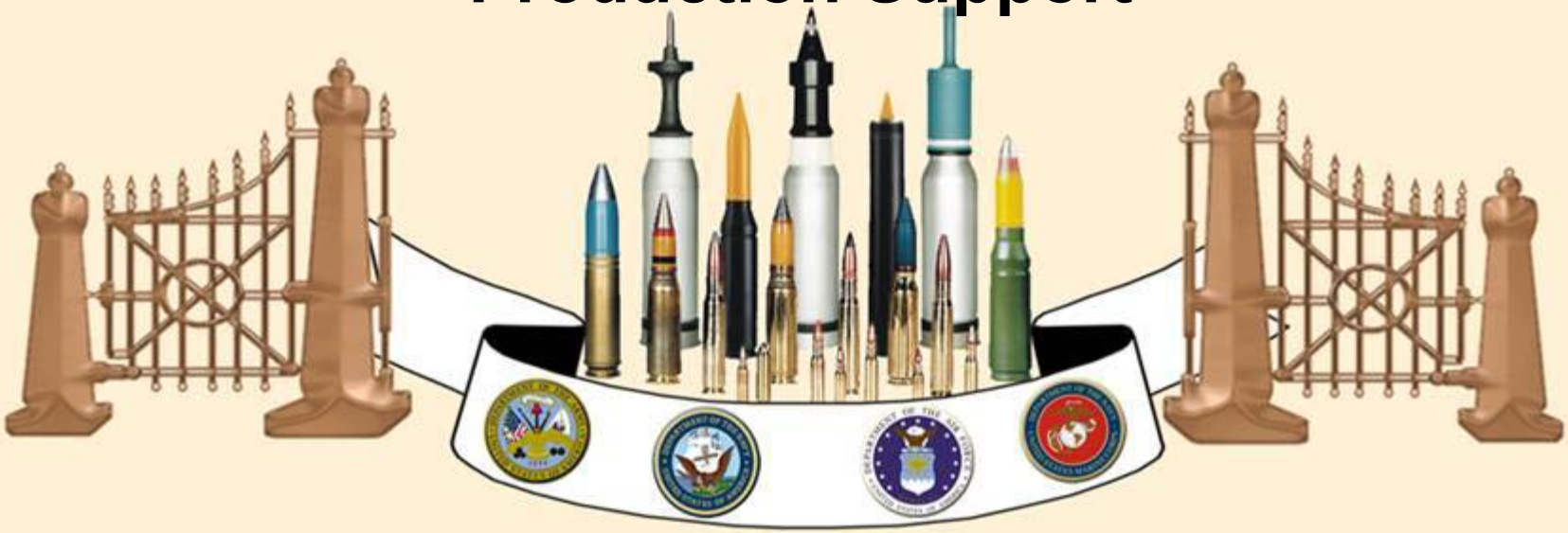
PROJECT MANAGER MANEUVER AMMUNITION SYSTEMS

Small and Medium Caliber Ammunition Production Support



LTC Matthew Butler

14 Jun 05

Reliable, Precise, Lethal

Take Aways

- **Meeting the Warfighters' Needs**

- **Must Continue Emphasis and Progress with:**
  - **Acquisition Strategies that Support Smart Industrial Base Strategies**
  - **Production at High Levels**
  - **Application of Technologies to Improve Products**

Agenda

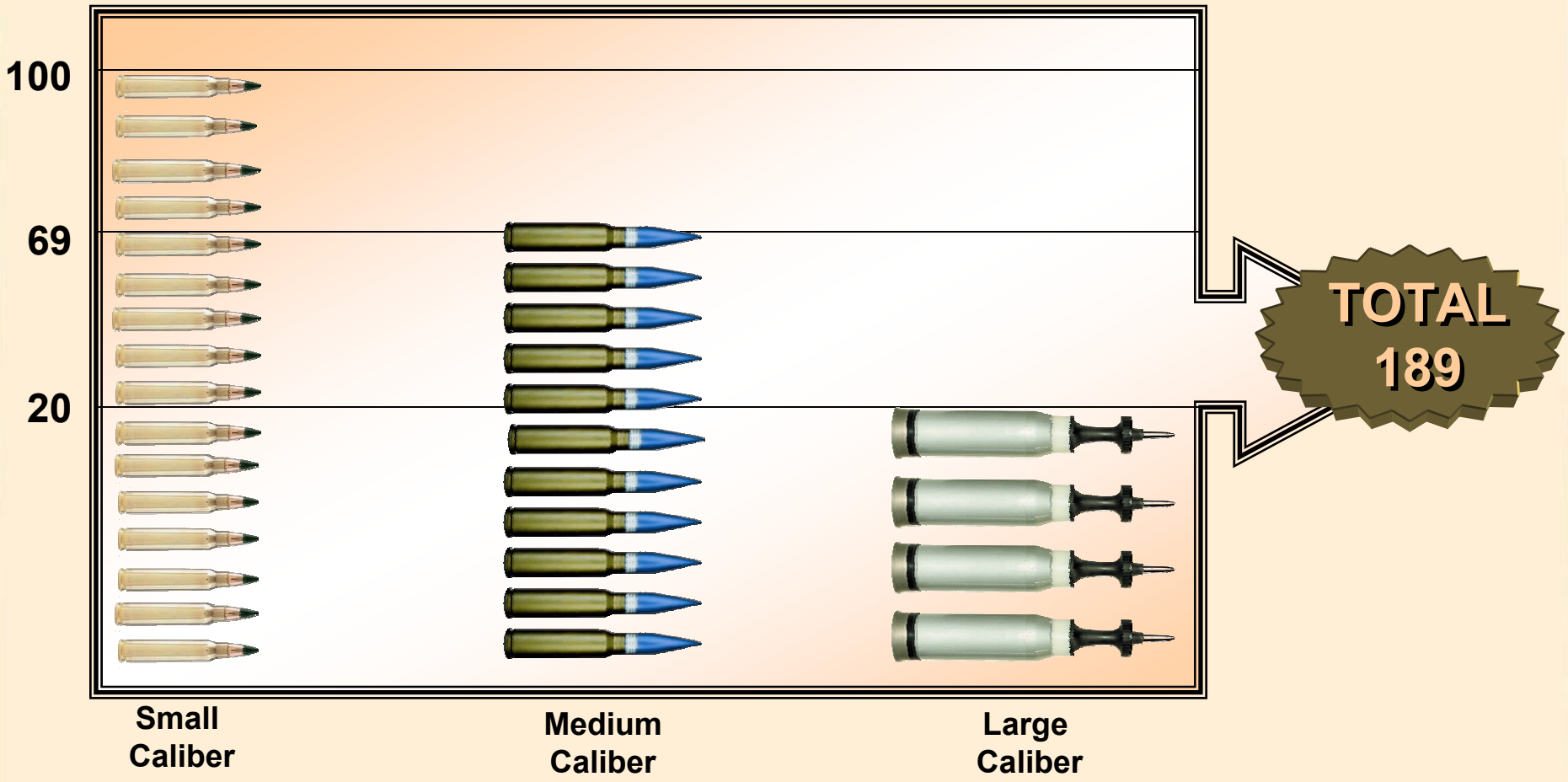
- **Robust Support to GWOT**
- **Acquisition Strategies to Position for the Future**
- **Requirements at High Levels: Contemporary Operating Environment (COE)**
- **Lethality Discussion**

PM-MAS Mission

PM MAS Provides Direct Fire Combat And Training Ammunition Capabilities To Warfighters (Army, Navy, Air Force, Marines) And Government Agencies To Support Dismounted Soldiers, Combat Vehicles, Helicopters, Naval Vessels, And High Performance Aircraft. The PM Does This Through Life Cycle Program Management Of Ammunition In The Following Categories:

Small Caliber
Medium Caliber
Large Caliber
Smart Munitions

Ammunition Products



Robust Support to GWOT

PM MAS
FY05 Production Quantities Projection

Small Caliber (1710M)	5.56MM	1,271M
	7.62MM	273M
	.50 Cal	80M
	9MM	75M
	MISCELLANEOUS	11M
Medium Caliber (21.5M)	20MM	4M
	25MM	1M
	30MM	5.5M
	40MM	11M
Large Caliber (233K)	105MM	.02M
	120MM TRAINING	.2M
	120MM TACTICAL	.013M

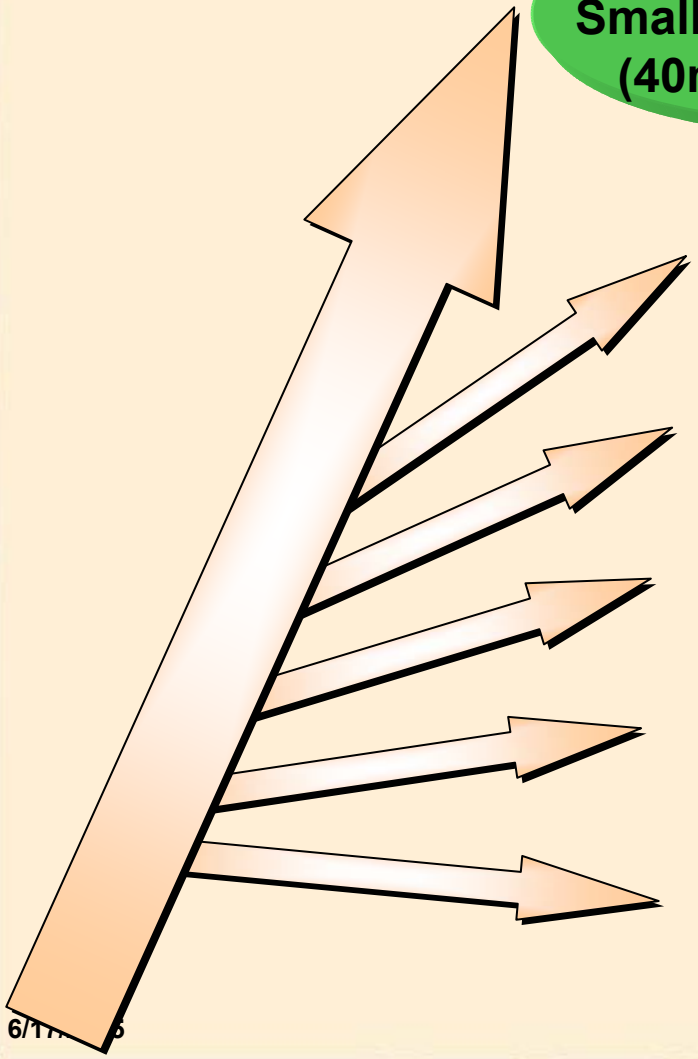
Robust Support to GWOT

Contributions to War on Terrorism (US Army Only)

Rounds / Operation	5.56mm	7.62mm	.50 Cal	Other Small Cal	Small Cal	Med Cal	Large Cal	Total
OIF (Sep 02-Oct 04)	371 M	80 M	25 M	14 M	490 M	12 M	211 K	502 M
OEF (Oct 01-Oct 04)	15 M	6 M	2 M	2 M	25 M	1 M	0	26 M

Robust Support to GWOT

Priority Road Map-Small and Medium Caliber Primary Efforts



 # 1

Small and Medium Cal (40mm) Production

Meet Ammunition Production Requirements for Warfighters

 # 2 — **Second Source Execution** — **Augment Small Cal Production Base**

 # 3 — **40MM Systems Contractor** — **Implement Systems Contractor Approach**

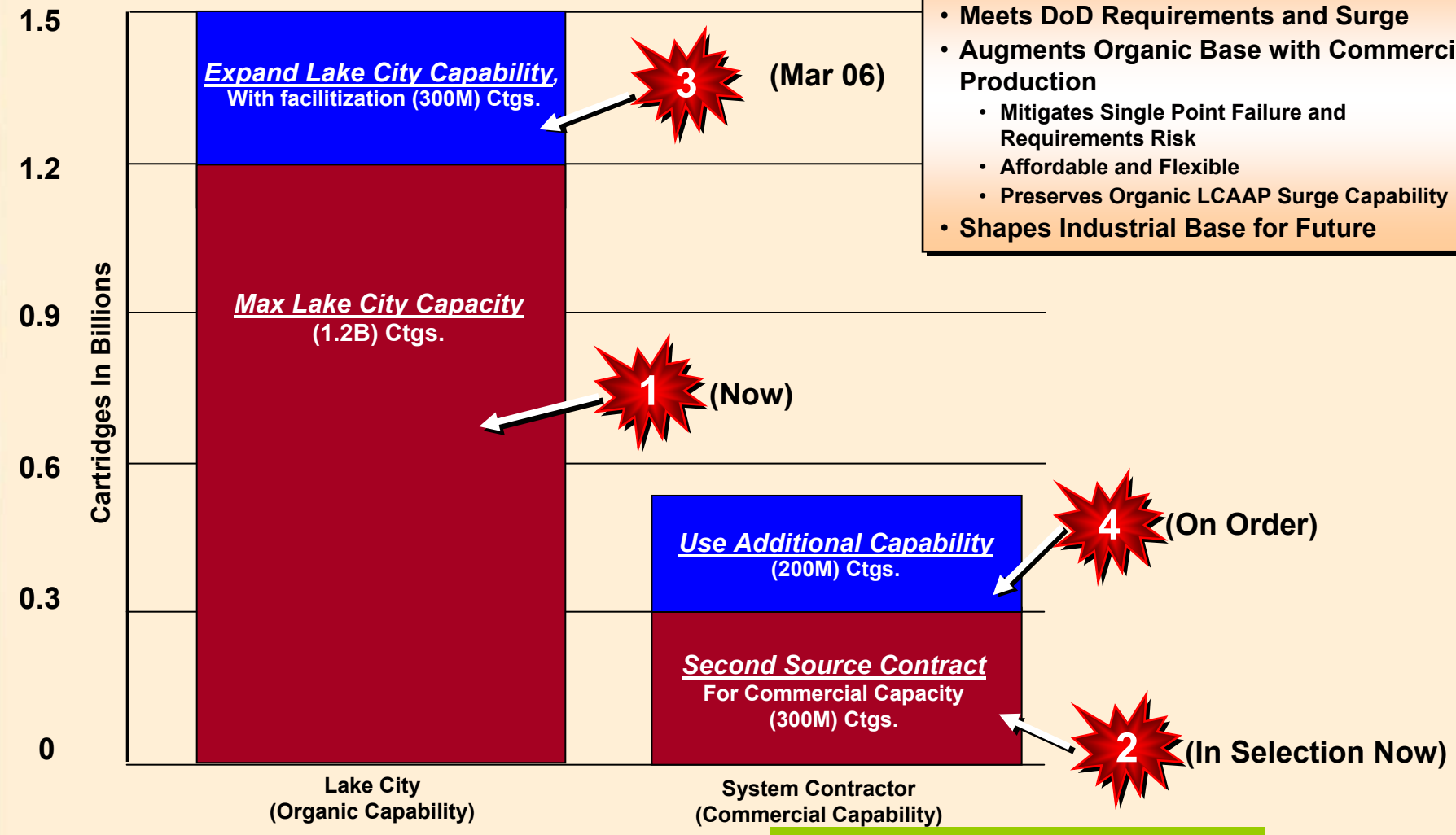
 # 4 — **Packaging Initiatives** — **Rapidly Improve Packaging**

 # 5 — **Lake City Modernization** — **Position This Strategic Asset for the Future**

 # 6 — **Positioning for the Future** — **Green Ammo, Lethality Study, 40mm Master Plan, Beyond FY08 Small Cal Strategy, Grow R&D**

Position for The Future

Small Caliber Ammunition Acquisition Strategy



Strategy Enables….

- Meets DoD Requirements and Surge
- Augments Organic Base with Commercial Production
  - Mitigates Single Point Failure and Requirements Risk
  - Affordable and Flexible
  - Preserves Organic LCAAP Surge Capability
- Shapes Industrial Base for Future

Position for The Future

Small Caliber Initiatives

- **LCAAP Capacity Expansion & Modernization**
  - Increases Capacity From 1.2B To Over 1.5B, Available Mar 06, Progressing On Schedule
  - Modernizes Antiquated And Obsolete Equipment, Improves Production Quality, Flexibility And Cost, FY05 Fully Funded (34.74)
  - Secondary Effort to Address Infrastructure Needs Being Developed
- **Second Source**
  - Urgency Buy – Four Contractors\ten contracts – currently executing (Oct 04 > April 06 deliveries)
  - Second Source System Integrator – Bids Received, Evaluation In Progress – June 05 award anticipated

Old Crate Loading System **New Crate Loading System**

WINCHESTER AMMUNITION

ATK

POONGSAN

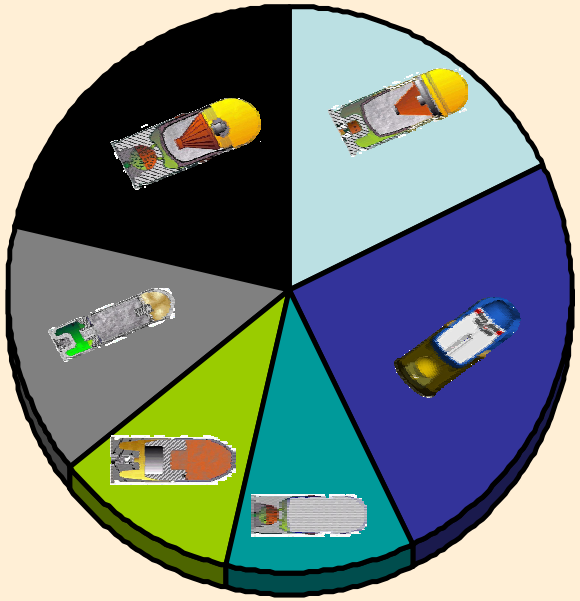
SNC TEC

Position for The Future

40mm Grenade System Strategy

- Reorganized the 40mm Procurements from a Breakout/Component Strategy to a Grouped Ammunition System Strategy
- Protect the 8a Base for M918/M385 Projectile Assemblies
- Awarded Long Term Firm Fixed Price Contracts in April 05 to 2 Joint Venture Small Business Teams

New Strategy: 6 Rounds, Two Producer Teams



Largest Small Business Set-Aside in US Army History (Up to $1.3B)

Position for The Future

40MM Grenade Initiatives

- **40mm Master Strategy**
  - **Awarded First System Contract for 40mm Ammunition**
  - **Baseline 40mm Grenade Performance**
  - **Assess Feasibility of M918/M385 mix**
    - Coordinating with DCD/TRADOC/G3
    - Assess Optimum Mix Ratios / Production Impacts
    - Potential for Significant Cost Savings
      - *$+50M Savings per year (Assumes 2:1Mix and 17M rds/yr)*
    - *Feasibility Test End of May/Early June with User*
  - **Aggressively Explore and Execute VE Initiatives on Family of Munitions**
    - M385A1 Material Replacement Effort ($1 per Ctg)
    - Single Chamber Cartridge Case Design (20%)
    - Links – Single Piece Design (25% vs. the Current Design)

DSE INCORPORATED

Position for The Future

Medium Cannon Cal

- **New Cannon Caliber PM**

GENERAL DYNAMICS
Ordnance and Tactical Systems

- **Family Buy Strategy**
  - **Multiple Year Contract for FY06- FY10**
  - **Considering 20mm, 25mm, 30mm**

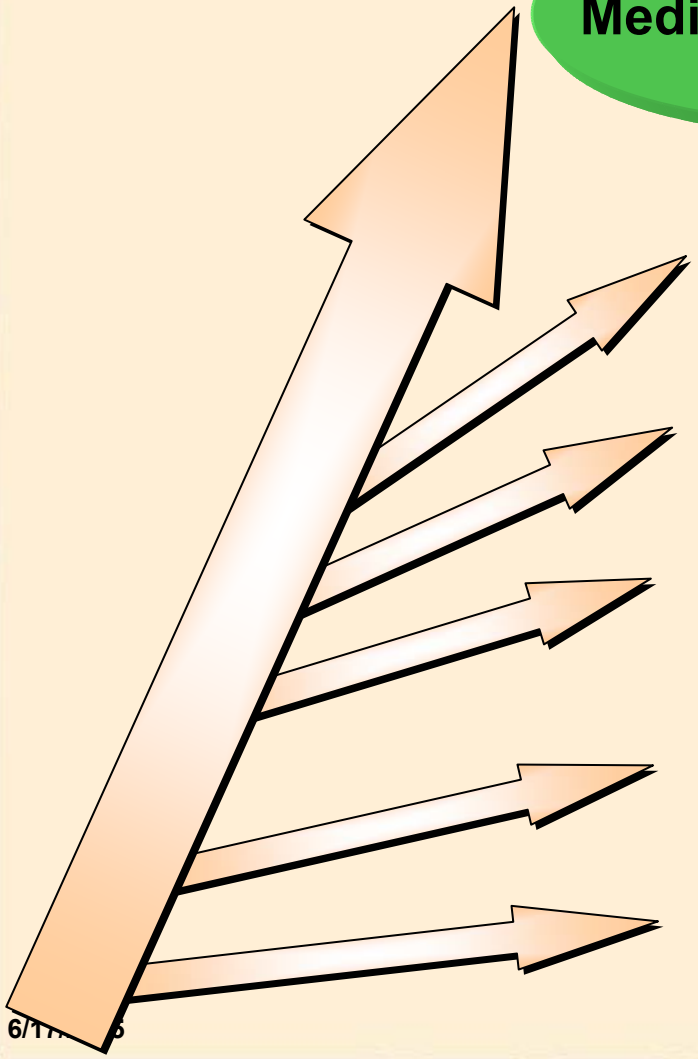
ATK

- **SMCA Support to Other Services**

SNC TEC

Position for The Future

Priority Road Map-Medium Cannon Caliber Primary Efforts



 # 1
Medium Cannon Cal Production

Meet Ammunition Production Requirements for Warfighters

 # 2 Standup New Product Office — Joint Support Cannon Cal Strategic Planning

 # 3 Medium Cannon Sys Contract — Implement Systems Contractor Approach

 # 4 M789 Support — Malfunction and Hangfire Investigation

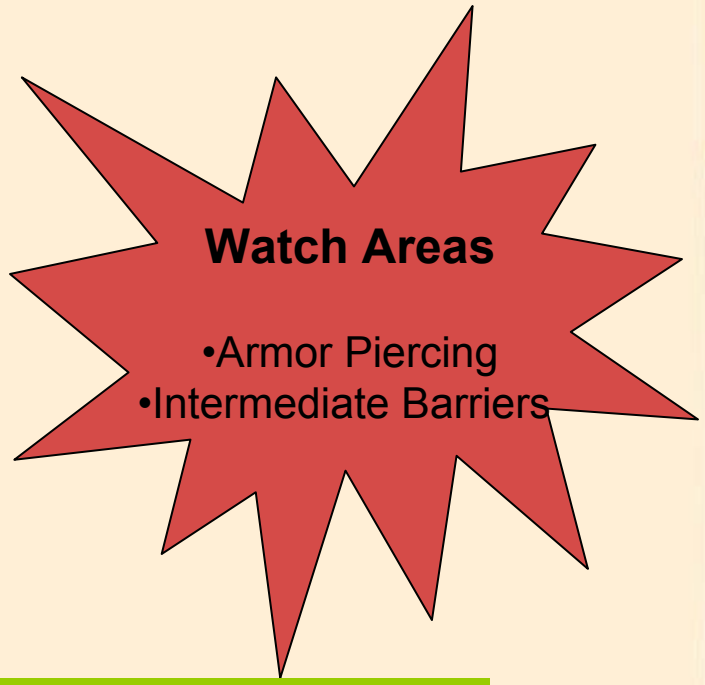
 # 5 Hybrid Propellant — Alternative Propellant for M919

 # 6 FCS Development — Prepare to Assume from SETI

Position for The Future

COE Drove Increase Demand

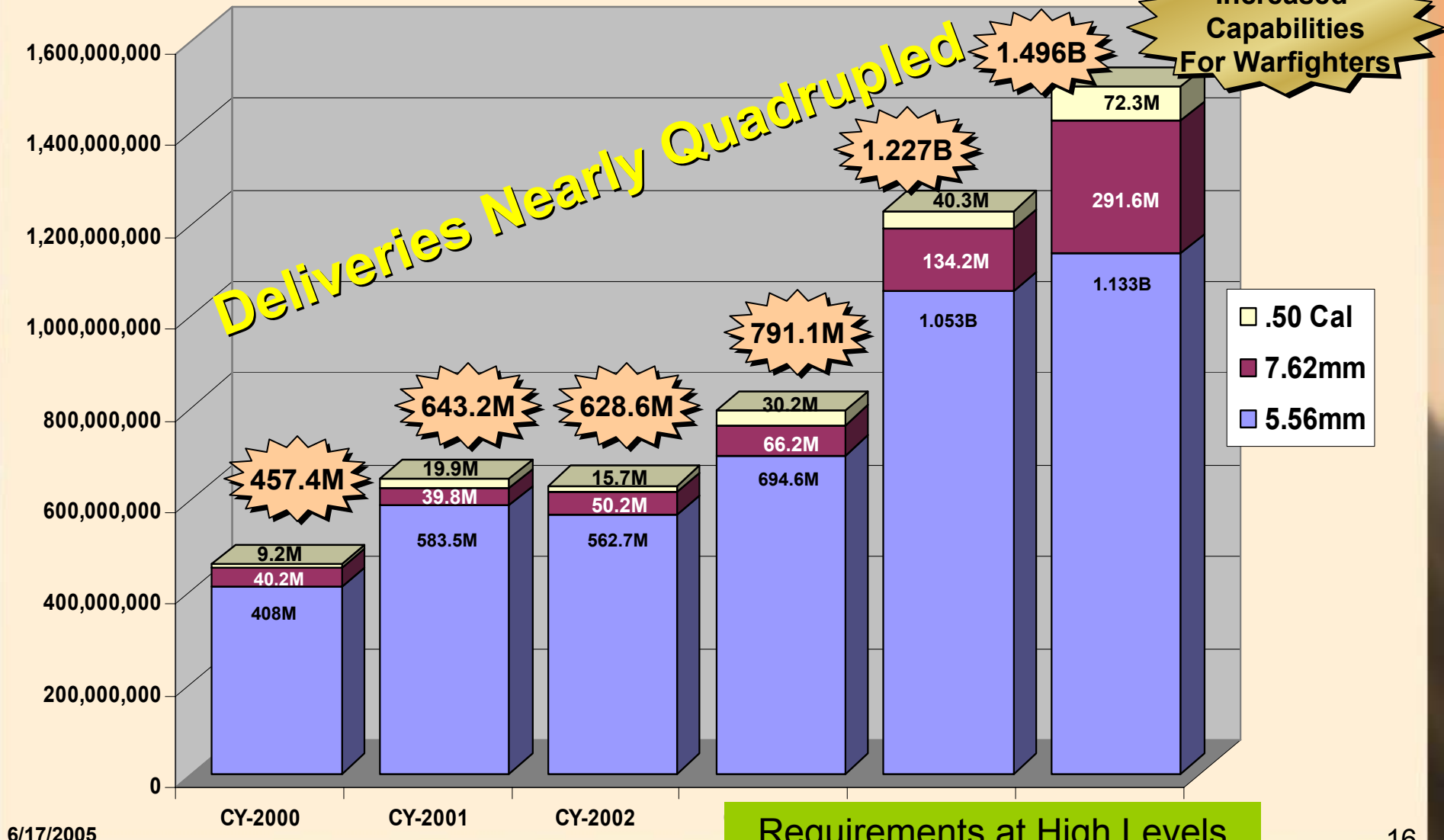
- **Small and Medium Caliber Ammunition**
  - **Pre GWOT**
    - **Less Training (Individual & Crew Served Weapons) (Non Infantry)**
    - **Living on Stockpile**
  - **GWOT On**
    - **CSA Initiative**
      - **"Every Soldier a Rifleman"**
    - **Modularity**
    - **Operational Use**



Requirements at High Levels

Small Caliber Ammunition State of the Union

(All Services, All Sources)



Small and Medium Caliber Lethality

- De-Emphasis on Armor “Hard” Defeat
- Requirement vs. General Purpose Capability
  - Long Range Defeat
    - Soft / Hard Targets
  - Close Quarters Battle
    - Soft / Hard Targets
- Strategy to Improve
  - Aggressively Bringing The Science Into The Art Of Small and Medium Caliber Ammunition
    - Deeper Understanding of Lethality
  - Building “Lethality” Tools To Give Better Answers Faster Throughout The Ballistic Test Community

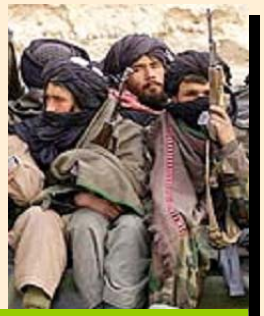
Issue: in-theater briefs said there was a problem with the M855's "stopping power" in close quarter battle (CQB) engagements

- On 15 April, 2002, the U.S. Army Infantry Center hosted a meeting to evaluate and address the concerns.
  - The consensus from the meeting was that the M855 was performing as it is intended. However, the role of the ground combatant has changed, as well as, the specific threat target.
- Currently in Afghanistan and Iraq, users were frequently engaging targets in Close Quarter Battle (CQB) scenarios. In CQB, targets are engaged as close as 10 feet.
- It was observed that the M855 has not been providing the "stopping power" the user would like at engagement ranges less than 150 yards.

Long Range Body Armor Penetration

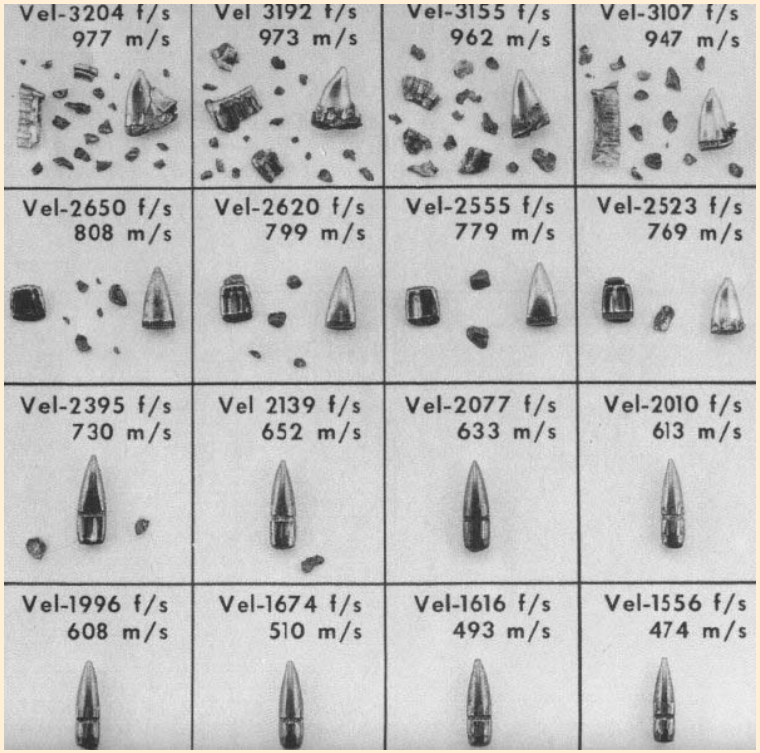
CQB Light Target Effectiveness

Paradigm Shift



Lethality Discussion

Lethality: A Complex & Controversial Issue



Lethality Discussion

Lethality Elements

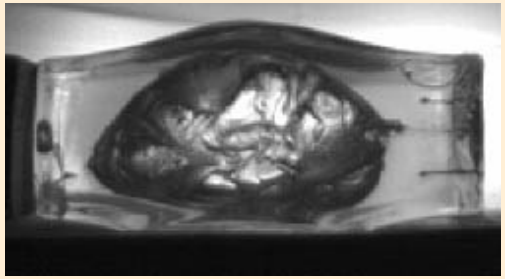
Bullet Lethality = shot placement +ballistics + projectile/target interaction + psychology

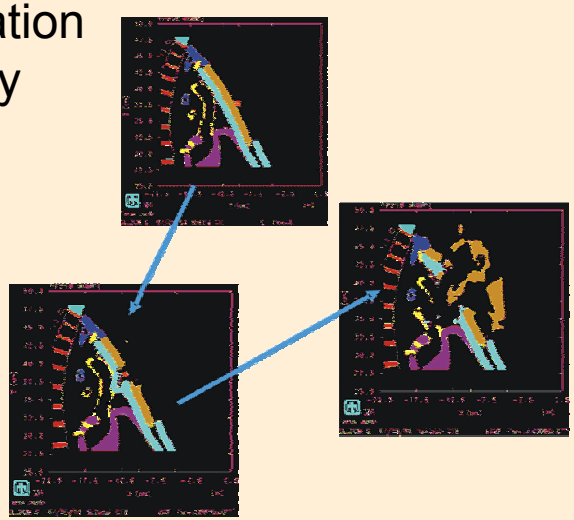
Lethality

1. Shot Placement
2. Geometry
3. Bullet Weight
4. Bullet Velocity
5. Bullet Yaw
6. Projectile Target Interaction
7. Psychology

Ballistics Interior/ Exterior

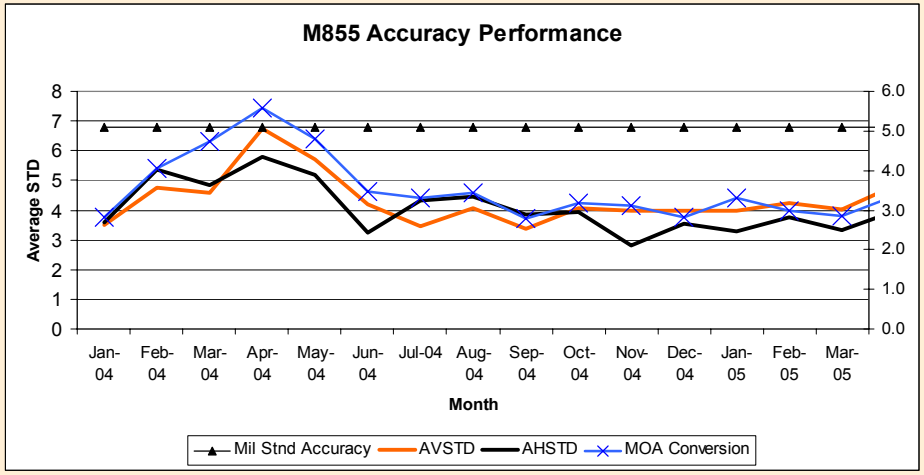
- Energy Deposit
- Damage / Trauma
- Incapacitation
- Physiology

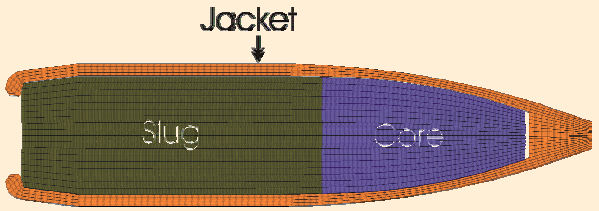




Small Caliber Initiatives

- **Improving Accuracy for Combat Rounds**
  - LV / HV Baseline Testing / Lethality Assessment
  - Build Models (PRODAS)
- **Developing Green Ammo**
  - Building Upon Phase I Material Characterization Results
  - Cost Control and Environmental Risk Mitigation are Overarching Goals
  - On Contract May 05

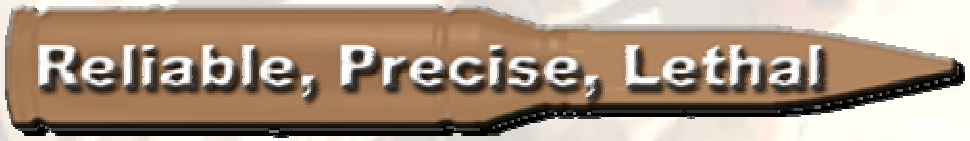




M855 Bullet Cutaway
Showing Lead Slug - Phase II
Effort will Focus on Replacement of Lead / Redesign Of projectile

Summary

- **Meeting the Warfighters' Needs**
- **Must Continue Emphasis and Progress with:**
  - **Acquisition Strategies that Support Smart Industrial Base Strategies**
  - **Production at High Levels**
  - **Application of Technologies to Improve Products**



Backup

Benefits To date

Es 9000

- ARL- Initial Models Developed For Exterior And Terminal Ballistics
- ARL - Some Models Developed Under Lethality Are Currently Being Applied To Green Ammo.
  - Reducing Decision Risk
  - Reducing Shooting Requirements
- ARDEC – Preliminary Models Started On 10% Gel.
- Arl-20% Preliminary Gel Models
  - Gel Aging Study
  - Gel Strength
  - Tissue Mechanical Properties
- ARL- Frag. Study In ComputerMan Started.
- Digitization Of ARL Baseline Technical Notebooks.

Es 9001

- ARDEC-standardized 10% Gel Manufacturing Standard
- ARDEC - Extensive 10% Gel Comparison Of 29 Small Arms Rounds.
- ARDEC - Completed Draft Reports On Above.
- ARL - Complete Aero On 14 Military 5.56MM Rifle Systems.
- ARL - Initial Fleet Yaw In Progress.

"Lethality" A Gauge or Metric of Effectiveness

The "Lethality" of a system is misleading and ambiguous

Fact: "Stopping Power" is the common term for lethality.

Goal: A straight forward way to evaluate and compare the typical or expected performance of weapon systems.

Issue: Terminal ballistics or more appropriately "Wound Ballistics" appears simple but involves diverse concepts in a variety of fields and disciplines.

Impact: Whenever the "Lethality" of a system is reported, you have to know specifically what is meant by "Lethality" and what simplifications and assumptions were made to give you that measure of expected performance.

"When a shooter asks the experts about his weapon's "lethality". He is likely to get more responses than he has rounds. These answers, like his shots, will all be off target to some degree."

A Closer Look at Some of the Variables

Lethality = **Shot placement** +Ballistics + Projectile/Target interaction
+ Psychology + Legal Restrictions + Logistics

Shooter

Knowledge (choice of target)
Accuracy & Conditioning. (proficiency & physical ability)
Stress (mental state)
Time (time to acquire)

Weapon System (weapon and ammo)

Quality (condition & design of the weapon and ammo. Including ammo tolerance)
Ranging errors (instrumental & shooter skill level)

Environmental

Exposure (Intervening barriers)
Weather Effects (Wind, Temperature, Humidity, etc)

A Closer Look at Some of the Variables

Lethality = Shot placement +**Ballistics** + Projectile/Target interaction
+ Psychology + Legal Restrictions + Logistics

Interior Ballistics

Propellant (pressure, flame temperature, etc…
Weapon (twist, barrel length, user restrictions, etc..)
Projectile (mass, diameter, geometry, etc.)
Recoil (this shot and the effect on accuracy of the next shots fired)

Exterior Ballistics

Effective Ranges (close up, far away, or all of the above)
Dispersion / Accuracy Requirements (tied to range)

Terminal Ballistics

Impact Velocity Requirements
Striking Yaw / Angle of Attack
Barrier Effectiveness Requirements (auto glass, steel, drywall, body armor)
Types of Target (hard/soft, prone/frontal/dorsal, etc)
Desired Effect (Suppression, Incapacitation, Death)
Time Frame (immediate, 30 sec, 5 min, 72 hr, etc)

A Closer Look at Some of the Variables

Lethality = Shot placement +Ballistics + **Projectile/Target interaction**
+ Psychology + Legal Restrictions + Logistics

Biological Factors

Circulatory Collapse (blood loss)
Central Nervous System and Vital Structure Injury (CNS, etc...)
Role of Pain (plays a role with less than "lethal" munitions)
Shot Line (path through the body)
Adrenaline / Drugs / Alcohol (Effect on pain)
Material Properties of Tissues (bone, muscle, etc are very resilient)

Event Mechanics

Permanent Cavity (the hole)
Temporary Cavity or Cavitation (stretching the medium)
Projectile Deformation / Fragmentation ("energy deposit" / material failure)

A Closer Look at Some of the Variables

Lethality = Shot placement +Ballistics + Projectile/Target interaction
+ **Psychology + Legal Restrictions + Logistics**

Psychology

Belief System / Motivation (Fight/Flight or no option)
Hollywood Effect (I've been shot! / false expectations of performance)

Legal Restrictions

International Conventions (no expansion, visible to x-ray, etc…)
Domestic Law Enforcement vs. Military (restrictions not the same)

Logistics

Time Considerations: Expected length of time till re-supply
Stowed Kills vs. rounds carried (weight considerations)
Versatility (How many weapon systems / countries / services use this ammo?)