



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**

“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

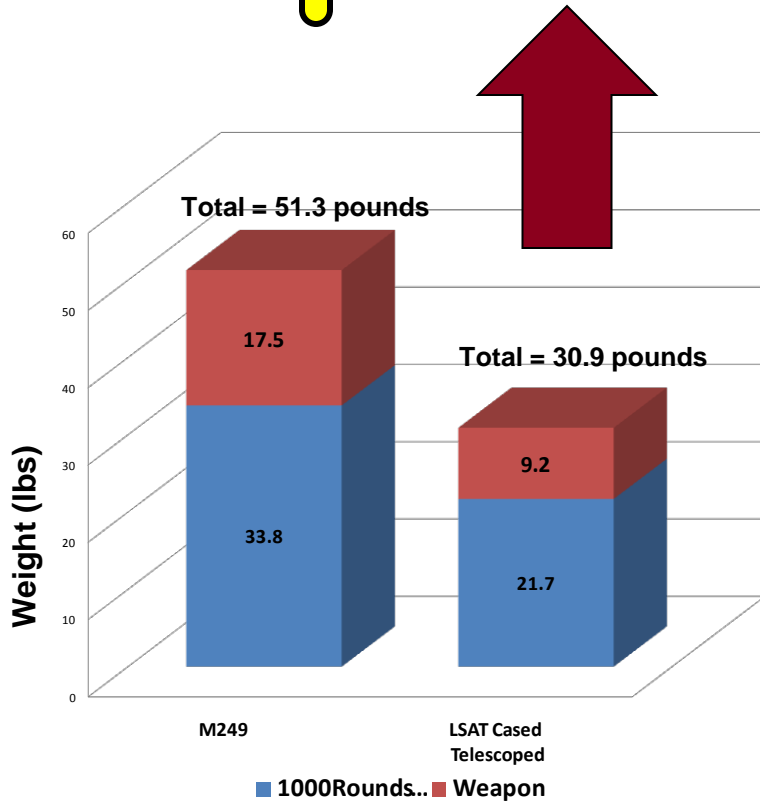
“The **fighting load should not exceed 48 pounds**, and the **approach march load...should be less than 72 pounds**...the primary consideration is not how much a soldier can carry, but how much he can carry without impaired combat effectiveness – mentally or physically.” (Army FM 21-18)

**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



**20.4 pounds of weight savings for the SAW Gunner**



We do it for *these* guys



The CT LMG provides a weight savings of over **THREE TONS** for an infantry BCT

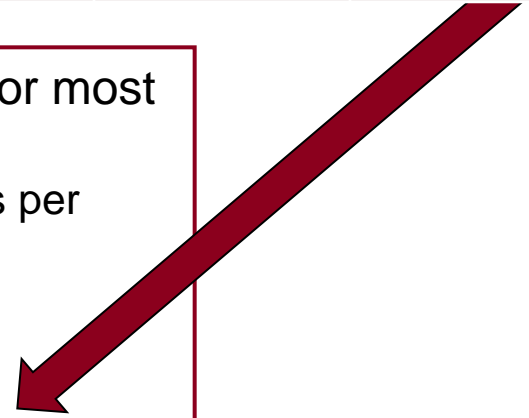
Unit	# of SAWs	CT Ammo Weight Savings	CT Weapon Weight Savings	Total Weight Savings
Individual	1	12	8	20
Squad	2	24	17	41
Platoon	6	73	50	123
Company	18	218	149	367
Battalion	54	653	448	1,101
BCT	328	4,438	2,722	7,160

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:

- 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
- 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:**
  - Reduced felt recoil over current SAW
  - Improved accuracy (based on preliminary testing)
  - Designed for increased reliability over SAW
  - Designed for reduced weapon maintenance
  - Thermal management decreases possibility of cook-offs
  - Selectable semi-automatic mode 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 effectiveness of entire squad



## ***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



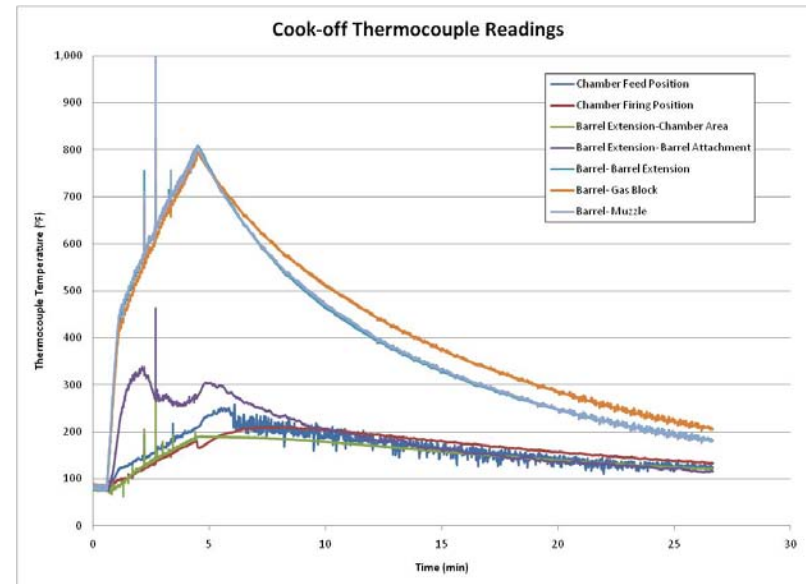
Caseless Light Machine Gun





- 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



- Attitudes Test:
  - 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

*Muzzle Up  
Orientation*

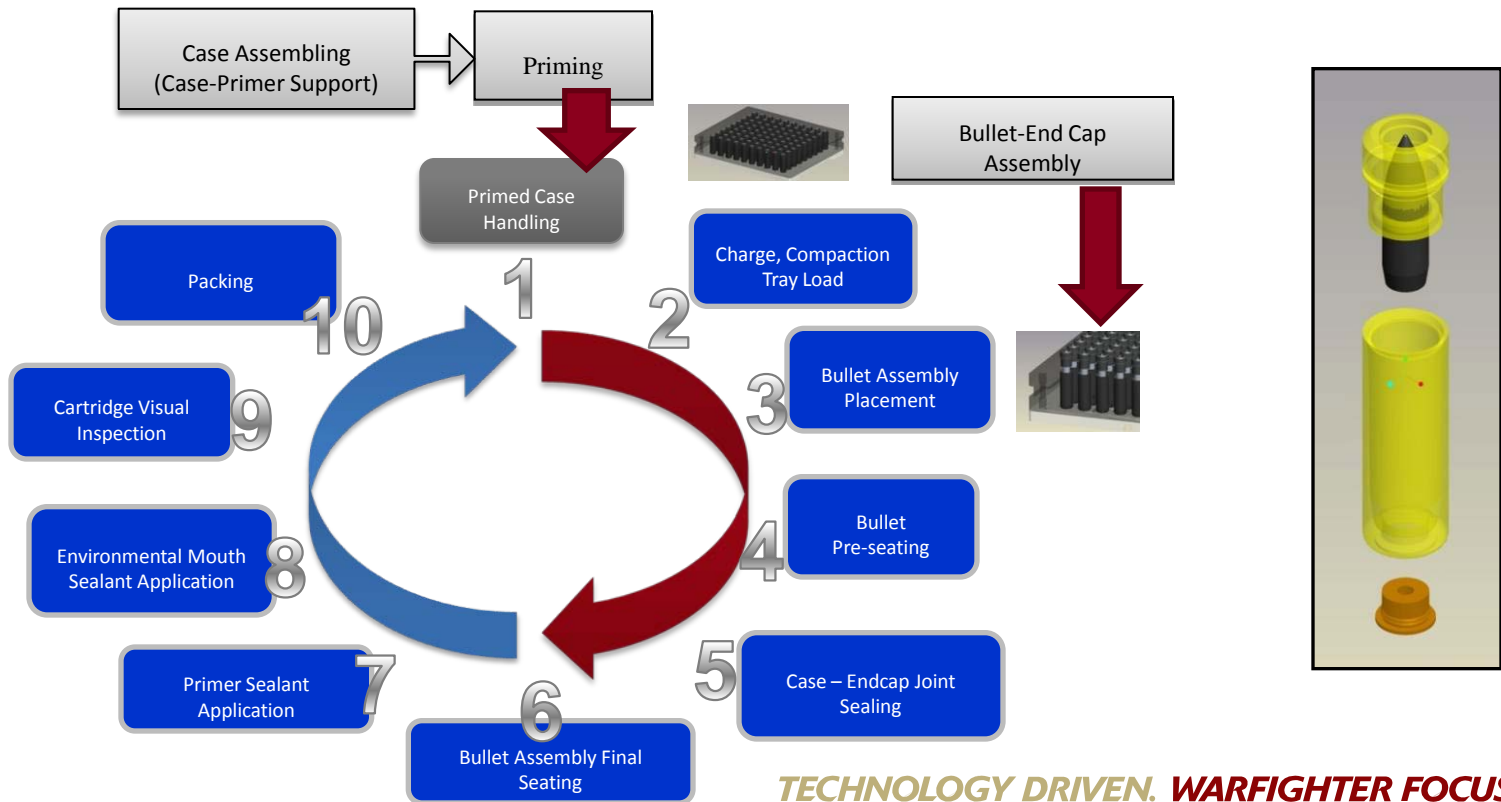


- Noise Test:
  - Compare weapon noise to M249 noise
  - Four microphones set up around weapon
  - Peak noise values were equivalent
  - Noise durations were slightly less for LSAT





- Ammunition Pilot Plant:
  - 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





- 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:
    - 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.

- Canada Activity: meeting with Canadians – DRDC and Colt Canada on 7 April
  - Each country provided technical and programmatic updates
  - Demonstrated CT LMG SN4
  - Canadians interested in buying CT Ammo and components for electronic ignition

**RDECOM Guidance:** 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.

**ARDEC Recommendation:** 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

**What to watch for:** 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!



- **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!**

