

TA Assignment - Jake Comer

by Jake Comer

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ACDA 5024 - Technical Authoring

Performance of the longbow and bodkin arrow against plate armour at
the Battle of Agincourt.

University of Wales Trinity Saint David

Ordnance, Munitions, and Explosives Level 6 Apprenticeship Degree
Bachelors Course

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Abstract / Executive Summary

Over the course of this report the study of the performance of the longbow and an examination of the claim that the longbow was the sole purpose for the English victory at the Battle of Agincourt. There have been claims made by historians that the longbow is the sole and only reason as to why the English won the Battle of Agincourt. This report is going to detail why these claims are false and misleading through exploring other factors that fell into the English's favour, as well as mathematical equations to back up the report's argument that the longbow was not effective against the French's plate armour.

This report will start off with an introduction to the battle and the weapon and armour used. The report will then look to examine the claim of the historian and then begin to provide detailed evidence as to why these claims are untrue. The report will explore the other factors that should be given credit for the English's victory and this report will provide evidence in the form of equation calculations and images to further legitimise the point of this report, to disprove the longbow being the decisive factor. At the end of this report there will be a conclusion section which will be a round up to all that has been covered with some final points.

Introduction

The Battle of Agincourt took place on the 25th of October 1415 during the 100 Years War. The 100 Years War was an ongoing conflict between the English and the French due to disputes over England's territorial claims in France. Due to political unrest in France and other factors back home in England, King Henry V made an offer to the French which was rejected. This caused King Henry V to form an army and invade France. They landed in Harfleur where they took siege of the town, although at a greater loss of men and a longer time frame than what the English had expected. Henry lost many of his men at this time, estimations of around a third which would have been around 3000 men. This was due to either injury or dysentery due to the poor living conditions of the English. After the success of the siege the English then headed to Calais to go home. However, it was at Agincourt they were cut off by the French and battle ensued.

The battle consisted of an English force of around 7500 men, the around 5000 longbow archers and the rest were men at arms. French force of around 15000 men which were made up of cavalry, men at arms, and archers. The battlefield conditions were poor with heavy rain the night before and exacerbated due to the horses' hooves. The battle went on for 2 hours until the remaining French retreated off the battlefield and King Henry V and his English force were victorious.

The longbow and needle bodkin arrows which were used by the English has caused some historians to give it the longbow the title of the deciding factor and the overall contributor to the English's victory, there is numerous equations and evidence that can be provided to disprove this claim which will be done so further in the report. Before that, the equipment used by both sides and also the contribution of other factors must be explored.

Weapons and Armour Used

In this section of the report, the equipment that is going to be analysed in calculations later in the report is going to be looked at with images used to give the reader a better understanding of what was used. Each item of equipment will also be given a description of what is and any other important information that the reader will need.

Longbow

In the Battle of Agincourt, the longbow was the bow which the archers used against the French cavalry and men at arms. The longbow was not a one size fits all and varied in size to meet the measurements of the archer, due to this the longbows measured 6 feet in height

(this could vary but 6 feet has been chosen for included equations). The longbow was made from yew wood so it was strong and also durable which would make it effective to use in battle. It was effective in battle due to it being light weight and it's accuracy was consistent due to its reliable structure. The longbow would create enough potential energy in the drawback of the string of the bow, that was then transferred into kinetic energy of the arrow. The impact velocity that the arrow would have when fired from a distance of 100m was 53.34m per second, this would be affected by 8.95m per second if the target was a knight on horseback and 0.9m per second if the target was a soldier on foot. Due to the large number of archers and the rate of fire of the longbow being around 5 shots per minute, this shows there was potentially 25000 arrows fired from the English archers as a collective every minute. In figure 1 below, there is a picture of a recreated longbow which gives the reader an idea of what the longbow would have looked like in comparison to the archer.

Figure 1 - Longbow [1]



Needle Bodkin Arrow

This type of bodkin arrowhead was used during the Battle of Agincourt and proved to be the most effective against mail armour. This was due to the arrowhead being long and thin and being able to penetrate the weak points of the mail armour to inflict flesh wounds. The length of these arrows was around 115mm and with a diameter of 11.11mm. It had a density of 6.35gcm^{-3} . The impact velocity of this type of arrowhead of 53.34m^{-1} . This is an important figure to remember as it will be heavily used to prove the effectiveness of the French's plate armour against this arrowhead. Below in Figure ?? shows a table of the arrowhead's properties.

Figure 2 – Bodkin Arrowhead Properties

Arrow Property	Value
Length (Arrow only)	115mm
Diameter	11.11mm
Density	6.25gcm ⁻³
Mass	0.28kg (based on arrowhead volume and density)
Angle of Obliquity	30°
Impact Velocity	53.34ms ⁻¹

In figure 3 there is a picture of a bodkin arrowhead to give the reader an insight into what the arrowhead would have looked like.

Figure 3 – Bodkin Needle Arrowhead [2]



French Plate Armour

The armour that the French used during the Battle of Agincourt would have been mail armour to cover the majority of the body and legs, with plated armour covering the torso, knees, shins, ankles and wrists as well as a helmet with slits for visibility. In the figure below, the properties of both the standard knight and the King's knights armour are shown, there is a difference of 1.5mm in thickness and also 250MPa in yield stress. There is also a difference of 2.90gcm⁻³. This figure shows that the King's Knight armour was stronger.

Figure 4 – Properties of the Armour used.

Armour Property	Standard Knight	King's Knight
Density	2.85gcm ⁻³	5.75gcm ⁻³
Thickness	2.5mm	4mm
Yield Stress	350MPa	600MPa

In figure 5 below, is an image that gives the reader an idea of what the armour of the French knights would have worn during the time of the Battle of Agincourt.

Figure 5 – Idea of what the French's armour [3]



Other Factors other than the longbow

This section of the report is to make the reader consider the other factors that are relevant to the battle and that landed in the favour of the English to ensure their victory. This is to help the reader to understand that it wasn't just the longbow that won the battle but a combination of multiple factors.

Knights Armour

The armour that the knights would have worn at the time of the battle would have been very bulky and heavy, this would have limited the mobility of the restrictive armour. This

would have caused the knight to have been exhausted during battle and being less effective against the English.

Another reason why the French knight's armour contributed to their loss is because of the restrictive sight they would have had due to the eye slits, this would have made the knights easy targets for being hit from positions that aren't visible to them due to low visibility from the helmet design.

Also due to the densely packed French men at arms at the front line of the battle (due to the concave line that the English held) there wasn't much room for the French knights to move and battle in, this was made worse by the bulky armour they wore. This made it difficult for the French knights to engage in effective combat.

Poor Terrain

The terrain on the day of the battle was extremely poor conditions to battle in due to the heavy rain that had occurred the day and night before. The poor terrain was then made worse by the hooves of the cavalry as they churned up the ground so that it was all mud.

The field that the battle happened on had also recently been ploughed, this and the mix of the heavy rain made the conditions even worse due to the ground not soaking in as much water as it would have done due to being ploughed.

Another reason why the poor terrain assisted in the English victory was that if French knights or men at arms were to slip over in the mud, it would require a lot of energy for them to get back up again due to the sticky and swampy nature of the mud. Also this mud would stick onto the armour of the knights leaving extra mass added to their already heavy armour. This would make them further fatigued and also much less mobile in combat.

These two factors leading to poor terrain made it incredibly difficult to move about on. This therefore made it difficult for the French men at arms to move across and by the time they had marched and engaged with the English they would have been fatigued. This would lead to the French being less effective in battle and not able to fight at their peak. Making them easier for the English to counter and to fight off.

Archer's Light Armour

The armour that was used by the English longbow archers were light and not restrictive compared to the French knight's armour. This led to the archers being incredibly effective in the battle.

One reason this factor helped win the battle for the English, is due to the high level of mobility and low level of restrictiveness of the archers due to this armour. This is because they could have a better view of the battlefield compared to the French knights and also meant that they could react to events of the battle and move into an advantageous position, in comparison to the French knights who were sluggish and slow due to their armour. This meant that the archers were able to alter their tactics to meet the demands of the battle

quicker than the French, massively contributing to the English victory. An example of this, is during the battle the archers were able to use the treeline as camouflage to surprise the French soldiers and also add another tactical advantage to the English.

Another reason why they were so effective is because they were able to manoeuvre themselves across the mud a lot easier and quicker than the French knights. Due to this when they flanked the French men at arms they were not tired from manoeuvring themselves and were able to engage at their peak performance.

Evidence for longbow and bodkin arrow ineffectiveness

This section of the report is going to debunk the claims of the historians using mathematic calculations using the figures that have been provided in prior text and figures/tables.

The argument that the needle bodkin arrow and the longbow was effective against the French's plate armour is untrue. This can be proven using mathematic and physic equations to examine the velocity of impact of the needle bodkin arrow and the velocity needed to penetrate both of the standard knight and also the king's knights armour.

The arrow that is fired is less than 1200m per second so is therefore a sub-hydrodynamic strike. The limiting penetration velocity equation will be used. This equation is used to determine the velocity required to penetrate the thickness of the armour.

The equation is shown in the figure below.

Figure 6 – Limiting Penetration Velocity

Limiting penetration velocity

$$V = \left[16.38 \frac{d^3}{W} \left(\frac{P \sec \theta}{d} \right)^{1.12} \right]^{0.5}$$

Where:

V= limiting penetration velocity (ms⁻¹)

p= armour thickness (mm)

d= Penetrator calibre (mm)

θ= impact obliquity

W= projectile weight (kg)

Before we compare the results of both the types of armour using this equation it is important to remember that the impact velocity of the bodkin needle arrow at 100m is 53.34ms^{-1} .

Figure 7 – Results of Standard and Knight's Armour

Standard Armour

$$\left[16.38 \frac{11.11^3}{0.28} \left(\frac{2.5 \text{ sec} 30}{11.11} \right)^{1.12} \right]^{0.5} = 133\text{ms}^{-1}$$

Knight's Armour

$$\left[16.38 \frac{11.11^3}{0.28} \left(\frac{4 \text{ sec} 30}{11.11} \right)^{1.12} \right]^{0.5} = 173\text{ms}^{-1}$$

Using the figure above with the input values that have been recorded and collected in prior sections of this report, it is clear with mathematical calculations that the velocity of the needle bodkin arrow (53.34ms^{-1}) is much less than the values that have been collected in from the equation:

Standard Armor needing 133ms^{-1} whilst the Knight's Armour needing 173ms^{-1} . Even considering the addition of 8.95ms^{-1} , due to the knights being on horseback. The velocity of the arrow on impact with the French's armour would still have only been 62.29ms^{-1} , which wouldn't have penetrated.

Conclusion

In conclusion, the longbow was definitely an effective weapon and a key factor into the English's victory at the Battle of Agincourt however with the data collected and the other key factors discussed it is untrue to crown it as the ultimate and decisive winning factor. It has to be mentioned that the longbow and the needle arrow's capability of causing impact injuries to the chest and head to the knight's plate armour, would have been highly effective and caused blunt force injuries. Also, if these arrows had struck the weak parts of the chain mail armour that the French wore, then there is a great possibility that there would have been penetration there. However, when it comes to the plate armour that the French wore, the arrows didn't penetrate and weren't effective in the way that certain historians make them out to be.

Overall, yes, the arrow was effective but the other key factors that have been mentioned and discussed as well as the data collected in this report, show that the longbow and the use of the bodkin needle arrow wasn't enough to win the battle on its own. Mainly due to the inability to penetrate the plated section of the armour.

References

- [1] "Primitive Bows," [Online]. Available: <https://primitive-bows.com/yew-longbow-58-28-no-131/>. [Accessed 04 2024].
- [2] ??, "By the Sword," [Online]. Available: <https://www.by-the-sword.com/p-1484-type-7-needle-bodkin.aspx>. [Accessed 04 2024].
- [3] ??, 08 2022. [Online]. Available: <https://armedfigures.com/t/french-man-at-arms-battle-of-agincourt-1415/5062>. [Accessed 04 2024].

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GRADEMARK REPORT

FINAL GRADE

30/50

GENERAL COMMENTS

Summary:

Jake, this was a very original piece of work, with a plagiarism count of only 1%. Your report flowed well but there were a few grammatical errors which detracted from the overall presentation. Please make sure you get a peer review. You have demonstrated that you can use text, figures and tables to manipulate information, which is a key learning outcome. Well done. Detailed comments below.

Detail:

1. There does not appear to be a working table of contents. Only the references are shown.
2. In the abstract did you intend to complete the first sentence with 'is discussed'? Otherwise, it is not a sentence. The abstract was a logical summary of your intentions, but what did it conclude about the report? Was the bodkin arrow and longbow a decisive factor??
3. Good introduction and presentation of the weapons used.
4. Good use of referencing and figures with appropriate cross referencing. However, for some reason you have figure ?? as opposed to Figure 2 on page 5. Not sure what happened there. Please check before submission.
5. Other Factor other, or do you mean Other Factors Than (see page 7). Or, Factors Other than...
6. Rather than use the word debunk, think about how you could have used a technical description.

Consider claims and determine the accuracy of the claims???? This sound better.

7. I liked Figure 6, very clear for the equations.

8. Yes, I agree the calculations, well done.

9. Do not use contractions in a technical report such as wasn't. It is was not.

10. Not too many references and all internet sources, so how do you know they are credible? This is something the historian could argue. It may have been useful to state this but point out that mathematical calculations are irrefutable.

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