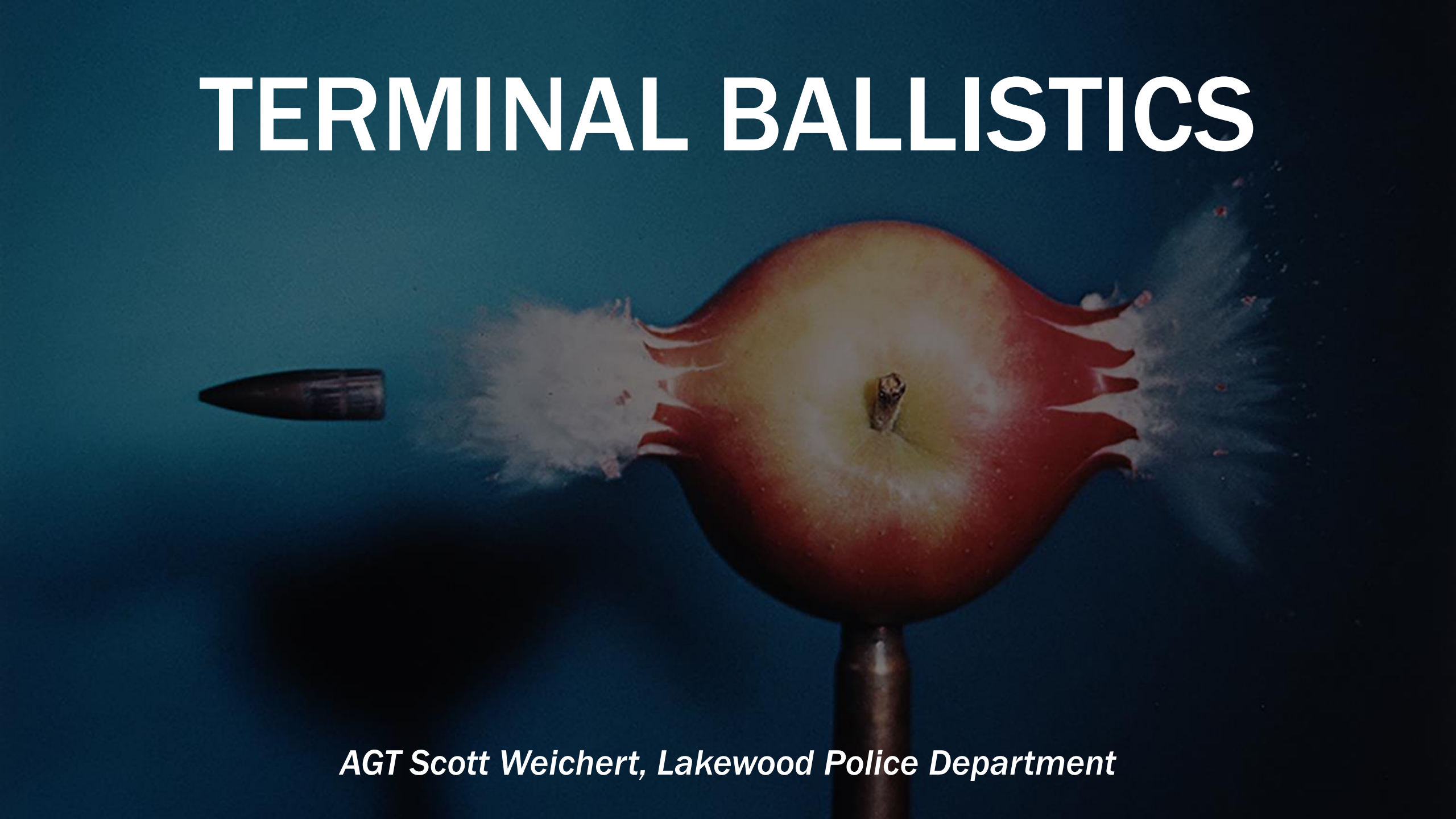
TERMINAL BALLISTICS



AGT Scott Weichert, Lakewood Police Department

WHAT WE’RE GOING TO TALK ABOUT

- BULLET CONSTRUCTION/SPECIFICATION BASICS
- GENERAL WOUNDING MECHANISMS
- SPECIFIC PROJECTILE WOUNDING MECHANISMS

DISCLAMIERS. *THERE ARE SEVERAL…*

- I DON’T HAVE A TON OF FORMAL MEDICAL TRAINING – TCCC/TECC
- MOST OF WHAT I’M GOING TO SPEAK TO IS FROM A POLICE/MILITARY PERSPECTIVE. MY STARTING POINT HAS ALWAYS BEEN “WHAT DO I WANT A BULLET TO DO?”
- BULLET PERFORMANCE UNDER LABORATORY CONDITIONS IS NOT 100% PREDICTABLE.
- BULLET PERFORMANCE IN LIVING TISSUE UNDER FIELD CONDITIONS IS MUCH LESS PREDICTABLE.
- THERE ARE PROBABLY EXCEPTIONS TO EVERYTHING I SAY.

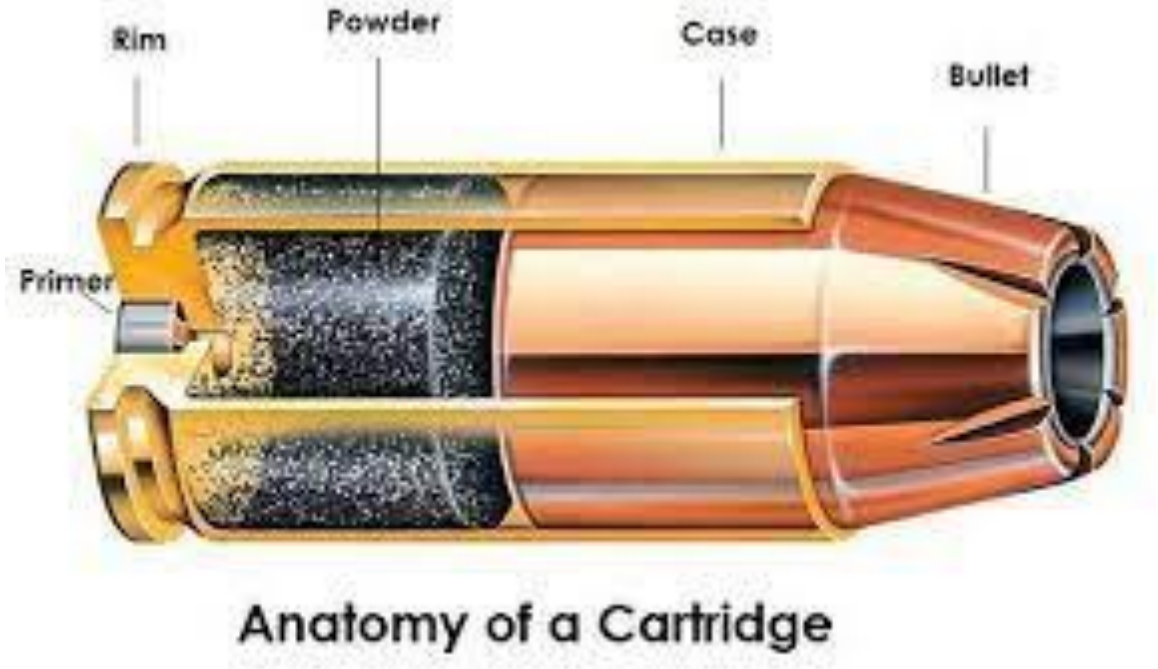
SO WHAT'S THIS GUY DOING HERE ANYHOW?

- MORE: WHAT YOU MIGHT SEE AND WHY IT HAPPENED THAT WAY.

- LESS: WHAT AM I SUPPOSED TO DO ABOUT IT?

WE NEED DEFINITION: WHAT IS A BULLET?

- A ROUND OF AMMUNITION OR ‘CARTRIDGE’ IS MADE OF:
  - BULLET
  - CASE
  - POWDER
  - PRIMER



- THIS **IS** A BULLET: 
- THIS **IS NOT** A BULLET: 

BULLETS ARE…

- GENERALLY MADE WITH A LEAD CORE AND A COPPER JACKET.
  - THE CORE AND JACKET MAY BE BONDED IN DIFFERENT WAYS FOR ADDITIONAL DURABILITY
  - THERE ARE OTHER BULLET DESIGNS (MACHINED COPPER, SINTERED METAL) BUT MOST HAVE A VERY SPECIFIC NICHE THEY FIT INTO
- MEASURED BY DIAMETER AND WEIGHT
  - DIAMETER IS CALLED “CALIBER” AND IS MEASURED IN DECIMAL INCHES OR IN MILLIMETERS, SOMETIMES BOTH. MM GENERALLY INDICATES A NATO OR EURO INFLUENCE.
  - WEIGHT IS ALMOST UNIVERSALLY IN “GRAINS”. 1 GRAIN = 64.8 MG = .0022 OZ
- CLASSIFIED IN GENERAL CONSTRUCTIVE TERMS OR “TYPE”

COMMON BULLET TYPES

- FULL METAL JACKET (FMJ)

- SOFT POINT (SP)

- JACKETED HOLLOW POINT (JHP)

- CAST/HARDCAST LEAD

- ETC, ETC, AND ETC

BULLET TYPES

- IN GENERAL…
- HANDGUN BULLETS ARE SHORTER, WIDER, AND SLOWER
- RIFLE BULLETS ARE LONGER, NARROWER, AND FASTER
- SHOTGUNS CAN BE A LOT OF THINGS:
  - SLUG: A LARGE SOLID PROJECTILE SIMILAR TO A HANDGUN BULLET
  - SABOT SLUG: A LARGE PROJECTILE MORE LIKE A RIFLE BULLET
  - BUCKSHOT: @9-25 ROUND PISTOL SIZED PELLETS (.25 - .33 INCHES-ISH)
  - BIRDSHOT: @250 (AVERAGE) SMALLER PELLETS (.10 - .15 INCHES-ISH)
  - VARIOUS METALS FOR VARIOUS PURPOSES
  - EXOTICS: SLUG+BUCK, FLECHETTES, COMPRESSED MAGNESIUM, BOLOS

BULLET TYPES VS BULLET PERFORMANCE

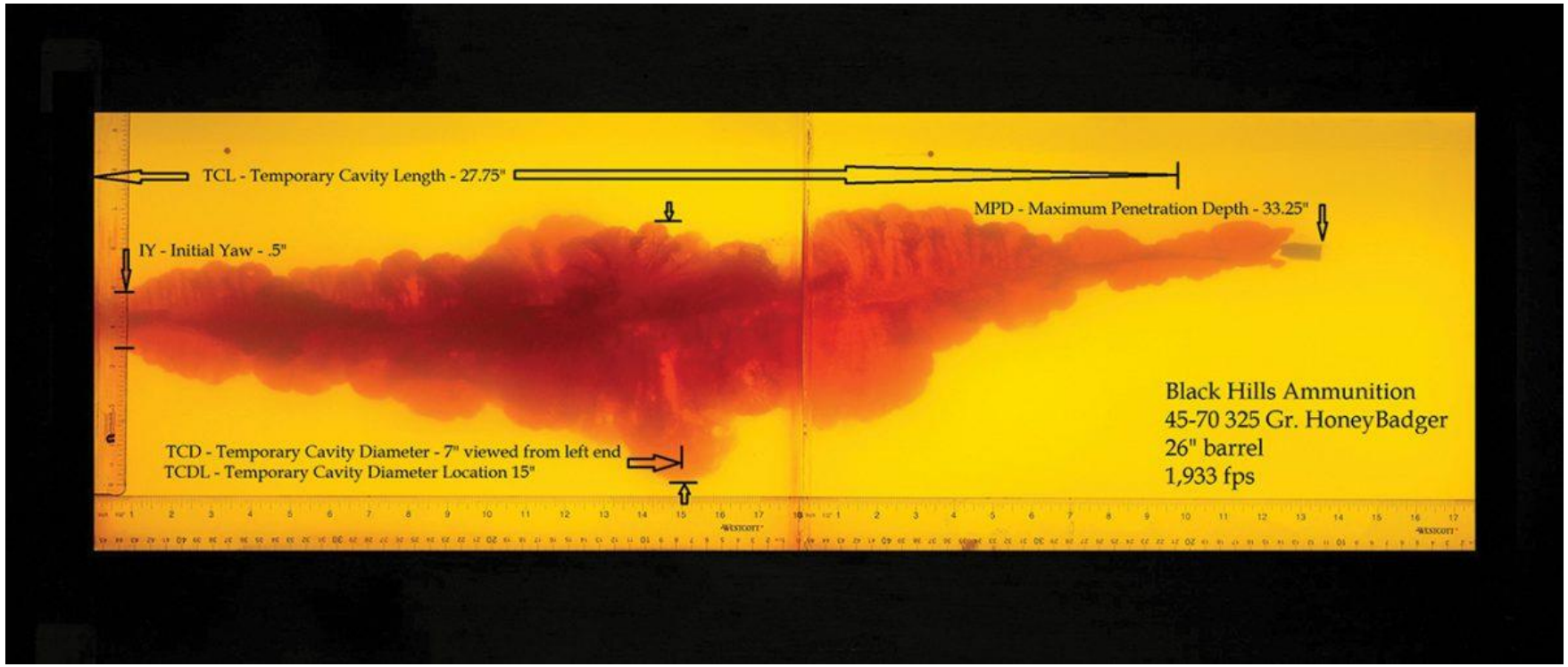
- THREE MAIN THINGS A BULLET IS DESIGNED TO DO OR NOT DO:
  - EXPANSION
  - PENETRATION
  - FRAGMENTATION
- THESE THINGS DON’T ALWAYS WORK TOGETHER

EXPANSION

- FAVORED BECAUSE IT MAKES A LARGER PERMANENT CAVITY
- UNFAVORED BECAUSE IT REDUCES PENETRATION, INCREASES FRAGMENTATION
- JHP, SOFT POINT, COPPER SOLIDS

PENETRATION

- FBI PROTOCOLS: 12-16 INCHES MINIMUM
- GENERALLY BULLETS THAT HAVE MINIMAL EXPANSION OR FRAGMENTATION
- FMJ, HARDCAST LEAD, SHOTGUN SLUG



FRAGMENTATION

- DESIGNED TO CREATE MULTIPLE PERMANENT WOUND CAVITIES
- COMES AT A COST OF PENETRATION, MANY DON’T MEET FBI PENETRATION RECOMMENDATIONS

BULLET WOUNDING MECHANISMS

- THERE ARE ONLY 2
  - 1. PERMANENT CAVITY
  - 2. TEMPORARY CAVITY

PERMANENT CAVITY

- TISSUE DEFORMED, DAMAGED, OR DESTROYED BY DIRECT CONTACT WITH THE BULLET ALONG ITS PATH THROUGH THE BODY.
- THE “BULLET HOLE” FOR LACK OF A BETTER TERM.
- SMALLER PERMANENT CAVITIES CAN BE FORMED BY PRIMARY FRAGMENTS (PIECES OF THE BULLET) OR SECONDARY FRAGMENTS (PIECES OF BONE).
- NOT A LOT OF CONTROVERSY HERE.

PERMANENT CAVITY

- THE SIZE AND VOLUME OF THE PERMANENT CAVITY IS AFFECTED BY SEVERAL FACTORS:
  - BULLET SIZE
  - EXPANSION, WHETHER DESIGNED OR INCIDENTAL, 60-70%
  - PENETRATION
  - YAW OR OTHER DESTABILIZATION (CHANGE IN FRONTAL SURFACE)

TEMPORARY CAVITY

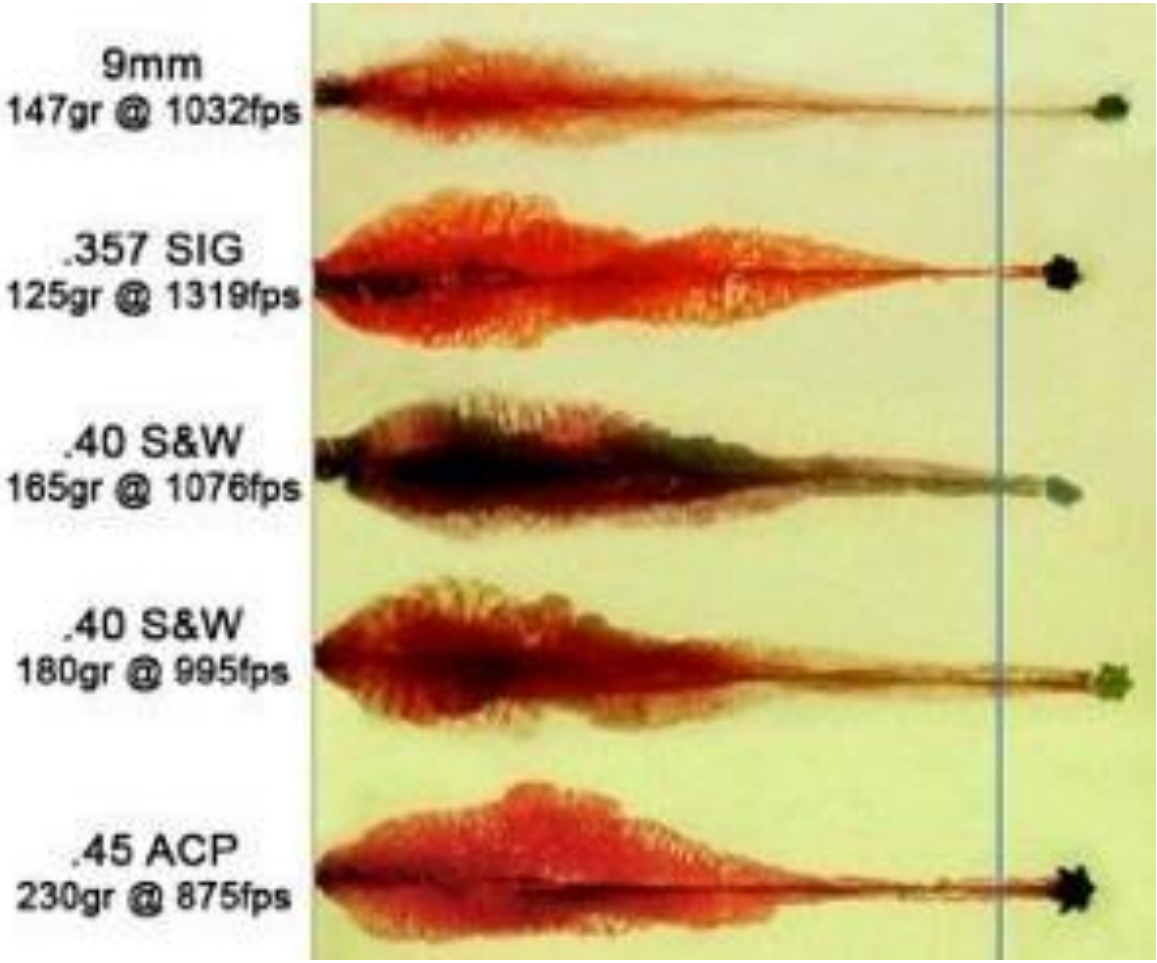
- THE TEMPORARY EXPANSION OR STRETCH OF THE PERMANENT CAVITY IN AN OUTWARD (RADIAL, CENTRIFUGAL) DIRECTION OF THE PATH OF THE BULLET.
- CAUSED BY KINETIC ENERGY TRANSFER.
- CONSIDERED GENERALLY SIMILAR IN EFFECT TO BLUNT TRAUMA
- PEOPLE FIGHT ABOUT THIS

TEMPORARY CAVITY

- IN GENERAL, THE SIZE AND VOLUME OF THE TEMPORARY CAVITY IS AFFECTED PRIMARILY BY BULLET SPEED.
  - ALL OTHER FACTORS BEING EQUAL OR SIMILAR: HIGHER SPEED = MORE KE AVAILABLE TO TRANSFER.
- BUT! OTHER FACTORS SUCH AS BULLET SIZE, FRONTAL SURFACE, AND FLIGHT PATH CAN CONTRIBUTE SIGNIFICANTLY IN EITHER DIRECTION.
- HOW MUCH DAMAGE ACTUALLY OCCURS FROM TEMPORARY CAVITY?
- DOES THE PRESUMED PRESENCE OF A TEMPORARY CAVITY REQUIRE EXCESSIVE TISSUE EXCISEMENT?

SPECIFIC EFFECTS - HANDGUN

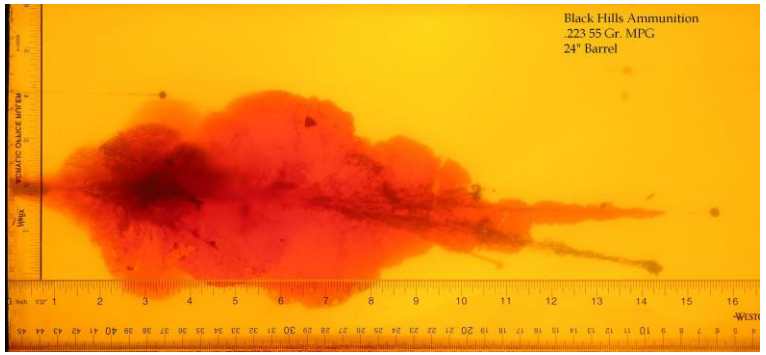
- LARGER SINGLE PERMANENT WOUND CAVITY
- EXPANSION LIKELY (60-70%) IF DEFENSIVE AMMUNITION USED
- INFREQUENT FRAGMENTATION CLOSE TO MAIN CHANNEL
- PENETRATION VERY DEPENDENT ON ROUND USED

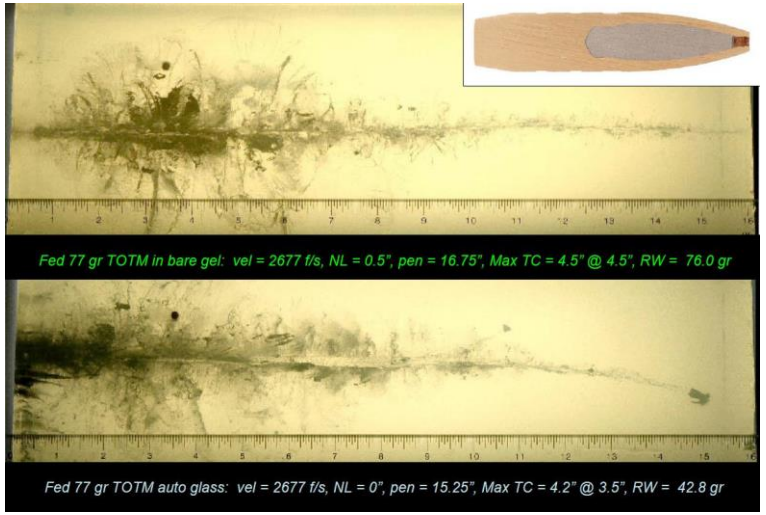


HANDGUN BALLISTIC GEL

SPECIFIC EFFECTS - RIFLE

- VARYING PERMANENT CAVITY
- MULTIPLE TEMPORARY CAVITIES POSSIBLE (YAW)
- ADDITIONAL SMALL PERMANENT CAVITIES LIKELY, POSSIBLY EXACERBATED BY TEMPORARY EXPANSION
- SMALLER CALIBERS ARE LIKELY TO FRAGMENT WITH CHANNELS FARTHER FROM THE MAIN CAVITY
- DEEPER PENETRATION OR COMPLETE PASS THROUGH POSSIBLE, ESPECIALLY WITH LARGER CALIBERS





RIFLE BALLISTIC GEL

SPECIFIC EFFECTS - SHOTGUN

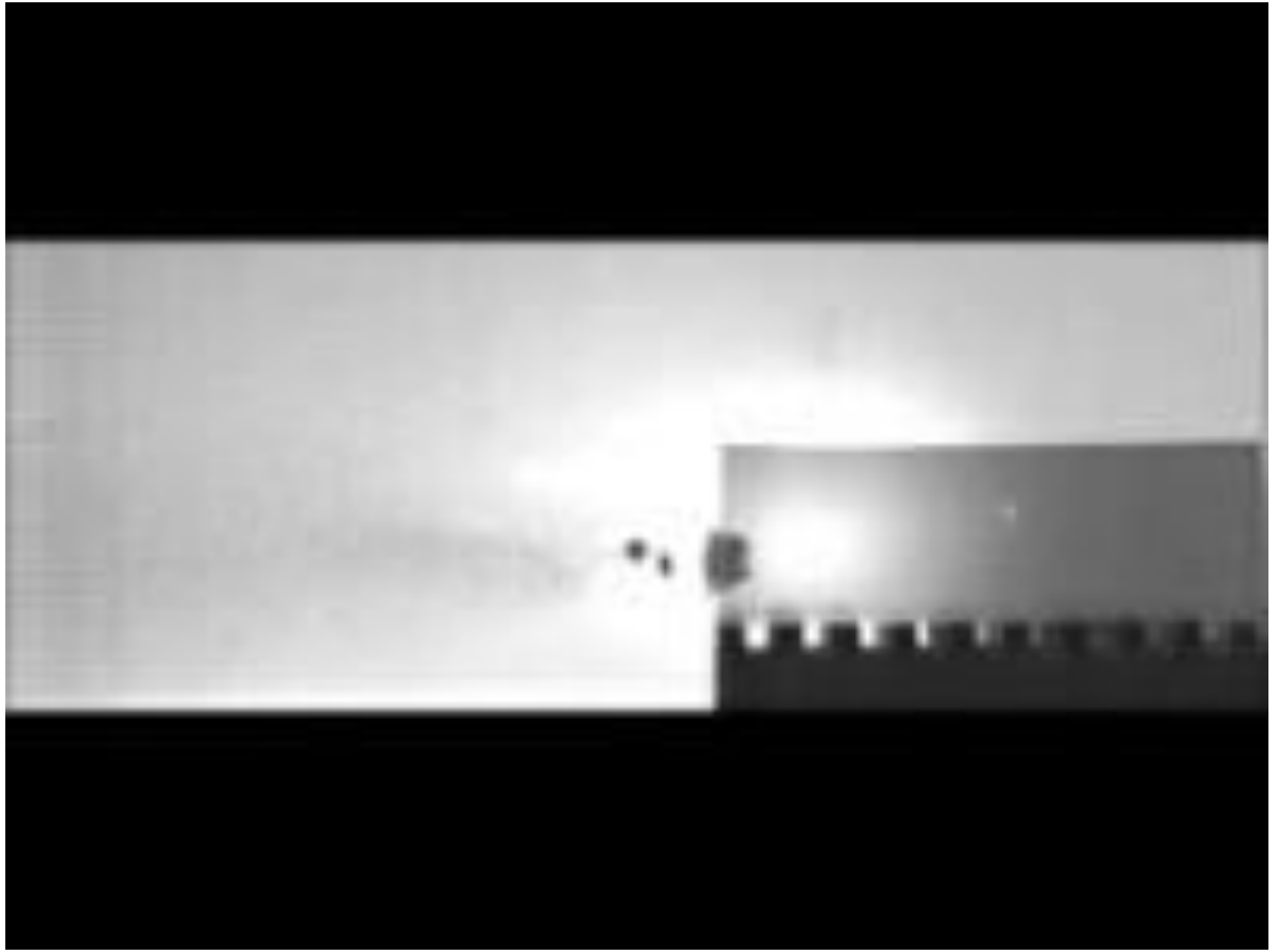
- SLUG
  - LARGER PERMANENT CAVITY, SECONDARY IMPACT FROM WAD WITH LITTLE OR NO PENETRATION
  - FRAGMENTATION NOT AS LIKELY, BUT SECONDARY FRAG FROM BONE LIKELY
  - COMPLETE PENETRATION PROBABLE
- SHOT
  - MULTIPLE SMALLER PERMANENT CAVITIES, BUCK SIMILAR TO SMALL CALIBER HANDGUN
  - LARGER PELLETS WILL PENETRATE DEEPER
  - TIGHTER PATTERN WILL EXACERBATE EFFECTS OF MULT SMALLER CAVITIES, ESPECIALLY NEAR ENTRY.

SPECIFIC EFFECTS - SHOTGUN

- EXOTICS, UM, WOW…
  - MULTIPLE WOUND CHANNELS OF DIFFERING SIZES (SLUG + BUCK)
  - ODD LOOKING PROJECTILES WITH UNPREDICTABLE DAMAGE (FLECHETTE)
  - LACERATING + PENETRATING INJURIES (BOLO)
  - PENETRATION VARIOUS AND DIFFICULT TO PREDICT
  - BURNS




SHOTGUN BALLISTIC GEL



SOURCES

- *Handgun Wounding Factors and Effectiveness*, SA UW Patrick, FBI Firearms Training Unit 4/14/1989
- *What's Wrong with the Wound Ballistics Literature, and Why*, ML Fackler MD, Letterman Army Institute of Research, July 1987
- Wound Ballistics Review Volume 1 Number 3, International Wound Ballistics Association, Fall 1992
- THIS IS ALL OPEN SOURCE, YOU MAY LIKELY ACCESS TO MUCH MORE DETAILED AND MEDICALLY RELEVANT DATA, ESPECIALLY REGARDING TREATMENT

QUESTIONS?

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