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PGK Precision Guidance Kit **Affordable Precision for Future Artillery**

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Types of Precision Munitions

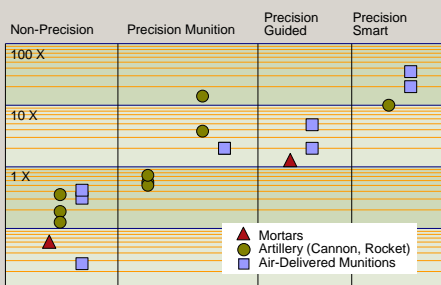


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Current Paradigm:

Order of magnitude cost increase from:

- Unguided to Precision
- Precision to Autonomous

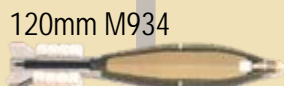


| Non-Precision (Area) Munition | Precision Munition Kits | Precision Guided Munition | Precision Smart Munition |
|---|---|--|--|
| Munition/submunitions subject to all ballistic conditions on the way to the AIMPOINT . | Munition corrects for ballistic conditions using guidance and control up to the AIMPOINT | Munition guides to TARGET with <10m accuracy delivering unitary or submunition warhead. Submunitions are subject to ballistic conditions to the AIMPOINT . | Munition/submunition autonomously searches, detects, classifies, selects, and engages TARGET(s) . Has a limited target discrimination capability. |

Relative Cost

| | | | |
|----|------|----------|-------|
| 1X | 3-5X | ~10-100X | ~100X |
|----|------|----------|-------|

120mm Mortar Ammunition



XM395 PGMM

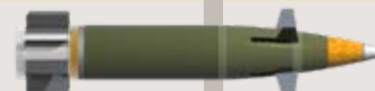
105mm/155mm Cannon Fired Artillery Ammunition



Unguided 155mm



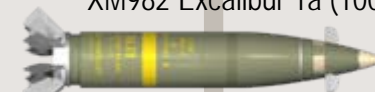
155mm GPS-Guided PGK



XM982 Excalibur 1a (100X)

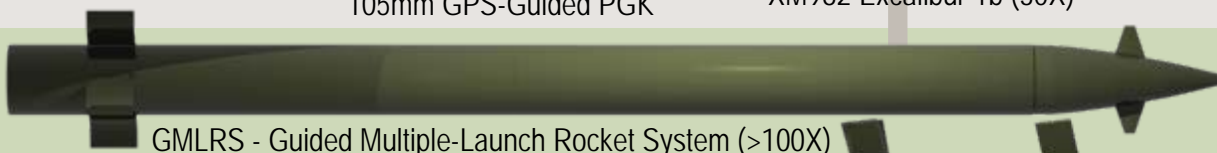


105mm GPS-Guided PGK



XM982 Excalibur 1b (30X)

221mm Rocket-Launch Artillery Ammunition

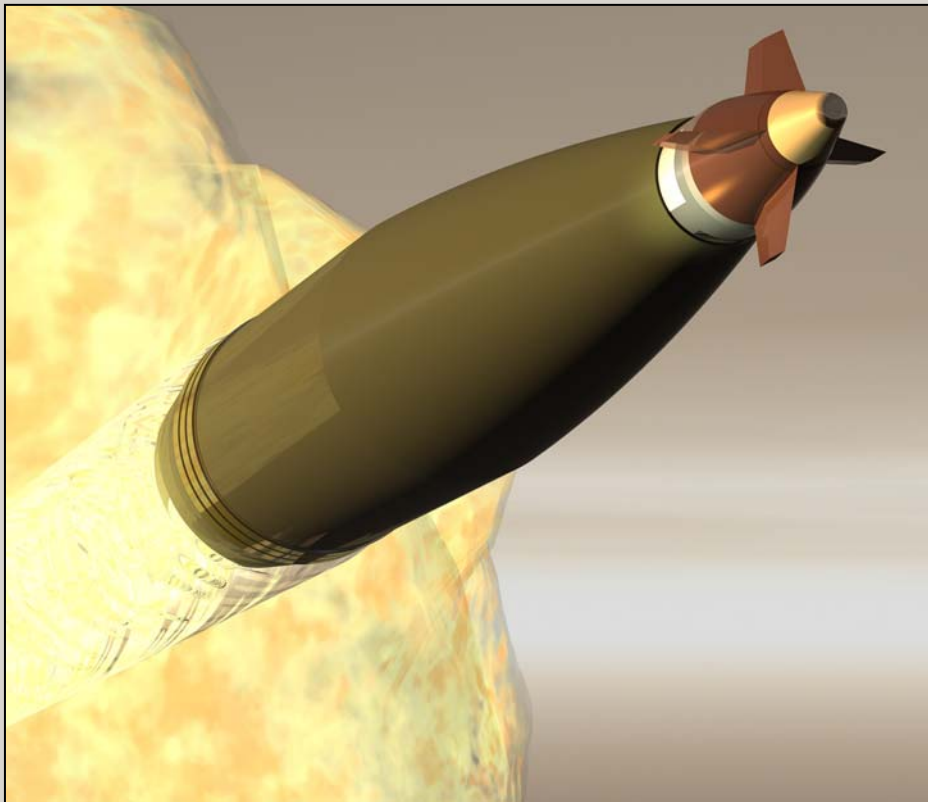


GMLRS - Guided Multiple-Launch Rocket System (>100X)

178mm Rocket-Launch Artillery Ammunition

PAM - Precision Attack Munition





Operational Benefits

- Transforms existing artillery inventory into affordable precision weapons
- Improves combat effectiveness
- Reduces collateral damage
- Reduces logistics footprint

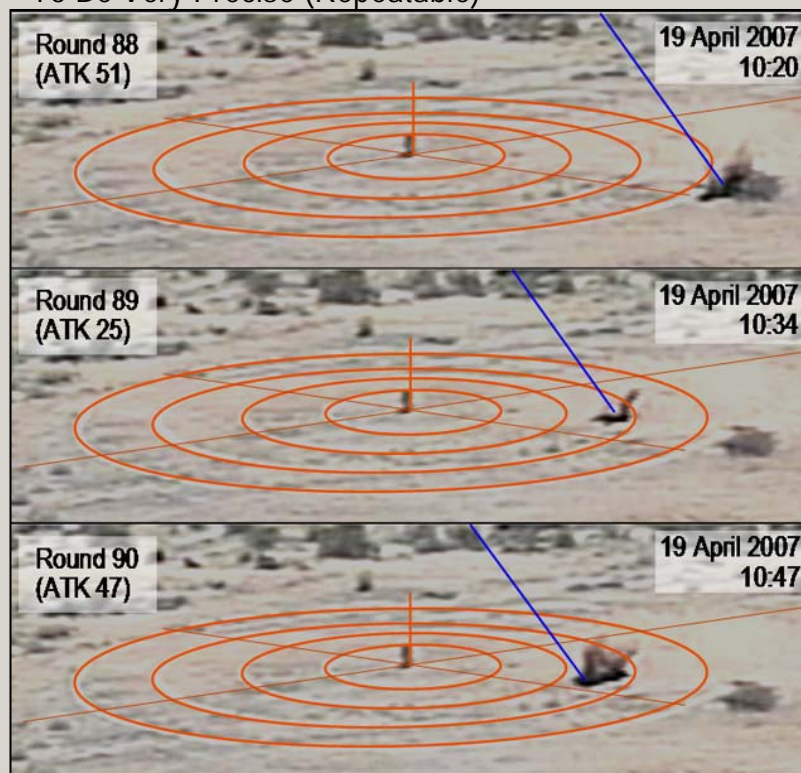
What is PGK?

- GPS Guidance Kit with Fuzing Functions
- Replaces the standard 155mm artillery projectile fuze
- PGK GPS guidance greatly improves the accuracy of conventional artillery in the inventory
 - <50m CEP vs. >200m CEP at max range**
- Maintains >90% of range capability of conventional projectile
- Requires no battery
- Has no "one-shots" or canard deployments
- Reliable - one moving "part"
- Uses COTS inertial sensors
- Full 2D Guidance to Impact

Technical Demonstration Program

Competitive Fly-Off
18 M549A1 Rounds @ 20.5 km
Demonstrated < 50m CEP
83% Reliability

2D Guidance Has Potential
To Be Very Precise (Repeatable)



Early SDD Field Test Objectives:

- Expand Aerodynamic and Guidance Characterization of PGK across family of 155mm Projectiles
- Validate Consolidation and Packaging to SDD-1 Electronics Form Factor
- Confirm System Performance of Second Source GPS Supplier

Non-Precision Conventional Mission

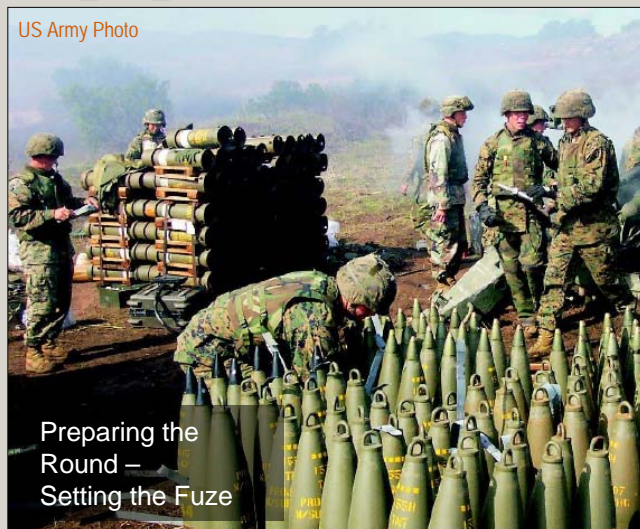


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Planning the Mission

US Army Photo

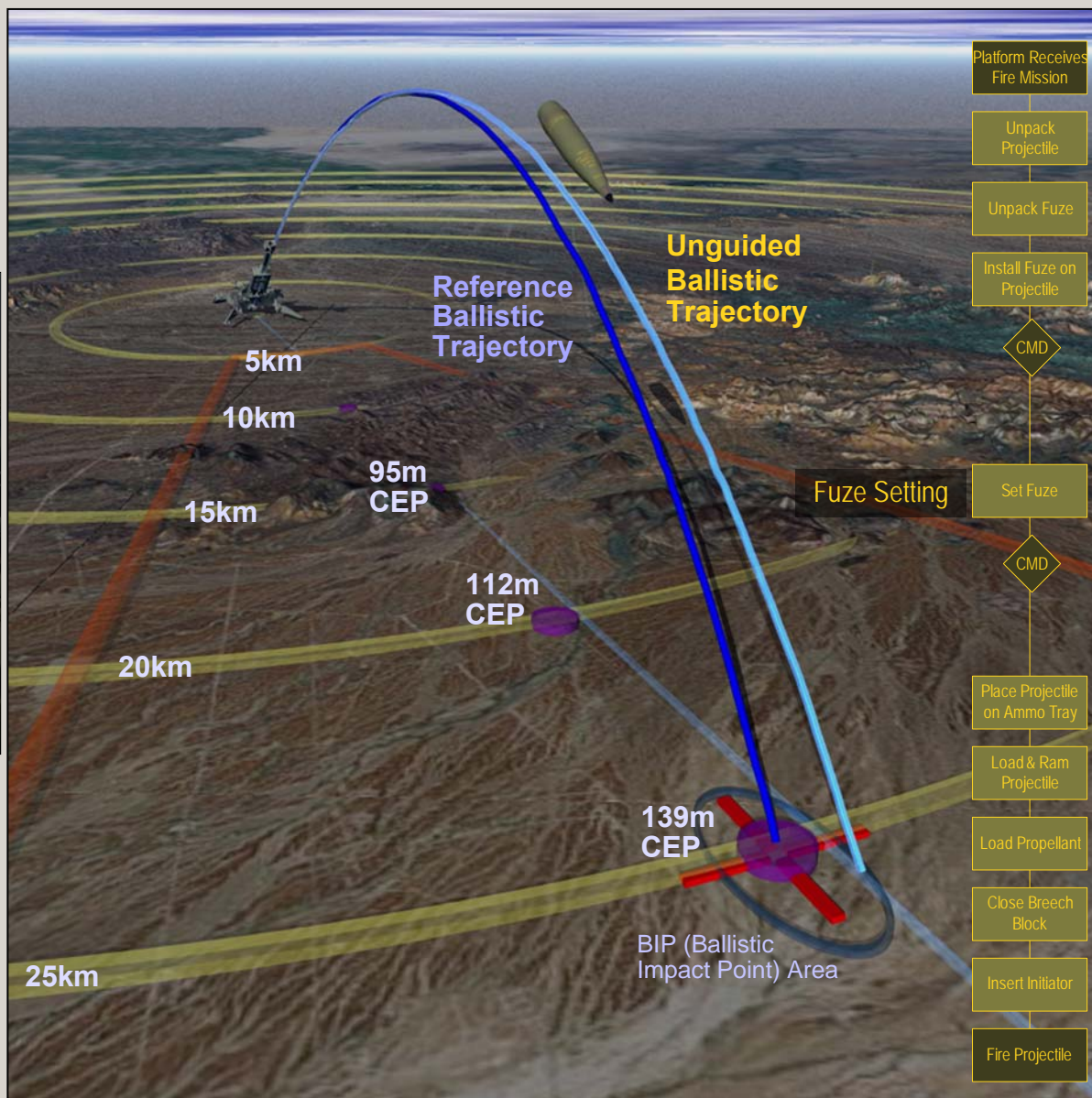


Preparing the Round – Setting the Fuze



Firing the Round From M777A2

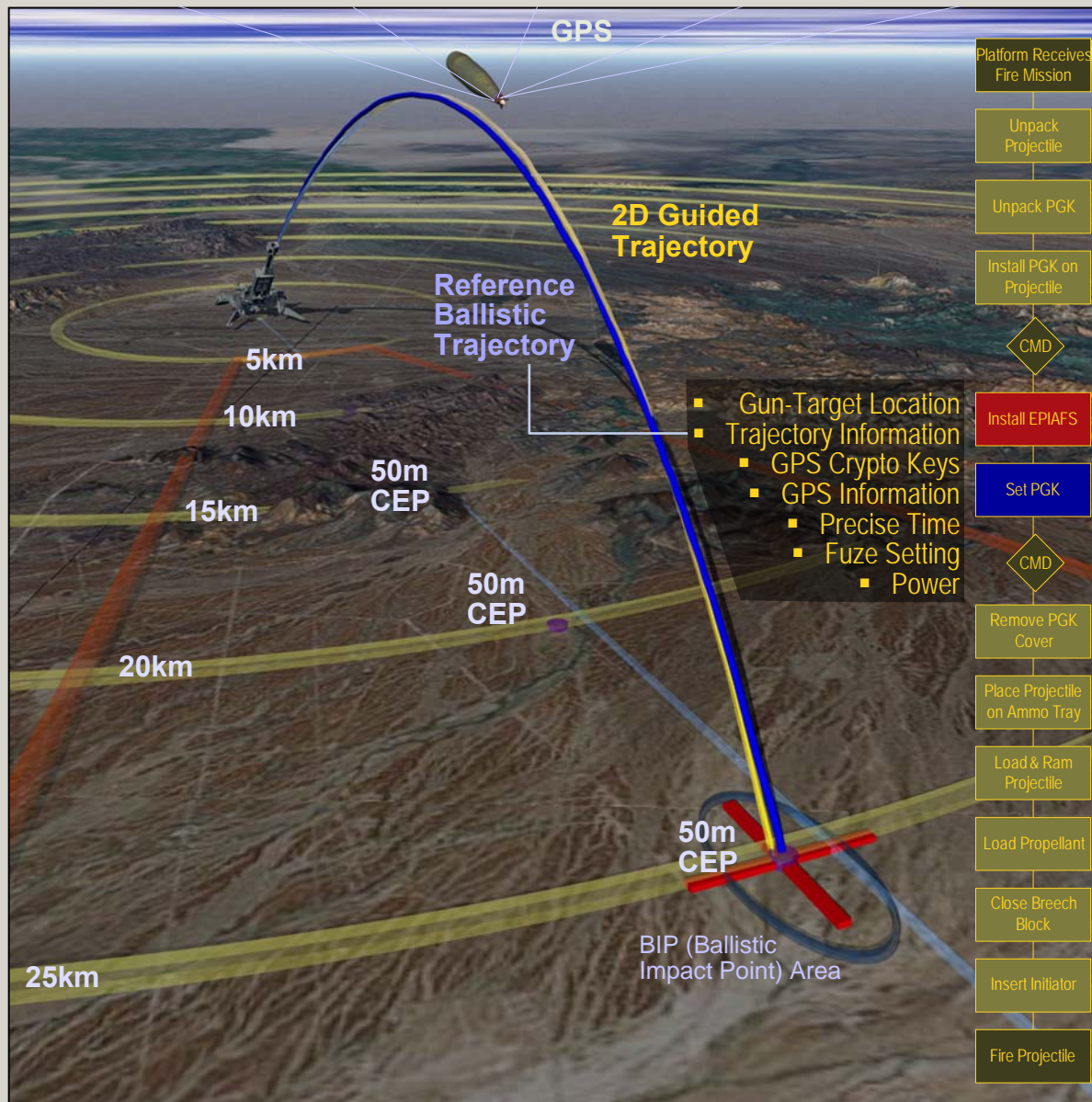
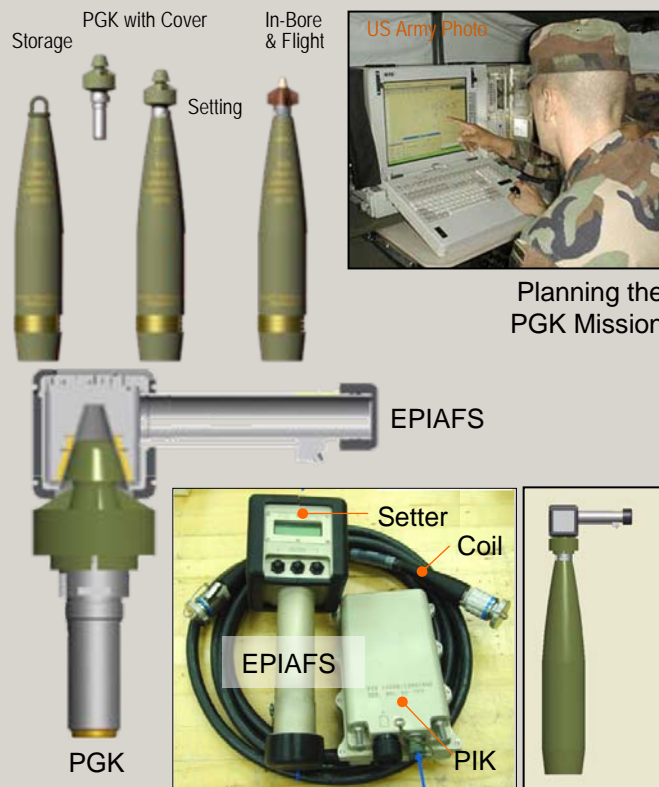
US Army Photo



Precision PGK Mission



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What Level of Precision is Needed?



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- Housing Density Can Vary Widely Over Small Distances Between Terrain Elements
- Selecting Munitions with Increasing Levels of Precision May Be Most Cost-Effective

Today's Capability: 183m CEP*



* M109A6 (Paladin) at 27km: 155mm (HE) M549A1

PGK: $\leq 50\text{m CEP}$

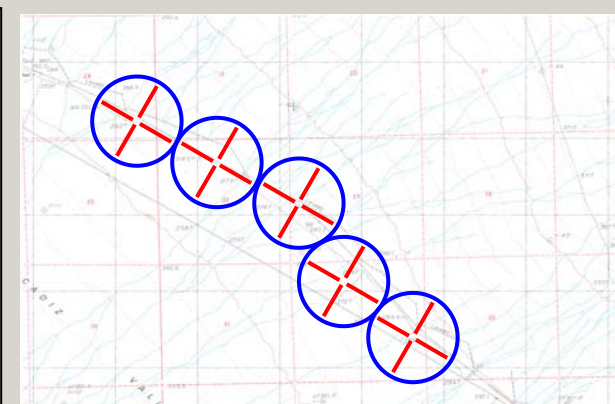
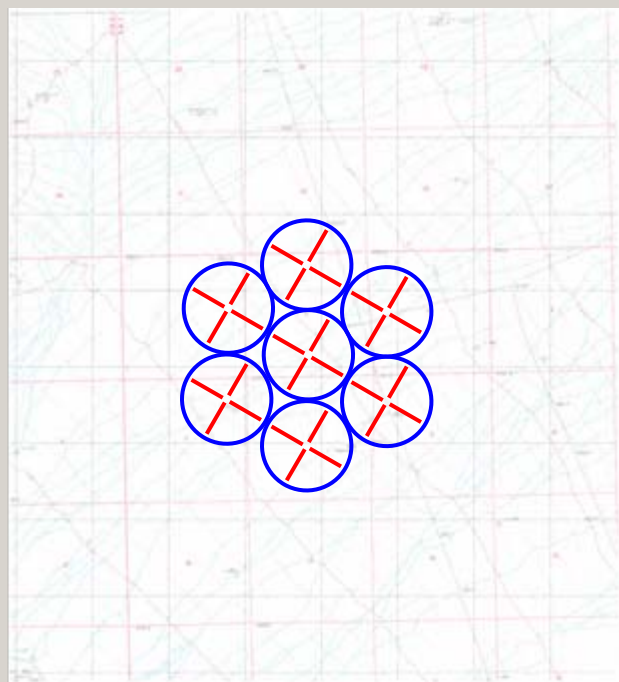


- Improves Munition Accuracy
- Greatly Reduces Possibility of Collateral Damage
- Increases Number of Kills per Basic Load of Ammunition

PGK Missions



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PGK performs the same missions as conventional 155mm HE munitions, but with better effectiveness consistent with a 50m CEP accuracy.



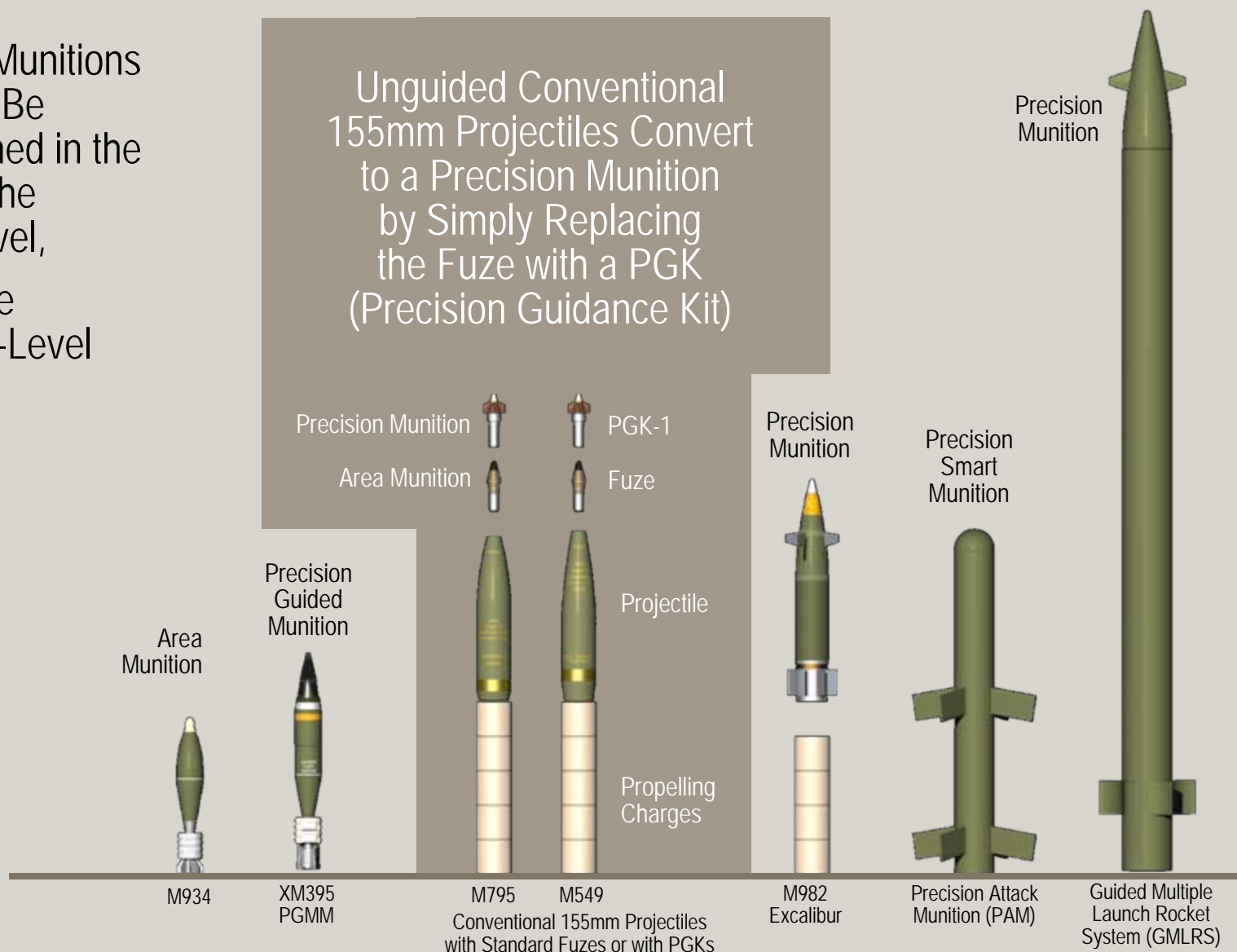
Logistics Cost is Driven by Tonnage/Volume



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155mm Munitions
Mix Can Be
Established in the
Field at the
Fuze-Level,
Not at the
Munition-Level

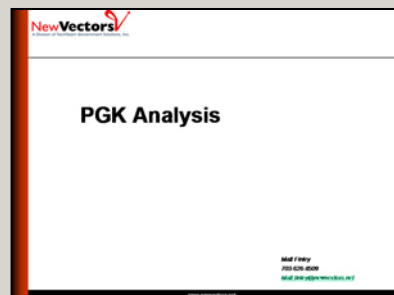
Unguided Conventional
155mm Projectiles Convert
to a Precision Munition
by Simply Replacing
the Fuze with a PGK
(Precision Guidance Kit)



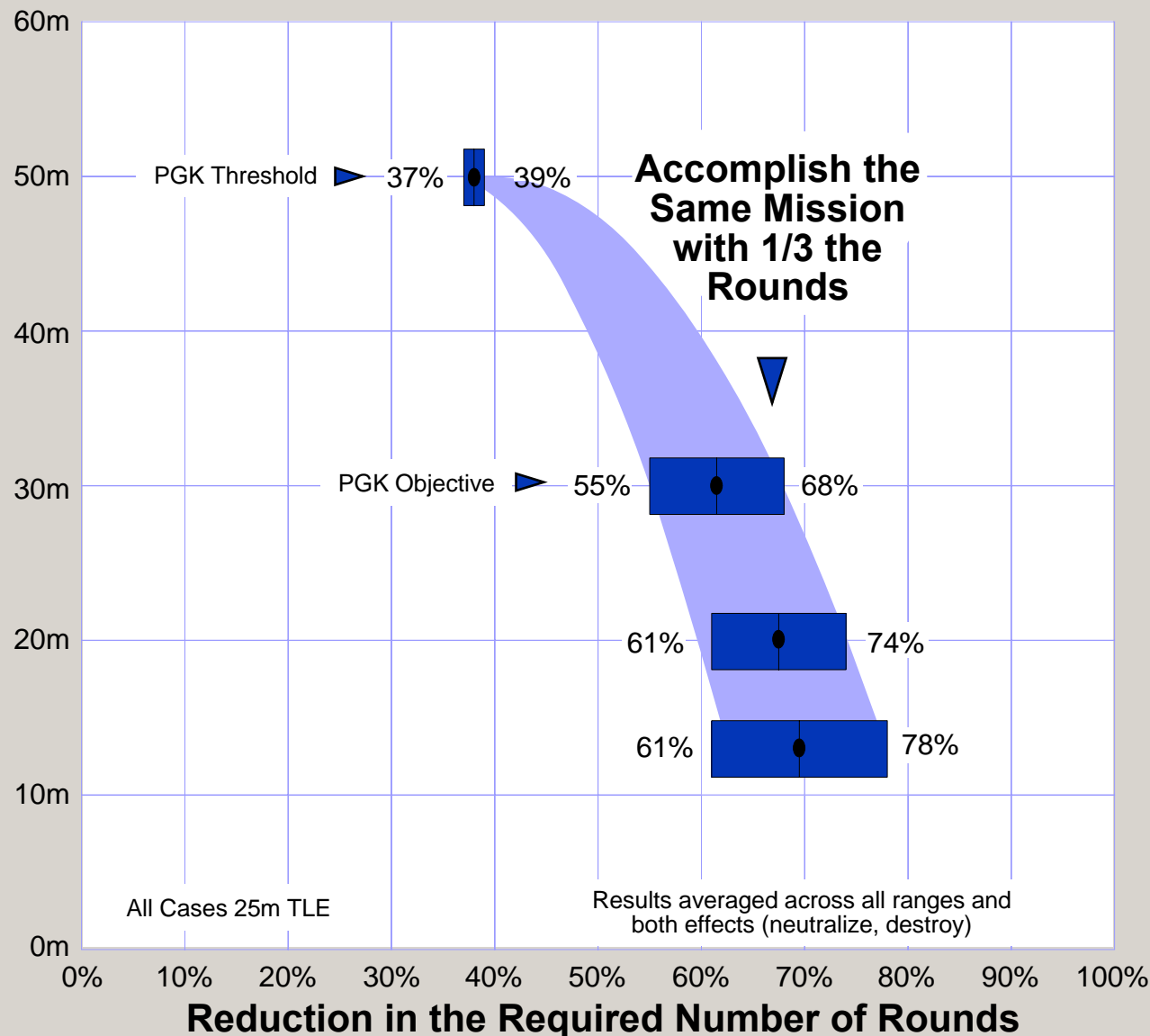
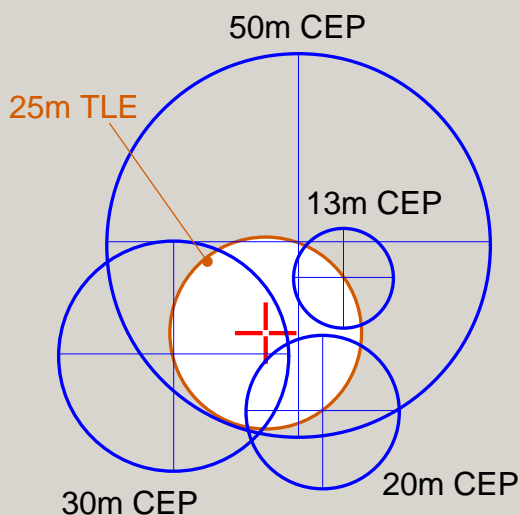
Precision Reduces the Number of Rounds



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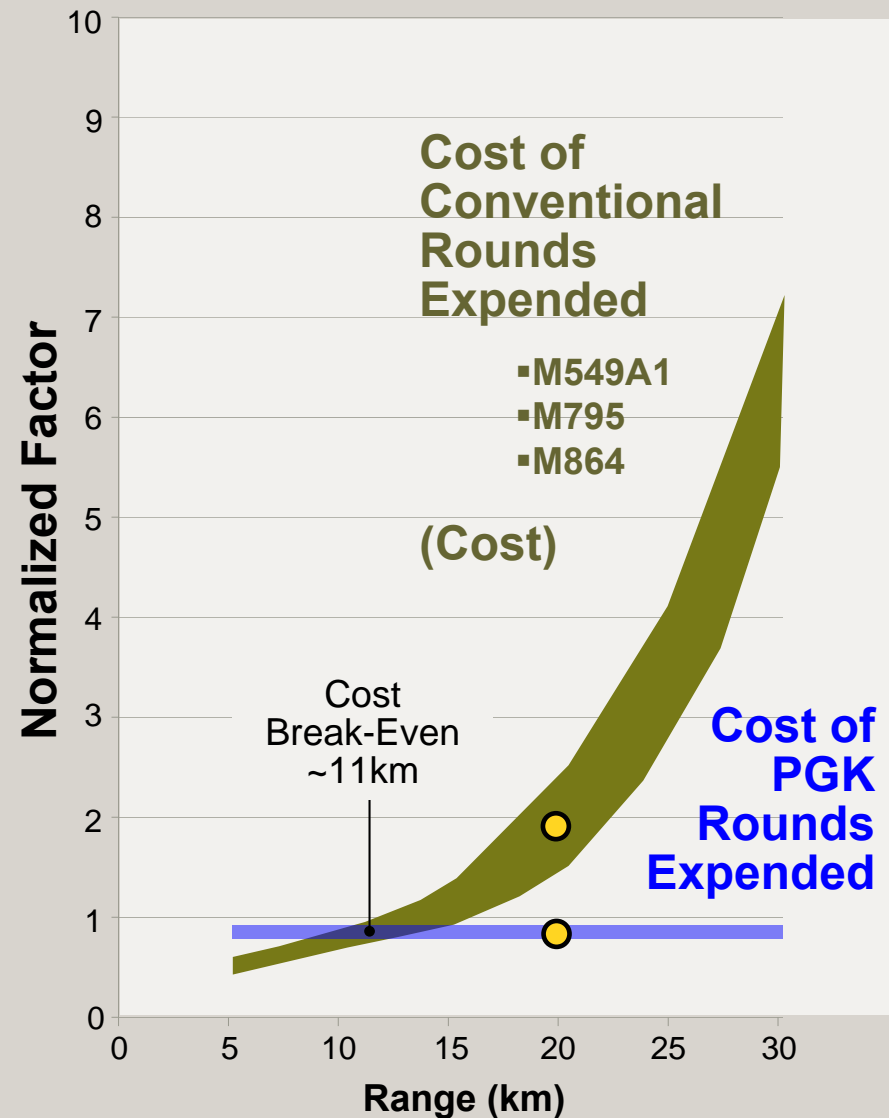
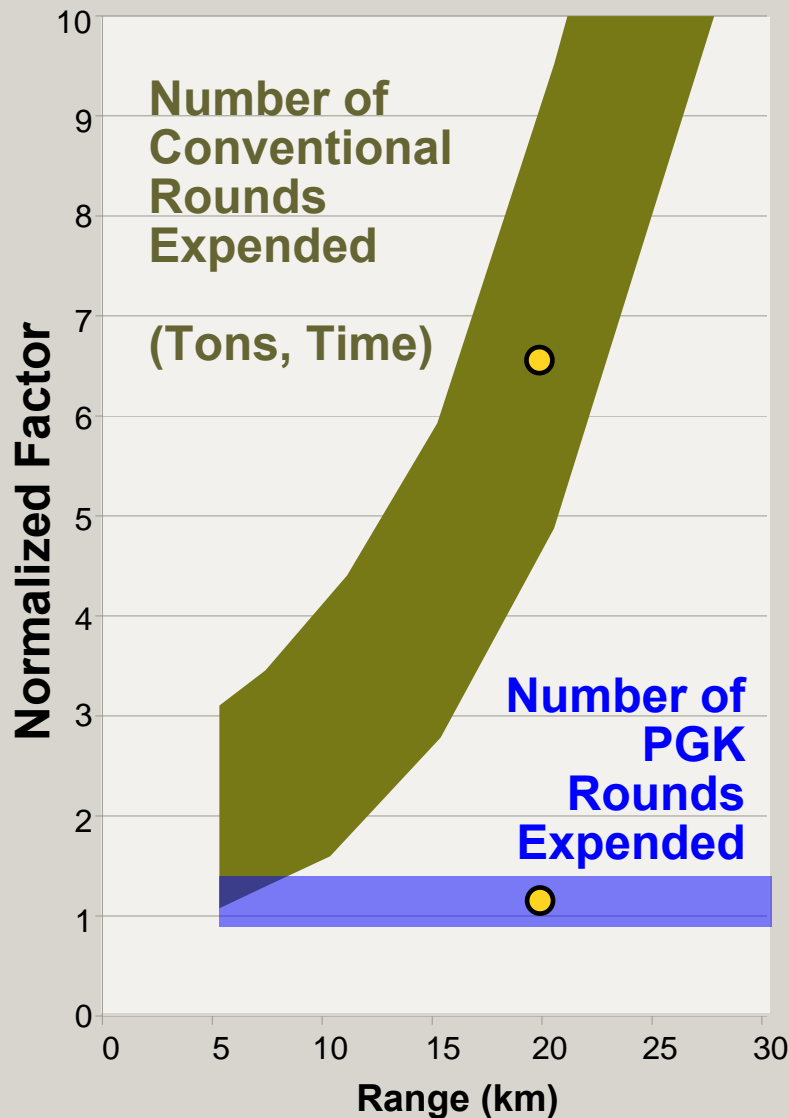
Accuracy of PGK Round (CEP)



PGK is Effective in Cost, Tons, and Time



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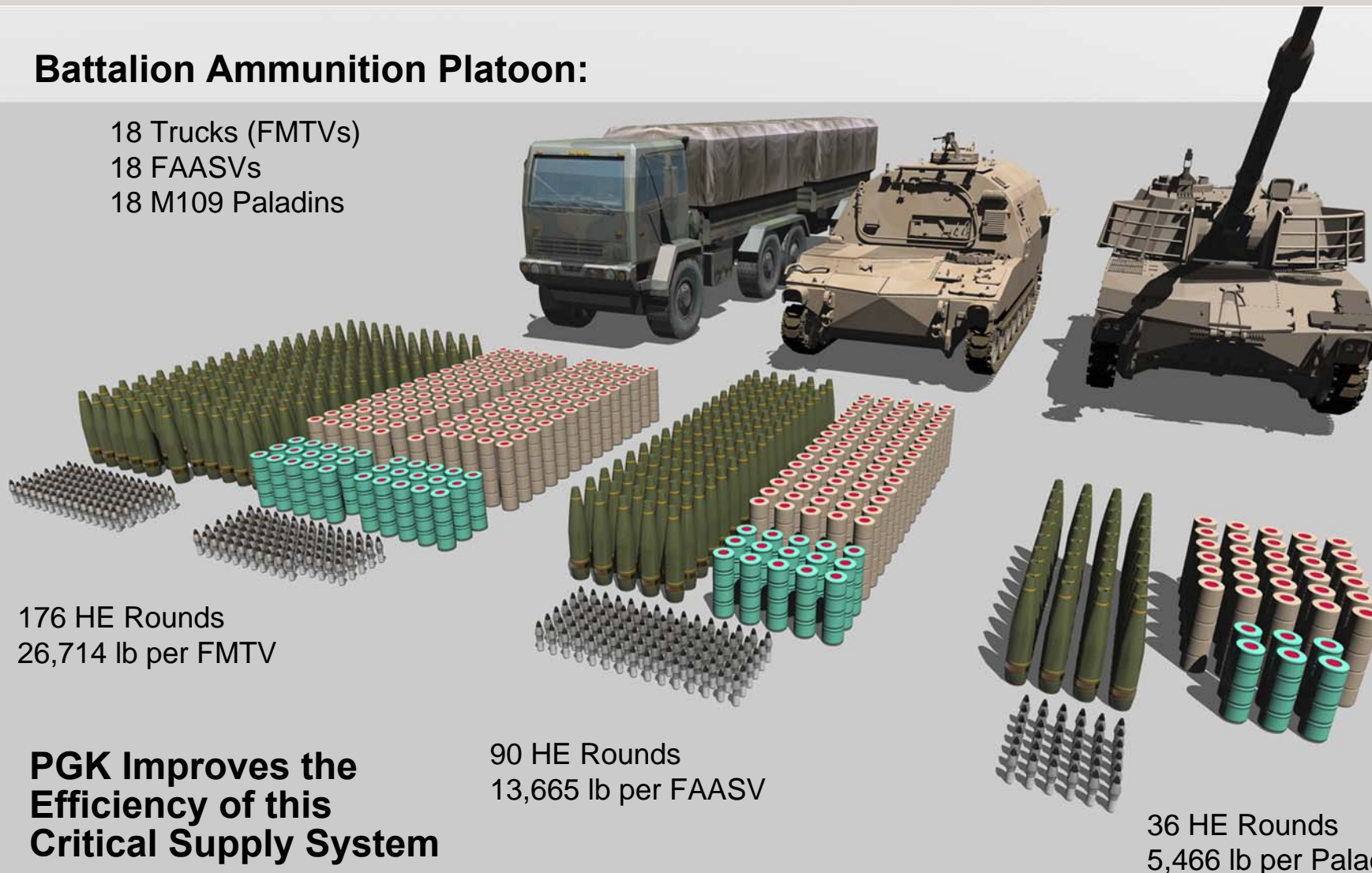
Re-Supply Ammunition is Loaded by Hand



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Battalion Ammunition Platoon:

18 Trucks (FMTVs)
18 FAASVs
18 M109 Paladins



176 HE Rounds
26,714 lb per FMTV

90 HE Rounds
13,665 lb per FAASV

**PGK Improves the
Efficiency of this
Critical Supply System**

36 HE Rounds
5,466 lb per Paladin

Savings Across the Logistical Chain



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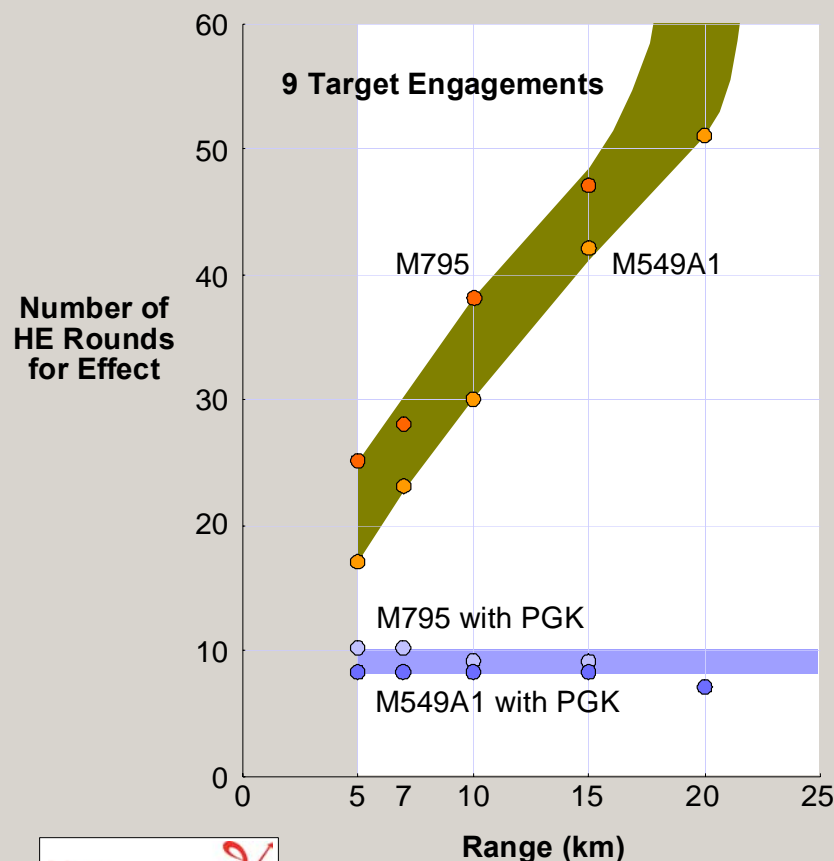
- Round Cost is Only a Small Percentage of the total Mission Cost
- Reduced Round Savings Has Multiplying Effect on Mission Savings

When the system and logistics costs are added to the cost of the rounds fired, a reduction of 55% to 68% in rounds fired makes an **all-precision stockpile a realizable goal**.

75% Reduction in HE Rounds for Same Effect



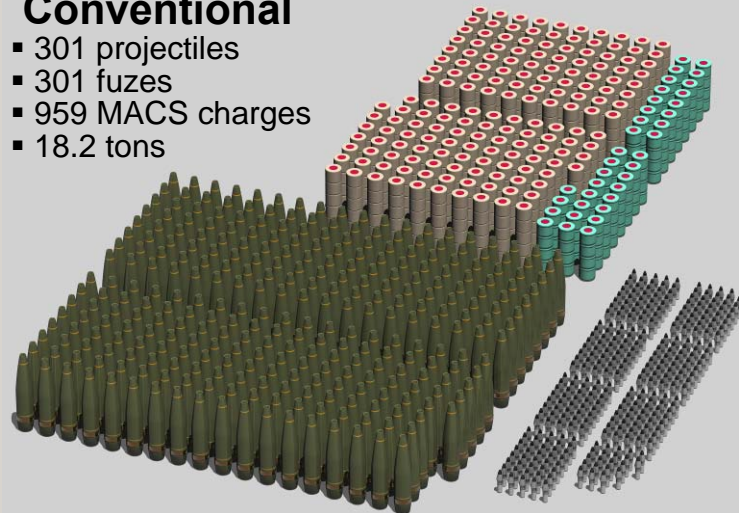
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- Target Effect Takes Less Time
- Target Effect Costs Less
- Less Tons of Munitions Needed to Achieve Target Effect
- Longer Times Between Re-Supply
- More Targets Engaged with Less Collateral Damage

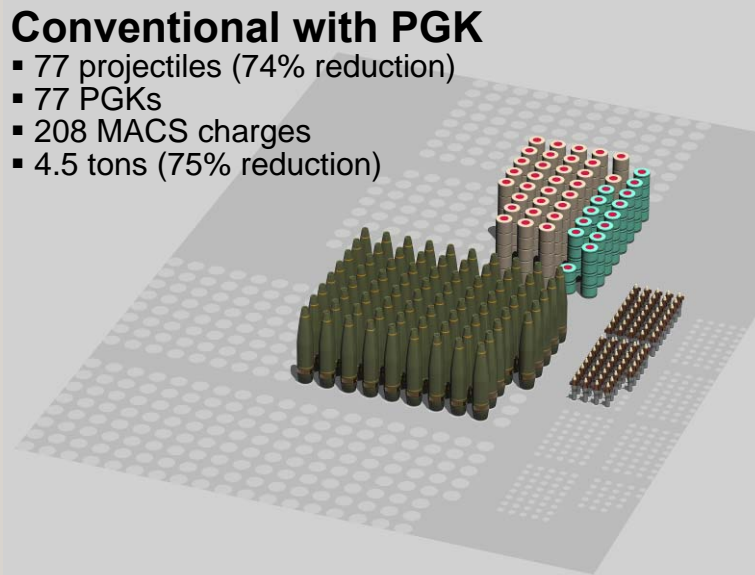
Conventional

- 301 projectiles
- 301 fuzes
- 959 MACS charges
- 18.2 tons



Conventional with PGK

- 77 projectiles (74% reduction)
- 77 PGKs
- 208 MACS charges
- 4.5 tons (75% reduction)



PGK is Affordable Precision



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PGK (PRECISION GUIDANCE KIT)

INSTALLS IN FUZE WELL

SIMPLE AND RUGGED

ONE MOVING PART

NO BATTERY REQUIRED

GPS ACCURACY

SAASM

FULL CONTINUOUS 2D GUIDANCE



Contact Information



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Precision Guidance Kit (PGK) for Artillery