Low Collateral Damage 105mm Artillery Shell

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Outline

- Objective, Approach & Warfighter Benefit
- Notional CONEMP
- Fabrication
- Fuze Integration
- Rotating Band
- Gun Launch Tests
- Lethality Tests
- Summary

Objectives, Approach & War Fighter Benefits

Objective: Develop and demonstrate a low collateral damage variant of the M1 105mm artillery shell

Approach: Replace steel M1 case with carbon fiber composite case and dense inert liner

War Fighter Benefits:

- **Allows target prosecution in collateral damage sensitive engagements**
  - **Increased prosecution rate decreases war time & cost**
- **Composite case disintegrates into non-lethal fibers upon detonation reducing collateral damage significantly**
- **Composite case requires less energy to rupture**
  - **4X - 5X lower density than steel**
  - **More energy partitioned to target damage function**

Notional CONEMP

Precision delivery via M102 gun system and AC-130 fire control system

Aircrew loading 105mm round into M102 Gun System derived from the Army field artillery M1A1 howitzer

FMU-153 Anti-ricochet fuze with Aluminum wind screen

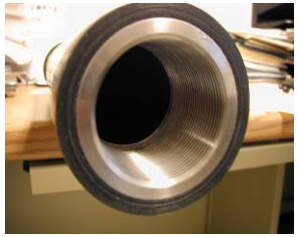
Carbon fiber/epoxy matrix composite case

Rotating Band: 10% glass fiber filled in Nylon 6/6

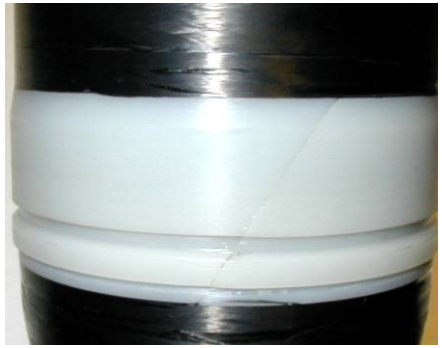
Boat Tail: 10% glass fiber filled in Nylon 6/6

Fabrication

Sand mandrel overlaid with non-stick tape



Integrated steel coupler



Integrated rotating band

Multiple spindles increase production rate

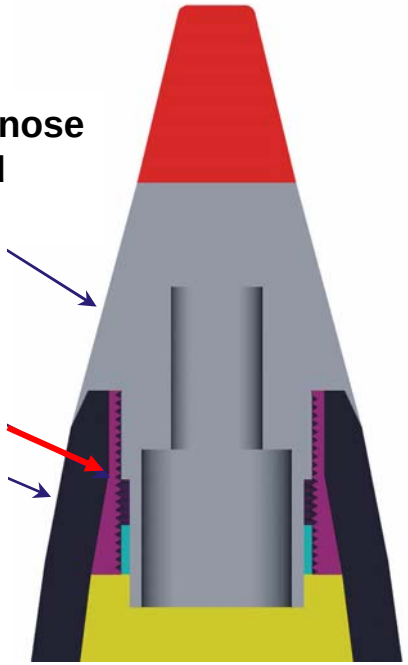
Nose Fuze Integration

FMU-153 Anti-ricochet fuze with Aluminum wind screen

Uses existing FMU-153 nose fuze body with modified compression shoulder

Internally captured nose/fuze ring (2 x 12 thread)

Carbon fiber composite case

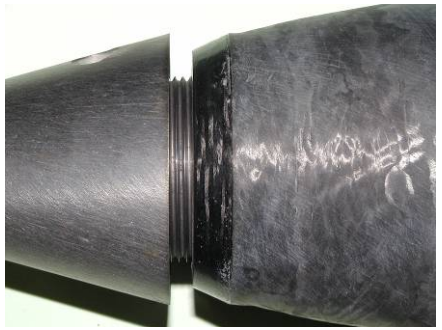


Internally-threaded reverse-tapered steel coupler

Initial coupler tested in compression test cylinder

Post Shot Results

Slight bulge behind the nose/fuze

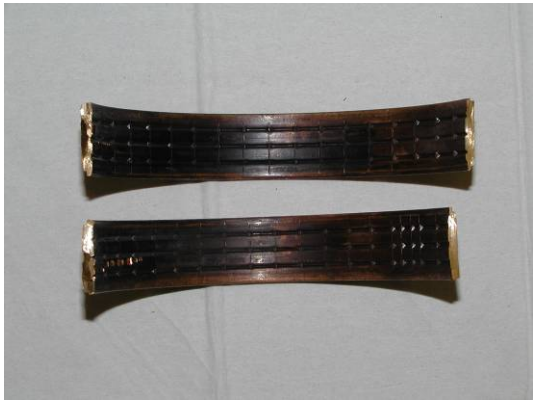


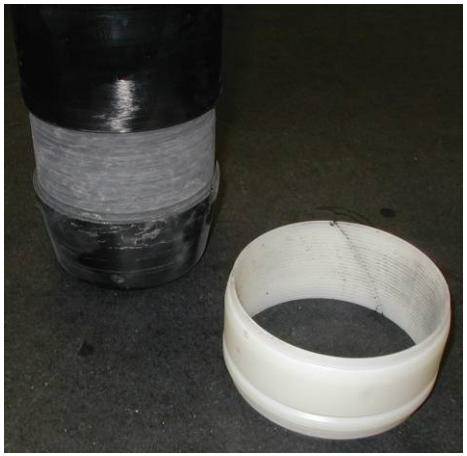
Coupler/body intact

Rotating Band

Composite case and M1 steel case

Swaged Copper alloy rotating band





•Composite case machined to accept rotating band

•Band with compound cut epoxy bonded & wound to case

Post launch rotating band intact

Boat Tail Integration

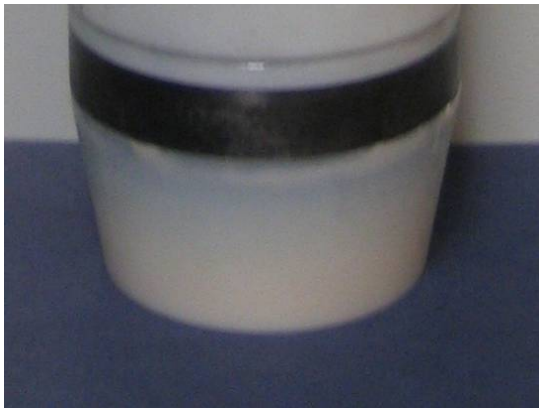
First Generation End Section

Boat tail machined from composite body

Boat tail intact, post shot

Improved End Section

Shape changed to increase strength



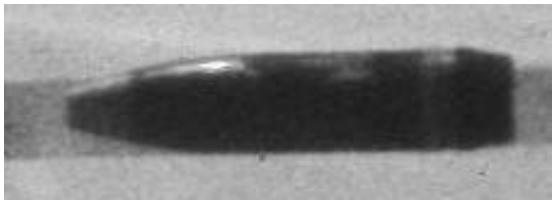
Nylon boat tail add-on

Gun launched survivability test

Captured velocity with radar

Sand target for soft recovery

Before After



Flight trajectory appears stable

No separation occurred at rotating band split

Lethality Tests

Target Response Diagnostics

Conventional M1 Response

- **Welded steel construction**
- **High-density foam**

Human Surrogate

LCD 105mm Response

Summary

- LCD 105mm artillery shell is composed of a composite case, dense inert liner, FMU-153 fuze and conventional explosives
- The LCD 105mm artillery shell offers a low collateral damage option
  - Case disintegrates into non-lethal fibers upon detonation reducing collateral damage significantly
- Initial gun-lauched tests conducted
  - composite case survives gun launch and spin-up

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