7.62mm, Lethal Limited Range Round (L^{2}R^2)
(US Coast Guard)

NDIA 2006

Prepared by:

Chad Sensenig
Small Caliber Ammunition US Army, ARDEC

Sung Chung
Aeroballistics US Army, ARDEC

Objectives:

Design, develop, and demonstrate a 7.62mm Lethal Limited Range Round (L²R²) to meet the unique needs and requirements of the US Coast Guard for use in harbor security applications. This ammunition will be fired from mounted 7.62mm, M240 Machine Guns or M14 rifles and will be capable of engaging and defeating a variety of seagoing vessels and personnel targets while reducing maximum range to minimize collateral damage to the areas surrounding the locations where the round will be employed.

Goals:

- Must function the M14 rifle and M240B machine gun with no weapon adapters / modifications.

- Defeat 1/4 inch of mild steel set at 30-degree obliquity angle at 200 meters.

- Effective against soft targets out to a range of at least 400 meter.

- Maximum range of 2000 Meters (1500 Meters desirable)

Previous In-house Limited Range Effort

Caliber .50 and 5.56mm Limited Range Training
   Ammunition (LRTA) Programs

Caliber .50 LRTA
   Requirements:
      - Match M33 to 1000 meters not more than 1 mil error.
      - Range not to exceed 2500 meters.
      - Price not to exceed M33 cartridge.
   Tested Designs:
   4 designs were tested in Ft. Dix Small Caliber Test Range
      - Non-conical boat tail design.
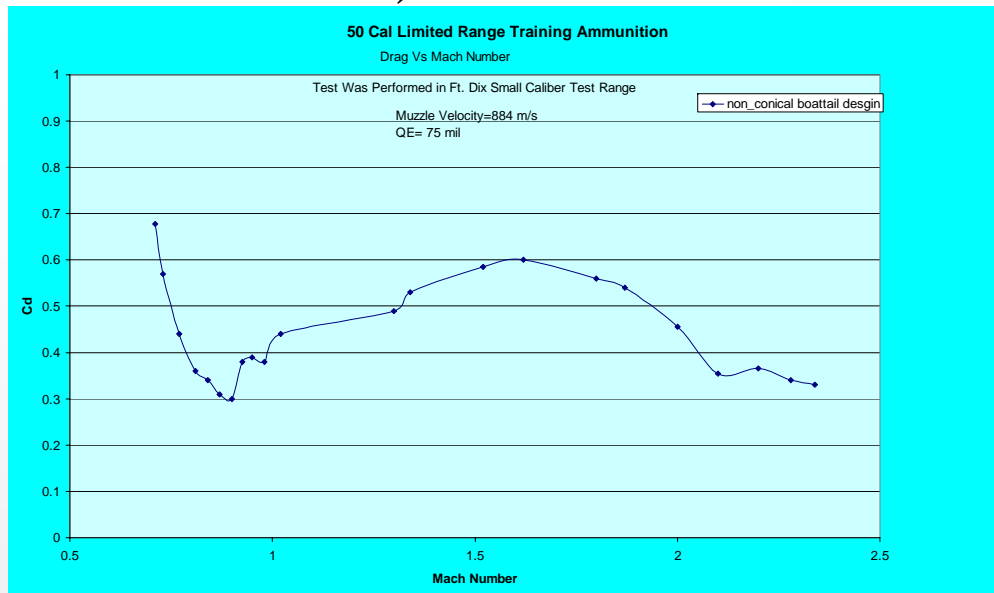   - Corkscrew boat tail design.
      - Straight fin design.
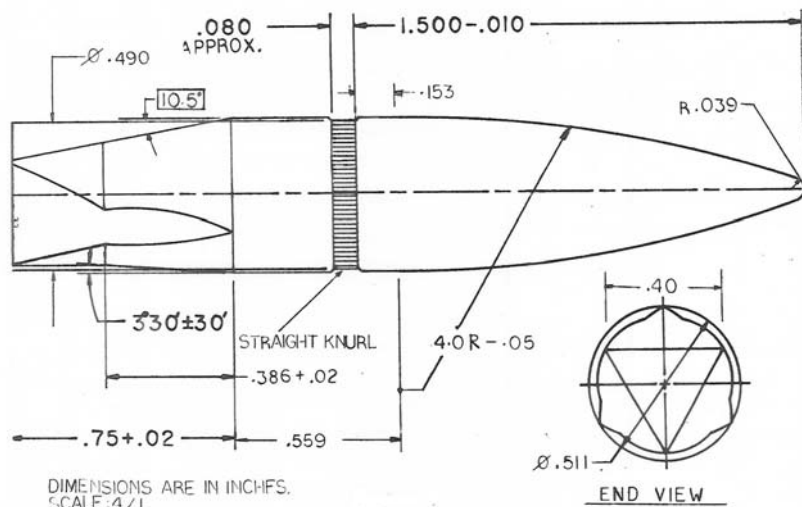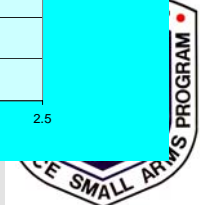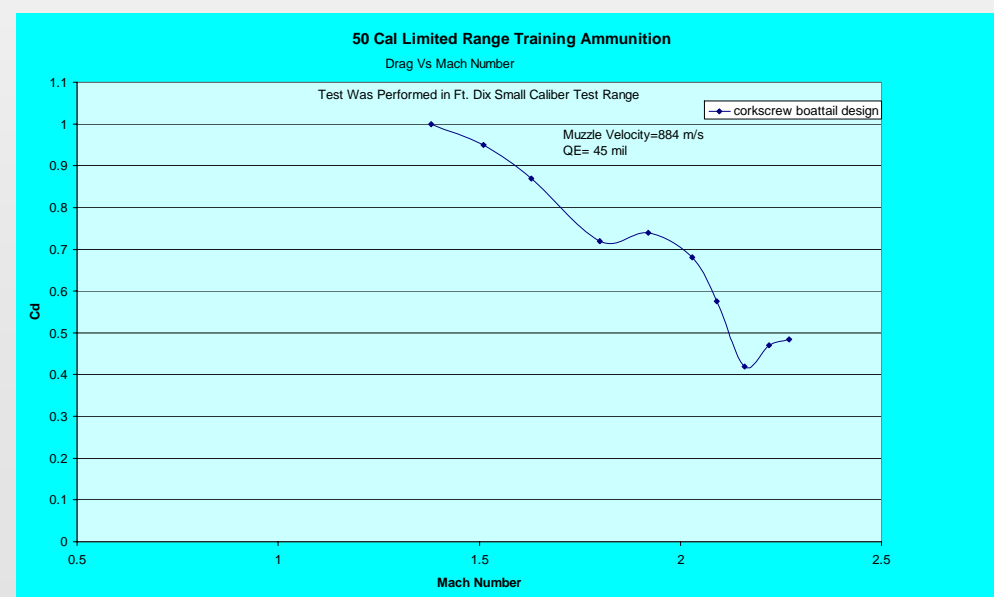   - Canted fin design.
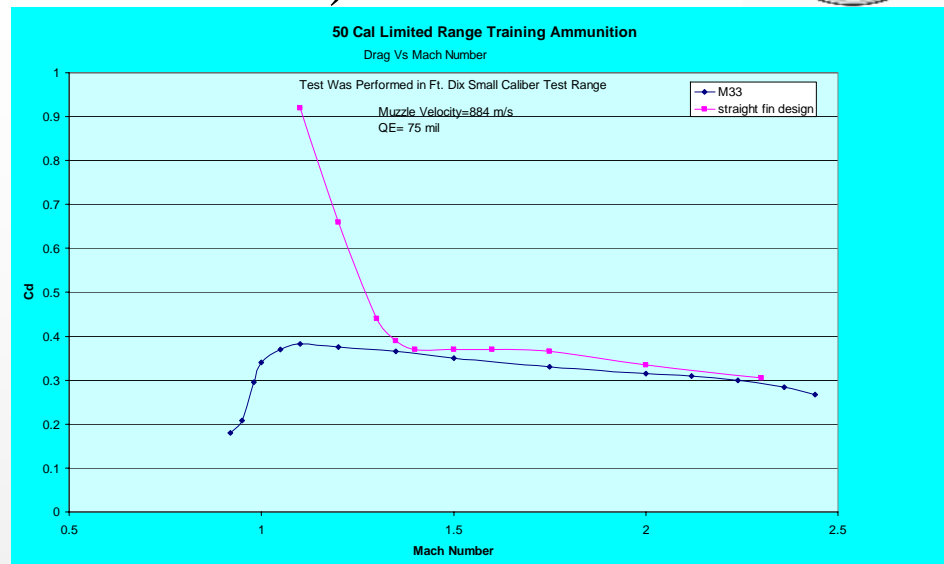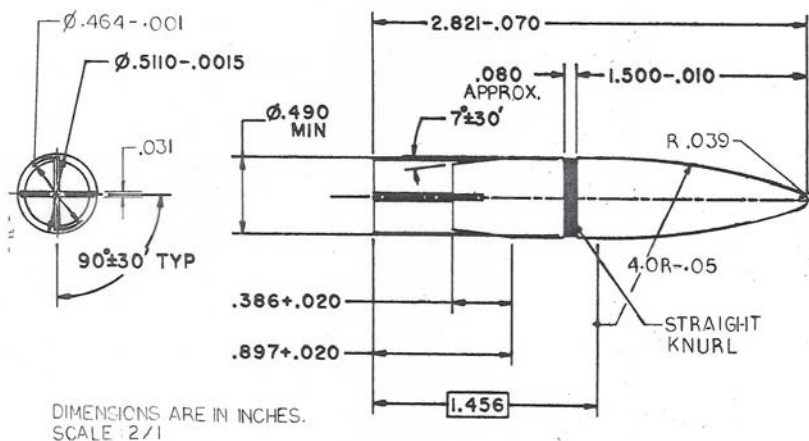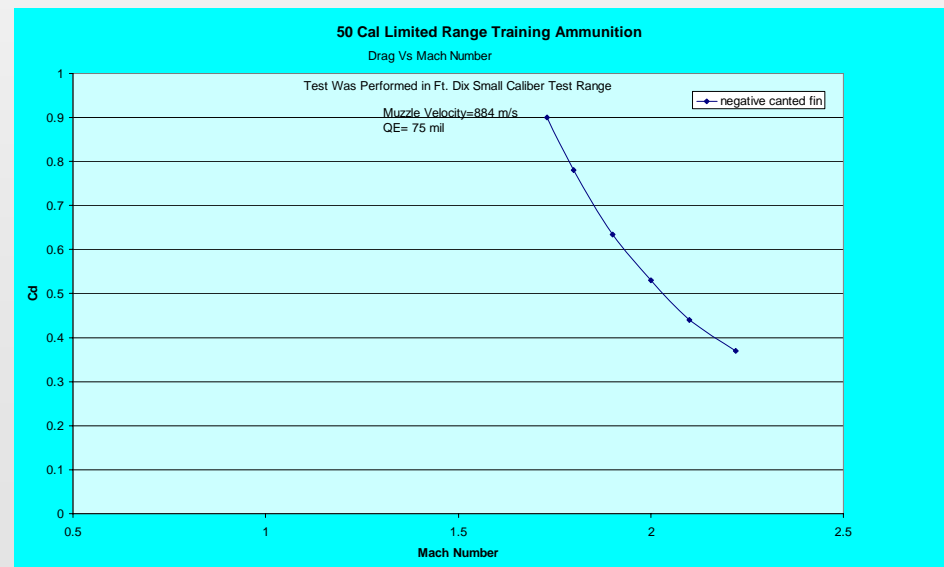
Caliber .50 LRTA Test Results
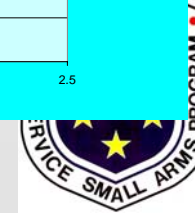# (Cd Vs Mach Numbers)

Caliber .50 LRTA Test Results
(Cd Vs Mach Numbers)

50 CAL LRTA STRAIGHT FIN

50 Cal Limited Range Training Ammunition — Drag Vs Mach Number

50 CAL LRTA TAPERED FIN 1

50 Cal Limited Range Training Ammunition — Drag Vs Mach Number
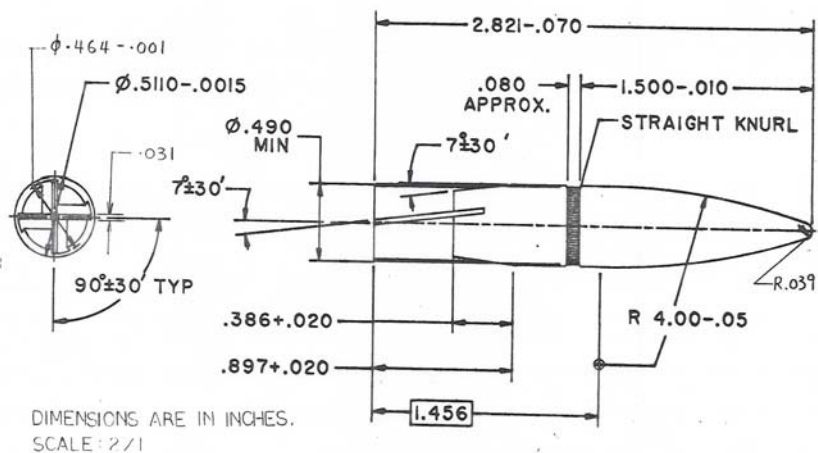
Continue

Design Approach on 7.62mm L^{2}R^2

- 7.62mm M80 external shape with the base straight fin is chosen for the design study.

- The base fin is designed to have sufficient fin area to create instability after meeting the effective range requirement. It will also increase the drag while unstable.

- Projectile mass properties are designed to minimize the max range and optimized launch stability while fulfilling the penetration requirement.
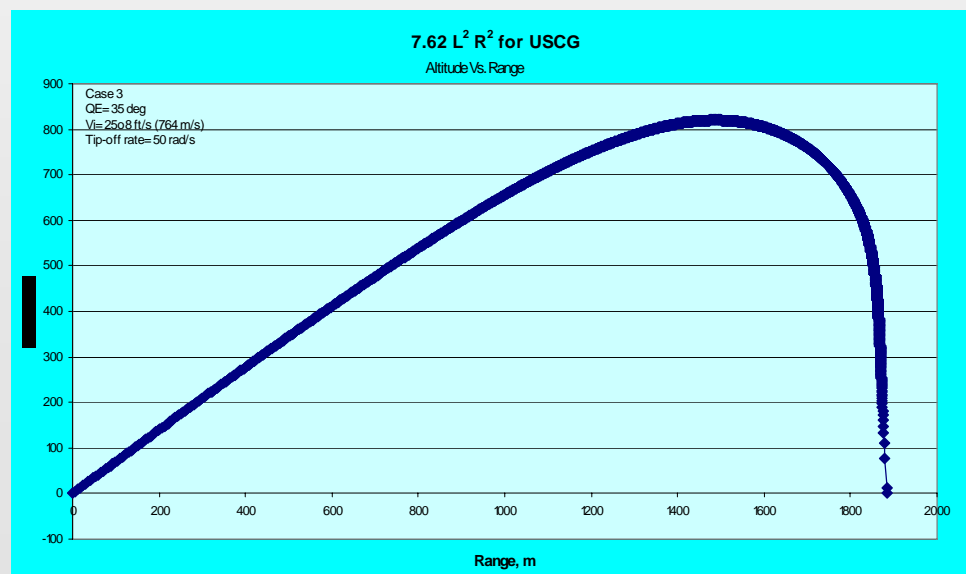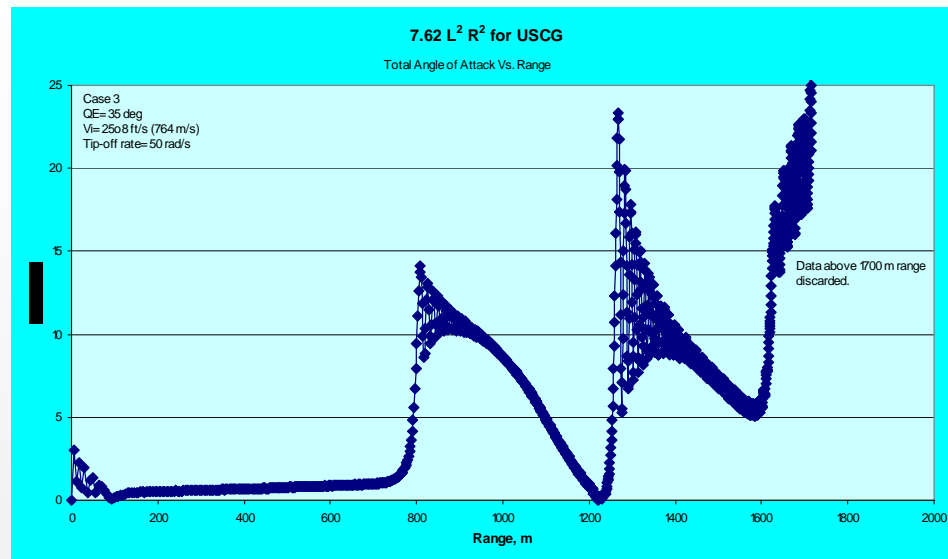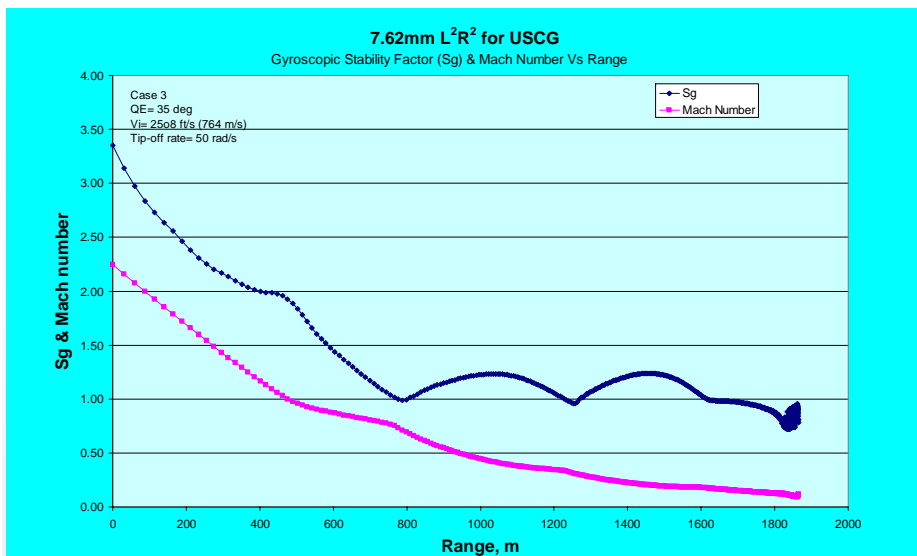
7.62mm L²R² Projectile Design Study Results

7.62mm Lethal Limited Range Round for USCG
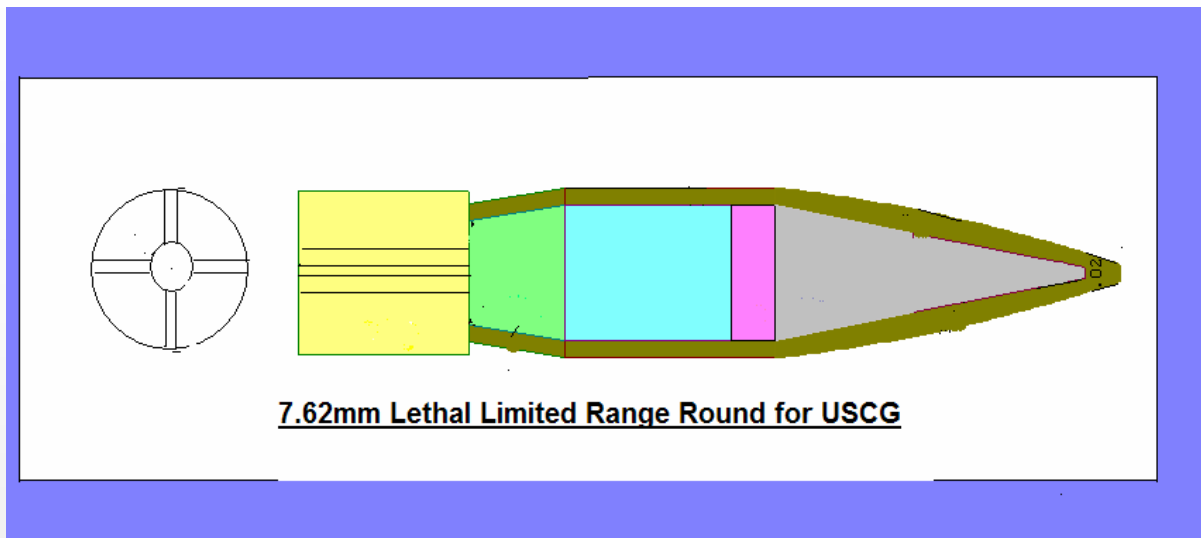
Case	Weight	Max QE Range	M. Vel
	grain/lb	m	ft/s
1	159 / .0227	2200	2508
2	125 / 0.0179	1750	2508
3	135 / 0.0193	1888	2508
4	149 / 0.0210	2105	2508
5	162 / 0.0231	2362	2508
6	146 / 0.0208	2012	2508

Projectile	QE	M. Vel	Weight	Ix	Iy	C.G.nose	Range
	deg	ft/s	grain/lb	lb-in^2	lb-in^2		m
M80	35	2850	147 / 0.021	0.0002	0.00138	0.6886	3705
M80	35	2508	147 / 0.021	0.0002	0.00138	0.6886	3548

7.62mm L²R² USCG 6-Dof Trajectory Simulation

7.62mm L²R² for USCG
Gyroscopic Stability Factor (Sg) & Mach Number Vs Range

Case 3
QE= 35 deg
Vi= 25o8 ft/s (764 m/s)
Tip-off rate= 50 rad/s

Sg
Mach Number

7.62 L² R² for USCG
Total Angle of Attack Vs. Range

Case 3
QE= 35 deg
Vi= 25o8 ft/s (764 m/s)
Tip-off rate= 50 rad/s

Data above 1700 m range discarded.

7.62 L² R² for USCG
Altitude Vs. Range

Case 3
QE= 35 deg
Vi= 25o8 ft/s (764 m/s)
Tip-off rate= 50 rad/s

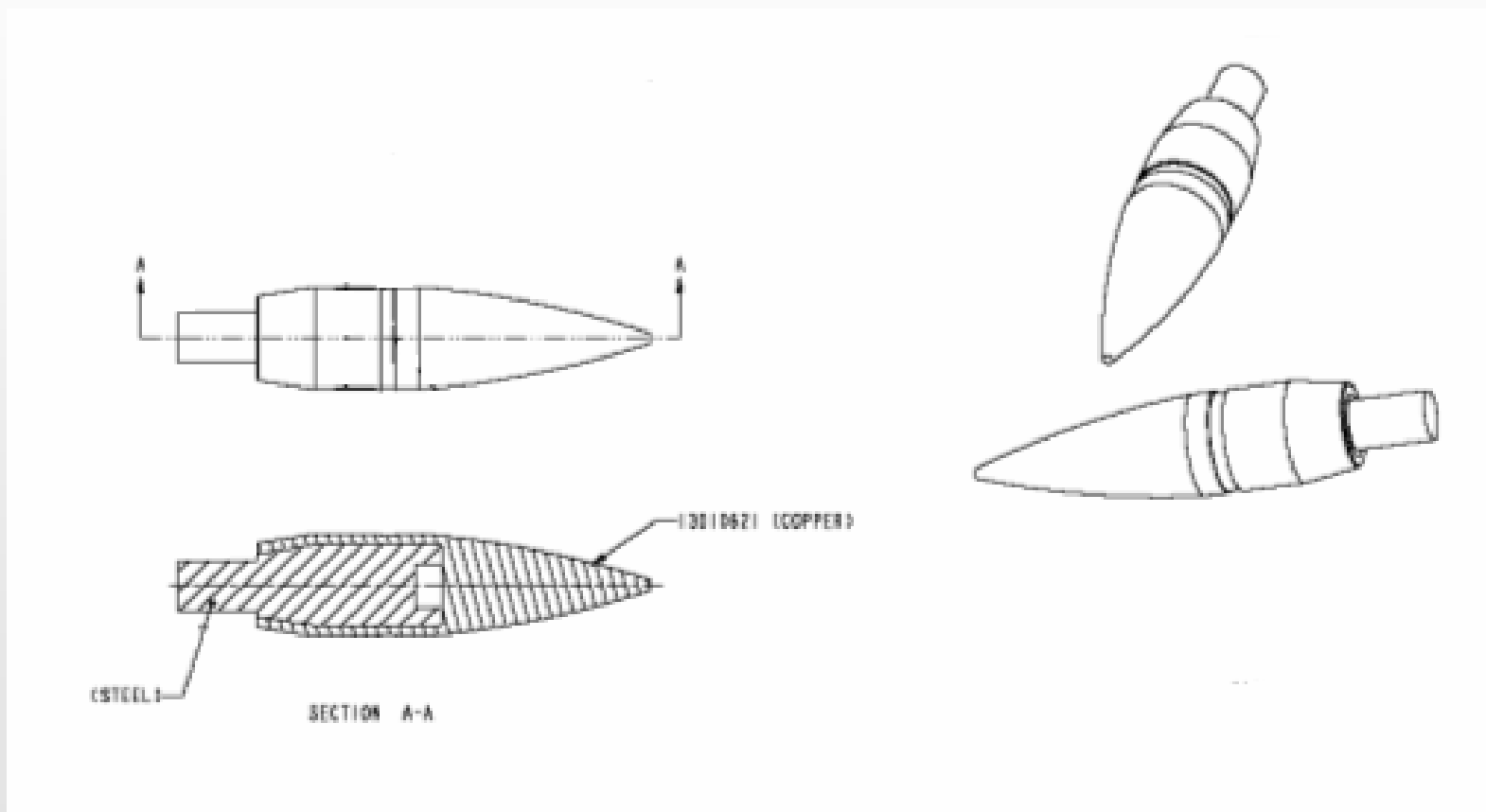# Design of Prototype Projectile
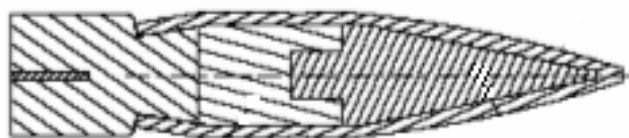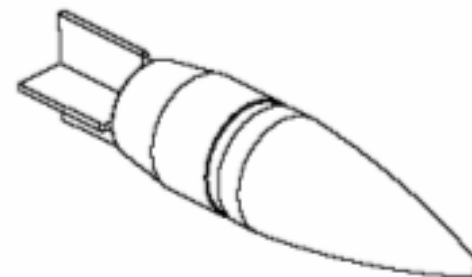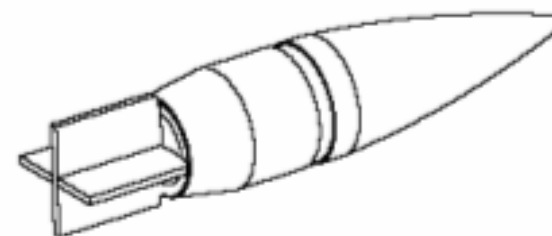
SECTION A-A

Design of Non-Finned Projectiles

SECTION A-A

Test I:
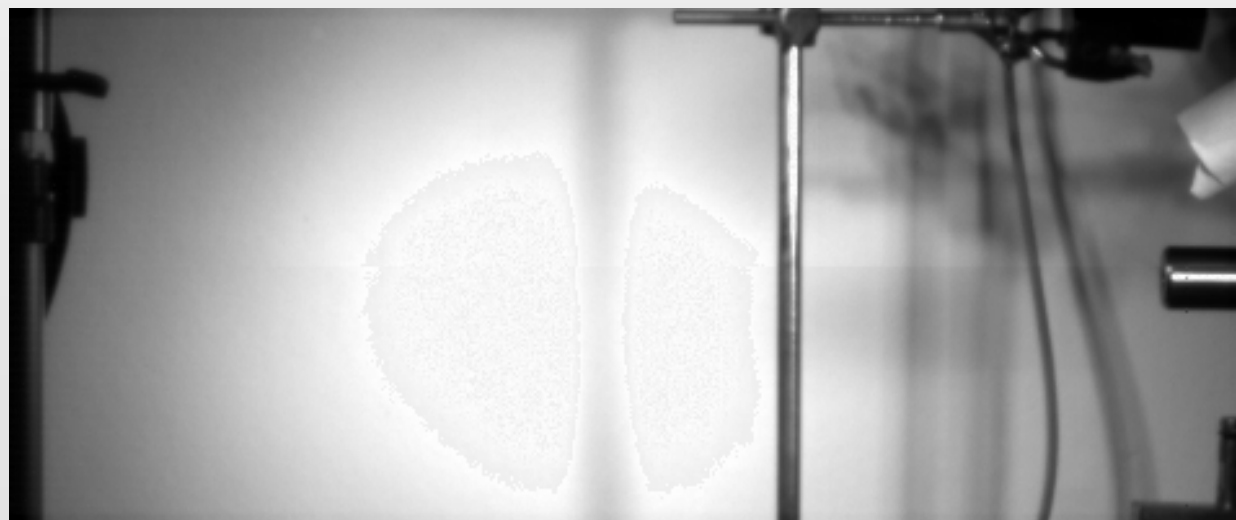# Testing of Non-Finned Projectiles

- Test Projectile
  - Lead time shorter than finned prototypes
  - Facilitated charge establishment
  - Verified adequate case capacity was available
    - Occupied the same case volume rear of the cannelure
  - Verified weapon function and feeding
    - Identical CG to finned projectile
    - Identical ogive to finned projectile
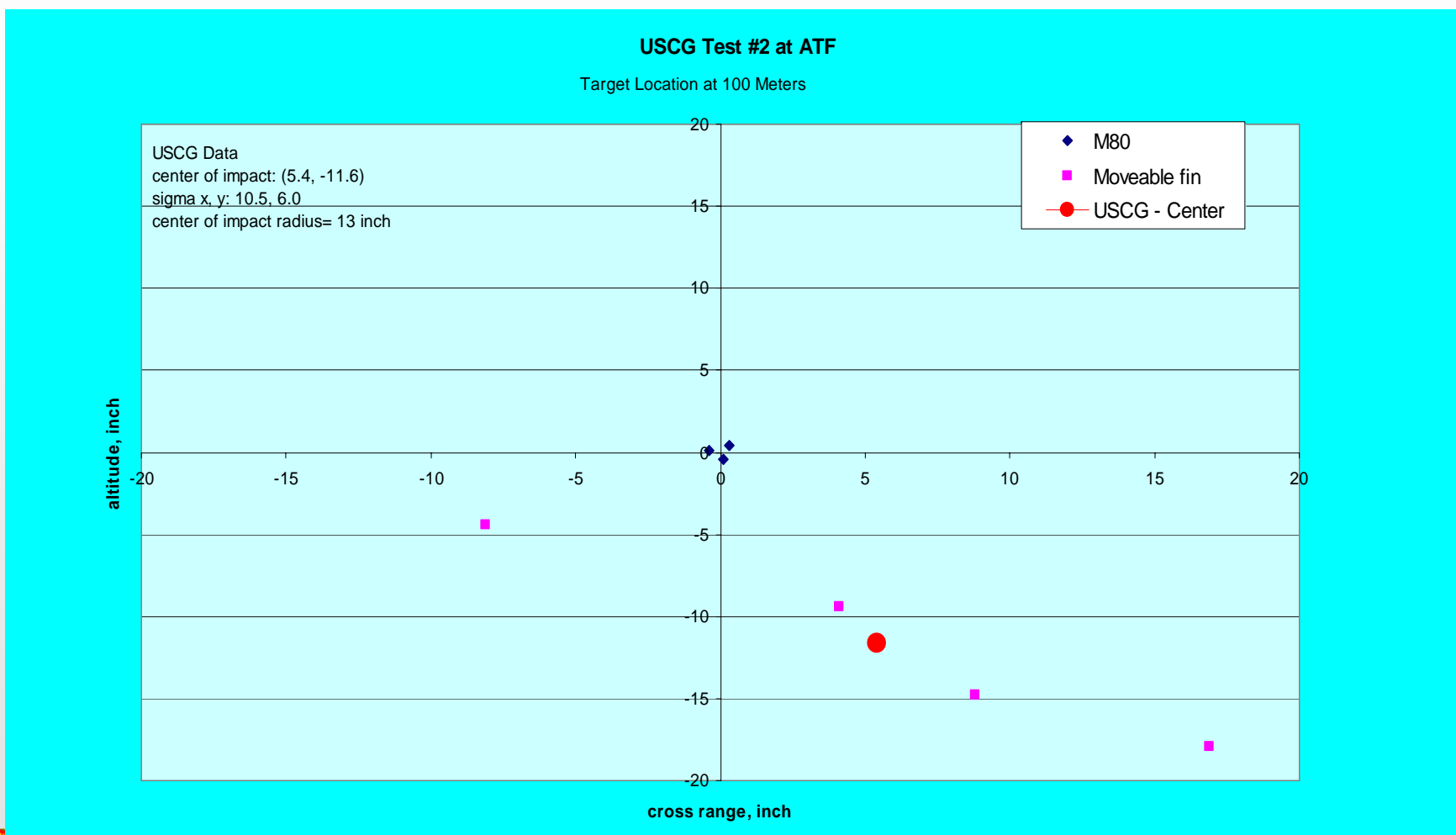
Test II:
Testing of Finned Prototypes

Corrective Actions to Projectiles

- Tightened tolerances on:
  - Jacket and internal parts
  - Boat tail
- Applied adhesive to internal mating surfaces

Test III:
Testing of Finned Prototypes Rev. I

USCG Test #2 at ATF

Target Location at 100 Meters

USCG Data
center of impact: (5.4, -11.6)
sigma x, y: 10.5, 6.0
center of impact radius= 13 inch

Legend:
- ◆ M80
- ■ Moveable fin
- ● USCG - Center

altitude, inch (y-axis, range -20 to 20)

cross range, inch (x-axis, range -20 to 20)

Corrective Actions to Projectiles

- Tighten Tolerances on boat tail
- High speed video indicated fins were deforming at launch
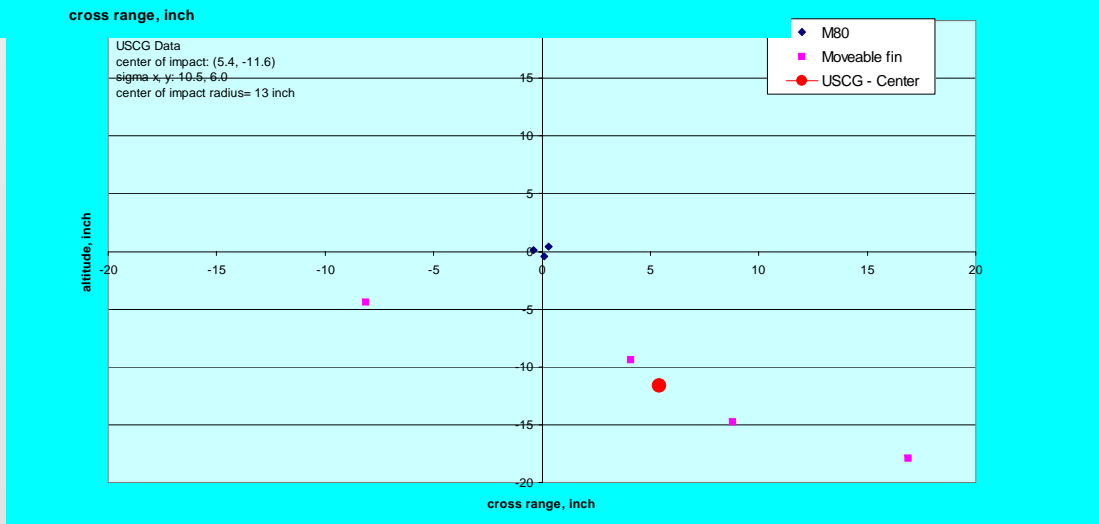 - Fin nesting redesigned
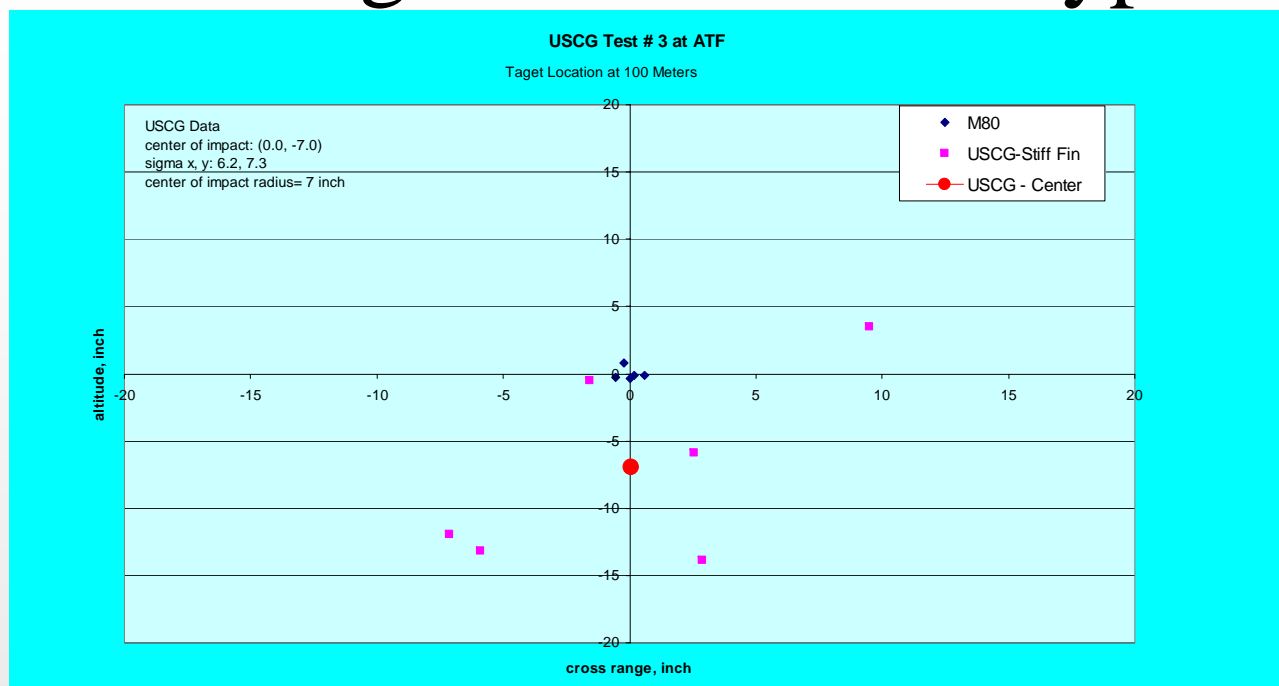- Eliminate anodization of fins

Test IV:
Testing of Finned Prototypes Rev. II

Test IV:
High Speed Video

Test VI:
Hard Target Penetration Testing

- ¼" A36 Mild Steel

- 200 meters

- 60 degree obliquity angle

- 10 Rounds fired, ALL perforated

Summary

- Current projectile design satisfies penetration requirements

- Additional design modifications have been made to further improve accuracy

- Radar testing to verify the maximum range of the projectile has been scheduled