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30mm x 113mm (LW30) High Explosive Incendiary – Tracer (HEI-T)

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Outline

- Applications
- Design/Performance Objectives
- Initial Design/Development Phase
- Final Design and Testing
- Summary

Applications

LW30mm M230 Chain Gun®

- Currently on Apache helicopter


M230 Chain Gun

LW30mm M230LF (Link Fed) Chain Gun®

- Based on proven M230 gun
- Low-recoil design makes gun adaptable to many systems
- Being implemented for ground and shipboard applications


ATK Invictus™

ATK System Application Examples for M230LF

- Invictus™
- Palletized Autonomous Weapon System (PAWS)
- Nobles Engineering Viper Gun System

Ground and Shipboard Applications Require Traced Ammo

Design/Performance Objectives

Design Objectives

- Percussion primed ignition system
- Utilize current LW30 components to expedite design and test
- Increased lethality
- Incendiary for increased collateral damage
- Traced
  - Trace distance to 2,000m
  - Daylight & infrared visible

Flight Characteristics

- Flight characteristics to current LW30 ammo

M789 HEDP | M788 TP

LW30 HEI-T Preliminary Designs Concepts

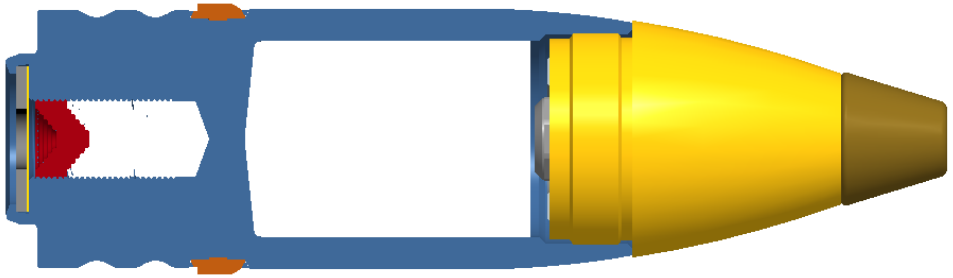
Design Considerations

- Projectile body materials
- Tracer metering disk vs. no metering disk
- Boomtail vs. no boomtail
- High explosive quantities

LW30 Common Components

- M759 Fuze
- PBXN-5 High Explosive
- Tracer & Igniter Composition

  (LW30 TP-T)

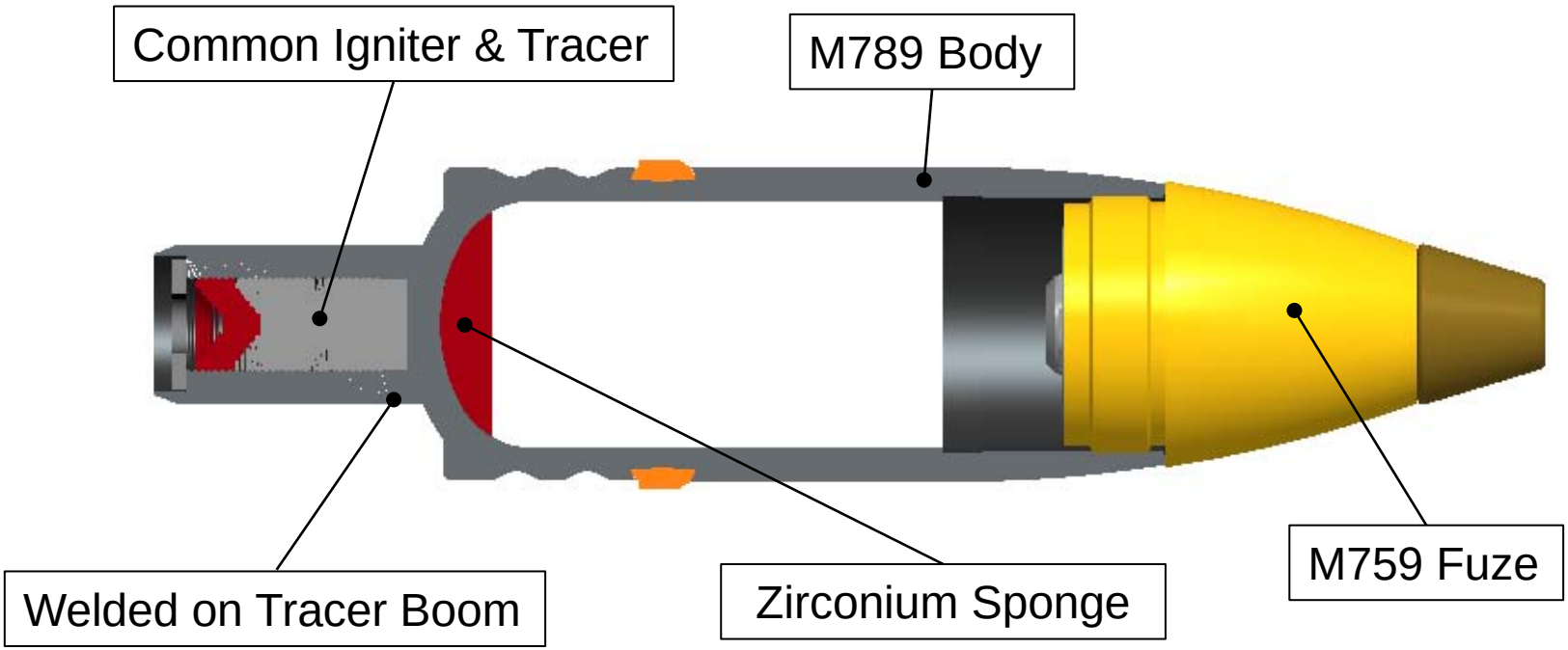


Option 1

Option 2

Option 3

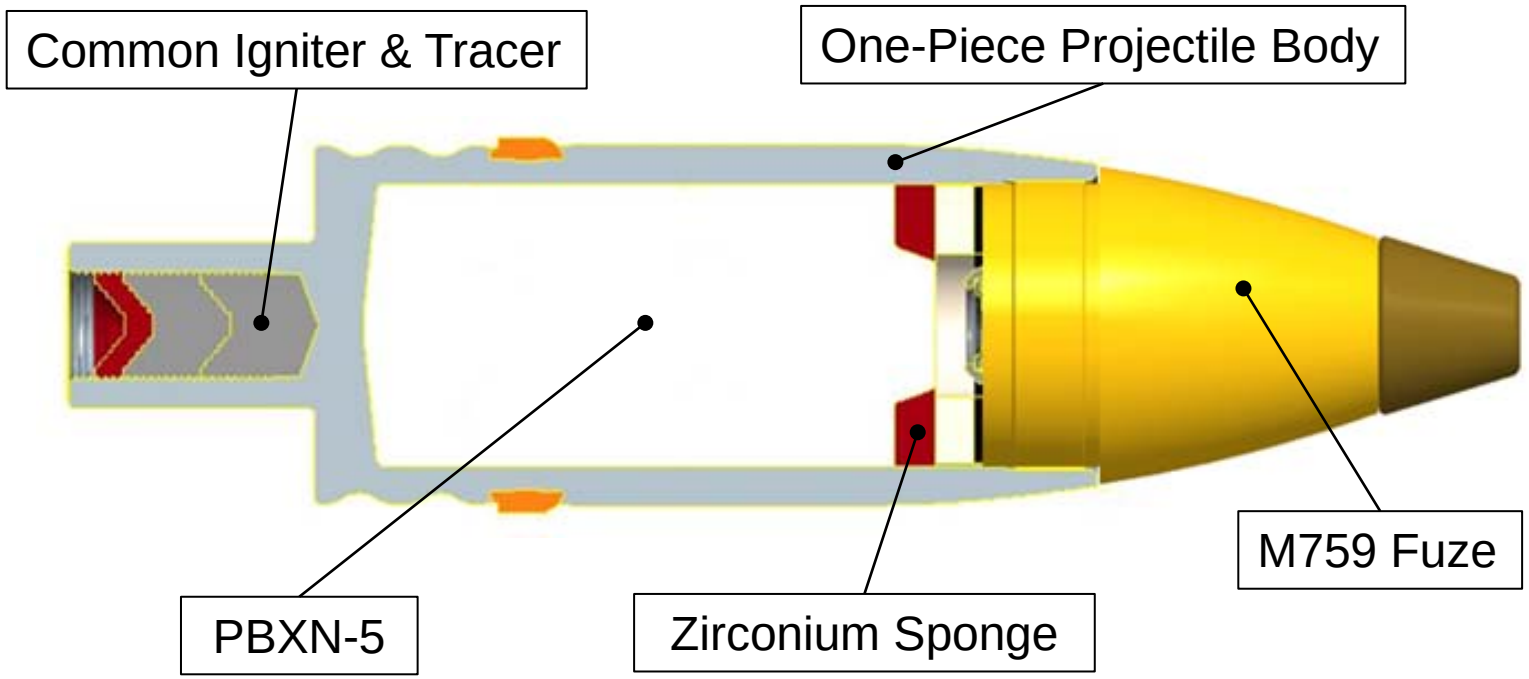
LW30 HEI-T Initial Design (Mod 1)



	Muzzle Velocity (m/sec)	Pressure (Mpa)	Gyro Stability Factor	Muzzle Jump
M789 HEDP	802	285	2.42	0.027
Mod 1	749.5 (est.)	274 (est.)	0.99 (est.)	0.027 (est.)

"Optimal" range for Gyro Stability Factor = 2 - 3 (Known good at 2 or above for air-based systems)
Minimum for margin of safety for Gyro Stability Factor (for ground-based systems) = 1.2
Unstable below 1.0

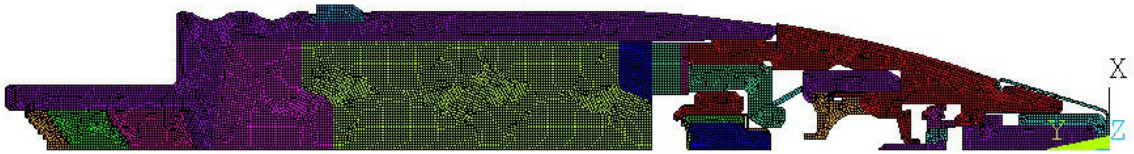
LW30 HEI-T Initial Design (Mod 2)



	Muzzle Velocity (m/sec)	Pressure (Mpa)	Gyro Stability Factor	Muzzle Jump
M789 HEDP	802	285	2.42	0.027
Mod 1	749.5 (est.)	274 (est.)	0.99 (est.)	0.027 (est.)
Mod 2	753.9 (est.)	266 (est.)	1.53 (est.)	0.03 (est.)

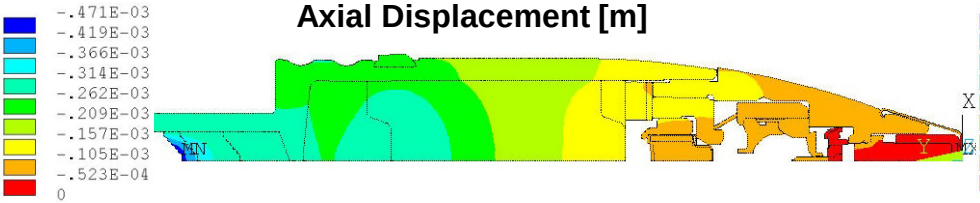
"Optimal" range for Gyro Stability Factor = 2 - 3 (Known good at 2 or above for air-based systems)
Minimum for margin of safety for Gyro Stability Factor (for ground-based systems) = 1.2
Unstable below 1.0

ANSYS FEA Analysis



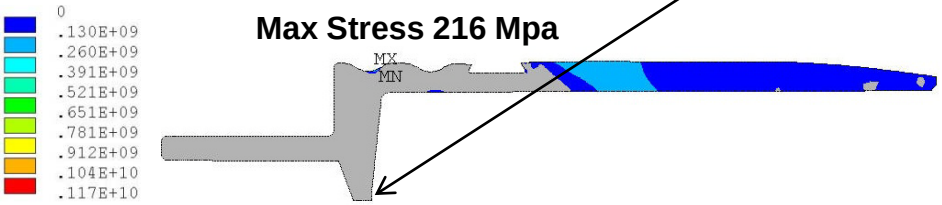
Aft Tracer Wall

Axial Displacement [m]



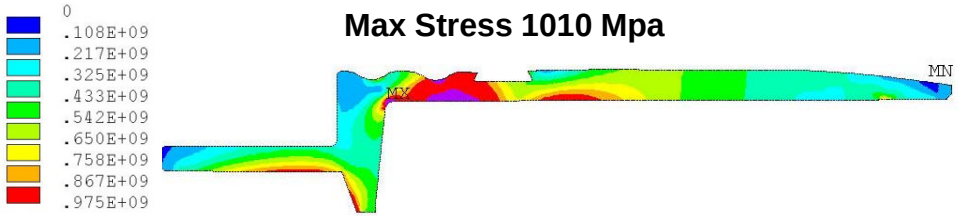
Max Principal Stress [Mpa]

Max Stress 216 Mpa

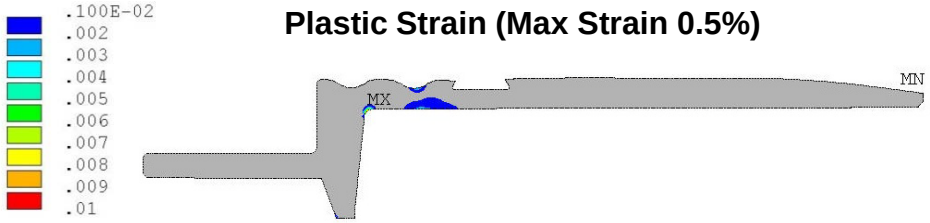


Equivalent Stress [Mpa]

Max Stress 1010 Mpa



Plastic Strain (Max Strain 0.5%)



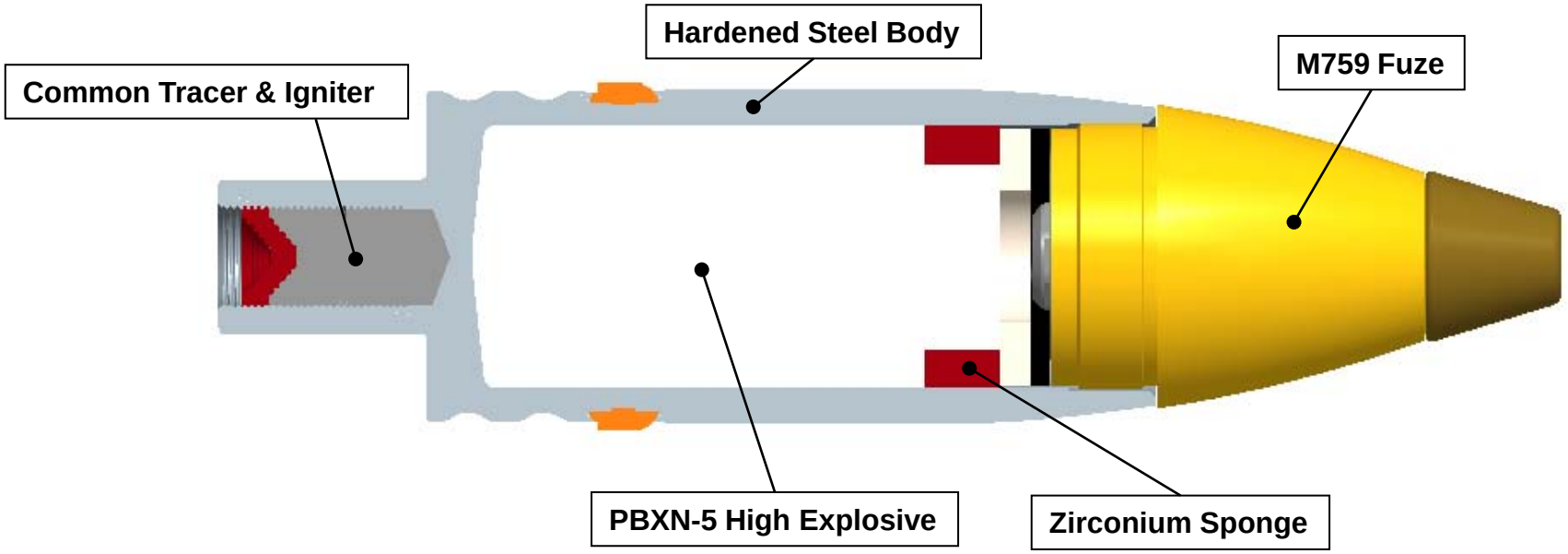
Model	Wall/Aft Reduction [mm]	Mass Reduction [gram]	MOS-Yield	Max Strain [%]	MOS-Ultimate	Comment
Baseline	0.0	0.00	0.0	0.7	4.5	Adequate Projectile Body
Modification 5	2.0	2.34	0.0	0.9	3.7	Adequate Projectile Body
FINAL	1.8	2.07	0.0	0.5	4.4	Adequate Projectile Body

LW30 HEI-T Final Projectile Design

Design Changes:

- Optimized projectile body design to minimize weight and increase ease of manufacture based on ANSYS analysis
- HE loading iteration trials to determine consistent/safe loading assembly process

Projectile Design:



LW30 HEI-T Test Plan

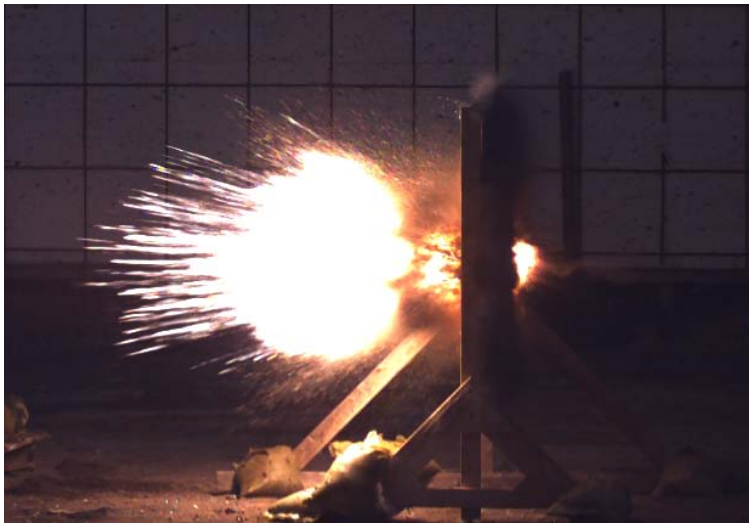
Test Plan

- Charge Establishment - Complete
- Charge Verification @ 500m Outdoor Range – Complete
  - Including target effects data
- PVAT, Dispersion, Yaw, Mann Barrel Function & Casualty
- Max Range Tracer & Radar
- Autogun Function & Casualty

LW30 HEI-T Projectile & Projectile Body

LW30 Target Effects (1/2” Plywood @ 500m)

Standard LW30 M789
~11.75” Diameter Hole



LW30 HEI-T

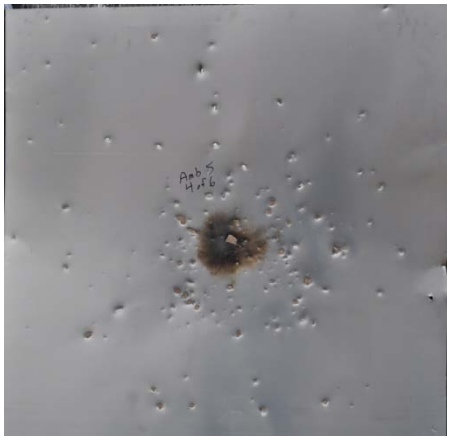
LW30 HEI-T
~16” Diameter Hole

LW30 HEI-T Target Effects (Multi-Plate Array @ 500m)

Impact Plate (4’ x 4’)
0.063” Aluminum

2nd Plate
(8” Behind Impact Plate)
0.040” Aluminum

3rd Plate
(16” Behind Impact Plate)
0.040” Aluminum



4th Plate
(24” Behind Impact Plate)
0.040” Aluminum

Summary

Initial Two Designs

- Did not meet ballistic match and flight objectives
- Had producibility and assembly concerns

Final Design

- Simulations and initial testing indicate this will meet ballistic and flight requirements

	Muzzle Velocity (m/sec)	Pressure (Mpa)	Gyro Stability Factor	Muzzle Jump
M789 HEDP (M230)	802	285	2.42	0.027
LW30 HEI-T (M230LF)	801	246	1.68*	0.028

* Gyro stability factor for ground based systems considered stable between 1 and 2

- Anticipate that the additional tracer mix will provide reliable tracer burn to 2,000m
- Structurally robust design (demonstrated in the CE and CV testing)
- Improved producibility and cost savings

Questions?

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