US ARMY RDECOM

U.S. Army Research, Development and Engineering Command

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Lightweight Small Arms Technologies

May 2009

Lightweight Small Arms Technologies

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Question #1: Why do we need to make weapons and ammunition lighter?

"Today, the average soldier load consists of a rucksack, weapon, ammunition, helmet, and other gear; the total weight can range from 63-130+ pounds depending on the variables of mission type, duration, and environment."

"…infantry Soldiers carrying a load of 101 pounds for 12.5 miles had a decrease of 26% in marksmanship (number of targets hit), a 33% increase in distance from the target center, and an increase in back pain compared to pre-load and march scores."

GEN Peter W. Chiarelli
Vice Chief of Staff, United States Army
Before the House Appropriations Committee
Subcommittee on Defense
March 11, 2009

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Question #2: How is this different from other efforts to lighten the load?

- Three main issues with polymer 5.56mm ammo:
  - Heat build-up in chamber
  - Unsupported area of case
  - Extraction loads

- LSAT:
- → Separate, rotating chamber
- → Fully supported cartridge case
- → Push-through feed and eject

- Purpose-designed weapon:
  - Make it lighter without losing any capability
  - Barrel length, muzzle velocity, range, dispersion, rate of fire…
  - Total weapon weight: 9.5 lbs (45% less than current)
- Modeling & Simulation:
  - 15 different M&S tools used
  - Everything from internal ballistics, finite element analysis, and thermal analysis, to dynamic function of the complete system
  - We even model Life Cycle Cost, training requirements, and maintenance…

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Question #3: Why are you doing CT, instead of focusing only on CL?

- Three main reasons:
  - Low risk
  - Significant weight reduction
  - Provides baseline
- Cased Telescoped Ammunition:
  - Over 10,000 rounds fired
  - Temperatures from -65F to +160F
  - 35-40% weight reduction
  - 10-15% volume reduction
- Cased Telescoped Light Machine Guns:
  - Conducted 4 major live fire demos
  - Beginning fabrication of third weapon
  - 45% weight reduction

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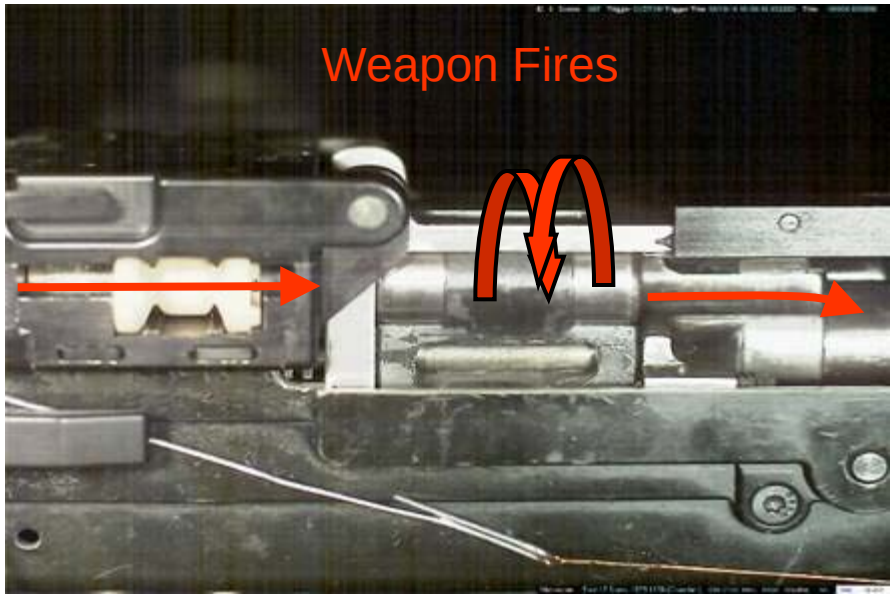
Question #4: What's the deal with that "rotating" chamber?

- Straight through feed and eject:
  - Allows use of cylindrical ammunition and circumferential polymer links
  - Increases reliability
  - No ejection groove required
- Ammunition fully supported in chamber:
  - Allows use of lightweight polymers with no additional reinforcement in base
- Thermal Management:
  - Isolated from barrel
  - Movement disperses heat

Cartridge Rammed From Feed Tray

Spent Cartridge Ejected from Chamber



Chamber Rotates into Feed Position

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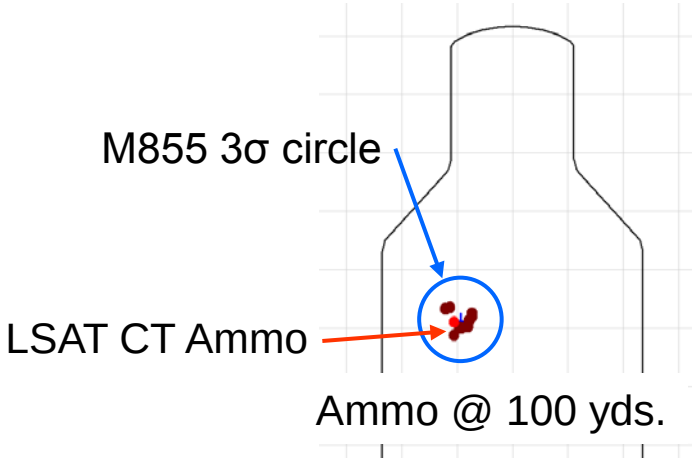
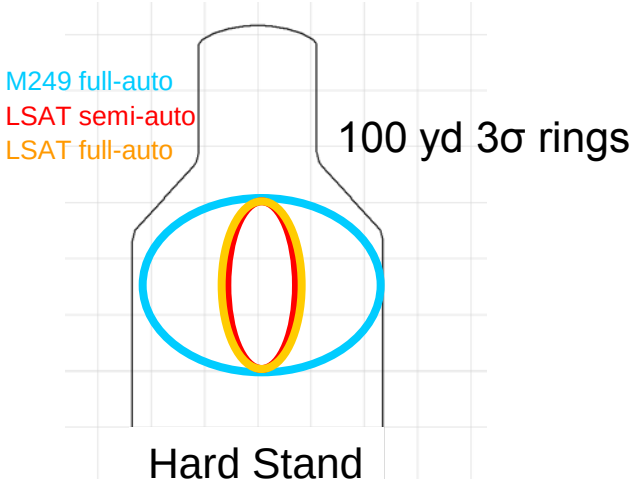
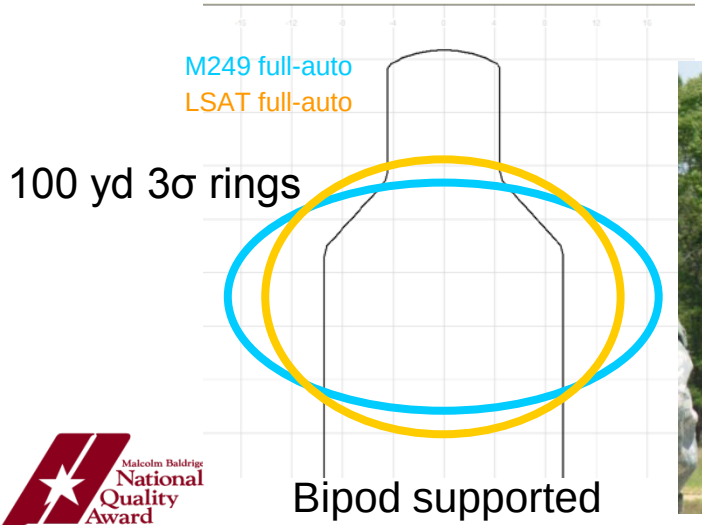
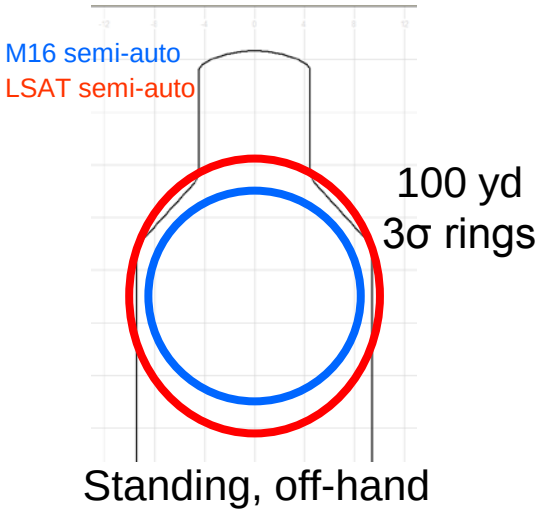
Question #5: What kind of dispersion does the CT system have?









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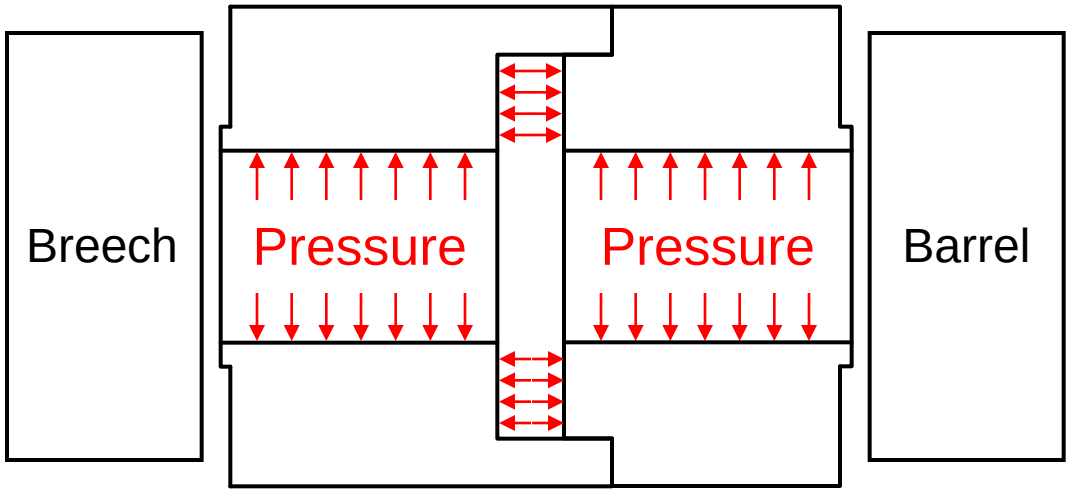
Question #6: How do you seal the caseless chamber?

- Two piece sliding chamber
  - Seals at breech and barrel faces
  - Allows expansion of propellant gases
- Sealed firing pin uses rotating motion rather than linear motion

Propellant ignition pressurizes the chamber



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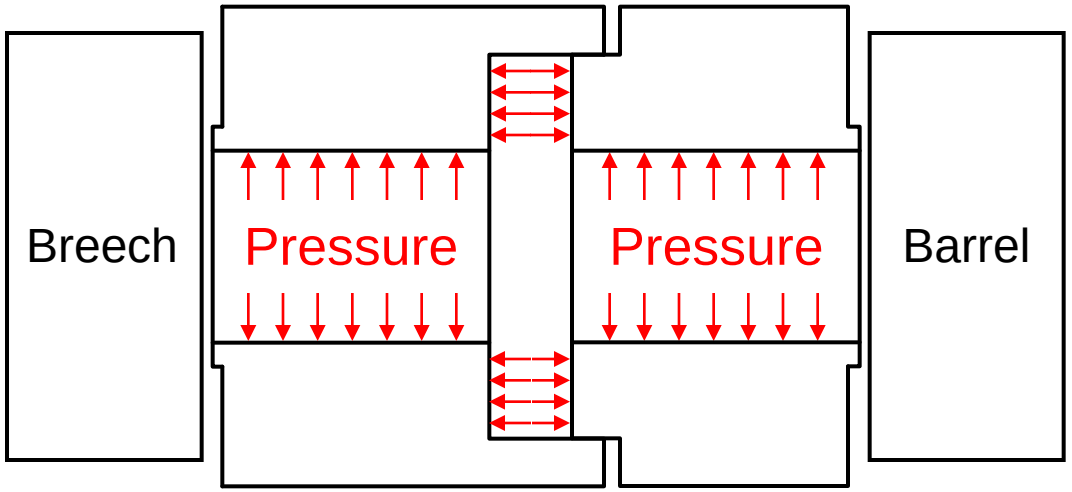
Chamber pressure acts on axial faces to spread chamber segments apart



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Question #6: How do you seal the caseless chamber?

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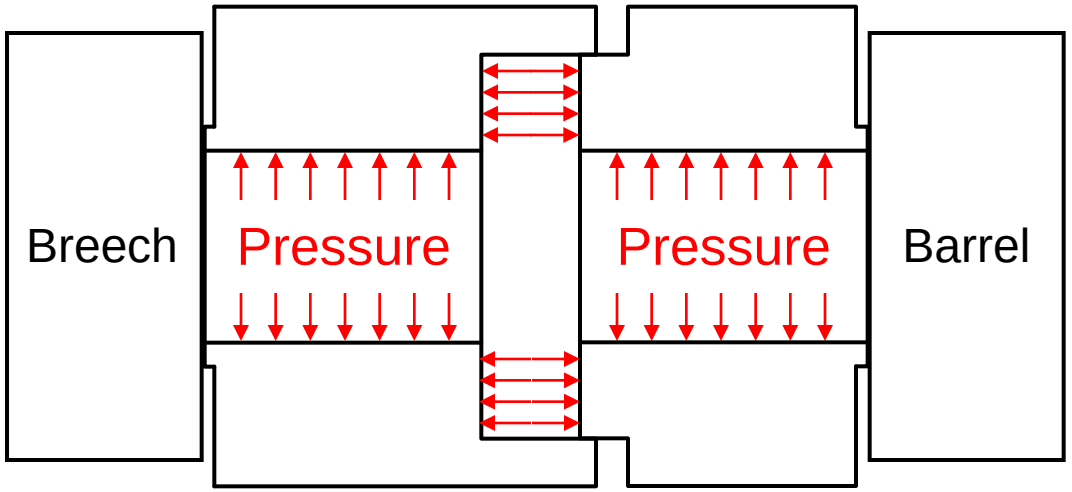
Chamber pressure completes spreading chamber segments apart



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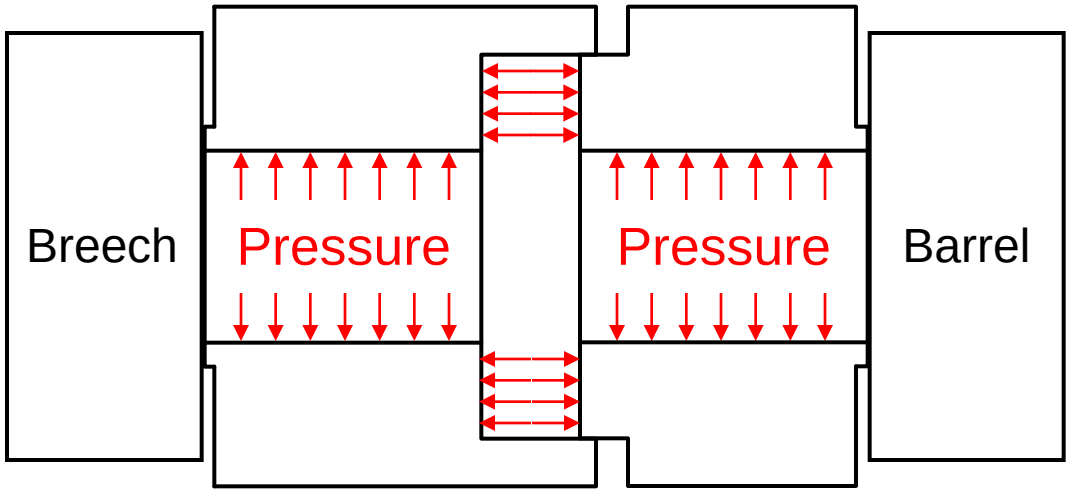

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Question #7: What gets ejected from the caseless weapon?

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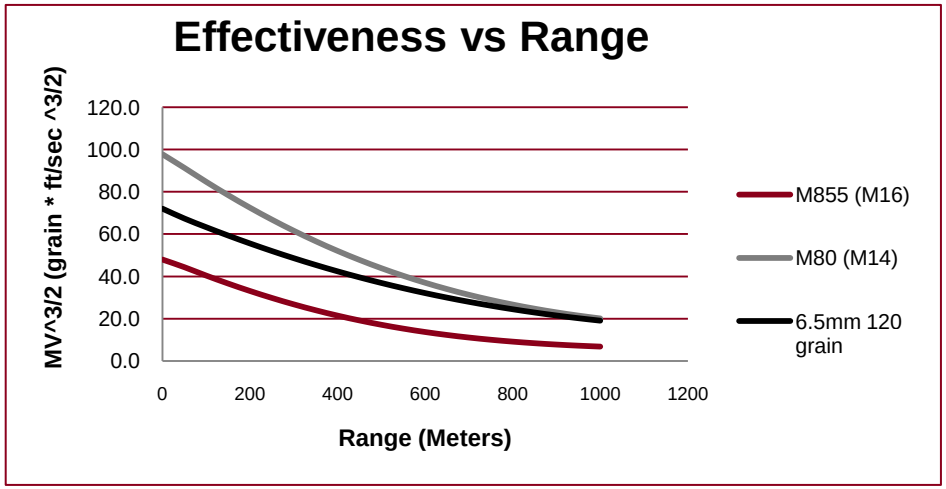
Question #8: Where else can we apply this technology?

- Ammunition calibers/configurations
  - Investigating "intermediate" calibers
  - Evaluation of Green Ammo projectile
- Weapon configurations
  - Rifle (in work)
  - Medium Machine Gun
  - Sniper Rifle



- Applications:

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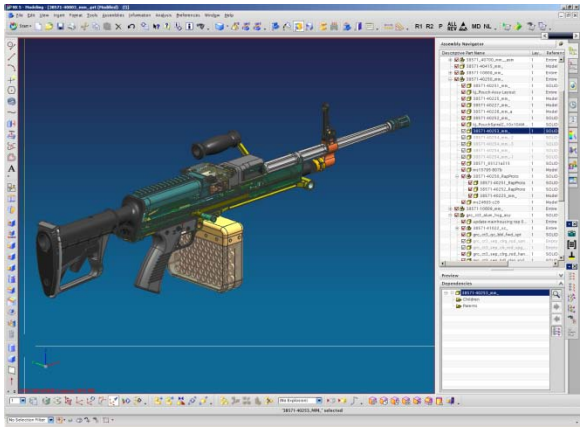
Question #9: Is it affordable?



- Weapon:
  - Current weapon costs used as baseline
  - Designed for ease of manufacturing and maintenance
  - Uses readily available materials

- Advantages of polymer
  - Uses conventional molding process
  - Can be outsourced to multiple suppliers
  - Adaptable to current assembly line

- Caseless :
  - Previous efforts proved feasibility
  - Future efforts focused on reducing cost

- Relative cost :

M1 Tank - $4.5 M

JSF- $83 M

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Question #10: When is this going to be fielded?

- Joint Capability Technology Demonstration
  - Purpose: to demonstrate military utility of lightweight small arms technology
  - Timeframe: Demonstration in 2011
  - Status: On hold pending DA approval

- Field Assistance in Science and Technology (FAST) team in Afghanistan
  - LSAT team responded to request for information in April
  - Feedback: "…a lot of people here like your program. If it were more mature, we'd get an ONS out…"

- Demo :
  - Conducted multiple demos already (one for this conference in 2007)
  - Looking to schedule more – USMC, SOCOM…
  - Generate interest, possible requirements

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Questions?