

Arrow-speed measurements



The effect of speed variation when releasing an arrow on its position on the target face is significant. Small variations lead to high and low arrows (and some left/right). Especially when shooting longer distances. Speed variations are an indication of errors in the shot execution. A good example is the forward release or loss of bow-arm pressure during the shot. If you could measure the average arrow speed of each shot and store that in the Artemis database together with all other parameters, and then analyse it, wouldn't that make a nice addition to the Artemis toolkit?

Introducing the average arrow-speed measurement feature!

What do you need?

This is an *ArtemisPremium* feature, so you need to upgrade to Premium. This feature depends on the accuracy and the sampling rate of the device you use. All Android devices support a 44kHz sampling rate and most devices even higher than that (e.g. 192kHz). The sampling rate is an indication of the accuracy of the speed measurement. With 44kHz, the system (in theory) is still accurate enough to be within a 0.1 ft/sec on 18m. However, this is theory. The actual accuracy of this function depends a lot on the sound processing hardware which differs a lot between devices.

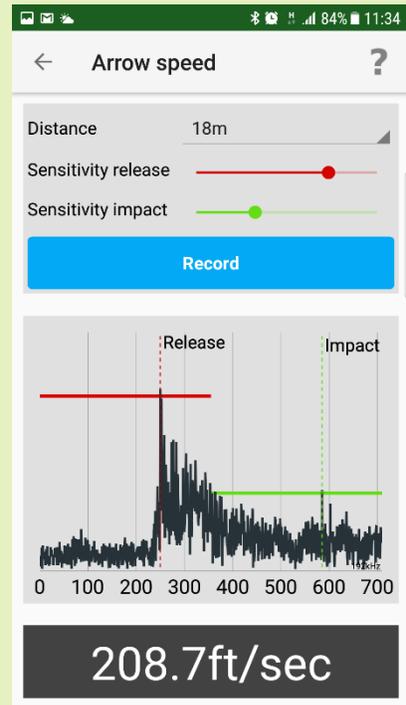
How does it work?

All Android devices have audio recording capabilities and can detect the sound of the bow shooting the arrow and the sound of the impact of the arrow on the target¹. Based on the audio recording, the time between these two events can be used to determine the average arrow speed, but only if we know the distance the arrow was shot at;

$$V_{average} = \frac{D}{\Delta t}$$

The actual formula is a bit more difficult, because we must take the time for the sound of release and the sound of impact to reach the device into account as well (which Artemis does).

¹ Only if the ambient noise levels are not too high, i.e. you are shooting alone.

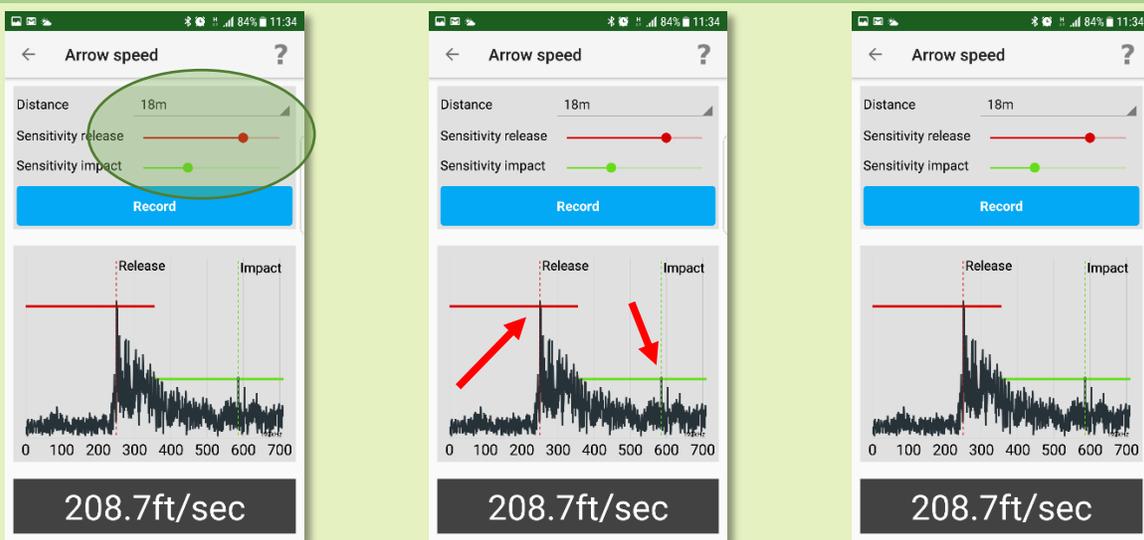


Setting things up

To turn on arrow-speed measurement, a few things must be setup first; Go to Options → Shot Details (or when plotting a match, just go to Settings), then check the item “*With arrows-speed measurement*” to turn it on.

Next; the device needs to be calibrated for the setup and distance you are shooting and the noise levels you are in. So, in the same menu (Options → Shot Details) there is a menu entry “*Arrow-speed sensitivity calibration*” that you need to click. Now, this is a bit more complicated.

Arrow speed measurement calibration



Select the distance you are shooting at; this must be 10m, 18m, 25m or 30m. Then adjust the recording sensitivities for both the release and impact. Start with the release sensitivity at about halfway and the impact sensitivity to about 1/3rd. Now press record and shoot an arrow.

Look at the recording and try to find the two peaks of release and impact. Adjust the release threshold such that the timing is triggered on the bow shooting the arrow². Then set the impact sensitivity to the impact³.

Try a couple of shots, fine tuning both thresholds, until each recording gives approximately the same speed result. Typically, the release threshold is set higher (less sensitive) than the impact threshold. Now you're set.

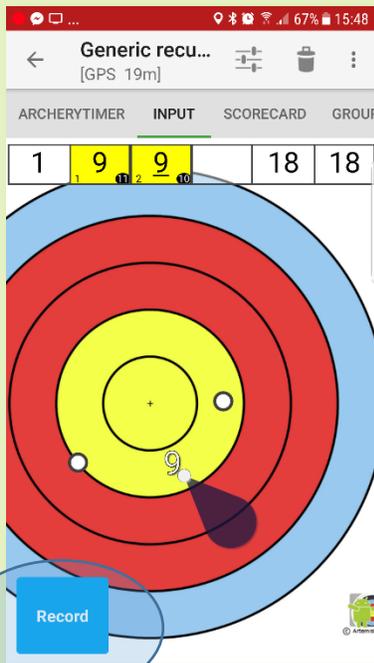
² For recurve; don't let it trigger on the sound of the clicker.

³ Not (as can be seen in the screenshot) on the reflection of the impact.



After calibration you're set to go;

Create a match (on the same distance as you just calibrated) and when plotting arrows, a blue record button appears. When plotting arrows, a blue "Record" button appears on the lower left of the screen. If no button appears, then either you haven't calibrated your setup yet or the distance you are shooting at is not the same as calibrated.

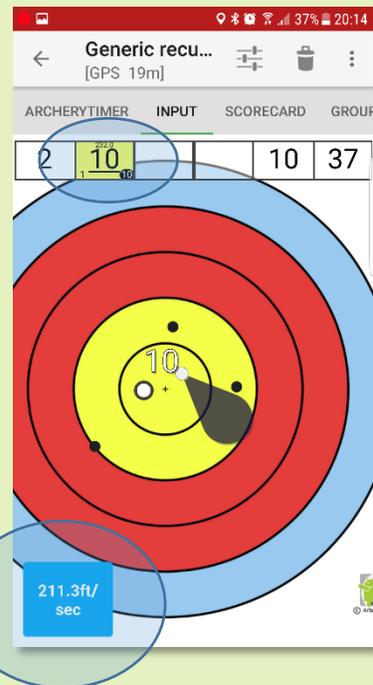


Before shooting, press the record button. After the shot, the button shows the measured average arrow-speed in ft/sec.

If the button shows "Invalid", it means the system triggered on something other than your shot, and the measured speed was "invalid". No speed can be recorded in that case.

If the measurement was successful, the blue button shows the measured arrow speed. If you now plot the arrow, this speed is recorded as well. In the scorecard, the speeds can be shown on the center-top of each score cell⁴.

Afterwards, in analysis, there is a filter that can show a scatterplot of arrow-speed vs. accuracy. This scatterplot shows on the horizontal axis the measured arrow speed and on the vertical axis the distance to the centre of the target.



Have fun!

⁴ To show the measured speed in the score-cell, go to Options → Scorecard and check "Show measured speed"

