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TEAE-SS

29 January 2014

MEMORANDUM FOR

Project Manager Maneuver Ammunition Systems (PM MAS), LTC Philip R. Clark,
SFAE-AMO-MAS-SMC, Building 354 Picatinny Arsenal, NJ 07806-5000
Armament Research, Development and Engineering Center (ARDEC), RDAR-MEM-I,
Mr. Theodore Poscablo, Building 65N Picatinny Arsenal, NJ 07806-5000

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1. References.

- a. MIL-STD-882E, Department of Defense, Standard Practice, System Safety, 11 May 12.
- b. DoDI 5000.02, Operation of the Defense Acquisition System, 8 Dec 08.
- c. U.S. Army Test and Evaluation Command (ATEC), Policy Bulletin No. 13-12, Software Safety Verification Policy and Guidelines, 15 Jun 12.
- d. Memorandum, U.S. Army Developmental Test Command (DTC), CSTE-DTC-TM-T, 11 Sep 07, subject: Safety Confirmation for the Close Combat Mission Capability Kit (CCMCK) in Support of Fielding.
- e. Memorandum, U.S. Army Military Police School, 14 May 10, subject: Request Exception to System Safety Risk Assessment for Close Combat Mission Capabilities Kit (CCMCK) Policy and TM 9-6920-3700-10.
- f. Memorandum, ARDEC, 5 Nov 07, subject: System Safety Risk Assessment for Close Combat Mission Capabilities Kit (CCMCK).
- g. Memorandum, Department of the Army, AMSJM-CG, 26 Jun 09, subject: Full Materiel Release of the Close Combat Mission Capability Kit (CCMCK) System which

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includes the following items; M1041 9mm Practice Ammunition, M1042 5.56mm Practice Ammunition – Rifle, M1071 5.56mm Practice Ammunition – Linked.

h. Memorandum, U.S. Army Evaluation Center (AEC), 10 Dec 07, subject: U.S. Army Test and Evaluation Command (ATEC) Abbreviated System Evaluation Report and Milestone C Recommendation for the Close Combat Mission Capability Kit (CCMCK) (XM1041/XM1042/XM1071).

i. Memorandum, AEC, 25 Feb 09, subject: U.S. Army Test and Evaluation Command (ATEC) Position for the Close Combat Mission Capability Kit (CCMCK) Full Materiel Release (FMR) Decision.

j. Test Record, U.S. Army Aberdeen Test Center (ATC), TEDT-AT-FPS, 28 Jun 11, title: Military Eye and Head Protection Device (EHPD) for Close Combat Mission Capability Kit (CCMCK).

k. Report, ATC, Feb 2007, title: Production Prove-Out (PPT) Close Combat Mission Capability Kit (CCMCK).

l. Report, Ultimate Training Munitions (UTM), Nov 08, title: Engineering Change Proposal SWD Goggle Ballistic Lens Non Penetration Test Using UTM Loose (Aluminum) and Link (Aluminum/Steel) 5.56 MMR.

m. Report, Air Force Research Laboratory (AFRL), 21 Feb 77, title: Ultimate Training Munition Man Marker Round Human Effects Assessment.

n. Report, AFRL, 25 Feb 05, title: Simunition Skin Penetration Assessment.

o. Plan, UTM, undated, title: Engineering Change Proposal Ammunition Testing Specifications.

p. Technical Manual (TM) 9-6920-3700-10, Technical Manual Operator's Manual for Close Combat Mission Capability Kit (CCMCK), 13 Mar 09.

q. Data Sheet, U.S. Army Research Laboratory (ARL), 7 Jul 11, title: CCMCK.xls.

r. E-mail, ARDEC, Mr. David Charowsky, 20 Jul 11, subject: FW: 2nd Annual TSS Workshop: Comprehensive Agenda Posted.

s. E-mail, ARDEC, Mr. David Charowsky, 22 Nov 10, subject: M1042/M1071 Velocity Change.

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t. E-mail, ARDEC, Mr. David Charowsky, 12 Dec 11, subject: CCMCK Safety Confirmation.

u. Memorandum, AEC, TEAE-MG, 20 Jan 12, subject: Amendment No. 1 to the Safety Confirmation for the Close Combat Mission Capability Kit (CCMCK) in Support of Fielding.

v. Report, ATC, 13 May 13, subject: FINAL REPORT, Ballistic Testing of the Military Eye and Head Protection Device (EHPD) with Close Combat Mission Capability Kit (CCMCK) Ammunition, Eye Tactical CM121, Simunition FX 9003, UTM Standard, UTM Prototype with Integrated Goggle, Phoenix NLTA.

2. Purpose. This AEC Amendment 2 to the Safety Confirmation for the CCMCK is provided for fielding. The purpose of this Safety Confirmation is to amend reference 1u to include additional commercial off-the-shelf (COTS) protective masks for use with CCMCK. A safety assessment in accordance with (IAW) MIL-STD-882E (reference 1a) has been conducted. The overall risk for the use of the CCMCK cartridges and COTS protective masks is considered MEDIUM provided the warnings, procedures, and mitigations identified in this document and in the TM (reference 1p) are implemented.

3. System Description.

a. The CCMCK is designed to allow force-on-force close combat training by temporarily converting service weapons (M16 series rifles, M4 series carbines, M249 Squad Automatic Weapons, and M9 and M11 Pistols) to fire low-velocity marking ammunition. Marking ammunition, manufactured in red, blue, or yellow, is loaded into the magazine of the converted weapon in the same manner as service ammunition. Once loaded, the weapon cycles and functions the same as service ammunition and marks the target. The system allows normal weapon employment cues such as aiming, firing, Force-On-Force training, and interactive live-fire scenarios. The M1042 and M1071 (5.56 millimeter (mm)) CCMCK ammunition is manufactured by UTM and the M1041 (9mm) ammunition is manufactured by SNC Technologies, Inc. The table below lists CCMCK cartridges approved for Full Materiel Release (reference 1g).

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CCMCK FMR Ammunition

Cartridge Nomenclature	DODIC	Caliber	Marking Color	NSN
M1041	AB12	9mm	Yellow	1305-01-536-7720
	AB13		Blue	1305-01-536-7721
	AB14		Red	1305-01-536-7722
M1042	AB09	5.56mm	Blue	1305-01-536-5822
	AB10		Red	1305-01-536-5827
	AB11		Yellow	1305-01-536-5829
M1071	AB15	5.56mm	Yellow	1305-01-536-9289
	AB16		Blue	1305-01-537-1521
	AB17		Red	1305-01-537-1522

b. The EHPD is designed to be used during force-on-force combat training when utilizing the CCMCK marking ammunition. There are five COTS EHPD that have been tested for use with the CCMCK: the UTM Standard Face Mask (P/N 69-0304), Eye Tactical Model CM121 Protective Mask, Simunition Model FX9003 Mask, UTM Prototype with Integrated Goggle, and Phoenix Nonlethal Training Ammunition (NLTA) Protective Gear. The UTM Standard Face Mask is designed to be worn in conjunction with Army-approved goggles (such as the ESS Profile goggles). The Eye Tactical CM121 Protective Mask, Simunition Model FX9003 Mask, UTM Prototype with Integrated Goggle and the Phoenix NLTA are designed with integrated protective goggles. The Eye Tactical CM121 Protective Mask, UTM Standard Face Mask, Simunition Model FX9003 Mask, and UTM Prototype with Integrated Goggle must be worn with the Advanced Combat Helmet (ACH). The Phoenix NLTA cannot be worn with the ACH. The EHPD are shown in the figure below.

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Figure: EHPD (from left to right): UTM Standard Face Mask, Eye Tactical Model CM 121 Protective Mask, Simunition Model FX 9003 Mask, UTM Prototype with Integrated Goggle, and Phoenix NLTA.

4. Evaluation Limiting Factors.

a. This Safety Confirmation does not address the requirement that the CCMCK projectile must not penetrate human skin when protected by the standard Hot Weather Battle Dress Uniform. The test was designed to determine the mean velocities of the cartridges and to assess the probability that the M1042 or M1071 projectiles could penetrate Army Combat Uniform (ACU) fabric and potentially break the skin.

b. There was so much shot-to-shot variability in the muzzle velocities of the M1042 and M1071 that statistical sensitivity tests could not be used to determine the probability of penetration as a function of distance. Therefore, the test methodology focused on assessing projectile behavior given a worse case impact velocity against the ACU fabric over gelatin.

c. There is no ATEC accredited skin penetration model or validated skin simulant; therefore, the ACU fabric was placed directly over 20% gelatin blocks.

d. Resistance to penetration testing for the EHPD was limited to a sample size of five items per manufacturer.

5. Evaluation Results. This AEC Safety Confirmation is derived from the results of testing conducted by ATC and ARL, and review of referenced documentation. The definitions from MIL-STD-882E (reference 1a) were used to assign hazard severity, probability of occurrence, and Risk Assessment Codes (RAC) of identified hazards. The CCMCK does not contain safety related Software as defined by reference 1c. Identified safety hazards are summarized below.

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a. The 2007 Safety Confirmation (reference 1d) and the ARDEC System Safety Risk Assessment (SSRA) (reference 1f) assessed the CCMCK as a Marginal-Probable hazard (RAC 3-B, SERIOUS risk) due to the probability of personnel injury associated with the use of the XM1042 and XM1071 UTM cartridges. This RAC was based on test results of developmental testing (DT) conducted by the ATC and a Limited User Assessment (LUA) conducted by the Maneuver Battle Laboratory (MBL) at Fort Benning, GA. During the ATC DT, there were multiple tears and penetrations of the combat uniform at a distance of 5 meters (m) (16.4 feet (ft)) when firing the XM1042 and XM1071 cartridges; there were no tears or penetrations when firing the XM1041 cartridge. Additionally, during the LUA there were two instances recorded along with other anecdotal accounts that the UTM cartridges (either the XM1042 or XM1071) penetrated clothing and gloves. One incident penetrated the glove and caused bleeding. As a result of these data, the Safety Confirmation limited the engagement distance to 5 m (16.4 ft). The 2012 Amendment to the Safety Confirmation (reference 1u) reduced the minimum engagement range from 5 m (16.4 ft) to 1.5 m (5 ft) and included a requirement for an approved COTS protective face mask. The engagement range was reduced based on results of testing conducted by ATC and the ARL, and the Engineering Change Proposals (ECPs) on the M1042 and M1071 UTM cartridges, which lowered the upper velocity tolerance to 450 feet per second (ft/s) from 500 ft/s. Testing was conducted to both characterize the projectiles from each weapon type (M16, M4, and M249) and to determine a statistical probability that the M1042 and M1071 projectiles would penetrate one layer of clothing and potentially penetrate the skin. Testing could not replicate every scenario with which a Soldier could be impacted with a CCMCK projectile. Soldiers impacted on bare skin at 1.5 m (5 ft) can reasonably expect to experience bruising and/or bleeding. This is assessed as a Marginal-Probable hazard (RAC 3-B, SERIOUS risk). Soldiers must wear approved Personal Protective Equipment (PPE) for protection of the eyes, head, neck, and groin. Soldiers must not aim at a Soldiers head and must aim center of mass. Additionally, Soldiers should not train with the CCMCK without all skin covered by a minimum of one layer of clothing including combat gloves. Wearing the appropriate PPE, taking the appropriate point of aim, inspecting the cartridge tips when loading the magazine, and maintaining a minimum engagement distance of 1.5 m (5 ft) mitigates the risk of injury and is assessed as a Marginal-Occasional hazard (RAC 3-C, MEDIUM risk). Note that an assessment of Occasional per MIL-STD 882E is defined as "will occur several times" in the life of an item. This assessment assumes Soldiers will incur bruising, welts, or tearing of the uniform. Probability of injury is expected to increase should Soldiers train with unprotected skin.

b. During ARL testing, there were instances where the plastic tips on the projectiles fell off during the loading process. During an inspection, some tips were easily removed. If cartridges are fired with a loose or missing plastic tip, the projectile velocities will be higher and the projectile can reasonably be expected to penetrate ACU

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fabric and skin. The protective face masks did stop the higher velocity projectiles. Soldiers should inspect the cartridges when loading the magazines for loose or missing tips. Additionally, inspection criteria should be added to the Lot Acceptance Test to ensure the tips remain properly affixed to the projectiles.

6. Conclusions and Recommendations. This AEC Safety Confirmation amendment is issued for the CCMCK for fielding. A safety assessment IAW MIL-STD-882E (reference 1a) has been conducted. The CCMCK has 1 identified MEDIUM hazard. The overall risk for the use of the CCMCK cartridges and COTS protective face masks is considered MEDIUM provided the warnings, procedures, and mitigations identified in this document and in the TM (reference 1p) are implemented in order to minimize risk.

a. Hazards identified in paragraph 5 should be eliminated or controlled to an acceptable level. If the hazards are not eliminated, the residual hazard(s) must be accepted by the appropriate decision authority IAW DoDI 5000.02 (reference 1b). The technical or operational limitations or precautions identified herein, needed to prevent injury and property damage during operation, are the responsibility of the PM MAS. To permit revision of this Safety Confirmation, all design changes effected by the PM MAS to reduce or eliminate hazards identified above will be verified and validated as acceptable through analysis or testing.

b. The following recommendations are provided to reduce risks:

(1). Soldiers should maintain a minimum engagement distance of 1.5 m (5 ft) with the CCMCK.

(2). This Safety Confirmation includes only M1042 and M1071 ammunition lots manufactured after 2010. Earlier lots have not been through the ECP. The Officer in Charge, Range Safety Officer, or local trainer should ensure the proper M1042 and M1071 ammunition lots are used. There are no restrictions to lots for the M1041 cartridge.

(3). Soldiers must wear approved PPE for protection of the eyes, head, neck, and groin. The Eye Tactical CM121 Protective Mask, UTM Standard Face Mask, Simulation Model FX9003 Mask, and UTM Prototype with Integrated Goggle protective face masks must be worn in conjunction with the ACH. The UTM Standard Face Mask must be worn with Army-approved goggles (such as the ESS Profile goggles). Failure to wear approved PPE can result in permanent partial disability due to the projectiles impacting the unprotected head, eyes, face, neck, or groin.

(4). Soldiers should not aim at a Soldiers head and must aim for the target's center of mass.

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(5). Soldiers should not train with any CCMCK weapon or cartridges without all skin covered by a minimum of one layer of clothing (including combat gloves). Soldiers training without complete PPE can expect to incur bruising, welts and possible broken skin.

(6). Soldiers must wear single hearing protection when training with any CCMCK weapon or cartridge.

(7). Soldiers should inspect the M1042 and M1071 cartridges to ensure the plastic tips are secure and cannot be removed by hand.

c. This AEC Safety Confirmation amendment does not negate the need for other safety activities or documents required for materiel release IAW AR 700-142.

d. This headquarters should be notified if any injury, equipment, or facility damage is incurred as a result of the reduced engagement range.

7. The AEC point of contact is Ms. Melissa Rhoads, TEAE-SS-M, melissa.a.rhoads2.civ@mail.mil, DSN 848.9606, commercial 443.861.9606.

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