U.S. Army Research Laboratory

U.S. Army Armament Research, Development, and Engineering Center

U.S. Army Infantry Center

U.S. Special Operations Command

U.S. Marine Corps Systems Command

WEAPONS TECHNOLOGY FOR LIGHT FORCES

There is an increasing emphasis on the rapid projection of U.S. military forces into a wide diversity of operations in various environments. To respond to these requirements, our soldiers must be equipped with weapons that provide overmatching lethality at significantly reduced weight and logistics burdens. The U.S. Army Research Laboratory (ARL), the Defense Advanced Research Projects Agency (DARPA), and others are investigating the potential for harnessing advances in sensors, communications, situational awareness, lightweight launchers, warhead technologies, and precision munition technologies to provide a capability for small infantry units to orchestrate precision fires that are immediately responsive to the call. The ARL concept has been identified as the Distributed Engagement System that is defined to dramatically enhance the lethality of dismounted forces by providing them with the capability to command lethality without having to carry it and to syncronize indirect fires with their close-in fire and maneuver. Currently, DARPA has two programs, Small Unit Operations (SUO) and Advanced Fire Support System (AFSS), that address calls for indirect fires from outside of the small unit area of operations. The Weapons and Materials Research Directorate of the ARL has a technology program to address technologies for organic, remotely operated, indirect fire support for small infantry units that is man-pack capable or can be transported, and possibly fired, from a small unmanned robotic vehicle that follows the individual foot soldier and can act as a porter, carrying other loads for the soldier. This technology program has been coordinated with the U.S. Army Infantry Center (Directorate for Combat Developments, DCD, and Dismounted Battlespace Battle Lab, DBBL), the U.S. Special Operations Command (USSOCOM), the U.S. Marine Corps Systems Command, and the U.S. Army Armament Research, Development, and Engineering Center (ARDEC). Estimates of effectiveness of proposed technology developments and/or system concepts will be evaluated using Distributed Interactive Simulation and other system analysis methods. Scenario developments and combat simulations will be pursued jointly with the DBBL and others.

Lightweight Weapon Technology Areas

- **Lightweight / Composite Materials**
- **Recoil Mitigation / Management**
- **Competent Munition Technologies**
- **Improved Warhead Fragmentation**
- **Automated Pointing and Aiming**
- **System Orientation and Lay**

Also – smaller (~60-mm) shorter range Enhanced, Organic Indirect Fire assets must be available.

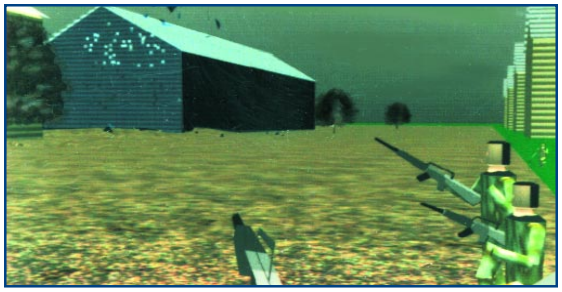
Lightweight 81-mm Mortar

Concept of a single tube small mortar that could be remotely emplaced and operated, automatically loaded and fired on command – man-pack capable – shown mounted on a small robotic vehicle.

Concept of a pod of small mortars that could be remotely emplaced and operated – man-pack capable – shown mounted on a small robotic vehicle.

System Analysis and Combat Simulation

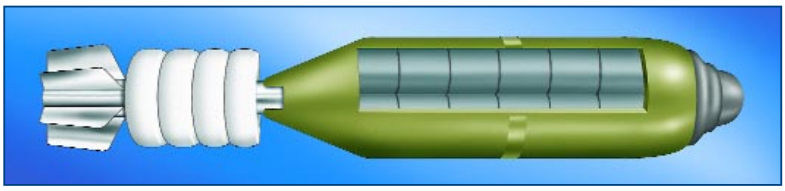
- **Distributed Interactive Simulation**
- **Variable-Resolution Terrain in Urban Terrain**
- **Synthetic Scenario Generation**
- **Weapons Concepts and Technology Analysis**
- **Mortar Analysis Modeling**
- **Military Operations in Urban Terrain (MOUT)**



MOUT Synthetic Environment Testbed

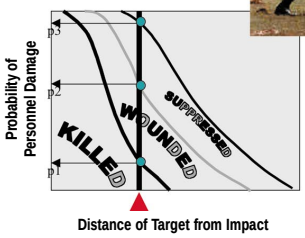
Near-term technology efforts that have been completed or are nearing completion

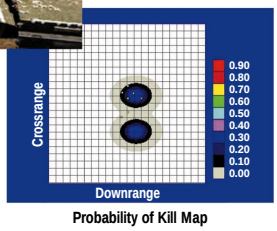
Advanced Mortar Projectiles



ARL has investigated the feasibility of developing an 81-mm mortar round capable of delivering Dual-Purpose Improved Conventional Munitions (DPICMs). By using lightweight material shell-body technology that has been demonstrated in large-caliber cannon artillery, a more lethal effect can be delivered than with existing rounds for the same projectile package weight. Alternatively, reductions can be made in the number of DPICM grenades packaged so that the weight of the projectile can be reduced by more than one pound while its lethal effect is equivalent to that of the existing inventory. New DPICM designs that can provide improved packaging and effectiveness (i.e., lighter and more lethal) require technology development that is not being pursued.

Mortar Effectiveness Modeling

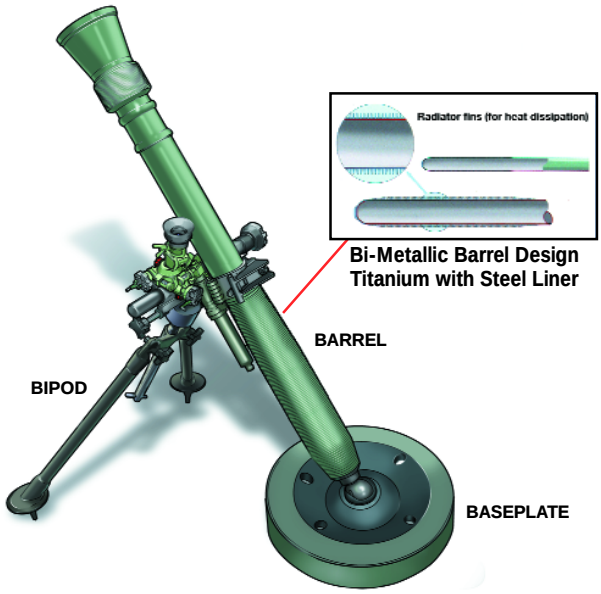




ARL has developed two numerical models for use in the analysis of mortar system performance. The **Mortar Mission Model** is a Monte Carlo (i.e. random sampling) technique that simulates the lethality and suppression effects of a mortar mission against an infantry unit that is stationary for the duration of the mortar mission. The model includes Fire Observation, Fire Adjustment, and Fire-for-Effect modes, as well as an Enemy Reaction Profile that features changes in posture in reaction to mortar fire. The Mortar Mission Model can be applied to parametric studies of mortar system performance and mission design and to optimization of Fire Adjustment techniques. The **Mortar Parametric Analysis Model** (MPAM) is a user-friendly interactive program (operating in a PC Windows environment) that predicts the expected number of kills for mortars fired at personnel targets. MPAM allows the user to select the round of choice, range to target, target-location or mean point-of-impact errors, target array and orientation, firing plan, and number of replications.

Lightweight 81-mm Company Mortar

ARL is developing advanced redesigned components demonstrated in a lightweight, man-portable 81-mm mortar system that could replace the M224 60-mm mortar system or the heavier M252 81-mm system. Through the application of advanced, high-strength materials, the new system is designed to weigh approximately 70 pounds, which is 30% lighter than the M252 system. A new prototype bipod assembly has been fabricated to achieve a 26% weight reduction. The new bipod incorporates graphite composite and titanium components into a redesigned, more portable configuration. A new baseplate features the integration of aluminum and fiber-reinforced composite to replace the existing aluminum base-plate. The mortar tube is being fabricated using a bi-metallic design of steel and titanium and will undergo firings to validate its structural integrity and robustness.



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TECHNOLOGY TO WIN