THE LONGBOW

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WEAPON

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Series Editor Martin Pegler

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Dedication

For John Waller

Author's acknowledgements

My thanks to my good friends Dr Tobias Capwell and Gordon Summers, who read some portions of the draft text and gave invaluable feedback. I owe an age-old debt of gratitude to Robert Hardy, whose groundbreaking work on the subject in his 1972 BBC documentary 'The History of the Longbow' started me on what has become a lifelong interest. His subsequent writings on the subject have been an inspiration, as have the scholarly writings of so many others, whose researches I have drawn on for this book. I am grateful also to Dr Alan Williams for his guidance in setting up the deceleration tests in 2003. I am equally grateful to Dr Matthew Paine, who organized the blunt-trauma impact tests in 2011. I am indebted to Ian Coote, Joe Gibbs, Mark Stretton and Gary Symonds, members of the English War Bow Society, who have allowed me to photograph them shooting their great warbows, who have participated in archery experiments for some of my television projects and who have been very generous with their time in answering my questions. My gratitude also extends to Mick Manns, fletcher, and Hector Cole, arrowsmith, who have both shared their extensive knowledge with me. The bowyer Chris Boyton has been a constant source of information over many years. I thank him for that and for the two longbows that he made for me. They delight me every time I shoot them. Thank you also to the numerous people and institutions who have provided me with photographs: their names are credited alongside the images. Mostly, however, I wish to thank all those many friends with whom I have spent countless pleasurable hours 'bow-in-hand' and who share with me a passion for this ancient weapon – I have learned much from you all. However, the opinions expressed in this work are entirely my own and not necessarily the views of those who have been kind enough to give me their time and advice in its preparation.

Editor's note

When citing medieval prices and wages, references in this book are to the pre-decimal British currency of pounds, shillings and pence: 12 old pence (12d) made one shilling (1s) and 20 shillings made one pound (£1). In modern decimal currency 100 new pence make one pound. Measurements are given using the imperial scale, which has the following approximations on the metric scale:
1 mile = 1.6km
1lb = 0.45kg
1yd = 0.9m
1ft = 0.3m
1in = 25.4mm
1 gallon (UK) = 4.54 litres
100ft/sec = 30.48m/sec

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INTRODUCTION

In 13th-century England, the longbow began to emerge as a symbol of empowerment for the yeoman classes. Many accounts of the Robin Hood legend root him in this period. The idea that strength and skill can triumph over wealth and status is a powerful one; it is an idea that offers the hope that ordinary people can throw off the yoke of lordly oppressors. Holding more rigidly to standards of chivalric propriety and feudal hierarchy, the French nobility deplored the fact that men of inferior class, men with longbows, were able to fell expensive knights. However, to a certain breed of Englishman, the fact that this simple stick, the weapon of Everyman, was able to usurp the natural order of things made the allure of the longbow all the more compelling. The longbow has remained a very potent symbol of common justice, which is probably why it has continued to receive such romantic treatment. Longbows are also a great joy to shoot.

There are various definitions for the term longbow, including narrow criteria set out by the British Longbow Society (BLS) that would exclude longbows of a medieval type.[1] The first written reference I can find to the term 'longbow' is in a letter from Margaret Paston to her husband John, written in 1449 (Gairdner 1986: 101). At the time John Paston was embroiled in a private war with Robert Moleyns; in 1450 Moleyns sent 1,000 men to dislodge Paston from his castle at Gresham, Norfolk, and his followers subsequently attacked Margaret Paston. She had good reason to attend to the defence of her house. In her letter, Margaret urges John to get some 'crosse bowis' because the house is too low for men to shoot out with a 'long bowe'. Here 'longbow' is a term used to distinguish it from the crossbow – the longbow was both held 'longwise', not mounted

1 The BLS, formed in 1951, exists to preserve the recreational shooting tradition of Victorian- and Edwardian-style lightweight longbows which, unlike medieval bows, have a stiff centre section. It acknowledges that the medieval style of battlefield longbow was of differing specifications and does not claim that what it defines as a longbow is of a medieval type. Medieval longbows bent 'full compass', that is with a continuous arc through the centre section; they also had no binding for the handgrip, which is only a feature of later bows.

'crosswise', and it was also longer than the bow (prod) on a crossbow. Prior to this, longbows were referred to simply as 'bows'.

There is a direct correlation between the length of a simple wooden bow and the length of draw – longbows are also long. Unlike longbows, composite bows – which consist of laminations of various materials including wood, horn and sinew – are capable of taking extreme bend without breaking, and so a laminated bow or bow of composite materials can bend with a much greater arc in proportion to length than can a bow that is fashioned from a single stave of wood – known as a 'self' bow – which is the case with a longbow.

Longbows stood taller than the man who drew them because the height of the man was proportionate to the length of his arms and thus the length of his draw. A longer draw required a longer bow or the bow might break, and it was a characteristic of the medieval military longbow that the archer drew back to the ear or shoulder, a measure that sent his arrows thudding into the enemy with even greater impact. In 1590 Sir John Smythe, soldier, diplomat and author of military treatises, wrote, 'Our English bows, arrows and archers do exceed all other bows used by foreign nations, not only in thickness and strength, but also in the length and size of the arrows' (Smythe 1964: 69).

A late-15th century depiction of archers in action at the battle of Crécy, 1346. They wear an assortment of sallet-style helmets; note the combinations of brigandines, mail and plate. The arrows laying on the ground are possibly an attempt by the artist to represent arrows stuck in the ground and standing upright, but the challenges of perspective may have defeated him here. (Froissart's *Chronicles*, Bibliothèque Nationale de France, Ms. Fr. 2643, f. 165v, © Bibliothèque Nationale de France/Art Archive)

In recent years the term 'warbow' has been coined to differentiate the recreational longbow and the hunting longbow from their more powerful martial cousin. 'Warbow' is not a medieval term but it is nonetheless a very useful descriptor and I will use it intermittently in the ensuing text. However, the warbows to be discussed here are also longbows and it is that latter term, fondly familiar to me, that I will employ primarily in referring to this enigmatic weapon.

On land, the longbow had been used as a skirmish and battlefield weapon in the hands of the Anglo-Saxons and the Vikings. A line in the epic poem *Beowulf*, which may have been written as early as the 8th century and no later than the 11th, hints at the prevalence of battlefield archery during this early period. It speaks of the hero, Beowulf, 'who often endured the iron-tipped arrow-shower, when the dark cloud loosed by bow strings broke above the shield wall, quivering; when the eager shaft, with its feather garb, discharged its duty to the barb' (Anon 1973: 117–18). The longbow was also used by the Normans; the Norman lord Richard de Clare (1130–76), known as 'Strongbow', took several companies

of Welsh archers with him for the Norman invasion of Ireland in 1169. There was nothing to distinguish the longbows of these cultures from their later medieval incarnation other than perhaps increased draw-weight for the later medieval bows.

More significantly the longbow of these earlier periods was not used in great numbers. Well into the 13th century it was still being used for campaigns in difficult terrain, but seldom in pitched battle. However, at the end of that century there was a shift in tactics, and what changed was the scale of the longbow's use. Armies now counted many thousands of archers amongst their ranks and the longbow emerged as a prominent battlefield weapon. It reached its peak of both fame and function when it was employed in massed numbers by English armies on the open battlefield during the Wars of Scottish Independence (1296–1357), the Hundred Years' War (1337–1453) and the Wars of the Roses (1455–85). As a maritime weapon, the longbow would remain of paramount importance throughout the medieval era and until the end of the 16th century, especially for the English.

Although medieval English armies used archers to a greater extent than any other nation, they did not do so exclusively. The Welsh used archers very effectively in guerrilla warfare against Edward I (r. 1272–1307) and subsequently in the service of English kings in foreign wars. The Scots fielded archers, in fewer numbers but in similar manner to the English, on the battlefield. Scottish bowmen also served with distinction in French armies during the latter part of the Hundred Years' War. During the 15th century, English archers were in high demand to fight in the armies of Burgundy, a powerful duchy that was itself at war with France. In the following pages, however, I concentrate solely on the longbow's use by English armies and by English navies, for it is in their service that it made its most conspicuous impact. Moreover, a greater focus has been given to its use in the campaigns of Edward III (r. 1327–77). I consider this to be the longbow's apotheosis and a source of many good examples of its versatility.

Any assessment of the longbow's lethal potential must encompass an understanding of how armour developed to deal with the threat. In fact it is mostly through the progress of armour that we can best track the development of the weapon. In appearance longbows from different eras looked much the same, but it is probable that as armour improved, the draw-weight increased. As we shall see, there was certainly an evolution in arrowhead styles, which included not only armour-attacking forms but also case-hardened points. It may be argued, however, that the most significant developments in the longbow's trajectory to iconic weapon status were changes in the recruitment and tactical deployment of the archer himself.

Archers faced a mighty and impressive foe. The most glorious, most splendid and possibly the most powerful warrior ever to put his stamp on the battlefield was the fully armoured medieval knight. He engaged the enemy by smashing into him, and it was the archer's task to stop the knight in his tracks. The bowman did not always pull it off – but when he did, he became the stuff of legend.

DEVELOPMENT

The longbow's genesis and production

ORIGINS AND DISCOVERIES

As a hunting weapon the longbow can be traced to the Neolithic period, which begins around 10,000 BC. Extant examples include that of Ötzi, a Stone Age hunter, whose preserved body was discovered in the Italian Alps in 1991. His yew longbow, dated to around 3,300 BC, was made from the heartwood only. Glacial refrigeration kept Ötzi's bow 'on ice' for us, but numerous longbows have been conserved by other geological caretakers, peat bogs and marine silts, which preserve organic material by creating oxygen-free environments.

In 1863, 40 longbows were discovered in a bog at Nydam in Denmark. Dating to the 4th century, these magnificent bows – some made of yew, some of fir – were recovered from three ship burials. The Nydam bows are in a state of almost immaculate preservation and are on display at Denmark's Nationalmuseet (National Museum) in Copenhagen. Of particular interest on two of the bows is a spike at one end – one of metal, the other of bone – suggesting an anticipation of close combat, for which the bow can be hastily converted into a pike/spear. Although relatively little is known of its use during this period, the military longbow had made its debut.

To date, no longbows from the actual medieval period have been unearthed, but there is abundant evidence for their physical form in the cache of superb mid-16th-century specimens that emerged from the Solent mud – the warbows of Henry VIII's warship the *Mary Rose*. This momentous development in our understanding of the longbow came between 1979 and 1982 with the excavation and eventual raising of part of the hull of the *Mary Rose*, which sank in 1545; of the 172 bows salvaged, 137 are fully intact. They represent the closest material resource for understanding the medieval longbow that we have to date (Hildred 2011: *passim*).

These bows proved to be of similar cross-section and length to many of the longbows that were retrieved from the Nydam ships. Fundamentally they were identical, though the draw-weights of the *Mary Rose* bows were notably heavier. Of further note is that not all the *Mary Rose* bows were of the same cross-section; some were plano-convex (D-shaped) while others were oval.

Within this narrow range of variation, the design of the longbow itself – the wooden stick – did not change very much over the centuries, but the longbow did not exist in isolation. It was part of a developed weapons system that included the archer as operator, the bow as the launch platform, the arrow as the delivery platform and many target-specific forms of arrowhead as the actual weapon. It is in these other elements that change and development are to be found. One of the main catalysts for these changes was the continual improvement in armour's defensive capability from the mid-13th century onwards, since, on the battlefield at least, armour was the principal challenge that the longbow faced. Before examining the bow itself, it is important to understand this challenge and what the longbow had to overcome to be a viable force on the medieval battlefield.

COUNTERING THE LONGBOW: MEDIEVAL ARMOUR

Any consideration of the longbow's effectiveness in battle must deal with the subject of armour. While a thorough survey of this topic would consume several volumes, there are a number of general principles that it is useful to understand.

Given average battlefield conditions, armour was reasonable proof against the weapons of the day. Had it not been, fighting men would not have gone to the expense of acquiring and wearing it. Throughout the Middle Ages, most troop types wore some form of armour and this is unlikely to have been the case if armour did not deliver adequate protection. Even at the lower end of the price range, there was a significant cost to armour relative to the means of the wearer. As well as the expense of its acquisition, armour demanded time and money for its maintenance.

There was also the inconvenience of armour. All types of armour, including full-plate armours, allowed the required range of martial movement. Nevertheless, the soldier would have been able to move more freely and more comfortably without it. Armour has always been a manageable weight, seldom exceeding around 65lb – significantly less than the standard weights carried by modern infantrymen. A 2007 Naval Research Advisory Committee report entitled 'Lightening the Load' gives the following weights for a US Marine Corps rifleman: Existence Load (landing zone – secure area), 167lb; Approach Load (20-mile march within eight hours maintaining 90 per cent combat effectiveness), 123lb; Assault Load (into the fight), 97lb. It should also be noted that the modern soldier carries the majority of this load on his/ her back, whereas medieval armour distributed the load across the body.

Even so, there was a weight factor to armour, which affected comfort and fatigue and which would not have been endured without compensating advantage. In warm weather armour was unpleasantly hot and, in winter

conditions, the metal conducted the cold. Ventilation was also a significant issue. With armour for the head, there was a trade-off between full protection and full peripheral vision.

Set against this premise are the legions of tests, from the backyard to the laboratory, that have demonstrated time and again the ability of arrows shot from a longbow to penetrate all kinds of armour.[2] The results of the tests are indisputable: arrows shot from powerful longbows punch through virtually everything put in front of them, and they do so to depths that would deliver mortal wounds. Such tests confirm that the longbow, at the appropriate draw-weight and with the appropriate arrowhead, was a formidable weapon. However, there are a great many factors that determine an arrow's ability to penetrate armour, and the isolated conditions of the testing ground never fully replicate the complex and chaotic circumstances of the battlefield.

Types and forms of armour varied a great deal over the centuries of the longbow's use and what follows is only a brief summary of some of the main elements the longbow confronted.

Shields

The shield was the most significant item of defensive equipment against arrows. Shields were of composite structure and although some were made from adjoining panels, the core of most was formed from a single piece of wood – a German stained-glass window fragment of *c*. 1400 in the Glasgow Museum's Burrell Collection shows a shield-maker working a shield from a solid block of wood using an axe. In order to retain the curved shape, seasoned timbers were essential. European poplar and lime (also known as linden, or basswood in the USA) were the favoured woods, known both for being lightweight and easy to carve. Sycamore was another common choice; it was a little heavier, but harder.

To bolster the dense, energy-absorbing properties of the wood, shields were reinforced with multiple laminations of heavy-duty canvas, sometimes with an additional layer of parchment, which were bonded with casein glue to both surfaces of the core. Mosaic strata of horn or bone were familiar facets on jousting-shields, many of which survive. Such an additional layer on battle-shields, few of which remain to us, would have been highly effective. Most shields were finished additionally with a facing of leather, sometimes rawhide. On the reverse was a linen-covered pad, often of hair-felt, which not only buffered the shock of impact but also gave yet more depth to challenge arrow penetration.

I am not aware of any longbow testing against an authentically constructed shield but I would be fairly confident that, if properly made, the shield would be up to the task. A shield did not protect the whole body, but, held just a little way in front, it gave effective cover to a wider area than its own surface dimensions, particularly to the vital areas of chest and head. For massed troops, those behind the men of the leading rank were to a large

2 Many of the most compelling tests of this nature have been carried out by Mark Stretton and others of the English War Bow Society (EWBS); the results have been published in Soar 2006 (127–52), which contains two chapters written by Mark Stretton.

extent shielded by those in front, and so a shield held at an angle above the head would have offered a reasonable umbrella of protection. The English chronicler Geoffrey le Baker observed that the French knights at Poitiers advanced in close formation, 'protecting their bodies with joined shields, [and] turned their faces away from the missiles. So the archers emptied their quivers in vain …' (quoted in Strickland & Hardy 2005: 237).

Cuir-bouilli

As a material for armour, cuir-bouilli, a treated, hardened form of leather that was soft and pliable before drying, was well suited to forming into shaped pieces of armour, such as those for the limbs. These shaped pieces were often reinforced with metal splints. It was also available in large sheets, something that was not usually possible with iron and steel until the latter part of the 14th century, and this made it ideal for making large, globose breastplates from a single piece. In fact we get the term 'cuirass' from the fact that early breastplates were made from *cuir* (leather). There is discussion among historical leather-workers as to the exact nature of cuir-bouilli (Richardson & Beabey 1997: 94–101). Some favour boiling the leather in water, making it very hard, though perhaps a little brittle; others support the idea of impregnating it with hot beeswax. Either way, it was considered an extremely tough material and made for very useful armour.

Mail

Perhaps the most universal metal armour of the medieval period was mail, which combined good protection with excellent flexibility. It also had the potential for repair and modification, important factors for those of lesser means. Not all mail was created equal; variations included the thickness of the wire and the diameter of the links as well as the quality of the metal. Some mail featured all the links being closed with a rivet, while other examples were comprised of alternating rows of riveted and solid links. The regular assembly method attached each link to four others – two in the row above and two below. However, there is evidence for heavier, six-in-one weaves, with three in the row above and three below, which created a much denser defence.

Mail tends to be especially effective in resisting cutting blows from a sword or axe. It is less useful against the punch of a bodkin-style arrow, but in order to be penetrated, the arrow needs to strike mail at a good angle at close to 90 degrees to the target surface. Even when it fails to prevent penetration, the mail continues to have some effect on an incoming arrow by absorbing a great deal of the delivery energy.

Mail standard or pizane, *c.* 1350. These were high-standing collars, offering protection to the neck and throat. The collar part extended into a mantle, which defended to just below the shoulder. Note 4:1 assembly ratio for the mantle and a 6:1 ratio for the standing part of the collar. The yellow metal (copper alloy) is decorative. This is a good example of how the defensive properties of mail can be increased over vital areas by altering the construction. For those who could afford them or had the opportunity to loot them, mail collars like this, known either as standards or pizanes, were popular forms of armour for archers during the 14th century. They did not affect the bowman's ability to draw his bow but gave good protection against downward strikes from a cavalryman's sword. (British Museum PE 1856,0701.2244 © The Trustees of the British Museum)

Textile armour

The key to the effectiveness of medieval armour was the use of composite, layered materials; the outer skin of

leather or metal was only the front line of defence, while the textile armour worn beneath provided the real stopping power. The base layer of any medieval armour was the aketon or gambeson, a stuffed and quilted knee-length coat that not only offered formidable resistance to the shock of impact but whose dense layers also obstructed penetration.

A popular form of armour among archers in the 15th century was the jack, a shorter-length coat of defence. One of several construction forms consisted of 25 or more layers of linen, plus often an outer layer of deerskin, stitched in a quilted pattern that gathered the material. This 'gathering' condensed the surface area, bunching the fibres into a denser, more impenetrable mesh, which provided excellent protection in addition to the depth of multiple layers. Textile armour, such as the jack and the gambeson, was considered to be so effective that it was often worn on its own.

Writing in 1483, the Italian traveller Dominic Mancini observed: 'the more common soldiery have more comfortable tunics that reach down below the loins and are stuffed with tow or some other soft material. They say that the softer the tunics the better do they withstand the blows of arrows and swords' (quoted in Strickland & Hardy 2005: 383).

Plate

A major enhancement to both mail and textile armour was the coat-of-plates. This consisted of metal plates riveted to the inside of a leather or linen base, giving protection to the front, back and sides of the torso. Most well-armoured knights at Crécy would have worn coats-of-plates over mail shirts, in turn worn over gambesons or aketons. This was significant, multi-layered, composite protection.

Exterior view of replica coat-of-plates. Note that this construction method allows for considerable shaping of the plates and that the larger plates over the chest are prominently domed. (Photograph by kind permission of Stanislav Prošek, Mac-Armour, Czech Republic)

The principle of riveting or stitching plates to a textile base was also used to good effect with the brigandine and the jack-of-plates. Here smaller plates were used and overlapped for improved resistance. These armours became increasingly common in the 15th century, especially for archers, because they retained the flexibility of mail but had the added stopping power of plate, which was necessary in an age when the archer more commonly confronted enemy archers in the opposing army.

For knights, the limiting factor in getting better protection for the torso had been the inability to produce large plates of iron or steel from the bloomery hearth process, hence the need to make larger structures out of smaller plates, such as the coat-of-plates. However, in the late 14th century it became possible to produce large plates of ferrous metal reliably and repeatedly (Williams 2003: 55). This technological advancement made one-piece breast- and back-plates a reality and heralded a fundamental shift in armour design.

Interior view of replica coat-of-plates. Note that the finished armour would be worn over a combination of mail and textile armour. (Photograph by kind permission of Stanislav Prošek, Mac-Armour, Czech Republic)

Before the advent of solid-plate body armour, all forms of armour were flexible to some extent – they gave on impact. This meant that the

North-west European brigandine, *c.* 1540–50, Royal Armouries, Leeds. This 16th-century example of a brigandine differs very little from medieval types. Note how the small overlapping plates not only articulate well but also allow for a tailored, form-fitting configuration that enhanced the wearer's range of comfortable movement, especially around the shoulders and armpits. In addition to the defensive capabilities of the plates, the mass of securing rivets and the layers of fabric also combined to augment the quality of protection. Originally the term 'brigand' referred to any foot-soldier and the armour derived its name from its ubiquitous use by such troops. (© The Board of Trustees of the Armouries)

energy of a blow could significantly affect the body's soft tissues, internal organs and even skeleton, as the armour flexed against the striking force, even though it might have prevented penetration. Large, shaped plates enabled rigidity. Now the body could be fully encased in a hard shell. There was still a need for some padding inside to absorb the shockwave of an impact, but much less than was required previously.

Further improvements came with the ability to harden the plates. Almost all medieval armour before the late 14th century was made of wrought iron, which could not be hardened and tempered because it contained only negligible traces of carbon. By the early 15th century, however, steel was becoming easier to produce in large amounts. An alloy of iron and a more significant amount of carbon (around 0.5–0.8 per cent), steel could be heat-treated in various ways to improve its protective qualities substantially – it could be hardened (Williams 2003: 938–39). Access to strong, tough, heat-treatable steel eventually allowed armourers to create fully arrow-proof harnesses for those who could afford them.

In the Statutes of the Armourers of Paris in 1451, the marks of Italian armourers are deciphered as meaning either *à toute épreuve* ('full-proof') or *à demi-épreuve* ('semi-proof'). The suggestion is that the semi-proof armours were tested with lever crossbows and that the full-proof ones had withstood being shot at with the more powerful windlass crossbow (Williams 2003: 924). Such a system would have given knights confidence in their equipment, though any perceived guarantee would be of small comfort if the claim proved to be false.

As well as its varying degrees of hardness and toughness, the effectiveness of plate armour was determined by its thickness and its shape. Plate armour could be thinner, and therefore also lighter, than might be expected, not only because of the strength of the metal itself, but also because of the structural integrity imparted by a strong form – a curved, dished plate being much more resistant to deformation than a flat sheet. The thickness of armour plates also varied according to the vulnerability of the different parts of the body; plates tended to be thinner on the arms and legs, and thicker on critical areas such as the chest and head, where a serious wound was much more likely to prove fatal. Limbs were therefore potentially more susceptible to arrow injury – but then they were also smaller, narrower targets and more likely to be in significant motion during combat.

Perhaps the most important element of plate armour's defensive capability was its ability to cause deflection. Unless an arrow strikes at an angle close to the perpendicular it is most likely to be deflected and, even if it bites, the impact will be greatly lessened according to the angle.

Great helm, *c.* 1350. Although early forms of the visored helm had been developed by the time of the battle of Crécy (1346), it was more common at this period for both English and French knights to wear great helms like this example. Great helms were usually worn over an open-faced bascinet, giving a double layer of metal protection to the skull. Ventilation was an issue and in the stifling heat of battle, some knights might take their chances against arrows, trusting to their shields, and wear only their open-faced bascinet. Arrow wounds to the face are commonly reported in the chronicles. An aventail of mail attached to bascinets would protect the throat, neck and shoulders, whether or not it was worn alone or beneath a great helm. The mail tippets seen on this great helm would have added a double layer of mail protection to a vulnerable area. (Germanisches Nationalmuseum, Nuremberg/Bridgeman Art Library)

Horse-armour

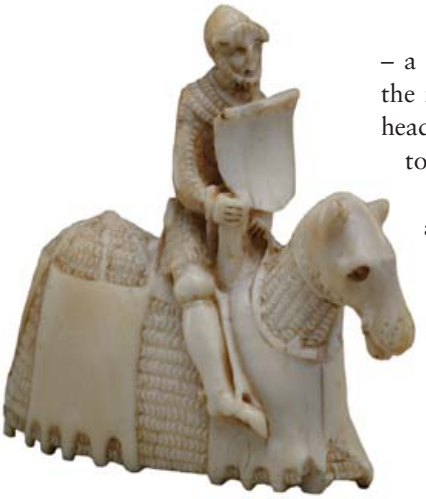
Horses, though extremely vulnerable on the battlefield, were not entirely undefended – they too had armour. By the end of the 15th century, plate armour began to be available for some horses, but until then medieval horse-armour consisted of padded textile, leather and mail (Breiding 2000: *passim*). Today these perishable and recyclable materials survive only as fragments. Clear images of this type of horse-armour are rare because an outer textile covering – the cloth caparison – mostly obscured it. However, it did exist. As early as the 13th century, during the wars of Edward I, there are records of squires with armoured horses being paid 1s per day, while those with unprotected horses were paid only 8d per day (Williams 2003: 42).

Philip VI of France had two horses killed under him at Crécy (Ayton & Preston 2005: 150). Circumstantially we can deduce that Philip's mounts were taken out by English archery. All armour could fail and horse-armour was no exception, even though a king's horse might be expected to have been fully armoured. Certainly it was technically possible to build full armour for horses, and it would be a mistake to assume that all medieval cavalry were easy targets. The animal's size meant that it was a costly business to armour it, especially if remounts were to be similarly equipped, and there was probably some variation in the amount and quality of horse-armour worn. Nevertheless, most knightly horses were fully enclosed with a protective 'bard'.

A chess piece, contemporary with the first part of the Hundred Years' War and now in the Metropolitan Museum of Art in New York, shows a full mail bard for the horse (see overleaf). The large panels hanging over the mail are not iron or steel – at this period it was not yet possible to produce single plates of this size. More probably they represent 'cuir-bouilli', a common material for armour. As with the rider's armour, there would have been padded textile armour beneath the mail. There appears to be some form of domed bolster of extra-thick padding on the horse's back behind the saddle

The Wallace Collection, London/Bridgeman Art Library

This type of visored bascinet, with steep deflecting surfaces, emerged around 1370 and is typical of those worn at Agincourt (1415). Dramatic developments of form can be readily discerned from the great helm. This design offered the optimal protection to a man walking towards an onslaught of arrows. The deep snout not only encouraged arrows to be turned aside but also allowed the sights to be placed significantly further forward from the eyes than had been possible previously, so that even long, narrow bodkins seeking to snake through the narrow slits would become wedged before piercing their target. It is hard to imagine a more unnerving experience than seeing this at first hand. The position of the sights reduces the wearer's field of peripheral vision, and it is for this reason that there are secondary sights beneath the snout. These allow the wearer to look down to see the terrain below, whether he is mounted or on foot.



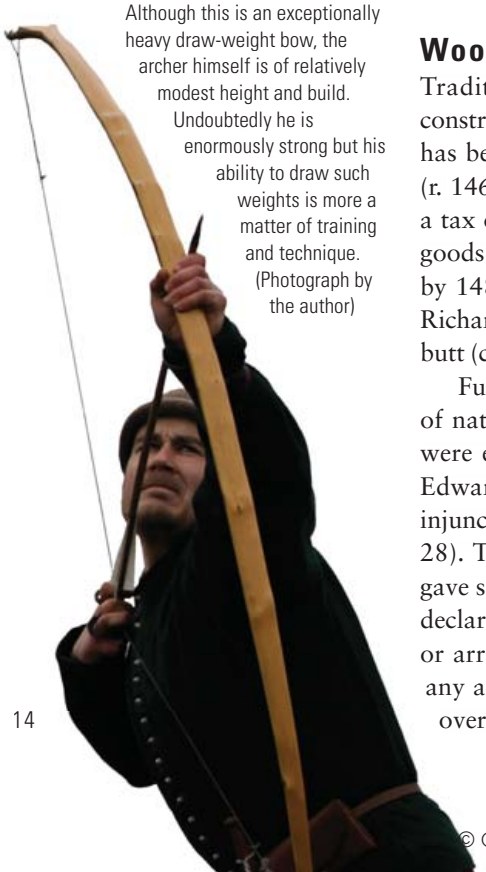
Ivory chess piece, believed to be English, from between 1350 and 1375. (The Metropolitan Museum of Art, New York, Pfeiffer Fund, 1968, 68.95, © The Metropolitan Museum of Art/Art Resource/Scala, Florence)

– a large area vulnerable to falling arrows, though equally exposed to the fall of a sword in close combat. The shaffron covering the horse's head, including its ears, has a moulded shape, suggesting that this is intended to represent cuir-bouilli.

The permutations of different types of armour, its varying quality and the extent to which it was provided for man or horse are many, but tests that purport to assess the capabilities of the longbow are equally tests that evaluate the effectiveness of armour, and the question should equally be 'did we get the armour right?' as much as it is 'did we get the archery right?' I will come to such tests in due course, but first to the heart of the matter – the bow.

BUILDING THE BOW

Whether a bow would bend or break was down to delicate judgements of the bowyer's eye and his ability to decipher the instructions from the fine print of the wood's grain. For this he needed good light and in 1371 Edward III ordered that 'no bowyer of London shall work by night from henceforth, on pain of paying … for each offence half a mark'; the same order also prohibits fletchers from working after dark (Memorials). Such a law tells us that the supply of sub-standard bows was a significant problem for an army that ordered them in great quantities. In 1399, an individual named Tom Coton was appointed the Maker of the King's Bows, and was charged with inspecting the quality of bows supplied to the English national arsenal at the Tower of London (Megson 1993: 30).



Joe Gibbs of the EWBS shooting a 170lb warbow made from Italian yew by bowyer Ian Coote. The staggering power of this immense bow is evident in the flex of its great limbs. Although this is an exceptionally heavy draw-weight bow, the archer himself is of relatively modest height and build. Undoubtedly he is enormously strong but his ability to draw such weights is more a matter of training and technique. (Photograph by the author)

Wood for bows

Traditionally, yew has been considered the wood of choice for the construction of longbows and yew from southern Europe, especially Italy, has been regarded as the best of all. In 1471, as the Yorkist Edward IV (r. 1461–70, 1471–83) resumed the English throne, customs tariffs levied a tax of four yew staves for every tun (cask with 252-gallon capacity) of goods imported into England from Italian merchants (Megson 1993: 54); by 1483, the year of Edward's death and the accession of his brother as Richard III (r. 1483–85), the duty had changed to ten bowstaves for every butt (cask with 126-gallon capacity) of Malmsey wine (Megson 1993: 85).

Furthermore, finished bows of any timber were regarded as an asset of national importance; accordingly, as well as import incentives there were export embargoes. In 1371, towards the end of the long reign of Edward III, 300 bows were confiscated at Southampton with a royal injunction that 'they shall not be taken out of the realm' (Megson 1993: 28). The following year an order to customs officers at Dover, which gave safe passage to a returning group of papal envoys and their retinues, declared, 'They or any of their company shall not take with them bows or arrows save two or three bows and as many sheaves of arrows, nor any armour, gold or silver in the lump, in plate or in any coined money over and above their reasonable expenses …' (CCR Ed III 1363).

A common alternative to yew was wych elm. The clergyman and chronicler Giraldus Cambrensis (Gerald of Wales) reported that the bows of the archers he encountered on his journey through Wales in 1188 were fashioned from elm (Cambrensis 1894: 371). Lord Admiral Thomas Howard, in accounting for deficiencies in some of the bow stocks supplied to the *Mary Rose* in 1513, complained that those that 'could not abide the bending' were of wych elm (quoted in Soar 2006: 12). The Anthony Roll inventory of the ship in 1546 records 250 'bows of eugh'; it makes no mention of other woods (quoted in Hildred 2011: 581). Taken together with the Admiral's statement, this might lead to the supposition that any wood other than yew was not fit for service. Earlier inventories of the Tudor fleet, however, record the regular use of bows of other woods, including elm (Hildred 2011: 580).

That yew was superlative for the task and was highly esteemed at the time is beyond question, but the Admiral's condemnation meant only that a particular consignment of wych elm bows, perhaps from the same supplier, were shoddy goods. I have spoken to a number of present-day archers who shoot with bows made from wych elm and they praise it universally as an excellent bow-wood. This is just as well because, for many medieval archers, their lives depended on it. Medieval longbows were fashioned from a diverse assortment of timbers.

Section of seasoned Italian yew, showing the natural bond between the creamy sapwood and the dark heartwood. Note that the grain is fairly straight, close and regular in size, which makes it ideal for building a heavy draw-weight bow. The yew tree – *taxus baccata* – grows throughout Europe, with some of the best growing conditions situated in the Italian Alps, although Spanish and Portuguese yew were equally prized. Trees in dense plantation, competing for sunlight, grew tall and straight. Moreover, on mountainsides or sandy soils with comparatively poor nutrition, trees grew slowly. Slow growth in even climate conditions resulted in a high-density, fine-grained wood that had the ability to store energy without failing. Modern bowyers talk about the sapwood of Italian yew as having a 'plastic' feel when being worked. Certainly it is more resistant to lifting than English or Welsh yew. This enables it to 'contain' the bow at draw, giving enhanced security against breakage and so making it the desired material for the heavier bows. (Photograph courtesy of Magén Klomp)

Draw-weights

From the moment the first *Mary Rose* bows were released from the care of the Solent mud, debates have raged about the draw-weights of medieval longbows. These mighty staves suggested draw-weights far greater than had previously been imagined, although circumference is not an infallible indicator of draw-weight – I have seen 100lb bows that have a more slender girth than some 80lb bows. Much depends on the individual stave of timber. Nevertheless, the *Mary Rose* bows were monsters and here they were in magnificent abundance.

Most modern recreational archers shoot bows in a 30lb to 40lb range and those who hunt with the bow find 70lb adequate for killing large animals such as deer. A 90lb bow used to be considered something

These six longbows have been constructed by bowyer Joe Gibbs from a range of woods in use during the medieval period. From left to right, with the draw-weight noted, these are: English yew (118lb @ 32in); plum (100lb @ 32in); ash (130lb @ 32in); hazel (160lb @ 32in); wych elm (160lb @ 32in); and holly (scorched from heat treatment; 130lb @ 32in). (Photograph by the author)

Ian Coote of the EWBS demonstrating the long draw of the medieval archer. The sole surviving complete medieval arrow found to date, the Westminster arrow, has a total length of 30½in. However, a tall man, such as the archer in this photograph, would require an arrow of around 32in. Medieval archers drew their bows back much further than modern archers do – 'Draw, archers, draw your arrows to the head!' (Shakespeare, *Richard III*, Act V Sc 3) – it was vigorous work and it required bows that would take this level of bend. (Photograph by the author)

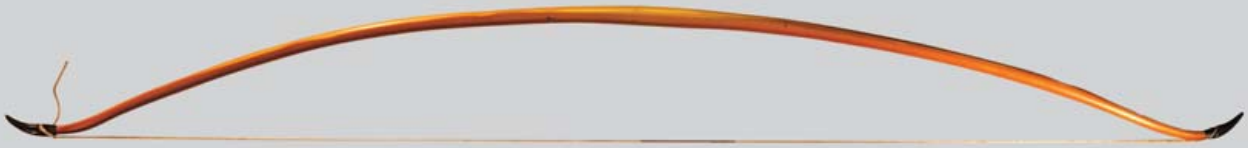
that only rare individuals were able to manage. Now the needle has shifted and 90lb is at the lower end of the dial for today's warbow archers. There are a growing number who shoot bows over 100lb with apparent ease and a select few are shooting above 140lb, with some managing an astonishing 170lb. By the time the printer's ink is dry on this page, there is likely to be a new record. Shooting exceptionally heavy bows is clearly possible and there is no doubt that the heavier the bow, the harder the hit and that there is good military advantage in that. Nevertheless, I consider it unlikely that any but a rare few would find the heaviest bows practical for battle.

In 1355, the year before the battle of Poitiers, archers from Cheshire were paid 6d per day and those from other areas 3d per day (Strickland & Hardy 2005: 204). It is probable that this pay differential distinguished the regular and elite archers, and we might expect the higher-paid archers to shoot stronger bows. However, in battle they too would need to be able to shoot them for a sustained period and with great urgency. When an enemy is bearing down on you, it is not only about what weight you can pull; it is also about the number of repetitions you can manage.

Circumstantially, based on the fact that the capability of armour to defend against arrows improved so much between the mid-14th and the mid-15th century, we can reason that the average draw-weight of bows increased gradually throughout this period in an attempt to edge ahead in the arms race. Everyone will have his or her own opinion and, for what it is worth, mine is that battlefield bows had draw-weights of between 90lb and 120lb around the beginning of the Hundred Years' War and that these increased in the ensuing century to between 100lb and 140lb, with the majority of archers shooting bows at the lower end of these scales.

The fact that people today can shoot bows of 170lb does not necessarily signal that this was a manageable weight in battle, but it does lend credence to the notion that archers of this ability would be capable of sustained, rapid shooting with 120lb or even 140lb bows. They would be the elite, however, and by far the greater majority would be shooting bows nearer the 100lb mark. I do not doubt that super-heavy bows existed for a super-elite of archers and that they could be of use in sieges or at sea, but I question the suitability of anything over 140lb for land battle.

Even drawing a 100lb bow remains a considerable feat, and for the men who bent these bows in battle, the work rate was phenomenal. Lactic acid builds up quickly at these weights, and in a desperate fight archers would have to push through immense walls of pain in order to keep their shafts flying.



The recurved longbow

A distinctive variation of the regular medieval longbow can be seen in many manuscript images. It was recurved at the ends. There is controversy in determining its geographical distribution and the extent of its use during the medieval period. Without the material evidence of actual bows, it is hard to be certain. Some maintain that it was exclusive to the archers in the service of Burgundy; this is based on the fact that recurved longbows are more commonly seen in Burgundian art. English archers were, of course, a mainstay of Burgundian armies during the 15th century, and so even if Burgundy were the source of this style, it may well have been adopted by some English bowmen also.

There is further debate about the method of manufacture. One theory proposes simply that staves were selected which already embodied a recurved profile. Another is that the limbs were bent into shape on a former and heat-treated to set them. (I own such a heat-treated bow. After three years the curves straightened out but they were reset and it has now lasted another six years. I still shoot it quite often. It is my favourite longbow, with a beautifully smooth action.)

ABOVE Modern replica of a medieval recurved longbow, made by Chris Boyton. The advantage of such a design is that the recurved shape makes the limbs work faster, the tips snapping forward like striking snakes, which in turn moves the string faster. This results in an arrow speed that would otherwise have required a bow of far greater draw-weight to initiate. Quite simply, it is a more efficient spring. (Photograph by the author)

The performance benefit of a recurved bow is that it has the ability for better cast – that is, it will propel the arrow further than a straight-limbed bow of equivalent draw-weight. The renowned bowyer Richard Galloway, a proponent of the ubiquity of medieval recurved longbows, calculated that recurving a bow added 20 per cent advantage to the cast (Soar 2010: 38).

It seems probable that there were various regional styles to the profile and cross-section of longbows, and that the option and benefits of recurved limbs were widely known by all. Nevertheless, there is considerably more work involved in fashioning a recurved longbow. They were therefore more expensive and took longer to make, so at times of high national demand it seems more likely that it was straight-limbed bows that were produced and stacked in their thousands in the nation's arsenals.

BUILDING THE LONGBOW ARROW

Arrow supply and demand

'And then the battle raged at its fiercest, and our archers notched their sharp-pointed arrows and loosed them into the enemy's flanks, keeping up the fight without pause. *And when their arrows were all used up*, seizing axes, stakes and sword …'. So wrote the anonymous chronicler of *The Deeds of Henry V*, reporting how the English archers ran out of arrows at the battle of Agincourt in 1415 (quoted in Curry 2009: 36 – my emphasis). It may be true that arrow resupply to detachments on the flanks was more difficult than it would be to archers in the front of the main army, and uncorroborated observations by individual chroniclers have to be read with a measure of caution. Nevertheless, our anonymous chronicler highlights a critical issue for effective military archery – arrow supply!

In 1360, 500,000 arrows were delivered to the national arsenal at the Tower of London, making an impressive addition to the existing stocks; this followed a consignment of 850,000 arrows sent the previous year (Hardy 1992: 84). In 1417, just two years after Agincourt, an order went out for six feathers from every goose; a year later the counties had to supply 1,190,000 goose-feathers to the Tower (Hardy 1992: 83). The Tower of London wasn't the only receiving depot; 11,000 arrows were

dispatched to Bristol prior to the Crécy campaign in 1346 (Hardy 1992: 83), and we may imagine various other regional repositories garnering similar numbers. Other sporadic statistics hint at the scale of supply, which, naturally enough, escalates considerably both just before and just after a campaign.

Apart from the limitations of what the nation's fletchers could supply, there were considerations of logistics, ships and wagons in getting ammunition to the battlefield. We know from the 1513 campaign conducted by Henry VIII (r. 1509–47) that 240,000 arrows required 26 wagons (Hardy 1992: 86). Edward III took around 7,500 archers[3] with him on his Crécy campaign in 1346. For an archer army of this size it is likely that he required between one and two million arrows, which makes for quite a wagon train.

The cost of arrows

Medieval longbow arrows were, arguably, the most expensive form of small-arms ammunition ever devised. Arrows were counted in sheaves, with 24 to a sheaf. At various times statutes required an archer to provide a sheaf of arrows, along with his own bow, as part of his equipment when he was arrayed. In 1356 a sheaf of arrows sold for 16d; arrowheads cost 2s 6d per hundred, and may have represented an additional cost (Strickland & Hardy 2005: 21). Most regular archers were paid 3d per day (Strickland & Hardy 2005: 204), though men of elite corps and mounted archers were paid more. In other words, at this time a sheaf of arrows might cost a man the equivalent of over five days' wages, so not only did his sheaf contribute to the overall army ordnance, it also meant that the archer understood, in a very personal way, the value of each shaft he shot. It was, furthermore, an inducement for him to retrieve what shafts he could for mending at the end of a battle.

Wood for arrows

Roger Ascham, Latin and archery tutor to Edward VI (r. 1547–53) and Elizabeth I (r. 1558–1603), wrote *Toxophilus*, the first book in English on archery, in 1545. It remains a standard work on how to shoot and is full of practical knowledge. In it he exhorts the use of ash for arrow-shafts, saying it is 'swiftest and again heavy to give a great stroke, which asp[en] will not do' (Ascham 1968: 166). He clearly understood the principle that the impact force of an arrow strike was determined by both the weight of the projectile and its speed. He lamented that the lighter, inferior aspen – known more commonly today as poplar – was in contemporary use. Samples from the 2,600 arrows recovered from the *Mary Rose* show that 77 per cent were fashioned from aspen/poplar (Hildred 2011: 674), although nine other woods have been identified.

3 Estimates vary. Clifford Rogers (Rogers 2000: 423) calculates 7,000 foot-archers plus an unspecified percentage of his estimate of 3,500 mounted archers and hobilars. Andrew Ayton (Ayton & Preston 2005: 189) offers a more conservative 5,000 foot-archers plus an unspecified percentage of 3,500 mounted archers and hobilars. I have steered between these two.

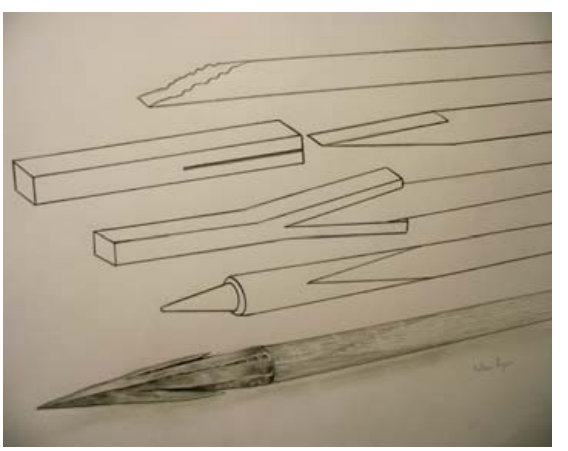
Aspen also appears to have been the wood of choice in the previous century. In 1416, Henry V (r. 1413–22) ruled that aspen could only be used for arrows (PRME: 24: III), prohibiting by the same order its use for pattens (wooden overshoes, with a deep carved sole similar to a clog; they were in widespread popular use during the medieval period). It was a ruling that confirmed his reliance on aspen shafts for his famed archer army. In fact, the preamble to this legislation states:

> 'The fletchers of the city of London and elsewhere in the realm have always been accustomed to use, and still do use, a wood called aspen, and no other wood, for making arrows of all kinds'; it goes on to declare, 'it is probable that within a short time the same wood called aspen will be completely exhausted by the said patten-makers, to the great and perpetual detriment of archery' (PRME: 24: III).

Errant patten-makers were to be fined the princely sum of 100s. This spotlight on potential shortages of arrow-making materials gives support to the idea that damaged arrows may have been harvested from the battlefield and taken for repair.

Recovering and repairing arrows

What percentage of shot arrows survived a battle, to be gathered by the victor, is hard to estimate. Shot arrows that landed on the ground, either directly or by ricochet, were vulnerable to the crowding stamp of both feet and hooves, while those embedded in a dead comrade or opponent might easily break during attempts to extract them. Depending on where an arrow broke, it was possible to repair it, and Ascham mentions 'piecing of a shaft with brazil or holly or other heavy woods' (Ascham 1968: 168). It was an elaborate process (today called 'footing') that involved splicing with fishtail joints, and so it was unlikely to have been accomplished in a campaign camp. With his mention of more exotic woods (brazil wood came from India), Ascham is referring to a bespoke, superior-grade arrow, but it would be equally possible to piece an arrow with the same species of wood as the main shaft. We might imagine that there was some profit in gathering arrows after a battle, including those that had broken near the head. However, they would all probably need expert attention in a fletcher's workshop before they could be recycled for use.



Stages of 'piecing' an arrow. First the broken end of the arrow is cut with precision into a wedge. A piece of new timber is sawn to receive the wedge and the two parts are spliced and glued together. The repair is then shaved to conform to the shape and size of the rest of the shaft. Before a head can be fitted, the foreshaft must be pared to receive it. (Drawing by Matthew Ryan)

By the time of the Wars of the Roses in late 15th-century England, during which both sides used massed archers, there may have been the possibility of gathering up enemy arrows before they were trampled, but in battles such as Crécy, Poitiers and Agincourt, no such opportunity presented itself. Arrow supply remained a critical factor for an army that was reliant upon massed archers.

Making an arrow

First, a stave of seasoned timber is split into *square blanks* (**1**). Aspen (white poplar), ash and birch were the commonest types of wood used for arrow-shafts. The square blanks are worked on a *shooting board* (**2**), which has a rounded groove in which to rotate the blank. It is first worked with a straight plane to take off the corners and to taper a bobtail profile, which narrows towards the nock end of the arrow, giving improved aerodynamic properties.

Next, a *finishing plane* is used (**3**). This has a rounded blade, which shaves the blank into a cylindrical shaft. The shaft is rotated in the groove of the shooting board as it is worked (**4**). A *gauge* (**5**) may have been used to check that shafts were the same diameter. Crooked shafts can be heated over a flame and worked with a device like this to straighten them. The spine (stiffness) of shafts is matched by flexing them in the hands and gauging by feel. Sheaves of matched arrows need to have a similar stiffness to suit a particular draw-weight of a bow.

The shaft is then smoothed using abrasives such as *sandstone* and *dogfish skin* (**6**). Note the bobtail taper on the shaft. After being treated with oil, a slot is sawn into one end of the shaft (**7**), ready to receive the *horn reinforce* for the nock. A sliver of cow horn or deer antler is inserted into the groove (**8**); this will prevent the nock from splitting under pressure from the string. The nock itself is then filed at 90 degrees to the horn insert (**9**), and the end of the nock is filed to a rounded profile.

The feather for the *fletching* is pared away from the *quill* (**10**), leaving only a thin, flexible portion of quill for attachment to the shaft. Goose, swan or peacock feathers were preferred. The quill on the fletching is scraped with a knife to make it smooth and even (**11**). *Glue*, in this case made from rabbit hide, is heated in a gluepot and then applied to the fletching (**12**), which is then placed by eye in the correct alignment on the shaft. Although the glue holds the fletching well enough for placement, it is neither strong enough nor durable enough for shooting; the fletchings have to be bound with linen or silk thread to secure them.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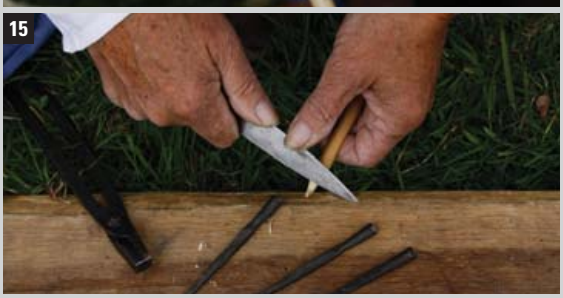
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This is done by teasing the barbs apart with a *bodkin* (**13**). The fletchings are then cut to shape (**14**) using shears or scissors; an alternative is to finish by burning a straight edge with a hot blade. The other end of the shaft is then shaved with a knife (**15**) to receive the *head*, which is first heated red-hot in order to ensure a snug fit.

Arrows destined for storage in barrels, to be kept in great military arsenals like the Tower of London, were treated with an *insect-repelling compound*; this was painted on between the fletchings (**16**). Feather mites could destroy an army's arrow supply very quickly. Tests on the *Mary Rose* arrows suggest a compound of glue, beeswax and copper sulphate was used. The copper, which shows as a green tint on the bindings, may have come from using copper gluepots, and it is uncertain whether or not the presence of copper compound was either intentional or essential.

The Westminster arrow was found in the rafters above Henry V's chantry in Westminster Abbey. A replica of the Westminster arrow was reconstructed by Mark Stretton of the EWBS (**17**). The original is believed to date to before 1437 and as such is the only known arrow from the medieval period in existence. Traces of a reddish compound, rather than green, still remain on the shaft. Other colours are seen in artistic depictions from the period. What is most likely is that various mixtures were used in an effort to prevent stored arrows disintegrating, and that individual fletchers had their own preferred recipes. In any event, it was yet one more process in the incredibly complex and laborious task of making a medieval war arrow.

17

(Photographs by the author)

MAKING THE ARROWHEAD

Although bowyers were forbidden to work after dark, the vast industrial demand for arrowheads meant that the anvils of the arrowsmith were obliged to ring out both day and night, working only by candlelight and the glow of the forge. Aside from type diversity, there were also variations in quality. As with armour, not all arrowheads were created equal.

Hardened points

In 1356 Edward III sent out orders for 240,000 'good' arrows and 24,000 'best' arrows; the difference was that the 'best' arrows were obliged to have 'heads hard and well steeled' (quoted in Strickland & Hardy 2005: 21). It is the unique attribute of steel, even relatively low-carbon steel, that its physical properties change when it is quenched – heated to red-hot and then cooled by plunging it in a liquid – a process that makes it a much harder material. It took extra time, smiths with a particular skill and the procurement of billets of wrought iron that had an adequate level of carbon. Consequently, hardened arrowheads were more expensive, which accounted for their representing only 10 per cent of the contract. In this case it was probably only the point of the arrowhead that was 'steeled' – that is, 'case-carburized' by reheating just the point and quenching it – but there are clues to another process.

A statute of Henry IV (r. 1399–1413) in 1405 complained of arrowsmiths supplying 'faulty' arrowheads and ordered that 'all the heads for arrows … after this time … be well boiled or brazed, and hardened at the points with steel' (Pickering 1762: 464). 'Boiled' may have been another way of saying 'quenched', since a red-hot arrowhead submerged into a quenching fluid will cause the fluid to bubble and give off steam in the manner of boiling. Alternatively, it may refer to the process of 'tempering', a necessary step after hardening to make the hardened material less brittle. Tempering requires a secondary heating. One method of tempering, used by modern gunsmiths for leaf-springs, is to boil the metal in a solution of salts that has the effect of heating it through to a uniform temperature. It is conceivable that a similar process, perhaps with animal fats, was used for arrowheads.

Replica of an arrowhead that was found on the battle site of Towton. It has the cutting blades of the head brazed to the socket. Note that there is some splash from the brazing because an excess spill of the material spreads around in the fire when multiple heads are in production. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

'Brazing' may have meant 'heated', as in 'placed on the brazier', or it could have the same meaning it has today, which is to join two pieces of metal together using brass as the welding medium. Arrowheads with traces of brazing have been found at the battlefield sites of both Crécy (1346) and Towton (1461). A possible explanation is that steel was several times more expensive than iron, so there could have been economic benefit in brazing steel points to iron sockets. Nevertheless, this union could have been achieved equally well by forge-welding the two pieces together. Being able to weld such tiny pieces undoubtedly required a high level of skill, but arrowsmith Hector Cole informs me that, having tried both methods, he finds it

Incendiary arrows

Incendiary arrows were of particular use for chevauchée (terrorizing the countryside) and siege, facets of medieval warfare that were far more frequent than pitched battles. They were also a mainstay of naval engagements. Various kinds of fire-bearing head have been identified, but the commonest were the cage type and the bag type. The tendency for incendiary arrows to extinguish during flight is especially problematic with the cage type, and an improved solution was the bag type. For this an extra-long bodkin – it is worth bearing in mind that bodkin points 9in in length were found on the *Mary Rose* – was required to prevent the shaft from burning. It was inserted through a sausage of incendiary materials, encased in a linen bag. Various recipes exist; one from *Das Feuerwerkbuch*, written in about 1400, recommends, 'Take three pounds of saltpetre, one pound of sulphur and half a pound of charcoal and mix all well to powder. Knead the powder into a paste with brandy … fill this bag with the paste … finally coat it with sulphur or resin' (quoted in Anon 2001: 60).

This was in effect a mixture of gunpowder[1] and alcohol! The brandy allowed the powder to be rendered into a paste without impairing its flammability and the resin sealed it from evaporation, which was useful for storage, as well as being a combustible material in its own right. I have experimented with recipes along these lines and even though the flame appears to extinguish in flight, there is sufficient heat and spark left to re-ignite the gunpowder compound when it thuds to rest at its destination – be it ship's hull or farmer's barn. Mark Stretton[2] has shot incendiary arrows with a similar recipe from a 140lb draw-weight bow, reaching a distance of 200yd, and the arrow has ignited in its target at the end of the flight. This was a terror weapon of considerable range.

ABOVE Mark Stretton shooting an incendiary arrow. In an age when ships were made of wood and canvas and when wood and thatch were universal building materials both for town buildings and for barns and store-houses, the destructive potential of fire was enormous. Fire was a widely used tool of medieval warfare and archers with incendiary arrows offered an efficient way to deliver fire from a relatively safe distance. (Photograph courtesy of Mark Stretton)

ABOVE Cage-type incendiary arrow. This type was the easiest for the archer to prepare in the field and at the moment of need. A wick of wool, hemp or tow, saturated with a flammable compound, was stuffed into the cage. The wick may already be prepared with the compound or it may be dipped in it *in situ*. Either way, the archer could travel with the wick and compound in a convenient pouch and have another pouch of push-fit cages to access if required. His quiver, however, would contain regular arrows that could be converted in an instant. (Photograph courtesy of Mark Stretton)

ABOVE Bag-type incendiary arrow. This was a more reliable incendiary arrow but it required more preparation, which needed to be done in advance. Consequently an archer would need to carry fully prepared incendiary arrows of this type with him. This picture shows the first stage of manufacture, with an extra-long bodkin arrowhead inserted through a canvas sausage of flammable paste. (Photograph courtesy of Mark Stretton)

ABOVE Bag-type incendiary arrow coated with resin. The second stage of making a bag-type incendiary arrow was to seal it with resin. The resin was itself a flammable substance but it also sealed the bag of the more combustible paste, helping to keep it from drying out completely and so becoming vulnerable to dispersing as ignited dust during flight. The resin held it together for long enough to complete the flight, when the more powerful burn of the contents then took over. (Photograph courtesy of Mark Stretton)

1 Gunpowder weapons were known in Europe from at least the first quarter of the 14th century. Gunpowder is only explosive when ignited in a confined space, otherwise it simply burns extremely fast. The ratios of carbon, saltpetre and sulphur vary according to intended use.

2 Mark has also conducted a wide range of tests with other incendiary arrow types. He wrote about these trials for *The Glade* magazine, articles which were subsequently published in Soar 2006: 149–52.

A short bodkin-type arrowhead said to have been found at the battle site of Crécy. Note the traces of brazing on its surface. The arrowhead was presented to its present owner by a mayor of Crécy, who had received it in the 1970s in exchange for some antique cannonballs from a gendarme, who claimed to have found it on the battlefield in the 1960s. (Private collection; photograph by kind permission of Chris Dawson)

quicker to forge rather than to braze the parts together. Certainly, far more forged arrowheads have been unearthed archaeologically than have brazed ones. A possible advantage of brazing was that it left visible evidence of process to inspectors, but that was no guarantee that steel had been used.

Whatever the problems of interpreting the exact manufacturing methods, having hardened-steel points was highly valued and the proportion of steeled heads increased dramatically over time. Hardened-steel arrowheads had a greater chance of penetrating armour, especially if they were harder than the armour they were striking. However, full penetration need not be the only useful military objective. Swords attacked armour effectively, not with the hope of slicing through it, but by biting and getting sufficient purchase on the surface to transmit blunt trauma. An arrowhead with a hardened point had a greater potential to bite and deliver force, even when it did not penetrate, and that alone was enough to justify the extra expense. The two types designed specifically to attack plate armour were the 'short bodkin' and the 'heavy war bodkin'.

Attacking textile armour

Heavy war bodkin. This robust style of arrowhead, a slightly meatier version of the short bodkin, was developed to attack plate armour. The point is supported against turning over by the curve and angle of the sturdy ridges that are created by the four faces of the head. Arsenal inventories and procurement orders often refer to 'quarrels'. These have traditionally been presumed to be exclusively crossbow ammunition. However, since the word 'quarrel' means square, and crossbow 'quarrels' also had a square cross-section and similar appearance, it may be that references to quarrels were not necessarily related only to crossbow ammunition. In some cases it is stated specifically that they are 'quarrels for crossbows', but otherwise the term may refer to this type of four-faceted military head for use on either crossbow bolt or longbow arrow. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

A different type of arrowhead was required if the shooter hoped to penetrate textile armour, which was worn beneath plate or mail armour or on its own. The two main types for the job were the 'cutting head', or 'broadhead', and the 'long-needle bodkin'. A third alternative, a 'Type 16' following the London Museum typology, combined some aspects of a bodkin with the cutting edges of a broadhead. Type 16s were also furnished with barbs, which impeded extraction. Barbed broadheads – a very wide variety existed for hunting – are frequently depicted in manuscript illustrations of medieval battle. Although of no use against any type of metal armour, they might have been effective against textile armour or unprotected horseflesh. Mail and textile armour were both vulnerable to the long-needle bodkin.

There is no one type of arrowhead that will defeat every type of armour. A long bodkin will curl against good-quality plate armour, while a short bodkin will not penetrate multiple layers of linen. A broadhead that will cut through textile armour will not penetrate mail. Different heads evolved for a reason, namely the need for different types of head for different targets.

ABOVE: Westminster Type 16. If the quantities that have been recovered archaeologically are any guide (and they may not be), this was possibly the arrowhead in most widespread use for medieval warfare. It combines the slender profile of a bodkin with the cutting edges and barbs of a broadhead. This particular example has been modelled on the arrowhead fitted to the arrow in Westminster Abbey – the only fully intact medieval arrow known to date. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

LEFT: Swallowtail. This is a typical broadhead with large cutting blades and barbs. In a hunting context broadheads are necessary to let blood, which not only causes progressive weakness but also produces a trail that can be followed. A bodkin-style arrow into flesh is effective if it hits a vital organ, but it may not produce a wound that bleeds out – the arrow-shaft can staunch the flow. Large broadheads like this were considerably more expensive to produce than bodkins, both in the cost of materials and labour. They also required greater preparation; the blades were capable of being honed to a sharp edge. Well-sharpened broadheads offered the prospect of cutting through leather and textile, and they could be very effective against inadequately protected horseflesh. However, they would not fare well against a mail bard and certainly not against plate armour. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

LEFT: Swept-out swallowtail. In this form of broadhead the blades have been drawn away from the socket to exaggerate the effect of the barbs, which prevented extraction. It is common to see this type of broadhead in medieval depictions of battle. However, it is uncertain to what extent they were actually used. It may be argued that artists sought a more visible and more sensational representation of an arrowhead for their portrayal, evoking an image of great bloodshed. Nevertheless, the sense of terror conjured by such arrowheads might have been as equally effective on campaign as it was in art. Cost may have dictated that they were used sparingly but the reputation of the hideously painful wounds these broadheads could inflict might have been of great psychological value. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

Selecting arrows for the battlefield

So what happened on the battlefield? Are we to suppose that an archer, in the manner of a golfer, selected different shafts according to his target? Did he take a short bodkin for shooting at a knight in plate armour, yet select a long-needle bodkin for the larger target of the horse, protected by a mail-and-textile-armour bard? Did he have broadheads at the ready for any unarmoured horses and for men-at-arms wearing gambesons?

I think that such an idea is possible. It would make sense of archers in battle setting their arrows in the ground, as is often seen in art. With his arrows in front and in plain view, it would be possible for the archer to select according to the chosen target and the arrangement of two, on occasion three, different types into distinct groups – long-needle bodkins to his left, short bodkins to his right and a few Type 16s in his belt – would be a simple matter.

Unlike precious hunting broadheads, which were generally fixed to the shaft by a pin that went through holes in the socket, battlefield heads were not even glued – they were affixed solely by means of a snug push-on fit. Aside from removing a stage of manufacture, this also meant that even when an arrow was withdrawn, the arrowhead was left behind in the wound – a contaminating barb, sawing painfully at the tender lesion with the victim's every move and breath.

The long-needle bodkin was best suited for attacking mail and textile armour. If it managed to strike within the centre of a mail ring and at a reasonably perpendicular angle, the expanding taper of the head had the potential to force the ring to open, breaking its rivet, and to push through to some depth. It also had some of the properties of a needle when attempting to thread through textile defences. Against plate armour, however, the slender tip had a tendency to coil like ornamental scrollwork. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

USE
At full draw

THE LONGBOW IN TRAINING AND PRACTICE

Archery and the law

On 1 June 1363, Edward III wrote to his sheriffs and commanded a

> … proclamation to be made that every able bodied man on feast days [including Sundays] when he has leisure shall in his sports use bows and arrows, pellets or bolts, and shall learn and practise the art of shooting, forbidding all and singular on pain of imprisonment to attend or meddle with hurling of stones, loggats, or quoits, handball, football, club ball, cambuc, cock fighting or other vain games of no value; as the people of the realm, noble and simple, used heretofore to practise the said art in their sports, whence by God's help came forth honour to the kingdom and advantage to the king in his actions of war, and now the said art is almost wholly disused, and the people indulge in the games aforesaid and other dishonest and unthrifty games, whereby the realm is like to be kept without archers. (CCR Ed III 1363)

It was on the statute book by 1369 and it heralded a string of similar laws and recommendations for more than the next two centuries. These included, *inter alia*, statutes from Edward IV, Henry VII (r. 1485–1509), and, of course, Henry VIII, whose first statute on the matter in 1512 specified that the requirement to practise was for all men 'not lame, decrepute or maymed' under 60 years of age; in 1541, Statute 33 echoed all the old calls for men to own bows and arrows, for them to practise and to eschew unlawful games, the list of which had grown. The *Journal of the House of Commons* (Vol. 1) has an entry on 30 May 1604 that records the first reading of 'The Bill for the Maintenance of Archery, and

Debarring of unlawful Games' and *The Calendar of State Papers Domestic: Charles I, 1631–3* records that on 31 August 1631 Charles I (r. 1625–49) invoked a commission that he had set up in 1628 to 'to quicken the execution of a statute of 33 Henry VIII for encouraging the use of archery'. Charles had been obliged to revoke the commission because of complaints from the counties that it was unenforceable, but it is interesting to note that the desire to promote English archery ran so late.

The basic mechanics of shooting a longbow can be taught and picked up quickly – arguably within a few hours. Some shooters are naturally good at aiming and ranging, while others need more practice. Regular practice and training are clear advantages in achieving a better aim, but good archers would be able to stay in reasonable form without having to do weekly work at the butts. The appeals for weekly practice that echo so loudly over the centuries were not because the longbow was an intrinsically difficult weapon. If you only used it for hunting or recreation, the longbow could be mastered relatively easily.

However, for it to be of use in war, there was a need for archers of exceptional strength, and that necessitated men bending-in their bows, rain or shine, for several hours every single week of the year. To be able to nock, draw to full length and, crucially, shoot rapidly under the extreme pressure of combat – facing an enemy charge – required not only a special kind of calm courage but also a muscle memory drilled to unfaltering precision and reliability, something that only came with constant practice. Drawing heavy bows is part strength and part technique. Neither alone is sufficient and both require a dedicated training regime.

The case for regular training is obvious, but those serving as military archers, or intending to do so, probably practised considerably more than once a week. For the soldier longbowman, time spent at the butts was surely a given; it did not need to be compelled by legislation.

I believe these archery laws were about more than the need for men to train. Undeniably the 1363 proclamation, and all the many others that followed it, had the effect of promoting archery, but I doubt that was either their exclusive or even their primary aim. Edward III's order was not restricted to longbow archery; practice with the sling or the crossbow ('pellets or bolts') were alternative pursuits that received equal approval. In fact, far greater emphasis was placed on what should not be done – the 'vain games of no value'. Edward does make mention of a concern that 'the realm is like to be kept without archers' but in the same year that it went into statute, 1369, the campaign army was estimated to have 3,858 longbowmen alongside 1,343 men-at-arms (Hardy 1992: 97). By that reckoning English archery was still in pretty good shape. There are hints, though, that Edward's decree should be seen in a wider social context.

On 12 June 1363, 11 days after his initial order, the king wrote to the sheriff of London urging various measures to keep the peace. These included adhering to a strict curfew, granting the power of citizens' arrest and an elaborate series of fines for aggressive behaviour. This featured such nuances as, 'if he strike any man with his fist and draw no blood he shall pay 2*s*. or abide in prison eight days, and if he so draw blood he shall pay 40*d*. or abide in prison twelve days'. Innkeepers had to ensure that their guests left

their weapons in their lodgings; failure to do so could result in prison. In addition, the king commanded a blanket prohibition stating 'that no man of whatsoever condition shall go armed in the city' (CCR Ed III 1363).

Such a catalogue of new laws implies a worrisome level of rowdiness and public disorder. This crime wave was fuelled in 1360 by the demobilization of thousands of fighting men after the Treaty of Brétigny, which sealed a temporary truce in the war with France. After nearly 15 years of profitable war, these men, used to violence, adventure and adrenalin, did not all step back into civilian life peaceably. Perhaps Edward's archery proclamation was intended more to regulate social conduct than it was to improve the quality of his army. If so, it may be likened to the calls for National Service as a remedy for hooligan behaviour that are still to be heard from time to time.

Whatever the motive, it seems likely that a great many of the men who trudged unwillingly to their local butts on a wet and cold Sunday morning – feckless youths, self-regarding burghers, the weak, the fearful and the frail – would have been entirely unsuited to military service and of no use in the front line. The inducement to create good, strong archers was in the decent pay they received and in the promise of reward on campaign that came with plentiful opportunities for looting.

A culture of regular archery practice must have fostered communities appreciative of shooting prowess, giving status to local men who could draw a strong bow – men who would go to the wars as heroes. It may have made some contribution to the readiness of an archer army, but it was more about discouraging dissolute activity. Roger Ascham wrote that

Training with the bow (opposite)

Archers setting up and shooting at butts (*c.* 1360). Butts were earth mounds that were set up in every town, village and hamlet and, by law, had to be maintained in good order. Erosion from rain and wind was minimized by the slope of the half-dome and the butts were held together by a covering of grass. As well as regularly tamping the sides into shape, maintenance involved frequent compacting of the face, and filling in the cavities created by arrow strikes. The grass would need cutting and in dry weather the butts would need to be watered. Regular Sunday practice at the butts was compulsory by law from 1363 for all men between 16 and 65. Targets, set against the backstop of the butts, were improvised and might consist of an oyster shell or a garland – a wreath of brushwood. Another popular target was the wand: a narrow stave of wood, set in front of the butt, the idea being to split it with the shot.

Inset: Shooting at the marks (*c.* 1500). Permanent courses were laid out in cities such as London for shooting over distances. Archers shot round these courses in groups, in the manner of golfers. They shot at designated marks set up at different distances. Each mark was identified by a distinguishing insignia on top of a wooden post, which was set in a stone plinth. In 1498 the mayor of London designated 11 acres of the city, Finsbury Fields, for archery practice. A map of the location dating to 1594 shows 194 marks, with distances ranging from 130yd to 345yd! Despite the designation of Finsbury Fields as a shooting area, it remained busy with the everyday traffic of people. Accidents happened, but the protocol was to call 'loose' if it was clear to take a safe shot and to call 'fast' (which originally meant safe) if shooting must be stopped to allow someone to pass. Playing 'fast and loose' was a dangerous game.

teaching youths to use a bow not only made them shoot well, but also removed the desire for 'noughtie pastimes, as dysinge, cardinge and bowlinge' (Ascham 1968: 113). The idea that archery was a morally beneficial pursuit seems to have been deep-rooted and became an almost obligatory statement by any author on the subject.

Encouraging universal capability with the bow was not without its concerns. The Peasants' Revolt of 1381 was indicative of a society in the throes of dynamic and tumultuous transition; low-born men armed with bows were a credible military threat to the established order. In 1396, Rychardus Wedyngton (Dick Whittington), mayor of London, issued a proclamation the day before a new session of parliament, which commanded every man 'to leve his bowe and his arowys at home in hys inne' (GC). Clearly he was concerned about the possibility of civil unrest at a politically sensitive moment, and the instrument that signalled the greatest threat was the longbow. It is possible that one of the reasons the French did not arm their peasantry with the bow to the same extent that the English did is that they feared armed rebellion from the feudal underclass (Hardy 1992: 98). However, the use of massed ranks of archers in England's armies was a matter of economic expediency, and a balance had to be struck between containing lawless behaviour and having a supply of trained and armed men.

Latimer's extolment of archery

Even after the decline of the longbow as a principal military arm, there continued to be laws compelling men to train with the bow. Always alongside the injunction to practise were reminders of archery as the source of the nation's strength, and that it was an exercise that was good for you. Similar language recurred in successive statutes over the years. It was echoed in a sermon on the subject delivered by Hugh Latimer, bishop of Worcester, in 1549. Latimer railed that 'The arte of shutyng hath ben in tymes past much esteemed in this realme, it is a gyft of God, that he hath geven us to excel all other nacions wythall … but now we have taken up horynge in townes, instead of shutynge in the fyeldes' (Latimer 1832: 177). The notion that archery had fallen out of use, compared to a perceived bygone golden age, and that it was a God-given gift to Englishmen was strikingly similar to that expressed by Edward III, 186 years earlier. Above all, the tone was

Archers shooting at earth butts, from the Luttrell Psalter, *c.* 1320–30. In this picture we see several styles of blunt arrowhead being used, and the earth butts are pockmarked with their imprints. The butt itself acts as a backstop and the actual target here is the wreath of brushwood, known as the garland. One archer gives the impression that he may be instructing the others. I do not think that the even spread of hits is intended to indicate that these archers were bad shots, but an artistic device to convey heavy use. (The British Library, Add. MS 42130, f 147v, © The British Library/Bridgeman Art Library)

moralizing rather than practical. This was in tune with the central theme of the sermon, which admonished society for its moral decrepitude.

Latimer did digress, however, with a momentary practical note, describing his own experience of archery. The good bishop, whose father was a yeoman farmer with modest landholdings, was eager to promote himself as a man of the people. He helped to cultivate that image by telling us that 'my poor father was as diligent to teach me to shute, as to learne any other thyng'; elaborating, he declared that his father 'taught me how to drawe, howe to lay my body in my Bowe, and not to draw with strength of armes, as other nacions do, but with strength of bodye' (Latimer 1832: 177), details that give us great insight into technique and which echo principles that we also read in Ascham.

Latimer added, 'I had my bowes brought me according to my age and strength, as I increased in them; so my bowes were made bigger and bigger; for men shall never shute well, excepte they be brought up in it' (Latimer 1832: 177). Here we return to a central idea of powerful bows – bows of heavy draw-weight – and the notion that such bows can only be managed by those who practise constantly.

Three replica blunts, made by Mark Wheatley, based on those depicted in the Luttrell Psalter. Note the waxed hemp twine binding set into the grooves of the example below. This may have the function of prolonging the life of the blunt head, which would be vulnerable to cracking from regular exposure to damp earth in the butts. (Photographs by Vince Beeton)

Practising with blunts at the butts

The principal mode of archery practice was shooting at the butts. Butts were man-made earth mounds, clad with turf and given a rounded roof, so that water would run off and they would be able to stay out in all weathers. Butts had to be maintained but, given proper care, could last for years. They were permanent features in towns and villages. It is uncertain why they are called butts, but they may have developed from the practice of using a large wine butt (barrel), filled with earth, as a target. Our best image of what medieval butts looked like comes from the Luttrell Psalter. Commissioned by Sir Geoffrey Luttrell, this exquisite manuscript was illustrated between 1320 and 1330 with detailed scenes of everyday life. Among them is an image of archers practising at the butts.

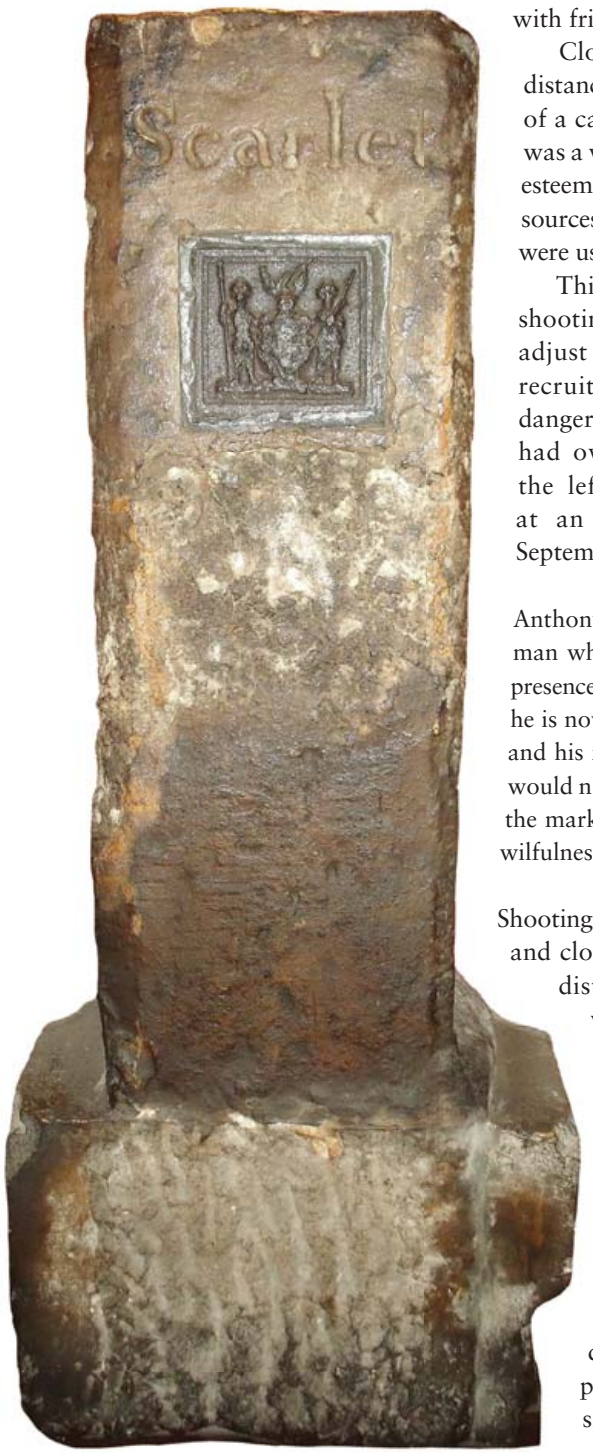
One theory for the presence of blunts in the scenes depicted in the Luttrell Psalter is that because Luttrell's lands were located within the bounds of a royal forest, his tenants had to comply with forest law. Among other deterrents to poaching, such as having your greyhound's longest toes amputated (lawed), it was part of forest law that no man could carry sharp arrowheads – sharp arrows, like greyhounds, were a threat to the king's venison. How, then, could such men comply with the law to practise their archery? The answer may have been to use blunt arrowheads.

An alternative theory is of a purely practical nature. Shooting sharp arrows with a bow with a heavy draw-weight into an earth mound could have resulted in arrows burying themselves to an irretrievable depth. Large-headed blunts prevented that from happening. Blunts were also used for shooting at small game, so as not to spoil the meat, but they did not necessarily have to be separate arrows. It is possible that the blunt was a cap that fitted over an existing arrow.[4]

Replica bodkin arrowhead with a push-on blunt cap for shooting at the butts. It would be especially important for such caps to be bound in order to prevent them from splitting under the pressure of a heavy warbow arrow acting to drive through them. (Photographs by Vince Beeton)

4 I am indebted to Mark Wheatley for suggesting this idea.

The stone plinth that held the wooden post for the mark known as 'Scarlet' in Finsbury Fields. It now resides in the care of the Honourable Artillery Company in Armoury House, London. (Photograph by Dave Watts)



Distance shooting

Other training activities included 'roving', 'clout shooting' and 'shooting at the marks'. In roving, archers nominated natural marks in the landscape – such as dark patches of earth, leaves or twigs – as the target and shot to see who could get closest. The nearest shot called the next mark. It was a congenial pastime that involved roaming the countryside with friends.

Clout (cloth) shooting entailed shooting at a fixed distance of 240yd. The target, 18in in diameter, consisted of a canvas facing backed with coiled straw. In the centre was a wooden peg, known as the 'prick'. It was an especially esteemed feat to cleave the prick. References in contemporary sources to 'prickshafts' indicate that lighter-weight arrows were used when shooting at the clout.

This form of shooting became especially popular for shooting matches during the 16th century. In order to adjust their aim better at such distances, archers often recruited the services of a marker, who would stand dangerously close to the clout and signal whether shafts had over- or undershot or whether they had gone to the left or the right. Queen Elizabeth I was present at an unfortunate incident involving a marker in September 1569:

> Anthony Hanmer, in a shooting match … struck his own man who gave him aim, in the head with a prickshaft, in presence of a great number of gentlemen and others, whereof he is now dead. The shaft was well shot towards the mark, and his man that gave aim, desirous to see his master win, would not avoid when he was willed by crying to from both the marks, but wilfully abode at the mark, and died by his wilfulness. (CSPDEA 1871: 83)

Shooting at the marks combined the challenges of both roving and clout. Marks (wooden posts) were fixed targets at set distances, but each distance varied and the marks were laid out over a stretch of countryside that might include natural obstacles such as a stand of trees between the shooter and his mark – or the mark might sit out of direct sight, over the brow of a hill. In 1498 the mayor of London designated 11 acres of the city, Finsbury Fields, for archery practice and a 1594 map of this location designates 194 marks, with distances ranging from 130yd to 345yd!

It may be argued that the ubiquity of these distance-shooting pursuits is evidence that the primary function of the military archer was to shoot at distant targets on the battlefield. While it

is undoubtedly true that the longbow had a significant capability at long range, the mere fact that distance shooting was a popular recreational activity does not in itself prove this use in battle. Shooting an arrow in the air and watching it fly is a joyous thing to do, and as well as the exhilaration there is the challenge of competing with one's fellows to hit a distant mark. This alone would be reason enough for a culture of distance shooting, but there may also be other reasons.

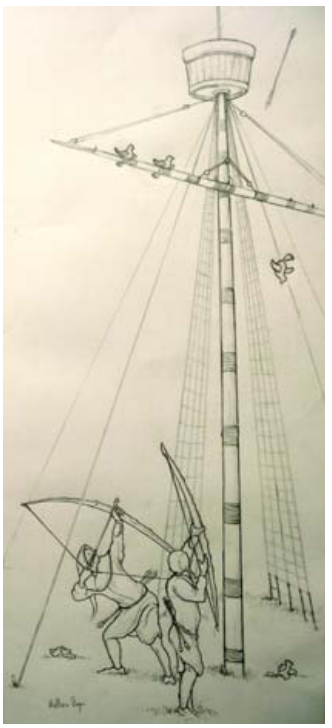
The strictures for an archer to be able to shoot a certain distance were characteristic of legislation that post-dated the use of the bow as a mainstream weapon on the battlefield. Henry VIII's statute of 1542 ruled that 'no-one under 24 shall shoot at any mark of eleven score or under with any prickshaft or flight under penalty of six shillings and eight pence' (quoted in Soar 2010: 194). Here it is clear that those aged under 24, those in their fighting prime, were required to be able to shoot with accuracy at a range of 220yd. Moreover, they had to do this with a heavy arrow, not the sort of lightweight arrow – 'prickshaft' – more commonly used for distance shooting. Note that the statute did not prohibit shooting at shorter ranges – it merely indicated the weight of arrow required for shooting at distance.

By 1542, battlefield archery was on the wane – though, in a last hurrah, English archers were to make a contribution to victory over the Scots at the battle of Pinkie Cleugh in 1547. Even so, the main application of the art of shooting in the Tudor period was for naval archery and, arguably, there was greater reason for naval archers to be able to shoot at distance.

Another possible reason for requiring distance-shooting ability was that it offered a visible demonstration that bowmen were shooting suitably heavy bows. Systems of measuring the power of a bow by means of draw-weight would probably have been viable with the technologies then available, but we do not know that this method was used. Although it is the system used today, it is not necessarily the best. It seems equally useful to measure the power of a bow by how far it can shoot. Setting a minimum distance with a specified weight of arrow would be one way of ensuring that bows of an appropriate power were being used.

Ascham, in referring to shooting at the 'prickes' (clout), makes the point that 'souldiours drawe quicklye in warre, for that maketh the shaft flye apace. In shootinge at the prickes, hastye and quicke drawinge is neither sure nor yet comely' (Ascham 1968: 203). He is making the point that a technique seen on the battlefield is not appropriate for elegant recreation. We must not assume that the practices of the training ground always mirrored those of the battlefield precisely.

As I shall discuss, distance shooting on the battlefield needed to be used sparingly but, for centuries, the ability to shoot at distant marks had been an essential skill for archers besieging a castle or town. Being able to range accurately was of particular use when shooting at blind targets over the walls. It is my view that the military rationale for these exercises was far less to do with the archer's work on the battlefield and much more related to his tasks during sieges and at sea.



Shooting at the popinjay. Popinjay targets took the form of wooden birds, set on spars, raised on tall masts. It is possible that the first instances of this were actual ship's masts, erected on land and stripped of extraneous paraphernalia. A popinjay is a medieval name for a type of parrot, the sort of exotic bird that would be familiar to sailors; certainly several species of parakeet, from India and Asia, were known in the Middle Ages and were depicted in bestiaries of the time. The spar could be raised and lowered, as it was for a sail, so that birds that had been knocked off could be reset easily. A ship's mast of 30–40ft was a modest target by the standards of today's popinjay shooters, who shoot to dizzying heights, but medieval ships were relatively small and that is all that was required. (Drawing by Matthew Ryan)

Training for war at sea

Naval archers were an extremely important element in the defence forces of the nation. As well as needing to be able to rake the decks of enemy ships from a distance, naval archers also had to be able to shoot at targets high in the rigging. When ships grappled together, men in the crow's-nests – archers, javelin-men and men with large rocks – would assail the enemy decks with missiles; those on the decks sought to pick off those aloft. The perfect training for this was shooting at the 'popinjay'.

Popinjay shooting entailed shooting at targets, usually in the form of birds, which had been set up on tall masts. Alternatively, as was the case at Kilwinning in Scotland, where an annual popinjay contest dating to the 15th century is still held, the target could be perched on a horizontal pole that extendxed from the church tower. One early 14th-century depiction of popinjay shooting shows the target bird atop the sail of a windmill, an ingenious solution (Decretals f. 89r).

Shooting at the marks, clout shooting and popinjay shooting were more than mere amusements. They developed real skills with martial application, but it was at the butts that the hard work was done – shooting sheaf after sheaf of arrows, week in and week out, building archers of immense strength: the pride of the nation.

THE ARCHER

Recruiting England's archers

Statutory obligations to practise may have helped to produce a reservoir of archers, but, during the ascendancy of the longbow, it was good pay and sound recruitment policies that filled the ranks of England's armies with an archer elite that was the envy of the world.

The golden age of the military longbow (*c*. 1270–*c*. 1500) was not the result of innovative weapon development. It was the consequence of gradual social change and economic expediency in England. Feudal power rested on land ownership – the more land under the control of an overlord, the more knights and their retinues he could command to fight in his service. Compared to the feudal might of France, England, having less landmass, was at a disadvantage. Even before the decimation of the population by the Black Death (1348–50), feudal structures in England had begun to change more than those on the Continent, and there had long been a greater reliance on commoners as an integrated component of the national fighting force. That is not to say that the archer classes were the lowest-born peasants – far from it. They came from a variety of trades and social stations but generally not from the agricultural serfs, whose essential contribution to feudal wealth was to work the land, rather than to be absent fighting foreign wars.

Henry III's Assize of Arms of 1242 introduced compulsory bow ownership for those owning land worth more than 40s – this was the

Regional recruitment

There is a persistent myth that the archer contingents of English armies were recruited almost exclusively from Wales. Certainly many Welsh archers drew their bows in the service of successive English kings but Wales was not the only region to produce strong bowmen. Edward II (r. 1307–27) needed archers for his Scottish campaign, and a 1323 order (CCR Ed II) commanding the exchequer to raise funds for their payment records archers from various parts of the realm: Gloucester and Hereford and the Forest of Dean – 1,000; Dorset, Somerset and Wiltshire – 500; Southampton – 500; Sussex and the Weald – 500; 'Salop' (Shropshire) and Stafford – 500; Lancaster – 400; and High Peak, County Derby – 300. Edward III took archers from Norfolk, London and many other areas as well as from Wales on his Crécy campaign, and the Black Prince considered foot archers from Cheshire to be worth paying 6d a day (Wadge 2009: 103).

The archer in this photograph (Joe Gibbs) draws an extremely powerful bow, armed with a heavy war arrow. He wears good, serviceable clothing of a 15th-century style. Archers were not the lowly peasants that they are portrayed to have been in modern fiction; they were fit and strong, well equipped and relatively well paid. On the battlefield, an archer of this period would also wear armour such as a brigandine for the body, plate armour for the legs (cuisses) and a sallet for the head. He represented a fighting force to be reckoned with and each man was capable of a deadly aim. (Photograph by the author)

yeoman class. Bow ownership was not restricted to the better-off yeomen; those of lesser means were also encouraged to possess a bow if they were able to do so: it just was not compulsory for such men. Although such measures signified a rising recognition of the archer's military usefulness as well as his increasing social status, its purpose and that of earlier assizes was the provision of a militia for county police work, coastguard duties and the maintenance of order at home. Nevertheless, by the last quarter of the 13th century, the assizes had resulted in a substantial national arsenal of equipment, ready for the scrutiny of arrayers.

Introduced by Edward I, 'Commissions of Array' initiated the recruitment of archers on a grand scale. Not only were archers enlisted into his armies in quantity, they were selected for quality. Arrayers vetted not only an archer's shooting ability but also the standard of his equipment. It was the beginnings of creating a professional army, and obligations of feudal service were increasingly sweetened with inducements of good pay. Regular pay for an archer in Edward I's reign was 2d per day and in 1277, 100 elite archers from Macclesfield, acting as the royal guard, were each paid 4d per day (Wadge 2009: 103).

Such differential pay scales underlined a change in approach, from turning out an unskilled feudal levy towards producing a body of seasoned and proficient troops and paying them according to ability. The fact that all archers were not deemed as being equal can be further detected in the pay of archers guarding Welsh prisoners at Bristol Castle, who each received only 1d per day in 1296 (Wadge 2009: 103). These were the 'home guard' men, not the young, strong, quick-shooting men needed on a campaign.

The extent to which feudal service obliged a man to fight in a king's foreign adventures, which included those in Wales and Scotland, was another matter. Arrayed troops were the financial responsibility of the counties, and by the beginning of Edward III's reign (1327) there was general agreement that if the king wanted to mobilize an army for a

foreign campaign, he would have to pay for it. Funding from the royal exchequer involved taking private loans and raising taxes through parliament: challenging efforts, which put severe constraints on the military budget. The versatility of archers – useful for raiding expeditions and castle sieges as well as on the battlefield – made them a fiscally astute choice when compared to expensive men-at-arms and knights. So it was that the ranks of England's armies were increasingly swelled with brawny men who could draw a hefty bow.

The 'Knight's Yeoman' in Chaucer's *Canterbury Tales* – 'he bore a mighty bow' (Chaucer 1981: 59) – is exactly that, an archer serving as part of a knight's fighting team. Chaucer goes on to state that he was also a forester. Foresters and parkers were professional huntsmen and expert shots with the bow. As such they were keenly sought after for service in the wars, and a number of royal commands called specifically for their recruitment (Ayton & Preston 2005: 222). Hunters have never favoured long-range shots and the skill of a parker or forester would have been in dropping a deer at between 10yd and 40yd. Although doubtless able to shoot at long range, I suspect that it was their deadliness as close-range killers that was in such demand. William and John Smart, parkers from St Osyth in Essex, received royal pardons for unspecified crimes in return for fighting in the Crécy campaign in 1346 (Ayton & Preston 2005: 223).

Mounted archers and mixed retinues

Companies of archers were organized in groups of 20 men, each led by a vintenar – 'twentieth man' – who received double pay. Five vintenars and their men were commanded by a centenary. There was not a set rate for centenaries, though obviously they received more than lower ranks did. As with all military service there was a risk of death or injury, and, even more likely, disease. However, the rewards were enticing and a few months' military service could give a man a good start in life.

By the 1340s, foot-archers were paid 3d per day and mounted archers got 6d per day (Wadge 2009: 103). The mounted archer, who rode to battle but dismounted to fight, was to become a key player in the Hundred Years' War. His mobility had clear advantages for expeditionary forces raiding on foreign soil, ravaging the countryside, then hastening home to their ships with the plunder.

In addition to providing a rapid-strike capability on campaign, mounted archers were also useful for surprise deployment on the battlefield. At the battle of Poitiers on 19 September 1356 the English commander, Edward the Black Prince's ally, Sir Jean III de Grailly, the Captal de Buch, took a force of 60 men-at-arms and mounted archers in a wide arc around the French flank and then fell upon them from behind (Strickland & Hardy 2005: 237). It proved to be the turning point of the battle.

Muster rolls invariably counted mounted archers together with hobilars, without making a distinction as to how many of each were present. Hobilars were also 'dragoon' infantry, but they were armed with long spears or polearms, not missile weapons; they were paid at the same rate as mounted archers, however. The fact that they were always accounted for together points to a crucial interdependence.

Archers cannot stand in an open field without protection. Cavalry will too easily trample them. When not defended by stakes or a ditch or similar, archers have to be deployed among other infantry with pikes or polearms. Andrew Ayton's groundbreaking analysis of muster records (Ayton & Preston 2005: 169 etc.) has demonstrated that archers in Edward III's armies were always recruited in conjunction with men-at-arms and other troop types as part of a mixed retinue. He argues persuasively for a 'combined forces' battlefield deployment, in which the archers are not a separate bloc but have men-at-arms and spearmen/billmen deployed in among them to defend against enemy assaults. Ayton also posits convincingly that Froissart's 'herce' reference, popularly interpreted as a description of archers in a harrow formation, may in fact derive from a French word for 'hedgehog' – *hérisson* (Ayton & Preston 2005: 328). This conjures an image of archers standing alongside men armed with long spears or bills, the formation bristling like a hedgehog.

As with armies fighting for England in later eras, the longbow contingents that accompanied successive English monarchs on campaign in the Middle Ages included more than a few criminals undertaking military service. Hundreds of royal pardons for crimes, including murder, were granted to archers during the wars in France. Of the thousands of archers recruited, hardened criminals remained a minority, but, in addition to good pay, the pardon was yet another inducement to enlist the very best bowmen in the land.

Archers were hired from many other walks of life. Richard Wadge (Wadge 2009: 243–55) tables the rank and the civilian occupations of archers recruited from London in 1337. Among them are: physician, butcher, tailor, dyer, furrier, parker, glover, chapman, barber, cook, skinner, smith, bowyer, cooper, clerk, armourer, baker and falconer. It is a random snapshot, but it reveals an illuminating cross-section of the non-military occupations of those who sought to boost their fortunes with a spell of military service.

By the end of the 14th century it had become common to sign up archers with indentures – longer-term annual contracts. Being an archer had become a profession in itself and the assurance of a year's pay made it worthwhile for a bowman to invest in a good bow, a sheaf of arrows, some armour and a horse, and to become a mounted archer. Pay of 6d a day at a time when a skilled mason earned 4d per day and an unskilled labourer only 1½d per day (Dyer 1998: 226) was a good return.

In addition to good pay were the rewards of plunder. Soldiering also offered adventure and camaraderie and the prospect of returning home a hero. It was a profession that attracted men in increasing numbers. By the time of the Wars of the Roses, the number of archers in an army was staggering. In 1471, Edward IV took steps to raise funds to pay for 14,000 archers (Megson 1993: 55).

Archers in battle, from Froissart's *Chroniques* (detail). Note short-sleeved gambeson, plate leg-harness, and ragged courtepy. The flared sleeve is probably no encumbrance to shooting, terminating, as it does, near the elbow. It has fringing which is a sign that it is wet-weather gear. The archers are also armed with swords. (Bibliothèque Nationale de France, Ms. FR. 2642, fo. 159v, © Bibliothèque Nationale de France)

THE LONGBOW ON CAMPAIGN

Archers' gear

Archers had to sustain a very laborious workload, drawing back their heavy bows again and again, and so non-restrictive attire was essential. At the same time, the archer's affiliation to a particular group needed to be evident. In Edward III's armies, shire companies of archers wore identifying liveries, such as red and white for Londoners or green and white for the Welsh and Cheshire men (Ayton & Preston 2005: 186–87). We may imagine others in blue and yellow and black and a variety of parti-coloured configurations. The commonest form of archer's clothing mentioned in the records is the 'courtepy' and this is probably the garment

that displayed this colourful allegience. The courtepy has been described as a short coat or tunic (Ayton & Preston 2005: 187), but I believe it was more like a hood with a yoke extending to just below the shoulder.[5] Wet weather was a constant menace to troops on campaign and so a hood was an essential piece of equipment.

An element of personal protection was also vital, however. Archers could be, and were, overrun by cavalry or men-at-arms on foot and had to engage in hand-to-hand fighting. In many instances they might also expect to be shot at by archers on the other side. During the early part of the Hundred Years' War the gambeson, a stout padded coat, augmented with a mail collar or coif and plate leg-harness, was typical equipment for an archer. By the later 15th century the jack and the brigandine supplanted the gambeson, giving both greater protection and ease of movement.

By dint of their profession, archers also needed good visibility. At the time of Crécy the archer wore a simple skullcap of iron or boiled leather,

A prosperous archer

One of the Black Prince's archers, whom we know held lands in Macclesfield, Cheshire, was William Jauderell. I have been to his grave, which is in St James' Church, Whaley Bridge, Derbyshire. The grave, prominent in the nave of the church, is marked by an engraved stone slab that reads 'William Jauderell, "the archer", died 1375'. This slab, not a contemporary marker, also lists his descendants, including his son, Roger Jauderell, who fought at Agincourt in 1415. Perhaps he shot there with his father's bow? William Jauderell was given two oak trees from the royal forest to repair his house in 1356 (Hardy 1992: 77). It would seem that the Crown looked after its veterans, no doubt as a further encouragement for recruitment. The family's prosperity, evident from the status of the memorial, is easily accounted for if Jauderell, in addition to being from Cheshire, were a centenary, or at least a vintenar, and perhaps a mounted archer to boot, who then invested his earnings wisely on his return. Being an archer could be a route to great social mobility. Moreover, there were ways in which good wages could be boosted.

John Jauderell, also an archer, who fought at the battle of Poitiers in 1356, looted a valuable silver salt cellar in the aftermath, which he sold at a handsome price (Wadge 2009: 125). Looting was a very profitable business and the prospect of valuable booty was a considerable lure to men signing up for the wars. There was a great deal of portable wealth, ripe for pillage, in the towns and churches that were routinely raided on campaign, as well as what could be found in the enemy's camp after a battle. There was also money to be had from the ransom of prisoners, though the more valuable prizes, the knights, tended to be the exclusive property of their social equals. Also of great value to plunder was armour. Stripped from the corpses of the fallen it could be sold and, equally importantly, be used to equip the archer himself.

5 In *Piers Ploughman*, a narrative poem written by William Langland *c*. 1360, the hermits cut their 'copes' into 'courtepies'. A cope was a full-length cape with a hood and so, by implication, a courtepy had an integral hood. The medieval hood, with its long tail, was an ingenious piece of wet-weather clothing that functioned in the same way as fringing on buckskins or motorcycle leathers. It wicked moisture from those parts of the fabric that lay wet against the body and allowed it to run off the end. Woollen cloth, treated with extra lanolin, would offer a reasonable, though imperfect, level of rain-proofing, but hoods at least facilitated drying out quickly after a storm. Medieval art commonly shows hoods with yokes that extend to just below the shoulder.

often beneath his characteristic woollen hat, the chaperon. By the late 15th century, during the Wars of the Roses for instance, when both sides used archery, some protection for the face became necessary; archers were often depicted at this period wearing sallets with visors.

We get a humbler impression of the archer's kit from the chroniclers who described the Agincourt campaign. The French chronicler Enguerrand de Monstrelet reported 'most of these archers were without armour, their hose about their knees …' (Curry 2009: 160). The soldier and chronicler Jean de Wavrin, an eyewitness on the French side at Agincourt, noted that some archers were barefooted; he described their headgear as being of boiled leather or osier – made from wicker and bound with iron strapwork (quoted in Curry 2009: 160). However, the fact that the lack of armour was worthy of note serves to emphasize that normally it would have been expected. At Agincourt Henry V's army was severely weakened by dysentery, 'the bloody flux', which explains both the choice to forego the burden of armour and the manner in which they wore their hose. Generally, however, archers were well-equipped, professional soldiers.

Heavy bows put immense strain on the fingers, and although a two-finger loose is often shown in medieval art, it is difficult to imagine this being possible with the heavier bows. The popular idea that the two-finger salute originated at Agincourt, as a response by English archers to the French threat to cut off those two fingers from any captured bowmen, is apocryphal. Sticking up two fingers was probably a vulgar gesture long before then. Moreover, the actual threatened penalty, according to the contemporary chronicler Jean de Wavrin, was that they 'would cut off the *three fingers* of their right hand …' (Curry 2009: 155 – my emphasis). (Archer: Mark Stretton; photograph by the author)

Care of the bow

Whatever weight or style of bow the archer carried, he needed to take care of it. Throughout the ages it has been the soldier's task to look after his weapon, and the longbow was no exception. It required regular treatment with a compound of heated 'wax, rosin and fine tallow … [which] did conserve them in all perfection against all weather of heat, frost and wet' (Smythe 1964: 69). When travelling, bows were kept in an oilskin linen bag to protect them further from weather, knocks and scrapes.

Famously sensitive to the weather was the bowstring, and legend has it that one of the reasons the English won the day at Crécy is because they had the good sense to put their bowstrings under their caps during the deluge that preceded the battle, whereas the dim Genoese crossbowmen allowed their strings to stretch. There are other reasons for the fate of the Genoese, which we shall come to, but I doubt it was their strings. Properly waxed crossbow strings should be proof enough against heavy rain and the reason the English kept their bowstrings under their hats is also probably misunderstood.

Sir John Smythe recorded that 'in times past the strings, being made of very good hemp, with a kind of water glue to resist wet and moisture … did very seldom break' (Smythe 1964: 70). These are probably the type of strings used at Crécy and, since they resisted wet, were not greatly threatened by the downpour. A greater enemy to strings bonded with this soft, tacky glue[6] was that the glue should dry out completely and become

6 A possible clue to the nature of this 'glue/gum' is in the heraldry of medieval Chester's Company of Stringmakers, a town guild. It featured crossed shin-bones on the shield (Soar 2010: 156). Various glues and gelatins were made from the shin-bones of cattle.

The archer in this photograph (Joe Gibbs) mirrors the stance often seen in contemporary manuscript images. It assists in drawing the very heavy draw-weight bows. Anyone who has done any weightlifting will know that the pelvis is tilted back in a similar way for a dead-lift. In part this offers some protection to the spine, opening up the vertebrae and helping to avoid the risk of rupturing a disc, which would otherwise suffer an enormous compression load. Mainly, though, this stance enables greater power to be recruited for the draw. It connects the elastic tension of muscles and tendons throughout the back and into the legs, so that the bow is drawn with the power of the whole body, not just the arms and lateral muscles. (Photograph by the author)

brittle. It was probably for this reason that the English archers kept their bowstrings under their hats – a place of stable humidity that helped to keep their strings supple.

Second bows

Bows can break in shooting and rough conditions on campaign might lead to further losses, but the enormous scale of military bow production (Strickland & Hardy 2005: 24–25) suggests a provision in excess of just having replacements for breakages. I think it is possible that archers on campaign might have carried at least two bows, of different weights. In a letter to Elizabeth I in 1589, one of her courtiers, Sir Thomas Heneage, remarked, '… nor seek ether ii strings to my bowe nor ii bowes for one marke' (Cecil 1562–97: 3). It seems likely this was a saying in common use and the sense of the 'two bows' part is that he was steadfast in a single course of action, not 'hedging his bets' with alternative stratagems. Having two bows for shooting at the marks, however, could be a very useful stratagem – using the heavier bow for distant shots and the other for nearer targets. Equally, dropping down from a 130lb bow to a 100lb bow could be a valuable option as the hours of a battle progressed – and who would wish to stand in the front line without a second bow to hand? It is a detail the art does not reveal to us, but then it does not show us the essential supply chain of arrows either.

Archers out foraging for the army might require lighter bows. *Le Livre de Chasse*, a 14th-century hunting treatise, recommends that 'the bow should not be overstrong; one should be able to draw it easily without shifting one's position and to hold it unwaveringly after drawing it to enable an oncoming deer to reach the best position for the shot' (quoted in Cummins 2003: 52). There may be ambush situations for a scouting party of mounted archers that would require the service of like bows, situations where a steady aim was required. Bows of different strengths are suitable for different applications, and a glance through the London Consistory Court Wills 1492–1547 (LCCW: *passim*) reveals constant references to 'best bows', 'next bows' and 'worst bows' bequeathed to beneficiaries, confirming the common practice of multiple bow ownership in the early 16th century. I imagine it was much the same during the longbow's glory days.

Carriage of arrows

Top view of an arrow-bag with wicker frame. (Photograph by the author)

Two dozen arrows per man would not have been sufficient for battle and so the bulk of the stocks were issued. During a battle there must have been a lively relay of hurrying boys keeping the archer lines supplied from the carts, and not a few intemperate shouts from archers who were running low. For storage and transport, the supply arrows were kept in barrels, but the individual archer carried his personal sheaf in a linen arrow-bag. These bags had a leather separator to prevent the fletchings from crushing. The advantage of the bag, compared to the quiver, was that it could be waxed and weatherproofed and pulled up so that the whole arrow was covered. It was also light. When shooting, the top of the bag could be rolled down and arrows withdrawn easily. Another version was a bag lined with a wicker frame.

It is equally common to see archers in medieval art with the arrows stuck in their belt (girdle). At first this would appear problematic; one might think that as arrows were withdrawn the consequent slackening of the girdle would allow the remaining arrows to slip through. However, Jonathan and John Waller (Waller 2010: 155–77) have demonstrated that a form of constrictor knot can be used – either a miller's knot or a marline hitch work equally well – so that as the knot loosens from the removal of arrows, it can be instantly tightened by a quick pull down on the girdle with the thumb. As a consequence the circumference of the girdle increases very slightly – just a few inches for an entire sheaf – but it remains above the hips and, more importantly, the arrows are held securely.

Top view of an arrow-bag with spacer. (Photograph by Matthew Ryan)

All of this was useful for an army on the move, but when it came to the time for archers to form up in battle order, contemporary images often depict them with their arrows staked out in the ground in front of them. Anyone who has done this will know that it can be a fiddly business, especially if the ground is dry, and it certainly anchors the archer in a fixed position. Even having to move a pace or more is an unwelcome chore. It is not the obvious choice and so there must have been good reason to do it.

Drawing of sheaf of arrows in constrictor knot. (Drawing by Matthew Ryan)

Full view of two arrow-bags. The arrow-bag on the left of the picture holds arrows separated by a leather spacer, a replica of those recovered from Henry VIII's warship, the *Mary Rose*. Although clearly unsuitable for use with broadheads, all forms of bodkin and many forms of Type 16 arrowhead can easily be withdrawn through the holes. As well as safeguarding the fletchings, this system also dampens down the clatter of arrows in transit, which was of particular advantage to mounted archers. On the right of the image is an arrow-bag with a wicker frame. Not only does this have the capacity for a greater number of arrows but the flared base is suitable for accommodating both broadheads and incendiary arrows. It is also resistant to crush, when stacked in the carts of a supply train. (Photograph by the author)

One advantage was that, from this position, arrows could be more quickly taken up and fitted to the string – an arrangement that hints strongly at the importance of being able to shoot rapidly. A second benefit, from the point of view of enemy mortality, was that arrowheads embedded in the ground delivered the bacillae they had collected there into the wounds they created, encouraging fatal infection. Whether this was understood, or even observed, is uncertain.

THE LONGBOW'S ROLE IN COMBAT

Pitched battles were important events in medieval warfare. They were the great stages upon which chivalry's celebrities – the knights – played their dramatic parts and where reputations were made and lost. Battles were literally the theatre of war. Loss or victory could have significant political consequence, but large-scale battles were relatively infrequent occurrences; the real business of medieval warfare, the daily slog of hostilities, consisted of chevauchée and siege. No troops were better suited to this work than bowmen, and none more rapidly deployed than mounted archers. This is why they were recruited into English armies in such numbers. The fact that they could also render battlefield service was a bonus. Horsed archers generally accounted for a much higher proportion of the archer contingent than did foot-archers.

The longbow as terror weapon – chevauchée

Chevauchée was the name given to a raiding campaign that swept through a swathe of the enemy's territory. The roots of the French word for horse – *cheval* – can be seen and chevauchée might be loosely translated as a 'raid on horseback'. It was done swiftly. In execution a chevauchée needed to keep momentum and not to get bogged down. Mounted archers

were the ideal troops to spearhead a chevauchée, having the versatility to forage, scout, raid, skirmish and lay siege. Footslogging troops and a lumbering baggage train were at the centre of a march but it was the light, mounted troops who did the lion's share of destructive work, ravaging the countryside for 15–20 miles either side of the main line.

Crops were burned, houses and churches were pillaged, and people were killed and terrorized. There was considerable brutality, and often atrocity, on chevauchée. Edward III's troops, in an assault led by his archers, stormed the town of Caen in July 1346, rampaging through the streets in a frenzy of indiscriminate slaughter; the fighting resulted in over 5,000 deaths and most of the town being razed to the ground.

A particular advantage of the chevauchée was that the vast sums of money laid out to fund the expedition could be offset with the gains to be had from plunder. The greatest prizes were the towns. Here were abundant goods and treasure to be looted; here were food, women and wine. Capturing a town enriched the king's coffers just as much as his soldiers' purses. Some towns surrendered without a fight; others did not. Medieval towns were fully enclosed behind high stone walls, having many of the defensive features of a castle; if they resisted, they had to be stormed by force.

Mounted archers were mounted to travel but dismounted for battle. However, there are occasional images in medieval art that show archers shooting from horseback. These are mostly in hunting contexts but there are some battle images. It is certainly possible to shoot a longbow from a galloping horse, as demonstrated by the author in this photograph. It would be a useful tactic for raids and skirmishes. Horsed archers were also effective in hunting down fugitives, whether it was pursuing those fleeing from a terror raid or chasing down a wanted man at home. Mounted archers were used for domestic law enforcement as well as for foreign service. (Photograph by Kim Hawkins)

The longbow in siege warfare

Town walls were not the only fortifications that could stall a chevauchée. Castles controlled the land, and from these secure bases mounted garrisons could pose a threat to detachments of the invading army. To ensure safe passage, castles often needed to be taken and, if so, they needed to be seized quickly. Laying siege to starve them out, undermining or building large siege engines to batter down the walls all took time. There was no time available while on chevauchée; it was a relentless, rapid rampage through hostile territory, making as much gain and causing as much pain as possible before the enemy could marshal the full might of his army. The quickest way to take a castle or a town was by escalade – going over the walls – and in order to accomplish an escalade, the support of archers was crucial.

Archers might begin a siege by sending incendiary arrows over the walls to fire the buildings, or they might terrorize with showers of regular arrows that put everyone in danger. Froissart's description of the siege of Tournai in 1340 records that 'the arrows shot over the crenelations [*sic*] and into the town were a marvel' (quoted in Rogers 2010: 95). In the same passage he lists six persons of note who were killed or wounded by these arrows, in many cases because, behind the perceived security of their walls, they were not wearing armour.

EWBS archers (Ian Coote and Gary Symonds) shooting in elevation or 'shooting underhand' (as it is also known), because the point of aim is below the hand of the bow-arm. Shooting in the air in this way is only depicted in medieval art when the archers are shooting at defenders on the fortified walls of a castle or town. (Photograph by the author)

During an escalade, the archers' main function was to keep the walls clear so that their own men could get over on ladders. Against the escaladers the defenders might use a combination of archers or crossbowmen, men hurling down stones and spears, and men using levers to push the scaling-ladders away. For the besieging archers, picking off these targets, who were often in close proximity to one's own men, required extremely accurate shooting.

Chevauchée (opposite)

A column of mounted archers on chevauchée. They are part of a detachment of 1,000 men who have just raided and looted the small town in the background and are hastening away with their plunder to rejoin the main army 15 miles away. There has been a great deal of violence and killing in the town, the population have been terrorized and many buildings have been set on fire.

A vintenar is stationed by the side of the road, checking that every one of the 20 men under his command has rejoined the column. Discipline was a challenge with men exposed to drink and riot.

As well as lining their own pockets with booty, the archers have also been able to forage for the main army and have packhorses laden with foodstuffs further back in the column. Other packhorses, as seen in this picture, accompany them with vital supplies for the raid, including bags of spare arrows.

What they cannot take with them they burn. A small group of mounted archers in the middle ground are shooting incendiary arrows at a barn, which holds winter feed for livestock. This scorched-earth policy was a terror tactic intended to create discontent among the enemy's vassals, to weaken him economically by destroying his food supplies and seizing his wealth and sometimes, ultimately, to provoke him into pitched battle.

Archers shooting in rotation through an arrow-loop. Note that the offset transverse slits give improved peripheral visibility for the archers inside but create an optically awkward pattern, making it harder for archers outside to find an aiming point. The stonework has been left exposed on the forward arrow-loop to show its architectural construction. However, all castle interiors were originally plastered and decorated, as depicted to the left of the drawing. (Drawing by Matthew Ryan)

Another threat to those going over the top was presented by arrows raking along the walls from arrow-loops set in projecting towers. Arrow-loops presented to the outside in three forms – a basic vertical slit; the same with a transverse slit forming a cross; and a vertical slit with offset transverse slits. The advantage of a transverse opening was that it extended the peripheral vision of those within. However, when this was cruciform, it created a good aiming point, like crosshairs, for attacking archers to use. Offsetting the transverse elements made it very much harder to shoot through the arrow-loop from the outside. I have had several opportunities to shoot into arrow-loops at various castles, using rubber blunts so as not to damage ancient masonry. Those arrow-loops with offset horizontal apertures offer a far greater challenge.

Although every arrow may not go through, those that rattled against the edges were also effective in keeping those inside pinned down. Shooting from within towards outside targets required an archer to step into the zone where he would be vulnerable to incoming missiles. He also faced other challenges. An arrow-loop creates a potential structural weakness in a wall. In order to compensate for this, it is buttressed by an embrasure with splayed sides, which can range from between 6ft and 10ft deep. There is insufficient room for an archer to shoot within it and he must stand back within the chamber, a considerable distance from the actual opening. Although this puts greater demands on his marksmanship,

The mounted archer's horse – the ambler

Mounted archers and accompanying hobilars rode a particular type of mount, a travelling horse, ideally suited to raiding warfare. These 'hobby' horses, also variously known as amblers or palfreys, had a fifth gait, called the amble (as in perambulate), whereby both legs on one side move together, followed by both legs on the other side. It is a kind of running walk. The result is an extremely fast pace, averaging 15mph, which is non-fatiguing to the horses. They can keep it up for hour after hour – compared to a canter, which they can only do for about 15 minutes before needing a lengthy walk down. An ambling gait is also extremely comfortable and non-fatiguing to the rider; he too can sustain riding at this pace for hours on end. A rider on an ambling horse experiences a gentle side-to-side rocking, as opposed to the up-and-down motion generated by other gaits, which require him to compensate with muscle-work of his own.

A number of surviving horse-breeds retain the medieval ambling gene, including the Peruvian Paso Fino, the American Standardbred, the Turkish Rahven and the Icelandic horse. I once used Icelandic horses to ride from Canterbury to London and was astonished not only at how non-strenuous the ride was but also how purposeful it felt. These sturdy little horses – and all medieval horses were small by modern standards – sped along and gave a real sense of going somewhere in a hurry.

In 1417, the retinue of William de la Pole, 1st Duke of Suffolk, had four horses for each of his 90 mounted archers (Wadge 2009: 122). A plentiful supply of remounts would enable a mounted contingent to maintain an unrelenting pace for days, with all the advantages of surprise that would bring. It seems unlikely, however, that Edward III provided his mounted archers with such a high number of replacements. He had 3,500 mounted archers and hobilars for his Crécy campaign and 5,000 mounted archers for the chevauchée of 1359 (Strickland & Hardy 2005: 203). However, horses do go lame and fall sick, so he surely made some provision for remounts.

Archers shooting at an arrow-loop from outside a castle. They are protected by mantlets, freestanding wooden constructions that shielded them against arrows shot from the castle, allowing the attackers to approach to a relatively close range. The wooden construction at the top of the castle battlements is a hoarding. Its overhang allowed rocks, hot sand, etc., to be dropped on to those approaching the base of the walls. Archers were also stationed within the hoarding. (Drawing by Matthew Ryan)

it does have another benefit. The further he stands back within the chamber, the wider the angle of shot he can achieve, creating a wider exterior killing zone.

Archers attacking a castle were generally equipped with pavisses or mantlets – large freestanding shields – so that they could shelter while nocking, stepping out only briefly to shoot. Several attacking archers can train their bows onto one arrow-loop. To counter this potential rate-of-shooting advantage, I have experimented shooting in rotation with another archer from inside an arrow-loop and it works very well. As one archer steps into the operational zone to shoot, the other steps out to fit another arrow to the string. A good rhythm can be achieved, resulting in a fairly constant stream of arrows through the arrow-loop.

The longbow in pitched battle

Generalizations are problematic because every battle has its own unique set of circumstances. Nevertheless, one universal essential for the effective use of archery is selecting the right ground. In the world of battlefield toxophily, topography is king. Archers required prepared positions, whether they commanded the higher ground, were defended by an organized infantry or were behind a bristling array of sharpened stakes. Where they did not have at least one of these they were driven from the field. On the flat plain at Verneuil (17 August 1424), English archers were swept away by the Lombard cavalry; before they had staked the ground at Patay (18 June 1429), they were caught by French cavalry and were helpless against the ensuing charge, which mowed through their ranks and cut them down in a terrible slaughter.

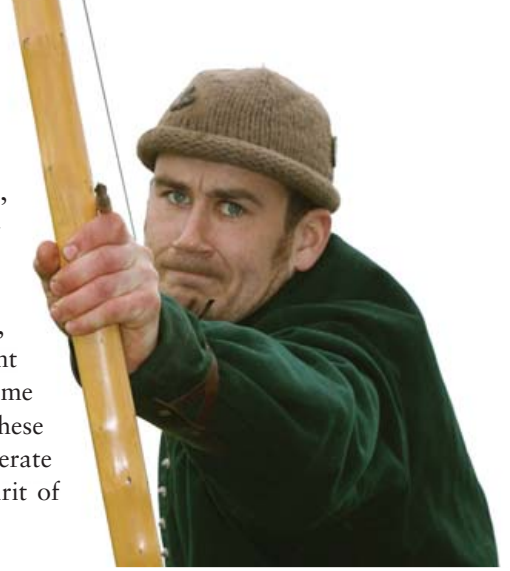
Having the advantage of ground was crucial. It was a particular advantage when that entailed possession of the higher ground. Shooting down on an enemy from a position of height was not the same as launching long-distance volleys in a high parabola; it may have produced a similar hailstorm pattern, but shots at 20yd from archers atop an 8ft bank would thump home with a great deal more force than those arcing in from long range.

It is my opinion that unleashing successive flights at distant targets had to be carefully rationed. I do not contradict that it was done, but I do suggest a shift in emphasis that moves towards considering that the greater portion of the archers' work was at ranges of 50yd and closing; towards thinking of the longbow as a very effective close-range weapon, with

A late 15th-century representation of the battle of Shrewsbury (21 July 1403). The archers are in the thick of the fighting, shooting their heavy bows at close range. During the battle both the leading protagonists from each side were shot in the face by arrows. The sixteen-year old Prince Harry (later Henry V) was wounded and his rival on the battlefield, Sir Harry 'Hotspur' Percy, was killed. The face was a primary target for archers and there are frequent accounts of arrows striking exposed faces. This is not because experienced soldiers were gazing upwards into a descending shower of arrows, but because commanders in particular may lift their visors either to give orders or to scan the battlefield for tactical information, making them vulnerable to a quick-eyed archer at close range loosing a well-aimed arrow. Philip VI of France received an arrow in the jaw at Crécy (1346), David II of Scotland was hit by two arrows in the face at Neville's Cross (1346) and Henry VI was wounded in the neck at St Albans (1455). (The British Library, Beauchamp Pageants, Cotton Julius E IV, art. 6, f. 4, © The British Library/ Bridgeman Art Library)

archers in the thick of the fighting. Moreover, much of that fighting was at extreme close range – when an enemy attack was stalling at the front line, slowed by stakes or caltrops or a hedge of spears, or when the archers' companion men-at-arms were engaged in hand-to-hand struggles, still then the archers, at 10yd, at 5yd, thudded their shafts, with deliberation, into the reeling bodies of their foes.

The psychology of shooting at a recognizable human target, close enough to see his eyes and hear his screams, is quite different from launching skyward volleys into a distant mass of men. To some this may remove a romantic gloss, but anyone who doubts that these tough, muscular, war-seasoned men were anything other than deliberate and dispassionate killers has miscalculated the fierce fighting spirit of the English longbowman.



Joe Gibbs of the EWBS takes direct aim at a chosen target. (Photograph by the author)

The longbow's role in victory

Equally important as the part it played in large-scale battles, the longbow was frequently indispensible in smaller affrays. A small group of 30 Scottish archers held the bridge at Baugé (21 March 1421), preventing the entire English army from crossing and giving the Franco-Scottish army time enough to rally and take up positions that led to its eventual victory. At Cravant (31 July 1423) English archers kept the French pinned down while the Earl of Salisbury led his men-at-arms across the River Yonne and onwards to victory. At Blanchetaque (24 August 1346), two days before the battle of Crécy, English archers were vital in giving cover to the English army as it crossed the Somme into a storm of crossbow bolts and an opposing force of 3,500 men on the French side, under the command of Godemar du Fey.

In all of these fights, preludes to larger battles, the longbow played a crucial role in setting the stage for eventual victory and was therefore as instrumental to the final outcome as anything that happened in the main battle itself. Moreover, it is difficult to separate the significance of one weapon or troop type from another in the course of a major battlefield clash. The truth is that battles are won and lost by a combination of factors and forces, and it is the marshalling and combining of all these elements that is the art of war.

In every encounter, the precise way in which archers were used and their contribution to the final outcome varied considerably. Nevertheless, Crécy stands as a textbook example of how best to use a large archer army in pitched battle. Crécy was the culmination of an immaculately planned campaign that saw Edward III launch his military bid for the crown of France. It was the beginning of the Hundred Years' War. His intelligent use of his archer arm was apparent not only in the conduct of the battle, but also in the campaign that led to the battle being fought where he wanted it. Fast-moving squadrons of mounted archers were the ideal troops to terrorize the countryside on chevauchée, provoking the king of France to battle. Philip VI summoned his mighty feudal host, but it was Edward's more mobile army that dictated where the battle would take place. He feigned that he had been caught on his retreat to his ships but, in fact, Crécy was a trap.

Crécy – the longbow's finest hour?

The battle of Crécy began as a duel between the longbow and the crossbow. On the English side were 7,500 longbowmen; on the French side were 6,000 Genoese mercenaries, highly respected, trained and experienced troops armed with crossbows. It is a mistake to think of the crossbow as a long-range weapon, at least before the mighty windlass- or crannequin-spanned steel-prod crossbows of the late 15th century. The type of belt-and-claw-spanned composite-prod crossbows brought to the field of Crécy by the Genoese probably had an average draw-weight of 300lb, only two to three times that of the longbow. However, the string travel on a crossbow is only a fraction of the string travel on a longbow; the forces act on the projectile for a much shorter distance, delivering a lesser ballistic performance. Crossbows require additional draw-weight in order to compensate for this shortcoming.

Moreover, the stubby little twin-vaned bolt does not have anything approaching the aerodynamic properties of an arrow. Arrows really do fly; bolts do not. In any range war, the longbow is going to triumph. Crossbow bolts have a powerful initial punch but once they begin to decelerate, they lose power very quickly. Radar tests on a bolt from a 300lb crossbow conducted at Britain's Defence Academy at Shrivenham showed that it maintained almost full power for 50yd, but after 80yd had lost so much power that it could no longer be considered effective.[7]

Pushed hurriedly to the front by commanders who had yet to learn the respect due to an English bowman, and with their pavisses left behind on the baggage train, the Genoese stood little chance. If they had been provided with their pavisses, they might have advanced with reasonable security and engaged the English archers at an effective range for their crossbows. Unfortunately for them, however, they were forced by the impetuous, irascible and irrational French command to advance regardless (Nicolle 2000: 63). It is often assumed that the English arrows pricked them at long range, but how close they came cannot be determined accurately.

Long-range shots would have been possible, but according to the chronicler Jean le Bel 'they came so close that the two sides shot at each other' (quoted in Rogers 2010: 132). For this to have been viable for the crossbowmen, the distance must have been less than 80yd. Furthermore, several of the chroniclers state that the Genoese were fired upon by the English guns[8] (Nicolle 2000: 65), which also supports the idea that the engagement was relatively close.

Either way, the Genoese were turned, only to run into the advance of the French cavalry. As the main body of French chivalry, mounted on their proud and puissant steeds, filed from the Abbeville road onto the battlefield, they encountered a steep bank where the higher ground fell

7 These tests were carried out for, though not shown in, a 2004 television programme presented by the author (*Weapons That Made Britain – Longbow*, Lion Television for Channel 4, UK).

8 It is not certain whether the English guns at Crécy were multi-barrelled ribaudequins (short range) or vase-shaped cannon like the Loshult gun. Chroniclers report that they were slow to load and that they caused much loss (Nicolle 2000: 65), so even if they were cannon rather than ribaudequins, the circumstances suggest they were loaded with grapeshot. The barrel of the Loshult gun has signs of wear consistent with being shot with a load of small iron pieces diced from a ¾in rod, which would cause 'much loss'. Peter Vemming of Denmark's Middelaldercentret informs me that the effective range for such a load is only around 30yd (private correspondence).

The Crécy battlefield today: a view of the bank on the eastern side of the Vallée des Clercs, looking north. This virtually sheer bank is a natural feature that existed at the time of the battle (Ayton & Preston 2005: 123). It has a 10–15ft drop and extends for over a mile. Too steep for thousands of armoured men and horses to go down, it funnelled the advancing French army on to the battlefield further along, creating crowd chaos in their ranks. It also dictated precisely where the French attack would come from and ensured that it was on a narrow front, so neutralizing their advantage in numbers. (Photograph courtesy of Andrew Ayton)

sharply away to the Crécy plain. It would not have been practical for them to have entered the battlefield down this extreme slope. Moreover, they would have come across this by surprise. (I have walked the battlefield and it is invisible until you are actually at the ledge.) This dramatic topographical feature forced the French to crowd on to the battlefield further along, and as they crammed through an ever tightening bottleneck, pushed forward by the eager masses behind, they confronted the retreating Genoese.

There were a great many Genoese casualties from this clash, and the Flemish chronicler Jean le Bel recorded that 'the weak horses fell over them and the others trampled them and they tumbled over each other like pigs in a heap' (quoted in Rogers 2010: 132). More significantly, from the point of view of the English archers, the direction of the first French cavalry attack was set. This was not a last-ditch stand by a beleaguered English army; it was the perfect battleground, a site selected by reconnaissance and a trap into which the French were lured.

At the other side of the valley, the English side, lay banks and terraces that offered ideal positioning for the archers. These banks were less steep and less high than the great bank on the French side, but they provided a vantage point for shooting and helped to slow a cavalry attack. According to the writings of another chronicler, Geoffrey le Baker, the English also dug pot-holes in front of their defensive position (Ayton & Preston 2005: 336), though this is not corroborated by other chroniclers. At the top, standing shoulder to shoulder with the archers, were men-at-arms and spearmen who created a secure barrier to halt a charge and prevent the archers from being overrun. This bristling hedgehog of spears, on raised ground, is the key factor that enabled the English archers at Crécy to stand and face such overwhelming numbers of French cavalry.

I have ridden across the battlefield at Crécy and it takes about 40 seconds, galloping on the soft, loamy earth, to cover the longshot distance of 250–300yd. Damage can be done in that time by skilled archery but probably not too much to well-armoured men. However, that first French attack was stalled and slowed by the retreating Genoese and they may have been within 100yd or less of the English line before they were able to get a charge going. It is immediately after the passage describing the traffic chaos with the Genoese that le Bel recounts the havoc caused to French cavalry by the English archers: 'When the horses felt these barbed arrows (which did wonders), some would go forwards, others leapt into the air as if maddened, others balked and bucked horribly …' (quoted in Ayton & Preston 2005: 132).

There is nothing here that tells us the horses were shot from a great range. Hindered by the Genoese, the French may well have been unable to charge the English from beyond bowshot, but, slowed from the front and pushed from behind, they moved forward haltingly, raggedly and slowly, becoming sitting ducks at medium to close range. This is where the problems arose with the horses.

A horse is a large target, but it also has a lot of muscle mass and only a relatively small percentage of its surface area is vulnerable to lethal wounds. Moreover, good-quality horse-armour was available at the time, though we cannot be certain of the extent to which it was used. Horses are provoked into unruly behaviour more by fear than by pain, though clearly there can be a connection between the two. Nevertheless, horses at full gallop charging towards the enemy are less likely to be deterred by the sting of arrows than those milling about in confusion. In a charge, horses have already triggered their fundamental survival mechanism, that of flight, and are moving as one in the herd. With their blood up, they would be stopped only by mechanically debilitating wounds. Horses without this impetus, on the other hand, such as those corralled and milling in the confusing crush with the Genoese, would be highly sensitive to the smart of an arrow.

Crécy (previous pages)

The basic English formation at Crécy was the 'herecon' (hedgehog), in which men-at-arms with long spears formed a pike wall and the archers stood between them. However, at the moment depicted in this artwork there have been several French charges and the French have taken heavy casualties – these casualties are starting to form a significant obstacle at the foot of the rise occupied by the English. This enables the English archers to step forward from the protective hedgehog and form a front rank on their own.

Crécy was a well-laid trap. The topography forced the French to enter the battlefield through a narrow bottleneck, minimizing the advantage of their superior numbers. It also dictated the direction of their attack, which pushed them towards strong English defensive positions where they were decimated by the combined forces of English men-at-arms, infantry and archers, who had the low evening sun at their backs. The archers had to work quickly, amid the sweat and danger of close combat.

The barbed arrows referred to could have been effective at cutting through textile bards, though probably challenged by mail. It is also worth noting that the chronicler does not talk about men being killed by arrows here, nor even that the horses were wounded, simply that the horses were 'maddened' by the hurt of the arrows. Whether or not an arrow penetrated the thickly padded horse-armour, a hit by a shaft from a powerful bow at near range would certainly sting.

Crucially, le Bel concludes this passage by saying that 'the English lords, who were on foot, advanced and pierced through these men' (quoted in Ayton & Preston 2005: 132). Here is a clear indication from the sources that the carnage took place close to the English front line, unless we are to imagine that dismounted English knights abandoned the safety of their lines and trudged across the heavy soil to engage the enemy 200yd away.

Once the French reached the English front, they did not just pull up, turn around and go away again. There was fighting. An enemy attacking formation is deep – the ones at the front are pushed forward by the ones behind and cannot easily turn around. All wanted to get to the front and have their chance at glory. While the fight went on, for many minutes with each assault, and with French knights and men-at-arms engaging English knights and men-at-arms, the archers probably continued to ply their trade. This is what we see in the art. It required rapid shooting and precision shooting and was, I believe, where the archers did their main work.

Men reeling from the impact of arrows, concussed and ataxic,[9] bruised, broken and wounded, were easy pickings for the dagger-men. Light troops, expert in martial arts, the dagger-men navigated the disorder at the front line, preying upon the archers' faltering quarry – finishing the job. As the long day wore on, the carcasses of horses and cadavers of men stacked in heaps before the English line, creating yet further obstacle to the French attack. Halted by these heaving, reeking human hedges, each successive French charge was more vulnerable than the last to the prowess of the English bowmen. Eventually the day was won for the English. It was a triumph for the men-at-arms, who had fought heroically, for the spearmen, who had held the line, and for the archers – but most of all it was a triumph for the tactical use of combined forces and the wise selection of ground.

The longbow after Crécy

The debacle of Crécy prompted changes in the French approach. Armour improved and at many battles the French opted to dismount their horses and attack on foot. They did so at Poitiers a decade later and again, after the initial disastrous cavalry attack, at Agincourt in 1415. Much has been made of the carnage wrought by English archery upon the French cavalry at Agincourt, but the original chronicles paint a less catastrophic picture. In describing the cavalry charge by Sir Guillaume de Sauveuses with 300 lances, Monstrelet reports that 'all of them returned, save for three men-at-arms … it was their sad misfortune that their horses fell amongst

9 Ataxia is a neurological condition that results in the loss of muscle co-ordination and loss of balance. It can be caused by blunt trauma to the brain and can manifest in what is commonly called being punch-drunk.

the stakes'; he does concede that 'their horses had been so troubled by the arrow shot of the English archers that they could not hold control of them' (quoted in Curry 2009: 161), but this is a very different story from the annihilating arrowstorm of popular legend. There were only three dead, and these casualties occurred because their horses were skewered on the stakes and their riders' skulls cracked beneath an archer's maul. The discomfited horses undoubtedly caused problems as they jibbed and bolted back towards their own lines. However, it was the fact that the mass attack turned back into the face of advancing men, trampling their own, that created the disaster of crowd chaos – one remarkably similar to the fatal mistakes made by the French at Crécy.

Agincourt was an astonishing victory against the odds, for the few against the many, but archery played only a small part in the outcome. It was tactics and terrain, sucking mud and incompetent French command

The longbow in pitched battle – triumphs and disasters

Falkirk (22 July 1298) English archers (together with crossbowmen and slingers) prove effective against unshielded Scottish schiltrons.

Bannockburn (24 June 1314) On the second day, English archers, in an undefended position, are ridden down by a flanking cavalry action from the Scots.

Boroughbridge (16 March 1322) English archers, defended by blocs of spearmen, have a major impact against Scottish cavalry.

Dupplin Moor (10–11 August 1332) Accurate archery from the English flanks forces a crush in the centre of the Scottish ranks, causing large numbers to die from trampling.

Halidon Hill (19 July 1333) English archers shoot down onto unshielded Scottish schiltrons attempting to attack uphill.

Crécy (26 August 1346) English archers decimate unshielded Genoese crossbowmen, then keep up a continuous barrage against repeated French cavalry attacks. The English bowmen are able to hold their ground from a strong defensive position. The French, forced by the terrain to attack on a limited front, are worn down by the incessant fury of the English archery and are defeated after hours of fighting and with a high death toll amongst their nobility.

Neville's Cross (17 October 1346) English archers form on a ridge, flanked by a river on one side and a steep gulley on the other. Scottish men-at-arms advance on foot with good-quality armour; they bow their heads and brace their shields against the English arrows and have initial success, although the Scottish king, David II, is wounded in the face by an arrow. A flanking action by the English archers proves effective against less well-armoured men marching behind the front lines. The Scots are routed and chased from the field.

Poitiers (19 September 1356) After an initial cavalry attack, the French dismount and their men-at-arms make a frontal assault against English archers on foot. Some chroniclers report that the English ran out of arrows. However, the English deployment of mounted archers, to assist in sweeping round the flanks and attacking the French rear, is the turning point of the battle.

Cocherel (16 May 1364) English archers, serving Charles II of Navarre, are unable to make much impact against the French men-at-arms who attacked on foot and who, according to Froissart, are 'so well armed and so strongly pavised that they took but little hurt' (Froissart 1904: 169). A French victory is subsequently achieved by a charge from reserve cavalry.

Aljubarrota (14 August 1385) Castilian–French men-at-arms are forced to attack on a narrow front, where they are hammered by a blizzard of arrows from the flanks. Archaeological excavations of the battle site have revealed a network of defensive pits and ditches to protect the contingent of Anglo-Gascon archers fighting for the Portuguese; in addition, Froissart records that the archers cut down trees to make cavalry-proof fences.

Homildon Hill (14 September 1402) English archers prevail against Scottish bowmen who hold the advantage of a defensive position at the top of the hill. It is uncertain whether or not the English advance up the hill or shoot from an adjacent vantage point; nor is the wind direction known, nor the numbers of archers involved on each side. In any circumstance it is a remarkable victory for the English longbowmen.

Shrewsbury (21 July 1403) Archers are used effectively and in large numbers on both sides. Sir Harry Percy, known as 'Hotspur', who had risen in rebellion against the reign of Henry IV, is killed by an arrow through his eye, while Prince Henry (later Henry V) is wounded by an arrow in the face; detailed accounts of its extraction indicate that it came from a more-or-less horizontal trajectory. During the medieval period, commanders were frequently obliged to raise their visors during battle in order to rally and command – this made them especially vulnerable to arrows.

that caused the French to lose; that and the fighting pluck of the English archers. However, with their arrow supplies exhausted, it was a victory the archers won in desperate hand-to-hand fighting rather than with their bows.

Throughout the Wars of the Roses Englishman drew bow against Englishman in unprecedented numbers. Despite the din of gunpowder weapons that now blew thick palls of smoke across every battlefield, squalls of arrows continued to darken the skies. At Towton in 1461, a grim battle fought in a snowstorm, there was a brutal archery duel between Lancastrians and Yorkists. Around 28,000 men died that day, the greatest number ever in a battle on English soil, and a great many of them fell to an arrow from a longbow.

Unfortunately we know very little about the use of archery at the battle of Bosworth (22 August 1485), although one account by the Italian chronicler Polydore Vergil states that Richard III lined up his archers

Agincourt (25 October 1415) English archers, stationed on the edge of the funnelling tree-line, operate from the flanks to force a crush in the centre. This neutralizes the French advantage of superior numbers, compelling them to attack on a narrow front into prepared defences including sharpened stakes, archers and men-at-arms. After a failed initial cavalry charge, French knights and men-at-arms attack on foot. The French have 4,000 longbow archers and 1,500 crossbowmen in their army, but conflicts within the French command prevent their deployment. The English archers exhaust their arrow supplies but win the day after a desperate hand-to-hand struggle.

Verneuil (17 August 1424) English archers have virtually no effect against the Lombard cavalry, armed with the best-quality Milanese armour for man and horse. The English are driven from the field by a cavalry charge. Ridden down and routed, the English archers never rejoin the battle. However, the English men-at-arms rally under John of Bedford and eventually win the day.

Patay (18 June 1429) English archers are attacked by French cavalry before they can prepare a defensive position with stakes. The archers are ridden down and killed in great numbers.

Formigny (15 April 1450) An English army of around 4,300 men, under the command of Sir Thomas Kyriell and including just over 2,000 archers, takes up a defensive position behind stakes, trenches and potholes and with its rear defended by a stream and woodland. The English face a French army under Charles, Comte de Clermont comprising around 3,000 men, among whom are 1,200 mounted archers. French men-at-arms, supported by their archers, attack the English flanks but are repulsed. However, the English archers are then provoked by heavy cannon fire to move forward from their secure positions and to capture the guns. The French quickly mount a counter-attack on the exposed English archers and recapture the guns. Next, the English are hit by the arrival of French reinforcements, including another 800 French archers. The English are overwhelmed and defeated.

Towton (29 March 1461) In a snowstorm Yorkist archers, with the wind at their backs, launch the opening shots; the Lancastrian response is hampered both by a headwind and near-zero visibility, both of which affect their ability to range accurately and to see where their arrows fall – they fall short. Once the Lancastrian arrow supplies are exhausted, the Yorkist archers advance, replenishing their own arrow stocks with those of their enemy and continuing their archery barrage. With no corresponding missile response available, the Lancastrians counter-attack on foot and drive the Yorkist archers to the rear of their army. The ensuing fight is decided by hand-to-hand combat and eventually turns in favour of the Yorkists after the arrival of reinforcements led by the Duke of Norfolk.

Tewkesbury (4 May 1471) As with other Wars of the Roses battles between Lancastrians and Yorkists, archers are used to provoke the enemy into leaving a defended position. In this instance the Lancastrians hold a strong position, but Edward IV uses his superior number of archers to goad them into attack. The Lancastrians, hit by a surprise flanking attack from Yorkist spearmen who had been hiding in the woods, are then routed.

Flodden (9 September 1513) The Scots bring their archers forward in a skirmish line interspersed with swordsmen; the Scots men-at-arms are so well armoured that the English arrows have little effect. English archers do, however, decimate the ranks of the unarmoured highlander divisions. Archery plays a role but cannon and heavy infantry armed with polearms are the decisive factors.

Pinkie Cleugh (10 September 1547) Although there are several thousand archers on both sides, the battle is decided in favour of the English by combined forces of cannon, arquebuses, cavalry, infantry and naval bombardment. It proves to be the last time the longbow is fielded in significant numbers.

in the front line 'like a most strong trench or bulwark' (quoted in Strickland & Hardy 2005: 384). The implication is that they were intended to act as the first line of defence in the event of an attack on Richard's cavalry and infantry divisions who were placed behind the long line of archers. Vergil does report an initial archery exchange between the two sides, but also records that 'whan they cam to hand strokes the matter was delt with blades' (quoted in Strickland & Hardy 2005: 386). The battle turned, of course, not on archers but on Richard's ill-fated cavalry charge. He was cut down and killed and the battle and the crown were lost.

Henry Tudor's victory at Bosworth ushered in the Tudor era. The longbow continued to be valued as a weapon for battles, but in reality its finest hour on land had passed. At sea, however, it would survive as a weapon of great significance for another hundred years.

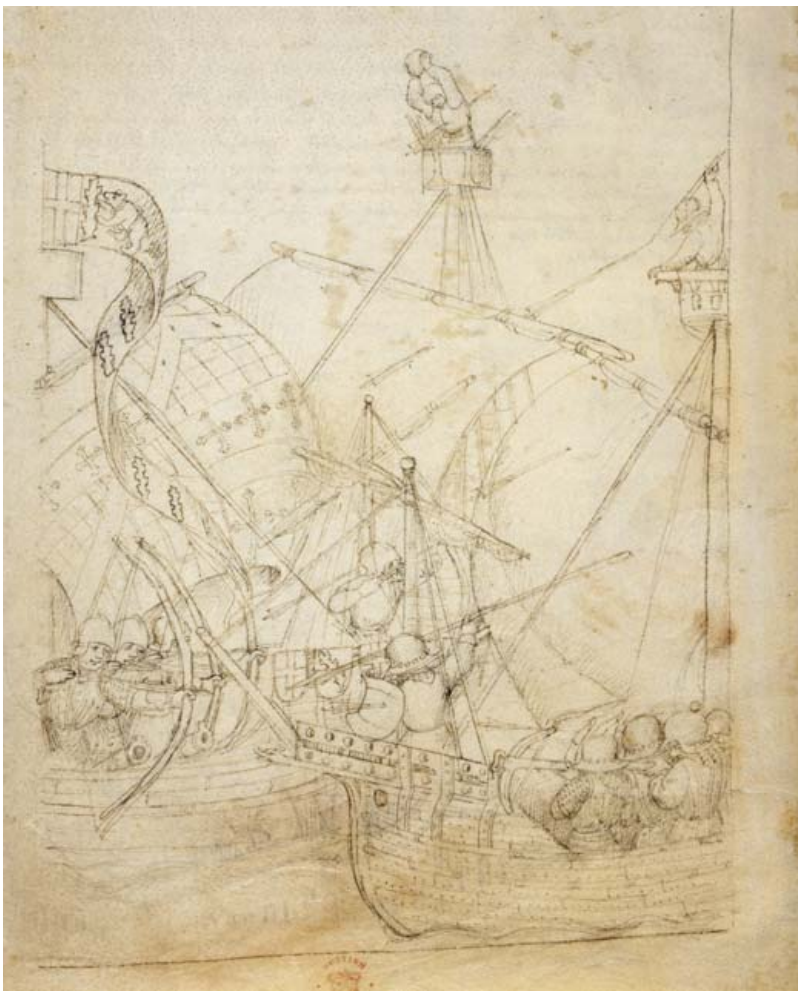
The longbow as a naval weapon

In contrast to the frustrating absence of actual longbows to study from the medieval period, we are blessed when it comes to examining both the Tudor period and naval archery. Here we have the remarkable time capsule of the *Mary Rose*, whose treasures continue to further our understanding of the longbow and which, doubtless, still have secrets to reveal.

Henry VIII's great warship the *Mary Rose*, which sank in the Solent in 1545, carried 250 longbows; in fact, the *Mary Rose* was but one of a fleet of 58 ships armed with a total of 4,835 longbows (Hildred 2011: 581). Among the rest of the diverse weaponry retrieved was a broad array of incendiary devices, having sundry means of delivery from gunpowder weapons to thrown weapons, to crossbows and longbows (Hildred 2011: 520–36). Fire on a wooden ship was generally a fatal blow and one that was dreaded more than anything else.

Seven of the recovered longbows have been noted to have a distinctive profile, with a flat-sided, trapezoid section at the grip (Hildred 2011: 602). They are among the most massive bows, with the potential for greater range, and it has been suggested that this slab-sided recess may

Two ships, from the Decretals of Gregory IX, late 13th–early 14th century. Note the archers in the aftcastle and the use of long hand-held weapons to reach across to the enemy ship. (The British Library, Royal 10 E IV, f. 19, © The British Library/ Bridgeman Art Library)



English longbowmen shoot at French crossbowmen in a ship battle in the Seine estuary in 1416. Note the menace from the crow's-nests, where men with large stones and javelins are a threat to the English archers. One has already been shot by an English arrow. Nevertheless, the main focus of the bowmen is shooting straight ahead and at close range to repel a boarding action. (From the Beauchamp Pageant, *c.* 1483–84. British Library, Cotton Julius E IV, © British Library/Bridgeman Art Library)

have been to accommodate a binding that would shield the bowstave from the searing heat of an incendiary arrow (Hildred 2011: 603). There would certainly be an advantage in having archers of exceptional power who could shoot these gigantic bows, sending their fiery-tailed shafts, comet-like, across the waves to bite into the timbers of the enemy's ship. However, the Tudor fleet was not short of regular arrows either: the Anthony Roll inventories 176,040 arrows for the 58 ships listed in 1546 (Hildred 2011: 581).

That archery was highly valued by the Tudor navy is evident, even though the *Mary Rose*, like other ships of the time, was also fully equipped with gunpowder weapons, from powerful cannon to arquebuses. Longbows nevertheless continued to have several distinct advantages at sea. Damp spray and gusts of wind could spoil or empty powder from the firing pan or extinguish a match, and there was a slight time delay between firing a gun and the main charge going off – a delay that could affect accuracy from a pitching and rolling deck. The longbowman, better able to compensate for such eventualities, was more reliable. He also had the advantage of a much faster rate of shooting.

Consider, then, how much more important the bow must have been before gunpowder artillery was an effective reality in naval warfare. (Guns are recorded in naval battles from as early as the battle of Sluys in 1340. However, they cannot be said to have had the range or power equivalent to those of later naval gunnery; they were more in the nature of anti-personnel, close-range weapons.) Not only was the bow a weapon of range, a weapon that could send showers of incendiary arrows to destroy an enemy vessel, it was also the key weapon in close-range ship-to-ship fighting. This was, to some extent, equally true of the crossbow, the favoured maritime weapon of other nations.

Naval battles during the Middle Ages were akin to land battles, with ships either grappling or at least closing together so their occupants could fight it out in hand-to-hand combat. Medieval warships were mostly adapted merchant ships, re-fitted with wooden defensive structures that were built fore and aft. Forecastles (the forecastle, or foc'sle, remains in nautical terminology) and aftcastles were sheer-sided bastions that defended against boarding. They were also elevated positions from which archers could shoot down upon the enemy decks – these cargo-carrying vessels had broad decks, which in time of war would be packed with troops, horses, munitions and supplies. A further threat to troops on the decks came from above in the form of men in the crow's-nests, who would hurl down stones, javelins, darts and pots of quicklime (a caustic powder). It was also the archers' job to tumble such men from their eyries.

Men-at-arms played an important role in ship-to-ship combat, using long pikes, staffs and spears to belabour the men on the opposing decks in a preamble to boarding actions with swords drawn. When the battle was between two rival fleets, one flotilla might create a defensive barricade by roping all its ships together. This is what the French did at Sluys on 24 June 1340, in a formidable confrontation with Edward III's navy.

Sluys (opposite)

English men-arms, supported by their archers, board a French ship. The French have formed a barricade by tying their ships together, which is why the French sails are down. The English ship has just manoeuvred alongside for a boarding action. The wooden structure at the front of the English ship is called the forecastle. These were built onto merchant ships known as 'cogs' to convert them into warships, and they were the key vantage points for the archers. Archers also combine with the mixed retinue of men-at-arms and spearmen to support the boarding action. This is similar to the way they operated on land.

The French employed Genoese crossbowmen to fulfil the same function as the English longbow archers. During a boarding action they endeavoured to keep the enemy force away from the sides of the ship, so that their own men could board. Both longbow archers and crossbowmen also shoot at the crow's-nests of the opposing ship. Here there were men armed with javelins, heavy rocks and pots of quicklime, which were hurled onto the heads of those below. A key weapon either to support or to repel boarding was the long spear, similar in length to a horseman's lance. At sea, the spearmen had the reach required to attack men at the sides of the opposing ship and on land spearmen became the archers' essential companion by creating a hedge of spears that protected archers from cavalry attacks.

The battle of Sluys was the first action of the Hundred Years' War. It took place in the massive harbour estuary near the Flemish town of Sluys. This great expanse of water has now silted up and been reclaimed as land. There were approximately 200 or more ships on each side, with the French employing some 20,000 Genoese crossbowmen among their forces; the English used both longbows and crossbows (Bradbury 1985: 102). Having the advantage of the wind, the English attacked with three squadrons, keeping a fourth in reserve.

The ships on each of the wings had their decks stacked with archers who, once in range, were able to pin down the flanks of the French fleet and thus prevent them from reinforcing the centre. Advancing with the tide, Edward's centre squadron, each vessel crammed with eager boarding parties of men-at-arms, closed on the French ships, which, according to the chronicler Geoffrey le Baker, were 'like a line of castles' (quoted in Bradbury 1985: 103).

Boarding actions were the order of the day, but these were only made possible by stationing yet more archers mixed in among the men-at-arms. The secret of success in battle, at sea as on land, was the use of combined forces, with the archers creating clear bridgeheads on enemy decks for their men to board. Archers also kept hostile boarders off their own decks. It was a constant workrate, with rapid shooting crucial to stem the tide of a swarming foe. Bowmen not only had to open their chests and pull back their shoulders, drawing their heavy bows time and again: their weary legs also had to ride the motion of a constantly rolling deck in a long day of fighting that extended beyond nightfall. It was exhausting labour.

The French lines were three or four deep, and the affray became more and more like a land battle as the boarders made deeper and deeper inroads into the floating wooden citadel, with archers needing to keep up with the advance as they drove the French defenders both back and overboard. On both sides attempts to board were repulsed and renewed, reversed and regained in constant, fierce forays. Eventually, the English triumphed; the French commanders were killed and thousands of men were tipped into the sea in their armour. It was said that if fish could speak they would have been able to learn French (Bradbury 1985: 103).

Not only was this a momentous victory for Edward, who was present, and his archers – he completely destroyed the French fleet, sending in divers to bore holes in their ships (Bradbury 1985: 103) – it also meant that, for quite some time, England was safe from any threat of counter-invasion and that the coming war would be waged exclusively on French soil.

Whether toppling a javelin-man from the high rigging, firing an enemy ship with incendiary arrows, establishing a beachhead or taking a harbour fort, naval archers were reliant on the skills they had honed at the marks, at clout and at the popinjay pole. When it came to supporting a boarding party, though, it was their repetitive power-shooting at the butts that was recalled. Archers were versatile troops and the medieval archer used his range of skills to shoot both at sea and on land.

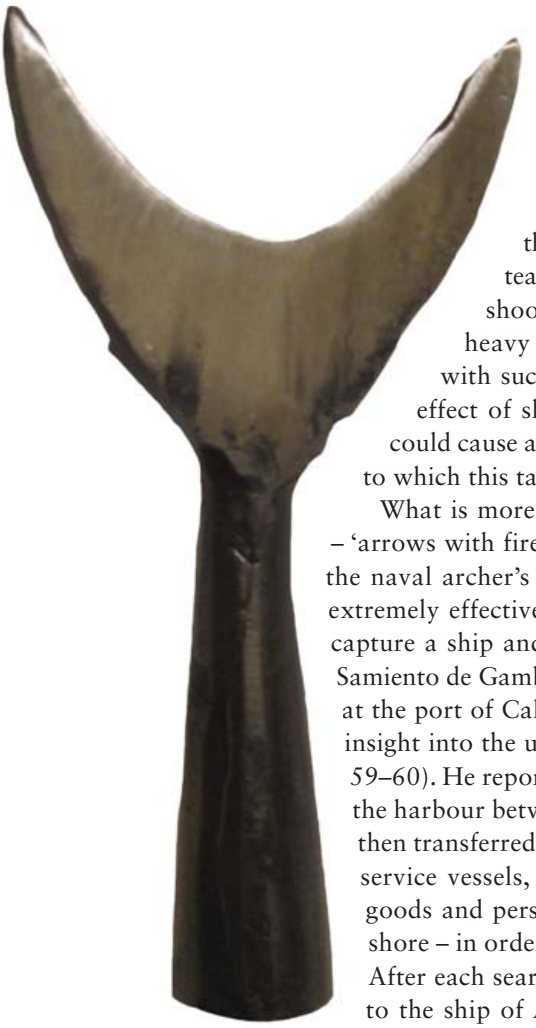
Archers covering a ship-to-shore escalade from their ships. The role of archers on ships was not restricted to fighting other vessels; they were also frequently critically important in giving cover to landing operations, such as at Cadzand in November 1337, when English bowmen drove off the French forces who sought to bar their landing (Strickland & Hardy 2005: 209). In this image we see archers shooting from their ships at the defenders of a coastal town. Many wealthy towns were fortified on the seaward side and an escalade, supported by archers, could sometimes be staged from ships sailing right up to the walls. (The British Library, Royal MS 15 E VI, f. 207, © The British Library/ Bridgeman Art Library)

The twilight of the longbow

Although the longbow, despite its many vociferous advocates, did not survive the Tudor period as a land weapon, it remained an essential weapon aboard ships well into the Elizabethan era. Recalling an encounter off the coast of San Francisco with a Spanish treasure ship in 1579, Sir Francis Drake's cousin John recounts that the Spanish captain refused to give up, even after a cannon shot had damaged the mizzenmast. It was not until 'an arrow shot wounded San Juan de Anton', the captain, that he struck sail and submitted (Nuttall 1914: 49). There was a precision to a longbow, even on a rolling deck, that could not be matched by the slow-firing arquebus of the time.

A bill of lading for the six ships returning from the Drake/Hawkins West Indies' voyage of 1595–96[10] – the *Defiance*, the *Garland*, the *Hope*, the *Elizabeth Bonaventure*, the *Adventure* and the *Foresight* – includes the following listings for archery-related gear: 'longe bowes'; 'bowe strings'; 'crossbows for firebaules'; 'longbowe shotte no firewourks'; 'bowstring tarslled'; 'arrows with ffirewourkes'; 'cinnset with ffirewourkes'; 'slimbowe arro for leade'; 'arrowros for longbows'; and 'chesstes for bowes and arrows'. Most entries have an obvious meaning, though some, such as the 'slimbowe arro for leade', are harder

10 Bill of lading from voyage of 1595–96, transcribed by Susan Jackson and published online by the Drake Exploration Society at http://www.indrakeswake.co.uk/Society/Research/billoflading.htm (accessed 7 December 2012).



Crescent arrowhead. This type of arrowhead, used for hunting birds, may also have had an application in naval warfare for ripping open enemy sails. When used for hunting, the head design delivers debilitating force to the strike without skidding off, as a blunt might, and has the potential to incapacitate wings without penetrating and making a mess of the flesh. (Arrowhead by Hector Cole; photograph by Matthew Ryan)

to decipher. A translation of 'cinnset' is given in the transcription as 'crescent'; crescent-shaped arrowheads may have been a type that had use in naval engagements. Often also called 'forkers', these heads are most usually associated with hunting birds.

However, tests by Mark Stretton have shown that a crescent arrowhead also has the capacity to tear sailcloth (Soar 2010: 148). Mark found that by shooting with these heads using a shallow angle at heavy canvas, he created 12in tears. Multiple shots with such arrows from a pursuing ship could have the effect of slowing down the target ship, and a high wind could cause a shredded sail to rip apart even more. The extent to which this tactic was used remains speculative.

What is more certain from the list is that incendiary arrows – 'arrows with fireworks' – continued to be an important part of the naval archer's arsenal. As an act of war, burning a ship was extremely effective; however, it was less useful if you wanted to capture a ship and her treasure as a prize. An account by Pedro Samiento de Gamboa, describing Drake's seizure of a Spanish ship at the port of Callao de Lima on 13 February 1578, gives a rare insight into the use of bows in a boarding action (Nuttall 1914: 59–60). He reports that Drake's ship, the *Golden Hinde*, entered the harbour between ten o'clock and midnight; boarding parties then transferred to the pinnace and skiff – smaller, oar-powered, service vessels, used by large sailing ships for the transfer of goods and personnel either from ship to ship or from ship to shore – in order to look over the Spanish ships anchored there. After each search they cut the anchor cables. When they came to the ship of Alonso Rodriguez Baptista, the *San Cristobal*, 'they boarded her, shooting many arrows at her sailors and pilot … Alonso Rodriguez was wounded by an arrow' (Nuttall 1914: 60). This daring night-time raid resulted in Drake's capture of the ship, laden with silver; he set sail into open water before the alarm was raised on land. After two days of pursuit, the Spanish gave up. In this instance the longbow gave an advantage of stealth to the raid, providing enough time for Drake to get a head start with the wind.

The American adventures of Drake and Sir John Hawkins fuelled English interest in the New World. During the summer of 1582, arrangements were drawn up for an expedition under Sir Humphrey Gilbert to colonize American territory in the name of the Crown. Among the agreements was a stipulation that those who held land in the new colony should also be able to provide arms for its defence. It reads: 'every tenant to sixty acres of land to maintain a longbow and a sheaf of arrows together with a sword, a dagger and a wooden target [shield] …' (CSPCA). The longbow featured in what must surely be the first 'assize of arms' on American soil.

IMPACT
Assessing the longbow

ELEVATION SHOOTING AND RANGE

There is no image in medieval art that depicts archers on a battlefield shooting up into the air, 'in elevation'. When bowmen are shown attacking a castle, there is abundant imagery of archers leaning back from the waist and angling their bows upwards, but you never see this in a battlefield context. It is also true to say that many contemporary depictions of battles represent both armies, and that the empty space in between has clearly been condensed for better picture composition. Even so, it would still have been possible for artists to show archers leaning back and shooting in the air, if this were the more familiar action. This is not to say that shooting in elevation could not be done on the battlefield, nor even to say that it was not done. It is simply to point out that although this is a familiar and iconic image from Hollywood, it is not an image from the medieval period.

Extreme ranges (approaching 300yd) were possible for a war arrow,[11] though 200–250yd was probably more typical. We also know there was a culture of distance shooting during the Middle Ages, at clout, at the marks and roving. Undoubtedly all this long-range shooting had practical applications in siege and naval warfare, but it does not automatically follow that shooting repeated volleys at distance on the battlefield was the best military use of the weapon, nor that it was the universal practice. The potential for long-range shooting is not in question and we can be

11 Joe Gibbs of the EWBS has shot a heavy livery arrow a distance of 292yd. Livery arrow is the name given to replicas of those found on the *Mary Rose*. They weigh around 2¼oz. The fletchings are a little over 7in long. The shaft is ½in at the shoulder with a bobtail taper towards the nock. These are very substantial arrows with considerable weight and drag compared to the type of arrows used by modern archers. The record was attained in 2012 and still stands at the time of writing. It was shot using a 170lb bow of Italian yew made by Ian Coote.

reasonably sure that it was used, but the regularity with which it was employed, the extent to which it characterized the archer's main activity on the battlefield and the percentage of his shafts spent in long-range flight all merit closer examination.

In the same passage in which he attests to the power of the Welsh bow, with tales of it being able to penetrate an oak door four fingers thick and pinning a knight's legs to his saddle through his leg armour,[12] the 12th- and 13th-century chronicler Giraldus Cambrensis stated that the bows used by the Welsh were 'not calculated to shoot an arrow a great distance but to inflict very severe wounds in a close fight' (Cambrensis 1894: 371). A bow capable of such penetrative feats would clearly have had the ability to shoot an arrow a very great distance. I interpret the chronicler's words to mean that the Welsh archers strategized (calculated) to shoot at close ranges, even though their bows were capable of shooting further. It does not necessarily make military sense to shoot at long range just because you can. I believe that this is exactly the view being put forward by Sir John Smythe in 1590, when he writes, in a marginal note:

> If musketeers may give effectual volleys twenty-four scores off (as is fondly reported), then some number of archers being chosen that could with their flights shoot twenty-four and twenty scores (as there be many that can) may by the same reason give volleys of flights at their enemies eighteen scores off, which both the one and the other are mockeries to be thought of, because there is no weapon in the field effectual to a convenient and certain distance. (Smythe 1964: 62)

RANGE AND DECELERATION

Range is a key factor that affects the force with which an arrow strikes. From the moment an arrow leaves the bow, there are forces of drag, which begin to slow it down. In 2003 I had the chance to gather some data on this. It was for a television programme[13] and the tests were conducted by the UK Defence Academy at Shrivenham, Oxfordshire, in collaboration with Dr Alan Williams.[14] An arrow, shot by Mark Stretton from a 150lb bow, was tracked by Doppler radar in order to measure its rate of deceleration. The deceleration was significant, slowing from 170ft/sec as it left the bow to 137ft/sec after just 0.8 of a second in flight.[15]

Frustratingly, the test did not tell us all we needed to know because the radar lost contact with the arrow before it began its descent – a malfunction that could not be corrected on the day. Clearly there would be a significant

12 At the time, 1191, this would be mail chausses, and the story is that having had one leg shot through and pinned to the saddle by an arrow, the knight wheeled his horse around, only to receive a second arrow, which nailed the other leg in the same fashion.

13 *Weapons That Made Britain – Longbow* (written and presented by the author, Lion Television for Channel 4, UK).

14 Dr Allan Williams, a leading archaeometallurgist, is Visiting Research Fellow at Reading University and consultant to the Wallace Collection.

15 A 300lb draw-weight crossbow was also tested. The fast punch of the crossbow meant that initially the bolt suffered very little drop in acceleration. It then decelerated dramatically after approximately 80yd.

pick-up in speed as the falling arrow came under the forces of gravity. Even so, this is unlikely to have been as great as the maximum speed achieved for the first 20yd or so of its flight.

The physics of arrow flight are complex and affected by many factors, which there is not space here to pursue further. I simply flag up some of the issues for consideration. However, it seems reasonable to suppose that the longbow was at its most powerful and effective at ranges up to 40–50yd, and that there was then a diminished capability until around 120yd, when parabolic shots received the assistance of gravity – albeit these are not quite as effective as shots at the closer ranges.

VOLLEY-SHOOTING

Although the word 'volley' may be used as a synonym for flight or salvo, simply implying a number of arrows being shot together; the phrase 'volley-shooting' has the more specific meaning of entire contingents shooting at once with coordinated timing. If three out of ten archers shoot more or less together, it could be called a volley. It is in that sense of the word that I have used it throughout this text. With thousands of archers in an army, there can be massed flights of arrows in the air at any one moment.

The tactic of volley-shooting, however, would require all ten archers to shoot at exactly the same moment and that is quite a different matter. This meme, beloved by the silver screen, seems implausible in practice. It may be possible with small groups of men, say ten or even 20, but it becomes exponentially more difficult to coordinate larger blocs.

Visual signals seem unlikely; it is inadvisable to stand in front of a line of bowmen. Shouted commands would not be heard above the clamour of battle by any beyond the immediate area. Musical cues from trumpets or drums may have been possible but they would also be an announcement to the enemy that a volley was about to be shot and so prompt them to take cover with their shields. Any potential advantage of saturating a zone in the enemy ranks with a shower of shafts would be muted by the recipients' ability to defend against it and then to advance with impunity until the next volley was trumpeted.

At Agincourt, the commander of the archers, Sir Thomas Erpingham, was said to call 'Nestroque' as a signal for his men to shoot. Various theories have been advanced as to the meaning of this but the one I favour is the one proposed by Hugh Soar (Soar 2010: 5). He deduces that it is a contraction of the phrase 'menée strike' and thus was an order to the trumpets to strike up (sound) the menée. The menée was one of a number of named medieval hunting calls; it was the one that signalled that the hounds were in full flight in pursuit of their quarry and doubtless sent a chilling message to the enemy as well as an order to the archers.

Following such an inaugural fanfare it is conceivable that the first shots would come more-or-less all at once, but heavy bows cannot be held at full draw awaiting the readiness of others; with thousands of archers, all with a different rhythm of nocking and drawing, subsequent flights would be unlikely to be synchronized. Certainly coordinated

volley-shooting would be nonsensical at close ranges, when everything is happening very quickly. Archers needed to react to immediate threats and had no time to wait for commands. Even if possible, at longer ranges the use of volley-shooting would have been of questionable military advantage. Ranging accurately – especially against a moving target – requires intuitive timing that is not conducive to being marshalled by a bugle. Moreover a tactic of 'shoot-at-will' would create less predictable patterns of onslaught that would be more unnerving to an enemy. In any event it was the arrows shot from closer ranges that had the most effect.

THE ARROWSTORM – A REINTERPRETATION

Very often, medieval chroniclers used precipitation metaphors to describe the density of arrows from thousands of archers – an arrowstorm. They likened it to hail and snow and rain; they said it blotted out the sun. Leaving aside the fact that a blizzard can be a horizontal event, one must allow a certain amount of poetic licence to those invoking poetic metaphor. In a similar vein Enguerrand de Monstrelet, a chronicler of the battle of Agincourt, wrote 'the French began to bow their heads so that the arrow fire [*sic*] would not penetrate the visors of their helmets' (quoted in Curry 2009: 160). This surely suggests the arrows were coming straight at the French! In fact, much of what the chroniclers reported with regard to arrowstorms could have been as true of a mass volley at 50yd as it would have been at 200yd. Even relatively near-range volleys may still be considered to have been hitting at 'a distance'; the chroniclers, alas, did not specify at what distance.

I consider it likely that shooting in a parabolic arc limited the odds of success. Although it offered depth to the salvo, the exposed target zone of each man was greatly limited by the physical presence of the ranks in front and shields were an effective means of ensuring that where gaps occurred, they were well defended. Certainly there would be casualties, but shooting in an arc did not offer a good percentage chance of success for those husbanding precious resources.

In contrast, shooting with a trajectory nearer to the horizontal would have allowed more targeted and more robust hits, causing great disruption as enemy men and horses fell in the path of those behind. When archers were used to shoot from the flanks, they could bring about significant problems of crowd chaos by targeting those on the edges of the attacking army, forcing a concentration of men towards the centre. Shooting into the centre with arcing volleys would have the opposite effect.

ARROW STOCKS – A KEY FACTOR IN BATTLE

Apart from the clear advantages of accuracy and impact, the issue that must have most concerned the massed archer companies of the 14th and 15th centuries was the question of arrow stocks. Medieval war arrows were a sophisticated and elaborate form of ammunition, which could not

be made readily by an army on campaign. It was serious news for the chamberlain of Chester to discover in 1356 that 'no arrows can be obtained from England because the king … has taken for his use all the arrows that can be found' (quoted in Hardy 1992: 84). On the one hand this tells us that the king took a lot of arrows with him on campaign, but on the other it reminds us that arrow stocks were a finite commodity.

I have discussed the scale of arrow procurement earlier and although we cannot be certain of the numbers, between one and two million is probably a generous guess for an expedition such as Edward III's Crécy adventure. Of course, not all of these shafts would have been available to the archers for the main battle. Commanders needed to ration their arrows, especially when on a foreign campaign. A good amount would have been used in the skirmishes and raids that occupied six weeks of relentlessly aggressive chevauchée prior to the battle, and ideally some stocks would have been held back to cover any hope of retreat in the event of an indecisive result on the battlefield.

Moreover, it is probable that a certain percentage was unusable. There are numerous warnings of dire consequences for those who supplied sub-standard arrows – such as in Edward III's 1369 order for 1,000 sheaves of arrows, which carried the sanction that 'unless the said sheaves be made of seasoned wood … the king will cause the sheriffs … to be arrested and imprisoned, their lands, goods and chattels to be seized' (CCR Ed III 1369). In addition to this penalty for those responsible for the procurement, the fletchers themselves were threatened with a punishment that 'shall be a terror to others' (CCR Ed III 1369). Such harsh measures indicate a significant problem with faulty goods – unseasoned, green-wood arrows that appeared good enough on delivery but warped subsequently, a flaw not discovered until they were unpacked from their barrel on campaign.

As a discussion point, let us say that Edward had one million arrows available for the main battle at Crécy.[16] If we suppose that the majority of bows were in the 100–120lb range, it seems reasonable to estimate a rate of shooting of eight arrows per minute.[17] Estimates for the number of archers vary but if we take a mean figure of around 7,500, then there is the potential for the archer corps to shoot 60,000 arrows a minute. It is obvious that no archer could sustain this rate of shooting with a heavy bow minute after minute, but the mathematics tells us that only just over 16 minutes of shooting at that rate is available to the army before stocks run out, irrespective of how those minutes are spread out during the course of the battle.

At Crécy, initial volleys were expended into the unshielded Genoese crossbowmen and the remaining stocks had to be husbanded to repel the French attacks. According to some authorities the French attacked 15

16 Robert Hardy (Hardy 1992: 83) suggests a more conservative figure of just half a million arrows being available at Crécy.

17 I can shoot 12 arrows per minute with a 70lb bow and there are others who can shoot faster. However, this is not with the heavy warbow. It therefore seems wiser to take a more conservative number. Mark Stretton of the EWBS can shoot ten per minute with a 140lb bow, but would not be able to shoot 20 in two minutes (private correspondence). He regards six per minute more achievable for consecutive minutes with such a bow, but if we consider that the average bow would be of a lower weight, then it is probably reasonable to propose a rate of shooting under pressure of eight arrows per minute.

Battle of Crécy from Froissart's *Chroniques, c.* 1470–75 (detail). Although this 15th-century image is anachronistic for Crécy, note that arrows are placed in the ground, the archers are well armoured, they shoot recurved longbows and they are in the midst of the fighting. (Bibliothèque Nationale de France, MS Français 2799, fol. 223, © Bibliothèque Nationale de France)

or 16 times (Hardy 1992: 73). We can be sure that each assault lasted more than a minute and so, quite quickly, the arithmetic becomes challenging. When the pounding hooves of the enemy charge are massing within yards of your front line it is surely no time to ration supplies, so commanders had to conserve their resources when they could by limiting the use of distance volleys.

Arrow stocks were not the only element to be used sparingly. Even the strongest archer could not keep up the work rate of shooting rapidly with a heavy bow for very long. Archers would need to have been ready to repel an attack when it came to close quarters with an unrelenting, pounding barrage of shafts. Expending energy on more speculative targets at longer ranges risked exhaustion for when it really counted.

Whether or not the French actually did attack 15 times at Crécy does not change this argument. As far as the English knew, they may have attacked less but, equally possibly, they may have attacked more; the battle may have lasted longer. There could have been another battle to come. In calculating both the stamina of the archers and the provision of arrows, a commander needed to be sure that every shot would count. Even if there were two million arrows available at Crécy, which I strongly doubt, the need to be prudent with them would have been just as great. The statistics and particulars will be different for every battle but despite a wide range of variables, the principle holds the same.

THE LONGBOW'S EFFECTIVENESS AGAINST ARMOUR

It is beyond the scope of this present work to catalogue, analyse and disentangle the results of all the dozens of penetration tests that have been carried out over the years. Without question, the longbow is capable of delivering arrows with sufficient force to pierce most types of armour in ideal conditions. What is less certain is the odds of these ideal conditions presenting in the random chaos of battle. Describing an arrowstorm at the battle of Agincourt, the Benedictine chronicler Thomas Walsingham recorded that 'many of the French fell, pierced with arrows, here fifty, there sixty' (quoted in Curry 2009: 52). Given such writers' propensity to exaggerate, these seem trifling numbers.

Arguably the most crucial factor in determining penetration is the angle of strike. Tests against static, perpendicular, flat sheets of metal or

other target material are informative because they show what effect an arrow would have if it struck at an angle of exactly 90 degrees to the surface. They show the potential of an arrow to penetrate. What they do not show is the probability of how many arrows would strike at this angle, which is affected by the deflective nature of armour's curves, the fact that a man in battle would be in a state of constant motion, the influence of wind at long range and archer's paradox at short range.

Arrows that strike at angles other than perpendicular to the target usually fail to penetrate. That is, in part, because some of the force arising from an arrow hitting goes along the line of the armour and not through it. It is also because an arrow is flexible and the force that is not along the line of the arrow will cause it to bend. When an arrow strikes at 90 degrees and does not bend, then the whole mass of the arrow is aligned behind the point and so there is a high force as all the mass is being slowed down at once. However, if the arrow bends on impact, then some of the mass of the arrow will try to continue forward with its momentum, causing the arrow to bend even more, which will result in a lower force being transmitted to the target.

Many tests set up the target armour against a rigid stand that allows for no movement on impact. Bearing in mind that an arrow strike from a heavy bow has the potential to lift a man off his feet – the equivalent of being hit by a sledgehammer – the energy absorbed by a moving body's response to the hit needs to be factored in. Countering that is the opposite effect of a body moving at speed, such as on a galloping horse, towards the arrow strike.[18] These are important variables.

Other variables include the draw-weight of the bow, the range of the shot, the weight of the arrow, the type of arrowhead, whether or not the arrowhead is hardened steel, and, of course, the quality of the armour, which can vary enormously. Not all armour was the best quality; nor were all arrows shot from the most powerful bows, nor with the best-quality arrows, nor with exactly the right type of arrowhead for their destined target. The battlefield was an inconsistent environment.

Penetration testing has become the Holy Grail for assessing the effectiveness of the longbow in war. This narrow focus has been useful as far as it goes, though tests against household objects or re-enactment-grade armour do not really count and the appropriate quality and combinations of metal and textile armour are seldom incorporated. Testing mail in isolation from an authentically constructed aketon, for instance, is irrelevant.

I have long thought, however, that the real merit of the longbow in battle does not rely on penetration alone; non-penetrating strikes were also effective and a great deal more common. Certainly, men were wounded and killed by arrows piercing the body; armour on occasion failed. Moreover, a man may not be completely protected by armour, either by choice – sacrificing full protection for the advantages of comfort and mobility – or because he could not afford it. Visors were raised to get a better view or catch a breath; there were moments of rashness

18 Mark Stretton has done some interesting tests using fast-moving oncoming targets on ziplines, which have been published under his authorship in Soar 2010 (140–43).

and vulnerability. Generally speaking, though, armour was reasonable proof against the weapons of the day.

If the longbow really did have the ability to puncture with certainty all medieval armour, English armies would have had the capacity to annihilate 100 per cent of their foes on the battlefield in very short order, and that did not happen. A generally accepted number of French men-at-arms killed at Crécy is 2,200 (Ayton & Preston 2005: 333). It was a genealogical catastrophe that gave the military aristocracy of France a crushing blow, the hammerhead of which was English archery. However, it was not total destruction. According to Froissart there were 20,000 French men-at-arms at the battle, though the more conservative Richard Wynkeley estimated only 12,000 (Ayton & Preston 2005: 269). Even if we take the lower number, we can see that a high percentage of men survived the arrowstorms. Seemingly, in most cases, shields and armours were adequate to the task.

However, penetration need not be the true measure of an arrow's military effectiveness. In fact it may not even have been the principal purpose of battlefield archery. There must have been reason for recruiting well-paid archer armies in so many thousands, more than just working the percentages against the odds of armour penetration.

My belief is that the main function of massed archers was to deliver a consistent barrage of hits; even though few would penetrate, all would strike with a significant blunt-trauma force, landing a debilitating onslaught of heavyweight blows – blows that would soften up and weaken an enemy, sapping his stamina and will. The ability to deliver repeated hits, consistently and unwaveringly, may have been a greater contribution to military success than scoring a random number of kills.

BLUNT FORCE AS A BATTLE-WINNER

In 2011 I had the opportunity to carry out some blunt-force tests. Once again it was for a television programme.[19] I recruited the help of Mark Stretton and Joe Gibbs of the EWBS, who each shot 140lb bows, and Dr Matthew Paine,[20] who set up a device to measure impact. A martial-arts mannequin was used as the mount. It had a weighted base, allowing the dummy to move when struck. The weight corresponded approximately to that of a man, creating a similar inertia. A custom force plate (CFP) measuring about 6in by 8in was affixed to the chest area. This CFP consisted of four three-component ICP 260A01 force transducers sandwiched between a pair of 2in-thick metal plates. Layered on the surface was ½in of modelling plasticine. Over this we suspended a sample of textile armour, consisting of 25 layers of linen with a deerskin top layer, and on top of this we placed a replica of a riveted mail shirt.

The archers stood approximately 10yd away and shot livery arrows shod with short bodkins from 140lb yew warbows. As

19 *Going Medieval* (written and presented by the author, Lion Television for H2 channel, USA).
20 Matthew Paine PhD, Senior Lecturer, Sports Biomechanics and Motor Control, Loughborough University, UK.

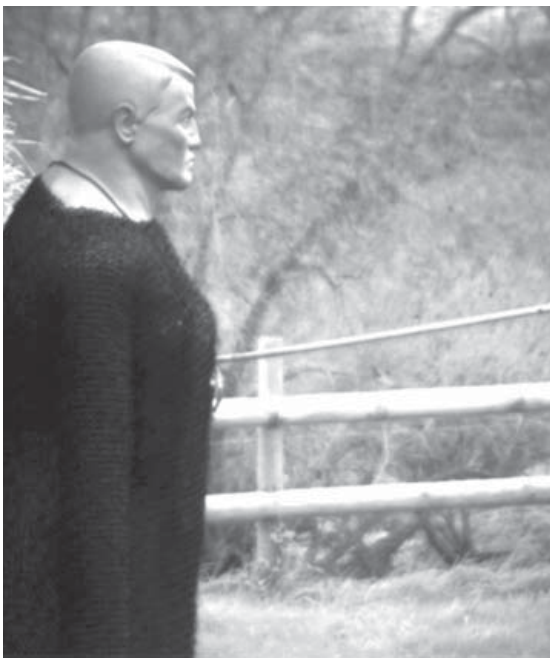
anticipated, the mail was defeated by many of the arrows, but even at this extreme close range and using the upper possibility of draw-weights, none of the arrows fully penetrated the textile armour. We knew that if the archers had used long bodkins, this type of armour could have been penetrated at this distance, but that was not the purpose of the test. Arrowhead selection was informed by our objective of determining a measure of blunt trauma in the event that the armour did its job.

Sample of textile armour made by Deborah Lee. Note that the stitching pattern has gathered the layers together in such a way that the density of the fibre mass has been intensified. This is the specimen that was used for tests measuring the effects of blunt trauma from a non-penetrating arrow strike. (Photograph by Tobias Capwell)

One of the more surprising outcomes of the test was that even though both distance and equipment were constant, impact forces varied considerably from 60lb to 300lb, with the vast majority of hits being between 160lb and 250lb. Of the several dozen arrows shot, the 300lb reading was a one-off extreme peak, but the shock of receiving such a hit can be compared to wearing a bulletproof vest and being hit by a .44 Magnum round! This is a measurement of the impulse/momentum – the thudding, stopping feeling that someone would experience on the receiving end of such a hit. However, the analogy should not be taken too far:the energy delivered by this arrow was only around 100 joules, whereas the energy for the lowest end for a Magnum is around 1,000 joules.[21] It should also be noted that the vast majority of arrow strikes in a battle would be at a greater distance and most bows would likely be of lesser draw-weights. We were testing the extremes.

Nevertheless, the test did highlight what I consider to be the key role of the longbow on the battlefield – to thump the enemy with very heavy hits. It was a bonus when a shaft penetrated, whatever the percentage chances of that may be, but nearly all shafts can be counted upon to hit. That was the fight. That was the battle – relentlessly striking the foe with powerful blows. It did not matter, within certain parameters, that the force of the blows varied in intensity, either because of the angle of strike or the draw-weight of the bow; even the lighter, but still strong, strikes would have taken their toll cumulatively. Archers were engaged in a slugging match; arrows were steel-clad fists with a considerable reach. It was attritional warfare, wearing the enemy down with hard strikes. In such a contest the power of the hits was important. Heavier bows and closer ranges were better, but the knockout punch was not everything. Of equal importance was the frequency of the hits, dependent upon both the rate of shooting and the number of archers.

21 Private correspondence with Dr M. Paine.



Screen-grab from the slow-motion camera recording blunt-force impacts. Note that this arrow is bending slightly on impact, which is already beginning to dissipate some of the force of the blow. An arrow hitting at a perfect 90 degrees, and which does not bend, will have the whole mass of the arrow aligned behind the point, thus creating a strike of greater impact. (Photograph courtesy Dr Matthew Paine)

The really big hits would rock a man and, before the advent of rigid plate armour, they could cause flexible armour to deform into the body, causing damage to internal organs. For the man-at-arms facing such a bruising attack, having a developed muscle-mass, especially around the abdomen and the neck, was as essential a protective layer as the armour itself. It was about being able to take the hits and it was about stamina.

For the archer, too, it was about strength and endurance. Repeatedly shooting heavy bows was arduous, back-straining, muscle-cramping, sweat-inducing toil. At range the longbowman occasionally had the opportunity to gall and goad standing troops, provoking them into abandoning their positions, but at whatever we consider to be the optimum range to begin shooting, the enemy ultimately closed quite quickly. That was when the archer's work was needed most and for the longest time – fighting at close range and hitting the enemy as hard as possible with targeted arrows.

Archers required a defended position – be that terrain, obstacles or a hedge of spears – without which they were extremely vulnerable. However, even a defended position needs to be actively defended and when the enemy attacked, the archer could not slack. He must set to his strenuous task without pause. If overrun, or if arrow supplies were exhausted, archers were expected to engage in hand-to-hand fighting. They were adaptable soldiers.

The longbow was an easily portable and powerful weapon that had a considerable impact on the medieval battlefield and even more so at sea and on campaign. Indeed, the longbow's greatest advantage was its versatility – its suitability for use in a wide range of military operations. However, it was not a magic stick and it was not infallible. Terrain and tactics had to be right for it to be effective and the arms race between the longbow and ever improving forms of armour was close-run, with neither side edging far ahead but rather maintaining a constant state of precarious balance.

Although there have been enormous advances during the past few decades, I believe that our full understanding of the longbow and the way in which it was used in medieval warfare remains incomplete. This, of course, fuels the endless fascination that many have for the subject. Personally, I would like to see future tests focusing more on 'rate of shooting' with heavy bows rather than on extreme range, and tests that concentrate more on trying to replicate the full array of medieval armour more accurately. We also need to find a way to simulate the constantly varying and random angles that targets present during battle, and we need always to keep open minds.

EPILOGUE

As the 16th century gave way to the 17th, the longbow disappeared entirely from military use. The English victories over the Scots at Flodden (1513) and Pinkie Cleugh (1547) were the last major land battles in which it played a significant part, and Drake's voyages saw its final use at sea. Gunpowder weapons got better, though the longbow still had many advantages and, over the years, its many ardent proponents. In 1625, prior to the English Civil War, William Neade proposed a system of training men with a bow-and-pike combination. His 'double-armed man' had a pike strapped to his bow, creating a defensive hedge against cavalry while allowing the same man to be an active shooter. Charles I was a supporter of the scheme and it had some initial traction before being eclipsed by the onset of war.

In 1798, with the threat of an invasion of Britain by French forces under Napoleon, another British military tactician, R. O. Mason, wrote a tract called *Pro Aris et Focis*, which was illustrated with various drill exercises for the archer/pikeman. Mason, too, argued that the bow was a superior weapon to the musket. However, perhaps the most articulate advocate for the reintroduction of the military longbow was Benjamin Franklin, though his recommendations ran contrary to the military thinking of the times; neither was there an adequate national resource of bowyers, fletchers or trained bowmen.

Nevertheless, in a letter to General Charles Lee in 1776, at the outset of the American Revolutionary War, Franklin proposed that longbows be standard issue for the Continental Army. His idea was prompted by a shortage of gunpowder, but he set out an argument that remained as true then as it had been the day the world shook to the first gunshot. Among his most important points were the facts that 'an archer can discharge four arrows in the time of charging and discharging one bullet' and 'that his object is not taken from his view by the smoke of his own side' (Sparks 1882: 170). I can do no better than close this brief study with another quotation from Franklin. He wrote that longbows were 'good weapons, not wisely laid aside' (Sparks 1882: 170).

GLOSSARY

Aketon: An earlier term used to describe a padded coat worn under armour.

Archer's paradox: A term given to the phenomenon of an arrow snaking for the first 10–15yd after it leaves the bow. The force of the string causes the flexible arrow to bend around the bow; this flex then counter-flexes because of the natural spring in the shaft and the effect perpetuates at a diminishing rate until the arrow finally straightens.

Arrayer: An officer of the crown or the county, responsible for recruitment and the inspection of the arms and armour such troops were required to provide.

Brigandine: Armour consisting of rectangular plates riveted to a cloth or leather coat.

Caltrop: A metal obstacle consisting of four spikes emanating from a central point, scattered in front of blocs of archers. Caltrops always presented with one spike sitting vertically and were a hazard to infantry and cavalry alike.

Chaperon: A knitted cap typically worn by medieval archers.

Courtepy: A hood, typically worn by medieval archers.

Crannequin: A geared mechanical device for spanning a crossbow.

Draw-weight: The amount of force – in pounds – required to pull a bow to full draw.

Escalade: An assault on a castle or fortified town that entailed sending troops over the walls by means of ladders or siege machines.

Footing: A piece of wood joined to the main shaft of an arrow by means of a splice.

Gambeson: A later term, originally used to describe padded coats when they were worn as armour in their own right. However, in time the coat worn beneath armour also came to be referred to as a gambeson.

Heartwood: The wood at the centre of a tree, which is considered to be dead but also resistant to decay. It is surrounded by the sapwood, which is the living wood of the tree, the conduit of water from roots to leaves.

Hobilar: A mounted infantryman, usually armed with a long spear, who could be used in a defensive formation with archers.

Jack: A type of textile armour, of jacket length. It may consist of multiple layers of linen, stitched in a gathered pattern, or it may be densely padded with fleece that has been tightly quilted, or – when it is known as a 'jack-of-plates' – it may consist of a mosaic of small iron plates sewn into the garment.

Pavisse: A large freestanding shield carried into battle by a crossbowman to give him a safe barrier behind which to span and load his weapon.

Quicklime: Quicklime – calcium oxide – caused painful burns on contact with the skin and blinded when thrown in the eyes.

Sallet: A 15th-century style of helm, commonly worn by archers.

Schiltron: A defensive formation of long spears designed to be impregnable to cavalry.

Shaffron: Armour that protects the head of a horse.

Windlass: A cumbersome spanning device for a crossbow, comprising a cylinder that was turned by two crank handles, one on each side. Ropes, attached to a hook that fitted over the crossbow string, were wound by the cylinder, reeling in the hook and so spanning the bow.

Yeoman: A loosely defined class of person during the Middle Ages who was often, though not exclusively, a small landowner. Archers were largely recruited from the yeoman class.

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