HELIOS Drop-Target Timing Test

Time-of-Flight × Target Motion Impact Study

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Purpose

The purpose of this test is to quantify how arrow time of flight interacts with target motion initiated after release to produce vertical impact point deviation **under controlled timing conditions**

This is not an animal behavior test. It is a physics-based timing experiment that measures how much a target can move during an arrow's flight when motion begins at a known delay.

Longer time of flight increases the magnitude of vertical displacement that can occur before impact when target motion begins earlier relative to arrow release.

Test Variables

Arrow Configurations:
• Light arrow (shorter time of flight, weight TBD)
• Heavy arrow (longer time of flight, weight TBD)

Distances:
• Multiple yardages (TBD)

Target Motion Timing:
• Adjustable drop delay triggered at arrow release

Shots per Condition:
• 3

Test Setup

1. Secure the HELIOS shooting machine to prevent movement.
2. Verify repeatable draw length, draw weight, and release parameters.

Aim Point Establishment

1. Remove the target from the drop system (no drop delay active).
2. At each distance, fire multiple shots to establish a consistent impact point.
3. Adjust aim until impacts are repeatable at the same location.
4. Lock aim for the remainder of the test.

Target Drop Configuration

1. Install the target into the drop mechanism.
2. Configure the system so target motion is triggered by arrow release.
3. Verify that drop timing and motion are repeatable.
4. Select an initial drop delay that begins motion late relative to arrow flight.

Test Procedure

For each distance and arrow configuration:
1. Set the drop delay to the starting value. The same drop delay is used for both arrow configurations at each step.
2. Fire three shots at the fixed aim point.
3. Record vertical impact location relative to the baseline impact.
4. Reduce the drop delay so target motion begins earlier.
5. Repeat three-shot groups at progressively shorter delays.
6. Continue until consistent vertical misses or complete misses occur.

Arrow Mass Comparison

Repeat the full procedure using the second arrow configuration.

No changes are made to aim, distance, target geometry, or drop motion profile.

Data Collected

- Arrow mass
- Distance
- Drop delay (ms)
- Arrow time of flight (ms)
- Vertical impact offset from baseline
- Impact classification (on-aim, high, low, miss)

Key Concept

Target motion begins at a known time.
Arrow time of flight determines how much motion occurs before impact.

What This Test Does NOT Claim

- This test does not measure or predict animal reaction time.
- This test does not model animal biomechanics or behavior.
- This test does not claim that animals move in a specific way or at a specific speed.
- Any hunting context is provided only as motivation for studying time-of-flight effects.

This experiment strictly evaluates the relationship between arrow time-of-flight and controlled target motion timing.