



**RDECOM**



# Development of 155mm M795 IM Precision Guidance Kit (PGK) Compatible Projectile



***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

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- The Army Qualified IMX-101 as the main fill for the 155mm M795 Artillery Projectile in June 2010
- The Army is now moving towards guided fuzes, ie Precision Guidance Kit (PGK), which is a deep intrusion fuze.
  - Due to the supplementary charge being removed for PGK use, IMX-101 would not be compliant with this fuze

## Changes via Army ECP (a)

## Changes via Army ECP (b)



Legacy D529

- Army developed projectile
- Contains 24lbs of HE
- Consists TNT supplemental charge
- Poor IM testing results



DA54  
Non-PGK Fuze Compatible

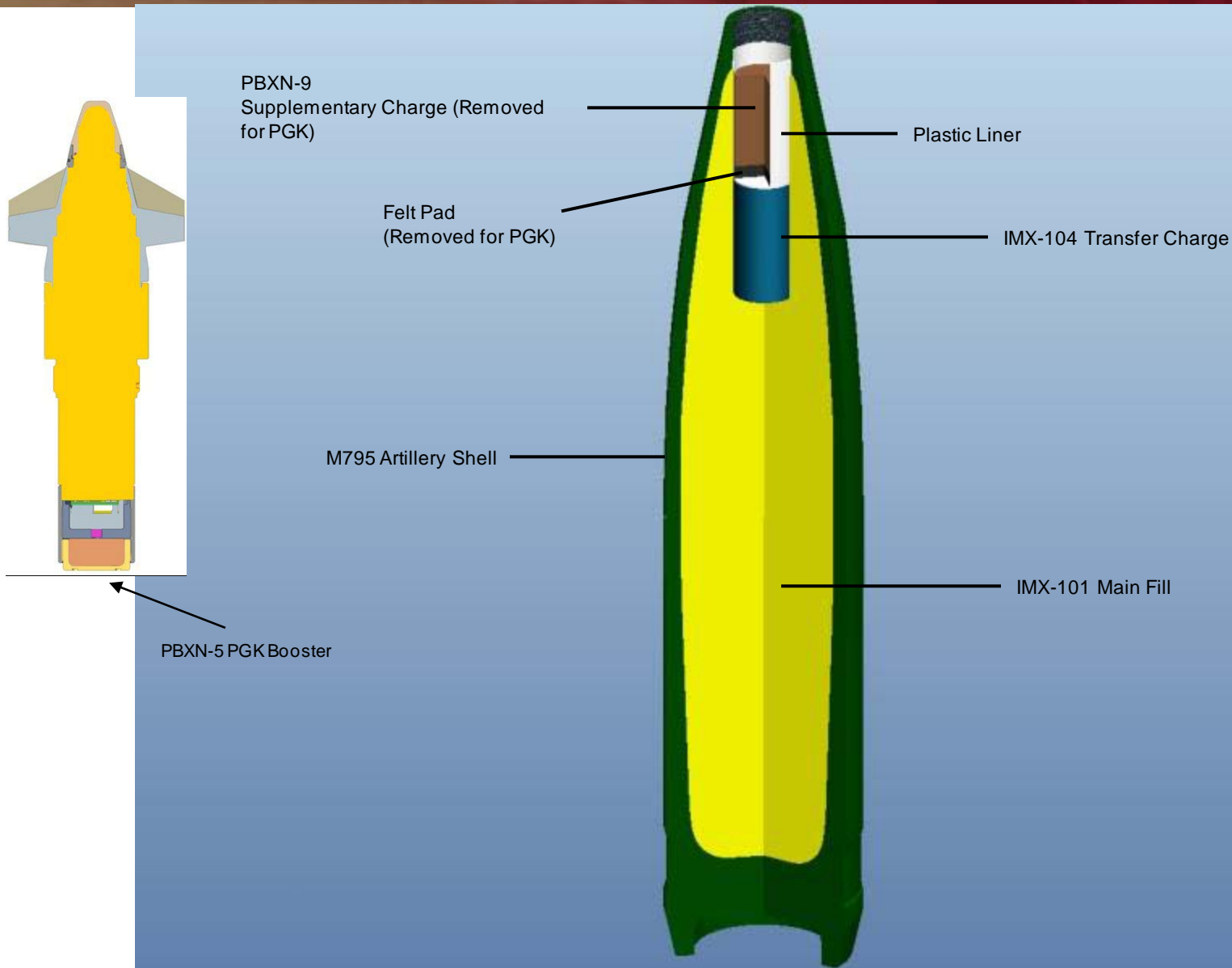
- Replaces TNT with IMX-101
- Consists PBXN-9 supplemental charge
- Less sensitive than legacy D529
- Not compatible with PGK fuze
- Currently not in inventory and no plans to field



DA54 PGK Fuze Compatible

- Similar to DA54 non-PGK fuze compatible, uses IMX-101 and PBXN-9 as supplemental charge
- Contains IMX-104 transfer charge to accommodate PGK fuze compatibility
- Maintains same IM performance as DA54 non-PGK fuze compatible projectile

# M795 IM PGK Fuze Compatible Round



Test	Configuration Tested	Results
Initial Safety	DA54 (Used as analogy for PGK-compatible)	Most Met Firing criteria, Others Safe for Demil
Worn Tube	DA54 (Used as analogy for PGK-compatible)	Successful
Safety Margin	DA54 (Used as analogy for PGK-compatible)	Successful
Adverse Environments	DA54 (Used as analogy for PGK-compatible)	Successful
Firing Tables	DA54 (Used as analogy for PGK-compatible)	Successful
Engineering	DA54 (Used as analogy for PGK-compatible)	Successful

**Testing Completed per ITOP: 4-2-504(1) Safety Testing of Field Artillery Ammunition**



# Product Qualification Tests (Continued)



Test	Configuration Tested	Results
Feasibility/Static	DA54 PGK Fuze Compatible	Successful
Proof of Principle	DA54 PGK Fuze Compatible	Successful
Fuze Train Optimization/Static	DA54 PGK Fuze Compatible	Successful
Sequential Environmental Test (SET)	DA54 PGK Fuze Compatible	Successful
12m Drop	DA54 PGK Fuze Compatible	Successful
Ballistic Match	DA54 PGK Fuze Compatible	Successful
Long Term Storage	DA54 PGK Fuze Compatible	No Results at This Time (Started October 2012)
Explosive Ordnance Disposal (EOD)	DA54 PGK Fuze Compatible	Good data to select an effective EOD procedure
Irreversible Growth Test	DA54 PGK Fuze Compatible	Minimal Changes
Adverse Environments – included in SET	DA54 PGK Fuze Compatible	Successful
Pallet Packaging Test – included in SET (Vibration Tests)	DA54 PGK Fuze Compatible	Successful

**No Safety Anomalies Reported on DA54 PGK Fuze Compatible Projectile**

Hazard Classification	IM	Results
UN Test 6 (C) Liquid Fuel/External Fire	Fast Cook-off*	V
Slow Heating	Slow Cook-off	V
Bullet Impact	Bullet Impact	IV
Fragment Impact	Fragment Impact	IV
UN Test 6(b) Sympathetic Reaction	Sympathetic Reaction*	Pass
Shaped Charge Jet	Shaped Charge Jet*	Pass
UN Test 4(a) Thermal Stability	Hazards Classification Testing	Pass
UN Test 4 (b) (ii) 40ft Drop	Hazards Classification Testing	Pass

\*AIMB accepted previous test scores via engineering assessments (previously tested with DA54 Non-PGK Fuze Compatible)

# Bullet Impact with PBXN-9 Supp Charge Aim Point Test Setup





- Three 0.50 caliber AP bullets into the SC @ 2749.8, 2762.4 and 2739.7 ft/sec
- First bullet caused a piece of the test unit to break off expelling the lifting plug.
- The second bullet still impacted the aim point.
- The third bullet missed the target due to it being knocked off.
- The farthest fragment recovered was a lifting plug at 39.75'
- Type V reaction. 0 PSI recorded on all gauges.



- Three 0.50 caliber AP bullets into the SC @ 2744.7, 2851.7, and 2780.4 ft/sec
- The first bullet caused the lifting plug to expel.
- The second bullet still impacted the aim point.
- The third bullet missed the target due to it being knocked off.
- The farthest fragment recovered was a lifting plug at 67.58'.
- Type IV reaction. 0 PSI recorded at all gauges.





- 18.6gm conical fragment fired @ 8186.2 ft/sec into the SC
- Upon impact there was a large fireball and the test article was knocked off of the stand.
- Large pieces of shell casing were found around the test range.
- Pieces of unreacted HE found from 0° to 300° out to 5.17'
- The farthest fragment recovered was a piece of projectile case found at 145.83'
- Peak pressure of 0.5 PSI was recorded at 20' distance from the test item.
- Type IV reaction.



- 18.6gm conical fragment fired @ 8415.3 ft/sec into the SC
- Upon impact there was a large fireball and the test article was knocked off of the stand.
- Large pieces of shell casing were found around the test range.
- Pieces of unreacted HE found from 0° to 360° out to 45'
- The farthest fragment recovered was a piece of lifting plug found at 169.58'
- Peak pressure of 0.4 PSI was recorded at 20' distance from the test item.
- Type IV reaction.







Type V







# UN Test 4(a) Thermal Stability Test\*



- One test for evaluating thermal stability
  - One M795 round in oven at  $167 \pm 35.6^{\circ}\text{F}$  for 48 hours
  - A thermocouple attached to the casing recording the temperature once per minute.
  - Passing criteria
    - No explosion
    - No ignition
    - No substance exudation
    - No temperature rise exceeding  $37.4^{\circ}\text{F}$
    - No damage to the outside casing

\* This test is for Hazard classification

# Thermal Stability – Results

- The visual inspection revealed no anomalies -

Pass



Thermocouple placement



Test Setup

# 40 ft Drop - Test Set Up



Base Down



Nose Down



Major axis Horizontal

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# 40 Ft Drop – Results



Pass



Pass



Base Down



Nose Down



Major axis Horizontal

- Changes were successfully made to M795 IM via Army ECP (DA54) to improve IM characteristics and for compatibility with PGK fuze use
  - These changes did not compromise the IM or Performance of this Artillery Round
- Future efforts will evaluate the use of a pressed transfer charge to reduce production costs
- M795 IM PGK Compatible Artillery Rounds will go into FY14 production schedule

# QUESTIONS?

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