
THE IMPORTANCE OF THE LONGBOW AT AGINCOURT

1906898 – George Tucker



Historia/Shutterstock.com



OVERVIEW

Battle Basics

Theoretical SPOME approach

Theory vs Reality

Other Factors

Conclusions

All to answer the question: *“was the longbow the most decisive factor in the Battle of Agincourt?”*

BASICS OF THE BATTLE

Agincourt Recap



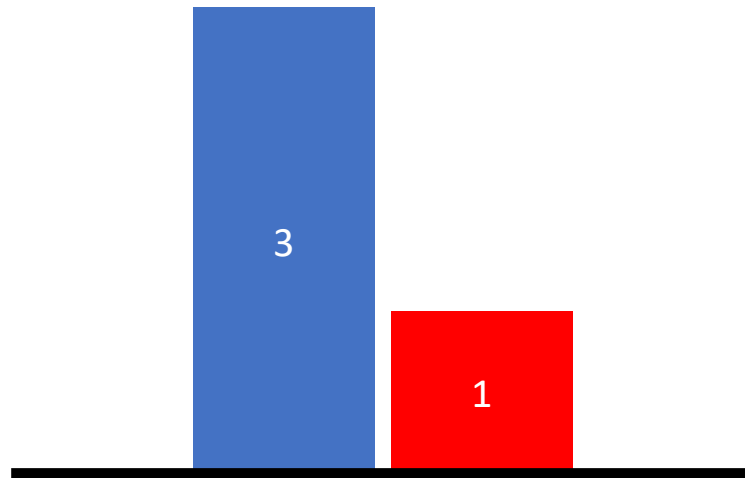
Shutterstock

BATTLE OF AGINCOURT

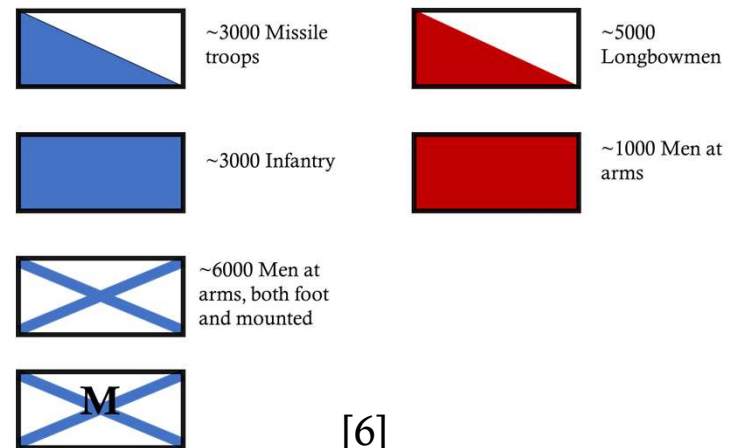
- Battle took place at Azincourt (correct spelling), Northern France, in 1415
- English victory over numerically superior French force
- Present in popular culture and divisive amongst historians

[10]

Army Size

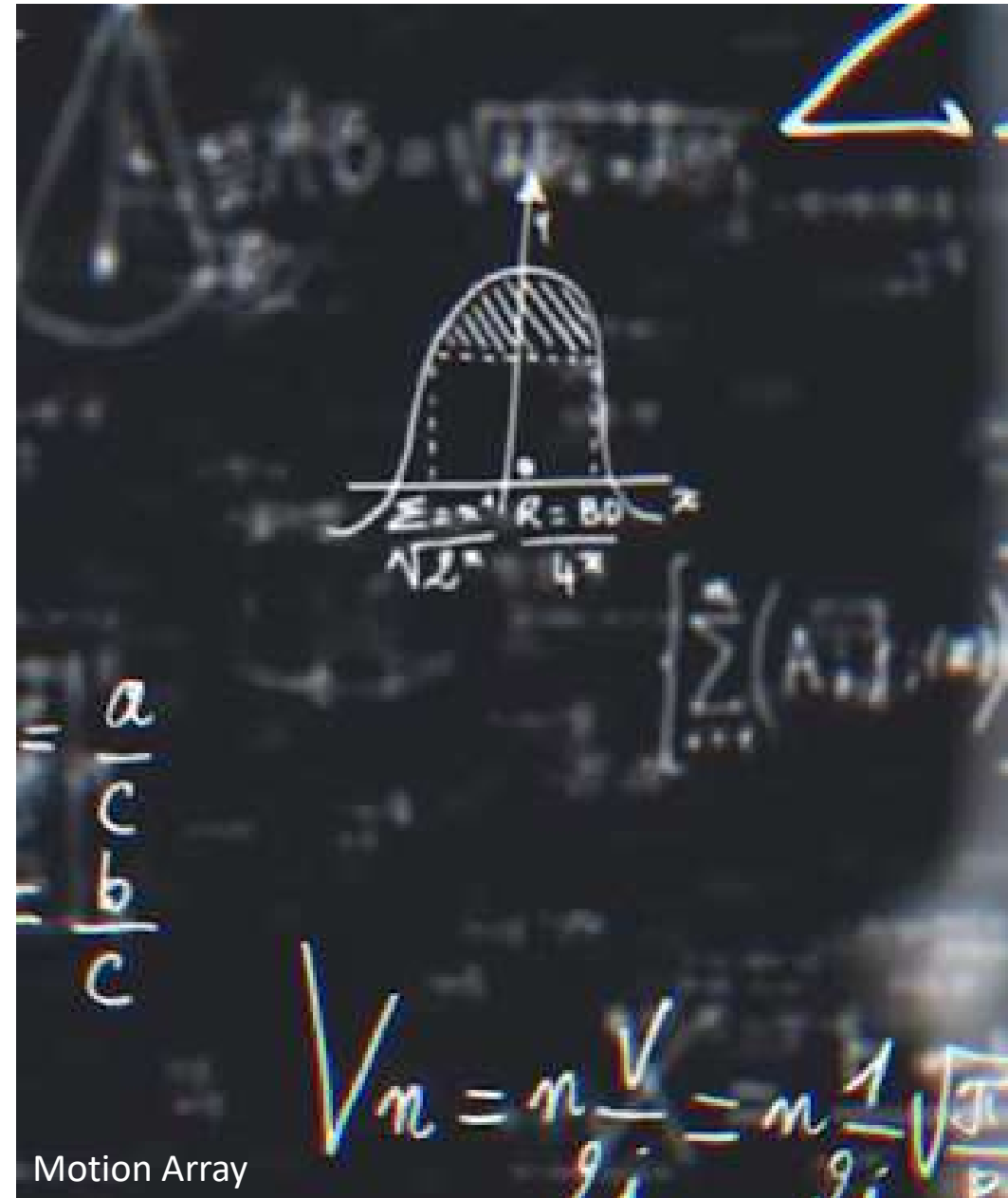


Army Composition



THEORETICAL APPROACH

Applying Scientific Principals of OME
(SPOME) to the English longbow



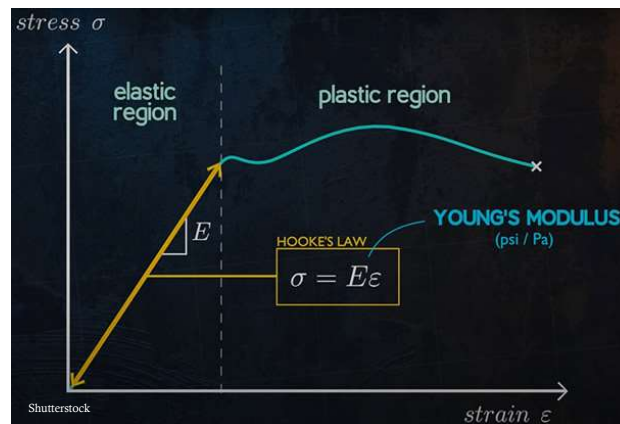
Motion Array

PENETRATION MECHANICS

The Mechanics

- Interactions are sub-hydrodynamic
- Governed by material properties, dimensions, and strike velocities
- Lots of history on working out formulae for penetration of materials

Material Properties



The Formulae

- Euler-Robins
- Tresidder
- Demarre
- Krupp
- Milne-Demarre
- Amongst others
[2], [3], [8]

TRESIDDER FORMULA

Formula

- Modified version of Euler-Robins formula for wrought iron:

$$V_L = 10140 \times \frac{t^{\frac{2}{3}} R^{\frac{1}{3}}}{M_P^{\frac{1}{3}}}$$

[3]

Variables

- V_L = Velocity to fully penetrate
- t = Thickness of plate
- R = Radius of projectile
- M_P = Mass of projectile

Rationale

- Wrought iron is a medieval armour material
- Other equations require experimental work to evaluate unknown constant

ASSUMPTIONS

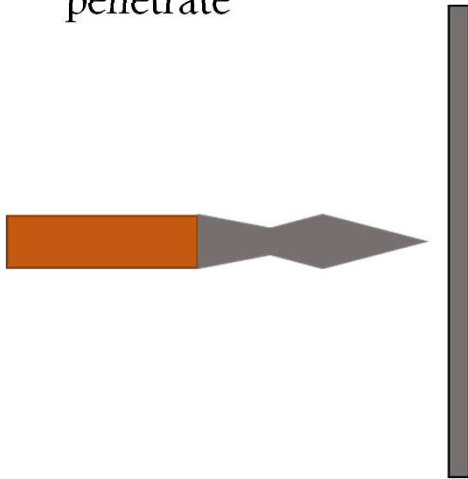
Variable	Assumption
Arrow Mass	0.116 kg
Arrow Radius	0.00635 m
Breastplate & Helmet Thickness	0.0035 m
Other Armour Thickness	0.001
Bow Draw Weight	81.6 kg (140 lbs)
Bow Draw Distance	0.71 m
Energy Transfer Efficiency of Bow	50 %

[4]

CALCULATIONS

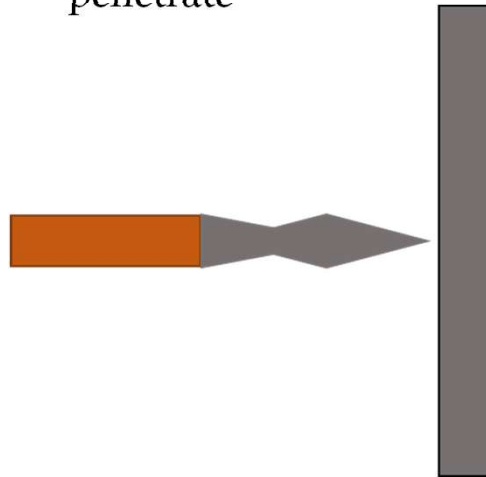
1 mm Thickness

- 38.5 ms^{-1} required to penetrate



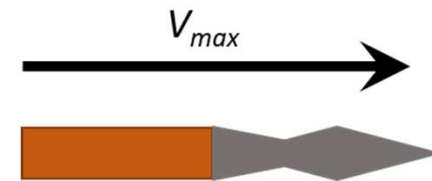
3.5 mm Thickness

- 88.75 ms^{-1} required to penetrate



Max Arrow Velocity

- Max theoretical 70 ms^{-1} arrow velocity from 140 lb warbow



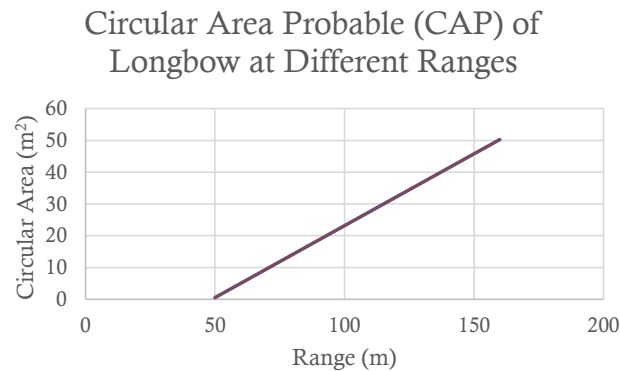
ACCURACY AND RANGE

Importance

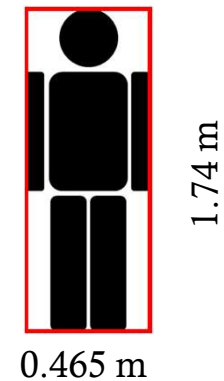
- Penetration may be possible, but first target needs to be hit
- Assumptions can be made about accuracy at different ranges
- Target may be hit, but what is the level of protection where it is hit?

[1], [7], [14]

Accuracy at Range



Probability of Hitting Target

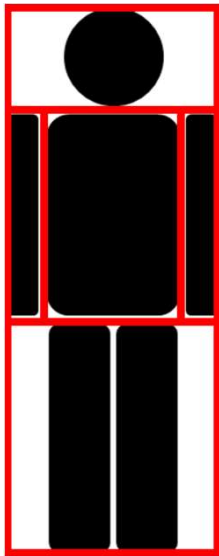


At 50 m = 100 %

At 160 m = 1.6 %

PROBABILITY OF PENETRATION

Subdivision of Protection



Probability

- By dividing up areas of the body covered with 1 mm or 3.5 mm plate we get:
- 68 % chance of hitting 1 mm plate
- 32 % chance of hitting 3.5 mm plate

What does this mean...?

- Penetrating doesn't necessarily mean injury or death
- Lethality mechanics are a whole other topic...
- Effectiveness is multifaceted and difficult to quantify

THEORY VS REALITY

Grounding our suppositions



Painting by Harry Payne

LIMITATIONS OF THEORETICAL APPROACH

Limitations of approach:

- Cavalry are larger targets
- Horses are not as armoured
- Penetration of plate does not necessarily mean injury
- Armour is multi-layered with different elements
- Armour thickness not uniform
- Armour isn't a flat sheet
- Arrow strike angle different at different ranges
- Approximations made for most variables
- Accuracy better than what is stated
- Targets are moving in reality and not stationary
- Numbers of archers and target size – 500 men in a square covers CAP area at 160 m
- Non-homogeneity of projectile
- Source materials
- Most importantly – not proven by experiment

CONTEMPORARY STUDIES



OTHER FACTORS

What else contributed to the battle?

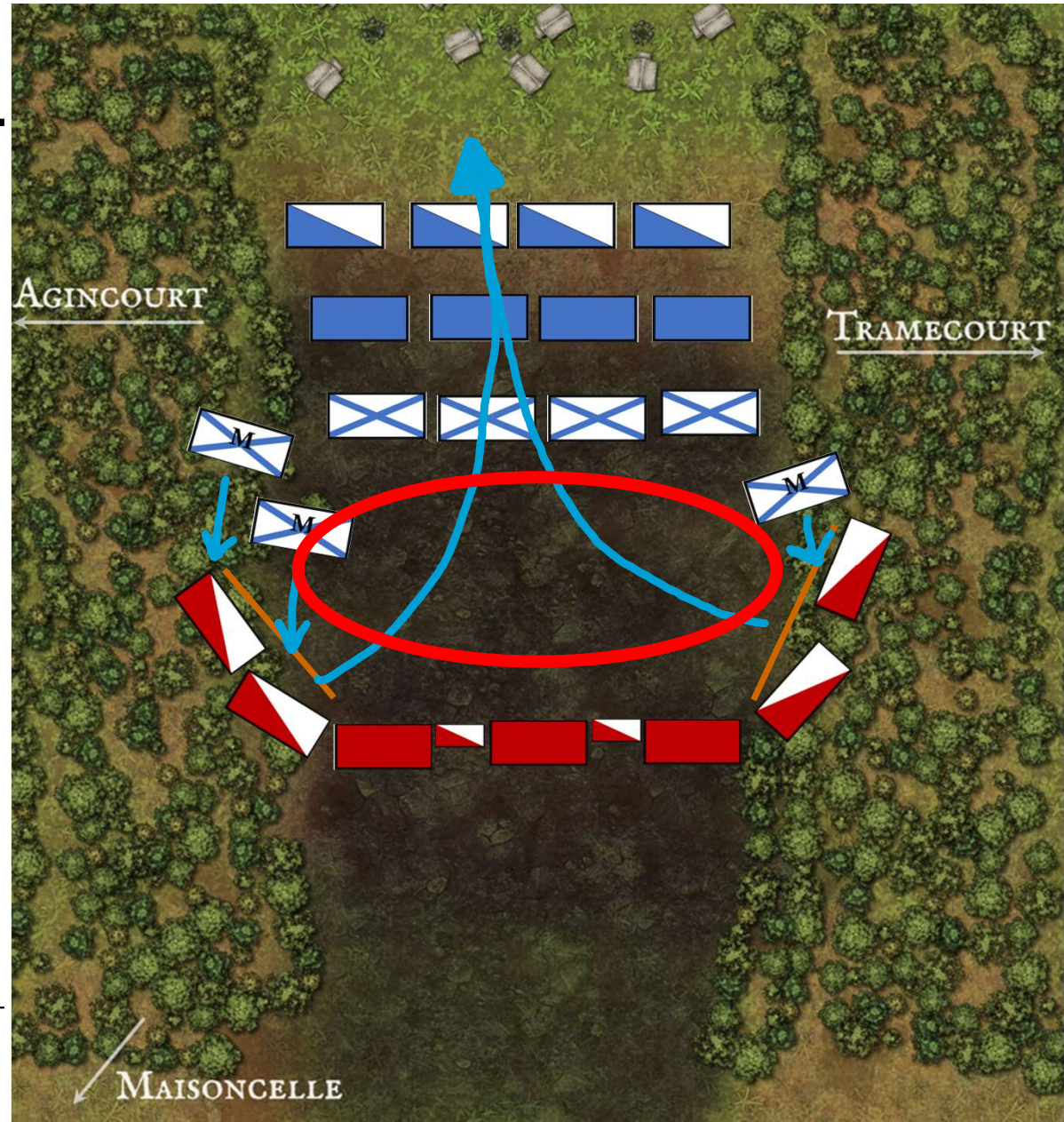


Morning of the battle of Agincourt by John Gilbert courtesy of ArtUK

OTHER FACTORS

- Tactics
- Order of Battle
- Weather + Terrain
- Fatigue
- Leadership and Morale

[10], [9], [5]



TRESIDDER FORMULA

Formula

- Modified version of Euler-Robins formula for wrought iron:

$$V_L = 10140 \times \frac{t^{\frac{2}{3}} R^{\frac{1}{3}}}{M_p^{\frac{1}{3}}}$$

Variables

- V_L = Velocity to fully penetrate
- t = Thickness of plate
- R = Radius of projectile
- M_p = Mass of projectile

Ration

- Wro armc
- Othe expe work
- Usef



CALCULATIONS

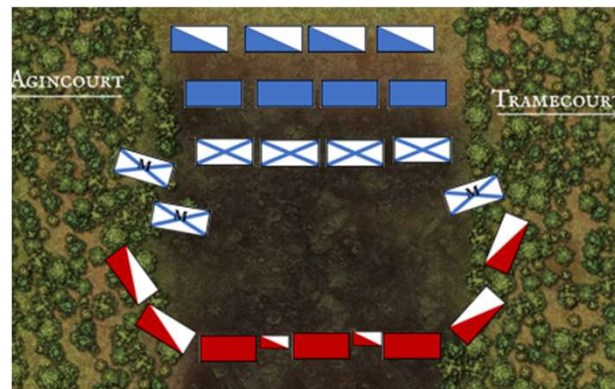
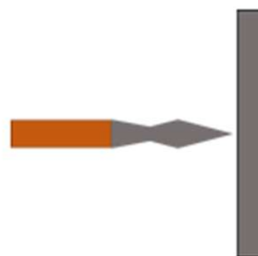
1 mm Thickness

- 38.5 ms⁻¹ required to penetrate



3.5 mm Thickness

- 88.75 ms⁻¹



CONCLUSIONS

- Explored the question from several angles
- Was the longbow a decisive factor at the Battle of Agincourt?
- Yes
- Was it *the* most decisive factor at the battle?
- No

THANK YOU

Questions?



Battle of Agincourt by William Kent copyright royal collection trust

REFERENCES

Reference
[1] D. Littlefield, Metric Handbook, Amsterdam: Elsevier/Architectural Press, 2008.
[2] A. Roberts, "Optimisation of small arms defeat via dynamic jacket removal," Cranfield University, 2016.
[3] P. E. S. John R. Davidson, "Environmental problems of space flight structure 2 meteoroid hazard," NASA, Washington, 1963.
[4] G. Collet, Tech Auth Assignment Brief, Swansea: UWTSD, 2023.
[5] C. Phillpotts, "The French Plan of Battle during the Agincourt Campaign," The English Historical Review, vol. 99, no. 390, pp. 59-66, 1984.
[6] A. Curry, "Participants in the battle of Agincourt," Oxford Dictionary of National Biography, Oxford, 2008.
[7] Various, "'Longbow' - Encyclopaedia Britannica," Encyclopaedia Britannica, 5 July 2019. [Online]. Available: https://www.britannica.com/technology/longbow . [Accessed 12 December 2023].
[8] Various, Encyclopaedia Britannica - 11th edition Vol 2, 2010.
[9] K. DEVRIES, "Technological Determinisms of Victory at the Battle at Agincourt," British Journal for Military History, vol. 2, no. 1, 2015.
[10] National Archives, "Campagin and Battle," National Archives, [Online]. Available: https://www.nationalarchives.gov.uk/agincourt/campaign-and-battle/ . [Accessed 09 December 2023].
[11] R. Allain, "How Much Energy From a Bow Goes Into Kinetic Energy of the Arrow?," WIRED, 08 DEcember 2014. [Online]. Available: https://www.wired.com/2014/12/much-energy-bow-goes-kinetic-energy-arrow/#:~:text=The%20data%20looks%20fairly%20linear,kinetic%20energy%20of%20the%20arrow . [Accessed 10 December 2023].
[12] World Archery Federation, "Barebow Archery," World Archery Federation, [Online]. Available: https://www.worldarchery.sport/sport/equipment/barebow . [Accessed 05 December 2023].
[13] A. B. Bront, "On the effects of the English longbow against armour in the XIVth and XVth century".
[14] A. GB, "Rules of Shooting," Archery GB, 2022.
[15] D. A. J. Stirland, Raising the Dead: The Skeleton Crew of Henry VIII's Great Ship, the Mary Rose: The Skeleton Crew of King Henry VIII's Great Ship the "Mary Rose", Wiley-Blackwell, 2000.
[16] A. Williams, The Knight and the Blast furnace, Brill, 2003.
[17] T. Cutler, "ARROWS VS ARMOUR – AGINCOURT MYTH BUSTING," Tod's Workshop, 30 August 2019. [Online]. Available: https://todsworkshop.com/blogs/blog/arrows-v-s-armour-agincourt-myth-busting . [Accessed 3 12 2023].