



U.S. Army Research, Development and Engineering Command



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Lightweight Small Arms Technologies
May 2010

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Program Goals:

- Fill critical operational needs
- Revolutionize weapons and ammunition
- Mature technologies for transition
- Maintain affordability of current systems
- Alleviate logistics burdens



Approach:

- “Clean Slate” design
- Trade studies - reduced weight is priority
- Extensive modeling & simulation
- Incorporate User feedback



- Inability to sustain operations at high tempo without significant fatigue, affecting warfighter effectiveness
- Inability to execute missions in difficult terrain or at high elevations without reducing combat load
- Inability to maneuver effectively around obstacles, in buildings or vehicles
- Weapons and ammunition are 2 out of the 5 heaviest items warfighters carry





- Significant weight and size reductions for small arms systems, with improvements to key system capabilities
 - Lighter weight weapons
 - Lighter weight ammunition
 - Reduced ammunition size/volume
 - Compatible with full range of ancillary devices
 - Improved system accuracy
 - Improved system reliability
 - Reduced system maintenance and training requirements





| | M855 Brass Cased Ammo | Cased Telescoped Ammo | Caseless Ammo |
|----------------------------|-----------------------|-----------------------------|-----------------------|
| Weight (600 rounds) | 20.8 lbs | 12.7 lbs | 10.1 lbs |
| Cartridge | | | |
| Propellant | Ball Powder | Ball Powder – Flash Reduced | HMX Based |
| Case | Brass | Polymer | None |
| Weight | 12.2 grams | 8.3 grams | 6.3 grams |
| Volume | 0.247 in ³ | 0.215 in ³ | 0.152 in ³ |
| Links | | | |
| Weight | 2.0 grams each | 0.5 grams each | 0.5 grams each |
| Material | Steel | Polymer | Polymer |
| Configuration | Open link | Full circumferential | Full circumferential |
| Ammunition Pouch | | | |
| Weight | 0.25 lbs | 0.28 lbs | 0.28 lbs |
| Capacity | 100 rounds | 150 rounds | 150 rounds |
| Quantity Carried | 6 | 4 | 4 |





Ammunition:



Cased



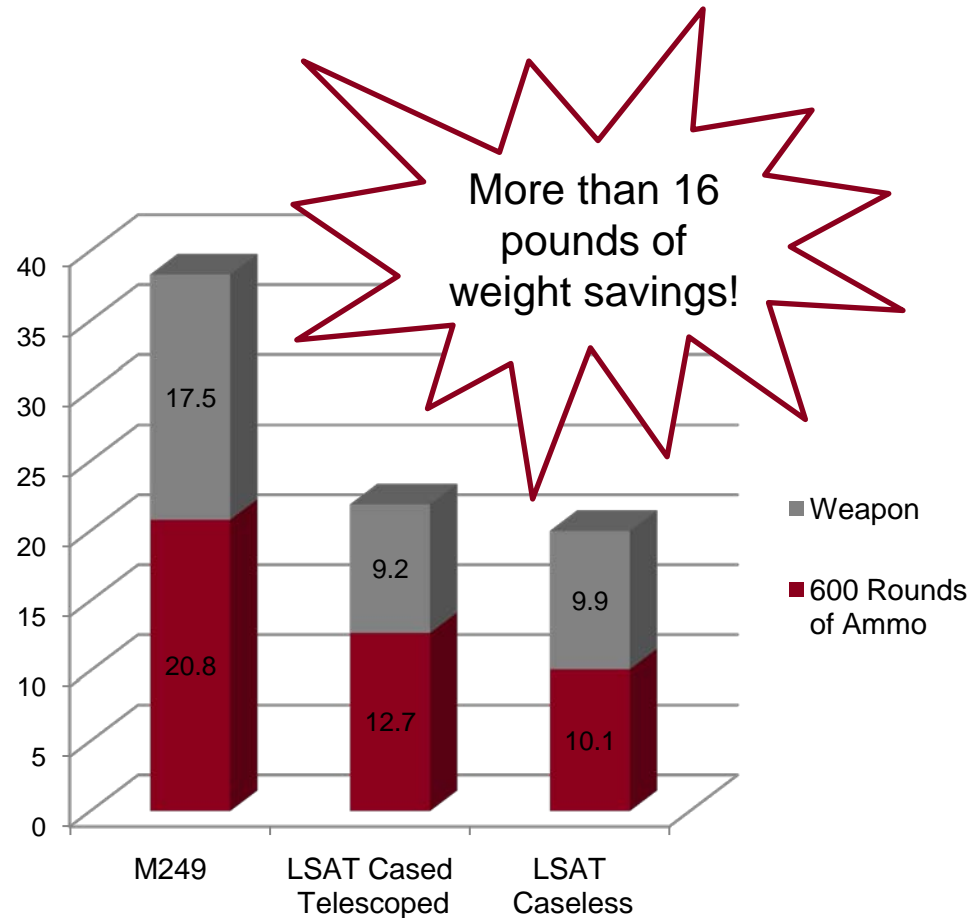
Caseless

- Develop technologies that can be applied across various platforms
- Demonstrate in 5.56mm

Weapon:



- Light Machine Gun (SAW) designs for both Cased Telescoped and Caseless Ammunition





M855 ball rounds provide lethality equivalent to M249

- Key Technologies**
- Use of telescoped ammo: Cased or Caseless
 - Structural configuration & lightweight materials
 - Thermal management
 - Caseless chamber sealing
 - Human factors
 - Integration of electronics

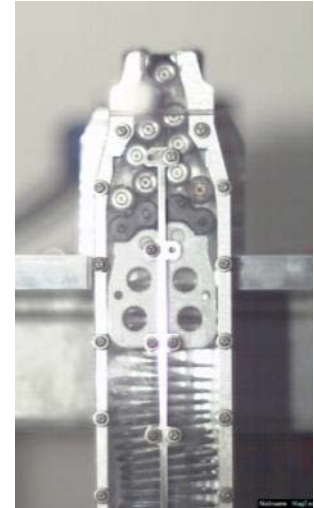


Both cased telescoped and caseless configurations





- Cased Telescoped Rifle:
 - Aft feed, rising chamber design
 - Same overall weight and length as M4, with *4" longer barrel*
 - 24.75" with buttstock folded
 - 42 round magazine
 - Weapon action testing started March 2010



Ejection Port

Charging Handle

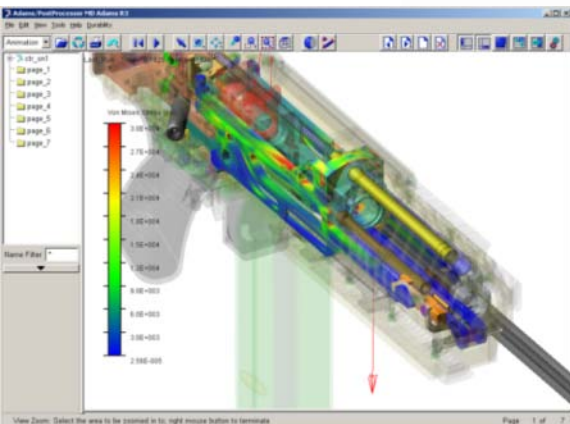
Selector Lever
(opposite side)



Magazine Release

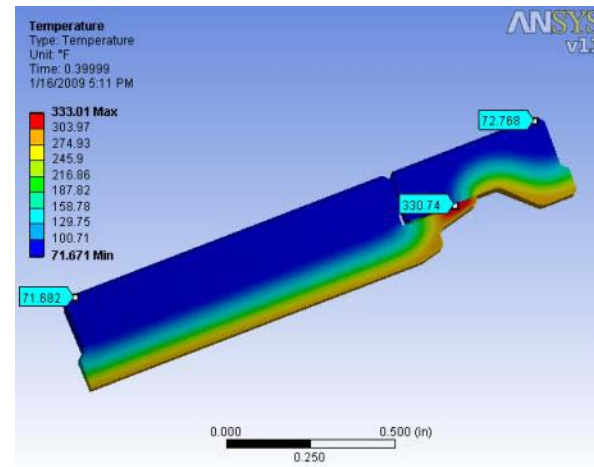


Weapon Action Test Fixture





- Unique features:
 - Two piece sealing chamber
 - Sealed firing pin
 - Gas expansion volume
- Test Status:
 - Firings in semi and full auto modes
 - Muzzle velocity, dispersion, etc.
 - Fired almost 500 rounds of caseless ammo
 - Two VIP demos conducted
- Future testing activities
 - Safety testing
 - Shoulder firing and demos
 - Wear, erosion, and reliability
 - TRL 5 demo





- Spiral 2 development completed:
 - Same basic formulation as HITP
 - Small pilot plant set up for fabrication
 - Over 1,000 rounds made, 500 tested
 - 50% weight reduction, 38% size reduction
- Spiral 3 development underway:
 - Replacement of legacy energetic binder (PNP)
 - One "quick-look" formulation using polyethylene glycol (PEG)
 - Mixing/molding studies completed
 - Testing showing promising results
 - Alternate binder formulation
 - Matrix of materials vs. key characteristics established
 - Includes non-energetic and energetic binders
 - Energetic binder selected (9-DT-NIDA)
 - Manufacturing process/facility study ongoing





- CT LMG SN1:
 - Fired over 8,600 rounds (300 last week!)
 - Conducted numerous live fire demos
 - Analyzed system characteristics
 - Weight: 9.97 lbs



CT LMG SN1 and SN2

- CT LMG SN2:
 - Fired over 2,200 rounds
 - Converted to fire Spiral 3 CT Ammo
 - Weight: 9.81 lbs



Live Fire Demo
at Ft. Benning

- CT LMG SN3:
 - *Weight reduced to 9.21 lbs*
 - Designed to incorporate lessons learned
 - Includes barrel handle, new bipod, new buttstock, updated housing, etc.
 - Over 250 rounds fired on weapon action
 - Integrated weapon testing to start in May



CT LMG SN3



Belt of CT Spiral 2 Ammo



- Spiral 2: Over 10,000 rounds fired
 - Mann Barrels and machine guns
 - Temperatures from -65F to +160F
 - 35% weight reduction

- Spiral 3: Over 1,600 rounds fired
 - 400+ fired from Mann barrel
 - Also fired from LMG's SN2 and SN3
 - Compacted propellant
 - 13% volume reduction
 - 41% weight reduction
 - Pilot production being established

CT
Spiral 1

CT
Spiral 2

CT
Spiral 3





- 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
 - Available for User demo by request
- Planning for Military Assessment:
 - Demonstrate military utility of lighter weight weapons and ammunition
 - Hardware available in May 2011
 - 8 Light Machine Guns and 100,000 rounds of CT Ammunition
 - Demo ties in to ICD and roadmap for future small arms





- Initial Capabilities Document: (aka Battle AXE)
 - Draft version 0.6 dated 16 April 2010, final draft planned for May
 - Joint document, with input from all services
 - Based on capability gaps identified in Capabilities Based Analysis (CBA)
 - Timeframe is 2015-2025
- Timeline:
 - Transition/Milestone B dependent on approval of requirements and funding
 - Once transitioned, 2-3 years for EMD, 1-3 years for Production & Deployment
 - Potential first unit equipped as early as 2016 (depends on final configuration)



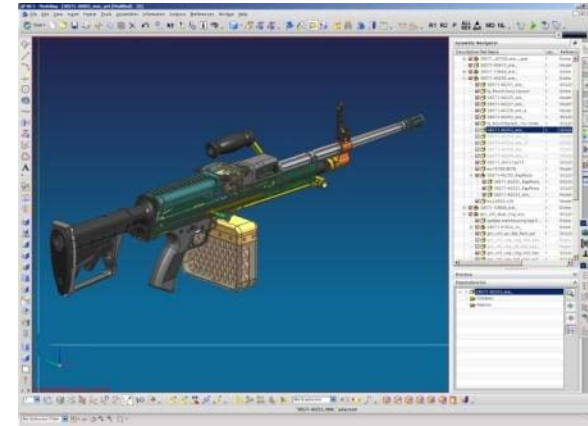


- Ammunition:
 - 5.56mm Cased Telescoped (TRL 5 now, TRL 7 in Apr 2011)
 - 5.56mm Spiral 3 Caseless (TRL 5 scheduled for Dec 2010)
 - Alternative projectiles possible in either CT or Caseless
- Weapons:
 - 5.56mm CT Light Machine Gun (TRL 6 now, TRL 7 in Apr 2011)
 - 5.56mm Caseless Light Machine Gun (TRL 5 scheduled for Sep 2011)
 - 5.56mm CT Rifle (TRL 5 planned for Jul 2011)
 - 5.56mm Caseless Rifle (basic design exists)
- Scalable design provides significant modularity and commonality





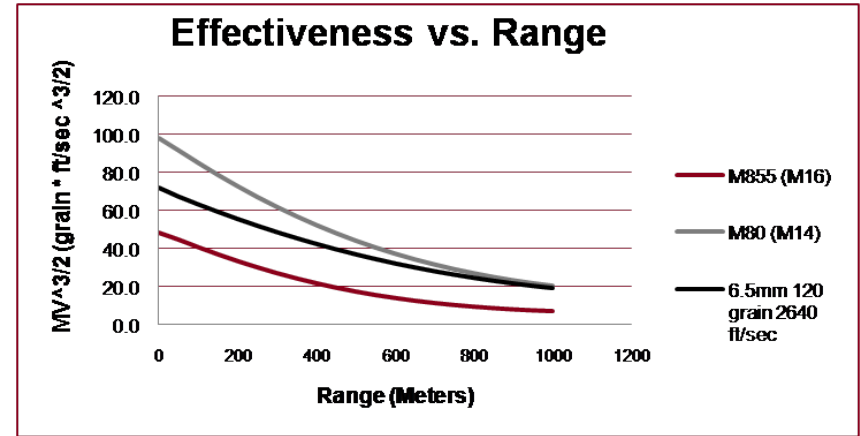
- Weapon:
 - Current weapon costs used as baseline
 - Optimized for manufacturing and maintenance
 - Uses readily available materials
- Cased Telescoped Ammunition:
 - Uses conventional molding process
 - Can be outsourced to multiple suppliers
 - Adaptable to current assembly line
- Caseless Ammunition:
 - Previous efforts proved feasibility
 - Current efforts focused on reducing cost
 - No reliance on price of brass





Flexible/modular technologies can be applied to:

- Ammunition calibers/configurations
 - "Intermediate" calibers
 - Integration of LFS/SOST
- Weapon configurations
 - Rifle (in work)
 - Medium Machine Gun
 - Sniper Rifle



• Platforms:



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



- Reduced weight and volume improves storage and handling



- Decreased need for resupply reduces fuel costs and associated hazards





- Improves Reliability
 - Fewer stoppages as a result of simplified feed & extraction
 - Reduces cook-off as chamber is thermally isolated
 - Reduces weapon powering requirement with lighter belt pull loads
- Improves Maintainability
 - Reduces maintenance intervals with low friction coatings
 - Simplifies field stripping with modular assemblies
 - Spares support levels consistent with current systems
- Durable Construction
 - No sacrifice of durability for weight reduction
 - Optimal mix of conventional metals/composite materials
 - Will undergo full spectrum of qualification tests





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"Weight is the currency with which we buy capability"

LTC Glenn Dean, US Army

