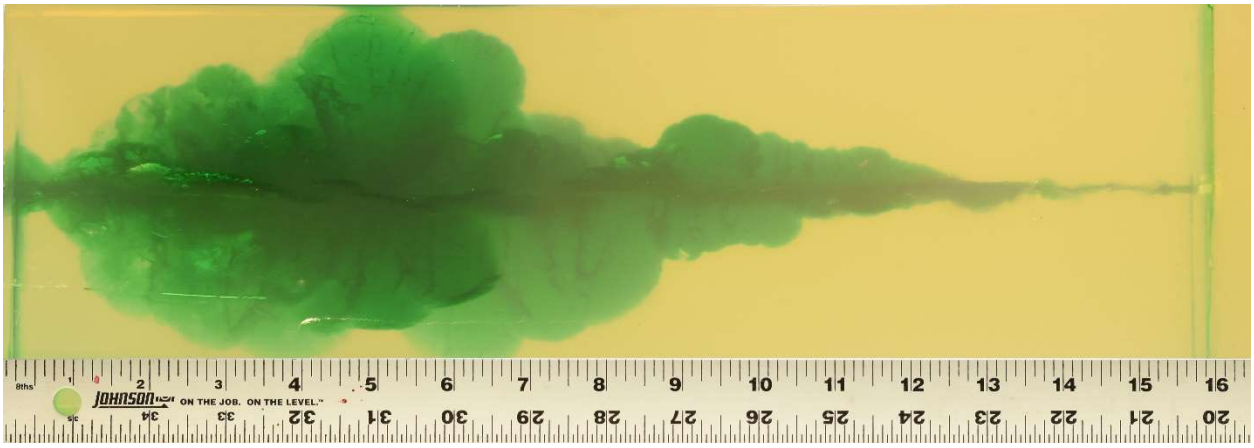
VISTA OUTDOOR

Capstone Project Proposal; Controlled Velocity Projectile Acceleration

OBJECTIVE:

To provide controlled muzzle velocity of projectiles independent of primer and propellent ignition variability.



BACKGROUND:

Traditional propellant driven cartridges operate by initiation of shock sensitive and flammable chemistries to generate pressure in a constrained chamber. As this pressure increases, static frictional and swaging forces are exceeded, and the projectile begins to accelerate toward the muzzle.

Terminal performance of projectiles is highly dependent on impact velocity. As such, variation in velocity due to inherent inconsistencies in primer/powder ignition and subsequent gas generation interfere with design experiments.

Common terminal performance characteristics include expanded diameter, mass retention, and penetration depths in various media.

Typical velocity range of propellant driven systems can easily exceed 50 feet per second across a small sample set. This creates ambiguity in separating the terminal effects that result from mechanical and geometric manufacturing variability from those that result due to impact velocity variation. Powder positioning and case fill density can drive this velocity range even higher. Once the projectile leaves the

pressure system (chamber and bore), it is subject to well-known external ballistics; therefore, constancy of muzzle velocity translates into consistency of all downrange velocities in a controlled environment.

Vista Outdoor has a need to determine the upper and lower impact velocity boundaries for given projectile geometries in order to downselect designs that will work in specific applications for a fixed cartridge. We need better control over shot-to-shot velocity variation.

In addition to research and development testing, ongoing quality control of production samples requires handloading independent of line loaded ammunition. Differences in process steps exacerbate velocity variation. We're not always testing a sample representative of the production build.

Commonly, decreasing a propellant charge will result in a corresponding decrease in muzzle velocity. But not always. In fact, at some point continuing to reduce a propellant charge will cause an increase in muzzle velocity due to excessive fracturing of nitroglycerin crystals exposing additional surface area. These effects are not easily controlled and many hours of load development and testing can be spent before achieving the correct initiation balance to hit the desired velocity target.

Commercially available air 'rifles' are capable of launching projectiles well in excess of typical handgun velocities and energy.

DELIVERABLES:

- A method and device to accelerate a projectile to repeatable velocities without combustible explosives or accelerants.
- Ability to adjust velocity incrementally.
- Minimize time between test shots.
- Be compatible with existing Vista test fixtures.
- Demonstrate maximum of 25 feet per second range across 10 shots at typical handgun velocities.
- Determine effects of projectile and bore diameter interference with respect to pressure.