



# **TRANSFORMING CANNON ARTILLERY with PRECISION GUIDED PROJECTILES**

## **The XM982 Excalibur Program**

2002 Gun & Ammunition Symposium  
18 April 2002

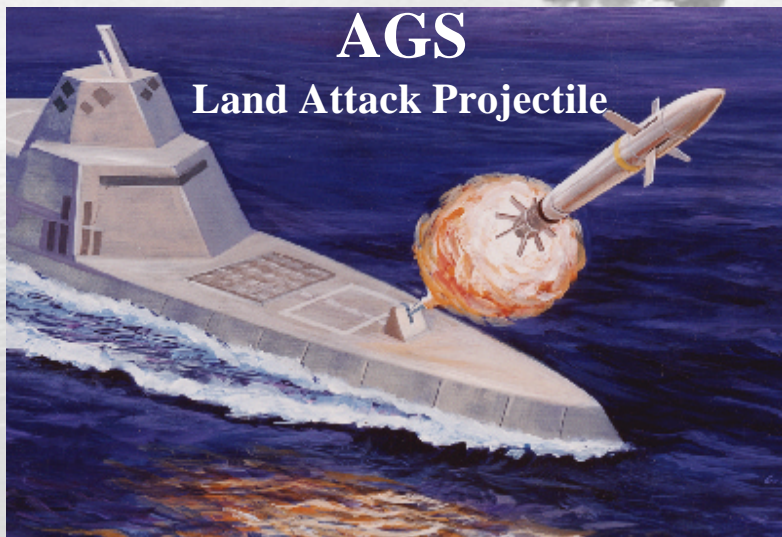
Colonel Frank Hartline (USA, Ret)  
Business Development Manager  
Raytheon Guided Projectiles

# Raytheon Guided Projectiles

Tucson, AZ



5" ERGM



AGS  
Land Attack Projectile



Excalibur



Precision-Guided Artillery Projectile

*Precision Guided Extended Range Artillery Projectile*



# GUIDED PROJECTILES IN THE US ARMY TRANSFORMATION



- XM982 Excalibur Precision-Guided Projectile
  - Modernizes **Legacy Force** platforms
  - Transforms **Interim Force** fire support
  - Enables **Objective Force** transformation
- Provides high lethality, long range dominance with low collateral damage/logistics burden
- Returns Field Artillery to the Close Fight
- Matures GP technologies for MRAAS/FCS
  - gun-hardened projectile guidance electronics
  - Leverages the digital battlefield for FCS
  - 3-6X light platform battlefield effectiveness

# Excalibur Description



**UNITARY**



**SFM**



**DPICM**

Family of Fire & Forget GPS/IMU Guided Projectiles

Compatible with Digital 155mm Howitzers

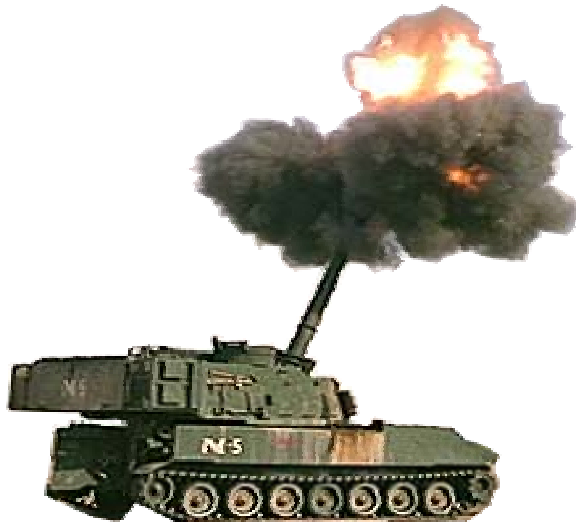
Precision Accuracy (<20 m CEP)  
Independent of Range

Paladin & JLW155: 6 to 37Km

Crusader: 6 to 50Km

Single Projectile Design Accommodates Multiple Payloads

Supports Legacy, Interim, & Objective Force



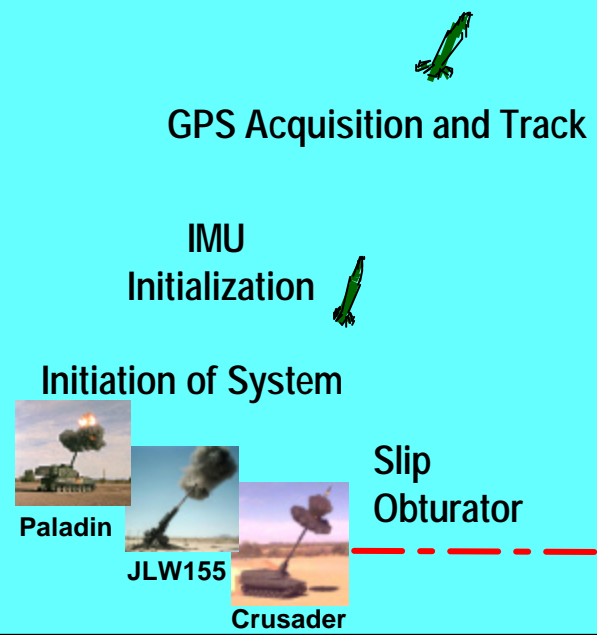
*Precision Guided Extended Range Artillery Projectile*

# XM982 Excalibur

## Operational Sequence



### Ballistic Flight



### Guided Flight



**Inductive Setting**  
 Gun/Target Locations  
 GPS Crypto Keys  
 GPS Precise Time

Mission Planning

Target: Latitude / Longitude / Altitude

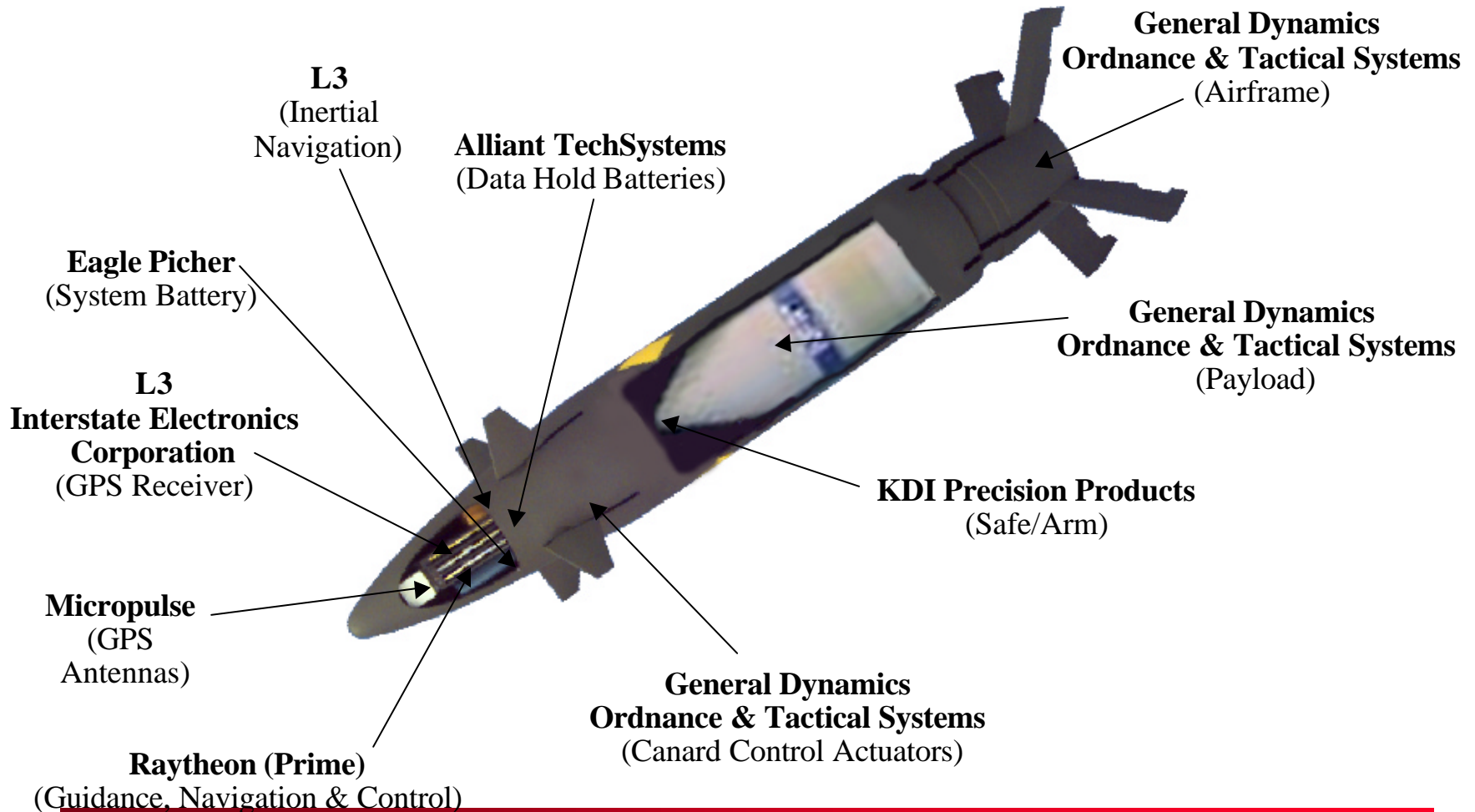
Targeting Systems

**Dual Mode Unitary Warhead**  
 • Structure Penetration  
 • Fragmentation (Area Targets)

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# Industry Team



*Precision Guided Extended Range Artillery Projectile*

# TEAM EXCALIBUR



## GOVERNMENT

PEO-GCSS, OPM-ARMS  
Excalibur Product Office  
ARDEC  
TSM-Cannon  
DCMC-Raytheon

## LOCATION

Picatinny Arsenal, NJ  
Picatinny Arsenal, NJ  
Picatinny Arsenal, NJ  
Ft.Sill, OK  
Tucson, AZ

## ROLE

Functional Management  
Program Management  
Technical Support  
User Representative  
Contractual Support

## CONTRACTOR

**Raytheon Missile Systems**  
General Dynamics - OTS

## LOCATION

**Tucson, AZ**  
Redmond, WA  
Niceville, FL  
St. Petersburg, FL  
Red Lion, PA  
Redmond, WA  
Horsham, PA  
Healdsburg, CA  
Anaheim, CA  
Broomfield, CO  
Parsons, KS  
Joplin, MO  
Cincinnati, OH  
Camarillo, CA

## ROLE

**System Integrator**  
Payload Dispense  
Unitary Payload  
Structure and Payload  
Airframe  
Inertial Measuring Unit  
Initialization/Fuze  
Control Actuator Sys  
GPS Guidance  
TM Antenna  
Submunition  
System Battery  
Safe and Arm Device  
GPS Antenna

L3 (Allied Signal)  
Alliant Techsystems  
Versatron (GD-OTS)  
L3 (Interstate Electronics )  
Ball Aerospace  
Day & Zimmerman  
Eagle Picher  
KDI Precision Products  
Micropulse

# Soft Recovery Projectile Validated!



- Developmental Tool
  - Guidance, Navigation & Control
- Aero Models Validated



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# Test Results

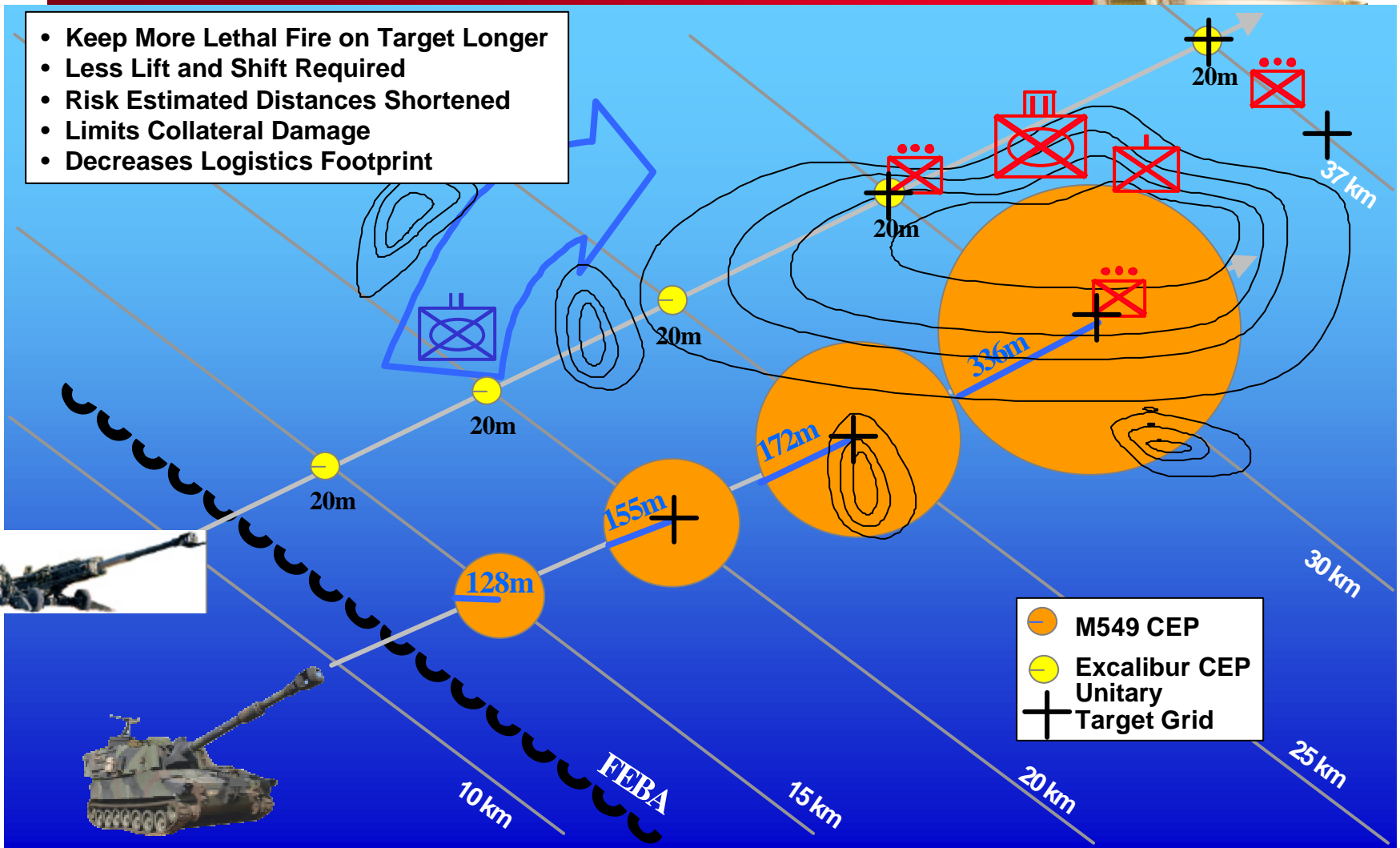


|                                  |        |
|----------------------------------|--------|
| <b>Despinning Obturator</b>      | ✓      |
| <b>Payload Static Dispense</b>   | ✓      |
| <b>GEU &amp; CAS Structure</b>   | ✓      |
| <b>Airframe Joints</b>           | ✓      |
| <b>Base Structure Eval</b>       | ✓      |
| <b>Soft Recovery System</b>      | ✓      |
| <b>Tactical Base Structure</b>   | Nov 01 |
| <b>Electronics Gun Hardening</b> | Feb 02 |

# The Benefits of Accuracy



- Keep More Lethal Fire on Target Longer
- Less Lift and Shift Required
- Risk Estimated Distances Shortened
- Limits Collateral Damage
- Decreases Logistics Footprint



*Precision Guided Extended Range Artillery Projectile*



## Number of Volleys Required to Achieve 20% EFD Against the ORD Target

### Excalibur DPICM

1 - volley

### M864

25 km - **6** - volleys

20 km - **3** - volleys

15 km - **2** - volleys

# Guided Projectiles And The Close Fight

MG Carl Ernst, FA Journal, Sep-Oct 1999



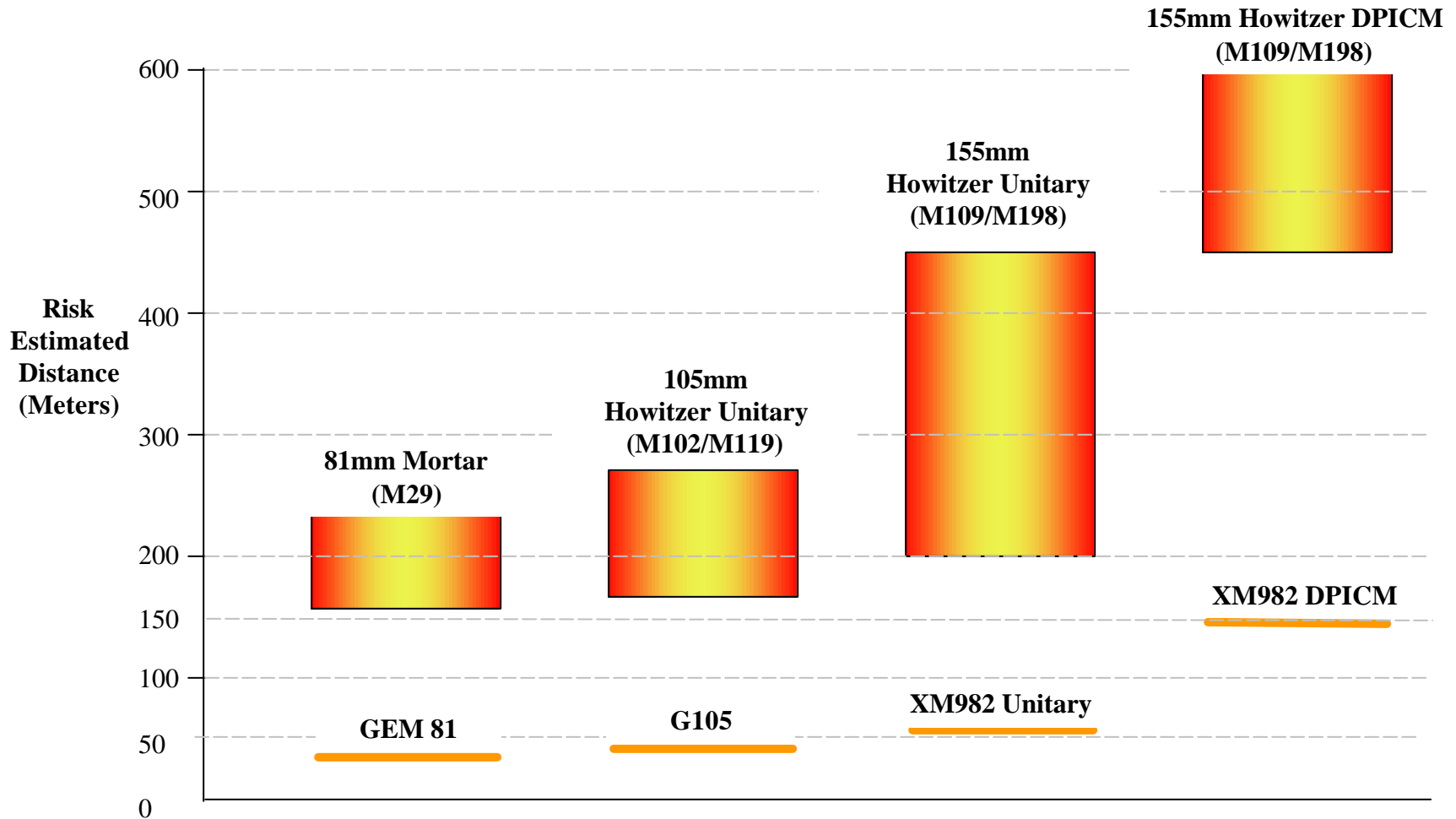
“...artillery and mortar fires must be able to support maneuver at much closer ranges than currently imagined.”

“(because of minimum safe distances) the maneuver commander must stop the firing of indirect systems long before it would be tactically prudent on the battlefield.”

“...the issue (is) logistics. It will come down to a matter of trucks and projectiles.”

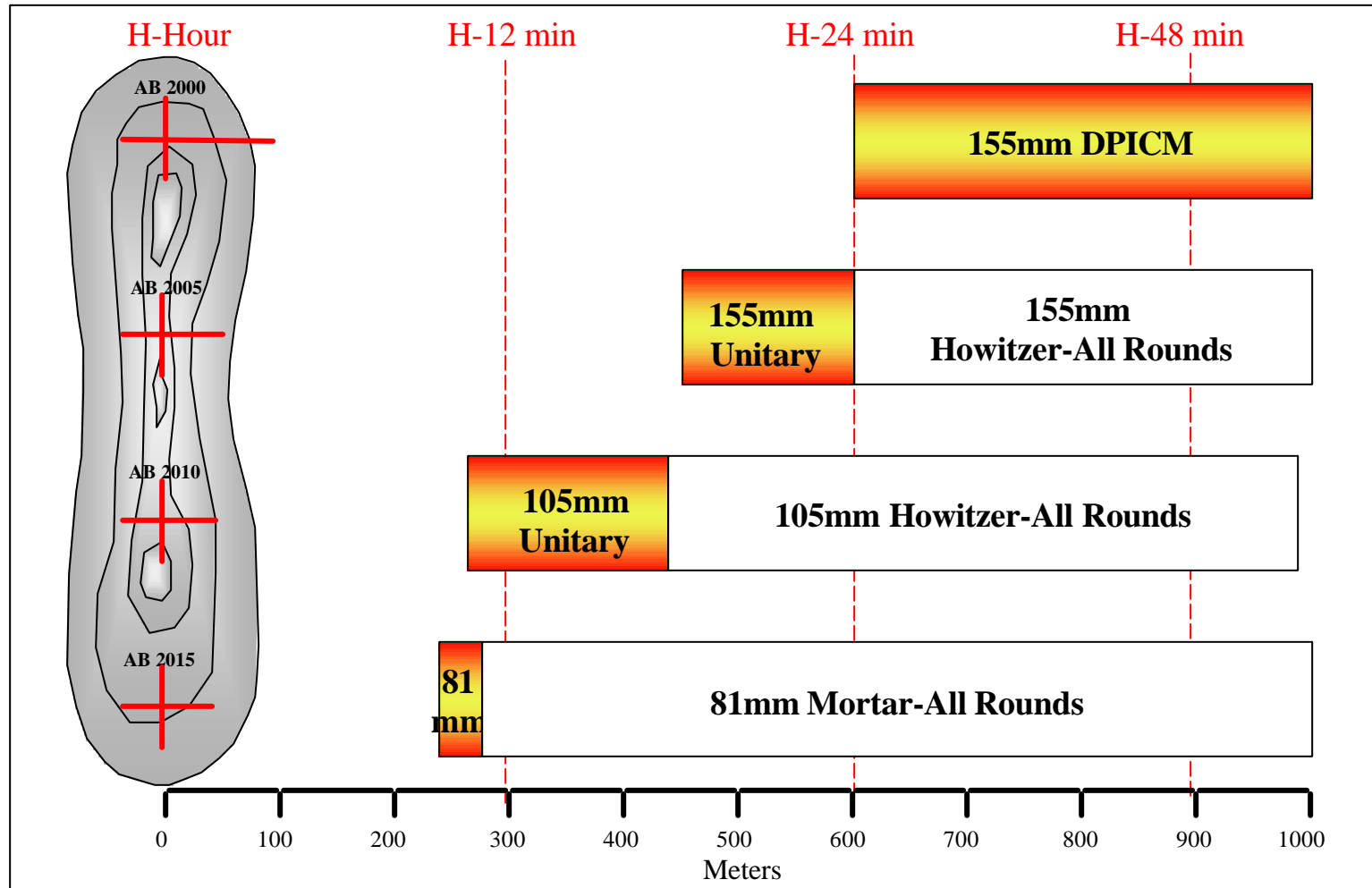
# Guided Projectiles And The Close Fight

Risk Estimate Distances (RED)(.1%PI, 1/3 - Max range)



# Guided Projectiles And The Close Fight

Echelon Fires for the Light Infantry Attack/Defense\*



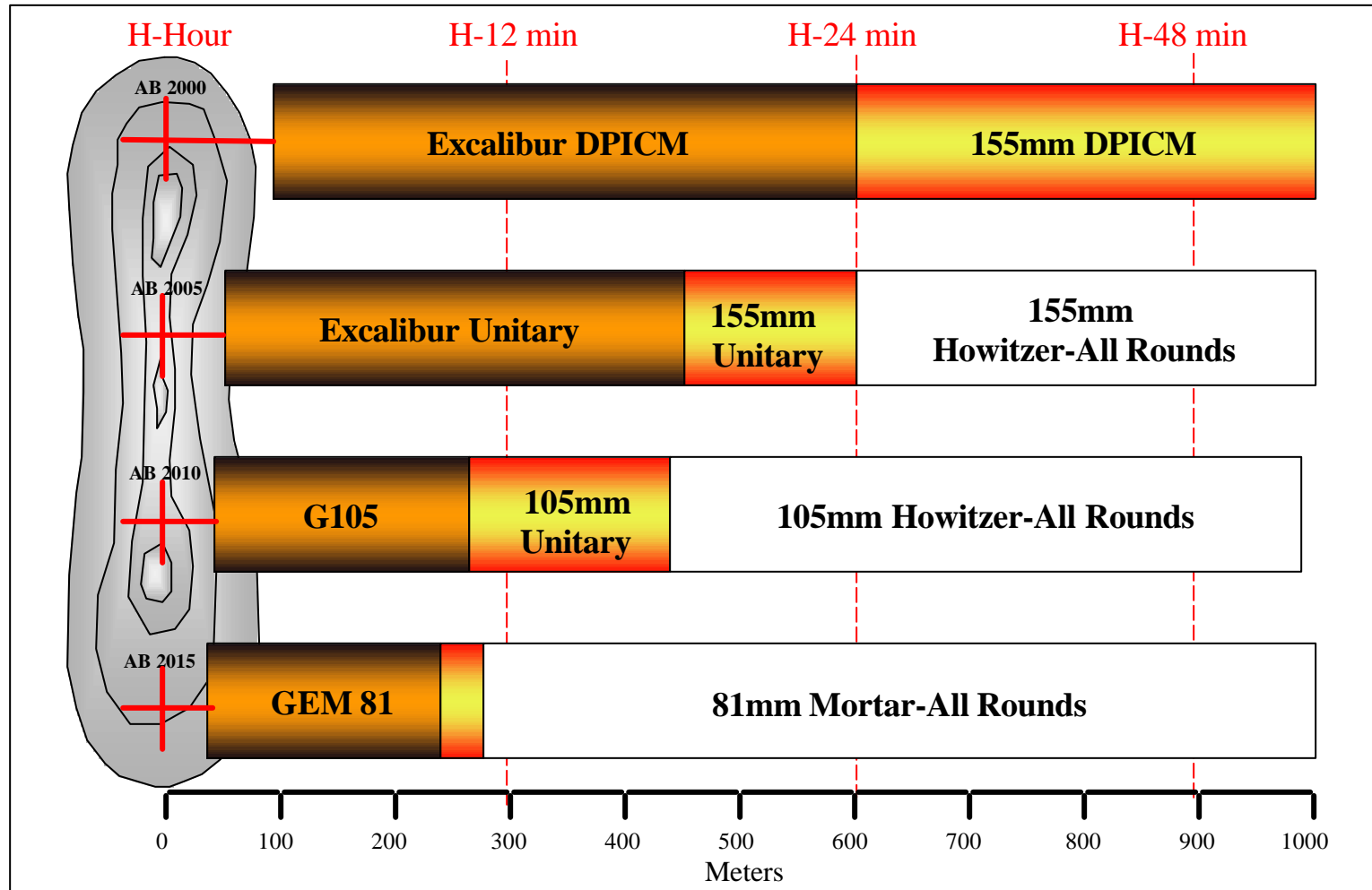
\* Close Fire Support (RED, 0.1% PI, Max Range)

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Echelon Fires for the Light Infantry Attack/Defense\*



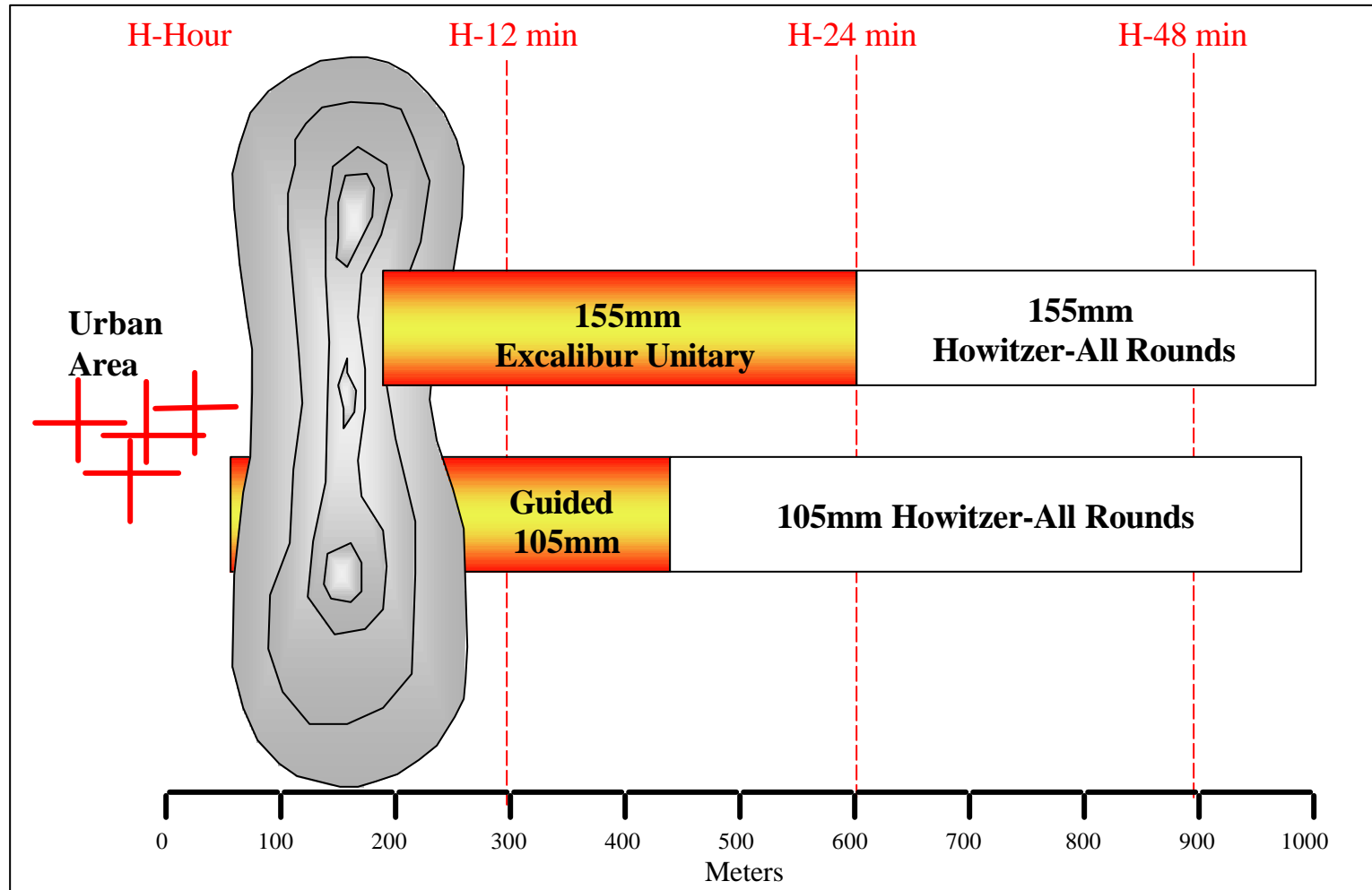
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Echelon Fires for the Light Infantry Attack/Defense\*

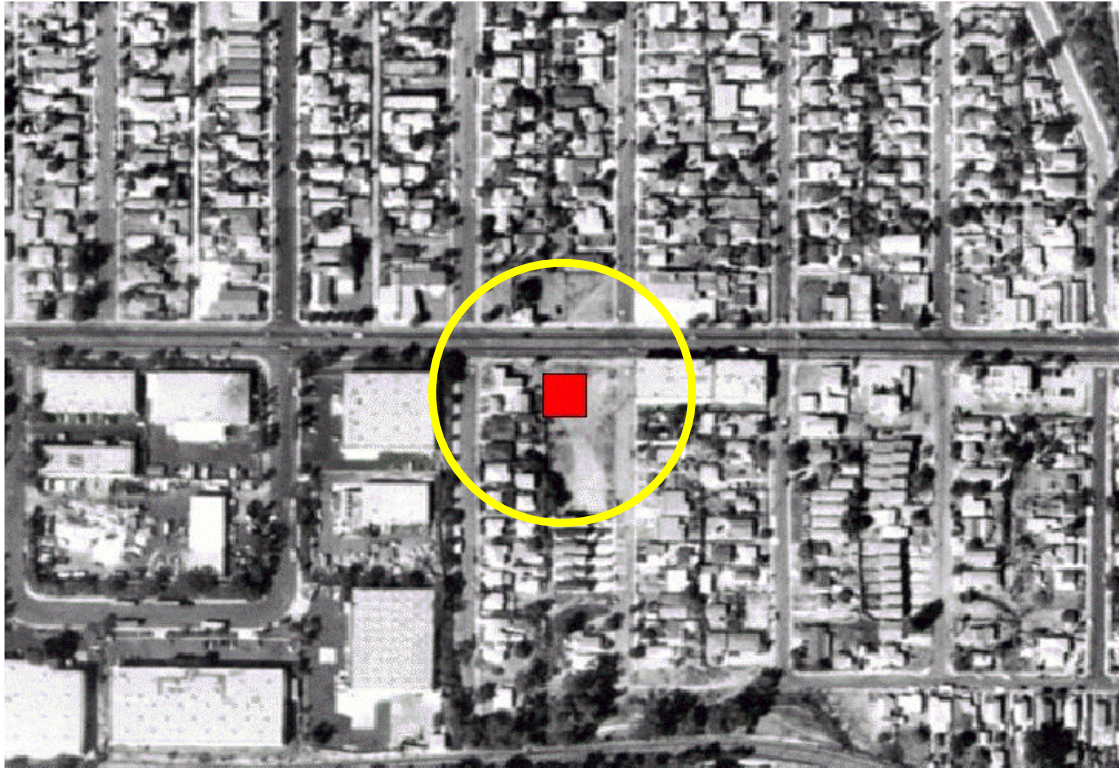


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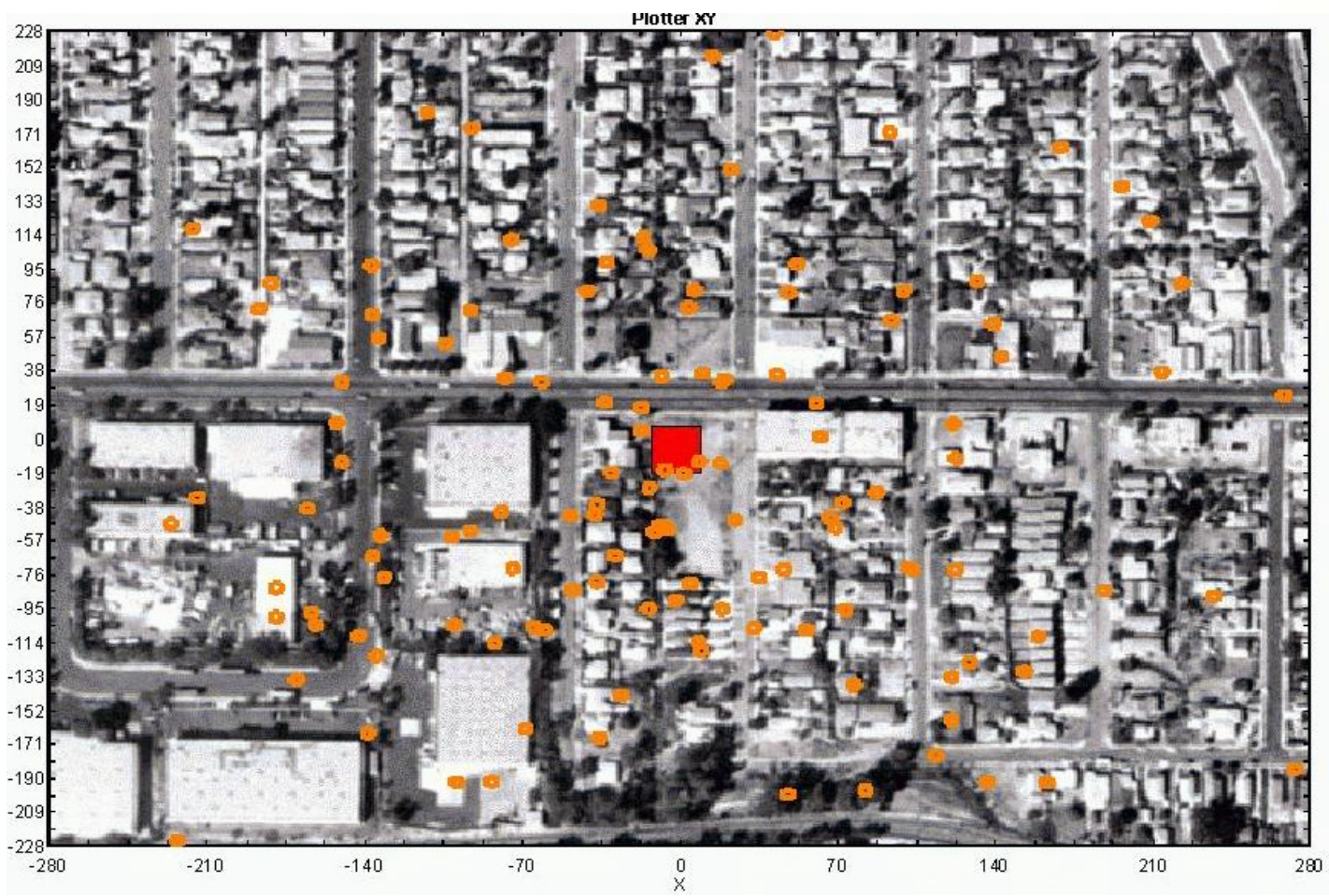




A command post  
in an urban environment.

A 20m X 20m structure.

10m Target Location Error



**Current M549 vs 20X20 structure: 147 rounds**



## XM982 vs 20X20 structure: 3 rounds

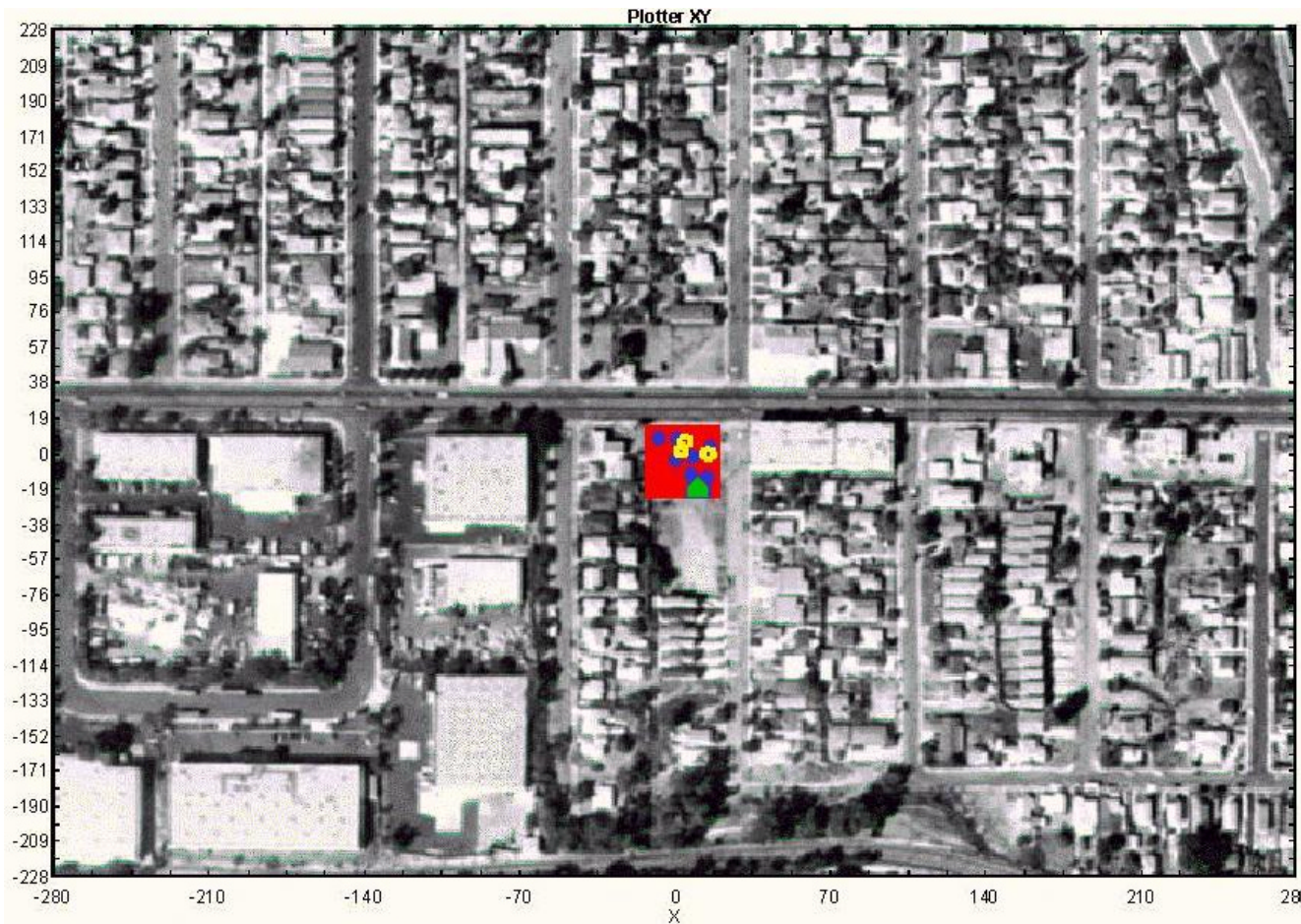


Towed Artillery/Crew  
Target (10m TLE)





Current M549 vs Towed artillery target: 39 rounds



**XM982 unitary vs towed artillery target: 3 rounds**

# Future Combat System Guided Projectiles



## Direct/Indirect Gun System

- Dual-Purpose, Advanced Propulsion
- Maximum Lethality/Weight Ratio
- System of Systems Design, Including projectiles/C3I/Log
- Extended Range, Dominant Platform
- Very High Stowed Kill Capability
- Deployable, 3-6 Times Less Logistical Burden

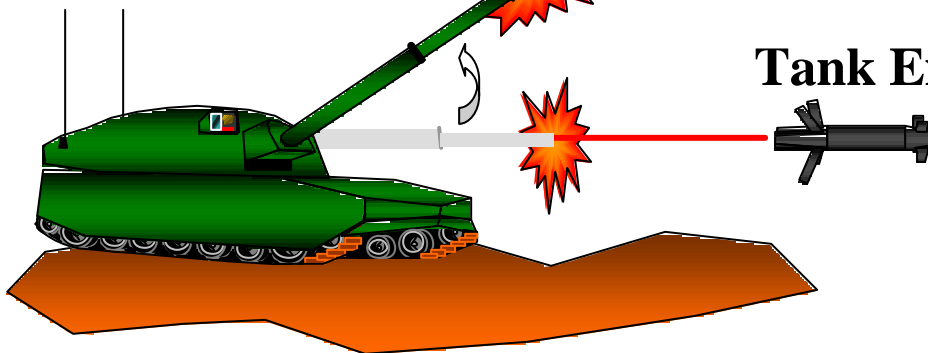
## Excalibur FCS

- Max Range: 50-100 km
- GPS/IMU 20 Meter Accuracy
- Family of Munitions
  - DPICM
  - SADARM
  - Unitary
- Digitized Battlefield Targeting System
- Advanced XM982/EX171 Design
- 3-6 Times Less Logistical Burden



## Tank Extended Range Munition (TERM)

- 0-20 km Range
- Pk>.9 Against Future Threat Tank
- Advanced Tri-mode (MMW, LARAD, IR) Seeker
- Counter Armor Protection System (CAPS)
- Aim Point Selection
- In-Flight Re-targeting
- 3-6 Times Less Logistical Burden!



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# Summary

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- **Transforms Interim Force fire support**
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- **Provides high lethality, long range dominance with low collateral damage/logistics burden**
- **Returns Field Artillery to the Close Fight**
- **Matures GP technologies for MRAAS/FCS**
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