

U.S. Army Research, Development and Engineering Command



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Lightweight Small Arms Technologies "The Final Installment" (or is it?)

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Ms. Kori Phillips US Army ARDEC (973) 724-7944 korene.phillips@us.army.mil

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Unburdening the Warfighter

"The Army recognizes that the weight a Soldier is carrying has a direct impact on his ability to perform his mission." "We have a full court press on lightening the load of Soldiers." "Every ounce counts" – GEN Chiarelli, Vice Chief of Staff of the Army, Congressional Testimony, March 2009

"Added weight and thermal loading make Marines less effective in combat." – BGen Kelley, Commander MARCORSYSCOM, Congressional Testimony, March 2011

One of the "five most critically needed technology enhancements" in the Naval S&T Strategic Plan is lightening the load of dismounted Marines. – Gen Amos, Commandant of the Marine Corps, in Congressional testimony, April 2008

"The fighting load should not exceed 48 pounds, and the approach march load...should be less than 72 pounds...the primary consideration is not how much a soldier can carry, but how much he can carry without impaired combat effectiveness – mentally or physically." (Army FM 21-18)

Average fighting load for a SAW gunner is 79 pounds and the average approach march load for a SAW gunner is 111 pounds. (Soldier Loads in Combat Study, Center for Army Lessons Learned, March 2005)

Reducing Soldier Load has been a problem for infantrymen that goes all the way back to the days of Alexander the Great." – Gen Amos, Commandant, USMC









CT Ammo & Light Machine Gun "So What"





We do it for *these* guys

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Logistical Impact



	Unit	# of SAWs	CT Ammo Weight Savings	CT Weapon Weight Savings	Total Weight Savings
a weight savings of over	Individual	1	12	8	20
THREE TONS for an infantry BCT	Squad	2	24	17	41
	Platoon	6	73	50	123
	Company	18	218	149	367
	Battalion	54	653	448	1,101
	BCT	328	4,438	2,722	7,160

Linked CT provides 40-50% improvement in throughput for most modes of ground transportation

- Weight and volume savings per pallet (21,600 more rounds per pallet AND a savings of 2,283 lbs)
- Able to fit 37% more ammunition in a standard CONEX

Weight Savings for a BCT Equivalent to:

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- 895 Gallons of water (179 five-gallon water cans)
- Enough fuel to fill the tanks of 35 HMMWVs
- 170 M1 105mm HE Artillery Rounds





Revolutionary, Next Generation Weapon System

Cased Telescoped (CT) Ammunition:

• Lightweight, cylindrical polymer case

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- 40% weight reduction; 12% volume
- 2 Weapon Configurations:
 - Light Machine Gun (46% weight reduction over M249)
 - Carbine (magazine-fed, M4 size/weight)





Cased Telescoped Ammunition Cased Telescoped Light Machine Gun



CT Light Machine Gun:

- Over 14,000 rounds fired from 4 light machine guns
- Technology Readiness Level 7 testing ongoing
- Numerous live fire demos conducted
- Military Utility Assessment (MUA) Sep 2011

CT Carbine:

- SN1 weapon action tested at TRL 5 in 2010
- SN2 (new design) being fabricated
- M16 functionality; M4 weight/length



- Cased Telescoped Caliber Study:
 - Evaluating multiple calibers for size, weight and propellant requirements
 - Final report scheduled for July 2011
 - May feed into development of CT Ammo for alternate platforms
- Integration of M855A1 Enhanced Performance Round:
 - Contract option awarded 29 April 2011
 - Will be assembled into CT cartridges, fired from test barrel
 - Compatibility and performance impact to be assessed



In addition to reduced weight the LSAT LMG offers other advantages:

• Increased Weapon Performance:

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- <u>Reduced felt recoil</u> over current SAW
- <u>Improved accuracy</u> (based on preliminary testing)
- Designed for <u>increased reliability</u> over SAW
- Designed for <u>reduced weapon maintenance</u>
- Thermal management <u>decreases possibility of cook-offs</u>



– <u>Selectable semi-automatic mode</u> increases weapon versatility and reduces ammo consumption

• Reduced Logistical Burden:

- 55% more ammunition transported for same weight
- 12% reduction in volume
- Other Potential Operational Impacts:
 - Decreased weight provides increased mobility and survivability for the automatic rifleman (most heavily loaded Soldier in rifle squad, and least mobile)
 - Increases mobility, survivability and <u>effectiveness</u> of entire squad



Caseless System



The "Holy Grail" of Weight Reduction

Caseless Ammunition:

- TRL 5 demo scheduled for September 2011
- Primarily funded by the Office of Naval Research (ONR)
- 50% weight reduction; 40% volume reduction
- Prior effort showed feasibility of technology
- Current effort is reducing cost and environmental impacts; improving safety



Caseless Ammunition

Caseless Light Machine Gun:

- Light Machine Gun (45% weight reduction over M249)
- Over 400 rounds fired from weapon
- Two live fire demos conducted



Caseless Light Machine Gun



TRL 7 Testing



- CT LMG & Ammunition TRL 7 Assessment:
 - Tests based on qualification criteria (TOPs) for small arms & ammo
 - TOP 4-2-016 Ammunition, Small Arms
 - TOP 3-2-045 Small Arms Hand, Shoulder Weapons, & Machineguns
 - Total of 30,000 rounds of ammo and 2 weapons will be tested
 - Level I and Level II tests for criticality
 - Assessing reliability, durability, environmental endurance, and safety
 - Completed tests:
 - Slow heating (ammunition)
 - Cook-off test
 - Attitude (orientation)
 - Noise
 - Upcoming tests:
 - Weapon: High/low temp; mud; dust; icing; humidity; rain
 - Ammo: rough handling; thermal shock; extreme temp; chemical compatibility





- Ammunition Slow Heating Test:
 - Part of Insensitive Munitions (IM) test series
 - Ammunition cooks off when it reaches 300 F
 - Takes ~85 minutes to reach temperature when chamber is set to 300 F
 - Cartridge separates, propellant is scattered unburned
- Weapon Cook-off Test:
 - Pass criteria: no cook-off after 250 rounds (M249 cook-off)
 - Fired 300 rounds fired w/no stoppages,
 76 rd/min in 2-6 rd bursts
 - Round 301 chambered for 30 min with NO cook-off
 - Maximum chamber/breech temperature ~200 F



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TRL 7 Testing – Attitudes & Noise



• Attitudes Test:

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- Weapon is fired from 6 different orientations
- Total of 100 rounds from each orientation
 - 30 rounds semi-automatic
 - 70 full auto (40 in 5-7 rd bursts, 30 in single long burst)
- 600 rounds fired with 2 stoppages (neither caused by weapon orientation)
 - 1. Feed arm retaining pin became dislodged
 - 2. Cartridge OD out of tolerance
- Rates of fire 668-702 rd/min
- Noise Test:
 - Compare weapon noise to M249 noise
 - Four microphones set up around weapon
 - Peak noise values were equivalent
 - Noise durations were slightly less for LSAT









Ammunition Pilot Plant:

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- Facility being set up at MAST Technology in Warrensburg, MO
- Output for pilot plant: 4,000 5,000 rounds per day
- Supplying 20,000 rounds for TRL 7 testing and 100,000 rounds for MUA
- Facility & producibility study underway





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- Weapons Manufacture:
 - SN3 & SN4 are complete; wear components will be replaced before MUA
 - Status of SN5-SN10
 - Most components released
 - Most critical component for schedule is housing
 - Weapon actions will be completed in mid July for testing



Weapon Action in Test Fixture



- Conducted multiple high-level demonstrations
 - Sergeant Majors, General Officers, Senior Executive Service
 - Reps from all US Armed Forces, Canada, and the UK have fired CT LMG
 - Most recent demo at Cranfield University in the UK in March
 - Upcoming demos at Ft. Benning and Ft. Bragg
- Planning for Military Utility Assessment (MUA):
 - Demonstrate military utility of lighter weight weapons and ammunition
 - Comparative Analysis of the Cased Telescoped Light Machine Gun (CT LMG) and the M249 Squad Automatic Weapon (SAW)
 - Maneuver Center Battle Lab at Ft. Benning doing planning and troop coordination
 - MUA scheduled for mid September
 - Hardware for test:

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• 8 Light Machine Guns and 100,000 rounds of CT Ammunition





- UK Activity: Attended "Reducing the Burden on the Dismounted Soldier (RBDS)" MoD firing demonstration and Open Day at Cranfield University on 7-8 March
 - Demonstrated CT LMG SN1 with Spiral 2 ammunition
 - Proof testing Conducted at London Proof House, passed, received proof mark
 - Open Day Demos were successful, held on a 75 yd. firing range







Definitive Proof The most common mark. Signifies that a gun has passed the proof tests.

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- Canada Activity: meeting with Canadians DRDC and Colt Canada on 7 April
 - Each country provided technical and programmatic updates
 - Demonstrated CT LMG SN4

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- Canadians interested in buying CT Ammo and components for electronic ignition



Future Plans



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<u>RDECOM Guidance</u>: Build enough prototypes to get soldier feedback and prove out technologies (Military Utility Assessment II); and conduct business case analysis. Build confidence and reduce risk for transition to PM.

<u>ARDEC Recommendation</u>: Considered numerous possible options and recommend the following:

- Conduct platoon or company-level assessment using operational troops in FY12-FY13
- Builds upon results and lessons learned from MUA I
- Utilize Maneuver Battle Lab as testing agency and Army Evaluation Center (AEC) as evaluator; ARL HRED for MANPRINT

<u>What to watch for:</u> If we are given the go-ahead to proceed, the plan will be briefed at the upcoming National Small Arms Center Membership Meeting 21-22 June

- Request for Project Proposal would then be posted on FedBizOps and on the NSAC website
- Stay tuned!



Summary



- LSAT Addresses Critical Capabilities:
 - Individual Soldier load reduced by 20.4 pounds for Automatic Rifleman
 - Designed for increased weapon reliability & reduced weapon maintenance

• Increases Effectiveness:

- Increased accuracy
- Ability to carry more ammunition
- Reduced probability of cook-off
- Increased weapon versatility with selectable semi-auto mode

• CT System Maturity Increasing:

- Undergoing TRL 7 assessment
- Ammunition pilot production and weapons manufacture
- Military Utility Assessment will provide hands on feedback
- The "Final Installment" may not be final after all!



Questions?





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