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REPLY TO
THE ATTENTION OF
AMSRD-ARL-SL

08 April 2004

MEMORANDUM FOR Office of the Deputy Under Secretary of Defense (Science & Technology), (Captain Michael Lilienthal), 3080 Defense Pentagon, Washington, DC 20301-3080

SUBJECT: Response to ODUSD(S&T)/Joint Forces Command Call for Proposals to Address Current, Proposed, and Candidate Efforts to Improve MOUT Weapons Effects Presented at the Weapons for Force Application in Joint Urban Operations, 30-31 March 2004.

1. At referenced meeting, CAPT Lilienthal presented a call for current, proposed, and candidate efforts to improve MOUT weapons effects that will be considered by ODUSD(S&T) and JFCOM for funding consideration, to begin with FY 2005. The enclosure to this cover letter encompasses the ARL SLAD proposal to energize the Standardized MOUT Target and Testing Board and MOUT modeling extension efforts to address the identified shortfalls.

2. We will provide a formal proposal if expectation of funding and particular areas of interest are indicated.

3. Technical Point of Contact is Mr. David Fordyce, AMSRD-ARL-SL-BB, dfordyce@arl.army.mil, (410) 278-6340, DSN 298-6340.

FOR THE DIRECTOR:

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Proposed effort to fund the Standardized MOUT Target and Testing Board (SMTTB) and MOUT model extension activities:

Impact on capabilities over the FYDP: Over the past three years, it has become evident that a substantial effort will be needed to improve prediction of the effects of Army munitions against urban materials. This new focus is primarily due to the increasing frequency at which military operations in urban terrain (MOUT) have occurred. During MOUT operations, the targets engaged by Army systems are often not the ones they were designed to operate against. Most Army systems were designed primarily to engage vehicle and personnel targets in open terrain. Much of the Army's analytical methodology was developed to estimate effectiveness in the same type of engagements. Just as weapon systems and tactics must be adapted to MOUT so must the methods used to analyze them. Accurate predictions of weapons effects can be vital to a commander in the field who is considering applying a particular munition against a particular structural target. Supporting this concern, a recent newsletter from the Center for Army Lessons Learned (November 2003) reviewed weapons effects on structures in Afghanistan and other places, and showed, for most cases, a very limited understanding of the effects of munitions on in-country structures.

Currently, MOUT modeling and simulation codes can predict to a limited degree basic weapons effects in a MOUT environment. DoD lethality and vulnerability models can estimate internal blast effects, casing fragment patterns, warhead penetration into a limited set of urban materials and personnel injury levels due to munition casing fragments, blast and flash burns. However, these models must be upgraded, within an end-to-end framework, in simulating individual and combined weapon effects of in order to credibly assess the potential for collateral damage, force protection, and to obtain the expected amount of structure/hostile force damage the commander in the field desires. Current models need to be upgraded to accommodate.

High payoff investment: The SMTTB/ARL SLAD will perform a concentrated effort to rectify this shortfall by executing a unified program of planning and experimental design, focused experimentation, and model integration and extension. This concentrated effort will specifically address the areas of the contribution to

lethality/vulnerability and personnel incapacitation from falling and projected building debris, secondary spall fragments, and building collapse. Blast effects within this environment will also be examined. The specific payoffs this effort will generate will be to give the warfighter better weapons effects data for use in operational and weaponeering contexts, to give the test and evaluation community improved tools, measures of lethality and collateral damage, and better data to examine developmental weapons effects, and to extend models to which investments have already been made by the tri-service community.

Required effort: Scope of this effort will depend upon the amount of time and funding available.

Planning phase:

Review existing integrated weapons effectiveness models
- Identify weapons effects gaps
- Consult TRADOC and Marine Corps existing training and doctrine documents and organizations to determine tactical significance and likelihood of the weapons effects occurring in MOUT
- Formulate experimental design plan based on above, and existing experimental data (or lack thereof) and augment with use of data from first principle physics based simulations such as hydrocodes and finite element structural response models.
- Experimental design plan contains:
    - target definitions
    - engagement geometries
    - instrumentation plans
    - data reduction procedures
    - cost and schedule estimates
- Manage effort through the tri-service Standardized MOUT Target and Testing Board
    - leverage SMTTB effort to characterize geo-typical set of building targets
- Prioritize experiments based on modeling gap priorities

CAVEAT: Some flexibility should be allowed to take advantage of emerging testing and experimentation methods to capture data for which there are currently no standard methodologies, e.g., secondary patterns, blunt trauma and multi-phase flows.

Experiment Execution phase:

- likely will take several years to execute
- experiments schedule will depend on priority and amount of funding available in any given fiscal year
- high quality experimental data generated
- fast running empirical computer models developed and validated using the experimental data
- data provided to warfighter, tri-service T&E and analytical communities, JFCOM and other identified customers as appropriate

Model extension and integration phase:

- begins on receipt of sufficient experimental results
- conducted in parallel with later experiments
- extend MOUT modeling within end-to-end framework
    - integrate fast-running models, particularly for these areas:

1) Penetration of kinetic energy (KE) and high explosive (HE) rounds into representative urban materials.

2) Penetration of shaped charges (SC), explosively formed penetrators (EFP) and follow through grenades into representative urban materials.

3) Blast and fragment loading on urban structures.

4) Generation, mass, shape, and spatial distribution of secondary debris.

5) Structural response of representative urban structures and tactical bunkers.

6) Damage to people from secondary debris and structural collapse including debris penetration and blunt trauma.

7) Loading from multiphase blast flows

8) Instantaneous and progressive structural collapse

Deliverables for the required effort:

Experimental Design Plan
Test Plans
Analysis Plans
Model Extension and Integration Plan
Extended Model Validation and Verification Plan
IPR types of documentation (e.g., briefings, white papers, fact sheets, etc.)
Upgraded functioning end-to-end simulation (with appropriate new measures of collateral damage and kill definitions as negotiated with tri-service user communities)
Software Design Documentation
Test Reports
Analysis Reports
Extended Model Validation and Verification Report