U.S. Army Test and Evaluation Command

Counter Defilade Target Engagement System:

Changing the Way the Individual Soldier Approaches the Urban Battlefield

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ITEA Presentation

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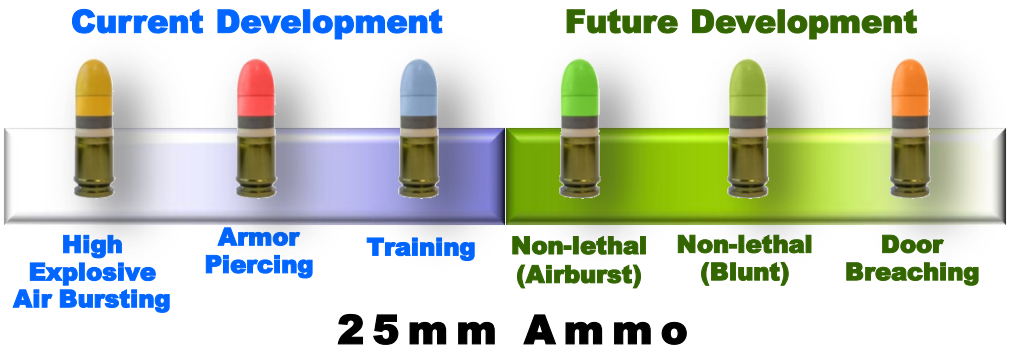
Army Proven
Battle Ready

Agenda

- System Description
- Concept of Operation
- Current Efforts
- Test & Evaluation Concept
- Conclusions

DISCLAIMER: The strategy for the XM-25 program of record is still in development and SHOULD NOT be taken as final.

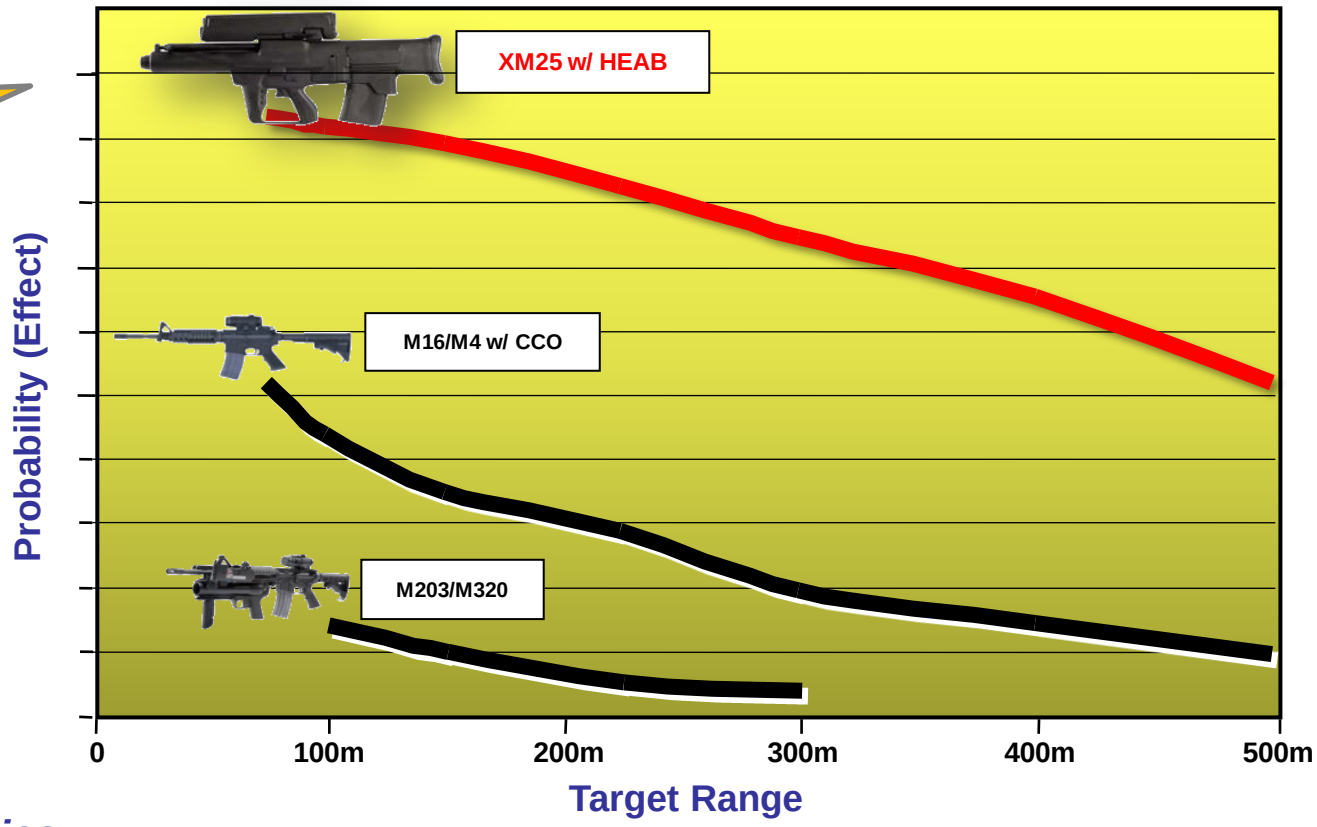
XM25 System Description



- Semi-automatic, magazine fed, rifle
- Family of 25mm ammunition
- Fully integrated target acquisition/fire control
  - 2x thermal sight w/zoom
  - 2x direct view optic
  - Laser rangefinder
  - Ballistic computer
  - Digital compass (cant, bearing, tilt)
  - Fuze setter
  - Internal display
  - Environmental sensors

Comparison of Effects

Based on initial Model Results



System Capabilities:

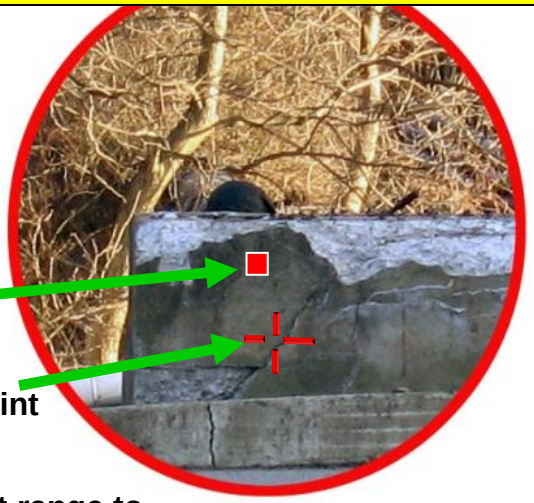
- **Defeats Defilade & Exposed Targets**
- **Point Target Range: 500 meters**
- **Area Target Range: 700 meters**
- **Point Detonate Range: ~1000 meters**

Concept of Operation

A. Target behind concrete wall

1. Place LRF Aimpoint on wall in front of Target and Lase

B. Target seeks cover behind wall

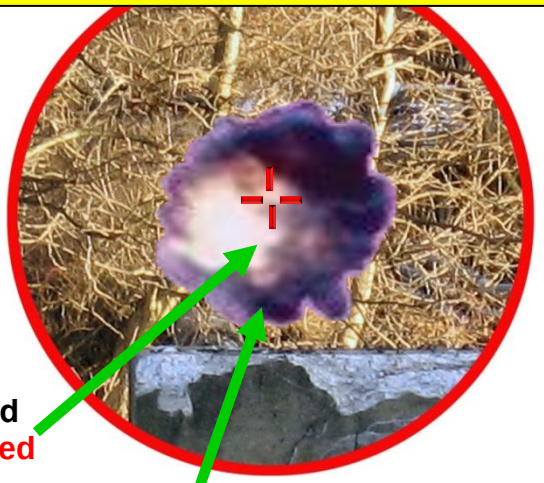


2. TA/FC determines range to wall

3. TA/FC moves the adjusted Aimpoint to the correct location on DVO

4. User can increment range to compensate for wall thickness.

C. Round Detonates above target

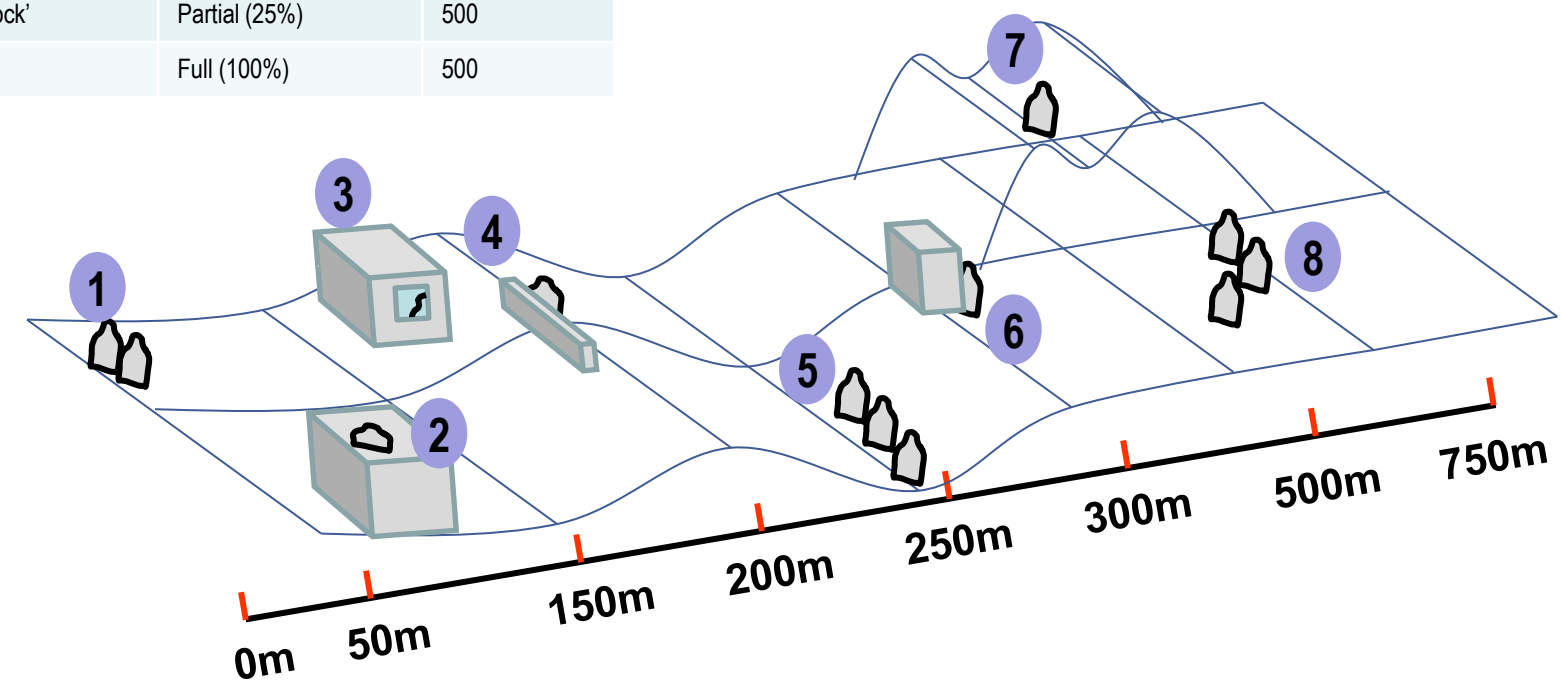


5. User raises XM25's barrel, which moves Adjusted Aimpoint up. Explosion will occur where the Adjusted Aimpoint is pointing. User squeezes trigger.

6. Explosion of 25mm Air Burst round is past the wall & over the enemy's head

Potential Target Scenarios

Target	Battlefield	Target Exposure	Range (m)
1	open	Full (100%)	<50
2	roof	Limited (20%)	75
3	door, window	Limited (25%)	150
4	barrier	None	200
5	low ground	None	250
6	corner	Partial (50%)	300
7	wall, 'rock'	Partial (25%)	500
8	open	Full (100%)	500



Current Status

- Program of Record Efforts
  - MS B Completed DEC 2010
  - Developmental Testing planned 2QFY12
  - Limited User Testing planned 1QFY13
- Forward Operational Assessments (FOA)
  - FOA 1 (DEC 2010-JAN 2011)
    - 5 Systems in theater initial look at employment to develop TTPs
    - Gained User feedback on system attributes
  - PM Efforts (Presently ongoing)
    - Reset weapons and interviewed gaining unit
  - FOA 2 (Planned for AUG –SEP 2011)
  - FOA 3 (Planned for 2012)

XM25 CDTE Evaluation Strategy

Effectiveness

Lethality
- Fragmentation
- Probability of incapacitation/shot
- Probability of hit/shot
- Defilade/Confined space targets

Accuracy
- Weapon
- Ammunition
- Probability of hit

Soldier Mobility
- System weight

Target Acquisition/Fire Control
- Probability of Target Identification
- Target Recognition
- Zero retention/repeatability
- Laser Range Finder accuracy
- Ballistic solutions

Environmental
- High/Low temperature
- Adverse environments
- Arctic/Desert/Tropics

Suitability

RAM
- *MRBEFF
- Probability of Successful firing
- Storability

Safety
- Fuze/Insensitive Munitions
- Transportation/Vibration
- Rough Handling

Integrated Logistics Supportability
- Supportability (Hardware, Ammo, Software)
- Technical Manuals
- Battery life

MANPRINT
- Training
- Human Factors Engineering (Includes Recoil Energy)
- Safety & Health Hazards (Includes Smoke, Toxic Fumes)

Airborne Operations
- Static Line
- Military Free Fall

Survivability

E3
- Radiated emissions
- Radiated susceptibility
- PESD
- Electromagnetic radiation
- HEMP
- HSED
- NSL

Solider Survivability
- Firing Signature
- Acoustic Signature
- Optical Augmentation

Information Assurance

NBCCS

*Mean Rounds Between Essential Function Failure

Test and Evaluation Resources for MS C

- Test Design to cover all areas of Effectiveness, Suitability, and Survivability for MS C:
- What was requested: 22k HEAB and 280k TP rounds
- What is affordable: 10.5k HEAB and 45.8k TP rounds
- How to maintain a adequate design to address all areas of the evaluation while managing risk levels?

Testing Opportunities

- Contractor Testing:
  - Limited test events at component and system level as initial prove out for readiness for Developmental
- Pre-Production Qualification Testing (PPQT) :
  - Testing at component and system level to verify the engineering and manufacturing maturity of the XM25 (weapon, TA/FC, and munitions)
  - Demonstrate the system can meet technical requirements sufficiently based on stage of development and that it can be safely stored, transported, operated, and maintained in a field environment
- Live Fire Test & Evaluation (LFT&E):
  - Testing at system level to verify fragmentation patterns and accuracy of airburst rounds for system lethality calculations
- Limited User Test (LUT):
  - Soldier in the loop event to gather early operational performance and form, fit, functionality of system in a mission context
- Post MS C Testing Opportunities:
  - Production Qualification Testing (PQT):
    - Demonstrate the production weapons meet the capabilities required in the Capabilities Production Document
  - Initial Operational Test (IOT) Airborne Limited User Test (ABN LUT):
    - Soldiers ,using production representative systems, are able to operationally perform mission essential tasks in accordance with required capabilities.

Ways to Efficiently Use Rounds Available

- Leverage Contractor testing:
  - Fuze Testing, Sequential Rough Handling sample sizes reduced
- Double counting rounds:
  - Reliability w/ LFT&E, Fuze, & Accuracy testing
  - Accuracy w/ LFT&E, Fuze, & Reliability testing
- Balancing risk between PPQT and PQT:
  - Sample sizes are balanced between both test phases to maximize data collection and mitigate risk level
- Modeling and Simulation:
  - Use of model will allow evaluation of scenarios not tested
- Training Simulators:
  - Allow for familiarization with system using less rounds for training during Operational Test events

Development of Sample Sizes

- Ammunition and TA/FC Testing
  - Used Binominal Operating Characteristic curves
  - Assumed various confidence levels dependent on test and known maturity of hardware
- Accuracy Testing
  - Used Normal Distribution
- Reliability Testing
  - Developed Growth Curve

Initial Plan for Accuracy Testing

- Factors:
  - Ranges, Illumination, Ammo Type, Weapons
- Each weapon/ammo type engaging each target
- Assumptions:
  - No risks with plan; would be able to fully evaluate after PPQT
  - HEAB and TP ammunition not ballistically matched
- Initial Design:
  - Range: 100, 200, 300, 400, 500
  - Illuminations: Day, Night
  - Weapons: 5
  - Ammo type: HEAB, TP
- Results in 100 targets x 3 iterations x 10 rds/target = 3000 rds

PPQT Plan for Accuracy Testing

- Assumptions for PPQT based on limited resources:
  - Risk can leveraged between PPQT and PQT
  - HEAB and TP rounds are ballistically matched
- PPQT Design:
  - Range: 100, 300, 500
  - Illuminations: Day, Night
  - Weapons: 5
  - Ammo type: HEAB, TP
- Results in 60 targets x 3 iterations x 10 rds/target = 1800 rds

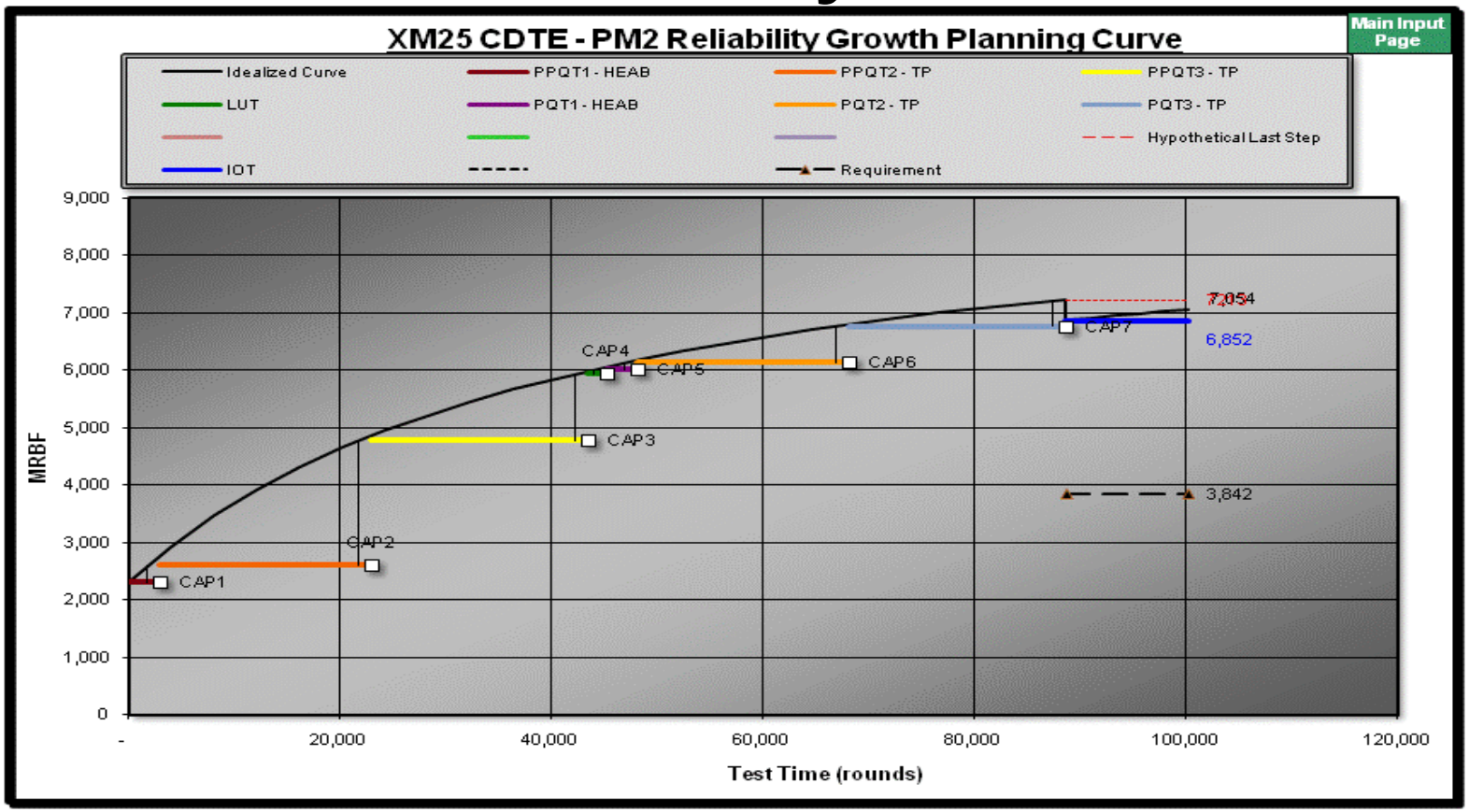
PQT Plan for Accuracy Testing

- Assumptions for PQT:
  - Risk can leveraged between PPQT and PQT
  - Accuracy between weapons is constant
  - HEAB and TP rounds are ballistically matched
  - No impact due to illumination
- Assumptions allow for Design of Experiments with Blocking
- PQT Design:
  - Range: 100, 200, 300, 400, 500
  - Illuminations: Day, Night
  - Weapons: 5
  - Ammo type: HEAB, TP
- Results in 20 targets x 3 iterations x 10 rds/target = 600 rds

Reliability Plan

- Original PPQT plan called for 6,200 HEAB and 243,800 TP rounds
  - This was allowing 8 failures on each of 5 systems to prove out MRBS and MRBF
- Reliability Growth required for system per DoD Guidance
  - Leverages PPQT, LUT, PQT, and IOT phases
  - Allows for incremental growth through all phases of test
  - Growth plan requires 6,450 HEAB and 81,750 TP rounds
- Will also leverage other sub-tests during PPQT and PQT
  - Fuze performance testing
  - Accuracy
  - LFT&E

Reliability Growth



Test Phase	HEAB Rnds	TP Rnds	Total Rnds	Cumulative Total Rnds
Pre-production Qualification Test (PPQT)	3,000	40,500	43,500	43,500
Limited User Test (LUT)	450	750	1,200	45,150
Production Qualification Test (PQT)	3,000	40,500	43,500	88,650
Initial Operation Test (IOT)			11,500	

Modeling and Simulation

- Using ORCA can model various target types and positions
  - Gives Probability of Incapacitation given a Hit
  - Will develop based on inputs from developmental testing

- Using NVTherm to model TA/FC Sight capabilities
  - Gives Probability of Detection and Recognition
  - Model developed based on technical specifications and validated through testing

Operational Testing

- Original LUT Plan called for 1060 HEAB and 1340 TP rounds
  - Proved out reliability with 80% confidence allowing 1-2 failures per system
- Training Simulators will be used to reduce rounds required during the LUT and IOT
- Operational Scenarios will be utilized with TP Rounds
- HEAB Rounds will be fired in limited scenarios for Soldiers to confirm ability to engage targets
- Current plan will use 450 HEAB and 750 TP rounds

Simulators

- Will be used to reduce rounds required during the LUT and IOT
  - Soldiers will be initially trained on simulator
    - Simulator has all the functionality of weapon system
  - Through sight video lets observers see what Soldier is seeing
  - Observers can give feedback on accuracy of round placement and estimated lethality of target based on intended shot location
  - Increases Soldier proficiency of round placement without cost of firing rounds
  - Reduces range time required for training

Other Areas for Consideration

- Combining test events where possible
  - IOT with ABN LUT
- Utilize FOA results to supplement development of TTPs and MANPRINT assessment during the OT events.

Conclusions

- Even with Limited Resources the evaluation is able to mitigate risk by:
  - Applying DOE
  - Leveraging contractor data
  - Using each round fired to satisfy multiple evaluation areas
- Using simulator provides Soldiers with the means of employing the system without having to expend rounds.
- Modeling and simulation can provide realistic estimates of system effectiveness while reducing testing.

Questions?