A Path to Overmatch Next Generation Individual Weapon System

by

Jim Schatz

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27 April 2016
A Quick Review

- **2008**
  - Capability Stagnation through Acquisition Dysfunction

- **2009**
  - New & Emerging Material Opportunities

- **2010**
  - Allied Agreement

- **2011**
  - IC - A Missed Opportunity

- **2013**
  - Falling Behind The Threat

- **2014**
  - A Strategic Opportunity

- **2015**
  - How to Counter the Threat
<table>
<thead>
<tr>
<th>Weapon</th>
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<th>PKP 7.62R</th>
<th>SVDS 7.62R</th>
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<td>M4 5.56x45</td>
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<td>PKP 7.62R</td>
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</tbody>
</table>

**Threat +4**

2 additional 7.62R's added
RUS/Chechen SF w/ 26 lb.* 7.62x54mmR PKM’s
From their Intl Trng Cntr for Special Forces Facebook page – Mar. 2016
**SO what have we learned since 2008?**

- The threat (RUS, ISIS, al-Qaeda, others) continues to exploit the stand-off advantages (800+ meters) of 7.62x54mmR weapons (PKs/SVDs) beyond 5.56mm NATO effective range (500 meters).

- The US & NATO acknowledge this capability gap. Response is:
  - 16+ caliber studies since 2005 (CAN, FR, GBR, GER, USA – RUS?)
  - 2014 US Army Small Arms Strategy spawned SAAC Study

- Key Enablers are available, being fielded/implemented **NOW**
  - Carbine Training to 600 meters (US Army Small Arms MMTC)
  - Disturbed Reticle Carbine Sight (Steiner ICS - Italian Army - 2016)
  - Lightweight Ammo for Legacy Weapons (MAC .50 BMG in SOF)
  - Industry/Govt LICC’s (.260 Rem., LSAT 6.5mm CTA, .264/.277 USA)
  - @ 6 lb. Host Platforms (in 7.62mm) for LICC, LSAT 6.5mm Carbine

- **SO** IW Overmatch Art-of-the-Possible is “fieldable” in 1-3 years.
Exploiting Available Next Generation Technology & Training Can/Will Bring Overmatch to the War Fighter in Short Order

BUT WE MUST ACT NOW!
Exploiting Available Technology = Overmatch
The Medium vs Heavy Machine Gun Example

- TRL7+ Maturity, IR&D Funded by GD-OTS, available now!
- 23 lb. weapon (versus 28 lbs. M240B, 84 lbs. M2HB)
- 1900 meter MER (= .50 caliber M2HB, Threat DShK HMG’s)
- 2X MER and 5X ME (at 1000M) of 7.62x51mm NATO
- .338NM Ammo Weight 1/3 that of .50BMG (+19% in polymer)
- Can replace both MMG (dismounted) and HMG (mounted) using exiting US tripods & mounts

System weight comparison for 10 minutes of sustained fire

<table>
<thead>
<tr>
<th>System</th>
<th>Load Break Down (3 person team)</th>
<th>Load Break Down (9 personnel)</th>
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<tbody>
<tr>
<td>M240</td>
<td>Gunner (wpn, sight 100 rd) 37 lbs</td>
<td>3 personnel (Weapon) 84 lbs</td>
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<td></td>
<td>A. Gunner (Trpd, S.Brl 300 rd) 37 lbs</td>
<td>1 person (Tripod) 44 lbs</td>
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<td>Ammo Bearer (400 rds) 27 lbs</td>
<td>1 person: (sp barrel and ACOG) 27.5 lbs</td>
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<tr>
<td>MMG .338 Variant</td>
<td>Gunner (wpn, sight 100 rds) 37.5 lbs</td>
<td>4 personnel (100 rounds each) 132 lbs</td>
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<tr>
<td>M192 Tripod</td>
<td>A. Gunner (Trpd, Sp Brl, 100 rds) 29.2 lbs</td>
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<tr>
<td>Spare Barrel</td>
<td>Ammo Bearer (300 rds) 36 lbs</td>
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<tr>
<td>800 Linked Rds 53 lbs</td>
<td>Total 101 lbs</td>
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<tr>
<td>500 Linked Rds 60 lbs</td>
<td>Total 102.7 lbs</td>
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<tr>
<td>400 Linked Rds 132 lbs</td>
<td>Total 287.5 lbs</td>
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So let’s do this for the rifleman (70-80% of our small unit, rifle squad, SOF team members)
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<th>Caliber</th>
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We must now focus on individual squad weapon overmatch.

Go from 5 to 2 Calibers/Cartridges! (5.56, 7.62, .300, .338, .50 to LICC and .338NM)
Next Gen IW Capabilities List

- Extended Stand-off Range (=/> existing, emerging threats)
- Improved PID, pH (point target), pS (suppression)
- Improved Speed of Target Engagement
- Improved Terminal Effects/pi (all ranges)
- Reduced Load (Ammo, Weapon, Soldier Combat Load, Transport)
- Family of Weapons (Mission-Tailorable SCW through SDMR/IAR)
- Open Architecture (for varying missions/AO’s, UMNS response time)
- 24/7 Signature Reduction (Flash, Sound, Blast, Location)
- Reduced Cost Burdens & Response Times
  (Development, Procurement, Life-Cycle Sustainment)
- Commonality (training, parts, operation, enablers)
- Superior Function (Safety, Performance, Reduced Maintenance)

ALL POSSIBLE TODAY WITH A LICC IW!
Incremental Advantages
Waiting to be Exploited

Safety
- Cook-off =/> 270 rds.
- Barrel failure =/> 900 rds.
- OTB Capable (0 second drain time)
- Sustained Fire Rate > 300 RPM

Reliability =/> 18,000 MRPF/S

Mission/AO Tailorable
- Quick-Change barrels, stocks, trigger groups
- Caliber Convertible
- Convertible Feed System
- Reduced life-cycle costs

Safety
- Cook-off =/> 270 rds.
- Barrel failure =/> 900 rds.
- OTB Capable (0 seconds)

pH =< 1 MOA

Terminal Effects ("Lethality")
- "Blind to Barrier" projectiles
- "Intermediate Caliber" options
- Increased Terminal Effectiveness
=/> 7.62mm NATO against unprotected and protected point targets out to 800 meters w/ 1/3 < recoil

Reliability =/> 18,000 MRPF/S

System weight
- =< 2.8 kg (6.1 lbs.) w/ an 800m MER
- LW ammo (27-36%)

Maintenance
- 72% < operator cleaning
- > 3X bolt service life
- > 3X barrel service life
- 2X receiver service life

Same Advantages for a Bullpup Configuration
For the 140K “Front Liners”

800 m. Disturbed Reticle Sight

LICC IW (.264 USA) (w/o 24/7 Suppression)
10.7 pounds
CURRENT (March 2016)

LICC Cartridge + “Blind to Barrier” Projectile = Overmatch

● +300m MER v. M4
● > pH to 800m
● Improved pl/K
● Reduced Signature 24/7
● Mission Tailorable (modular)

ALL NEXT GEN CAPABILITIES (Slide 11)

Next Gen LICC IW (with 24/7 Suppression)
9.98 pounds
Ready 1-3 Years
Cartridge Comparison

Left to Right
- 5.45x39mm 7N6 FMJ
- 5.56x45mm M855A1 EPR
- 7.62x54mmR 7N1 Sniper FMJ
- LICC (.264 USA) Polymer 108 gr. OTM
Comparison of Cartridges
USA vs. Threat vs. LICC

Combat Load Comparison
(Qty of Rounds at 5.25 lbs. Weight. US M4A1 Basic Load = 210 rounds)

<table>
<thead>
<tr>
<th>Caliber/Cartridge</th>
<th>5.45x39mm (53 gr. 7N6 FMJ)</th>
<th>5.56x45mm (62 gr. M855A1 EPR)</th>
<th>7.62x54mmR (151 gr. 7N1 Sniper FMJ)</th>
<th>.264 USA Poly (6.5x48mm) (108 gr. OTM)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Rounds</td>
<td>210</td>
<td>210</td>
<td>112</td>
<td>168</td>
</tr>
<tr>
<td># of Rounds</td>
<td>98 (147 grain 7.62x51mm US M80 Ball)</td>
<td></td>
<td>120 (108 gr. Brass Case)</td>
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</tbody>
</table>
System Weight (Weapon + Sight)

(1) Systems as defined on Slide 15
Comparison of Systems
USA vs. Threat vs. LICC IW

AK74M w/ ACOG\(^{(1)(2)}\) 5.45x39mm
8.87 pounds. 16.3” bbl. 30-rd mag.
(14.1 pounds with 210 rounds)\(^{(4)}\)

US M4A1 w/ ACOG\(^{(2)}\) 5.56x45mm
8.67 pounds. 14.5” bbl. 30-rd mag.
(13.9 pounds with 210 rounds)\(^{(4)}\)

SDVS w/ PSO-1\(^{(2)}\) 7.62x54mmR
10.3 pounds. 22.2” bbl. 10-rd mag.
(20.8 pounds with 210 rounds)\(^{(4)}\)

LICC IW w/ DRS\(^{(3)}\) 6.5x48mm LICC
8.60 pounds. 16.5” bbl.\(^{(5)}\) 25-rd mag.
(15.2 pounds with 210 rounds)\(^{(4)}\)

(1) AK74 pictured  (2) Graduated Reticle Sight  (3) Disturbed Reticle Sight (DRS)  (4) Comparable Combat Load to US M4 + 210 rds.  (5) Fluted Barrel
Maximum Effective Range – This is the maximum range at which an average shooter can hit a human-sized target (US E-type Silhouette [20”Wx40”H]) 50% of the time.
By exploiting superior cartridge accuracy on both long-range and smaller partially obscured targets, superior external cartridge ballistics, a full-solution disturbed reticle aiming point and magnified optics, pH is increased through simplified ranging/aiming/target BDA & rapid adjusted follow-up engagements.

This is the best path to achievable IW overmatch.
A Capability Gap exists for 80% of US and NATO riflemen who are armed with 5.56mm weapons. The threat engages friendly forces with 7.62mmR weapons 300+ meters beyond the effective range of 5.56mm NATO ammo. These 5.56mm riflemen have no effective means to engage the enemy.

7.62mm NATO weapons and ammo provide a counter to this threat overmatch but add unwanted weight, cost and recoil to the warfighter.

Paradigm-changing key materials (LICC Ammo, Disturbed Reticle Carbine Sights, Blind-to-Barrier Bullets, LW Modular Weapons & Advanced Training) ARE AVAILABLE TODAY to counter this current threat & emerging threats.

The 140K US “Frontliners” need this capability NOW. It could be transitioned to the support ranks as funding and availability allows.

The DoD or ACOS GEN. Milley/US Army or US Marine Corps or USSOCOM should brief Congress (SEN’s McCain, Ernst, Cotton, the SASC, the HASC) ask for $100M to develop and field the next gen IW and LICC cartridge for our most deployed/at risk weapon system; our “Frontliners”.

Overmatch IW Capabilities can be ours but we must ask for it!
Thank you for your attention!

“Over every mountain there is a path, although it may not be seen from the valley.”

Theodore Roethke

Jim Schatz  schtred@aol.com
Back-up Slides
Polymer Case Enabler

**Game-changer!**

- Greater Effect and MER with Less Weight & Volume
- Enables Paradigm Shift in Weapon Design, Employment
- Increased Stowed Rounds
- Increased Sustained Rate of Fire
- Improved Safety, Reduced Cook-off
- Improved Accuracy

**Weight Reduction**

@ 28-40% over brass (caliber dependent)

**Volume Reduction (CTA)**

@ 12 to 24% (caliber dependent)

**Production, Transport Costs (ROM)**

@ 10-20% lower after initial tooling costs

**First Fielding in 2015 in caliber .50 BMG**
Art of the Possible – Now/Emerging
Time to Challenge the Industry!

Polymer Case Weight Savings (20-40%)

Affordable Individual Weapon FS/FCS

Intermediate Caliber Cartridge Overmatch

Advanced Marksmanship Training

Lightweight Barrels

Advanced Integrated Signature Suppression

Modular/Tailorable Caliber-Convertible Weapon Systems (SCW – LMG)

One-Way Luminescent 24/7 Tracers

Novel Recoil Reduction Technology

Novel Projectile Designs

Polymer Case Weight Savings (20-40%)

Advanced Marksmanship Training

Lightweight Barrels

Advanced Integrated Signature Suppression

Modular/Tailorable Caliber-Convertible Weapon Systems (SCW – LMG)

One-Way Luminescent 24/7 Tracers

Novel Recoil Reduction Technology

Novel Projectile Designs
## “Tailorable” Modular Weapon System
### On-the-Fly “Changing with the Times”

<table>
<thead>
<tr>
<th>CLIN/Item Description</th>
<th>Caliber</th>
<th>Barrel (OL/Type)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Subcompact Weapon, cpl.</td>
<td>ICC</td>
<td>8.5”/Standard</td>
<td>One Common Receiver</td>
</tr>
<tr>
<td>2. Carbine, cpl.</td>
<td>ICC</td>
<td>12.5”/Standard</td>
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<tr>
<td>3. Rifle/IAR, cpl.</td>
<td>ICC</td>
<td>16.0”/Standard</td>
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<td>4. SDMR, cpl.</td>
<td>ICC</td>
<td>18.5”/Standard</td>
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<td>5. LMG, cpl.</td>
<td>ICC</td>
<td>18.5”/Standard</td>
<td>LMG Receiver</td>
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<td>1.A.- 5.A. Barrel Assemblies, cpl.</td>
<td>All</td>
<td>SCW, Carbine, Rifle/IAR, SDMR, LMG</td>
<td>Operator install-able w/o tools/ special tools</td>
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<tr>
<td>1.B.- 5.B Magazines, cpl.</td>
<td>All</td>
<td>10, 20/30, Hi Capacity Magazine</td>
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<tr>
<td>1.C.- 5.C. Accessories</td>
<td>All</td>
<td>Grenade Launcher, Sign. Suppressor, Bayonet, Sights, Slings, etc.</td>
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</tr>
<tr>
<td>1.D- 5.D Kits, Caliber Conversion</td>
<td>5.56mm, 7.62mm</td>
<td>Includes bolt, barrel, magazine. For support troops, trng, reverse comp.</td>
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<tr>
<td>1.E.- 5.E Spare Parts</td>
<td>All</td>
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<tr>
<td>1.F.- 5.F Tools, Gauges</td>
<td>All</td>
<td>To include Manuals</td>
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ICC - (Intermediate Caliber Cartridge)  OL - Overall Length (in.)  Cpl. - Complete
O-T-S Lightweight ICC IW (Polymer CTA)

- .264 (6.5mm) Polymer CTA Intermediate Cal.
- 800/1200 meter MER (33% > 5.56mm)
- < Drift, Drop, > Retained Energy, Penetr.
- ME > 7.62mm M80 Ball at 600 m. & 800 m.
- Shorter than an M4 Carbine w/ stock closed

Operational and Performance Capability

- Reduced Soldier Load – An optimized intermediate caliber CT system will provide lethality equivalent to 7.62mm with significant weight reduction. Example:
  - 0.264” caliber CT system lethality equals 7.62mm at 1,200m
  - Provides 21 lb (43%) weight reduction vs. 7.62mm M240B/M80, same lethality
  - Is 5 lb lighter (10%) than 5.56mm M249/M855, provides significant increase in lethality
- Improved Controllability – long stroke, soft recoil, semi/full-auto firing modes
- Compact Size – 27” (folded, short barrel)
  - Reference- M4: 29.75” (collapsed)

Why not a 11pound 100-round belt-fed ICC Individual Weapon?
O-T-S Lightweight ICC IW (Conventional Polymer)

Small Case Option: .450” Base, 2.60” OAL, 40gr. Case Capacity

AR-10 7.62x51mm - 9.64 lbs

AR-12 264 USA - 7.23 lbs (16” bbl)

M4 5.56x45mm - 6.24 lbs

L: 264 USA (Brass case)
R: 264 USA (Polymer case - 28-31% lighter)

Large Case Option: .471” Base, 2.80” OAL, 53.5gr. Case Capacity

Brass - 24% weight savings - Polymer

.260 Rem. LaRue PredatOBR – 9.98 lbs
(18” heavy bbl, no optics or bipod)
The MER Capability Gap being exploited by our enemies (Insurgents, Russia, China, others)

Infantry engagements are taking place at longer than expected distances.

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<td>US 5.56mm M4, M16 MER with M855A1 EPR</td>
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<td>CURRENT Threat 7.62x54mmR SVD, PKM/PKP</td>
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<td>Saudi Arabian (LWRCI/ATK) “SIX8”</td>
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Capability Gap

General Thoughts on Modern Warfare and Small Arms Technology

1 The asymmetric threat, unencumbered by “western” doctrine and politics, exploits our capability gaps faster than we can react within our cumbersome infrastructure.

2 Kinetic Energy (KE) kill mechanisms (launched bullets, fragments) have been and remain state-of-the-art weapons technology since the 15th century. That will not change anytime soon so we should embrace and improve on it.

3 Man-portable “directed energy” technology is decades away. One cannot “schedule a break through”, regardless of what the sci fi writers and S&T community developers espouse.

4 For the ground combatant, pH and pl/K has not been markedly improved by so-called “Leap Ahead” or “Revolutionary” technology and “Star Wars” S&T projects, yet $B’s have been spent on unrealistic and undelivered promises.
5 Desired Target Effects (direct hits or effective target suppression) depends on aiming and launch “hold proficiency” (marksmanship) be it used for semi, burst or full auto KE fire, air-bursting engagements via accurate lasing, XM25 or “TrackingPoint”-style FS/FCS, or even directed energy “pulses”.

6 Repeatable First Shot hits/kills will never be readily accomplished due to the many “hold” and error factors beyond the control of the operator. Immediate through-optic BDA and rapid adjusted follow-on shots offer the greatest chance of improved target effects, BUT the equipment must provide that core capability to the trained operator.
General Thoughts on Modern Warfare and Small Arms Technology

7 Snipers as “force multipliers” exploit magnified optics, superior weapons, sights and ammunition to increase pH & PI/K at all ranges, especially those beyond assault rifle range. Rifleman can/should leverage that capability by employing affordable “paradigm shifting” precision enablers.

8 Training is paramount to effectiveness BUT advanced hardware enables advanced training and employment.

9 Incremental, available and emerging (and affordable) advancements in small arms, sighting and ammunition technologies offer the greatest return on investment and are waiting to be exploited.
“Infantry Direct Fire Suppression” – Cranfield University
Published 31 August 2009 – Author MAJ M Baker - RIFLES

Looked at past suppression data, studies. Interviewed UK OIF/OEF Combat Infantry Veterans.

Determined the Chief Factors of Small Arms Suppression are:
- Accuracy (proximity of the rounds to the target)
- Kinetic Energy (mass, velocity) of the Projectile
- Volume of Fire (number of rounds passing the target)

The larger and faster the projectile the greater suppressive effect it has when passing the target at a given distance.

UK Operational Feedback: “5.56mm Taliban ignore, 7.62mm worries them, 0.5 scare them”

Path Forward? Intermediate Caliber Cartridge, Precision Weapons, Magnified Optics, True Rifleman Training => Suppression, pH, pI/K
# Emerging Polymer Case Payoff in Weight Savings

Near equal weights (# rounds per caliber/cartridge type)

<table>
<thead>
<tr>
<th>Metallic Cases</th>
<th>Polymer Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD COMBAT LOAD</td>
<td>Approx polymer wghts</td>
</tr>
<tr>
<td>210 rds 62gr M855 = 5.58 LBS</td>
<td>174 rds 108gr 264 USA = 5.56 LBS</td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td>163 rds 123gr 264 USA = 5.56 LBS</td>
</tr>
<tr>
<td>13 rds 108gr 264 USA = 5.55 LBS</td>
<td>155 rds 135gr 277 USA = 5.55 LBS</td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td></td>
</tr>
<tr>
<td>127 rds 123gr 264 USA = 5.55 LBS</td>
<td></td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td></td>
</tr>
<tr>
<td>123 rds 135gr 277 USA = 5.55 LBS</td>
<td></td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td></td>
</tr>
<tr>
<td>97 rds 175gr M118LR = 5.55 LBS</td>
<td></td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td></td>
</tr>
<tr>
<td>104 rds 147gr M80 = 5.54 LBS</td>
<td></td>
</tr>
<tr>
<td>EQUIAL WGT to 5.56 load</td>
<td></td>
</tr>
<tr>
<td>108 rds 135gr M80A1 = 5.51 LBS</td>
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</tr>
</tbody>
</table>

**Basic Combat Load**

- **62 grain 5.56mm M855 (brass case)** = 210 rds
- **108 grain 264 USA (polymer case)** = 174 rds (-36, 17%)
- **123 grain 264 USA (polymer case)** = 163 rds (-47, 22%)
- **135 grain 277 USA (polymer case)** = 155 rds (-55, 26%)
- **147 grain 7.62mm M80 (brass case)** = 104 rds (-106, 50%)
The Cost to Change Calibers

- 2012 Battelle study conducted for JSSAP on the ROM cost to convert production at Lake City Army Ammunition Plant (LCAAP) from brass to polymer-cased telescoped 5.56mm M855 and M856 Tracer ammunition.

- One-time LCAAP Retooling Costs were estimated to be:
  - @ $98M for up to 200M rounds per year
  - @ $160M for up to 400M rounds per year
  - @ $400M for up to 1B rounds per year

- The study’s author was asked what the cost difference would be if tooling was purchased for an intermediate caliber cartridge was produced instead of 5.56mm. His response was “same cost”. So for the same cost the US could not only reduce the load on the war fighter by 20 - 40% using polymer-cased ammunition but could also vastly improve the pH, pl, and pS of the entire small unit by switching to a squad-common ICC.
ROM Cost to Change from 5.56mm & 7.62mm to a Squad-Common Lightweight Intermediate Caliber Cartridge (SCLICC) for Front Line Troops

One Time Costs Estimate: $230 MIL
- SAAC Study = $10M (Department of the Army G-8 estimate)
- New Polymer Ammunition Production Machinery (LCAAP) = $160M (2012 Battelle study)
- Competition/Contract Award – Intermediate Caliber Rifle (ICR) & LMG = $30M
- Logistical Materials – ICR & LMG (gauges, rifle racks, mag pouches, etc.) = $30M

Initial Operational Capability (IOC) Estimate: $653 MIL
- 140K Front Line Ground Combatants
- Intermediate Caliber Rifles (w/ BILI) @ $1400 each x 140,000 = $196M
- Intermediate Caliber LMG’s (w/ BILI) @ $4500 each x 14,000 = $63M
- Intermediate Caliber Optical Sights @ $1000 each x 154,000 = $154M
- Rounds, LICC @ .60 each x 400M (1 year usage) = $240M
- Miscellaneous Ancillary Equipment (LICC unique spare parts, accessories)

Logistical Support (dollars already being spent on 5.56mm & 7.62mm systems)
- Manuals, Training, POI’s, TTP’s
- Spare Parts
- Ranges (LICC SRTA [ballistic match] to use current training ranges)

(1) Total Cost includes One-time Costs.
(2) 140K – Estimated number of current front line combatants (Infantry, Marines, Special Operations Forces)
(3) This funding is already being spent on 5.56mm M4A1 Carbines and M249 SAW’s/M240L’s and ancillary equipment. It could be preprogrammed to the new caliber with little to no increase in overall cost.