

## Human Effects Advisory Panel

# The Attribute-Based Evaluation (ABE) Report of Less-Than-Lethal, Extended-Range Impact Munitions

**PRESENTED BY:**  
**Dr. John M. Kenny**  
(814) 863-9401  
jmk14@psu.edu  
June 4, 2002



# Human Effects Advisory Panel

## Background

- There continues to be a need to know more about NLW blunt impact munitions.
- LASD and ARL/Penn State (IEDT) formed a team to conduct this test.
- Our objective – Identify and measure common criteria for launched, extended range impact munitions



# Human Effects Advisory Panel

---

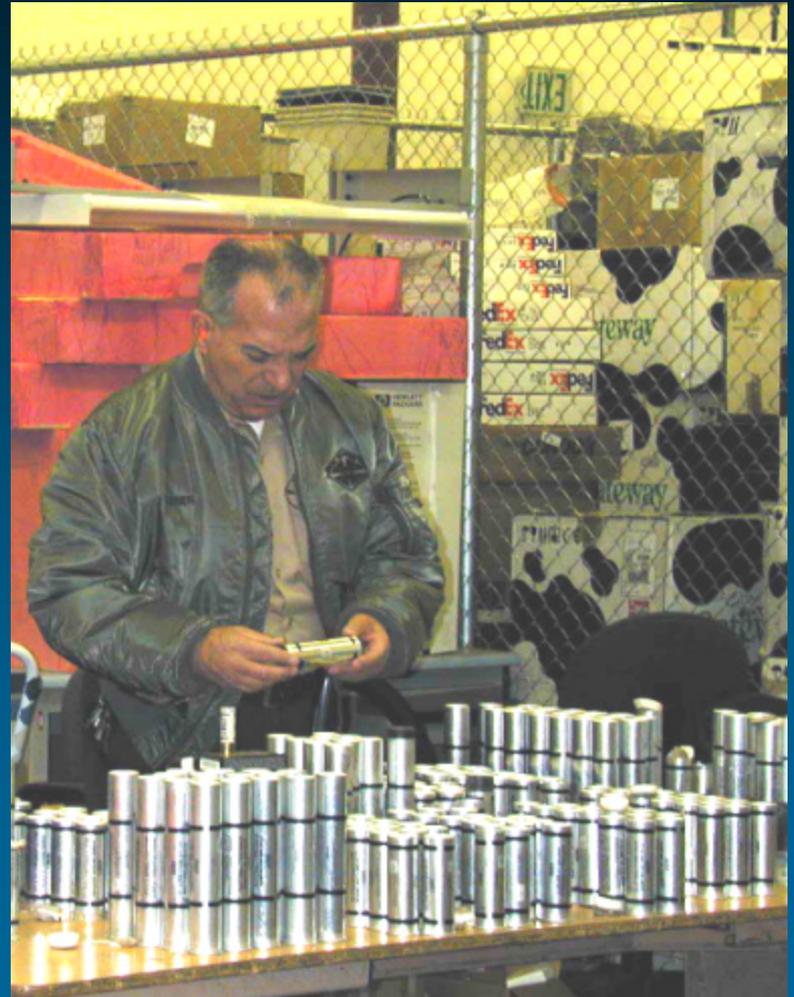
## Attribute based evaluation

- Launched, extended range impact munitions
  - “Bread and butter” of available less lethal munitions
- Focused on features common to all
  - Price, availability, configuration, accuracy, ranges, and so forth
- Oriented toward informed consumer
  - Measurements, not recommendations

# Human Effects Advisory Panel

## Methodology

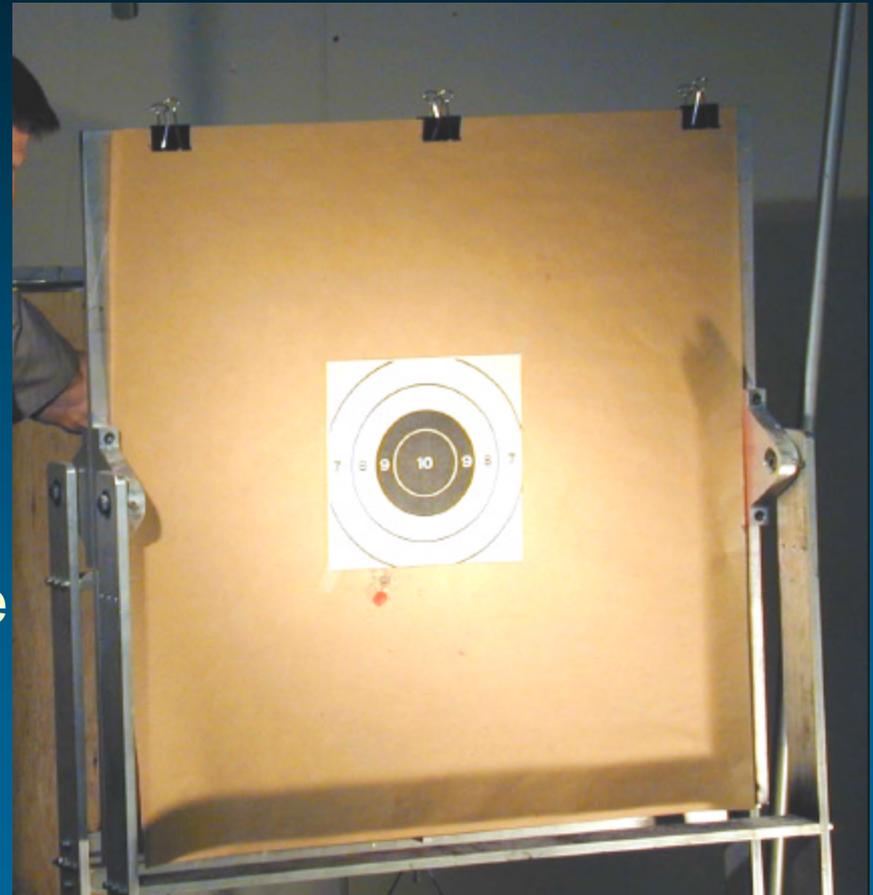
- Projectiles were segregated and weighed
- Five rounds of each ammo type were fired at two distances
- Momentum transfer and accuracy for each test was recorded
- Over 600 tests were conducted in two days



# Human Effects Advisory Panel

## The ballistic pendulum

- SARA's equipment
- Measure momentum transfer (mass x velocity)
- Calibrated prior to each day's test
- Paper target placed on the face of the pendulum to measure accuracy



# Human Effects Advisory Panel

## Blunt Impact Non-Lethal Munitions

- Airfoil
- Baton – Foam, Plastic, Rubber, Styrofoam, Wooden
- Drag-Stabilized
- Encapsulated
- Fin-Stabilized
- Pad - Rectangle, Round
- Pellets — Single, Large, < .5 inches-1.3cm, Small, > .5 inches, 1.3cm



# Human Effects Advisory Panel

## Weapon Types

Shotguns (12  
gauge):

-Ithaca

-S&W

-Mossberg

Assault Rifle

Sage Launcher



# Human Effects Advisory Panel

## Weapon Types

### Grenade Launchers:

- 37 mm
- 40mm (unrifled)
- 40mm (rifled)

### Paint ball guns



# Human Effects Advisory Panel

---

## Ranges and encounters - what we know

- 88% of all field encounters occur at less than 40 feet (12.2m)
- 70% occur at less than 30 feet (9.1m)
- 52% of the impacts will strike the abdomen or chest area
- More than 60% of all encounters require more than one impact

# Human Effects Advisory Panel

---

## The measurements

- Opted for “field-like” conditions Range
  - Based upon tactical needs, not developer specifications
  - 21 feet and 75 feet
- Accuracy
  - Dispersion, not point of aim/point of impact
- Imparted Momentum
  - Amount of momentum transferred at impact

# Human Effects Advisory Panel

## Configuration



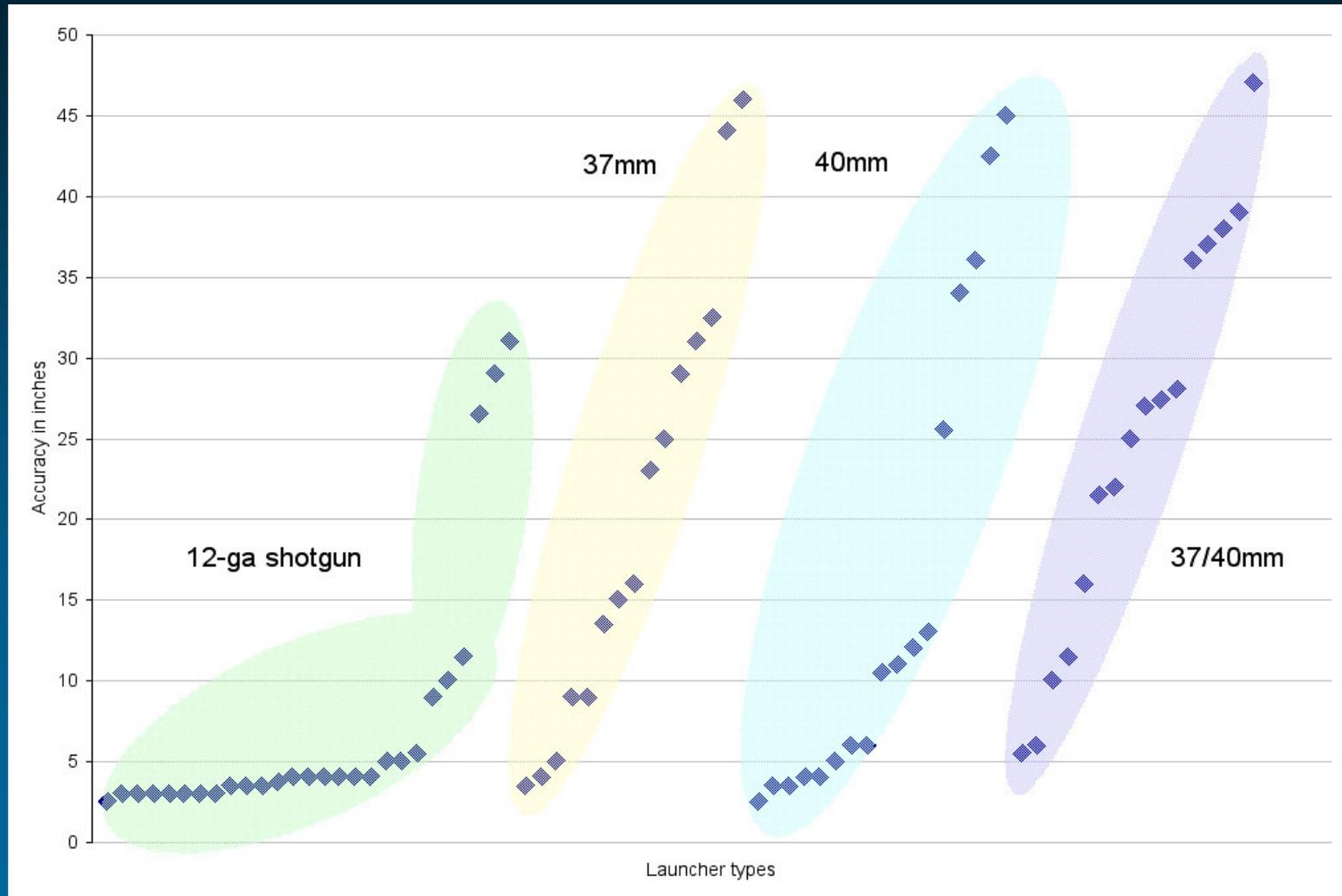
# Human Effects Advisory Panel

## Material



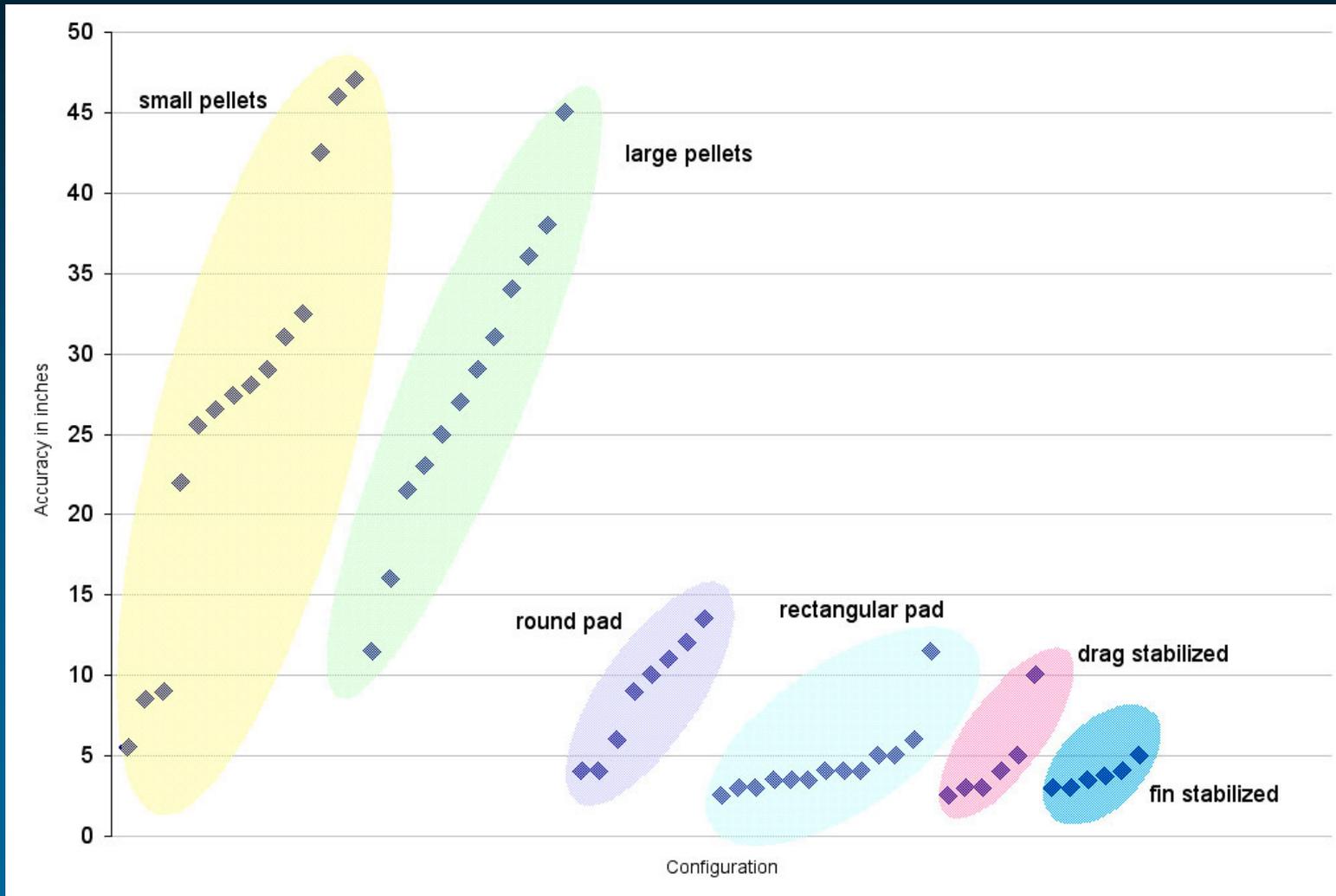
# Human Effects Advisory Panel

## Accuracy (by launcher type) - 21 Feet



# Human Effects Advisory Panel

## Accuracy (by configuration) - 21 Feet



# Human Effects Advisory Panel

---

## Accuracy at 75 Feet

- Thirty seven munitions were fired at a range of 75 feet. Of those 37 munitions:
  - 17 had an accuracy dispersion of 18 inches or less (46%)
  - 11 had a dispersion greater than 18 inches but equal to or less than 36 inches (30%)
  - 9 could not reliably hit the impact plate (24%)

# Human Effects Advisory Panel

## Field Identification



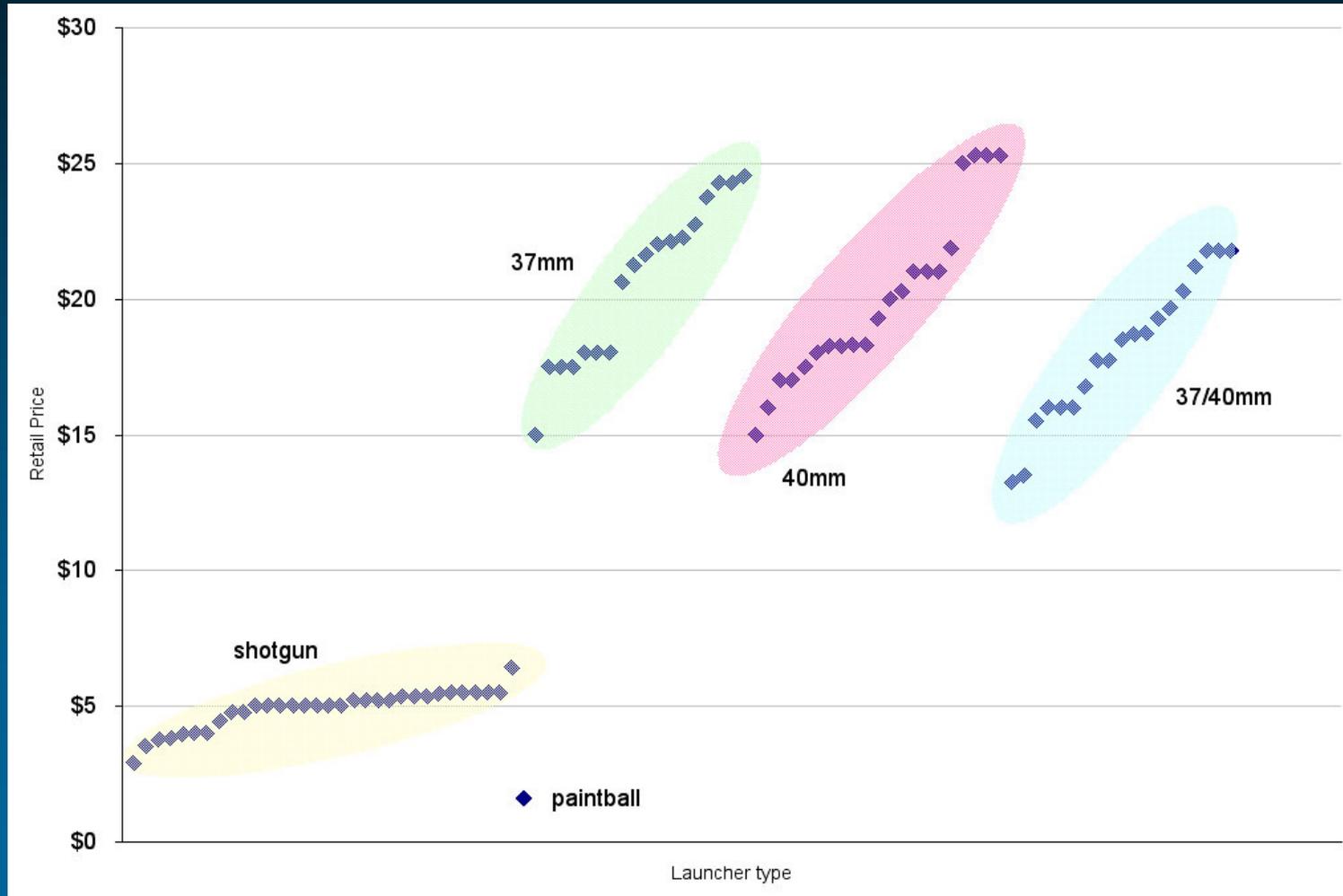
# Human Effects Advisory Panel

## Field Identification



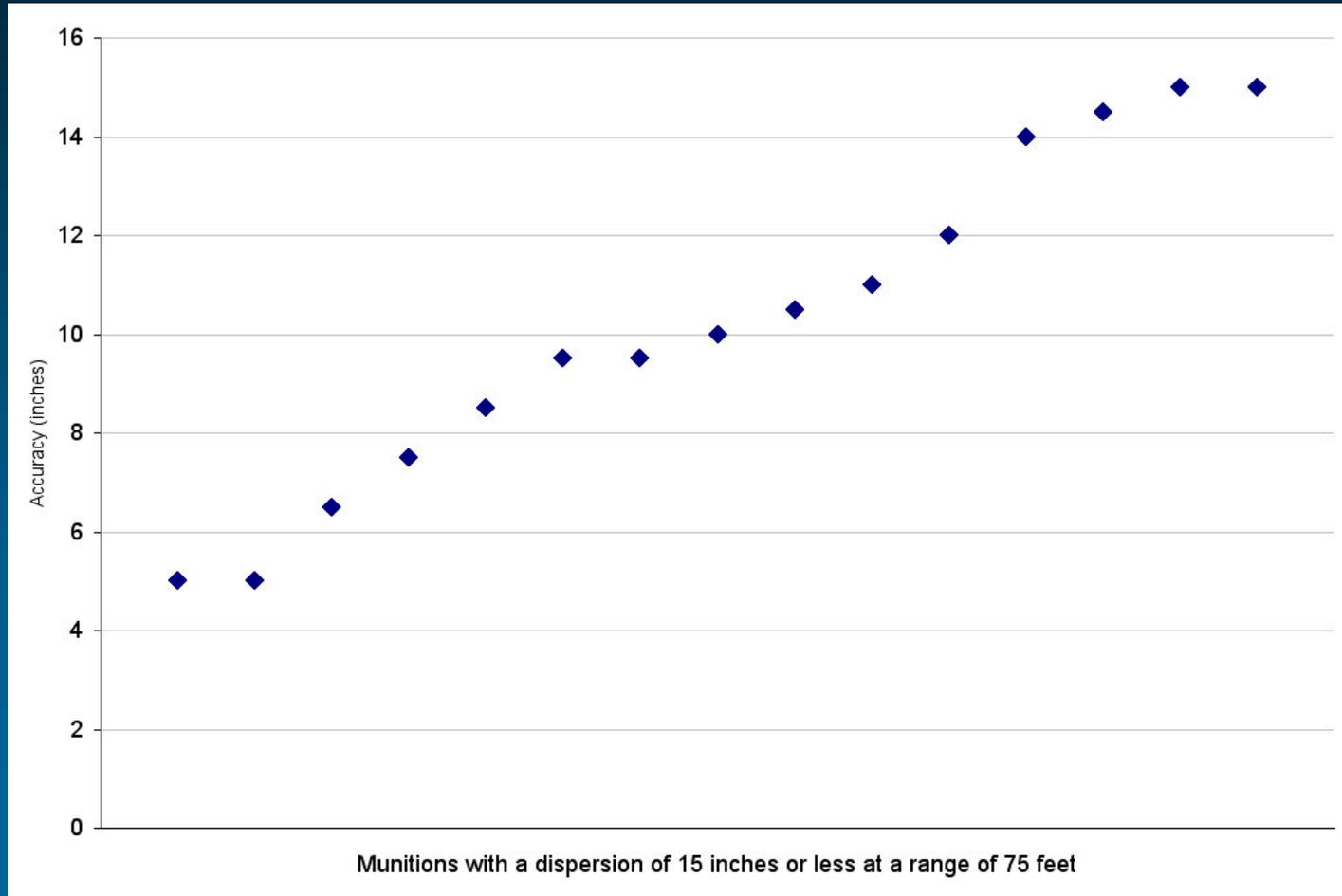
# Human Effects Advisory Panel

Retail Price – \$1.60 to \$25.30 per round



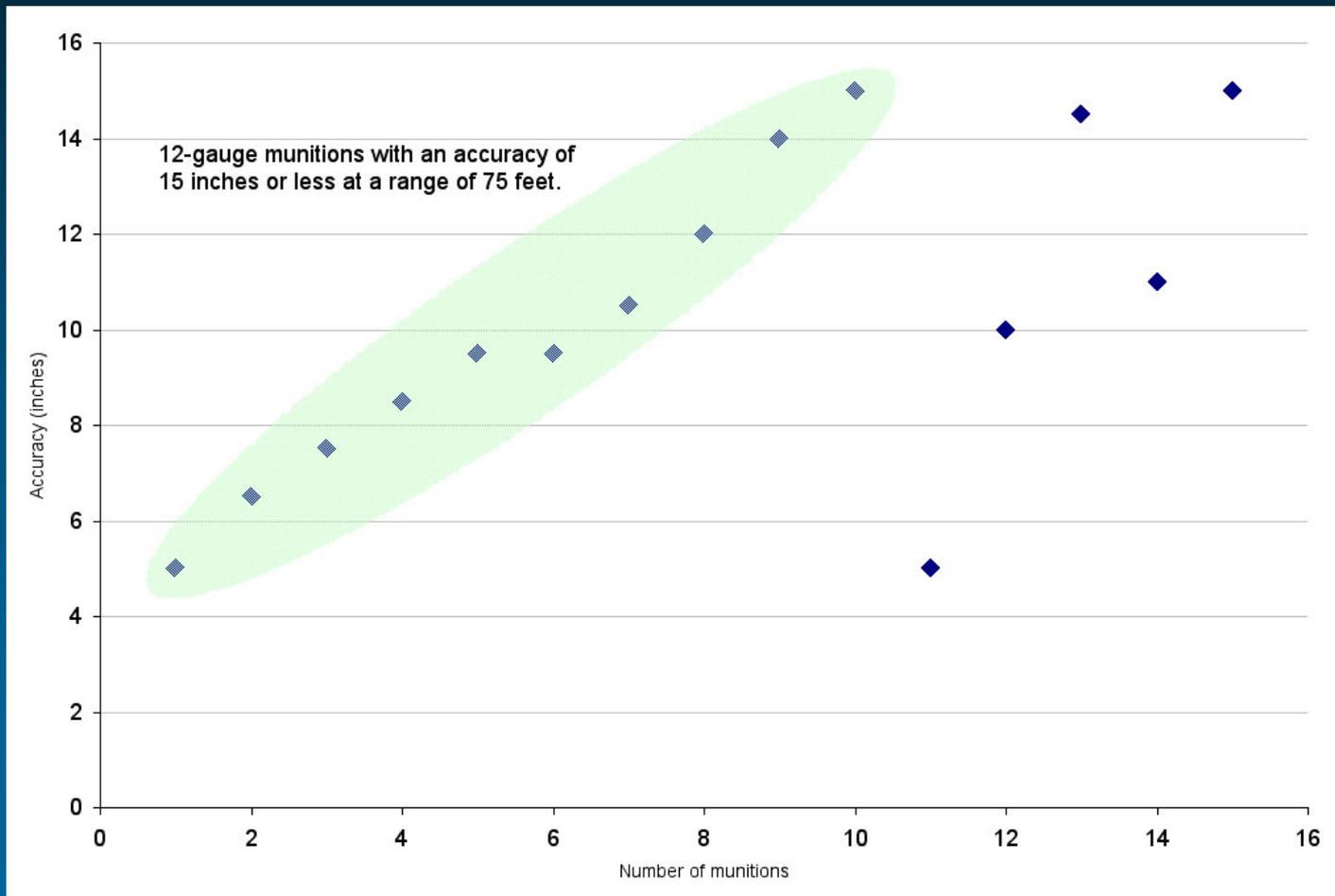
# Human Effects Advisory Panel

**Example - Step 1:** Munitions with dispersion of 15 inches or less at 75 feet (15 of 37)



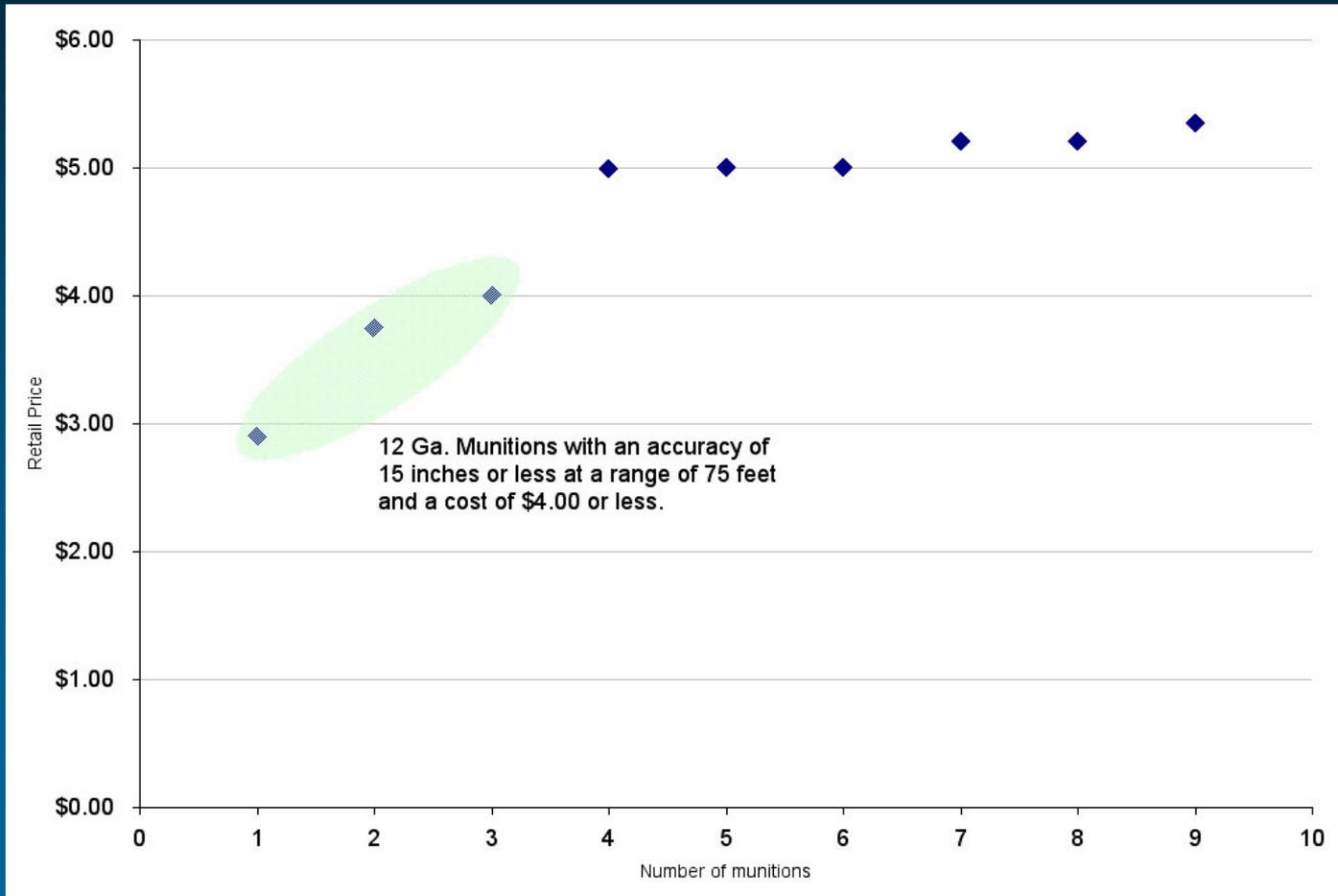
# Human Effects Advisory Panel

**Example - Step 2:** Segregate by launcher type. Looking for 12-gauge munitions (10 of 15)



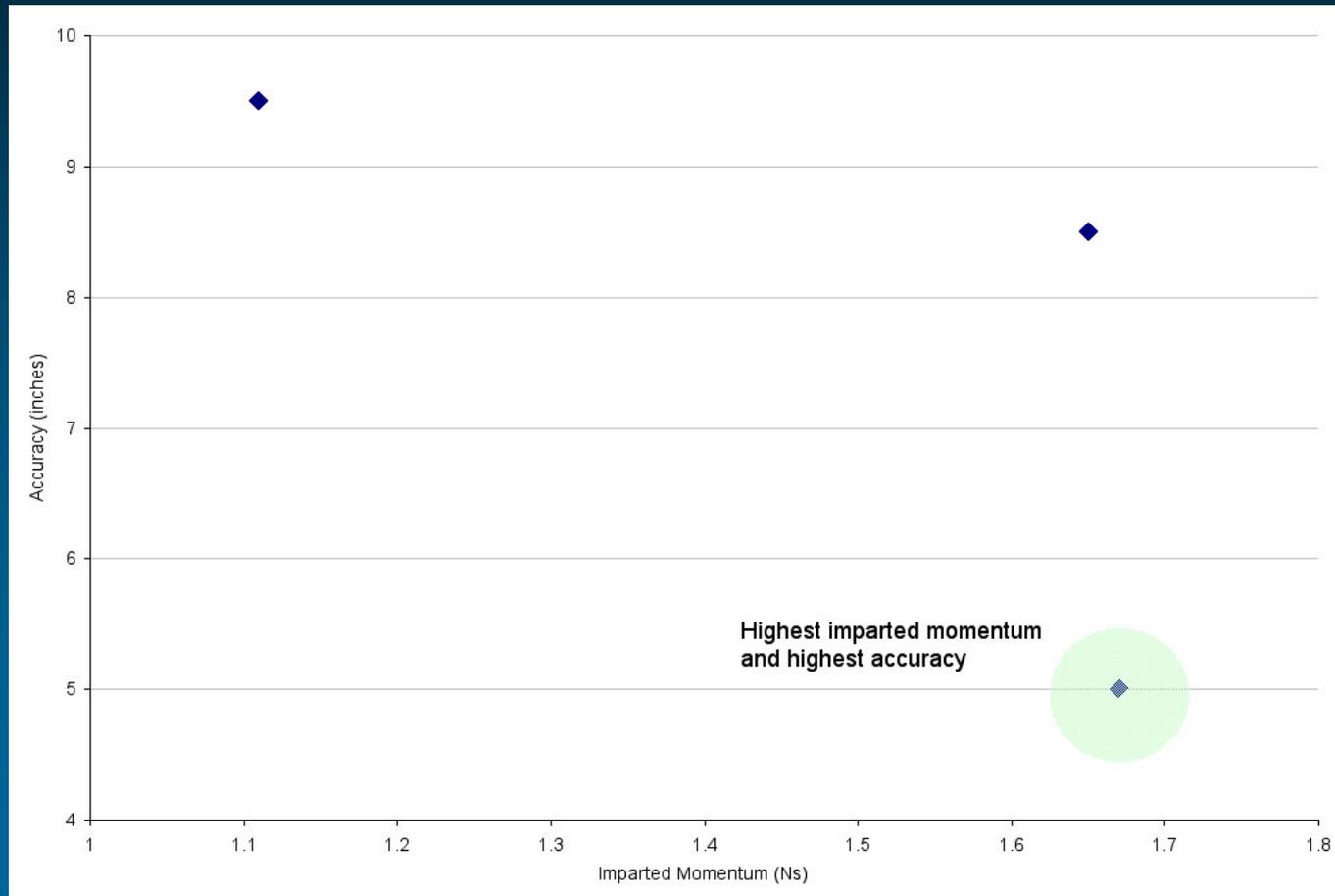
# Human Effects Advisory Panel

**Example - Step 3:** Commercially available munitions with a cost of \$4.00 or less at 75 feet (3 of 10)



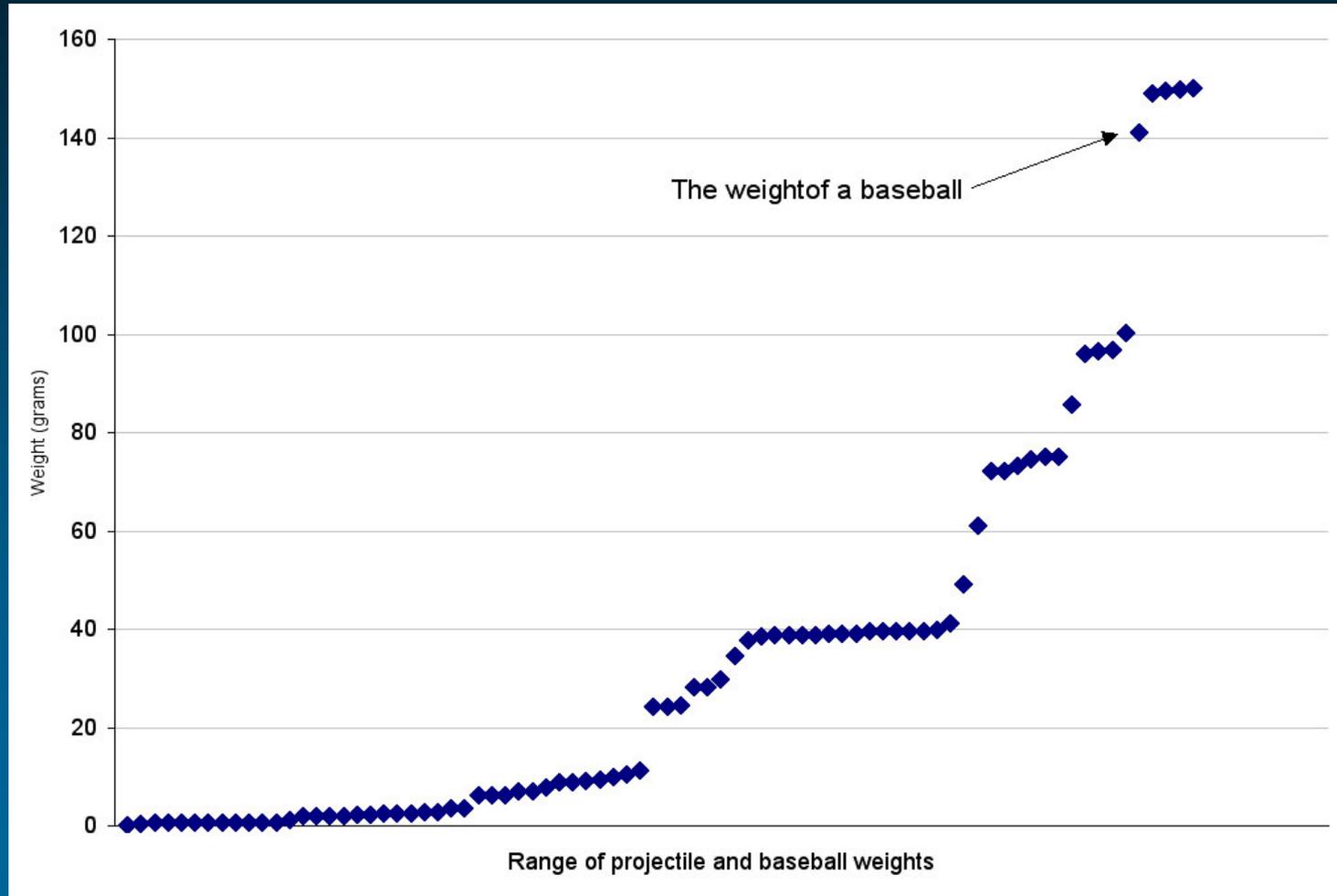
# Human Effects Advisory Panel

**Example - Step 4:** Munition with the highest accuracy and imparted momentum at 75 feet (1 of 3)



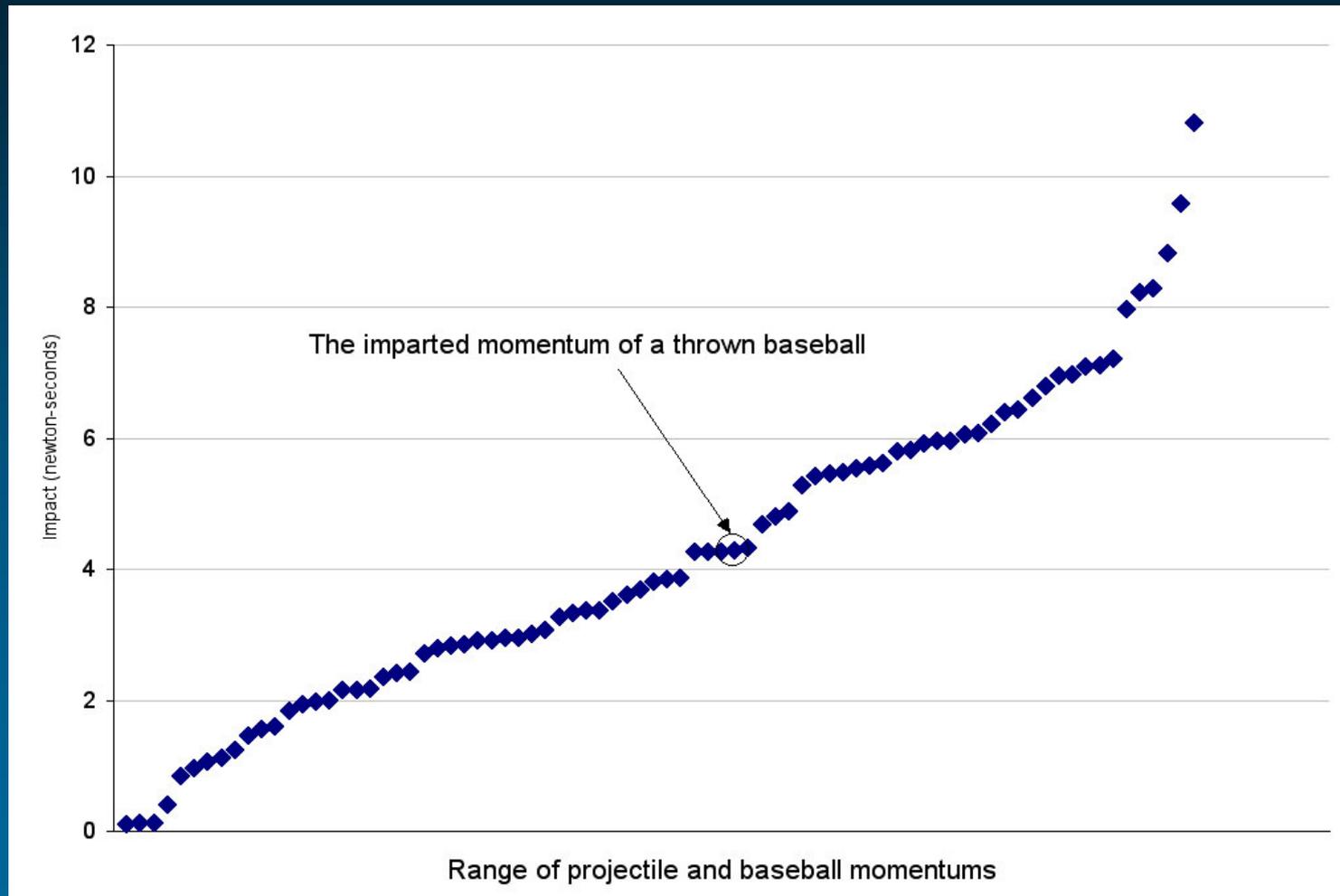
# Human Effects Advisory Panel

## Baseball Comparison – Weight



# Human Effects Advisory Panel

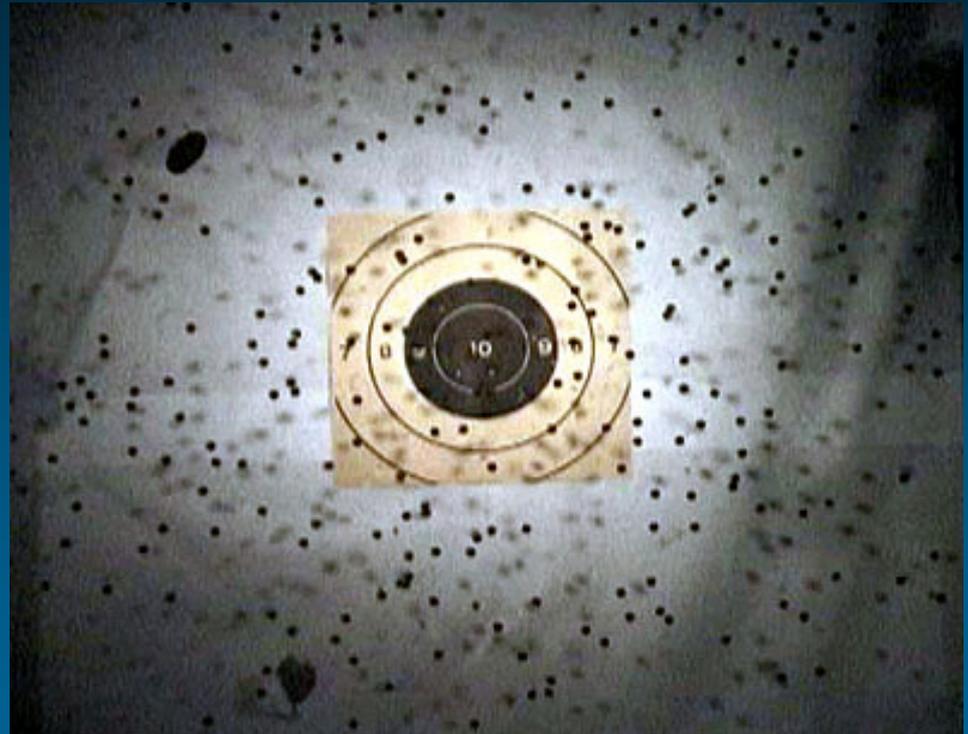
## Baseball Comparison – Imparted Momentum



# Human Effects Advisory Panel

## Findings

- **Accuracy**
- **Reliability**
  - **Misfires**
  - **Foul bores**
  - **Muzzle velocities**
- **Skip firing**
- **Cost**
- **Ricochets**



# Human Effects Advisory Panel

---

## The Report

- Co-authored by ARL and LASD
- Charts/graphs comparing various attributes with appendices of the entire database
- Does not contain recommendations, but the reader will have sufficient information to make an informed selection
- Available on the web:  
[www.arl.psu.edu/areas/defensetech/defensetech.html](http://www.arl.psu.edu/areas/defensetech/defensetech.html)

# Human Effects Advisory Panel

---

## Press Coverage

- CBS (Los Angeles) ran a short segment on the late news 26 October
- ABC (Los Angeles) ran a five minute segment during the prime time news on 5 November
- LASD is making a documentary film of the test

# Human Effects Advisory Panel

---

## Payoff - Law Enforcement and Military Communities

- Comparison of non-lethal blunt impact munitions
- For the first time, they can select munitions as an informed consumer
- Report and data is available to the law enforcement community
- LASD Chief anticipates that this report will “become a landmark in the law enforcement world”

# Human Effects Advisory Panel

---

## Summary

- Data available to the law enforcement community
- Demonstrates the value of this data and opens the door to future research:
  - Comprehensive repeat tests
  - Skip firing
  - Energy transfer and finite element modeling
  - Skin penetration
  - Accuracy improvement
  - Cost reduction
- This report is the first step in better understanding the capabilities and limitations of less-than-lethal munitions.

**Comments?**

**Questions?**