentrated on the weapon's performance, fuzing and ensured that it was available in sufficient quantity. By the time Bufton returned to targeting with the Combined Strategic Targeting Committee the tactical role of TALLBOY had been affirmed along with its use against U-boat pens.

The Squadron's ability to adjust to such changes in the operational application of TALLBOY once in service can be attributed to the fact that throughout its existence the Squadron might be considered an operational development unit. Harris's original policy statement allowed for the fact that the Squadron would be made up of experienced crews who would operate on an infrequent basis. The expectation was that their non-operational periods would be spent in refining their skills and training with new equipment to improve accuracy and efficiency. In many cases the Squadron assisted in the development of its new weapons. They had time to undertake trials, many of which

²⁹ While accurate from an operational perspective, this view mis-represents the origins of the technique. The PFF OBOE marking used on the Squadron's targets in December 1943 had limited range and could not be used beyond the Ruhr. The low level Lancaster marking developed by Cheshire over the V-sites was only suitable for undefended or very lightly defended targets. Thus neither technique would have been suitable for the heavily defended ship lift.

³⁰ Wallis originally envisaged TALLBOY being dropped in the ground alongside concrete structures not directly on them. Their structural integrity would be destroyed by earth movement, rather than by direct impact or penetration of the concrete. Subsequently for U-boat pens he recommended multiple impacts, with initial hits cracking and weakening the roof sufficient for penetration by subsequent bombs, see pp 143-147.

were for weapons which they would later use, and the experience served as training for them.³¹

It will be noted that on occasion the Squadron's training was sometimes used for additional benefit. Low flying practice to maintain the Squadron's UPKEEP capability was used to assist in the development of defences for vulnerable British dams. The Squadron's work up with SABS in the autumn of 1943 was used to undertake the trials at Braid Fell, reducing both the time taken to complete the trials and the number of bombs needed to attain the required number of hits. When it came to the final dropping trials for TALLBOY it was prudent to use Squadron crews since they would use the weapon when it entered service and thus provided the most accurate indication of the aiming errors likely to be attained.

The gathering of data for operational research extended to operations themselves. The attacks on the V-1 sites in December 1943 were seen as an operational trial to determine the effectiveness of differing bomb loads. In many respects they may be seen as a progression of the Braid Fell trials. Accuracy was essential to assess the damage caused by hits and near misses and the Squadron was the one unit capable (in theory) of attaining this. The first operation with TALLBOY against the Saumur tunnel was described as an 'operational trial', suggesting that it was seen as much as a means of providing information about the bomb's performance as of destroying the target. Subsequent operations were carefully analysed to provide information that might be used in the planning of further attacks. The attacks on *Tirpitz* were similarly scrutinised in an effort to determine the use of TALLBOY as an anti-shipping weapon. When SABS was being considered as a promising sight for use against shipping a request was made for the Squadron to conduct trials.³² Once again the use of operationally experienced crews provided the most accurate assessment of likely results.

With hindsight the Squadron's development of precision marking can be placed in the same category. It was originally developed as a way of ensuring accurate marking for the Squadron; the technique was then taken over and further developed by the No. 54 Base Marker Force and used by No. 5 Group.

In conclusion, looking back over a perceived strategy derived from the operational record, even with the benefit of hindsight, it is not always possible to identify points of

³¹ In many cases the Squadron operated the only aircraft capable of carrying UPKEEP, TALLBOY and the Boom Patrol Boats

³² This was subsequently amended to use tour expired ex-squadron crews posted to the Air Sea Warfare Development Unit specifically for the task.

change let alone the planners' original intentions. The reason for modifications cannot be fully understood without knowing the circumstances at the time they were made. Direction changes as the result of apparently unplanned actions: the failure of technique or equipment, the spontaneous appearance of new weapons or tactical needs. There are no blind alleys, parallel projects or unfulfilled possibilities.

This thesis shows that by looking beyond the technical development and operational execution a new and different picture emerges. Policy for the Squadron was devised not in response to one strategy but as a series of individual strategies. The concept is not new. According to von Moltke, for instance, "Strategy is a system of expedients."³³ The result is not a single line, between key dates and events, but rather an iterative process, a series of stages at each of which circumstances are reassessed and the next course of action is reviewed dependent on the present situation. In such a process the final objective may remain relatively constant, but the route and the means to achieving it will, of necessity, adapt to the circumstances of the time. Along the way new objectives may emerge for which a new strategy is planned and will become subject to similar modification as time passes. The short answer to our headline question 'Considered policy or haphazard evolution' is thus found in a series of interacting considered policies and that evolution, while sometimes messy, was not haphazard.

New understanding enables changes in direction to be identified and correctly interpreted. The result is a new perspective on a familiar picture which reveals it to be far more complex and multi-layered than previously considered. Strategies were varied and various - the result of considered forward planning, a response to unforeseen events or recalculation of purpose. Some addressed strategic, tactical or operational requirements, others were the result of miscalculation, delays and indecision. Not all were implemented and some were curtailed.

In several cases the evidence reveals strategies that are totally absent from the operational record, yet led to fundamental changes of direction and strategy.³⁴ In other cases, individual operations can now be identified as components of intended campaigns that either failed to materialise, or were so widely spaced that the connection between

³³ Originally in Moltke, Helmuth, Graf von, *Militarische Werke*. Vol. 2, part 2, pp 33-40. Reproduced and translated in Daniel J. Hughes, (ed) *Moltke on the Art of War: selected writings*. (New York, New York: Presidio Press, 1993), p 45-47.

³⁴ Notable among these were the further use of UPKEEP and the plans to attack Rothensee ship lift.

them has been lost.³⁵ At times strategies ran in parallel, and might on occasion combine.³⁶ Some had their roots in earlier proposals which never came to fruition and seemingly ad hoc operations were also so connected.³⁷ Others can now be seen in their true colours, having motives other than those assumed or immediately apparent.³⁸

Examination of the planning process reveals the relationship between the Squadron's strategy and the overall bomber offensive to have been much closer than has been noticed hitherto. The thesis has found that the Squadron was used both to complement the work of main force and address directive objectives that main force could not undertake. Under this new light Squadron operations previously regarded as unique or specialised one-off can now be seen to fall into a wider pattern, relating to attacks on other similar objectives that required less precision.³⁹

Long term planning and determination of the targets and timing of future operations that would use new and untried weapons was an art rather than a science. Hence in planning for the future it was also necessary to prepare for the future to be different when it became the present.

The problem facing Bufton and the planners was not new. The difficulty of predicting the course of events and hence the nature of the forces and equipment required is an age old problem for military commanders. Col G.F.R. Henderson, professor of military history at Camberley (1892-99) wrote of the lessons learned from his experiences of the war in South Africa:-

It is as useless to anticipate in what quarter of the globe our troops may be next employed as to guess at the tactics, the armament, and even the colour ... of our next enemy. Each new expedition demands special equipment, special methods of supply and special tactical devices, and sometimes special armament.... Except for the defence of the United Kingdom and of India, much remains to be provided when the cabinet declares that war is imminent.⁴⁰

³⁵ These include the attacks against targets intended to support the Italian campaign, including attacks against viaducts and future attacks with UPKEEP.

³⁶ For example, the development of target marking and use of the Mosquito combined the need to replace the failed OBOE technique and devise a method for the ship lift.

³⁷ Examples are the proposals for attacks on industry in occupied territories that developed into the BLACKMAIL campaign, and the December attack on Liege.

³⁸ The 1943 CROSSBOW attacks and SOE BLACKMAIL campaign.

³⁹ e.g. the moonlight campaign against industry in occupied territory.

⁴⁰ Christopher Bassford, *Clausewitz in English: The Reception of Clausewitz in Britain and America, 1815-1945* (New York: Oxford University Press, 1994).

<http://www.clausewitz.com/readings/Bassford/CIE/Chapter9.htm> [Accessed 31/7/14].

The effect of such becomes readily apparent when the ways in which the Squadron was provisioned with weapons and equipment are examined. The process is revealed to be less of a well-oiled machine than might be assumed. Not only is there the well-established friction between Bufton and Bomber Command, but also confusion between the Air Ministry, MAP and those responsible for developing weapons and the aircraft manufacturers. Production and procurement are seen to resort to unofficial and unorthodox procedures in order to meet deadlines. A multitude of disparate processes, requirements, decisions and pressures ran in parallel. They interacted and influenced each other, sometimes in ways that were not always apparent. Indeed, it is doubtful whether any one individual or grouping had them all in view. A further aspect here is accelerating tempo: the changing war situation, availability of assets and many other factors demanded continuous re-assessment of priorities at an ever increasing rate. For those in command these and contracting timescales posed a mammoth task of co-ordination. Perhaps the task was too great. Even by the end of the war, when Bomber Command was considered a highly efficient organisation, elements were less so.

Appendices

Appendix 1

Operations by No. 617 Squadron: July 1943 – April 1945

Appendix 2

The Chronological Process

Appendix 3

TALLBOY and GRAND SLAM expenditure: June 1944 – April 1945

Appendix 1

Operations by No. 617 Squadron: July 1943 – April 1945

DATE	Day/Night	TARGET	TYPE OF ATTACK	HT	Marking	Bomb Load
16/05/1943	N	Operation Chastise	Independent	LL	N/A	UPKEEP
15/07/1943	N	San Polo D'Enza / Aquata Scrivia	Independent	ML	N/A	500 lb and Inc
24/07/1943	N	Leghorn	Independent	ML	N/A	4,000lb and 500lb
29/07/1943	N	Milan, Genoa, Bologna, Turin	Independent	ML	N/A	Leaflets
14/09/1943	N	Dortmund-Ems Canal (R)	Independent	LL	N/A	12,000lb HC
15/09/1943	N	Dortmund-Ems Canal	Independent	LL	N/A	12,000lb HC
16/09/1943	N	Antheor viaduct	With 619 Sqn	ML	N/A	4,000lb and 1,000lb
11/11/1943	N	Antheor viaduct	Independent	ML	N/A	12,000lb HC
10/12/1943	N	SOE Drop, France	Individual aircraft	LL	N/A	N/A
16/12/1943	N	Flixecourt V-1 site	Independent	HL	PFF Oboe	12,000lb HC
20/12/1943	N	Liege / SOE Drop	Independent / Individual aircraft	HL	PFF Oboe	12,000lb HC
22/12/1943	N	Freval V-1 site	Independent	HL	PFF Oboe	1,000lb
30/12/1943	N	Flixecourt V-1 site	Independent	HL	PFF Oboe	12,000lb HC
04/01/1944	N	Freval V-1 site	Independent	HL	Lancaster	1,000lb
21/01/1944	N	Domart en Ponthieu	Independent	HL	Lancaster	1,000lb and 500lb
25/01/1944	N	Freval V-1 site	Independent	HL	Lancaster	1,000lb and 500lb
08/02/1944	N	Limoges	Independent	HL	Lancaster	12,000lb HC
12/02/1944	N	Antheor viaduct	Independent	HL	Lancaster	12,000lb HC

DATE	Day/Night	TARGET	TYPE OF ATTACK	HT	Marking	Bomb Load
02/03/1944	N	Albert	Independent	HL	Lancaster	12,000lb HC
04/03/1944	N	St. Etienne (R)	Independent	HL	Lancaster	12,000lb HC
10/03/1944	N	St. Etienne	Independent	HL	Lancaster	12,000lb HC
15/03/1944	N	Woippy	Independent	HL	Lancaster	12,000lb HC
16/03/1944	N	Clermont Ferrand	Independent	HL	Lancaster	12,000lb HC
18/03/1944	N	Bergerac	Independent	HL	Lancaster	12,000lb HC
20/03/1944	N	Angouleme	Independent	HL	Lancaster	12,000lb HC
23/03/1944	N	Lyons	Independent	HL	Lancaster	12,000lb HC
25/03/1944	N	Lyons	Independent	HL	Lancaster	12,000lb HC
29/03/1944	N	Lyons	Independent	HL	Lancaster	12,000lb HC
05/04/1944	N	Toulouse	Independent	HL	Mosquito	12,000lb HC
10/04/1944	N	St. Cyr	Independent	HL	Mosquito	12,000lb HC
18/04/1944	N	Juvisy	With No. 5 Group	HL	Mosquito	1,000lb and 500lb
20/04/1944	N	La Chapelle	With No. 5 Group	HL	Mosquito	1,000lb
22/04/1944	N	Brunswick	With No. 5 Group	HL	Mosquito	1,000lb and 2,000lb
24/04/1944	N	Munich	With No. 5 Group	HL	Mosquito	'J' Clusters and Incs
03/05/1944	N	Mailly le Camp	With No. 5 Group	N/A	Mosquito	Spot Fires
05/06/1944	N	Operation TAXABLE	Independent	N/A	N/A	N/A
08/06/1944	N	Saumur, railway tunnel	Independent	ML	Mosquito	TALLBOY
14/06/1944	D	Le Havre E-Pens	Independent	HL	Mosquito	TALLBOY
15/06/1944	D	Boulogne, E-Pens	Independent	HL	Mosquito	TALLBOY
19/06/1944	D	Watten	Independent	HL	Mosquito	TALLBOY

DATE	Day/Night	TARGET	TYPE OF ATTACK	HT	Marking	Bomb Load
20/06/1944	D	Wizernes (R)	Independent	HL	Mosquito	TALLBOY
22/06/1944	D	Wizernes (R)	Independent	HL	Mosquito	TALLBOY
24/06/1944	D	Wizernes	Independent	HL	Mosquito	TALLBOY
25/06/1944	D	Siracourt	Independent	HL	Mustang	TALLBOY
04/07/1944	N	Creil/St Leu	Independent	HL	Mustang	TALLBOY
06/07/1944	D	Mimoyecques	Independent	HL	Mustang	TALLBOY
17/07/1944	D	Wizernes	Independent	HL	Mustang	TALLBOY
20/07/1944	D	Wizernes (R)	Independent	HL	Mustang	TALLBOY
25/07/1944	D	Watten	Independent	HL	Mustang	TALLBOY
31/07/1944	D	Rilly la Montagne	With No. 5 Group	HL	Mosquito	TALLBOY
01/08/1944	D	Siracourt (R)	Independent	HL		TALLBOY
04/08/1944	D	Etaples, Bridge	Independent	HL		1,000lb
05/08/1944	D	Brest, U-boat Pens	Independent	HL		TALLBOY
06/08/1944	D	Keroman, U-Pens	Independent	HL		TALLBOY
07/08/1944	D	Lorient, U-Pens (R)	Independent	HL		TALLBOY
09/08/1944	D	La Pallice, U-Pens	Independent	HL		TALLBOY
11/08/1944	D	La Pallice, U-Pens	Independent	HL		2,000lb AP
12/08/1944	D	Brest, U-Pens	Independent	HL		TALLBOY
13/08/1944	D	'Gueydon' - Brest	Independent	HL		TALLBOY
14/08/1944	D	'Gueydon' - Brest	Independent	HL		2,000lb AP
16/08/1944	D	La Pallice, U-Pens(R)	Independent	HL		2,000lb AP
18/08/1944	D	La Pallice, U-Pens	Independent	HL		TALLBOY & 2,000 lb AP
24/08/1944	D	IJmuiden, E-Pens	Independent	HL		TALLBOY

DATE	Day/Night	TARGET	TYPE OF ATTACK	HT	Marking	Bomb Load
27/08/1944	D	Brest, Shipping	Independent	HL		1,000 lb
15/09/1944	D	<i>Tirpitz</i> , Alten Fiord	With No. 9 Sqn	HL	N/A	TALLBOY
23/09/1944	N	Dortmund Ems Canal, Aqueduct	With No. 5 Group	HL	No. 54 Base	TALLBOY
03/10/1944	D	Westkapelle Sea Wall (R)	With No. 5 Group	HL		TALLBOY
07/10/1944	D	Kembs Barrage	Independent	HL & LL	N/A	TALLBOY
29/10/1944	D	<i>Tirpitz</i> Tromso	With No. 9 Sqn	HL	N/A	TALLBOY
12/11/1944	D	<i>Tirpitz</i> Tromso	With No. 9 Sqn	HL	N/A	TALLBOY
08/12/1944	D	Urft Dam (R)	With 5 Group	HL		TALLBOY
11/12/1944	D	Urft Dam	With 5 Group	HL		TALLBOY
15/12/1944	D	IJmuiden, E- Pens	Independent	HL	N/A	TALLBOY
21/12/1944	D	Pölit	With 5 Group	HL		TALLBOY
29/12/1944	D	Rotterdam, E-Pens	Independent	HL	N/A	TALLBOY
30/12/1944	D	IJmuiden, E-Pens	Independent	HL	N/A	TALLBOY
31/12/1944	N	Oslo Fiord, Shipping	Independent	HL	N/A	TALLBOY
12/01/1945	D	Bergen, U-Pens	Independent	HL	N/A	TALLBOY
03/02/1945	D	Poorteshaven Midget Sub Shelter	Independent	HL	N/A	TALLBOY
06/02/1945	D	Bielefeld viaduct (R)	Independent	HL	N/A	TALLBOY
06/02/1945	D	Bielefeld viaduct (R)	Independent	HL	N/A	TALLBOY
08/02/1945	D	IJmuiden, U-Boat Pens	Independent	HL	N/A	TALLBOY

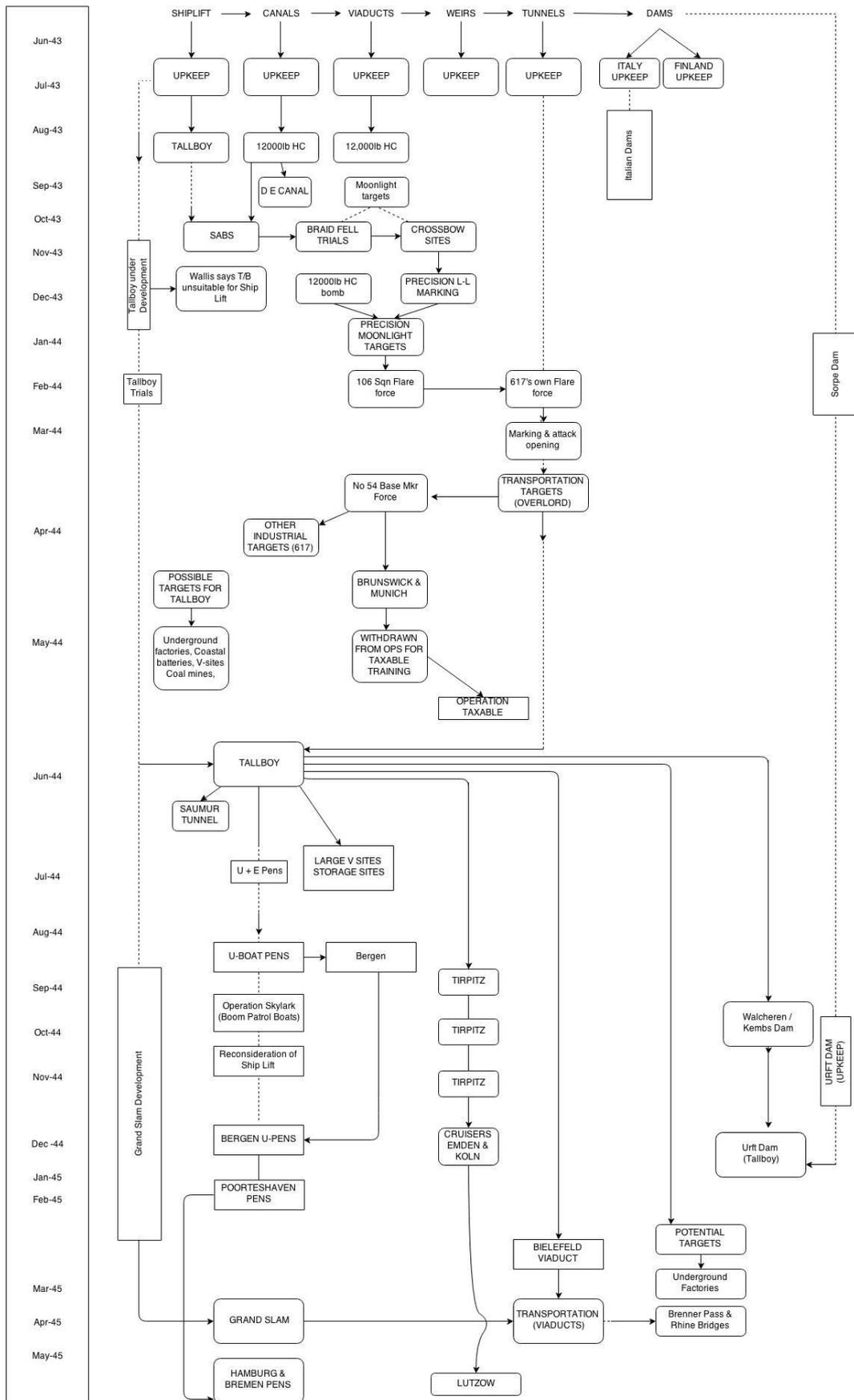
DATE	Day/Night	TARGET	TYPE OF ATTACK	HT	Marking	Bomb Load
14/02/1945	D	Bielefeld viaduct (R)	Independent		HL N/A	TALLBOY
22/02/1945	D	Bielefeld viaduct	Independent	HL	N/A	TALLBOY
24/02/1945	D	Dortmund-Ems Canal (R)	With No. 5 Group	HL	N/A	TALLBOY
09/03/1945	D	Bielefeld (R)	Independent	HL	N/A	TALLBOY
13/03/1945	D	Bielefeld (R)	Independent	HL	N/A	TALLBOY
14/03/1945	D	Bielefeld	Independent	HL	N/A	GS / TALLBOY
15/03/1945	D	Arnsberg	Independent	HL	N/A	GS
19/03/1945	D	Arnsberg	Independent	HL	N/A	GS / TALLBOY
21/03/1945	D	Dreyse	Independent	HL	N/A	TALLBOY
22/03/1945	D	Nienburg	Independent	HL	N/A	GS / TALLBOY
23/03/1945	D	Bremen	Independent	HL	N/A	GS / TALLBOY
27/03/1945	D	Farge	Independent	HL	N/A	GS / TALLBOY
06/04/1945	D	Ijmuiden (R)	Independent	HL	N/A	TALLBOY
07/04/1945	D	IJmuiden	Independent	HL	N/A	TALLBOY
09/04/1945	D	Hamburg, U- Pens	With No. 5 Group	HL	N/A	GS / TALLBOY
13/04/1945	D	Swinemünde, <i>Lützow</i> (R)	Independent	HL	N/A	TALLBOY/1,000lb
15/04/1945	D	Swinemünde, <i>Lützow</i> (R)	Independent	HL	N/A	TALLBOY/1,000lb
16/04/1945	D	Swinemünde, <i>Lützow</i>	Independent	HL	N/A	TALLBOY/1,000lb
19/04/1945	D	Heligoland	With No. 5 Group	HL		GS / TALLBOY
25/04/1945	D	Berchtesgaden, Eagle's Nest	With No. 5 Group	HL		TALLBOY

D: Day, N: Night, HL: High Level, LL: Low level, (R): Recalled.

Appendix 2

The Chronological Process

THE CHRONOLOGICAL PROCESS



Appendix 3

**TALLBOY and GRAND SLAM expenditure:
June 1944 – April 1945**

TALLBOY AND GRAND SLAM DROPPED ON OPERATIONS

TALLBOY		TB carried	Dropped	Dropped accidentally	Jettisoned or abandoned	FTR	
Saumur	08/06/1944	19	19				
Le Havre	14/06/1944	22	22				
Boulogne	15/06/1944	22	11	1			
Watten	19/06/1944	18	17	1			
Wizernes	24/06/1944	16	16				
Siracourt	25/06/1944	17	16		1		
St Leu	04/07/1944	17	11				
Mimoyecques	06/07/1944	17	13		1		
Wizernes	17/07/1944	16	16				
Watten	25/07/1944	16	15		1		
Rilly	31/07/1944	16	12				
Brest U-pens	05/08/1944	15	14				
Lorient U-pens	06/08/1944	12	11		1		
La Pallice U-pens	09/08/1944	12	12				
Brest U-pens	12/08/1944	10	9				shortage of TBM 2,000 lb carried
Brest U-pens	13/08/1944	5	5				shortage of TBM 1,000 lb carried
La Pallice U-pens	18/08/1944	11	6				shortage of TBM 2,000 lb carried
IJmuiden E/R pens	24/08/1944	8	8				shortage of TBM 1,000 lb carried

TALLBOY		TB carried	Dropped	Dropped accidentally	Jettisoned or abandoned	FTR	
Paravane	15/09/1944	22	15	2	14		8 x 9 Sqn and 14 x 617 Sqn TB. 6 other a/c carried JW
Ladbergen	23/09/1944	17	6			3	6 x 9 Sqn and 11 x 617 Sqn TB 6 x9 with 1,000lb
Kembs	07/10/1944	13	12			1	
Sorpe Dam	15/09/1944	18	16				
Obviate	29/10/1944	33	33				With 9 Sqn
Catechism	12/11/1944	39	29				With 9 Sqn 20 x9 Sqn and 19 x 617 Sqn
Urft Dam	08/12/1944	24	3	1			With 9 Sqn 5 x 9 Sqn and 19 x 617 Sqn
Urft Dam	11/12/1944	37	35				20 x 9 Sqn and 17 x 617 Sqn
IJmuiden	15/12/1944	17	13		3		
Pölitz	21/12/1944	16	12				
Waalhaven	29/12/1944	16	16				
Oslo Fiord	31/12/1944	12	10				
Bergen	12/01/1945	34	26		2		With 9 Sqn 17 x 9 Sqn and 17 x 617 Sqn

TALLBOY		TB carried	Dropped	Dropped accidentally	Jettisoned or abandoned	FTR	
<i>IJmuiden</i>	<i>03/02/1945</i>	<i>18</i>	<i>17</i>				<i>9 Sqn</i>
Poorteshaven	03/02/1945	18	18				
IJmuiden E-pens	08/02/1945	15	15				
<i>Altenbeken viaduct</i>	<i>14/02/1945</i>	<i>aborted</i>				<i>1</i>	<i>9 Sqn</i>
Bielefeld viaduct	22/02/1945	18	18				
<i>Altenbeken viaduct</i>	<i>22/02/1944</i>	<i>16</i>	<i>16</i>				<i>9 Sqn</i>
<i>Ladbergen</i>	<i>24/02/1945</i>				<i>1</i>		<i>9 Sqn</i>
<i>Ladbergen</i>	<i>03/03/1945</i>	<i>19</i>	<i>17</i>				<i>9 Sqn</i>
<i>Sassnitz port area</i>	<i>06/03/1945</i>	<i>20</i>	<i>19</i>				<i>9 Sqn</i>
Arnsberg viaduct	13/03/1945	18	2		1		9 Sqn 19 x 617 did not bomb
<i>Arnsberg viaduct</i>	<i>14/03/1945</i>	<i>15</i>	<i>14</i>				<i>9 Sqn</i>
Bielefeld viaduct	14/03/1945	14	12	1			14 TB and 1 GS
Arnsberg viaduct	15/03/1945	16	10	1			With 9 Sqn 14 x 9 Sqn and 2 x 617 Sqn
Arnsberg viaduct	19/03/1945	13	12				13 TB and 6 GS
<i>Vlotho Bridge</i>	<i>19/03/1945</i>	<i>18</i>	<i>15</i>				<i>9 Sqn</i>
Arbergen Bridge	21/03/1945	18	17			1	18 TB and 2 GS

TALLBOY		TB carried	Dropped	Dropped accidentally	Jettisoned or abandoned	FTR	
<i>Bremen Bridge</i>	<i>22/03/1945</i>	<i>17</i>	<i>15</i>		<i>1</i>		<i>9 Sqn</i>
Nienberg Bridge	22/03/1945	14	12				14 TB and 6 GS
<i>Bad Oeynhausen</i>	<i>23/03/1945</i>	<i>11</i>	<i>10</i>		<i>1</i>		<i>9 Sqn</i>
Bremen Bridge	23/03/1945	14	11				14 TB and 6 GS
<i>Farge Oil store</i>	<i>27/03/1945</i>	<i>15</i>	<i>14</i>		<i>1</i>		<i>9 Sqn</i>
Farge U-shelter	27/03/1945	7	6				7 TB and 13 GS
IJmuiden Sperrbrecher	07/04/1945	15	15				
<i>Lutzkendorf oil plant</i>	<i>08/04/1945</i>	<i>18</i>	<i>16</i>			<i>1</i>	<i>9 Sqn</i>
Hamburg U shelters	09/04/1945	15	15				15 TB and 2 GS
Lützow	16/04/1945	14	13		<i>1</i>		14 TB and 4 with 1,000lb
Heligoland	19/04/1945	30	27				16 x 9 TB, 14 x 617 TB and 6 GS
Berchtesgaden	25/04/1945	33	25	<i>1</i>			17 x 9 Sqn and 16 x 617 Sqn
			840	<i>8</i>	<i>29</i>	<i>7</i>	
Total TALLBOYS dropped			884				

Sources: 617 Sqn ORB and Flower, 2009. Note: Discrepancies exist between various official documentation and published sources.

GRAND SLAM DROPPED

Target	Date	GS carried	Dropped	Dropped accidentally	Jettisoned or abandoned	FTR
Bielefeld viaduct	14/03/1945	1				
Arnsberg viaduct	15/03/1945	1				
Arnsberg viaduct	19/03/1945	6				
Arbergen Bridge	21/03/1945	2				
Nienberg Bridge	22/03/1945	5				
Bremen Bridge	23/03/1945	5				1
Farge U-shelter	27/03/1945	12				1
Hamburg U shelters	09/04/1945	2				
Heligoland	19/04/1945	6				
Total		40				2
Total dropped		42				

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GRAND SLAM AND TALLBOY (% OF SQUADRON)

Target	Date	GS	TB	% GS	
Bielefeld viaduct	14/03/1945	1	14	7	
Arnsberg viaduct	15/03/1945	2	14	13	Only 1 GS dropped
Arnsberg viaduct	19/03/1945	6	13	33	
Arbergen Bridge	21/03/1945	2	18	10	
Nienberg Bridge	22/03/1945	5	14	31	1 GS not dropped
Bremen Bridge	23/03/1945	6	13	33	1 GS jettisoned
Farge U-shelter	27/03/1945	12	8	60	
Hamburg U-shelters	09/04/1945	2	16	11	
Heligoland	19/04/1945	6	14	30	
		42	124		

Sources: 617 Sqn ORB and Flower, 2009. Note: Discrepancies exist between various official documentation and published sources.

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