PRECISION STRIKE ASSOCIATION

Precision Strike 2009 Summer Forum

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"Affordable Precision Munitions - the Reliable Choice for Modern Battle"

Whippany, NJ

June 9 - 10, 2009

Agenda

Tuesday, 9 June 2009

OPENING REMARKS:
Jim Sutton—PEO Ammunitions, Picatinny Arsenal, NJ

PICATINNY LABORATORY INITIATIVES:
Dr. Joe Lannon—Director, US Army ARDEC, Picatinny Arsenal, NJ

THE NEW STRATEGIC ENVIRONMENT:
Peter Huessy—President, GeoStrategic Analysis

ROLE OF ENERGETICS IN AFFORDABLE PRECISION MUNITIONS:
Dr. Robert Gates—Technical Director, Naval Surface Warfare Center, Indian Head Division

ARMY PEO MUNITIONS PROGRAMS OVERVIEW PANEL:
- *Jim Sutton*—PEO Ammunitions, Picatinny Arsenal, NJ
- *Chris Grassano*—PM Maneuver Ammunition Systems (PM MAS), Picatinny Arsenal, NJ
- *Colonel Ole Knudson*, USA—PM Combat Ammunition Systems (PM CAS), Picatinny Arsenal, NJ
- *Joe Pelino*—Deputy Product Manager, IMS, Picatinny Arsenal, NJ

OSD MUNITIONS PERSPECTIVE:
Tony Melita—Deputy Director, Land Warfare & Munitions, OUSD (AT&L)

MARINE CORPS MUNITIONS OVERVIEW:
Jerry Mazza—Project Manager for Ammunition, Marine Corps Systems Command, Quantico, VA

Wednesday, 10 June 2009

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EXTENDED AREA PROTECTION SURVIVABILITY GUN /BULLET :
Manifredi Luciano—EAPS Project Manager, Picatinny Arsenal, NJ

ARMY MUNITIONS REQUIREMENTS:
- *Colonel Richard Mason*, USA—Chief, Army Munitions Directorate, G-3/7
- *Don Chrans*—Headquarters Department of Army G-8
- *Sue Carlson*—Chief, Munitions Division, Army G-4

ARMY LOGISTICS UPDATE:
Major General Vincent Boles, USA—Assistant Deputy Chief of Staff, G-4

RELIABLE PRECISION MUNITIONS —PROVIDING THE DECISIVE EDGE ON THE MODERN BATTLEFIELD:

Colonel Art McGettrick, USAF—Chief, Force Application Engagement Division (J-8), The Joint Staff

COMMON SMART SUBMUNITION:
Pam Ferlazzo—ARDEC Program Manager, Textron Defense Systems

MUNITIONS RELIABILITY:
Jason Cook—Acting Chief, Quality Engineering and System Assurance Sciences Division

REMOTE WEAPONS STATIONS:
Michael George—Project Lead in Remote Weapons Branch, Weapons Systems & Technology, ARDEC, Picatinny, NJ

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AGENDA
TUESDAY, 9 JUNE

0700 **REGISTRATION / CONTINENTAL BREAKFAST**
(Sponsored by: General Dynamics-OTS)

0800 **SUMMER FORUM WELCOME:**
Andy McHugh—Chairman of the Board, Precision Strike Association

0810 **OPENING REMARKS:**
Jim Sutton—PEO Ammunition, Picatinny Arsenal, NJ

0830 **KEYNOTE ADDRESS:**
Major General Paul Izzo, USA—Commanding General, US Army RDECOM, Aberdeen, MD

0915 **PICATINNY LABORATORY INITIATIVES:**
Dr. Joe Lannon—Director, US Army ARDEC, Picatinny Arsenal, NJ

1000 **NETWORKING REFRESHMENT BREAK**

1030 **THE NEW STRATEGIC ENVIRONMENT:**
Peter Huessy—President, GeoStrategic Analysis

1115 **ROLE OF ENERGETICS IN AFFORDABLE PRECISION MUNITIONS:**
Dr. Robert Gates—Technical Director, Naval Surface Warfare Center, Indian Head Division

1200 **LUNCHEON** *(Sponsored by: AMTEC Corporation)*

1300 **ARMY PEO MUNITIONS PROGRAMS OVERVIEW PANEL:**
- ***Jim Sutton***—PEO Ammunition, Picatinny Arsenal, NJ
- ***Chris Grassano***—PM Maneuver Ammunition Systems (PM MAS), Picatinny Arsenal, NJ
- ***Colonel Ole Knudson, USA***—PM Combat Ammunition Systems (PM CAS), Picatinny Arsenal, NJ
- ***Joe Pelino***—Deputy Product Manager, IMS, Picatinny Arsenal, NJ

1415 **NETWORKING REFRESHMENT BREAK** *(Sponsored by: Orbital Sciences Corporation)*

1445 **OSD MUNITIONS PERSPECTIVE:**
Tony Melita—Deputy Director, Land Warfare & Munitions, OUSD (AT&L)

1530 **MARINE CORPS MUNITIONS OVERVIEW:**
Jerry Mazza—Project Manager for Ammunition, Marine Corps Systems Command, Quantico, VA

1615 **EVENING RECEPTION—HEAVY HORS D'OEUVRES** *(Sponsored by: Northrop Grumman Corporation)*

Dr. Robert Gates
Technical Director,
NSWC, Indian Head
Division

Dr. Joe Lannon
Director, US Army ARDEC,
Picatinny Arsenal, NJ

Peter Huessy
President,
GeoStrategic Analysis

AGENDA
WEDNESDAY, 10 JUNE

Copies of the presentations will be available 1-2 weeks after the Forum. You will receive an email from Dawn Campbell giving you the link to the presentations approved for distribution. Please note: not all presentations are approved for distribution, this option is left up to the speaker.

There are pages to take note in the back of this booklet. Please take advantage of these pages to help remember key points from the presenters.

0730 **CHECK-IN / CONTINENTAL BREAKFAST** *(Sponsored by: ATK)*

0815 **JOINT FIRE GAPS:**
Captain James C. Hamblet, USN—Maritime Warfare Systems/Surface Strike Branch Head on CNO Staff (N864) OPNAV

0900 **EXTENDED AREA PROTECTION SURVIVABILITY GUN/BULLET:**
Manifredi Luciano—EAPS Project Manager, Picatinny Arsenal, NJ

0945 **ARMY MUNITIONS REQUIREMENTS:**
- ***Colonel Richard Mason, USA***—Chief, Army Munitions Directorate, G-3/7
- ***Don Chrans***—Headquarters Department of Army G-8
- ***Sue Carlson***—Chief, Munitions Division, Army G-4

1045 **NETWORKING REFRESHMENT BREAK** *(Sponsored by: Honeywell Int'l)*

1115 **ARMY LOGISTICS UPDATE:**
Major General Vincent Boles, USA—Assistant Deputy Chief of Staff, G-4 Headquarters, Department of the Army

1200 **RELIABLE PRECISION MUNITIONS—PROVIDING THE DECISIVE EDGE ON THE MODERN BATTLEFIELD:**
Colonel Art McGettrick, USAF—Chief, Force Application Engagement Division (J-8), The Joint Staff

1245 **LUNCHEON** *(Sponsored by: Kaman Precision Products)*

1330 **COMMON SMART SUBMUNITION:**
Pam Ferlazzo—ARDEC Program Manager, Textron Defense Systems

1415 **MUNITIONS RELIABILITY:**
Jason Cook—Acting Chief, Quality Engineering and System Assurance Sciences Division

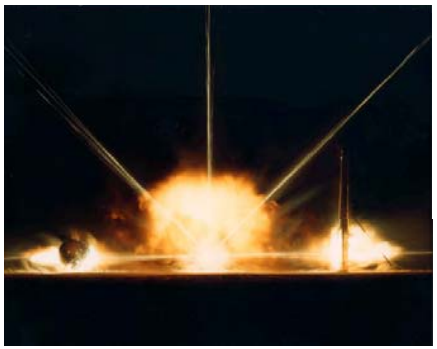
1445 **REMOTE WEAPONS SYSTEMS:**
Michael George—Project Lead in Remote Weapons Branch, Weapons Systems & Technology, ARDEC, Picatinny, NJ

1515 **CLOSING REMARKS**: Andy McHugh, Chairman of the Board, PSA

ARMAMENTS TECHNOLOGY FIRE POWER FORUM COMMITTEE

PSA Programs Chair: Ginny Sniegon
PSA Programs Vice-Chair: CAPT Gregg "Mongo" Sears USN
Event Chair: MG Paul Greenberg, USA (Ret)
Precision Strike Representatives:
CAPT Larry Burt USN, Col Bill DeMaso USAF, Col Robert Valin USAF, COL Lance Moore USA (Ret), LTC Joe Horab USA, LCDR Scott Wilson USN, LtCol Chuck Kelly USMC (Ret), and LTC Ken Britt, USA (Ret)
Executive Director: Dawn Campbell

What's So Important About Energetics?
EVERYTHING



9 June 2009

Dr. Robert V. Gates
Technical Director
Indian Head Division
Naval Surface Warfare Center
robert.v.gates@navy.mil
(301) 744-6519

Fallujah 2004

“An awesome piece of ordnance”

IHDIV
DoD ENERGETICS CENTER
Excellence for the Warfighter

"It would be a strategic mistake for the United States to fail to have a forward-looking, aggressive R&D program in energetics. Furthermore it is inconceivable that the United States should be anything but at the cutting edge of "energetics"...it is fundamental for achieving battle space dominance".

Retired General Michael Hagee
former US Marine Corps Commandant

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Energetics Are Critical to the Warfighter

Challenges of Tomorrow

- Asymmetric Warfare
  - Precise Application of Force
  - Avoid Collateral Damage

- Increased Effects Application
  - Greater standoff, stealth and lethal radius
  - Defeat buried/covert/moving targets
  - Increased energy on target
  - Multi-mode warheads
  - Structural energetic materials

Energetic materials are a critical enabler for war-fighting dominance

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5

A New Technology Approach

Numerous new Energetic technologies are emerging to meet capability based requirements:

- Energetic materials by design
- Structural energetic systems
- Energetic materials for power generation systems
- Micro detonics for sensor deployment
- Nano material technology
- High energy density materials
- Reactive materials
- Directed Energy
- Thermobarics
- Micro Electro-Mechanical Systems
- Adaptable ordnance
- Miniature munitions
- Non-toxic liquid propulsion
- 0-signature
- Low collateral damage ordnance
- Selective effects
- Green AP replacement

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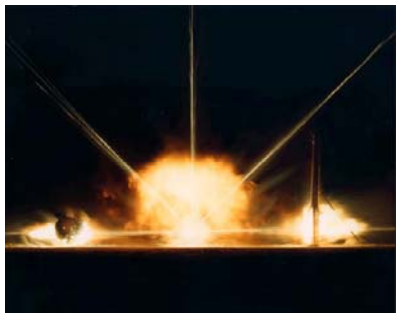
Waning Investments



Research and development is waning in a field responsible for advanced firepower. We allow this decline to continue at our peril.

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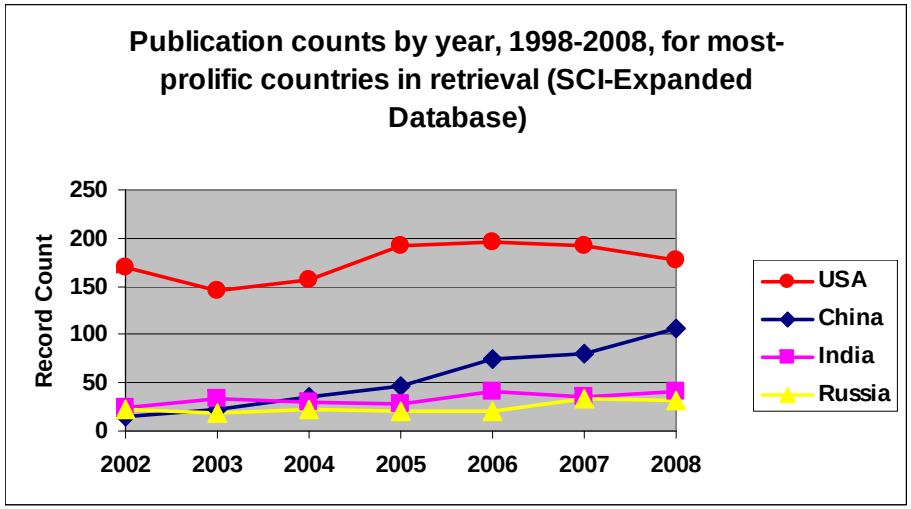
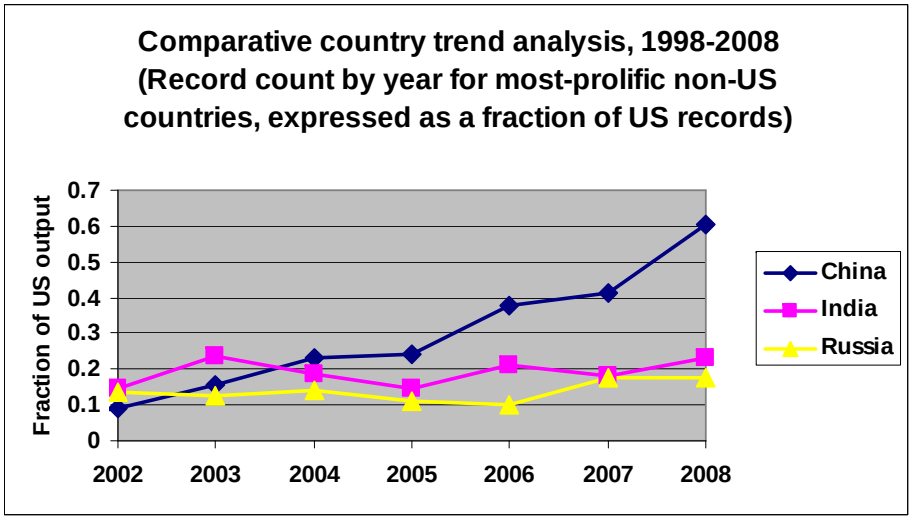
Investment on the Rise Globally





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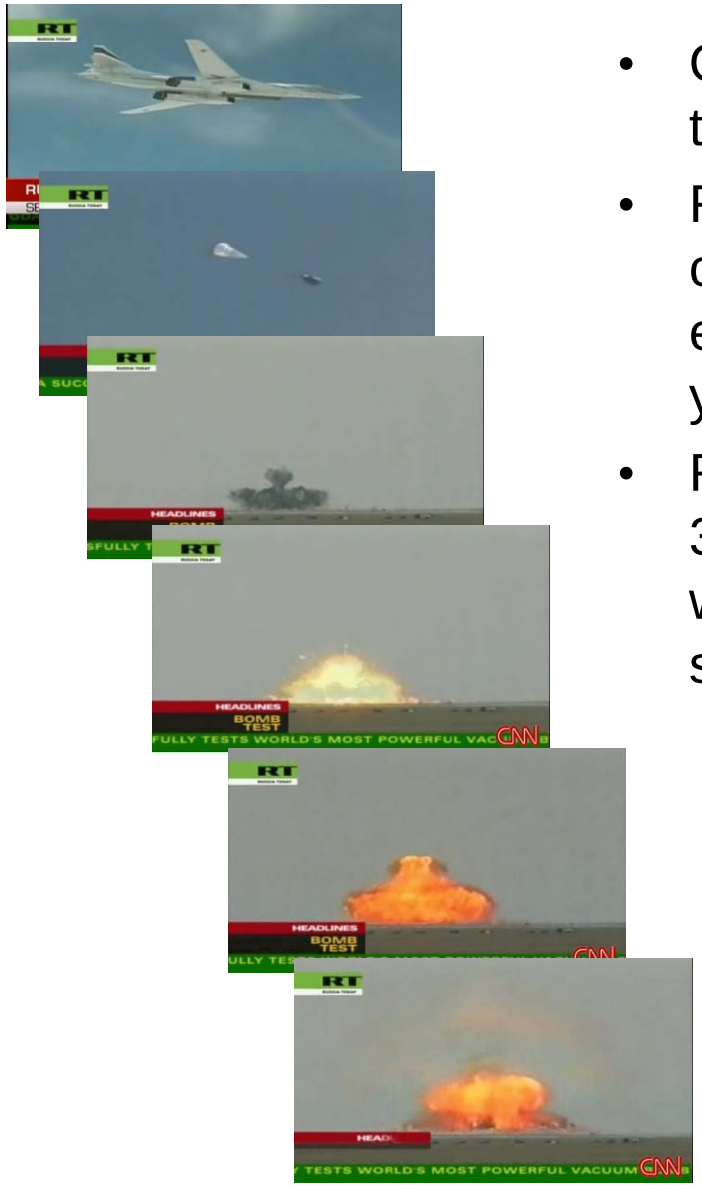
Technological Surprise



- On 11 September 2007, the Russian military tested a massive yield warhead.
- Russian officials claim that the warhead contained 7.8 tons of “highly efficient” explosives that produce an effective explosive yield equivalent to 44 tons of TNT explosive.
- Russian claims are that the blast radius was 300 meters (990 ft) and the blast and pressure wave had a similar effect on the ground as a small nuclear device.

Enhanced explosives 4 to 10 times TNT's energy density were not expected to be produced before 2010. (Office of Naval Intelligence)

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New Weapons with Legacy Energetics

Predator

Fire Scout

Reaper

Armed Robotic Vehicle

Vigilante

Ferraris on Kerosene

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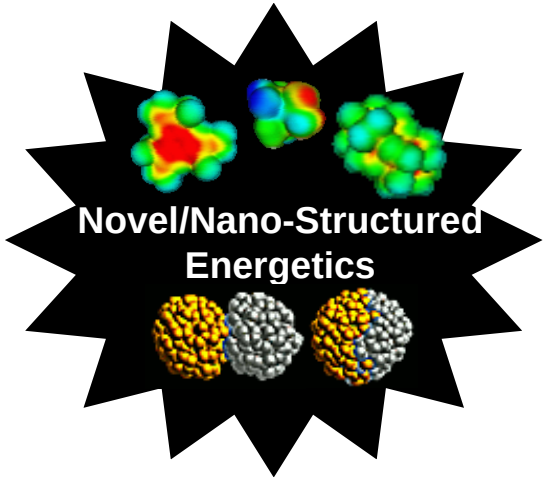
Energetics from the Start

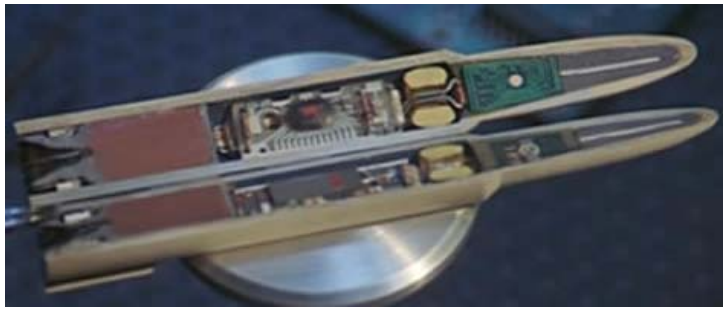
Micro Munitions

Bio Inspired

UCAV

JSF





Smart Bullet

The Key “Ingredient”

- One-third of the current energetics “experts” will retire in the next three years,
- It can take five years or longer to fully train a college graduate with a science or engineering degree to work with energetic materials.

  “Without the opportunity for the current workforce to train the next generation of expert scientists and engineers, much corporate knowledge may be lost. This knowledge is key to maintaining the current weapon stockpiles safety, to ensuring their performance, and to developing the next generation of energetic materials.”

- Critical shortages exist in rocket propellant formulation, underwater explosive formulation, ingredient synthesis, chemical scale-up, detonation physics, explosive effects modeling, and modeling of energetic manufacturing processes.

Summary

- There is a National Security imperative for continued effort in energetic materials research, development, and manufacturing technology
- The overarching issue is one of ensuring a critical national defense capability is nurtured and maintained
- A coordinated and sustained effort is required to focus the energetics community on addressing the warfighting challenges of the future
- A revitalized energetics workforced is required
- Requires visionary leadership, competent scientists and engineers, challenging work, and state-of-the-art facilities

Energetics is a National Responsibility

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Thank you …

Project Manager
Maneuver Ammunition Systems

Precision Strike Association
(Affordable Precision Munitions)

Distribution Statement A:
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Chris Grassano
Project Manager

9 June 2009

Agenda

Small Caliber

- EXACTO

Medium Caliber

- Programmable Airburst Munition (PABM)
- 40mm Efforts

Large Caliber

- Advanced Kinetic Energy (AKE)
- Advanced Multi-Purpose (AMP)
- Mid-Range Munition (MRM)

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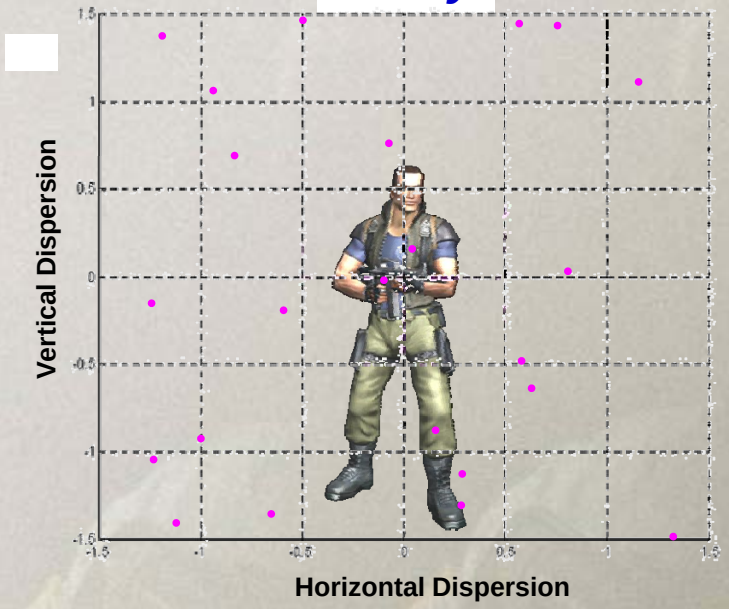
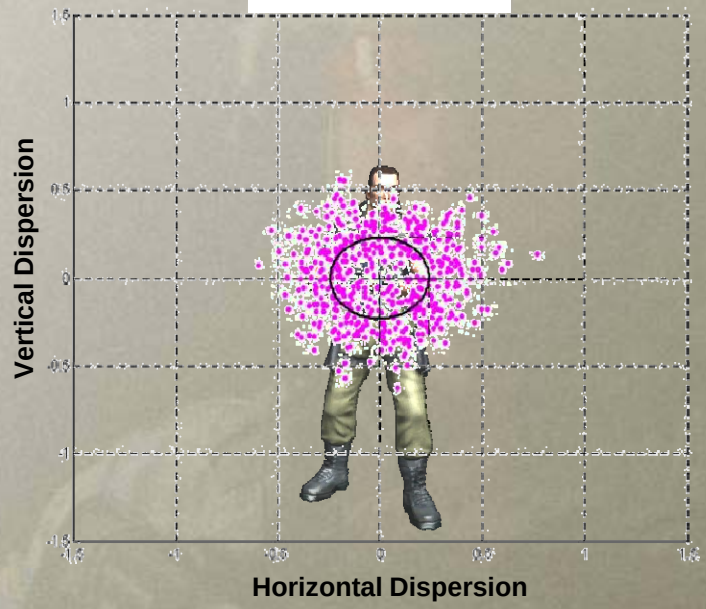
EXACTO
(EXtreme ACcuracy Tasked Ordnance)

Today



Tomorrow



Deadly Accuracy at Extreme Range

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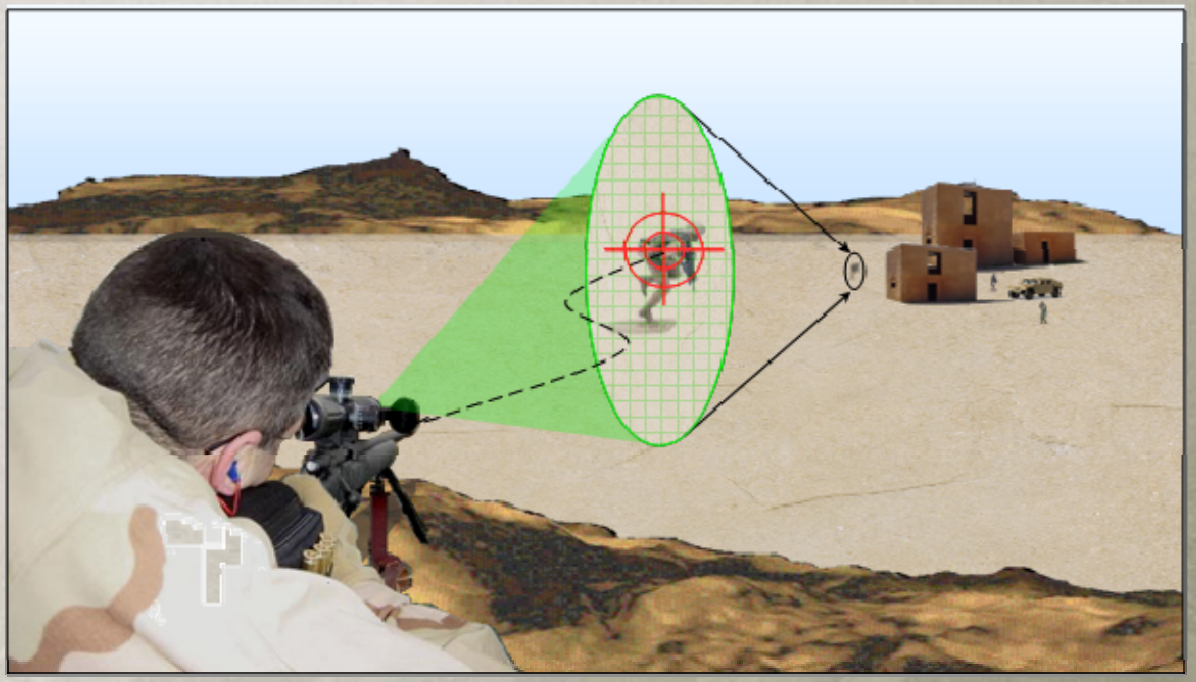
EXACTO Concept

EXACTO is a system composed of:

- **An optical guidance system that provides information to direct the projectile to the target regardless of environmental or target perturbations**
- **An actively-controlled 50-caliber projectile that uses this information for real-time directional flight control**



EXACTO delivers high accuracy against moving targets under environmental conditions

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Acquisition Strategy

- **Three phase program:**

  Phase I: Component Development, Preliminary Design and Performance Validation

  Phase II: System Integration and Prototype Demonstration

  Phase III: Operational Assessment/Transition

- **Progression to subsequent program phases contingent on meeting end of phase go/no go criteria and availability of funds**

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Medium Caliber Precision Munitions: Areas of Focus

- **Current Effort: FCS 30mm Programmable Airburst Munition**
- **Potential Future Efforts: 40mm Suite of Munitions**
  - **Increased Yield**
  - **Precision, Steerable Munitions**

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Current Efforts: FCS 30mm Programmable Airburst Munition

- **Warhead**
  - High Explosive Air Burst with Base Mounted Fuze
  - Hardened Nose for Performance Against Materiel Targets
  - PBXN-5 Explosive
  - Zirconium Incendiary

- **Cartridge**
  - Aluminum Case
  - Single Base Propellant
  - M36A2 Percussion Primer
- **Fuze Operating Modes**
  - Point Detonate
  - Point Detonate Delay (up to 1 ms)
  - **Air Burst**
  - Self-Destruct: Detonates at Maximum Mission Time
- **Status:**
  - PABM-T Fuze Design accepted by Army, Navy working mods
  - Joint Qualification Test to Date Resulted in 43% Functional Failures
  - Approximately $1.5M additional required to Achieve >85% Reliability
  - FCS program cuts may end this program

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Future Efforts:
40mm Suite of Munitions

- **BLUF: There are currently NO requirements for 40mm accuracy / lethality improvements…but:**
  - **Increased explosive yield has been mentioned by soldiers in the field**
  - **Future Requirements may call for steerable/ guided munitions and associated sighting systems:**
    - **40mm rounds have room for micro-electronics**
    - **New platforms (i.e. M320 GLM) allow for longer rounds**

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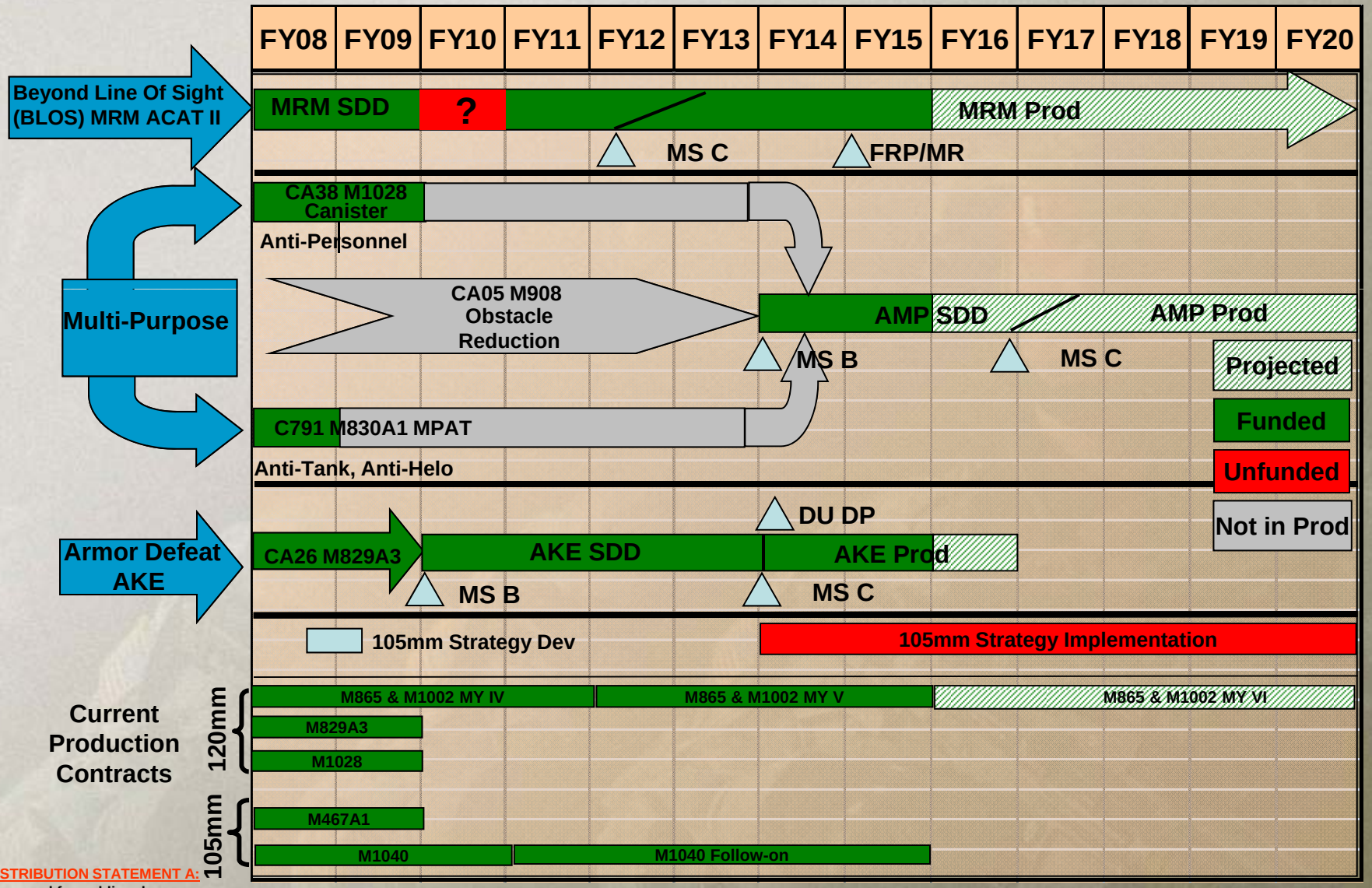
PM-Large Caliber 120mm Ammunition Strategic Capabilities Plan



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M829E4 (AKE) APFSDS-T

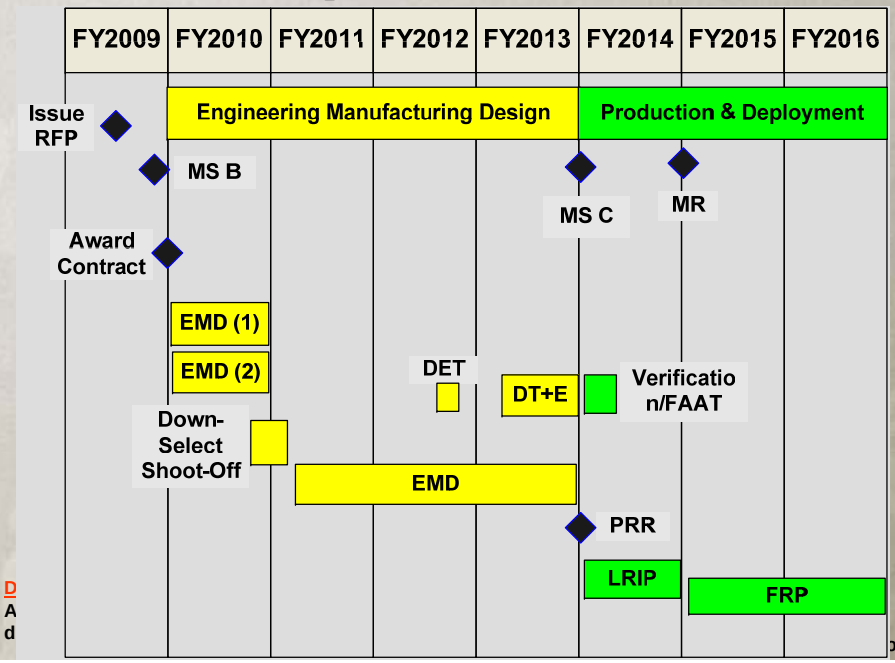
Description & Requirement

- The M829E4 is the 5th Generation 120mm Kinetic Energy Cartridge Developed to Provide the Abrams M1A2 SEP with Heavy Armor Defeat Capabilities
- M829E4 Provides M1A2 the Capability to Engage and Destroy Main Battle Tanks with Advanced ERA at extended ranges

Status/Key Accomplishments

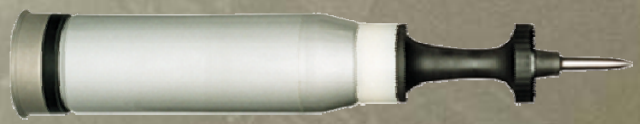
- EMD/ Production Acquisition Prepared
- Draft RFP Released
- Industry Day Complete
- Milestone B Documentation Being Prepared

Top Level Schedule



Acquisition Plan:

- Full & Open Competition to Select Two Phase I EMD Competitors
- Contract is for EMD Phase I (FY10) With Options For EMD Phase II, LRIP, FRP I, FRP II
- Down select Based Upon Shoot-Off & Updated Proposals
- Restrict To Depleted Uranium (AEROJET)



M829E4

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AMP 120mm (Advanced Multi Purpose)

Description

- Incorporate the Performance of M908 (Obstacle Reduction), M830 (HEAT), M830A1 (MPAT), and M1028 (Canister) within a Single Cartridge
- Mutli-Mode Programmable Fuze
- Reduced Logistic Footprint
- Adds Capability of Engaging Infantry in Open at Significantly Increased Range
- Breach Rebar (Concrete Reinforced Wall)
- Airburst Technology
- Program Start planned for FY14

Requirements

- Defeat ATGM Team
- 30” x50” Hole in Wall
- Bunker Defeat
- Defeat Light Armor BMP with ERA
- Infantry / Anti-Personnel

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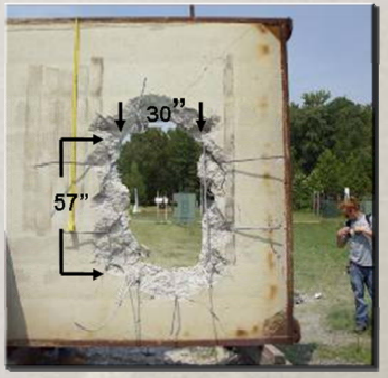
AMP Summary

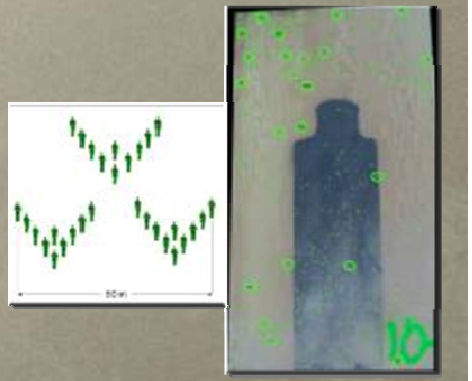
Bunker Defeated 1 Shot

T-55 Defeated 1 Shot



Double Reinforced Concrete
Defeated 2 Shots

Simulated ATGM Defeat



30 Man Platoon Defeated

AMP Video

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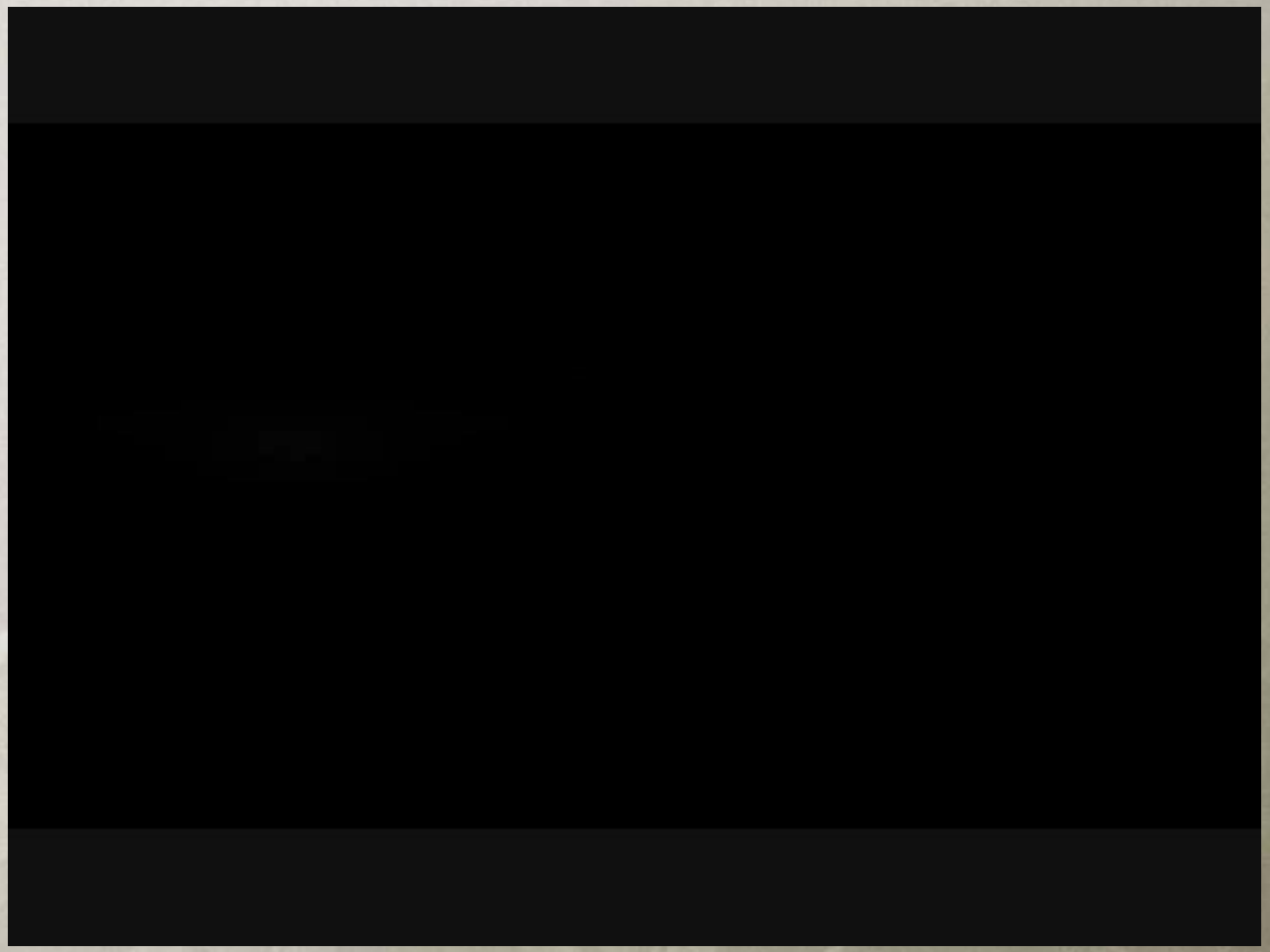
AMP Video



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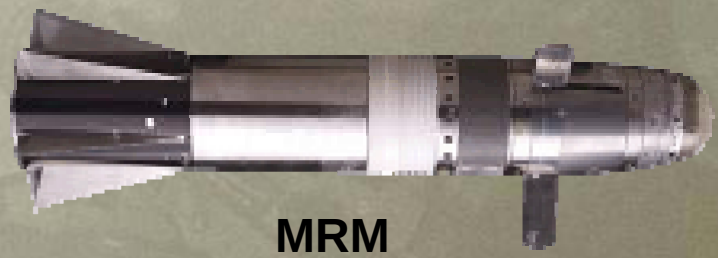
Mid Range Munition

Description & Requirement

- Mid Range Munition (MRM) Round is First Generation Fire and Forget Gun-launched Precision-guided Munition
- Materiel Solution For Beyond Line Of Sight (BLOS) Capability Gap
- Originally Developed to Provide Future Combat System (FCS) Mounted Combat System (MCS)
- Current Design Is Interoperable With Abrams
- Provides Capability to Engage & Destroy High Value Moving and Stationary Enemy Targets Throughout Area Of Operations up to 12km
- Dual Mode Gun Launched Precision Munition
  - Semi Active Laser (SAL)
  - Imaging Infra-red (IIR)
- Target set Includes:
  - Main Battle Tanks
  - Light Armor
  - Self-propelled Artillery
  - Air Defense Artillery
  - Earth and Timber Bunkers

Key Accomplishments

- Successful Cartridge Integration Test Dec 08:
  - Fired From Abrams M1A2 SEP
  - Autonomous Shot Using IIR Hit T-72 at 5.2km
  - IIR seeker searched, acquired & tracked
  - No external queuing
- SAL Shot Successful Against Moving T-72 at 8.7km
- Dual Mode Shot (SAL and IIR) Successful Against Stationary T-72 At 5.2km
- Airframe and Propulsion Test Sequences Underway
- Warhead Down-Select Completed



MRM

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Modes of Operation

Three Modes of Operation (Video)

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MRM Video

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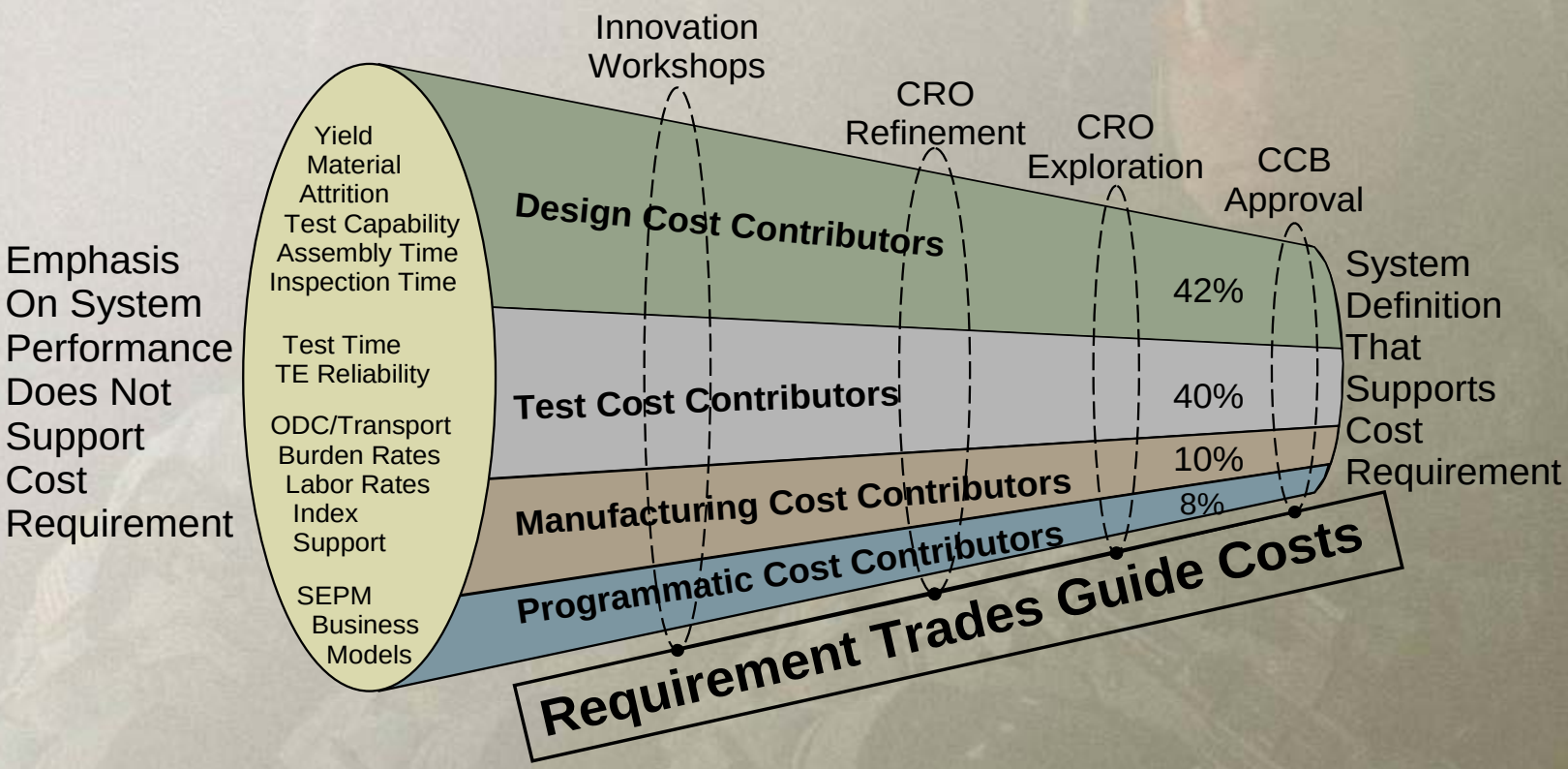
Affordability

Cost Drivers of the System



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Refining Cost Reduction Opportunities

1. Innovation Workshops

Definition of Trade Space & Cost Drivers

1 – 2 Day Focused Idea Generation

Cross Functional With Outside Thinking

2. Refinement Project

Opportunity Worksheet

Cost Model & Performance Model Analysis

IPT Schedule Insertion Roadmap

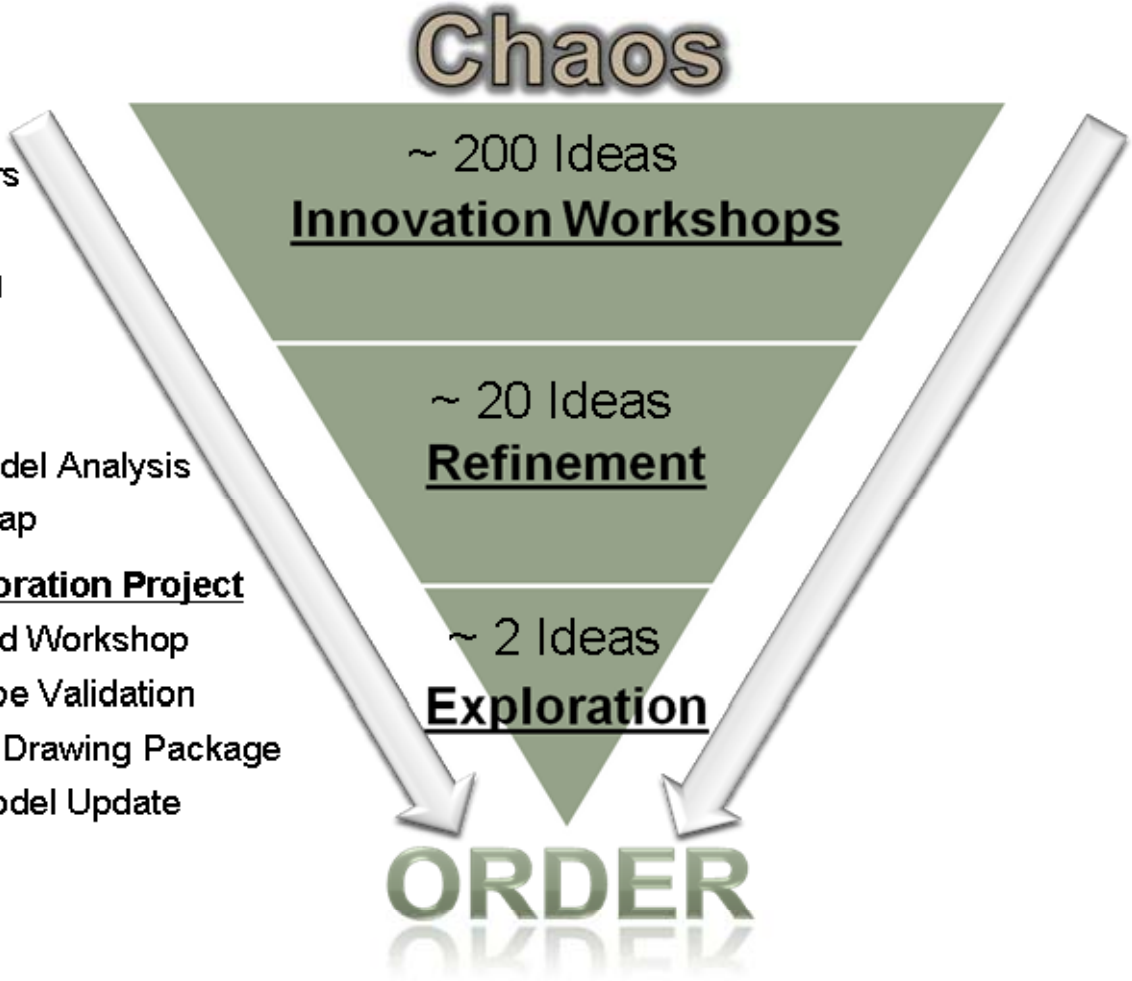
3. Exploration Project

Targeted Workshop

Prototype Validation

Update Drawing Package

Cost Model Update



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Enabling An Affordable Solution

- Know your cost targets
- Document and understand your entire value stream
- Aggressively identify cost reduction opportunities and submit them to the opportunity register
  - Eliminate waste in EMD and LRIP
- Identify requirements that drive cost and flow it back to systems
- Design to eliminate current production rework drivers
- Incorporate Critical Parameter Management to ensure your design is within manufacturing process capability
- Make affordability part of your performance development goals

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MRM Current Situation

- MRM Program was Initially Funded to Support the Future Combat System (FCS) Mounted Combat System (MCS)
- MRM is Required to be Fully Compatible with the Abrams Cannon
- An Abrams Capabilities Development Document (CDD) is Currently in Staff which Contains a Key Performance Parameter (KPP) for the Beyond Line of Sight (BLOS) Mission that only MRM can Fulfill
- FY10 President's Budget Indicated Zero Funding for MRM
- Government Direction Provided to the System Contractor regarding the following:
  - Reduction of Program Scope
  - Utilize Existing Funding to Work Critical EMD Efforts and Close-Out Activities
- The Revised Plan will Continue at a Reduced Level at which point the Program will either be Restructured or Terminated

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Summary

- **Advancing "Precision" Munitions Across Calibers**
  - **Providing Improved Capabilities**
- **Pursuing Cost Reduction and Affordability**
  - **Lean Innovation**
- **Committed to Providing the Warfighter with the most Reliable, Lethal and Affordable Ammunition Available**

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The New Strategic Environment

Eight New Challenges and Eight New Strategies

By Peter Huessy, President of GeoStrategic Analysis, Potomac, Maryland June 9, 2009

Missile Threat Grows Against U.S. June 7th, 2009

- A new report by the National Air and Space Intelligence Center reveals that the missile threat to the U.S. from potentially hostile nations is growing.
- The report, "Ballistic and Cruise Missile Threat," details the dangers posed by the missile programs of North Korea, Iran, China, Russia and other nations.
- It comes as the Obama administration is planning to reduce spending on missile defense systems, the Washington Times observes.
- The NASIC report discloses that since 2006, North Korea has deployed nearly 50 new missiles with a range of more than 2,000 miles. It has also tested the Taepodong-2 missile, which has a range of 3,400 miles. Both tests of the missile have been failures, but the report says they demonstrate North Korea's "determination to achieve long-range ballistic missile and space launch capabilities."
- It also warns that the Taepodong-2 could be exported to other countries in the future.
- The NASIC report cites Iran's April launch of a missile that "can serve as a test bed for long-range ballistic missile technologies."
- China, the report notes, has "the most active and diverse ballistic missile development program in the world," and the number of Chinese ICBM warheads capable of threatening the U.S. is expected to grow to "well over 100 in the next 15 years."

Revolution by Herbert E. Meyer Published by American Thinker on 20 May 2009 May 20, 2009

- We have lost our free-market economy as quickly as we have lost the rule of law. Money is to an economy what blood is to a body; life and death resides within the organ that controls its flow. The government already owns our country's leading banks, which means the government now controls our economy.

By Fred Weir | *Correspondent of The Christian Science Monitor* from the March 23, 2009 edition

- Russia Will Help US With Iran: Right? **Russia sees chance to boost US ties**
- **Obama's outreach to Iran lifts hopes that the US and Russia can find more common ground in their bids to get Iran to curtail its nuclear program.**
- **[Articles with the theme of Russia helping the US on Iran: Google hits: 55,500,000; Russia Arming Iran: 2,790,000.]**

March 19th, 2009, Encyclopedia Britannica Blog, Interview between B. Slavin of the Washington Times and Leslie Gelb of the Council on Foreign Relations re: his new book "Power Rules":

- ***Slavin:*** *How would you deal with the Russians and persuade them to cooperate on Iran and on other nuclear nonproliferation issues?*
- *Leslie Gelb: "We have to give them [Russia] a role and take their perspectives into account. This will slow things down but eventually offer us a better chance to get them done…Within ten years Iran will be our closest ally in the region."*

Drunken Nation: Russia's Depopulation Bomb
By Nicholas Eberstadt | World Affairs

Thursday, April 2, 2009

- Russian Demographics
- Between 1976 and 1991, Russia recorded 36 million births; between 1992 and 2007, 22 million births; 24 million deaths between 1976 and 1991 and now 36 million deaths between 1992 and 2007. Instead of growing by 14 million, Russia has declined by 14 million, which exceeds the drop between 1941 and 1946 of 13 million. UN projections put Russia's population in 2050 at 82 million, less than Yemen.

From Dale Brown's "Strike Force"(2007), fiction account of the Battle for Control of Iran with the following real news stories:

- Stratfor, 9 Nov 2004: An Iranian official said Iran has acquired the ability to produce medium-range ballistic missiles in mass quantity including the Shahab 3 with a range of 1250 miles…"
- New York Times, Elaine Sciolino, 26 November 2004, "Iranians Refuse To Terminate Nuclear plans".
- "Russians Helping Iran Create Europe Missile Threat: British Paper(AFP)October 16, 2005---"Former members of the Russian military have been secretly helping Iran obtain the technology needed to make missiles capable of hitting European capitals…Iran would be able to build missiles capable of a range of 3500 kilometers, (2200 miles). "

  Stratfor, August 17, 2005: "Russia Warns Against Military Force"…Military force against Iran would be counterproductive and dangerous…calling for a diplomatic solution…"
- Stratfor, 27 September 2006:"Russia has just signed a contract for the delivery of 80 tons of nuclear fuel with Iran…closer ties with Iran allows Russia a foothold in the Middle East while keeping pressure on the United States…"

Russia's Resource War Against the West

- "Russia's Energy Imperialism by Christina Lin, former Director of Chinese Affairs in policy Planning in DOD
- "Russia's foreign policy of weaponization of energy policy is demonstrated by its invasion of Georgia over the BTC pipeline that by-passes Russian control, cutting oil and gas supplies to former Soviet Republics, dividing Europe via bilateral energy deals at the expense of its near abroad…"
- "The concept of military assistance is tied into the increasing military aspects of energy security…especially the Caspian and Eurasion basin…"

Oil Dependency by Michael Frodl, National Defense April 2009

- “Moscow has approved its national security doctrine up to 2020 and its focus is control of the hydrocarbon rich regions (of Eurasia) in competition with the US…the world is in an energy Cold War”.

Resource War

- Of particular note is Russia's resource war against the West, specifically its use of natural gas to blackmail its neighbors. It seeks to control the flow of oil and gas from Central Asia both to the East and to the West. Moscow also has a growing control of critical mineral resources, such as palladium and platinum mining and processing. We have what Daniel McGroarty and Dr. Christina Lin, in two recent but separate publications, describe as "economics as the continuation of war by other means" and "utilizing the Russian resource sector to once again reassert Russia's imperial status", respectively.

- Peter Huessy, Where is the Russian Reset Button?

INVESTOR’S BUSINESS DAILY
New Business For G-20 Meeting: Russia's Strategic Resource Grab

- BY DANIEL MCGROARTY
  Posted 4/1/2009
- Metals conglomerate Norilsk Nickel owns the United States' only producing platinum and palladium mine, purchased in 2002-03 when U.S.-Russian relations were in the realpolitik equivalent of "harmonic convergence":

RealClearPolitics
MARCH 11, 2009

- 'Buy American' Should Start with Minerals
  By Daniel McGroarty
- That’s where the geo-political story comes back to Stillwater – the only active PGM mine in the United States. But while Stillwater is American-based, it’s not American-owned: Seven years ago, Russian oligarchs Vladimir Potanin and Mikhail Prokhorov bought a majority share of Stillwater through mining giant Norilsk Nickel.

Chavez and Russia (2)

- 2007Gustavo Coronel, member of the Venezuelan Congress elected in 1998, since disbanded, (6/8 Human Events)
- Increased tonnage of cocaine moving through Venezuela…increased cooperation with Iran, Hamas and Hezbollah, and connections to Nicaragua, El Salvador, Ecuador and Bolivia…$14 billion assistance to Cuba…$6 billion in weapons purchases from Russia and China…alliance with FARC

Chavez and Russia

U.S. Alarmed by Chavez's New Missiles
Monday, June 1, 2009 9:19 PM

By: Juan O. Tamayo, McClatchy Newspapers Article Font Size MIAMI — Venezuela's recent purchase of the most lethal shoulder-fired anti-aircraft missiles in the Russian arsenal is sharpening U.S. concerns that parts of President Hugo Chavez's massive weapons buildup could wind up in the hands of terrorists or guerrillas in neighboring Colombia. Washington's unease is well-founded, U.S. government officials say, because of credible evidence that three top Venezuelan officials offered Colombia's FARC rebels weapons, money and contacts to buy anti-aircraft missiles in

Washington Times, Wednesday, June 3, 2009

EXCLUSIVE: Al Qaeda eyes bio attack from Mexico

- U.S. counterterrorism officials have authenticated a video by an al Qaeda recruiter threatening to smuggle a biological weapon into the United States via tunnels under the Mexico border, the latest sign of the terrorist group's determination to stage another mass-casualty attack on the U.S. homeland.
- The video aired earlier this year as a recruitment tool makes clear that al Qaeda is looking to exploit weaknesses in U.S. border security and also is willing to ally itself with white militia groups or other anti-government entities interested in carrying out an attack inside the United States, according to counterterrorism officials interviewed by The Washington Times.

By Peter Huessy, President, GeoStrategic Analysis
Asia-Pacific Security Challenges, Prague Security Studies Institute,
Prague, Czech Republic, September 2008

- The PRC may very well find itself in military conflict with the US and its allies and Russia over access to and control over petroleum supplies and the sea lanes through which petroleum is shipped;
- PRC military acquisition appears aimed at just such a strategy while the US has failed to build a nuclear plant in 40 years and has had a moratorium on OCS development for 40 years as well. Alaskan Pipeline was built 35 years ago; new gas pipeline from Alaska to Upper Midwest through Canada is the largest energy project in American history recently agreed to by Alaska and Canada.

Breaking Wind, The Limbaugh Letter, June 2009

- Denmark produces about 20% of its electricity through wind power but because wind is so unpredictable, the Danes have had to use 50% more coal-generated electricity to cover the power gaps, causing carbon emissions to go up 36%. For every “green” job created, they have lost 2.2 other jobs and they have yet to close a single fossil-fuel plant. They also have the highest electricity costs in Europe according to the National Post of Canada.

Waxman Markey Energy Bill

- Cut carbon emissions 17% by 20220 and 83% by 2050, below the 2005 baseline; These means business gets an arbitrary “allowable” emissions level; 85% of the emissions level “rights” were given away for free for the first 15 years of the legislation to get companies to buy into the bill; but those who did not get the “right” to emissions must pay for their current emissions levels to the tune of $200 billion annually. (Human Events, June 8th, 2009

Energy And Iran

- The major suppliers of gasoline to Iran have come under congressional scrutiny. One supplier, Reliance Industries Ltd. of India, did not ship gasoline to Iran in February and March 2009 after members of Congress called for an investigation of loan guarantees provided by the U.S. Export-Import Bank to help Reliance expand a refinery where it was refinining petroleum for sale to Iran. According to recent reports, however, Reliance has resumed shipments to Iran. A second supplier, British Petroleum, stopped its own shipments after deciding that the company's extensive North American business interests were more valuable than the Iranian market

Energy and Iran

- A bipartisan group of Members of Congress has also asked Energy Secretary Chu to review a $50 million contract awarded to the Swiss company Vitol, Iran's largest supplier of gasoline, and to consider debarring Vitol for its role in the United Nations Oil for Food scandal.

Iran and Oil

- On April 22, 2009, the Iran Diplomatic Enhancement Act, H.R. 1985, was introduced in the House by Representatives Mark Kirk (R-IL) and Brad Sherman (D-CA) and 23 other Democratic and Republican House members. H.R. 1985 seeks to extend current U.S. sanctions to suppliers, brokers, insurers, and tankers involved in selling refined petroleum to Iran.

Iran and Energy

- On April 28, 2009, The Iran Refined Petroleum Sanctions Act was introduced by a bipartisan group of U.S. Senators. The legislation would provide for sanctions on any person or entity that provides refined petroleum to Iran or helps Iran to import refined petroleum or develop its refinery capacity. Co-sponsors included Senators Evan Bayh (D-IN), Joe Lieberman (ID-CT), Jon Kyl (R-AZ), Kit Bond (R-MO), Barbara Boxer (D-CA), Sam Brownback (R-KS), Richard Burr (R-NC), Ben Cardin (D-MD), Tom Coburn (R-OK), Susan Collins (R-ME), Russ Feingold (D-WI), Lindsey Graham (R-SC), James Inhofe (R-OK), Mike Johanns (R-NE), Amy Klobuchar (D-MN), Mary Landrieu (D-LA), Robert Menendez (D-NJ), Barbara Mikulski (D-MD), Patty Murray (D-WA), James Risch (R-ID), Charles Schumer (D-NY), Debbie Stabenow (D-MI), John Thune (R-SD), David Vitter (R-LA) and Ron Wyden (D-OR).

Cannon Artillery and Mortar Precision Effects

Presented by: COLONEL Ole Knudson
Project Manager for
Combat Ammunition Systems
973 724-2003, ole.knudson@us.army.mil

"The presentation to the effect that disclosure of information does not imply any specific intent or commitment on the part of the U.S. to provide further information on the topic."

What Level of Precision is Needed?

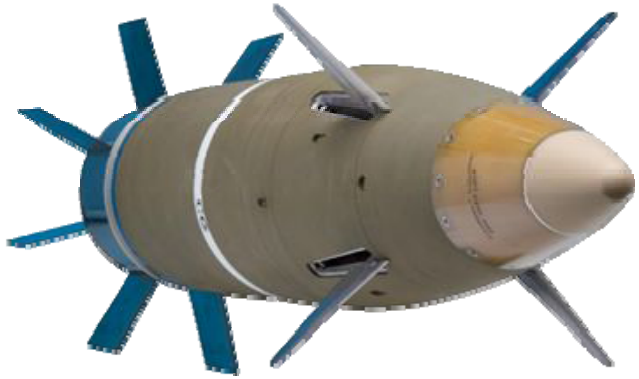
- Urban Density Can Vary Widely Over Small Distances Between Terrain Elements
- Munitions with Varying Levels of Precision May Be Most Cost-Effective

Cannon Artillery and Mortar Precision Effects Capabilities

- All weather 24/7 continuously “loitering” precision capability
  - ✓ Responsively and precisely attack targets… can precisely “mass” fires
  - ✓ Minimizes collateral damage…“discretion” & “close” engagements
  - ✓ Inherent scalability with multiple shooters and multi-round missions
  - ✓ Dramatically reduced logistics burdens (less qtys and transport/storage)

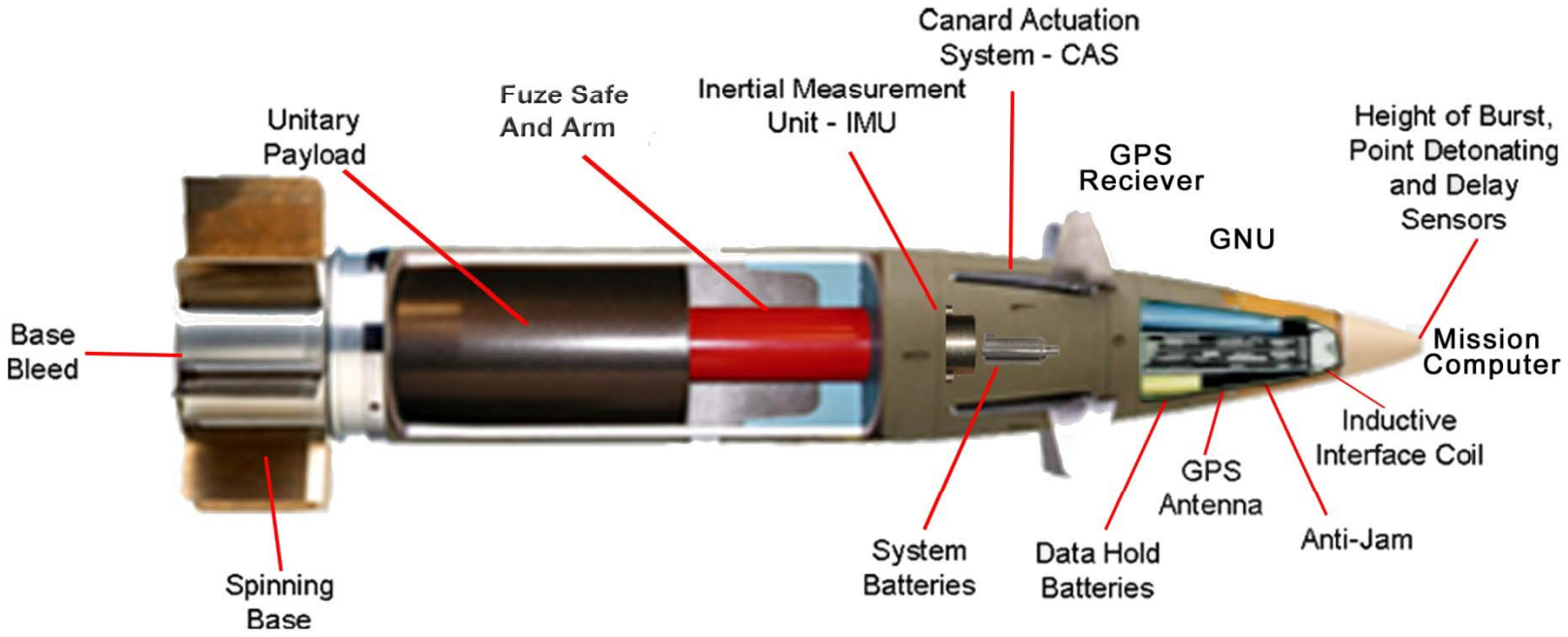
- Employed with current cannon artillery & mortar systems and force structure… & accurate targeting systems (FS3, LLDR, PSS-SOF, and others)
  - ✓ Easily additive to current systems and capabilities… “compatibility” is key
  - ✓ No additional manpower or force structure is needed
  - ✓ Maintains current Smoke & Illum capabilities
  - ✓ Maintains area fire & suppressive fires capabilities… “precise” area fires?

Excalibur Increment Ia

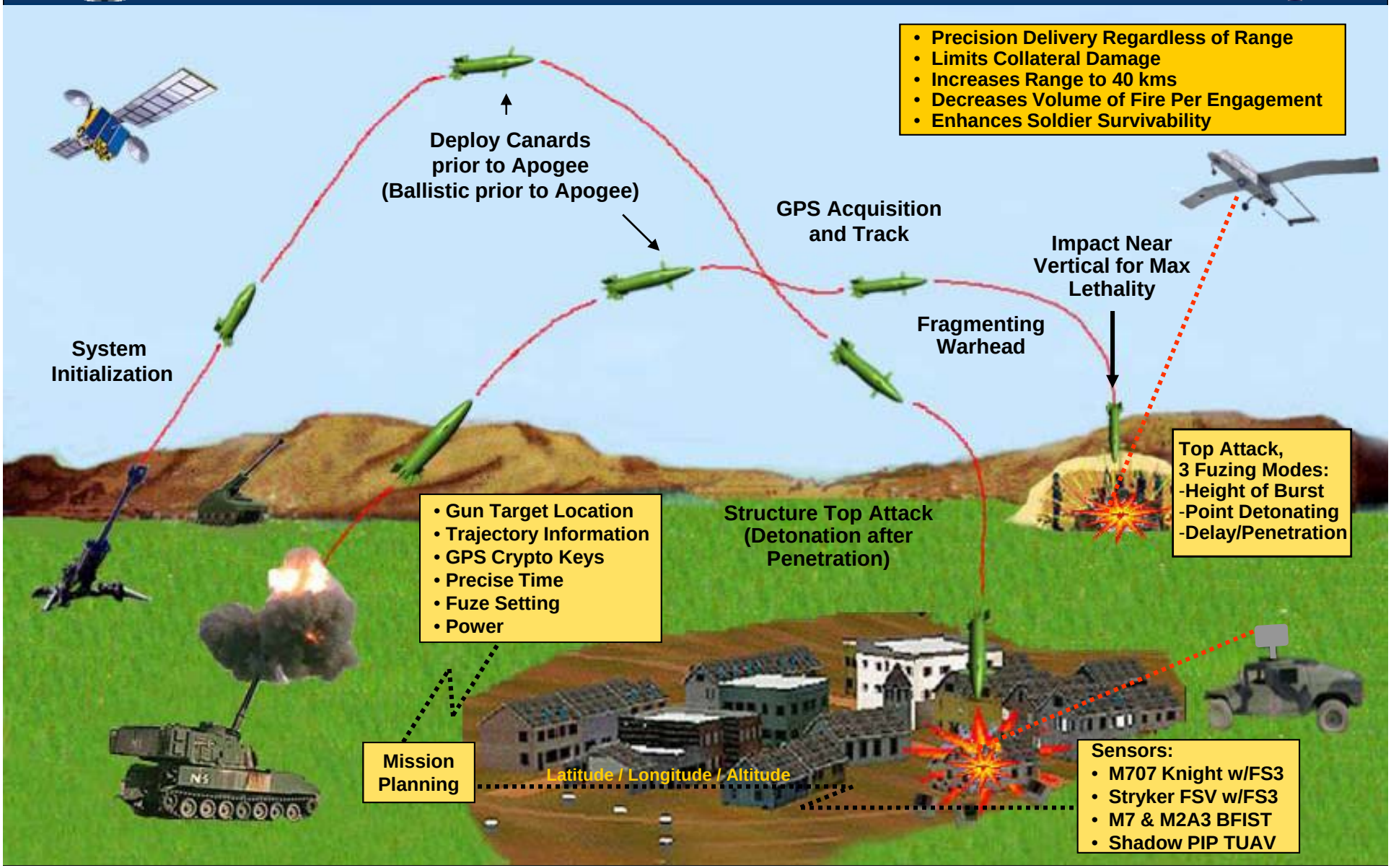


System Characteristics/Description:

- ✓ Precision Guided 155mm Cannon Ammunition (CEP < 10m)
- ✓ Fin Stabilized, Gliding Air Frame
- ✓ All Weather, Day/Night, Fire & Forget, Urban/Complex Terrain
- ✓ Compatible with NLOS-C, Paladin and LW155 Howitzer Platforms
- ✓ One Meter Length / 106 lb



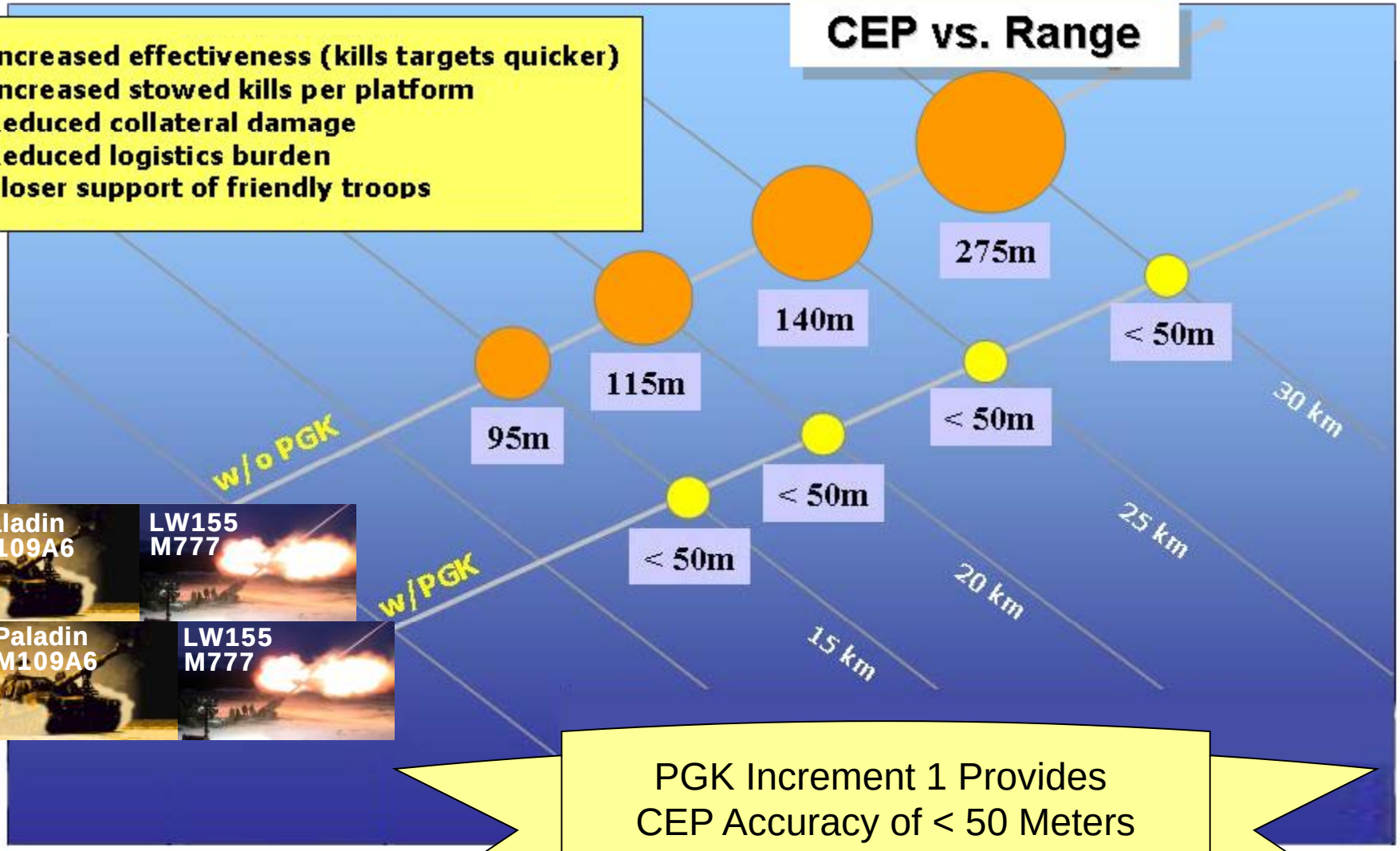
Excalibur Concept of Operations

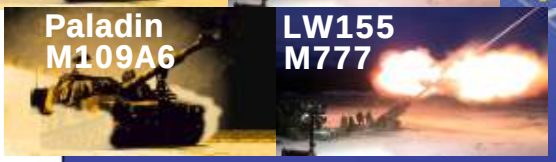


Excalibur Video

Precision Guidance Kit (PGK)
155mm Projectile Accuracy

- Increased effectiveness (kills targets quicker)
- Increased stowed kills per platform
- Reduced collateral damage
- Reduced logistics burden
- Closer support of friendly troops



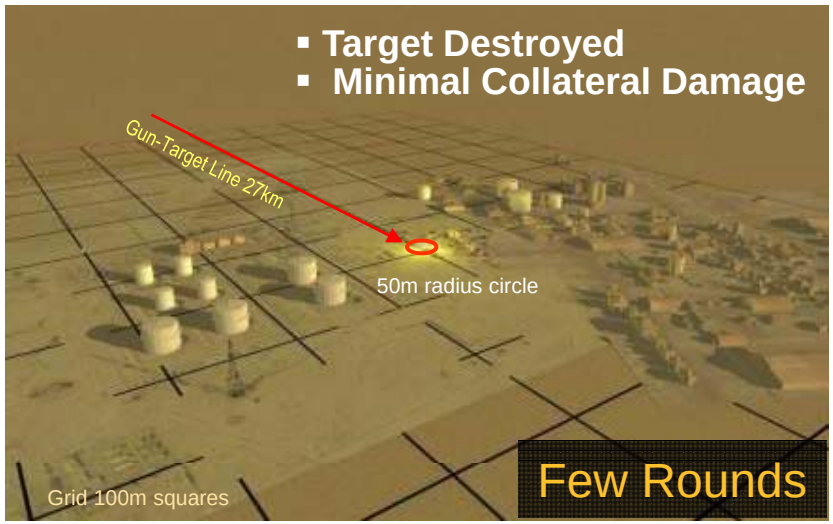


PGK Increment 1 Provides
CEP Accuracy of < 50 Meters

Operational Benefits

Today's Capability: 183m CEP*

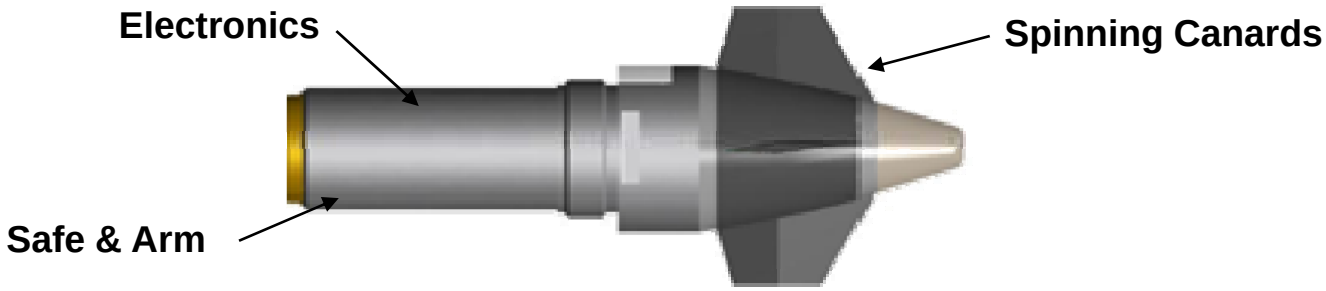
PGK: ≤50m CEP



* **M109A6 (Paladin) at 27km: 155mm (HE) M549A1**

- **Improves Accuracy – Significantly Reduces Ballistic Dispersion**
- **Significantly Decreases the Time Needed to Achieve Desired effects**
- **Minimizes Collateral Damage and Enables Closer Support to Friendly Troops**
- **Increases Number of Kills per Basic Load of Ammunition**
- **Greatly Reduces Logistics Burdens**

PGK Design (Increment 1)



- Fits in standard 155mm High Explosive artillery projectile fuze wells (deep intrusion)
- GPS guidance (incorporates SAASM)
- 20 Year Storage Life (no battery)
- Proximity & Point Detonating Fuzing

PGK Video

Emerging Needs/ Future Requirements

- IBCT Organic Precision Requirements
  - ✓ 40 Plus IBCTs within Army structure…have mortars &105mm
  - ✓ PGK-2 is funded…implemented with 105mm digitization
  - ✓ ONS for organic very responsive precision with <10m CEP
- "Cheap" or "Very Affordable" Precision
  - ✓ Key technologies… GPS, Fuzing, Power, AJ, & SALs
  - ✓ ARDEC/ARL CRADA efforts to mature components and integrated concepts…applicable to artillery and mortars
  - ✓ Several Industry efforts ongoing…should enable competition
  - ✓ Wider use in training…confidence, proficiency, and quantities

Is Very Affordable Precision "Coming Soon"?

U.S. ARMY ARMAMENT RESEARCH,
DEVELOPMENT & ENGINEERING CENTER

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Advanced Technology and Precision Armaments- ARDEC Perspective

Dr. Joseph A. Lannon,
Director, US Army ARDEC

9 June 2009

Presentation Outline

- ARDEC Overview
- Advanced Technology & Precision Armaments
  - Increased Precision
  - Force Protection / Survivability Needs
  - Longer Standoff
  - Affordability
  - Reduced Logistics Burden
  - Adaptive Lethality / Reduced Collateral Damage
  - High Reliability
- Modeling and Simulation
- ARDEC Accomplishments
- BRAC Added Capabilities
- Rewards and Recognition
- Summary

ARDEC Support to Two LCMCs

Headquarters, Department of the Army

Assigned/Direct Support
Coordination

Army Material Command, AMC
Gen. Ann E. Dunwoody

Joint Munitions & Lethality LCMC
BG Larry Wyche

PEO Ammo
Mr. James C. Sutton

- Project Manager Close Combat Systems (PM CCS)
- Project Manager Combat Ammunition Systems (PM CAS)
- Project Manager Maneuver Ammunition Systems (PM MAS)
- Project Manager for Joint Services (PM Joint Services)

Research, Development and Engineering Command, RDECOM
MG Paul S. Izzo

Armament Research, Development and Engineering Center, ARDEC
Dr. Joseph A. Lannon

TACOM LCMC
MG Scott G. West

- Program Executive Office Combat Support and Combat Service Support
- Program Executive Office Ground Combat Systems
- Program Executive Office Soldier

2007 Award Recipient

Armament Research, Development & Engineering Center

- Research

- Development

- Production

- Field Support

- Demilitarization

Vision:

Innovative Armaments Solutions for Today and Tomorrow

Mission:

To develop and maintain a world-class workforce to execute and manage integrated life-cycle engineering processes required for the research, development, production, field support and demilitarization of munitions, weapons, fire control and associated items

Advanced Weapons – line of sight/beyond line of sight fire; non line of sight fire; scalable effects; non-lethal; directed energy; autonomous weapons

Ammunition – small, medium, large caliber; propellants; explosives; pyrotechnics; warheads; insensitive munitions; logistics; packaging; fuzes; environmental technologies and explosive ordnance disposal

Fire Control – battlefield digitization; embedded system software; aero ballistics and telemetry

Provides the Technology for Over 90% of the Army's lethality; Significant support to other services' lethality

ARDEC Executive Team

Director/Deputy Director
Dr. Joseph A. Lannon/COL Scott Flynn

Enterprise & System Integration Ctr.
COL Scott Flynn/Mr. Tony D'Agosto

Tech Base/MANTECH
Ms. Barbara Machak

Quality Engineering & System Assurance Directorate
Mr. Dominick Carra

Weapons & Software Engineering Center
Mr. David Castellano

Financial Management Office
Ms. Mary Manser

Munitions Engineering Technology Ctr.
LTC Bosworth/John Hedderich III

Senior Research Scientist for Warhead Technologies
Mr. Richard Fong

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARDEC Organization Chart

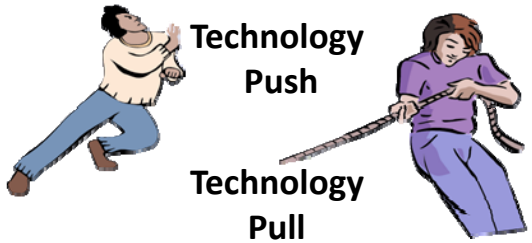
Mgm't Tiers

- Tier 1
- Tier 2
- Tier 3

Director/Deputy Director

- Munitions Engineering Technology Center
- Weapons & Software Engineering Center
- Tech Base/ MANTECH
- Quality Engineering & System Assurance
- Enterprise & Systems Integration Center
- Financial Management Office

- Technology Innovation & Competency Development
- Financial Support
- Cost, Schedule, & Performance Adherence, Systems Engineering, Strategic Planning & Business Development
- Product Verification & Validation



Empowered Teams Support Customer Needs throughout the Lifecycle

Collaboration Drives Success

Malcolm Baldrige National Quality Award 2007 Award Recipient

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

ARDEC at a Glance

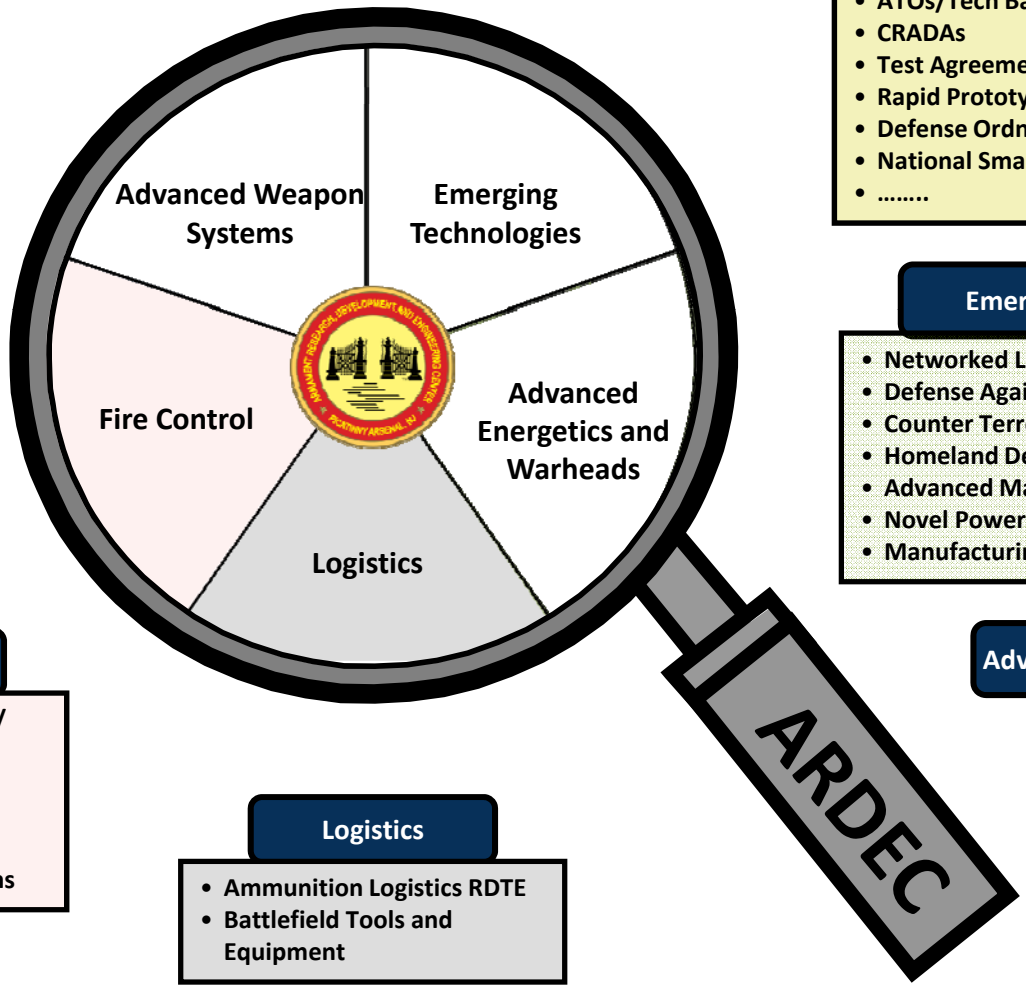
- Established “Center of Mass” for Armament Systems and Munitions for Joint Services
- ARDEC is the largest tenant at Picatinny Arsenal
  - Over 800 Buildings/64 Laboratories
- Proven track-record supporting transition of technologies to the field; in FY08…
  - >14 Materiel Releases (MR)
  - >13 Urgent MR
- > ARDEC & Partners Fielded 134 New Weapons, Ammunition and Equipment since 9/11
- Recruiting and Nurturing Top Talent- Onsite Armaments Training Facility
- ARDEC Government Personnel ~ 3321; **1191 new hires since FY99***
  - Picatinny Site = 2880
  - Benet (Watervliet Arsenal) = 239
  - Rock Island Arsenal = 144
  - Adelphi & APG = 58
- >$120M invested in “World Class” experimental R&D facilities since mid-90’s; Additional $75M planned
- Strong partnerships with Industry, Academia, and other Government agencies - Growth and Success through Cooperative Research and Development Agreements (CRADAs) = 121
- Intellectual Property: Invention Disclosures – 12; Patent Applications – 16; Patents Issued – 8; Patent License Agreements – 14
- In-house rapid prototyping initiatives demonstrating new desired capabilities, supporting production prove-out and initial fielding demands
- > $100M Tech Base portfolio addressing Joint needs (Core Tech Base/ManTech only; does not include SBIR or Congressional Plus-ups)

* As of 30 Apr 09

ARDEC Technology Focus Areas

Advanced Weapon Systems

- Direct Fire
- Indirect Fire
- Scalable Effects
- Non-Lethal Systems
- Small/Medium/Large caliber ammunition
- Directed Energy
- Remote Armaments
- Insensitive Munitions
- Fuzes
- Telemetry
- Precision Armaments
- Grenades
- Maneuver Support Munitions
- Demolitions



Collaboration Mechanisms

- ATOs/Tech Base
- CRADAs
- Test Agreements
- Rapid Prototyping
- Defense Ordnance Technology Consortium
- National Small Arms Consortium
- ……..

Emerging Technologies

- Networked Lethality
- Defense Against Unmanned Systems
- Counter Terrorism Technologies
- Homeland Defense Technologies
- Advanced Materials / Nanotechnologies
- Novel Power & Energy Systems
- Manufacturing Science Technologies

Fire Control

- Battlefield Digitization / SW Applications
- Embedded Systems SW
- Firing Tables
- Ballistics
- Automated Test Systems

Logistics

- Ammunition Logistics RDTE
- Battlefield Tools and Equipment

Advanced Energetics and Warheads

- Propellants
- Explosives
- Pyrotechnics
- Warheads
  - Kinetic Energy
  - Chemical Energy
  - Shaped Charges
  - EFPs
  - Fragmentation

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Advanced Technology and Precision Armaments

- The Future is Now: Warfighter Needs are being actively addressed
  - Increased Precision
  - Force Protection / Survivability Needs
  - Longer Standoff
  - Affordability
  - Reduced Logistics Burden
  - Adaptive Lethality / Reduced Collateral Damage
  - High Reliability

- *Where we are going*
  - *Satisfy the Warfighter's needs thru continuous/Life Cycle investment in S&T, SD&D and O&S*
  - *Focus on Reliability, Cost and Transition to the Warfighter*

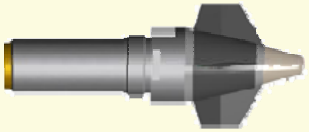
Recent Activity – Increased Precision

Mid Range Munition

- Transitioned in FY07 to PM MAS
- 1st BLOS smart munition
- Autonomous and SAL designated
- Raytheon (Technology Base Provider) selected for SDD

Precision Guidance Kit

- **Provides Affordable Near-Precision Accuracy**
- **Fits in standard 155mm High Explosive artillery projectile fuze wells (deep intrusion)**
- **GPS guidance (incorporates SAASM)**
- **20 Year Storage Life (no battery)**
- **Proximity & Point Detonating Fuzing**



Excalibur & Excalibur 1B

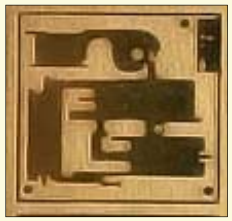
Excalibur Experiencing Tactical Success

Excalibur 1B in Development

- Improvements Over Baseline
  - Cost Reduction
  - Reliability Improvement
  - Improved Accuracy in CM Environment
  - Increased Range

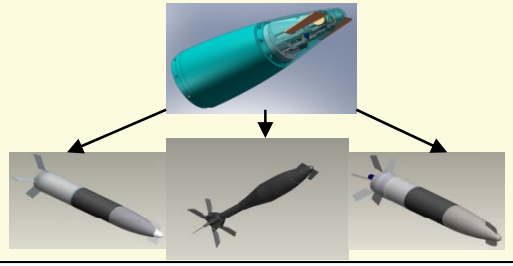
MEMS IMU

- Transitioned in FY07 to PM CAS
- Co-developed with AMRDEC
- Common munitions / missile IMU
- Used in Excalibur



Very Affordable Precision Projectile / Very Affordable Precision Mortar

- Precision at $10,000 / RD
- Government design
- Forthcoming CDD for 105mm



Affordable Precision Component Technologies

- **Demonstration of Industry & Government Concepts for Low Cost Guided Munitions and Associated Technology**
- **Focus on commonality across mortars and artillery**
- **Component Technology Evaluation of power source, Guidance Module, GPS receiver/processor (if required)/SAL; and control system (e.g., canards, vents, thrusters)**

APCT will provide low cost precision accuracy in artillery & mortar systems lacking that capability.

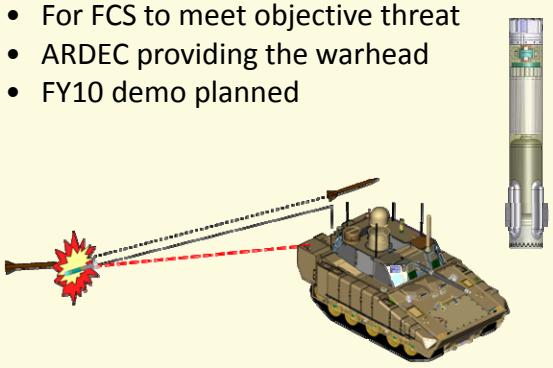
Recent Activity – Force Protection / Survivability

Extended Area Protection System (EAPS)

- 50mm gun and guided bullet
- Counter rocket artillery and mortar

KEAPS

- For FCS to meet objective threat
- ARDEC providing the warhead
- FY10 demo planned

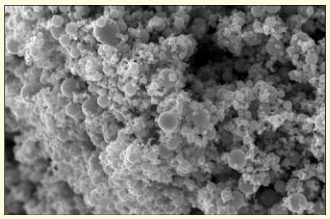


Gunfire Detection & Location

- Enhanced acoustic, UV, IR, narrow-band, and/or optical augmentation sensors to detect/locate/ID shooters
- Provide combat forces with actionable understanding of hostile shooters & gunfire in real-time & enhance TTPs to defeat threats

Novel/Nano Structured Energetics

- High performance extremely insensitive fills
- Structural Energetics



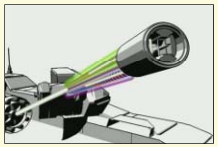
Insensitive Munitions (IM)

- HPC institute, ARL and ARDEC teamed to develop the next generation of M&S for Insensitive Munitions application
- New M&S capability: Faster design and implementation
- Improved tactical and combat survivability
- IM efforts for HE Munition and new IM Fills

Recent Activity – Longer Standoff

EM Gun

- Eliminate use of energetics with increased lethality
- Enhanced Survivability with reduced launch signature
- 20MJ Railgun Launcher, Integrated Launch Package, & 20MJ Pulsed Power supply

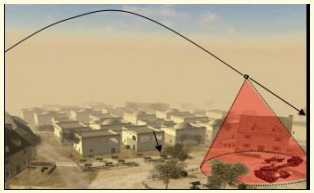


Projectile

- XM1113 Extended Range Artillery redesigned to achieve 1200m/s muzzle velocity with a 20m CEP
- Velocity Augmented solution leverages ERGM design to achieve ranges with larger payloads

HPM Conceptual Payload

Ability to neutralize targets outside the range of vehicle based DE with minimal collateral damage



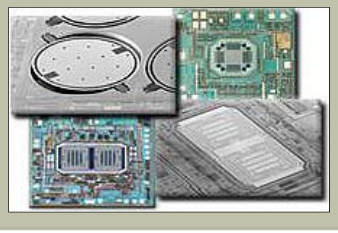
Weapon Improvements

- Extended Length
- Composite Barrel
- High Efficiency Muzzle Break
- Laser Ignition
- Modular Recoil
- Increased Muzzle Velocities

Recent Activity – Affordability

MEM S&A

- S&T and MTO
- Proven at TRL 6 and MRL 7 for 20mm and 155mm
- Saves space for more lethality



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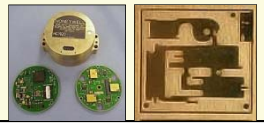

Excalibur & Excalibur 1B

- Improvements Over Baseline
  - Cost Reduction
  - Reliability Improvement
  - Improved Accuracy in CM Environment
  - Increased Range

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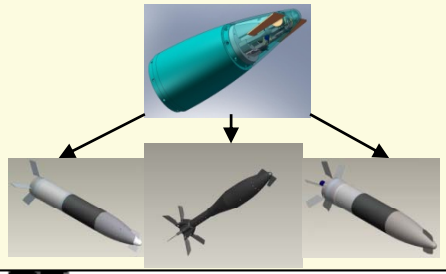

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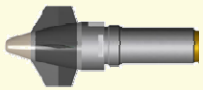
APCT will provide low cost precision accuracy in artillery & mortar systems lacking that capability.

Precision Guidance Kit

- **Provides Affordable Near-Precision Accuracy**
- **Fits in standard 155mm High Explosive artillery projectile fuze wells (deep intrusion)**
- **GPS guidance (incorporates SAASM)**
- **20 Year Storage Life (no battery)**
- **Proximity & Point Detonating Fuzing**



Recent Activity – Reduced Logistics Burden

Joint Modular Intermodal Distribution System (JMIDS)

- JMIC+JMIP transition in FY09 to PM-FSS
- Critical supplies delivered faster -
  45% fewer C17 missions
- Reduces exposure to IEDs -
  40% fewer vehicle trips

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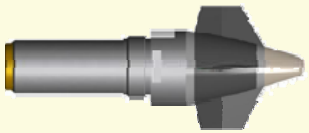
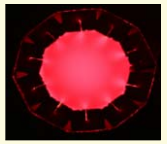
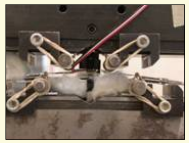
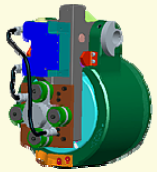


Breech Mounted Laser Ignition

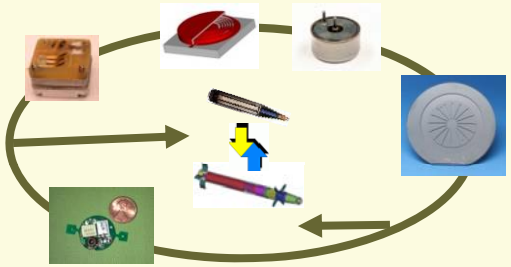
- Being developed for 155mm artillery
- Replacement for primer based ignition
- Provides logistics and operational benefits
- Improves mission readiness
- Supports continuous high rates of fire

Recent Activity – Adaptive Lethality / Reduced Collateral Damage

Fuze and Power

- High Voltage Fireset
- MEMS Impact Sensor
- Thermal/Reserve Batteries
- Shaped Charge Array for MP ESAD

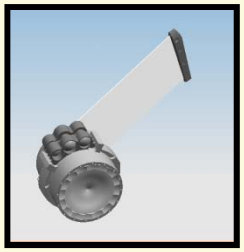


Multi-Mode Warheads

- Target Selectable (e.g. armor or bunkers)
- Scalable (Full or mitigated effect)
- Tunable (non-lethal to highly lethal)

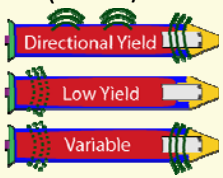
Common Smart Submunition

- Increased lethality sensor fuzed munition
- Combined effects warhead
- Multi platform 128mm



Scalable Technology for Adaptive Response (STAR)

- Scalable, selectable & adaptive lethal effects
- Demonstrators: 250mm (GMLRS), 155mm (Excalibur), 30mm (M789/Mk238

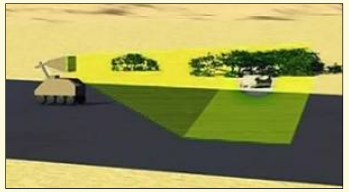


Hardened Combined Effects

- Bash through structures
- Transitioned already to NLOS-LS PGMM and MRM

High Power Microwave

- Weapon and a payload technologies
- Multi-effects across multiple targets



Recent Activity – Affordable Reliability

- To Achieve Affordable Reliability we Need…
  - Infrastructure (Teams, M&S, Process)
  - Reliability Toolkit
    - Tools (Like Relentless Root Cause Process/Probabilistic Technology)
    - Training
    - IT Resources
  - Culture to Apply Reliability Tools
    - Support for Reliability-Driven Design
    - Focal Point for early Demos
    - Significance in Acquisition Approach & Source Selection
  - Broadly Applied Method to Qualify Materials (Potting, Adhesives, Elastomers) & Components
  - Process to Increase Component Reliability
  - Do It Early!

Increased use of Modeling and Simulation

Change ARDEC's Product Development Culture to Model-Test-Model

- **Focus on enhancing these M&S areas initially:**
  - Design & Testing: Structural, Software, Energetics
  - Operational and System Analysis
  - Systems Integration
  - Manufacturing
- **Key Initiatives:**
  - **Training/Certification –** ***M&S Modules in APO training (once a month)***
    - **Management**
    - **Workforce**
  - **Infrastructure**
  - **Test Community acceptance**

Emphasis on Rapid Prototyping and Speed of Technology Transition

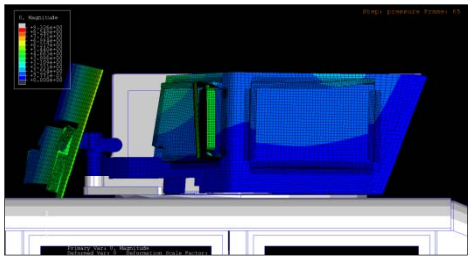
High Performance Computing (HPC) Resource Utilization

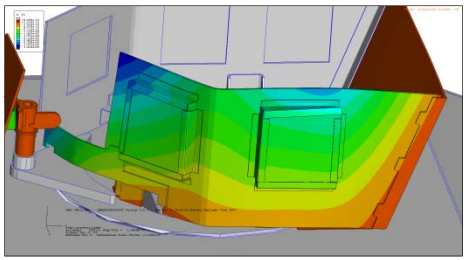
- **Increasing available High Performance Computing**
  - **Acquired a Local HPC Resources for ARDEC Engineers**
    - ✓ **Dell HPC Cluster (Supercomputer) on-line and available for use**
      - ✓ **192 CPUs 96 Nodes; ~2.5TFlops; 768GB RAM**
      - ✓**Connectivity to ARDEC enterprise storage - Secure Area Network (SAN)**

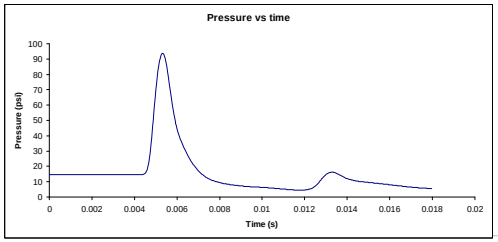
Significantly Increases ARDEC Capabilities to Solve Complex Armament Systems Design Challenges

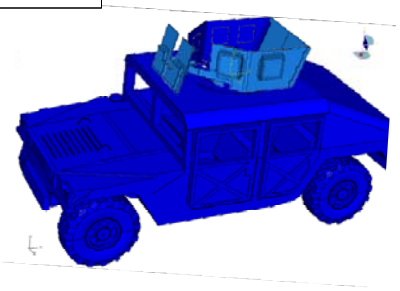
M&S Value Added- Example
Objective Gunners Protection Kit (OGPK)

- Issue
  - Soldiers requested more visibility on Gunners protection kit (GPK)
  - Concern over excessive deflection of armor when subjected to blast
- Modeling Effort
  - Modeled Blast effects on structure
  - Developed larger glass panels
  - Effort completed in 2 weeks
- Benefits
  - Saved 4 months of testing
  - Saved $1.0 M
  - Could not have met fielding schedule





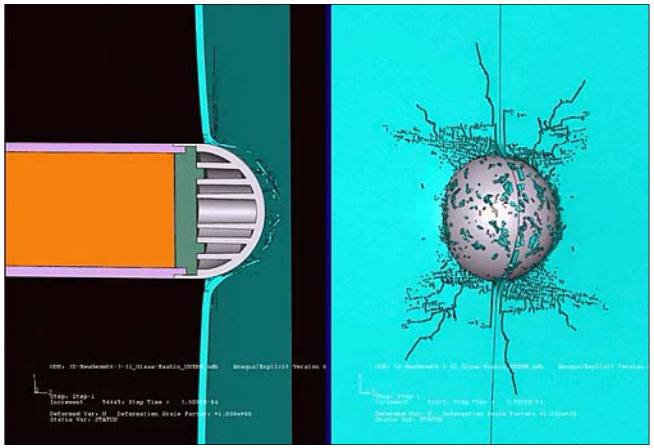


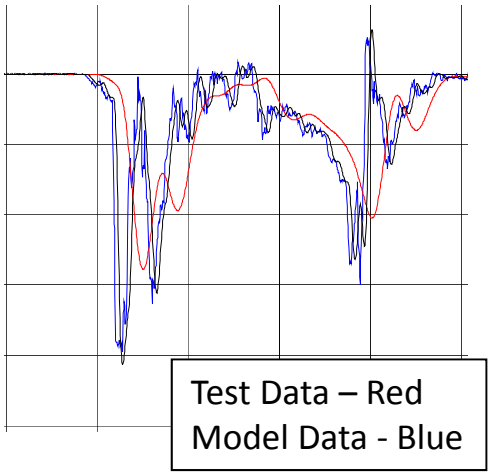


Test cost and schedule prohibitive

M&S Value Added - Example
Surveillance Grenade Development

- Issue
  - Surveillance grenade design (SmADSNet) requires transmitter to survive impact into concrete after passing through a window
- Modeling Effort
  - Modeled multiple designs for front end of grenade to absorb impact
  - Each iteration can be run at various impact angles
  - Effort is ongoing
- Benefits
  - Saved 2-3 years of trial and error testing
  - Saved an estimated $1M to date





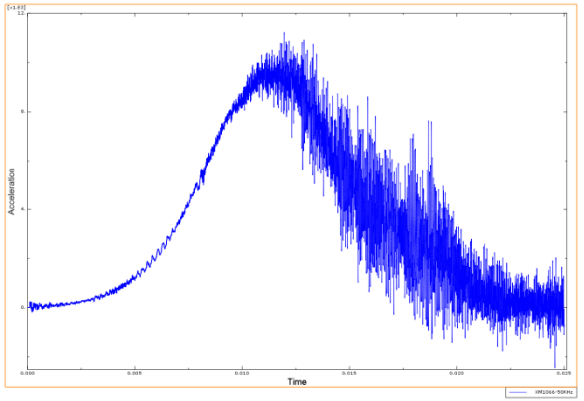
Modeling efforts key to success of program

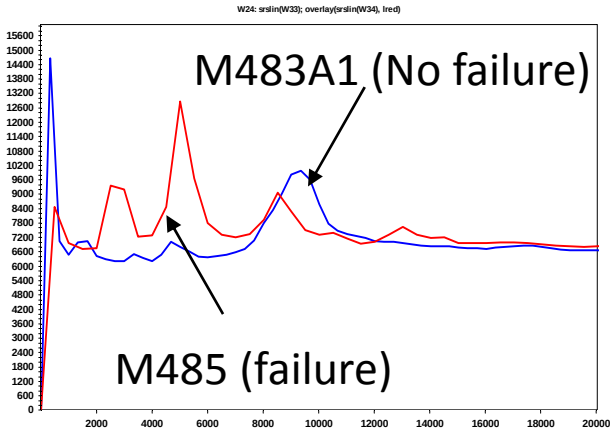
Malcolm Baldrige National Quality Award 2007 Award Recipient

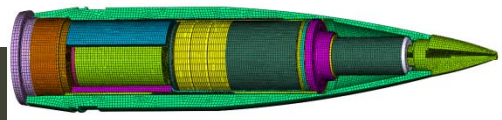
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

M&S Value Added- Example
M485 Illumination Round

- Issue
  - M485 illumination projectile is suffering from fuze failures in lot acceptance testing
  - Previous testing showed no issue
- Modeling Effort
  - Modeled M485 projectile as well as M483 projectile which did not exhibit failure
  - Testing and model are showing dynamic structural issues
  - Effort is ongoing
- Benefits
  - Saved 6 months of trial and error testing
  - Saved an estimated $1M to date



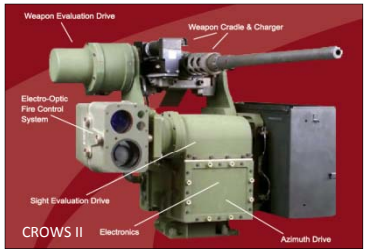




Failure analysis ongoing and strongly leveraging modeling

2007 Award Recipient

Accomplishments
Weapons and Ammunition
Fielded Since 9/11



- **Armor (9)**
- **Artillery (26)**
- **Aviation (6)**
- **Engineer (24)**
- **Infantry (56)**
- **Log (1)**
- **Mil Police (13)**
- **SF (4)**

Additionally, ARDEC has provided numerous materiel changes and improvements to fielded items

M982 Excalibur
Block IA-1 Projectile

Malcolm Baldrige National Quality Award
2007 Award Recipient

TECHNOLOGY DRIVEN. ***WARFIGHTER FOCUSED.***

Recent- Rapid Fielding in Support of Overseas Contingency Operations

FY06

PBS

PBS Coalition LAV

Rapid Entry Veh (REV)

Shape Charge Assembly

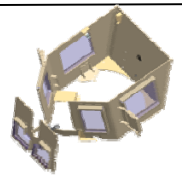
Army's Greatest Inventions

FY07

SWORDS

M1A1/A2 Gunner/Loader Protection

BEB Force Protection



O-GPK PHII

RG31 Air Line/Tank Protection Kit

Excalibur 1a-1

Sparrow

Bloodhound (OIF)

CROWS Lightning/ PDCue

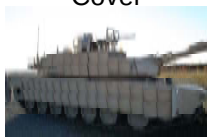
M110 SASS

O-GPK (RG31 Variant)

FY08

O-GPK Overhead Cover

M2 Cal 50 Extender



XM32 Abrams Reactive Armor Tile II

Picatinny Weapon Elevation Kit

Schonstedt

Rattlesnake

Bloodhound (OEF)

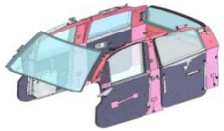
Titanium Gunner Protection Kit (SOCOM)

Small/Med Machine Gun Weapon Cradle

FY09

Objective Weapon Elevation Kit

Watchdog



Non-standard Vehicle Armor

134 Successful fieldings since 09/11/2001

ARDEC Facilities

Davidson Advanced Warhead Development Facility

Opened 2000, $11.7M
Maximum 50 TNT equivalent capability
100m indoor warhead test range

Armament Software Engineering Center

Opened 2005, $15.5M
Integrated S/W & H/W development/integration
Multi-platform SOSI highbay capability
CMMI Level 5 Certified

Armament Technology Facility

$10M Expansion Underway

Opened 1996, $8.4M
100 and 300m indoor ranges
Environmental chambers
Addition–Opening FY09
100m indoor range

Precision Armaments Lab

Opened 2003, $8.8M
2 Lab grade elevators for sensor development
3 Target locations; 150m, 400m, and 1500m

High Energy Propellant Formulation Facility

Opening FY10, $17.7M
45,000 ft2 Propellant Pilot Plant
Characterization Laboratories
Magazine Storage / Offices

Pyrotechnic Research & Technology Complex

Opening FY10, $9.9M
33,000 ft2 Engineering Offices and Laboratories
Pilot manufacturing facility
Energetic stowage

Soft Recovery System (SRS)

Opened 2008, $9.0M
High-g test Munition/Components to 20K g's
155mm capability (current); Only one in existence
Navy 5", 120mm mortar, and EM Gun planned

Explosives R&D Loading Facility

Opening FY10, $8.0M
28,000 ft2 Melt Pour Operations *and* Engineering
Climate Controlling Machining
Explosive Pressing, Cast Cure, and X-Ray

Picatinny Arsenal BRAC Overview

- BRAC 05 recommendation created an Integrated Weapons & Armaments Specialty Site for Guns and Ammunition Research, Development and Acquisition (RDA) at Picatinny Arsenal. Functions being realigned:
  - Army – ARDEC Fuze Detachment currently located at Adelphi, MD; group has 44 positions and performs Fuze Technology, Development and Production
  - Navy – functions will be realigned into the Picatinny Navy Detachment; reporting to Indian Head Division, NSWC, MD :
    - ❖ Naval Surface Warfare Center (NSWC) Earle Detachment - Group located at Earle, NJ; has approx 67 positions that perform Packaging, Handling, Storage and Transportation (PHS&T) RDAT&E
    - ❖ NSWC Louisville Detachment - Group located at Louisville, Ky; has approx 106 positions realigning to Picatinny that perform acquisition, production and operational support for in-service engineering and emerging Naval gun systems
    - ❖ NSWC Crane Division – Group located at Crane, IN; has approx 57 positions that perform acquisition and sustainment of Navy and Marine Corps guns and ammunition
    - ❖ Naval Air Surface Warfare Center China Lake – Group located at China Lake, CA has approx 4 positions the perform research, development and acquisition of aircraft guns
- Personnel status:
  - ➢ Navy Transition Manager on-site
  - ➢ Currently 16 Navy employees on-site (performing Crane, IN functions). No personnel expected to move from Crane; Navy hiring as vacancies occur.
    - ➢ Anticipate hiring additional 15 employees in FY09
  - ➢ Two Army (Adelphi) employees on-site
  - ➢ Remainder of Army and Navy personnel moves scheduled in mid to late FY11 as construction projects completed

BRAC Military Construction

- Military Construction Projects:
  - 3 Navy projects, 1 Army project
  - Total cost of $76 M
  - Total of 168,000 Sq Ft – 2/3rd renovation of existing buildings; 1/3rd new construction
  - Solicitations issued for 1 Navy project and the Army project
    - Groundbreaking ceremonies will be scheduled; likely in late Aug 09
  - Two remaining Navy projects still in design phase; solicitations expected to be issued in late FY09
  - Construction scheduled for all projects during 2009-2011 timeframe
  - Permanent occupancy scheduled in mid to late FY11

ARDEC Recent Awards

- **5 Army R&D Achievement Team Awards** with 18 individual recipients in FY07; 8 Teams with 33 individual awards in FY08

- **Top 5 DoD Environmental Award:** On 21 April 2008, Secretary of the Army awarded ARDEC 2007 Environmental Award for Environmentally friendly pyrotechnic work

- **Zernow Best Paper Award:** The winning paper entitled “Combined Effects Aluminized Explosives" by Dr. E. L. Baker, (ARDEC’s Energetics and Warhead Division) provides new understanding of the physics of combined effects explosives, and demonstrates the extraordinary technical abilities of the authors.

- **Richard Goodman Strategic Planning Award**: ARDEC is the first DOD organization to be recipient in the category of government. The association bases the award on organization strategic planning process.

- **Army Large Research and Development Lab of the Year:** ARDEC is the recipient for 2008.

- **Popular Science Magazine 2009 Invention Award:** RIPSAW unmanned tracked vehicle selected for 2009 Invention Award.

- **2009 National Federal Laboratory Consortium (FLC) Award for Excellence in Technology Transfer:** MINDS has been developed with investment from the U.S. Army's Armament Research, and Development Engineering Center ("ARDEC") at Picatinny Arsenal, NJ, and is being commercialized by InSitech (Partnership Intermediary) the exclusive licensee of Princeton University. MINDS is a practical, cost effective, software-based, nuclide identifier that monitors the environment for the presence of radionuclides in real time.

Summary

- ARDEC has technology programs in place to support a broad range of emerging requirements

- Precision Munitions are becoming integral to most Gun-Fired inventories
  - Advantages of Precision Fire Accepted and Reflected in Acquisition Programs
  - Broad Base of Production and R&D

- Affordable, High Reliability Design is Key and will be accomplished with the right Tools, Process, and Culture

SUPPORTING THE WARFIGHTER
A MARINE CORPS TRADITION

PROGRAM MANAGER, AMMUNITION
MARINE CORPS SYSTEMS COMMAND

ARMAMENTS TECHNOLOGY FIRE POWER FORUM

MARINE CORP MUNITIONS OVERVIEW

Jerry L. Mazza
Program Manager, Ammunition
Marine Corps Systems Command
703-432-8777 Jerry.Mazza@usmc.mil

9 June, 2009

AGENDA

1. PM Ammunition Overview
2. Munitions Requirements
3. Funding
4. Quality & Reliablity
5. Precision
6. The GWOT Environment
7. Summary

PM Ammunition Overview

MARCORSYSCOM ORGANIZATION

COMMANDER

EXECUTIVE DIRECTOR *

Sergeant Major

PEO Land Systems
- PM Expeditionary Fighting Vehicle
- PM JPMO, Lightweight 155, Picatinny, NJ
- PM Light Armored Vehicle MPC
- PM LVSR
- PM JLTV
- PM MTVR
- PM G/ATOR
- PM CAC2S

Chief of Staff
- CIO
- Facilities & Services Operations Cell
- Reserve Affairs
- Security

Special Staff
- International Programs
- Counter-Improvised Explosive Devices
- Corporate Communications
- Counsel
- OSBP
- Safety
- Strategic Change Management Center

Deputy Commander Resource Management *^
- Resource Mgmt Competency Domain/ Competency Leaders
- Director, Financial Management
- Director, Workforce Management and Development

Deputy Commander SIAT *^
- Research & Systems Engineering Competency Domain/ Competency Leaders
- Director, Information Assurance/Joint Certifications
- Director, MAGTF and Joint Integration & Certification
- Director, Systems Engineering and Technology
- Commanding Officer MCTSSA Camp Pendleton, CA

- Product Group 09 Director, Operational Forces Systems
- Product Group 10 Director, Information Systems & Infrastructure
- Product Group 11 Director, MAGTF C2, Weapons & Sensors Development & Integration
- Product Group 12 Director, Communications, Intelligence, & Networking Systems
- Product Group 13 Director, Infantry Weapons Systems
- Product Group 14 Director, Armor &Fire Support Systems
- Product Group 15 Director, Ground Transportation & Engineer Systems
- Product Group 16 Director, Combat Equipment and Support Systems

Program Manager, Ammunition
- Program Manager, Global Combat Support System-Marine Corps
- Program Manager, Light Armored Vehicle Warren, MI
- Program Manager, Mine Resistant Ambush Protected
- Program Manager, Robotic Systems Warren, MI
- Program Manager, Training Systems Orlando, FL
- Deputy JPEO, Chemical & Biological Defense Arlington, VA

Assistant Commander Contracts ^
- Contracts Competency Domain/ Competency Leaders

Assistant Commander Life Cycle Logistics ^
- Life Cycle Logistics Competency Domain/ Competency Leaders

Assistant Commander Programs ^
- Program Mgmt Competency Domain/ Competency Leaders

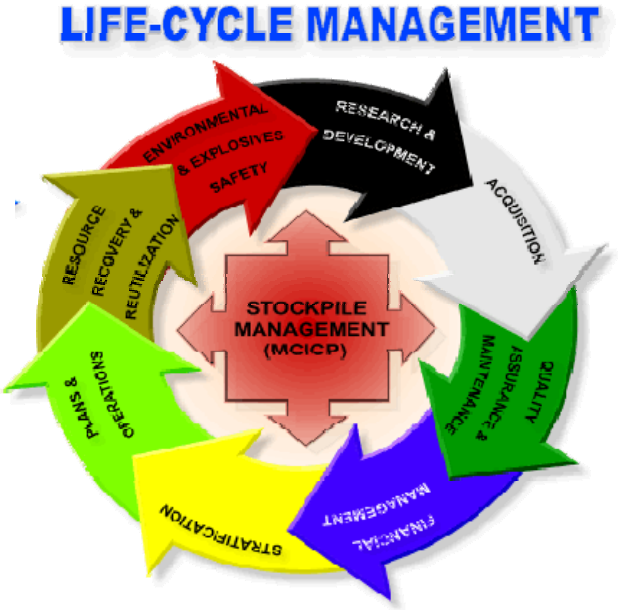
* = SES Position
^ = Competency Director

Updated 17Oct08

PM AMMUNITION MISSION

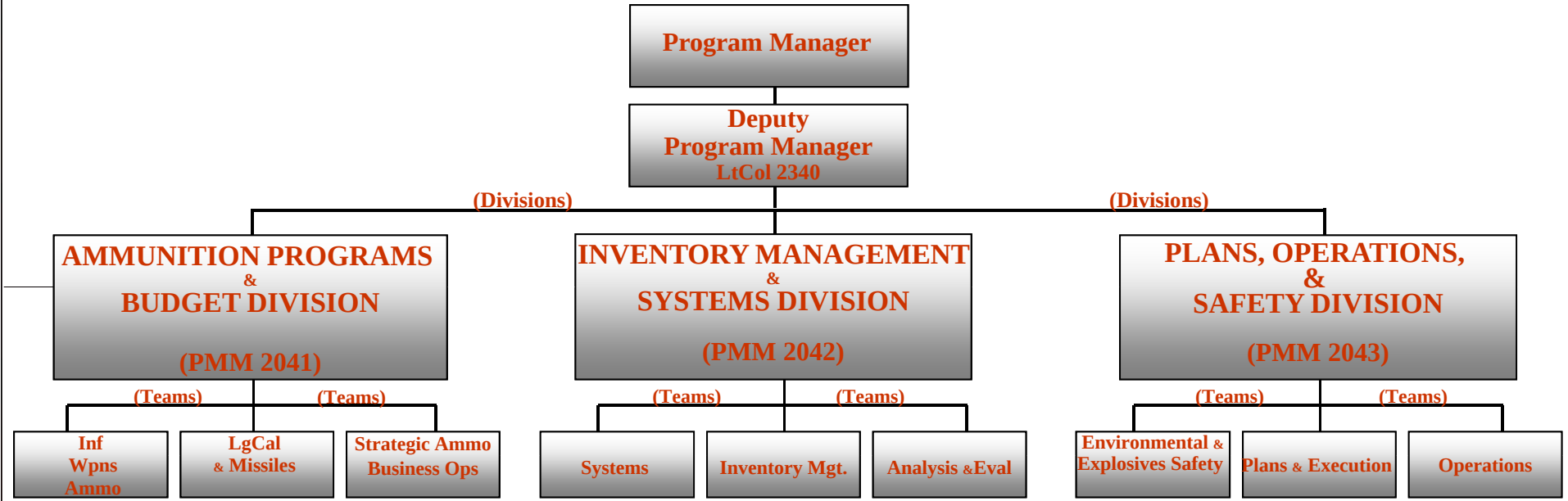
Conduct acquisition, life cycle management support, and limited research & development for all conventional ground ammunition (Class V(W)) required by Marine Corps Forces to train for and successfully conduct Expeditionary maneuver Warfare.

"sustaining the forces"



SUPPORTING THE WARFIGHTER
A MARINE CORPS TRADITION

PM Ammunition Overview



Conduct research, development, procurement planning, budgeting, acquisition, maintenance and surveillance, of ammunition in support of the operating forces.

Manage the ammunition stockpile, develop and maintain configuration control of Ordnance Information Systems, and conduct Class V(W) accountability oversight.

Enable Class V support in the functional areas of MAGTF planning, operations planning, explosives safety, and environmental Compliance.

PM Ammunition Overview

(Divisions) (Divisions)

AMMUNITION PROGRAMS & BUDGET DIVISION (PMM 2041)

(Teams) (Teams)

- Inf Wpns Ammo
- LgCal & Missiles
- Strategic Ammo Business Ops

INVENTORY MANAGEMENT & SYSTEMS DIVISION (PMM 2042)

(Teams) (Teams)

- Systems
- Inventory Mgt.
- Analysis &Eval

PLANS, OPERATIONS, & SAFETY DIVISION (PMM 2043)

(Teams) (Teams)

- Environmental & Explosives Safety
- Plans & Execution
- Operations

LIFE CYCLE OF MUNITIONS

LEVEL OF EFFORT

- R&D
- O&R 6.2
- FCT's
- SBIR's
- WSESRB
- Munitions Qual & Cert
- Insensitive Munitions Waivers
- Acquisition
- PPBE
- Quality Production Mgt
- Transportation
- Explosives Safety
- Contracting
- Transportation
- MARFOR Support
- Prepo
- Deliberate Planning
- Inventory Management
- Total Asset Visibility
- Stockpile Surveillance
- Renovation & Rework
- Demil

A — Concept Refinement — Concept Decision

B — Technology Development — Program Initiation

C — System Development & Demonstration — Design Readiness Review

IOC — Production & Deployment — FRP Decision Review

FOC — Operations & Support

PM Ammunition Overview

CLASS V(W) Conventional Ground Ammunition (300 + Items)

JP 1-02 munition — "A complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological, or chemical material for use in military operations, including demolitions."

- **Small Arms Ammunition** - 12 gauge, 9mm, .45 cal, 5.56mm, 7.62mm, .50 Caliber, Non-Lethal, SESAMS, tracer, sniper, frangible, green, paintball, AK47, REHA
- **Medium Caliber Ammunition** - 25mm, 30mm, 40mm
- **Mortar** - 60mm, 81mm, 120mm (HE, Smoke, Illum, Infrared)
- **Tank** - 120mm KE, HEAT-MP-T, MPHE, Training, Canister (APERS)
- **Artillery** – 155mm HE, DPICM, ADAMS, RAAMS, RAP, Smoke, Illum (VL/IR), Excalibur PGM, Propellant Chgs, MACS, fuzes, primers.
- **Pyrotechnics** - (Smoke, diversionary grenades, flares, obscurants, signaling devices)
- **Demolition** - (C4, TNT blocks, LDC, Initiators/ignitors, Demo kits, APOBS)
- **Rockets/Missiles** - (LAAW, SMAW Family, TOW, JAVELIN, AT-4, STINGER)

Supports ALL Howitzers, Mortar Tubes, rifles, shotguns, tanks, 40mm grenade launchers, LAV, EFV, mine clearing capabilities, anti-armor, bunker busting, pistols, EFSS and, all self defense, hand emplaced items (hand grenades, demo blocks, signaling devices)

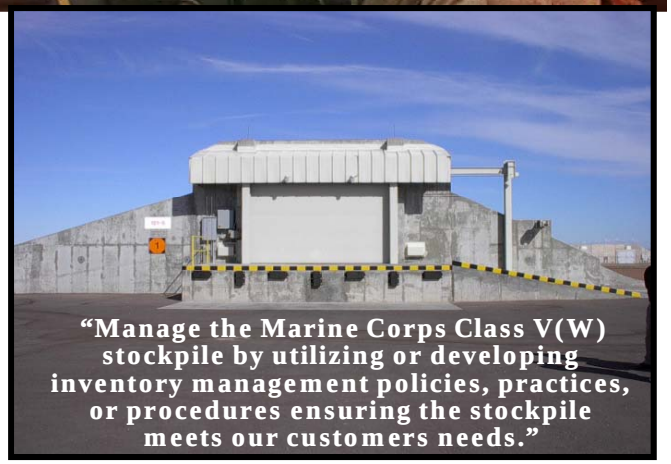
Designed to Kill and Destroy - Personnel & Materiel

Explosives Safety

"Provide environmentally compliant, explosives safety support throughout the life cycle of ammunition"

- **HQMC (SD) Designates Cmdr, MCSC "lead" for Explosives Safety (ES)**
  (MCO 5100.29A Marine Corps Safety Manual 4.I.(3))
- **PM Ammo executes the Corps wide ES Program**
  - Develops & promulgates ammo management policies ISO Marine Forces
  - Ensures compliance with environmental & explosives safety regulations
  - Provides compliant munitions disposition instructions
- **Serves as Principle on the DOD Explosives Safety Board**
- **Guiding Explosives Safety Policies:**
  - DoDD 6055.9 STD
  - OPNAVINST 8020.14/ MCO P8020.11 -DoN Explosives Safety Policy Manual
  - MCO P8020.10A - USMC A&E Safety Programs for Class V Materiel
  - MCO 8023.3A - USMC Qualification & Certification Program for Class V Materiel
- **Explosives Safety Site Plans/Waivers**
  - **Incorporating ORM & SAFER**

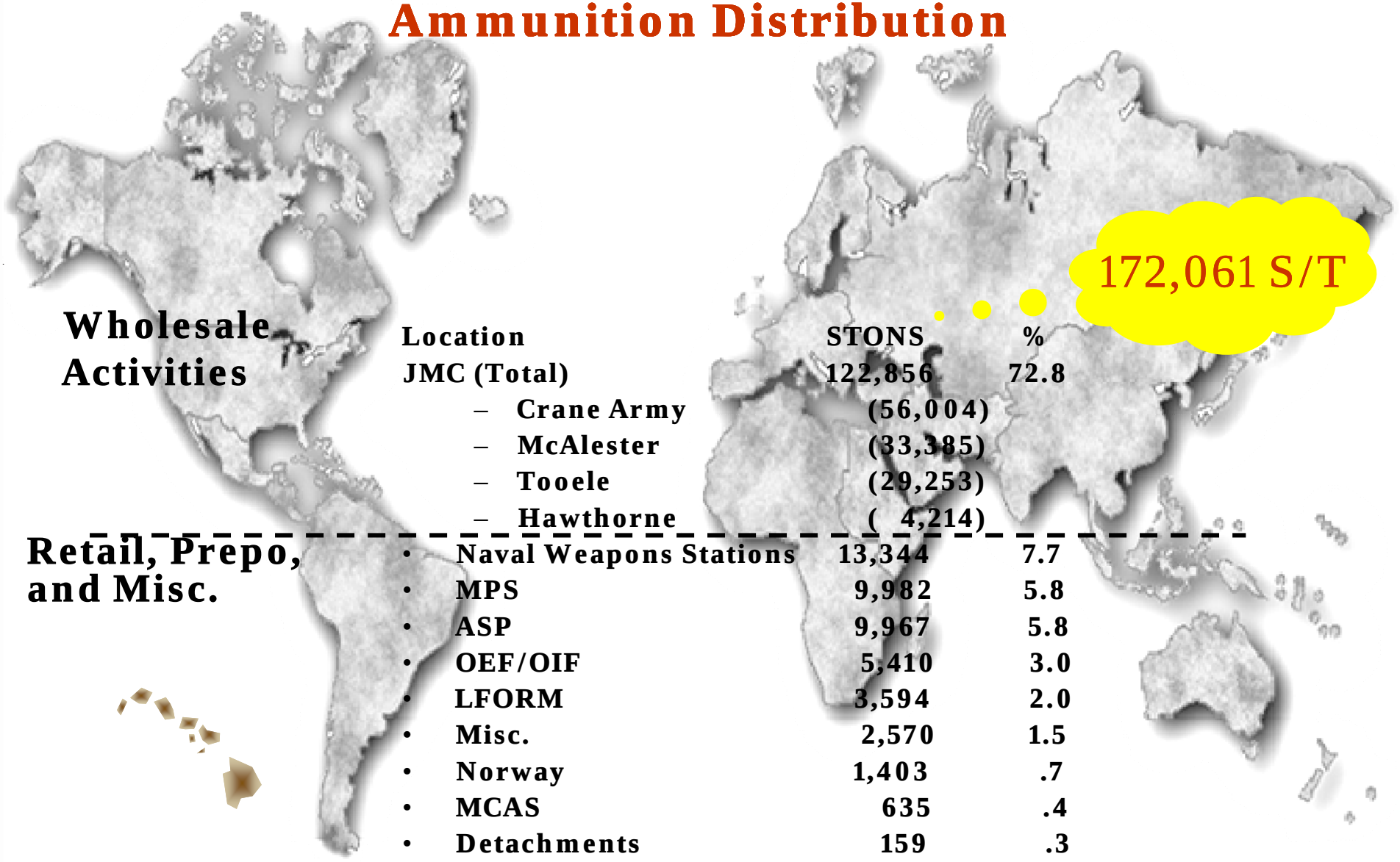
Inventory Control Point (ICP)



- **Manage the stockpile ($6.0 Billion)**
  - Stratification/Cross-leveling (Right size the stockpile!)
  - Sourcing:
    - War Reserve Materiel: Preferred lots suitable f/long term storage
    - Ensure assets that are showing degradation are resourced first
    - Identifies assets "excess/deficient in" the USMC Class V(W) stockpile
    - Quarterly Readiness Report to Congress (QRRC)
    - Quarterly Stockpile Valuation Report (DC P&R)
- **Stockpile Reclassifications - Suspensions (NARs/AINS, etc.)**
- **Provides:**
  - sourcing data & supportability to assist in building TPFDD
  - retrograde destinations at completion of operation
  - disposition instruction on unserviceable assets, assets not cost effective to renovate, and assets no longer required
  - an accurate inventory at the end of each fiscal year (30Sep),
  - inventory and location as a basis for decisions on testing, and maintenance to move assets in support of projects.

PM Ammunition Overview

Ammunition Distribution



Wholesale Activities

Location	STONS	%
JMC (Total)	122,856	72.8
– Crane Army	(56,004)	
– McAlester	(33,385)	
– Tooele	(29,253)	
– Hawthorne	(4,214)	

Retail, Prepo, and Misc.

• Naval Weapons Stations	13,344	7.7
• MPS	9,982	5.8
• ASP	9,967	5.8
• OEF/OIF	5,410	3.0
• LFORM	3,594	2.0
• Misc.	2,570	1.5
• Norway	1,403	.7
• MCAS	635	.4
• Detachments	159	.3

Information Technology

" Provide Life Cycle Management support for all ammunition management systems used to account for Class V(W) assets"

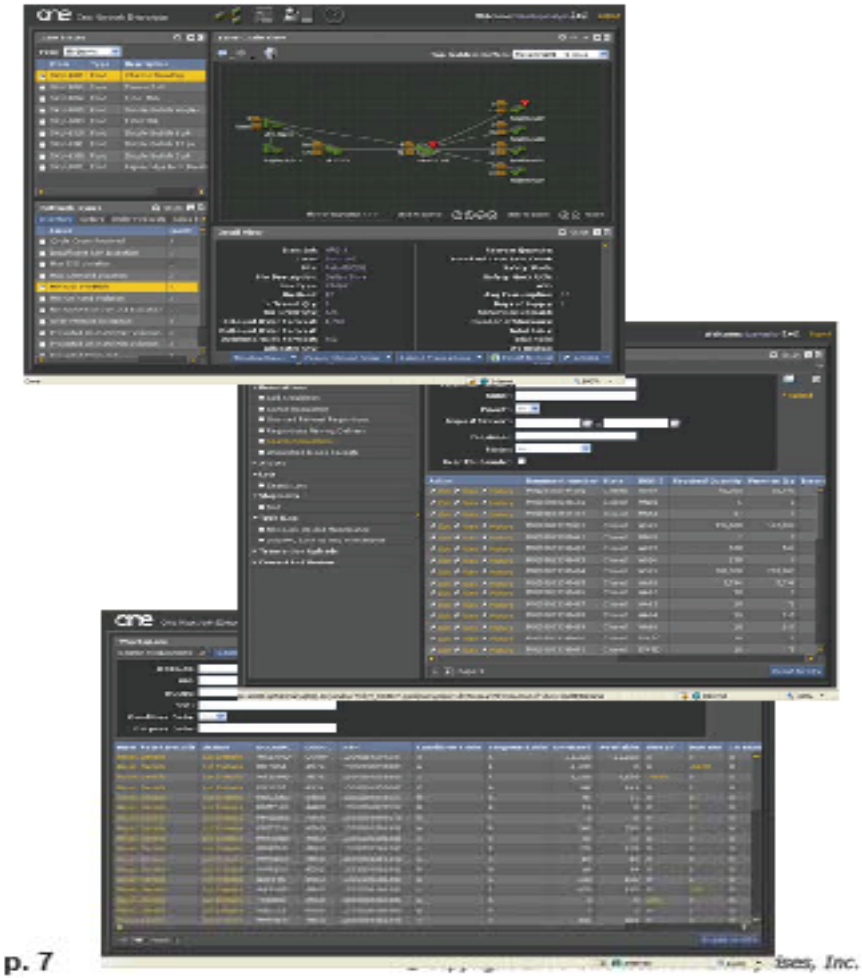
- **Wholesale Accounting**
  - **Ordnance Information System – Marine Corps (OIS-MC)**
  - **Class V(W) Wholesale Accounting System**
  - **Significant IT effort; joint with USN; NLI Initiative and ONE NETWORK!**
  - **Transition during Oct'08 with ONE NETWORK Functionality**
  - **Retired MAARSII Legacy System**

- **Retail Ordnance Logistics Management System (ROLMS)**
  - **Retail-level accounting system for ASPs & Liaison Activities**
  - **Standard system for all Marine & Navy users**
  - **Capable of running stand-alone on a PC workstation or laptop for use during deployment.**

OIS-MC Overview

one
One Network Enterprise

- **MAARS-II system modernization**
- **Key capabilities:**
  - Requisition management (create, receive, fill, track)
  - Inventory visibility and maintenance
  - Lot and serialized item tracking
  - Tech data management
  - Receipts from procurement*
  - LSA process* (allowance budgets)
  - Supported Unit Ammunition Module* (unit-level ammunition inventory management)
- **Extensible foundation for future efforts and business transformation**



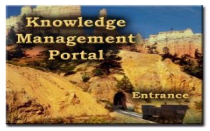
SUPPORTING THE WARFIGHTER
A MARINE CORPS TRADITION

PM Ammunition Overview

State of the Stockpile

Program Manager for Ammunition, Marine Corps Systems Command
Knowledge Management Portal

Welcome to the One Stop Shop for Ground Ammunition Information. Provided by the Program Manager for Ammunition.



This Portal is a Prototype.
Prototype: *Process of building an experimental system quickly and inexpensively for demonstration and evaluation so that end users can better determine information requirements.*

"Inventory numbers represented in this Portal are extracted from the Marine Corps Ground Ammunition Inventory Control Point system MAARS II and include Total On-Hands, Total Due-Outs, Total In-Transit and Total Freeze Quantities. In the future this Portal will break out the aforementioned quantities individually."

The following data sources have been included in this phase of the Knowledge Management Portal:

- CAIMS Technical Data as of 11/7/01
- MAARS II Daily Inventory as of 11/16/01 4:00:48 AM (PDT) - by Condition Code, Location
- MAARS II Procurement as of 10/22/01
- MCCDC Total Munitions Requirements as of 3/7/01
- MCD Cataloging Handbook as of SEP 2001
- PM-AMMO In Lieu of (Interchangeable DODIC) as of 5/14/01
- MCPD Field Inspection CD as of 4/1/01
- MCD 7 Year Maintenance Plan as of OCT 2001
- MCD Tech Data Sheet CD as of 11/2/00
- PM-AMMO 30 SEP Inventory as of OCT 2001
- MCPD State of the Stockpile as of OCT 2000

More data sources coming soon!

BEGIN YOUR SEARCH BY CLICKING THE KNOWLEDGE MANAGEMENT PORTAL IMAGE OR BY CLICKING ON THE SEARCH BUTTON AT TOP OF PAGE.

Daily Inventory, Condition Code, Location

Program Manager for Ammunition, Marine Corps Systems Command
Knowledge Management Portal

Inventory

DODIC: C995

Enter DODIC [ ] New Search
Click here to search DODIC page instead

Current Inventory as of 11/16/01 4:00:48 AM
Condition Codes

NSN	A	B	C	D	E	F	G	H	J	K	L	M	N	P	V	Total
1315012454950	41,850	2	524		8	6,323		60		42			3,373			52,182
Total	41,850	2	524		8	6,323		60		42			3,373			52,182

30 SEP 2001 Inventory as of 10/25/01
Condition Codes

NSN	A	B	C	D	E	F	G	H	J	K	L	M	N	P	V	Total
1315012454950	42,805	10	624		5	4,093		47		42			3,297			50,923
Total	42,805	10	624		5	4,093		47		42			3,297			50,923

Green	Current State of the Stockpile	Current
	Serviceable	87.7% 45,757
	Unserviceable	12.3% 6,425

	30 SEP 2000 State of the Stockpile	30 SEP 2000
	Serviceable	91.8% 46,741
	Unserviceable	8.2% 4,182
	30 SEP Inventory:	

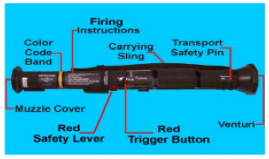
Technical Data

Program Manager for Ammunition, Marine Corps Systems Command
Knowledge Management Portal

DODIC

Enter DODIC [ ] New Search

Interchangeable DODIC:
Can be used in Lieu of:



Cartridge and Launcher, 84mm M136 AT-4 (DODIC C995)

Item Description: The Cartridge and Launcher, 84mm M136 AT-4 (DODIC C995) is mainly employed against armored personnel carriers. However, it can be used against battle tanks when fired at the flanks or rear. It can also be employed as an assault weapon against bunkers, field fortifications, and other hard-point positions. Issued as one round of ammunition, the AT-4 tactical round is a self-contained, lightweight, disposable weapon consisting of a launcher and cartridge. The launcher is fiberglass-reinforced with a smooth bore barrel that is environmentally sealed. The AT-4 is equipped with an aluminum venturi, a firing mechanism with three safety devices, front and rear sights, and a carrying sling. The cartridge assembly consists of the projectile and the cartridge case. The projectile is a free flight, fin-stabilized warhead. It is pressed and cemented into the cartridge case. The cartridge case contains a double-base propellant, percussion primer, and igniter. The AT-4's warhead features behind-armor secondary effects. [DODIC Plain Description] penetrates the vehicle's armor protection, a high-pressure incendiary effect occurs. This action, which is accompanied by a blinding flash, is designed to effectively knock out the crew of the enemy vehicle, even if the penetration hole is relatively small.

Serviceable		Unserviceable		Total QTY	Maint. Due	Planned Procurement
87.7%	45,757	12.3%	6,425	52,182		

Field Insp CD | Procurement | DODIC Inv.

NSN
1315012454950
Cat. Tech.

^ back to top

Total Munitions Requirements

7 Yr. Master Maintenance Plan as of 10/1/01	
Project No.	
Fiscal Year	
Quantity	
Project Cost	
Component Cost	
Justification:	
Scope of Work:	

Total Munitions Requirements as of 3/7/01	QTY
Combat Requirements	54,148
Residual Readiness Requirements (RRR)	
Strategic Readiness Requirements (SRR)	
War Reserve Material Requirement(WRMR)	54,148
Training Requirement	2,315
Current Operational Requirement (COR)	
Testing Requirement	129
Training Logistical Support (313 Day Pipeline)	1,985
Testing Training Logistical COR (TTCOR)	4,429
Total Munitions Requirement (TMR)	58,577
Approved Acquisition Objective (AAO)	56,133

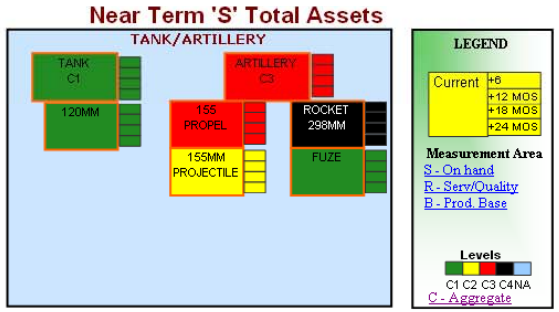
Current Inventory By Condition Code

30 SEP Inventory By Condition Code

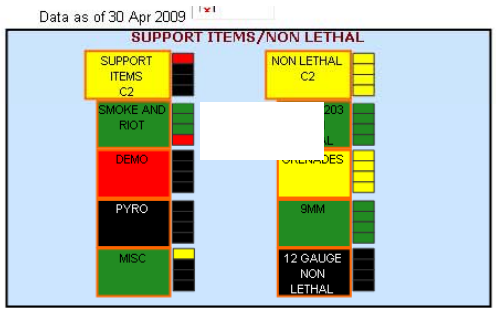
Activity Level

^ back to top

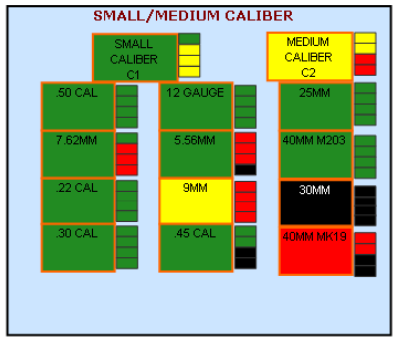
PM Ammunition Overview

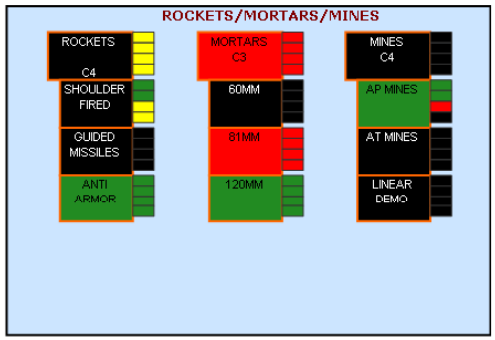


TANK/AT



Munitions Readiness Reporting (MRR)





Munitions Requirement Process

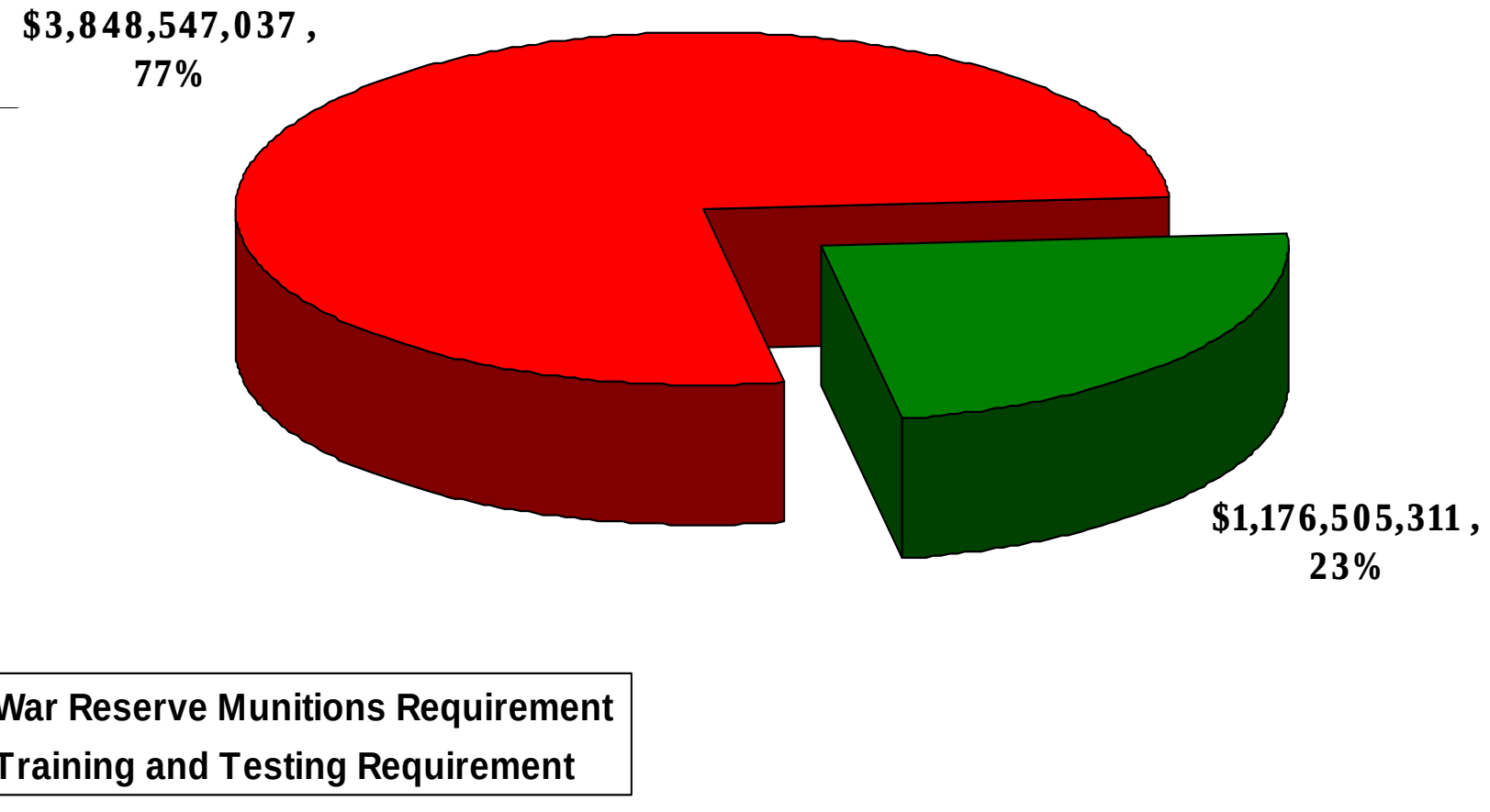
- Total Munitions Requirement (TMR)
  - **DIRECTED** by DoDI 3000.4/MCO 8000.8 - Munitions Requirements Process
  - **EXECUTED** by Logistics Integration Division, Capabilities Development Directorate, MCCDC
  - **MODELED** based on scenario durations and MCO end-states identified by the DPG, COCOM determined targets, and Marine Forces input.

- **WAR RESERVE MUNITIONS REQUIREMENT (WRMR)**
  - Combat Requirement (**CR**) - The quantity of munitions required to equip a specified force structure to its designated military capability and to meet Combatant Commander's objectives, including munitions needed for overlap.
  - Current Operations/Forward Presence Requirement (**CO/FPR**)- The sum of munitions required to arm forces to conduct current operations and meet forward presence obligations in accordance with the DPG. Forward presence includes Global Naval Force Presence Policy and operations that the National Command Authority (NCA) directs.
  - Strategic Readiness Requirement (**SRR**) - The quantity of munitions needed to arm forces not committed to support combat operations in the assigned MTW's as well as those in the strategic reserve. It also includes any additional munitions requirements generated from treaties or statutory obligations to allies.

- **TESTING and TRAINING REQUIREMENT (TTR)**
  - Testing (**T**) - Surveillance, acceptance testing and production losses of munition items are accounted for in this category.
  - Training (**TR**) - Munitions required to train forces and support Service programs ensuring that weapons and platforms deliver the intended effectiveness (can be stated as an annual requirement, a Future Years Defense Program (FYDP) requirement, and/or projected life cycle of each munition)

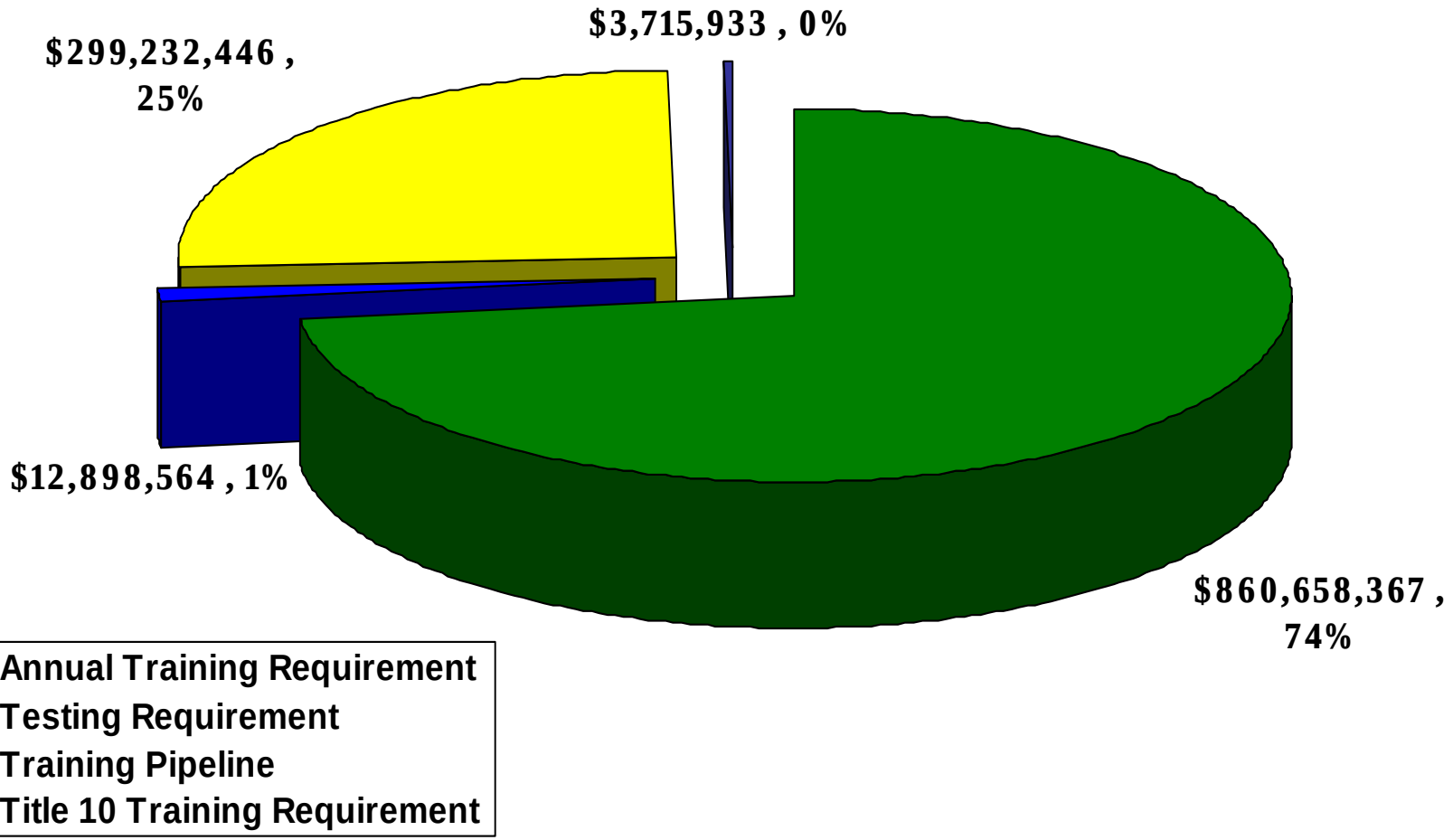
Munitions Requirements

POM10 TMR - $5,025,052,348



Munitions Requirements

Testing & Training Requirement (TTR) - $1,176,505,311

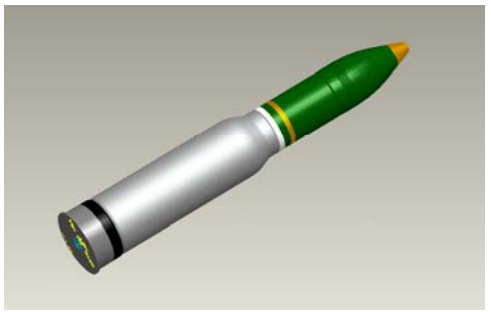


Munitions Requirements

- **Future Requirement Drivers:**
  - **Cluster Munitions?**
  - **Landmines? (SPIDER, IMS)**
  - **25mm Mk 2 SAPHEI-T**
  - **USMC Shift to OEF; Artillery, 120MM Mortar**
  - **2 Additional Tank Companies (FY11) +28 M1A1's**
  - **Shoulder Fired Rockets:**
    - **Increase M72 LAAW Procurements**
      - **80% M72A9 ASM; 20% M72A7 AT**
      - **AT4 – War Reserve Only**
    - **SMAW II FFE MP Warhead**

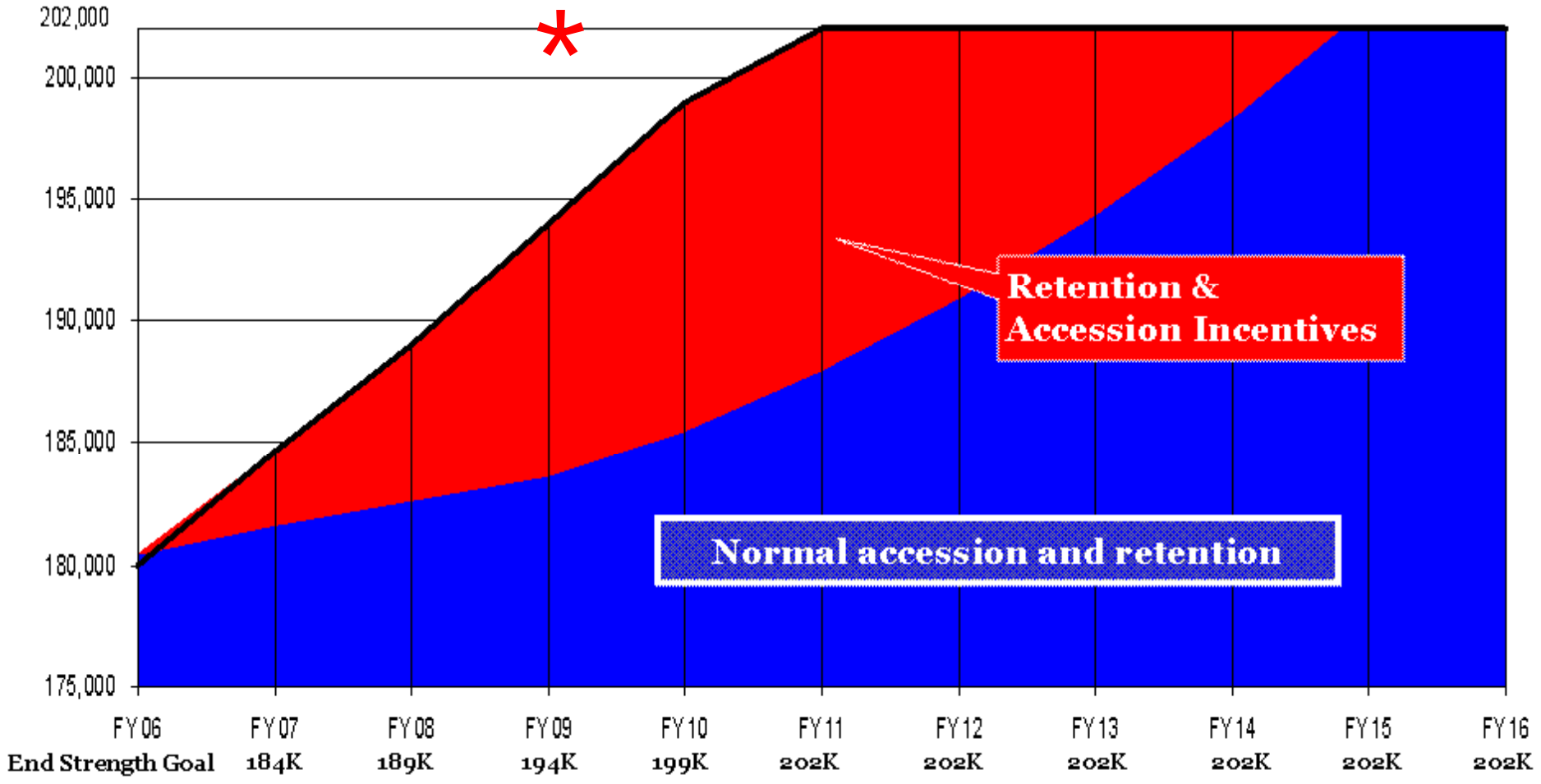
Munitions Requirements

- **Future Requirement Drivers:**
  - **Urgent Universal Needs Statements - Supported**
    - **120MM Canister, M72A7 LAAW, SAA-AP, Foreign Wpns SAA, 155mm Excalibur, 155mm IR**
  - **Urgent Universal Needs Statements - Working**
    - **120MM MP-HE**
    - **capable of point- or delayed-detonation for anti-materiel application or air burst for anti-personnel (fragmentation)**



Munitions Requirements

- **Future Requirement Drivers:**
  - **USMC 202K Growth - all heavy shooters**



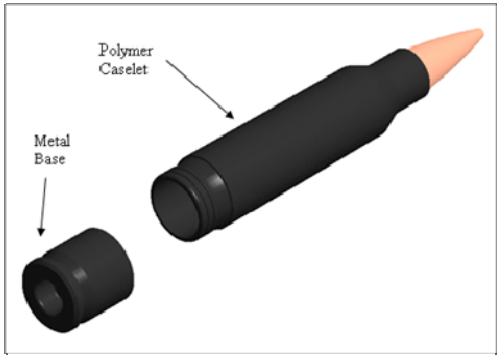
Product/Service Enhancements

- **FCT:**
  - Screening Colored Smoke Grenade (SCSG)
  - 66mm Grenade Discharger, Visual and Infra-Red Screening Smoke (VIRSS)
  - M72A7 LAAW Insensitive Munitions Effort
  - 40MM Low/High Velocity Day/Night Marking

- **SBIR**
  - Red Phosphorus Fill - Mortars

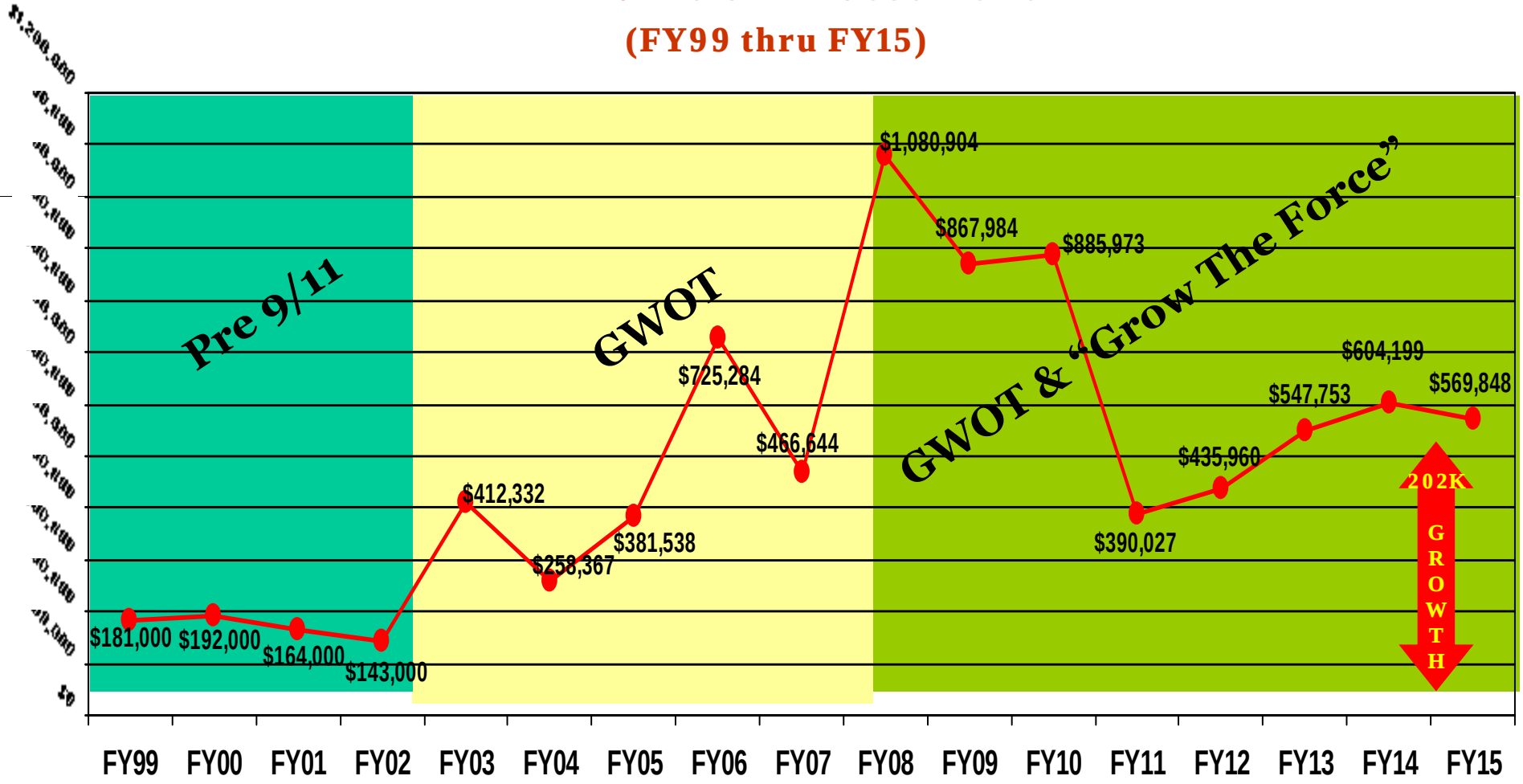
- **TTA (Technology Transition Agreement (ONR)**
  - Linear Demo Charge Insensitive Munitions Effort; Supports ABV Survivability

- **TITLE III - Polymer Cased Small Arms Ammunition**
  - Two component design: Polymer Caselet & Brass Base
  - Benefits (all calibers)
    - Weight savings: 23-25% demonstrated
    - 28-35% indicated (design goal)
    - Same or lower cost in full production
  - Calibers in development: 5.56mm, 7.62mm and .50cal

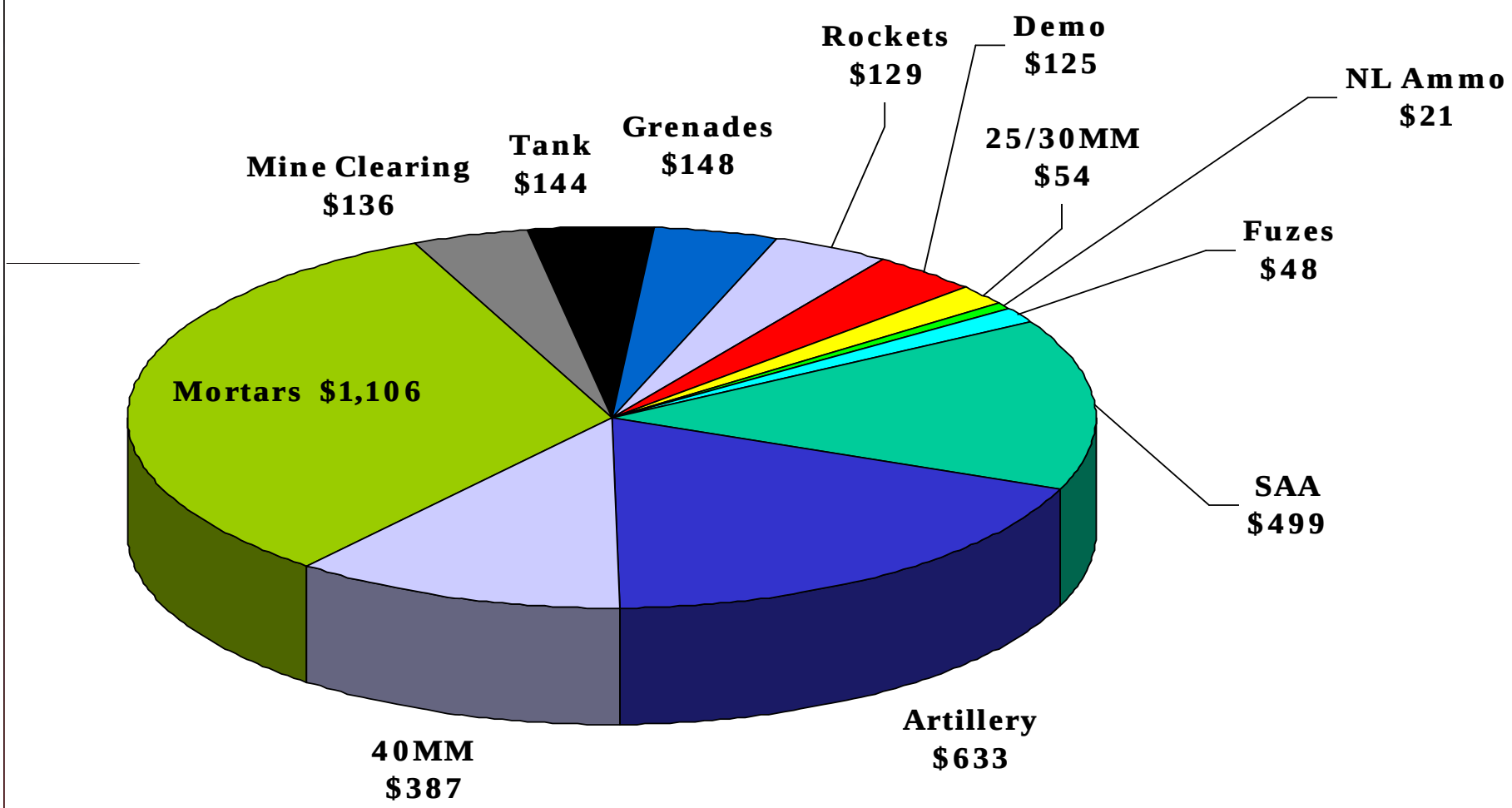


Funding

Ammunition Investment
(FY99 thru FY15)



Funding



FY08-FY13 Procurement Breakout = $3.6B

(PRESBUD 09)

Funding

- **Unstable, erratic profiles, bill payer, unknowns**
- **Product Cost**
- **Non-Product – Cost of doing business;** **FY10-FY15 = (-$300M)**

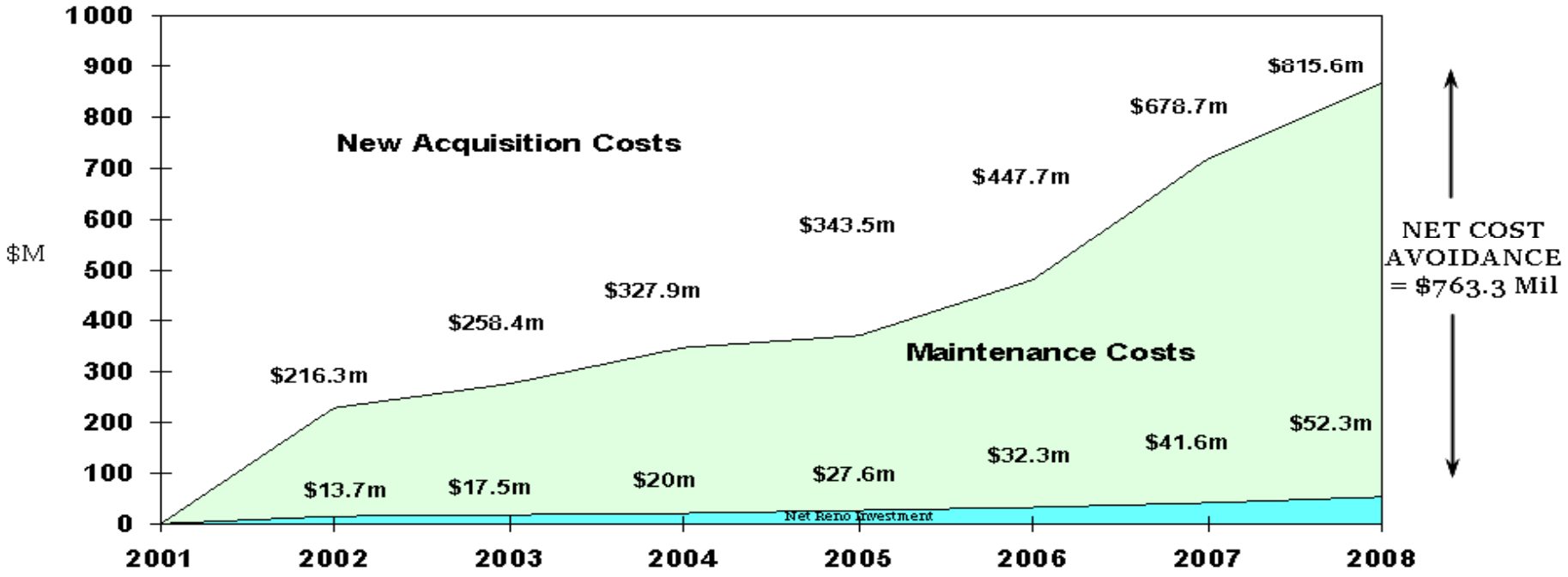
$1.00
PAN&MC

	FY05,$K	FY06,$K	FY07,$K	FY08,$K
TOTAL	362,425	627,935	466,644	1,086,989
ESIP	18,121	31,397	23,332	54,349
WUA	7,123	9,473	8,458	12,651
CEOSS	0	0	0	307
Insensitive Munitions Efforts	4,226	3,356	5,300	8,025
Support of Infrastructure	1,000	1,000	1,000	1,000
Navy Qualification of Army Systems	2,000	2,500	2,500	2,500
FDT		4,091	5,101	10,000
TAXES	2,434	2,769	2,536	3,414
Total Adjusted	327,521	573,349	418,417	994,743
%, Adjusted	90.36918	91.30704611	89.66509	91.5135802

$0.90
PAN&MC

Maintenance & Renovation (O&MMC)

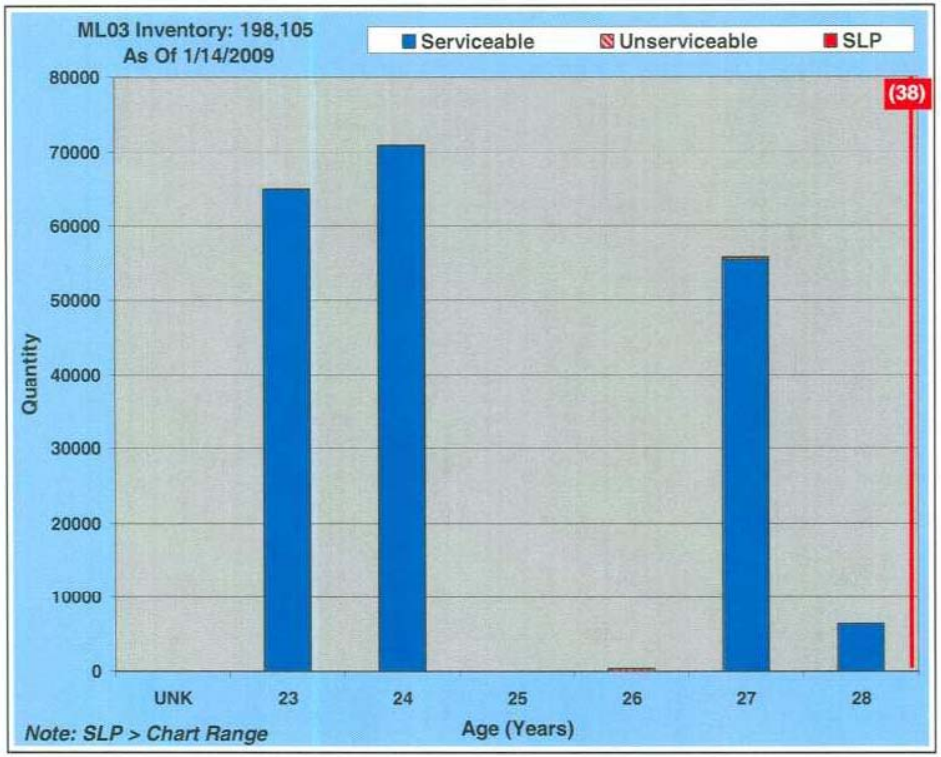
- **Significant "RETURN ON INVESTMENT" (ROI) vice costlier, new production**
  - Ammunition Maintenance Process Guide for Quality (AMPGQ)
  - Automated Data List
  - Missile Round Reset Procedures (RRP)
  - Letter of Instruction LOI
  - DMWR (e.g., 9-1375-M913-F50, REV B)
- **Cumulative Return on Investment (ROI).**



Quality Assurance

"Continuous assessment of the Quality & Reliability of a multi-billion dollar stockpile"

- **Service Life Accelerated Aging Test program (SLAAT) provides a process framework allowing the selection of an appropriate test method linked with an analytical technique to support service life prediction. SLAAT provides stockpile assessment data necessary to make informed management decisions concerning the state of the Marine Corps Ground Conventional Ammunition Stockpile.**

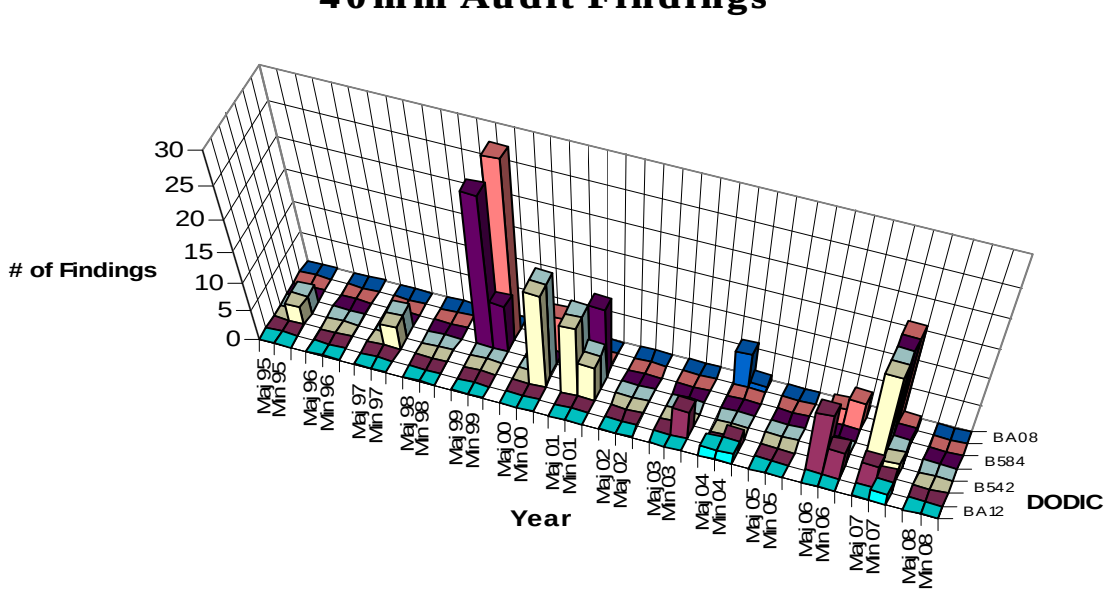


Quality & Reliability

Quality Assurance

"Continuous assessment of the Quality & Reliability of a multi-billion dollar stockpile"

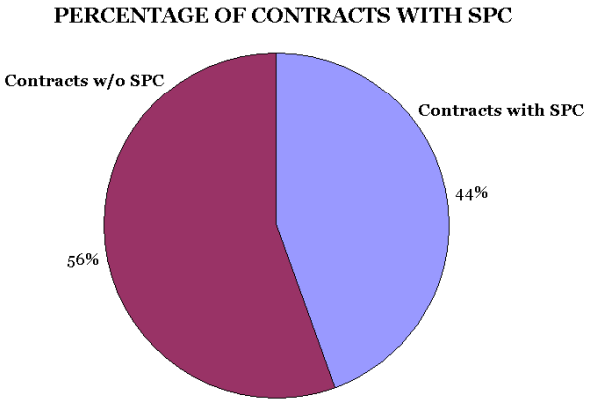
40mm Audit Findings

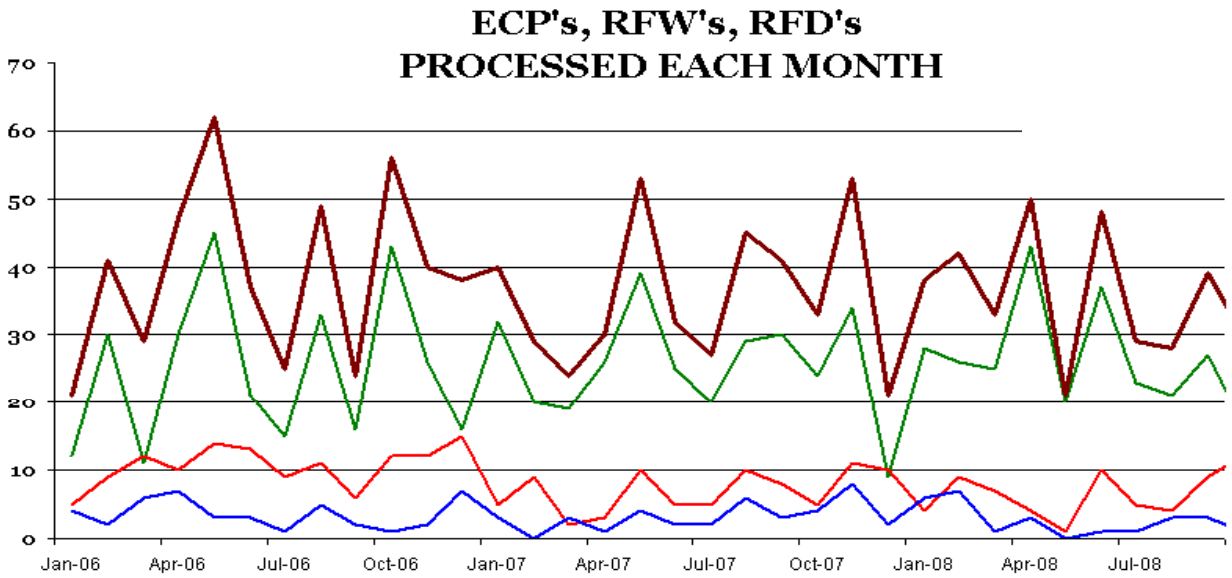


	Maj 95	Min 95	Maj 96	Min 96	Maj 97	Min 97	Maj 98	Min 98	Maj 99	Min 99	Maj 00	Min 00	Maj 01	Min 01	Maj 02	Maj 02	Maj 03	Min 03	Maj 04	Min 04	Maj 05	Min 05	Maj 06	Min 06	Maj 07	Min 07	Maj 08	Min 08
BA12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	0
B535	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	0	0	11	5	4	2	0	0
B542	0	3	0	0	0	4	0	0	0	0	0	16	12	6	0	0	0	0	0	0	0	0	0	0	18	3	0	0
B546	0	3	0	0	0	4	0	0	0	0	0	16	12	6	0	0	0	0	0	0	0	0	0	0	18	3	0	0
B584	0	0	0	0	0	0	0	0	25	8	0	0	0	12	0	0	0	0	0	0	0	0	0	0	18	3	0	0
B519	0	0	0	0	0	0	0	0	5	29	5	6	0	0	0	0	0	0	0	0	0	0	3	5	18	3	0	0

Quality & Reliability

• Continuous and Sustained Improvement





	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
ECP	12	30	11	30	45	21	15	33	16	43	26	16	32	20	19	26	39	25	20	29	30	24	34	9	28	26	25	43	20	37	23	21	27	17	25	45
RFD	5	9	12	10	14	13	9	11	6	12	12	15	5	9	2	3	10	5	5	10	8	5	11	10	4	9	7	4	1	10	5	4	9	12	3	6
Totals	21	41	29	47	62	37	25	49	24	56	40	38	40	29	24	30	53	32	27	45	41	33	53	21	38	42	33	50	21	48	29	28	39	30	34	53
RFW	4	2	6	7	3	3	1	5	2	1	2	7	3	0	3	1	4	2	2	6	3	4	8	2	6	7	1	3	0	1	1	3	3	1	6	2

Precision

FY08
1st Buy
Excalibur

FY10
1st Buy
PGK

FY??
120MM
Precision Extended Range Munition

The GWOT Environment

- Annual Live-Fire Training growth
  - Pre 9/11: Average approx. $220M annual
  - Post 9/11: Average approx. $320M+ annual
  - Change in TTP and new Pre-deployment Training Packages (PTP)
- Combat Expenditures
- UUNS
- USMC Special Operations Command (MARSOC) – 2,400 Marines
- Investment:
  - $2,468,000,000 - Baseline Corps Investment FY03-FY10
  - $2,484,000,000 - Supplemental Funds thru FY03-FY10

- Undefined GWOT Duration, End-Strength Growth, Live-fire Training, War Reserve Stockpile - Risk, Fluid Fiscal Environment, Production Lead-Times, Production Turbulence, PP&O Prioritization, MARCENT focus, new capabilities, Urgent Needs, Special Allowances, etc, etc., etc.....

Summary

The wide range of responsibilities under one Program Manager is unique in that,

it provides the Marine Corps with a single point of visibility to assess the quality, quantity, and the positioning of ammunition, and the ability as the occupational field sponsor, to effect supply of that ammunition to Marine Forces.

Summary

PM Ammo Strategic Plan:

"There are many classes of supply and ours, inherently unique by nature, is the last in terms of use by our Corps. That does not mean last in importance, priority, or criticality to the combat arm of this institution we support. Rather, despite any other commodity, the vehicles, weapons systems, the clothing and equipment, the deliberate planning; despite the mass movement of our Marines, the P-O-L, communication equipment, spare parts, subsistence, etc, ammunition IS the last stage in the war fight. It is that which directly destroys the enemy combatant. Thus it represents the finality of all the preceding events leading up to its use. "

Ammunition…that which makes the tip of the spear, pointy and lethal"

QUESTIONS?

2009 Fire Power Forum

OSD Perspective

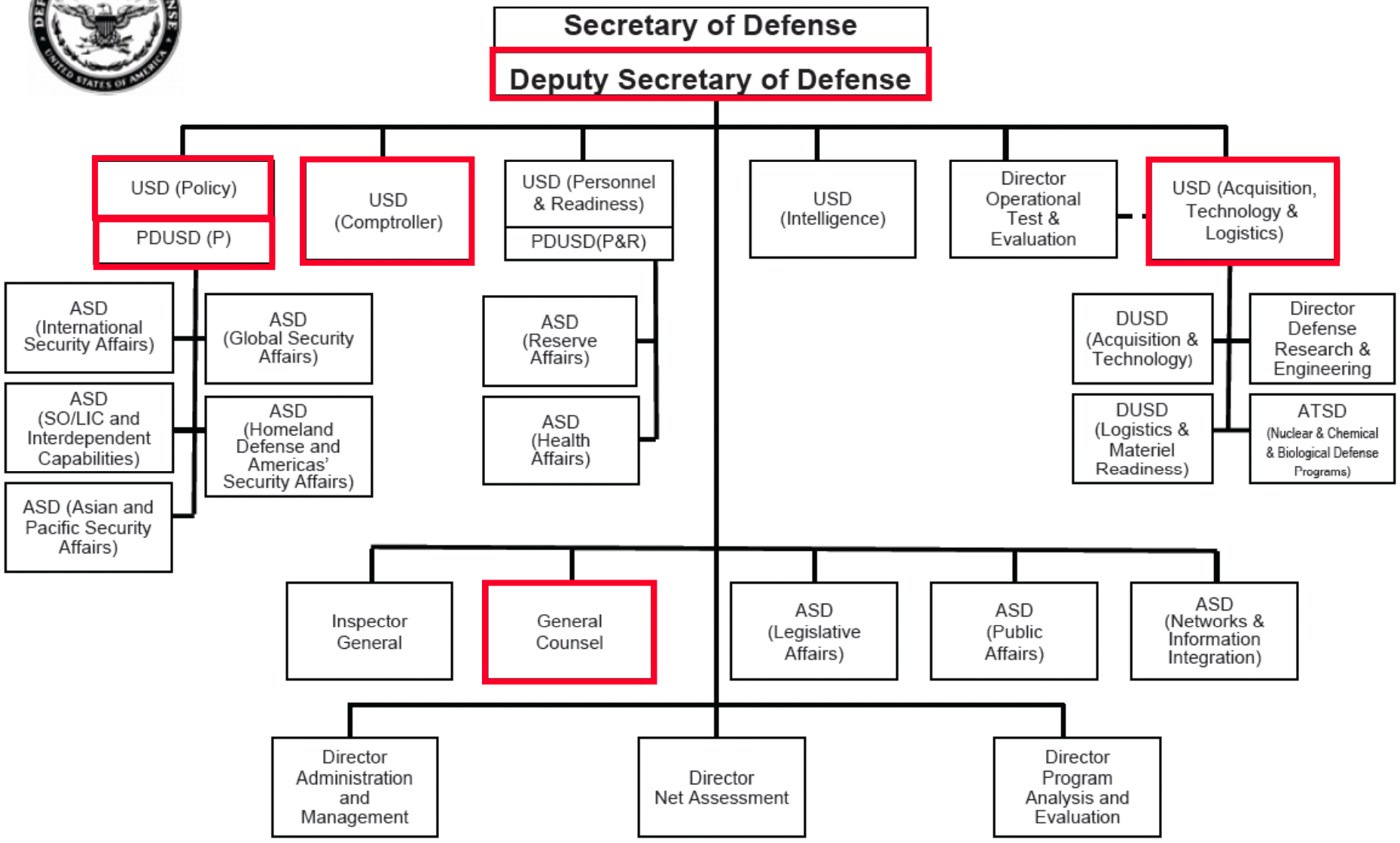
Anthony J. Melita

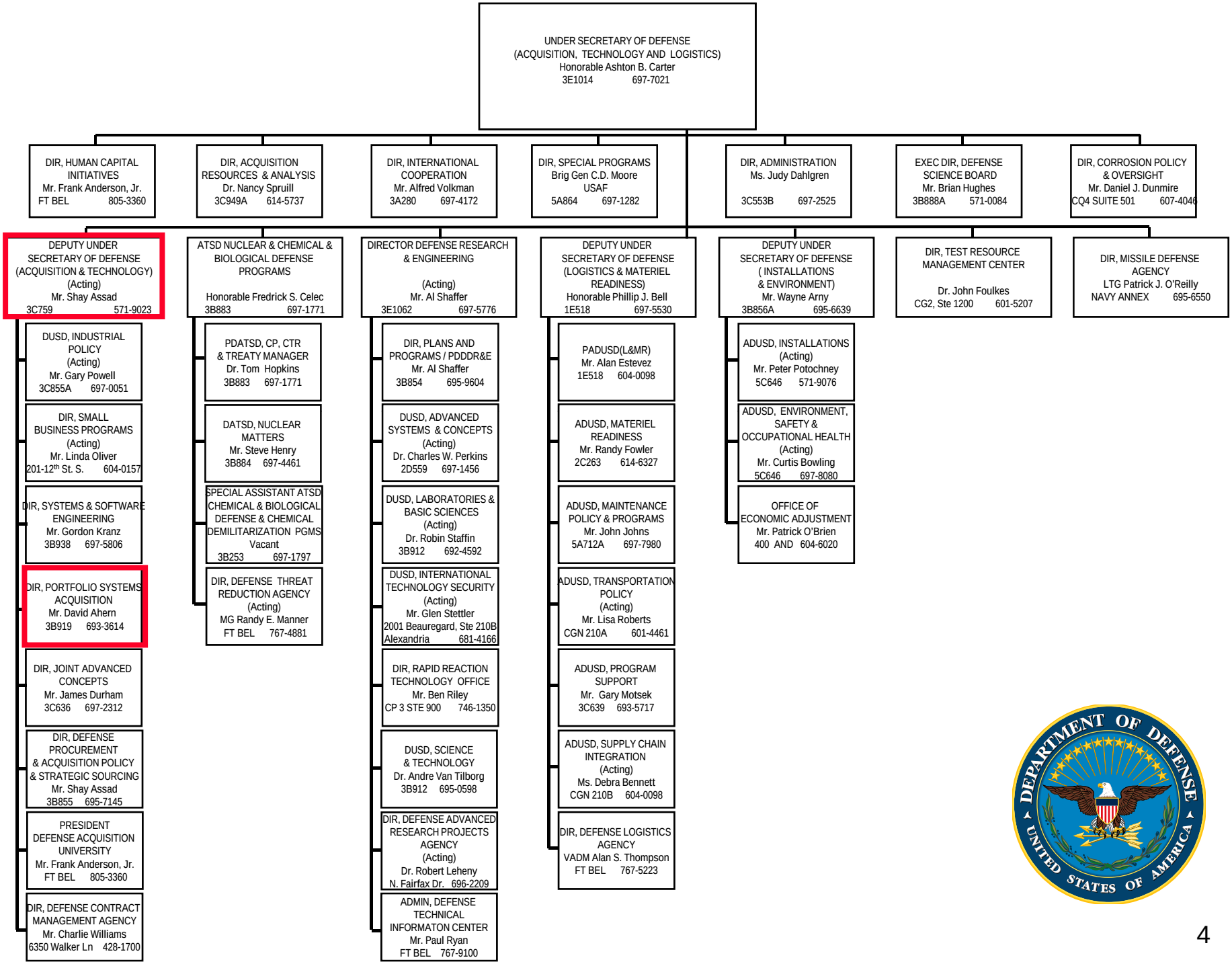
OUSD (Acquisition, Technology & Logistics)
Deputy Director, Portfolio Systems Acquisition,
Land Warfare and Munitions

Discussion Topics

- OSD / AT&L Organization
- Department Priorities
- Budget Trends
- Acquisition Reform
- Munitions Interest Areas
  - Conventional Weapons Joint Assessment Team
  - Insensitive Munitions
  - Fuze Technology
  - Joint Munitions Program
  - DoD Ordnance Technology Consortium (DOTC)
  - TATB
  - Cluster Munitions
  - Conventional Munitions Demil

Office of the Secretary of Defense

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Mr. David Ahern
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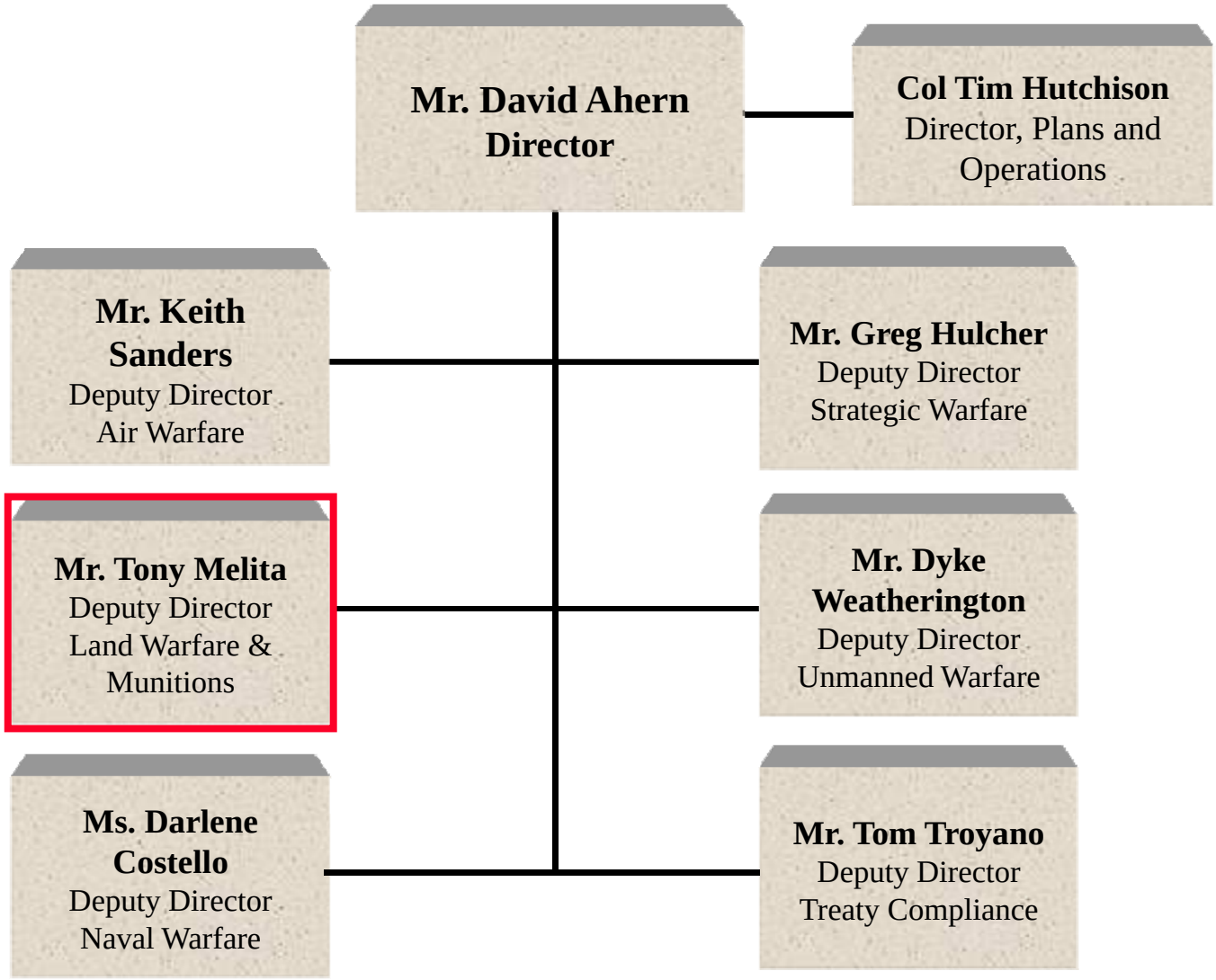
LTG Patrick J. O'Reilly
NAVY ANNEX 695-6550

PORTFOLIO SYSTEMS ACQUISITION (PSA)



Department Priorities

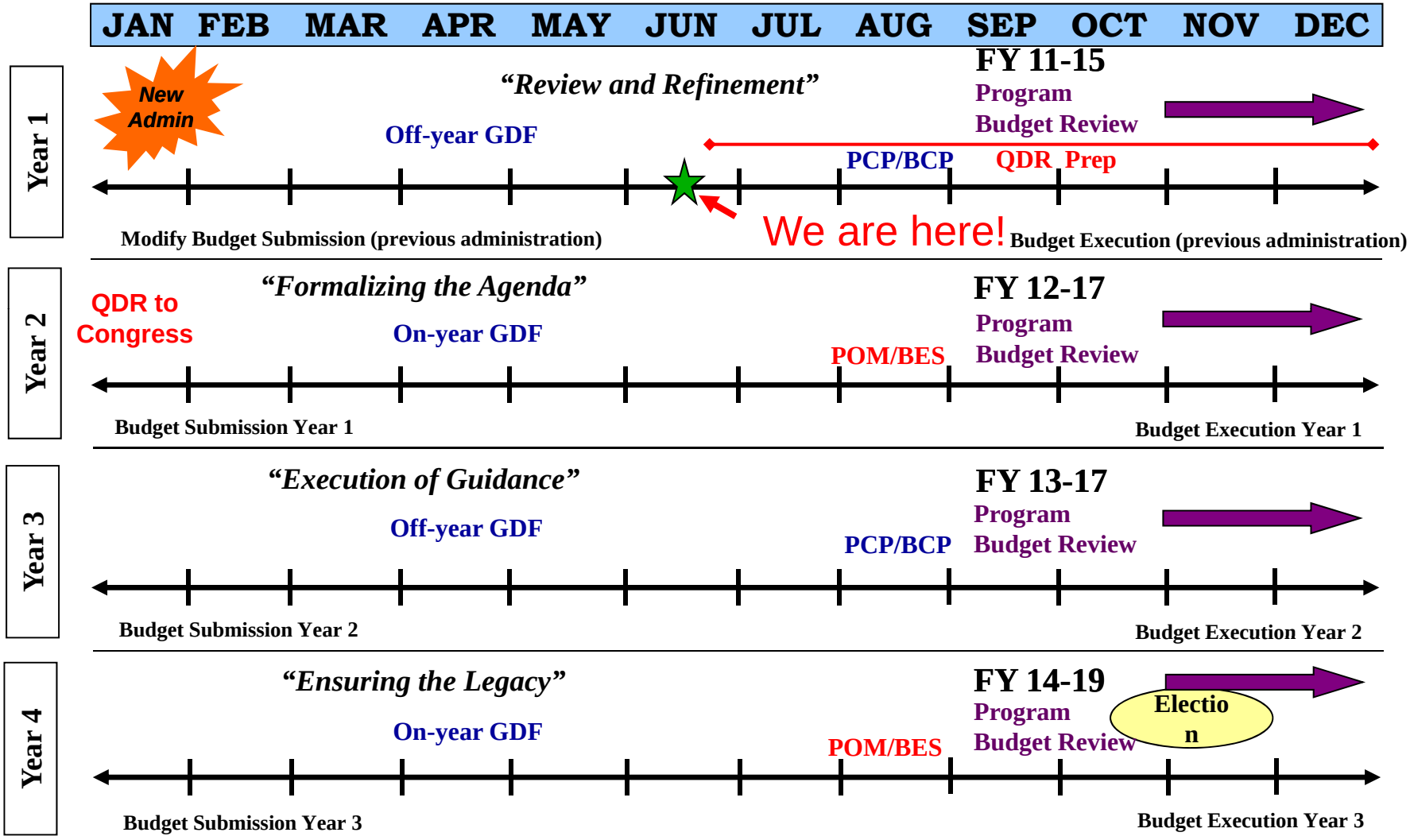
Secretary of Defense Priorities

1. Reaffirm commitment to take care of the all-volunteer force – “America’s greatest strategic asset”

2. Rebalance the Department’s programs to fight today’s wars and the scenarios we are most likely to face in the future, while providing a hedge against other risks

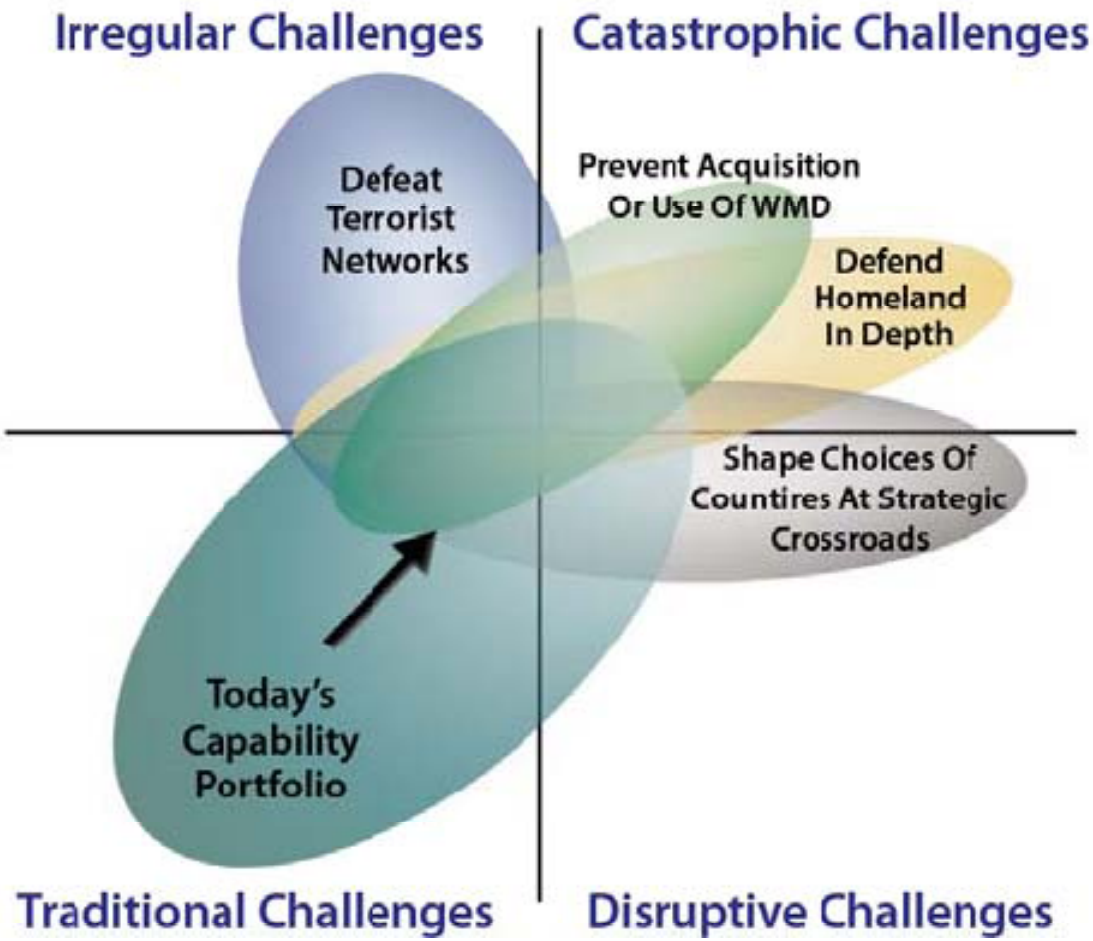
3. Fundamental overhaul of procurement, acquisition, and contracting processes; requires:
   - Stopping programs that exceed budget or buy more capability than the nation needs
   - Ensuring requirements are reasonable and technology is adequately mature
   - Ensuring realistic program costs, budget stability, adequate staffing, and disciplined oversight

Planning, Programming, Budgeting, and Execution



4 Administration Years with 2-year PPBE Cycle

2006 QDR - Operationalizing the Strategy



2010 QDR

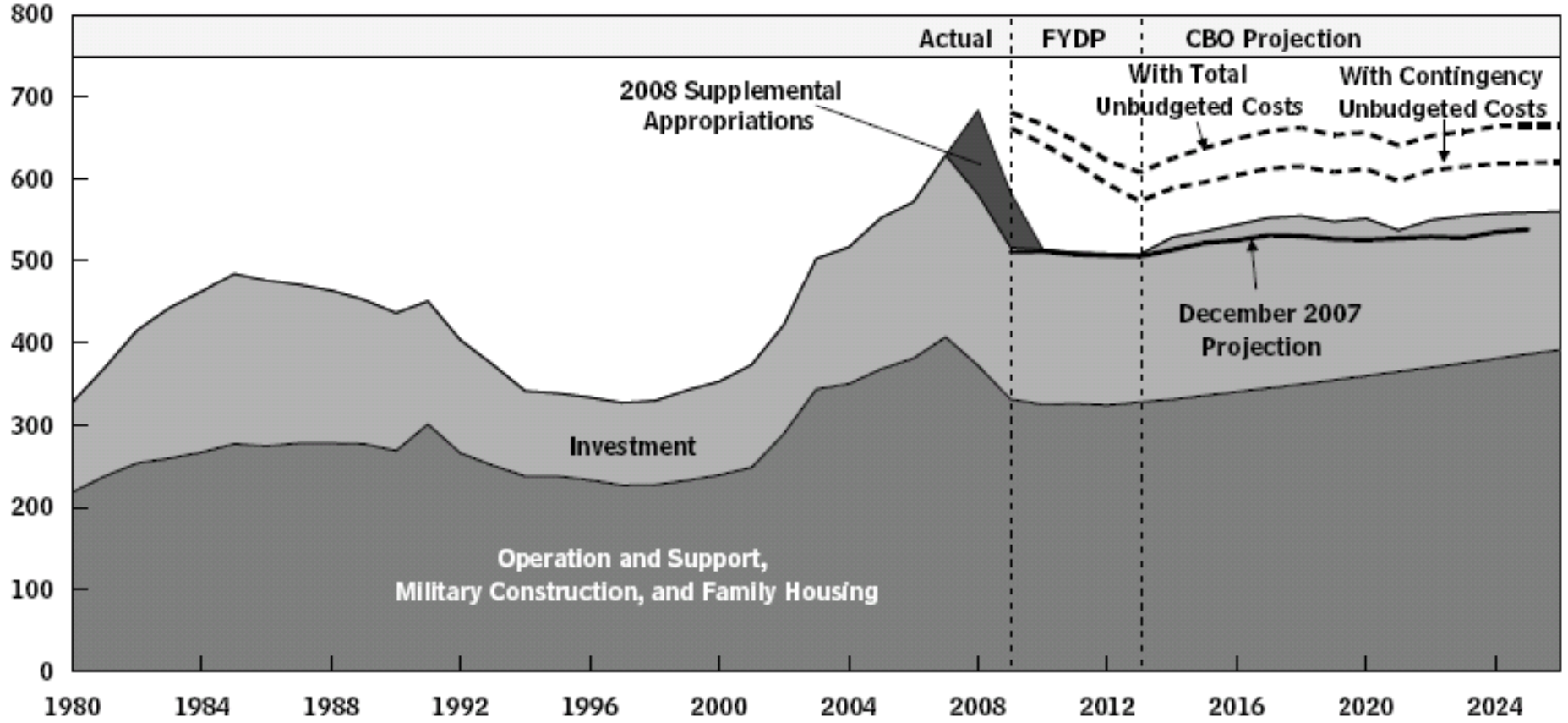
- QDR will assess threats and challenges the nation faces and re-balance DoD's strategies, capabilities, and forces.
  - Principal means by which NDS is translated into new policies and initiatives.
  - Provides strategic framework for force development and management; provides guidance across the FYDP.

- Issues Teams
  - Irregular Warfare – further institutionalizing capabilities and capacities to include building partnership capacity.
  - High-end Asymmetric Threats – addressing threats posed from the use of advanced technology and WMD.
  - Global Posture
  - Civil Support (at home and abroad) – strengthening support to civilian-led operations and activities.
  - Cost Drivers

Budget Trends

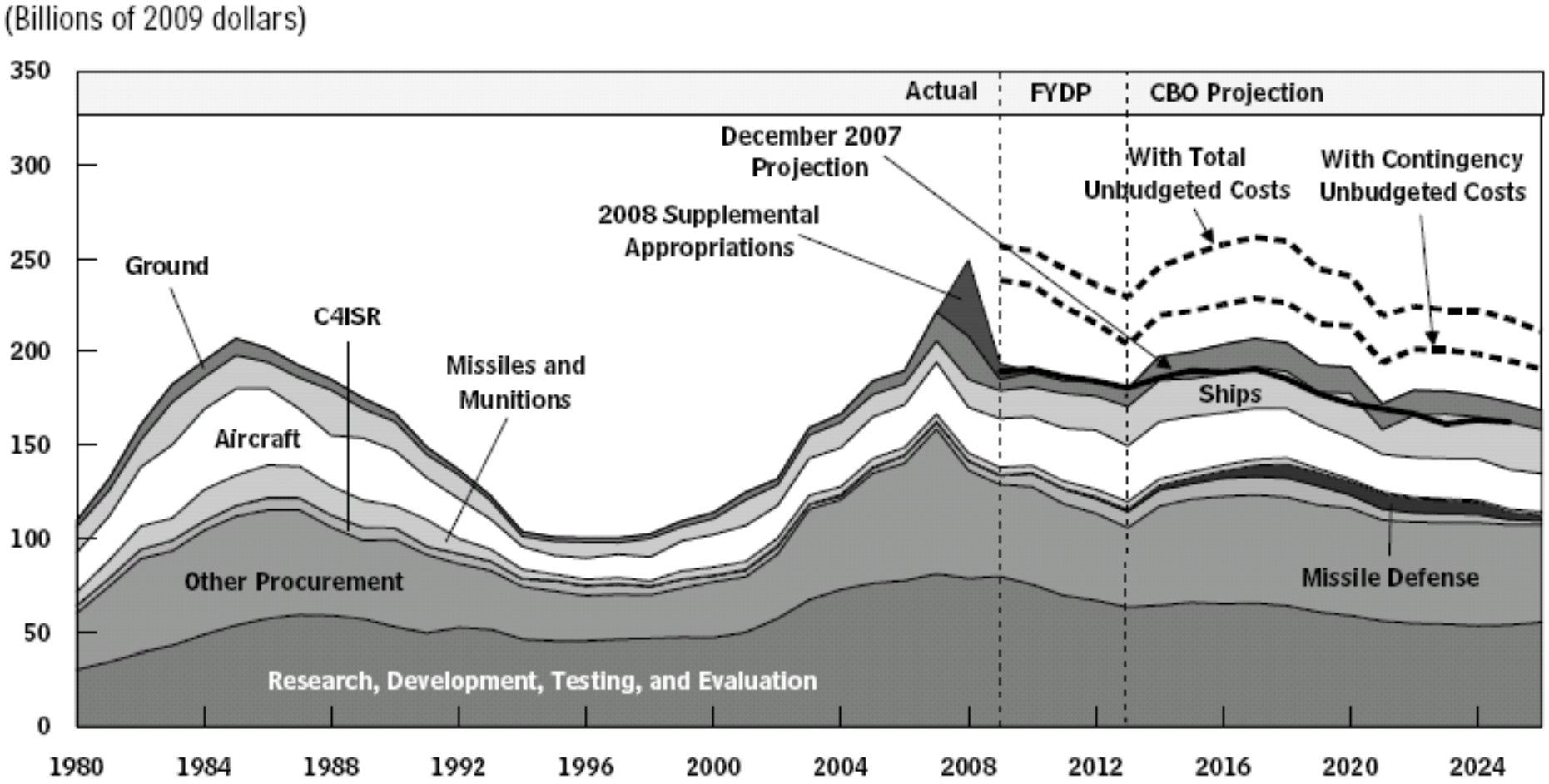
Past and Projected Resources for Defense

(Billions of 2009 dollars)



Source: Congressional Budget Office, “LONG-TERM IMPLICATIONS OF THE FISCAL YEAR 2009 FUTURE YEARS DEFENSE PROGRAM,” January 2009

Past and Projected Resources for Defense Investment



Source: Congressional Budget Office, “LONG-TERM IMPLICATIONS OF THE FISCAL YEAR 2009 FUTURE YEARS DEFENSE PROGRAM,” January 2009

FY 2010 President's Budget
Munitions Appropriations

	2008	2009	2010
Ammo (A)	2,703	2,557	2,433
Ammo (N/MC)	1,640	1,431	1,551
Ammo (AF)	938	1,041	1,079
Missiles (A)	2,474	2,946	1,901
Missiles (AF)	5,030	5,476	6,337
Weapons (N)	3,375	3,383	3,527
($ M)	16,160	16,834	16,828

Acquisition Reform

Weapon Systems Acquistion Reform Act of 2009

- **Title I – Acquisition Organization**
  - **Section 101** Creates Senate approved position replacing existing D, PA&E with Director, Cost Assessment and Program Evaluation (CAPE)
  - **Section 102** Requires SECDEF to appoint a Director, Developmental Test & Evaluation and a Director, Systems Engineering to report to USD(AT&L)
  - **Section 103** Requires a SECDEF designated official to conduct and oversee performance assessments and root cause analysis for MDAPs
  - **Section 104** Codifies a DoD practice of conducting assessments of technological maturity of critical technologies of MDAPs
  - **Section 105** Directs the JROC to seek and consider input from COCOMs

Weapon Systems Acquistion Reform Act of 2009

- **Title II – Acquisition Policy**
  - **Section 201** Requires SECDEF to ensure mechanisms developed and implemented to consider trade-offs among cost, schedule, and performance objectives in establishing requirements for acquisition programs
  - **Section 202** Requires SECDEF ensure acquisition strategies include measures to preserve competition, throughout the life of a program
  - **Section 203** Requires SECDEF modify acquisition guidance to require competitive prototyping prior to a MS B decision
  - **Section 204** Requires the PM to notify the MDA if prior to a MS B decision if cost or schedule grow > 25%
  - **Section 205** Programs receiving MS B approval on a waiver basis (statutory requirements) must be reviewed by MDA at least annually and flagged in budget documentation for Congress
  - **Section 206** Requires a root cause analysis following a critical breach, includes presumption of termination
  - **Section 207** Requires SECDEF to revise regulations dealing with contractors' organizational conflicts of interest

Munitions Interest Areas

Conventional Weapons JAT

Purpose

- Assess S&T funding in the area of conventional weapons.
- Implied is need to create weapon roadmaps
- Influence FY2011 Budget Review

Process

- Identify priority capability areas
- Identify current S&T funding
- Assess capability areas and associated S&T funding

Deliverables

- Weapon Roadmap for each Capability Area
  - Breakout of enabling technologies (being pursued and/or required) for each capability area being addressed
- Identification of “suppressive” systems and their requirements
  - Highlight minimum Industrial Base requirements
  - Highlight technologies that will assist IB
- Conclusions & Recommendations

Insensitive Munitions (IM) Update

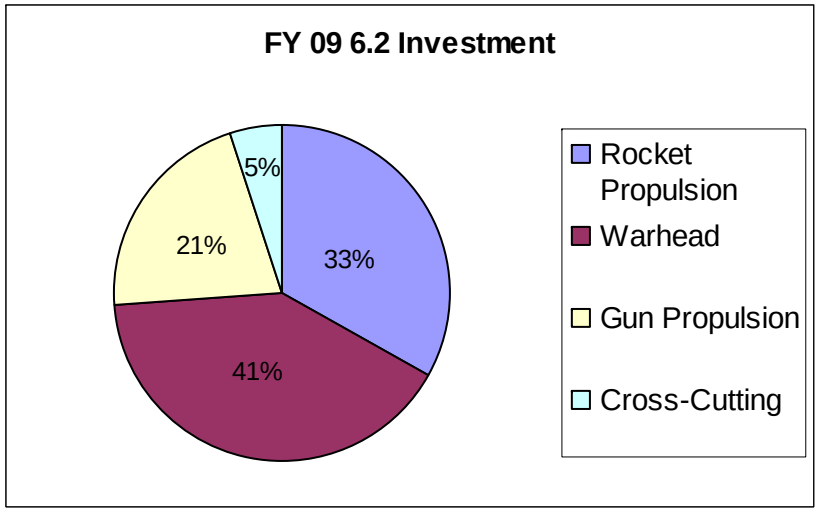
- IM Strategic Plans continue to be the primary vehicle for oversight and insight of Service IM implementation.

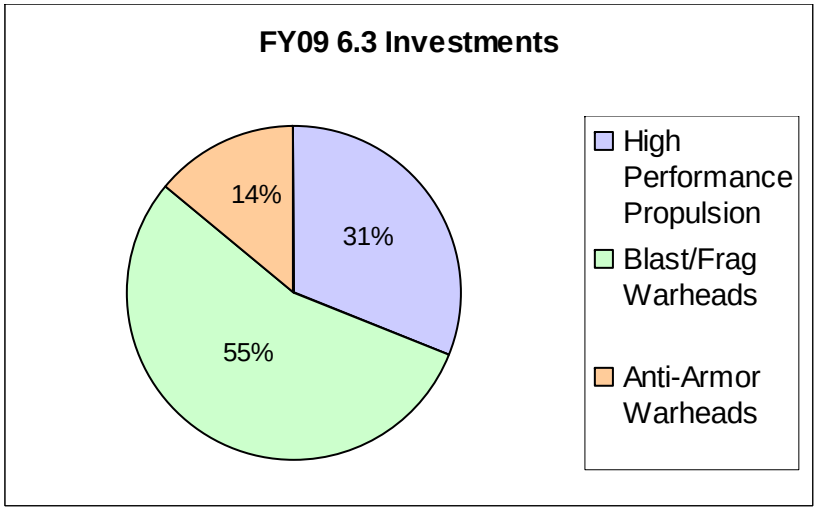
- Third submission of strategic plans has highlighted significant improvements in some systems, while identifying other areas that need focus.
  - (+) Army M107/M795 155 Artillery
  - (+) Navy SM-2/3/6
  - (+) Air Force Focused Lethality Munition
  - (+) USMC Portfolio wide improvements
  - (-) Linkage between PM programs and S&T Investments
  - (-) Metrics for gauging IM program success

- IM Strategic Plans remain the primary tool for guiding IM technology investments

Joint IM Technology Program

- FY09 Total $25M, $15M (6.2), $10M (6.3)
- Total FY10-15 Funding is $231M Focused on developing and demonstrating enabling technologies in 5 munition areas:
  - High Performance Rocket Propulsion
  - Minimum Smoke Rocket Propulsion
  - Blast/Fragmentation Warheads
  - Anti-Armor Warheads
  - Large Caliber Gun Propulsion
- First technology transfer should occur in FY09
  - IMX-101 TO US Army/USMC M795 155mm artillery round
  - Fragment Impact Warhead Technology for AIM-9x Warhead
- *DOTC is the mechanism for engaging industry*





Fuzing Science & Technology Efforts

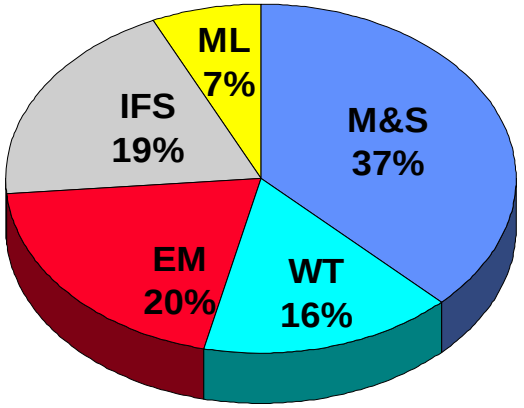
- Total FY2010 – FY2015 funding is $79.8M

- 4 Fuze Area Technology Groups formed:
  - Hard Target Survivable Fuzing
  - Tailorable Effects Weapon Fuzing
  - High Reliability Fuzing
  - Enabling Technologies and Common Architecture

- Participants
  - DoD communities: S&T / Requirements / Acquisition
  - Dept. of Energy
  - Industry via DOTC

Joint DoD/DOE Munitions Program (JMP)

- Goal: transition technologies and tools developed by the JMP-DOE National Labs to NWEC members in accordance with federal laws & Lab rules
- FY 09 $23.7M, FY10-FY15 $143.6M
- Approx. 40 projects in 9 Technology Coordinating Groups arranged in 5 focus areas:
  - Modeling & Simulation (TCG I & II)
  - Energetic Materials (TCG II & III)
  - Initiation, Fuzing & Sensors (TCG X & XIII)
  - Warhead Technology (TCG IV & XI)
  - Munitions Lifecycle (TCG IX & XIV)



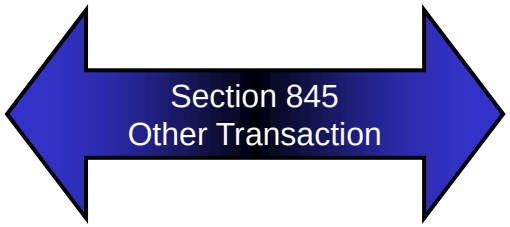
FY09 Funding

DoD Ordnance Technology Consortium

DoD Laboratories

National Warheads & Energetics Consortium

Rapid & Agile Acquisitions

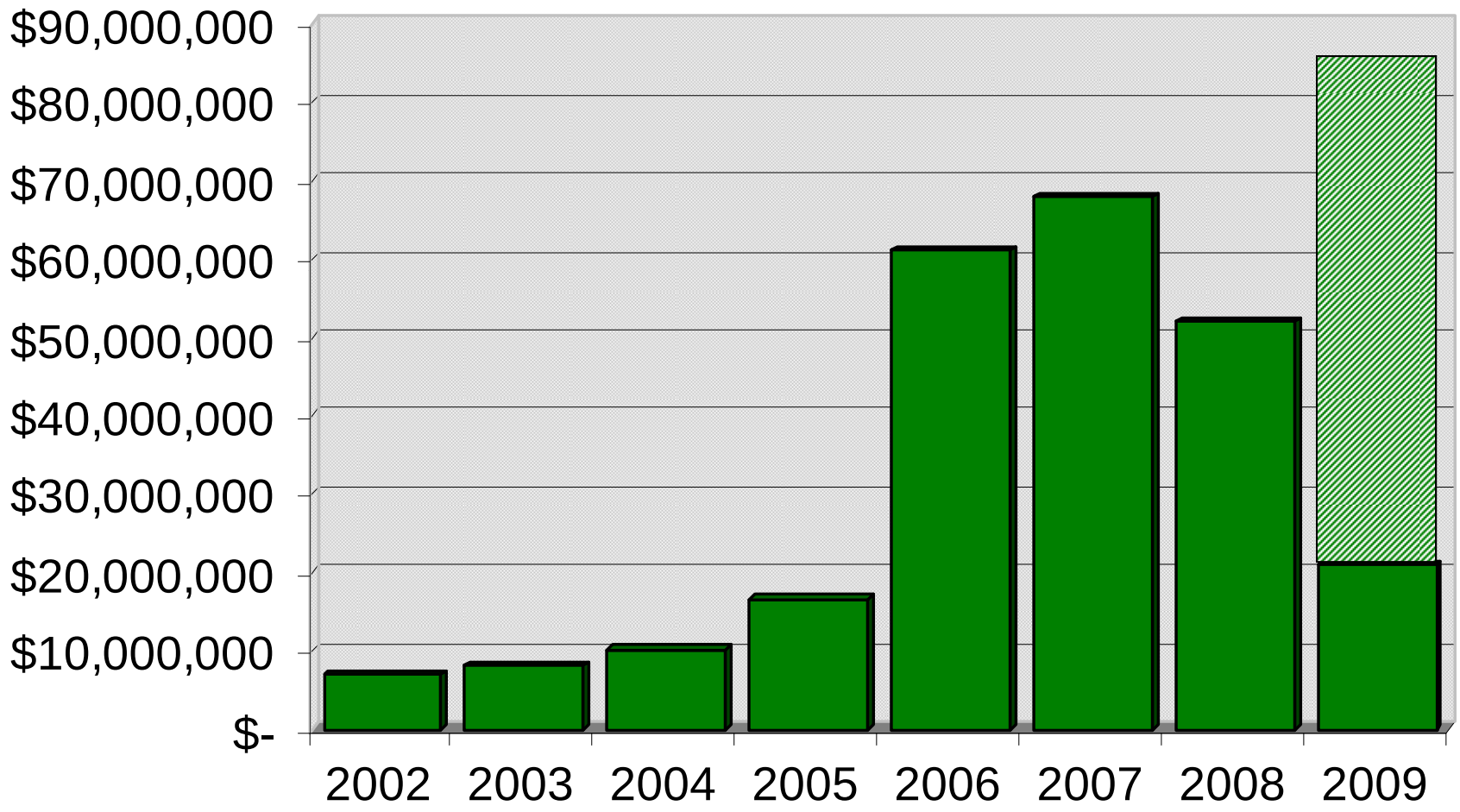


- OUSD (AT&L) LW&M
- Department of The Army
- Department of the Navy
- Department of the Air Force
- Department of Energy
- Special Operations Command
- Other Agencies and Departments

- Defense Contractors
- Traditional & Non-Traditional
- Academic Institutions
- Not-for-Profits Organizations

DoD and NWEC… Partnering to Leverage Capabilities and Investment

DOTC Resources



TATB

BACKGROUND

- **Triaminotrinitrobenzene (TATB) is one of the least sensitive explosive materials known**
  - TATB is a critical ingredient in the booster explosives PBXN-7 and PBXW-14 for DoD applications
  - TATB is used in PBX 9502 and LX-17 for DOE applications
- **2005 last qualified OCONUS source ceased production and closed in 2006**
- **2006 MANTECH unsuccessful in developing a production source**
- **2007 TATB DoD/DOE Working Group formed**

ROAD AHEAD

- **Reestablish Benziger TATB Route**
- **Leverage DOE TATB Strategic Stockpile**
- **Funding for reclaimed TATB**

ISSUES

- **DoD dependent on DOE stockpile for at least the next two to three years**
- **Earliest relief may come from reclamation effort**
- **TATB will ONLY be available for DoD components and FMS**

Cluster Munitions

- DoD policy issued June 2008; after 2018 all cluster munitions must have UXO rate of 1% or less.
  - Convention on Cluster Munitions signed by 94 nations in December 2008; bans nearly all cluster munitions; U.S. is not a signatory
  - U.S. is negotiating within the Convention on Conventional Weapons to regulate (not ban) use of cluster munitions
- Impacts of new policy and treaty:
  - Increase in demil liability
  - Potential new R&D and production of replacement munitions
  - Possible changes in how U.S. operates with coalition partners who signed Convention on Cluster Munitions
- Joint Staff led PDM Assessment highlighted:
  - Need for more analysis (TRADOC assessment Sept 09, POM12 MRP, etc…)
  - Support for GMLRS Alternative Warhead program
  - Support for new DoD Fuze S&T program

STAY TUNED

Design for Demilitarization
Policy Memo Signed by USD(AT&L) August 2008

- If not considered early in the design, increases weapons' life cycle costs

- During system design, weapons designers can optimize demil methods and resource reclamation and reuse
  - Facilitate disassembly and access to energetic materials
  - Use energetic materials and components having reclamation or reuse potential
  - Efficiently accommodate existing demilitarization processes
  - Reduce the use of environmentally sensitive materials
  - And enhance safety for demil operators

- PMs will now include in acquisition documents and in design reviews how they intend to address demil in design and test

Questions?

PM CLOSE COMBAT SYSTEMS

PM Close Combat Systems
Briefing for:

Precision Strike Association
NDIA Picatinny Chapter

June 2009

Mr. Joe Pelino
Deputy Product Manager, IMS
(973) 724-3457
joe.pelino@us.army.mil

PM CCS Mission

PM CLOSE COMBAT SYSTEMS

Provide the Warfighter world-class close combat, force protection & assured mobility capabilities across full spectrum operations through professional, integrated Joint Life-Cycle Management.

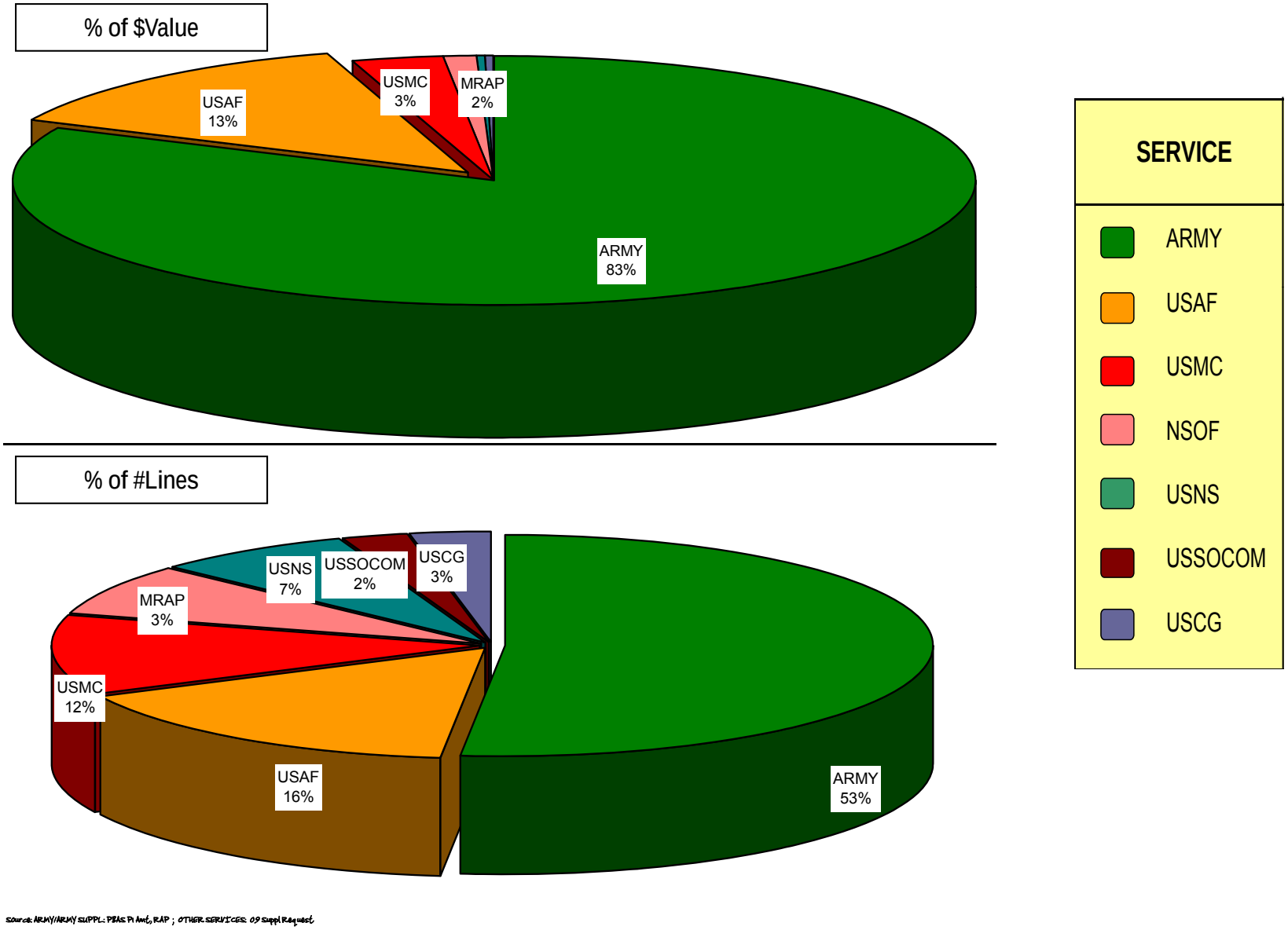
PM Close Combat Systems
Product Lines

PM CCS Mission: Provide the Warfighter world-class close combat, force protection & assured mobility capabilities across full spectrum operations through professional, integrated Joint Life-Cycle Management.

- Networked Munitions
  - XM7 Spider
  - XM1100 Scorpion
- Legacy Mines
- Countermine
- EOD Equipment
- IED Defeat
- Grenades
- Pyrotechnics
- Demolitions
- Shoulder-Launched Munitions
- Non-Lethal Systems & Munitions
- Special Projects

http://www.pica.army.mil/pmccs/

PM CCS FY09 FUNDING BY CUSTOMER



source: ARMY/ARMY SUPPL: PBAS P1 Amt, RAP ; OTHER SERVICES: 09 Suppl Request

PM CLOSE COMBAT SYSTEMS

Networked Munitions Role on the Battlefield

As **Tactical** Networked Munitions,

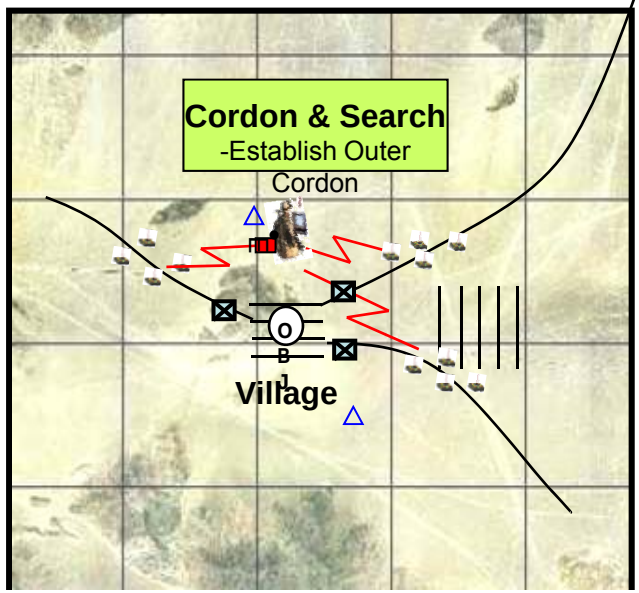
Spider & Scorpion are employed to attack the enemy or to deny the enemy's freedom of maneuver along the enemy's expected avenue of approach, movement route, or future location.

This equates to enhanced countermobility and terrain shaping capabilities.

As **Protective** Networked Munitions,

Spider & Scorpion are employed to protect friendly forces, installations, routes, and actions within a specific operational area.

This equates to protection capabilities in the form of local security and area security.

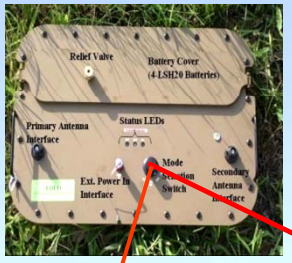


SPIDER
Networked Munitions System

PM CLOSE COMBAT SYSTEMS

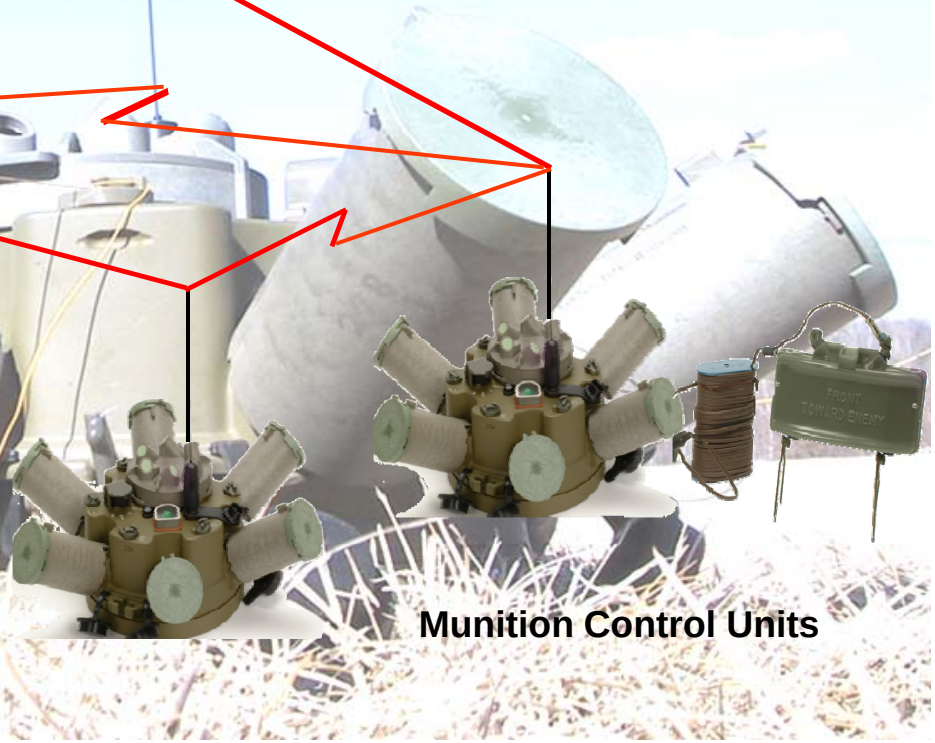
Validated Operational Needs Statement (44)	4 Aug 08
Updated ONS validated (66)	16 Oct 08
User Acceptance of MON	Jan 09
UMR Approval by TACOM	Jan 09
UMR Approval by JMC	Jan 09
Ship 66 systems	Mar-May 09
Completed NET	Mar-May 09

Repeater



Peer-to-Peer Networking

Remote Control Station



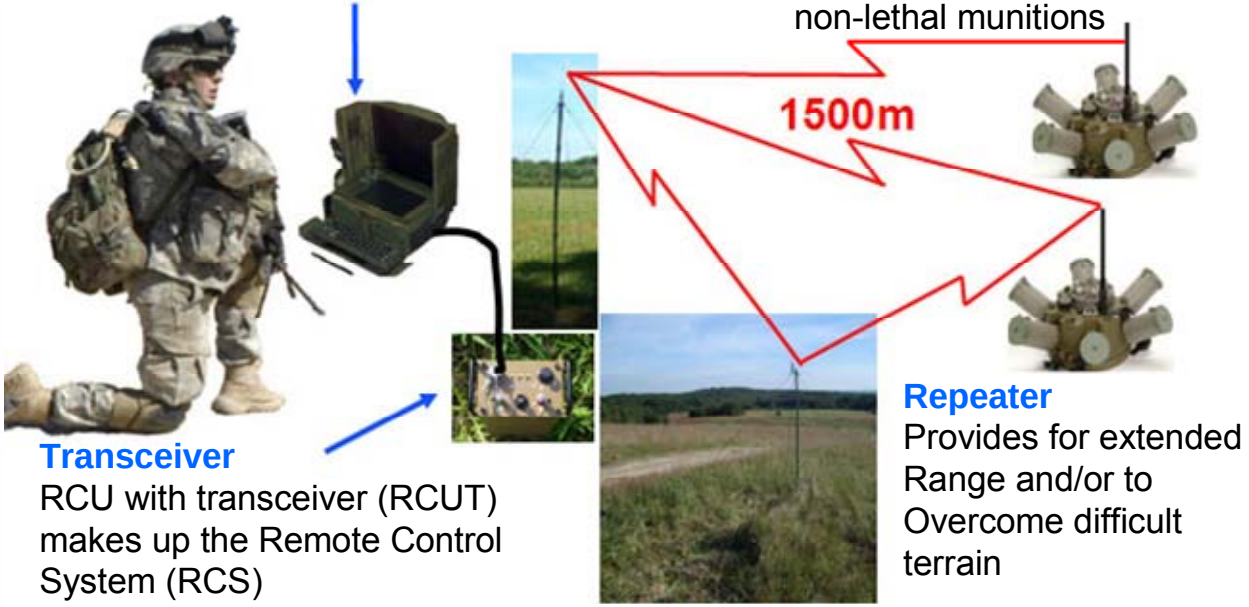
Munition Control Units

PM CLOSE COMBAT SYSTEMS

Spider System Overview

Remote Control Unit - RCU
Man-in-the-Loop (MITL) command and control of all munitions in the field

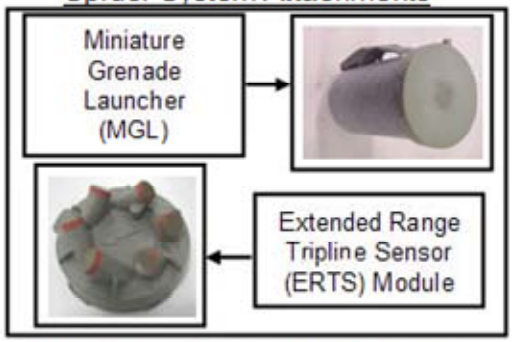
Munition Control Unit - MCU
Hand emplaced, remotely controlled munitions. Detects intrusions, controls lethal and non-lethal munitions



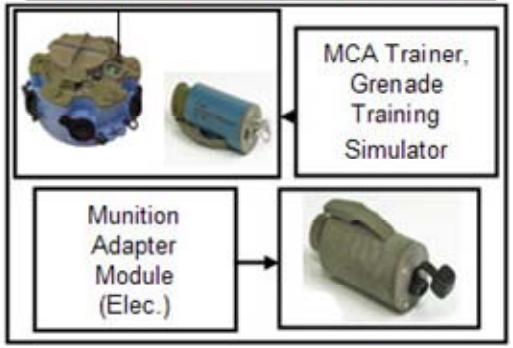
Transceiver
RCU with transceiver (RCUT) makes up the Remote Control System (RCS)

Repeater
Provides for extended Range and/or to Overcome difficult terrain

Spider System Attachments



Additional Spider System Hardware

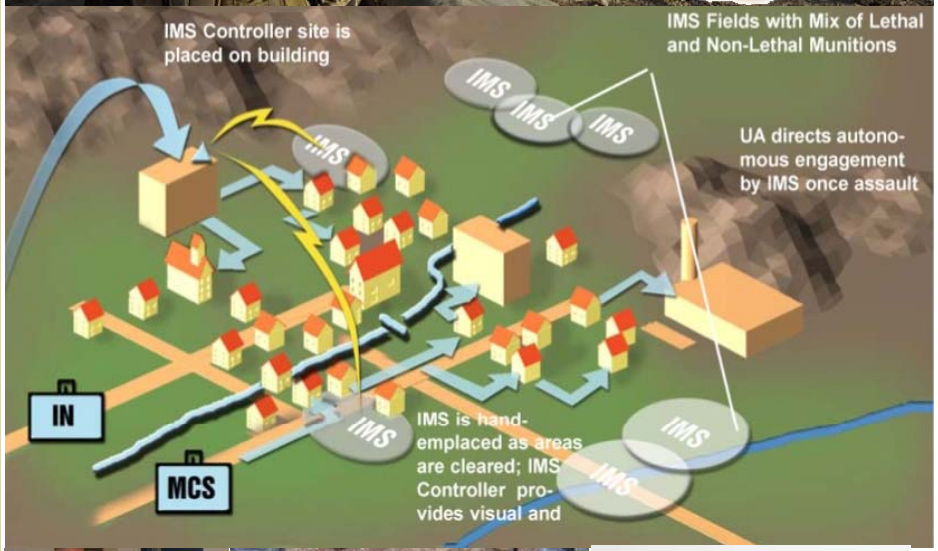


System Capabilities

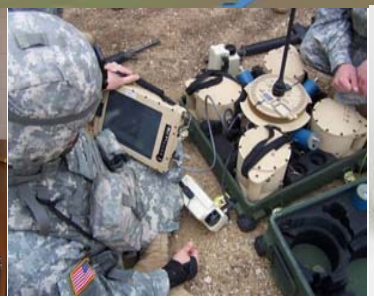
- **Self Destruct & Self Deactivate**
- **Command Reset/Recycle Self Destruct**
- **Transfer of Control**
- **Interface to ABCS via removable media**
- **ON – OFF – ON (safe passage/maint.)**
- **Multiple Effects (Lethal / NL / Demo)**
- **Reusable**
- **Command Destruction**

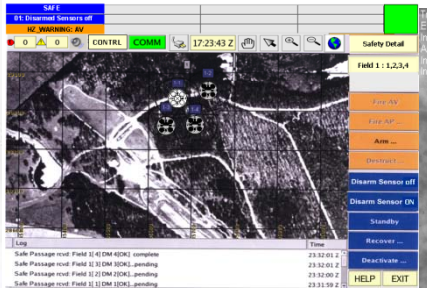
SCORPION (Intelligent Munitions System)
Networked Munitions System

PM CLOSE COMBAT SYSTEMS



- **Networked Munitions System**
- **Enables a scalable response**
- **Provides temporary & fixed site security**
- **Persistent surveillance & screening**
- **Anti-Vehicle / Anti-Tank System**





Scorpion Increment 1 System Overview

Command & Control (C2)
- Via handheld controller
- Can control other munitions
- Spider radio as interim for JTRS

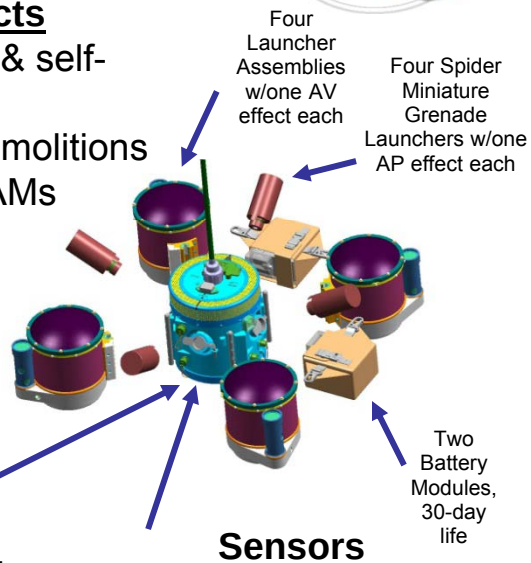
Control Station

1500-3800 m

Dispensing Module
- Hand-emplaced
- 100m protective obstacle
- Employed in 5 minutes
- 145 lbs (max), 24”x24”x14.5”

Modular Components

Effects
- Lethal AV & self-protect AP
- Initiate Demolitions
- Spider MAMs



Effects Electronics Module
- Provides central C2 in
- the field
- Sensor fusion
- Munition controller

Sensors
- Enable coordinated attack
- Ground Sensors: Acoustic, seismic, & MMW RADAR
- Airborne Sensors: Passive & Active IR

System Capabilities

- Self-Destruct & Self-Deactivate
- ON-OFF-ON — “Safe Passage”
- Transfer of control, regain control
- Large lethal engagement (100m)
- Provides situational awareness information
- Re-usable, modular design reduces log footprint
- 30-day operational life (tactical)
- Immediate kill “out of the box”
- Multiple DMs can create larger field

Use or disclosure of data contained on the page is subject to restrictions on title page

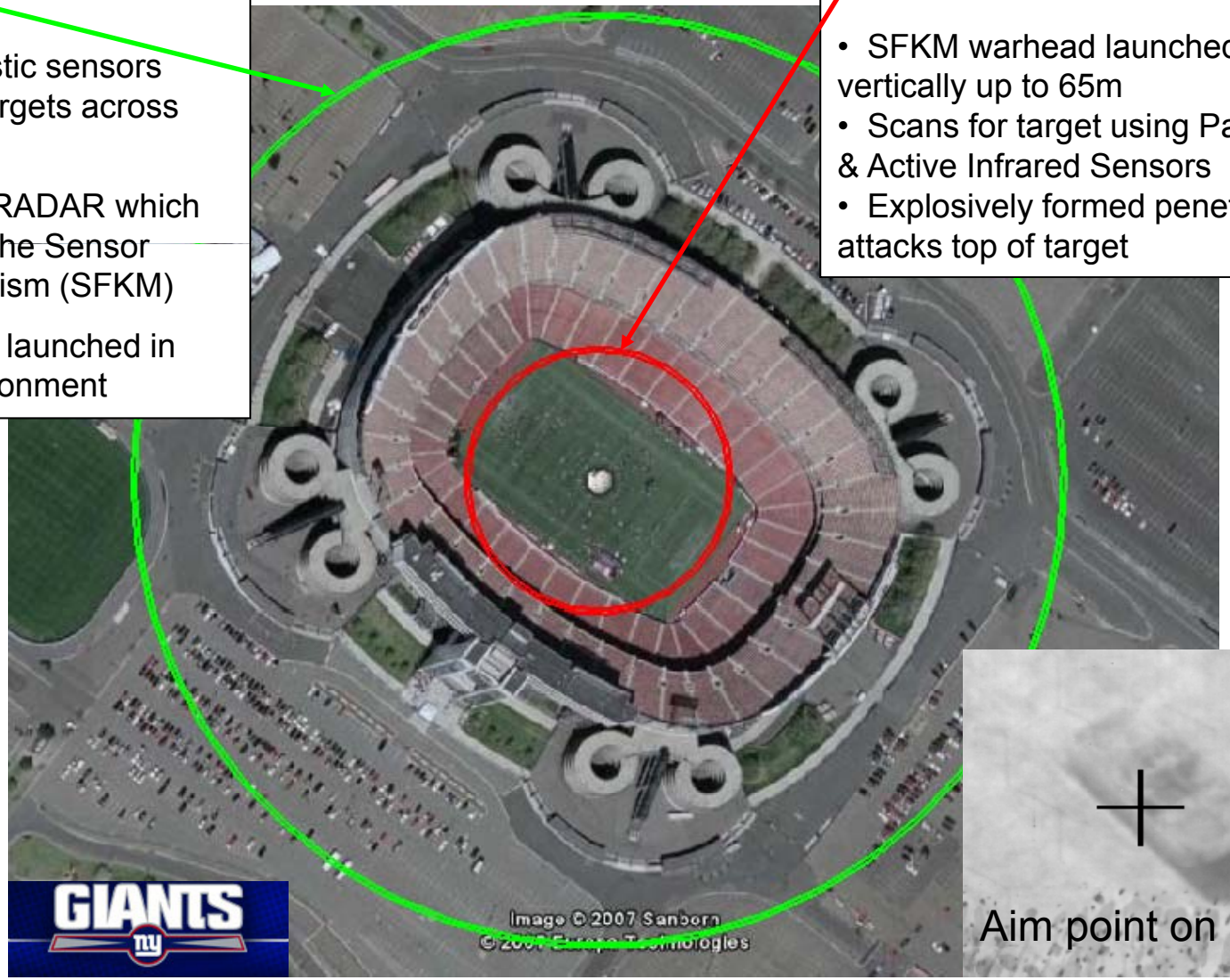
Scorpion Area of Influence

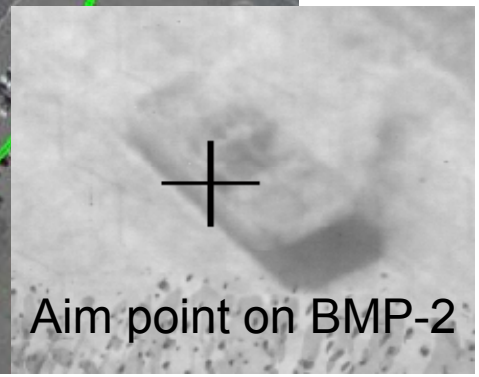
Effective Situational Awareness Coverage (400m diameter)

- Seismic & Acoustic sensors detect and track targets across target set
- Turns on MMW RADAR which triggers launch of the Sensor Fuzed Kill Mechanism (SFKM)
- SFKM precisely launched in known target environment

Effective Lethal Range of AV Effect (100m diameter)

- SFKM warhead launched vertically up to 65m
- Scans for target using Passive & Active Infrared Sensors
- Explosively formed penetrator attacks top of target





PM CLOSE COM

Major Areas of Concentration

PM CLOSE COMBAT SYSTEMS

PM CCS Focus Areas

Development of New Systems

- Spider
- Scorpion
- ASTAMIDS
- GSTAMIDS
- IAM

Fielding New Non-Developmental Capabilities

- <u>IED Defeat</u>
  - SPARK
- <u>Protect Force</u>
  - VLAD
  - TASER
- <u>Shoulder-Launched</u>
  - AT4-CS

Modernizing Production Ammunition

- MDI
- M67 Grenade
- M211/M212 CM Flares
- AT4/AT4-CS
- M18 Smoke Grenade
- Bangalore Torpedo

PM CLOSE COMBAT SYSTEMS

Ammo Acquisition Philosophy

- Best Value Competition based on technical capability/quality
- Restricted to NTIB IAW Section 806
- Long-term (5yr) partnerships with high quality suppliers
- Contracts for logical, economical groups of products (families)
- Strong cooperation/collaboration between contractor & government engineers
- Continuous product & process improvement
  - Modernization of materials, design & production processes
- Allow for risk, & invest savings in improvements/future risk mitigation
  - Reliability, producibility, weight reduction, environmental compliance, logistics supportability

Modernization through Acquisition

Affordable Precision Munitions
The Reliable Choice

PEO Ammunition
Mr. James Sutton
June 2009

PEO Ammunition

Single Manager for Conventional Ammunition

PEO Ammo Transformation

Material Releases Since 2002

Ammunition – 67
Electronics – 7
Weapon Systems – 32

Friendly Too

PEO Ammo Overview

Mr. James Sutton, PEO
June 2009

PEO Ammo Transformation

Material Releases Since 2002

Ammunition – 67
Electronics – 7
Weapon Systems – 32

Precision Awareness Areas

- Mix of Precision
- Insert Precision
- Migrate Precision
- Produce Precision
- Fund Precision
- Culture of Precision
- Demil of Precision

At the End of the Day…

We're Meeting Joint Warfighter's Needs !

UNCLASSIFIED

U.S. ARMY LOGISTICS

SUSTAINING AMERICA'S ARMY: THE STRENGTH OF THE NATION

AMERICA'S ARMY: THE STRENGTH OF THE NATION

Army Logistics Update

10 June 2009

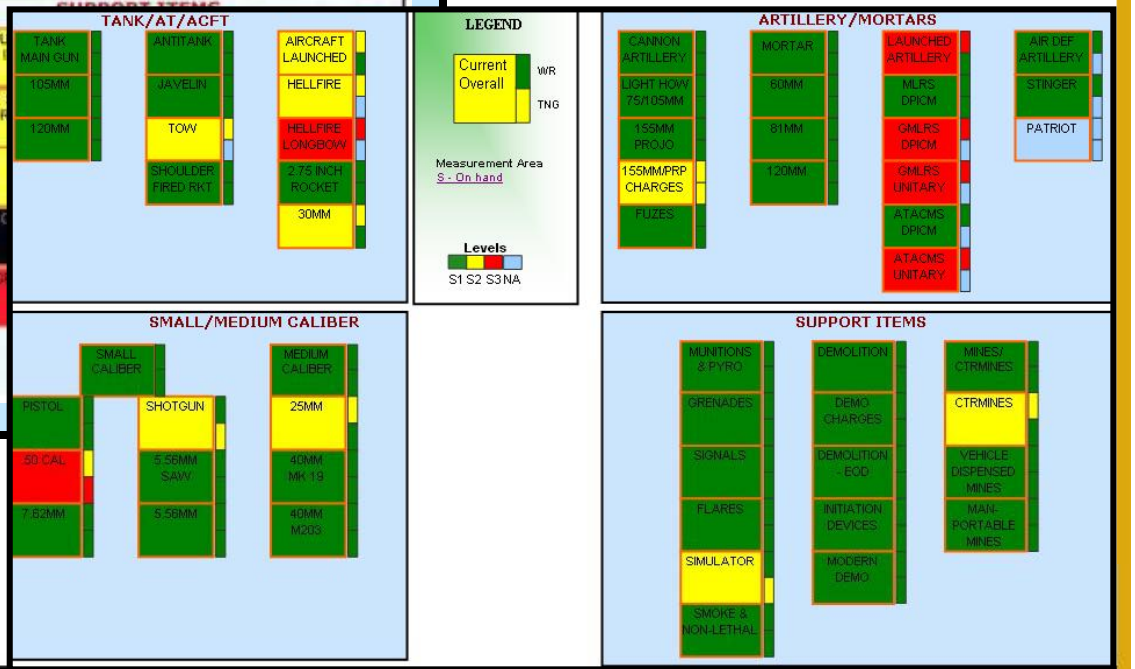
★ ★
MG Vincent E. Boles
Assistant Deputy Chief of Staff, G-4
Headquarters, Department of the Army

Agenda

- Munitions Readiness
- Why Munitions Readiness?
- Ammo Funding
- Logistics Operations Supporting Southwest Asia: Munitions Support
- Precision Munitions: Excalibur and Guided MLRS
- Hellfire Missile Development
- OIF Drawdown Challenges, OEF Plus Up
- Diagnostics and Prognostics for High Value Critical Munitions
- Missile Sustainment Science &Technology
- Army Transformation Done Right
- Questions?
- Munitions: Way Ahead

Munitions Readiness Report

Status Dec 02



Today

Munitions Readiness

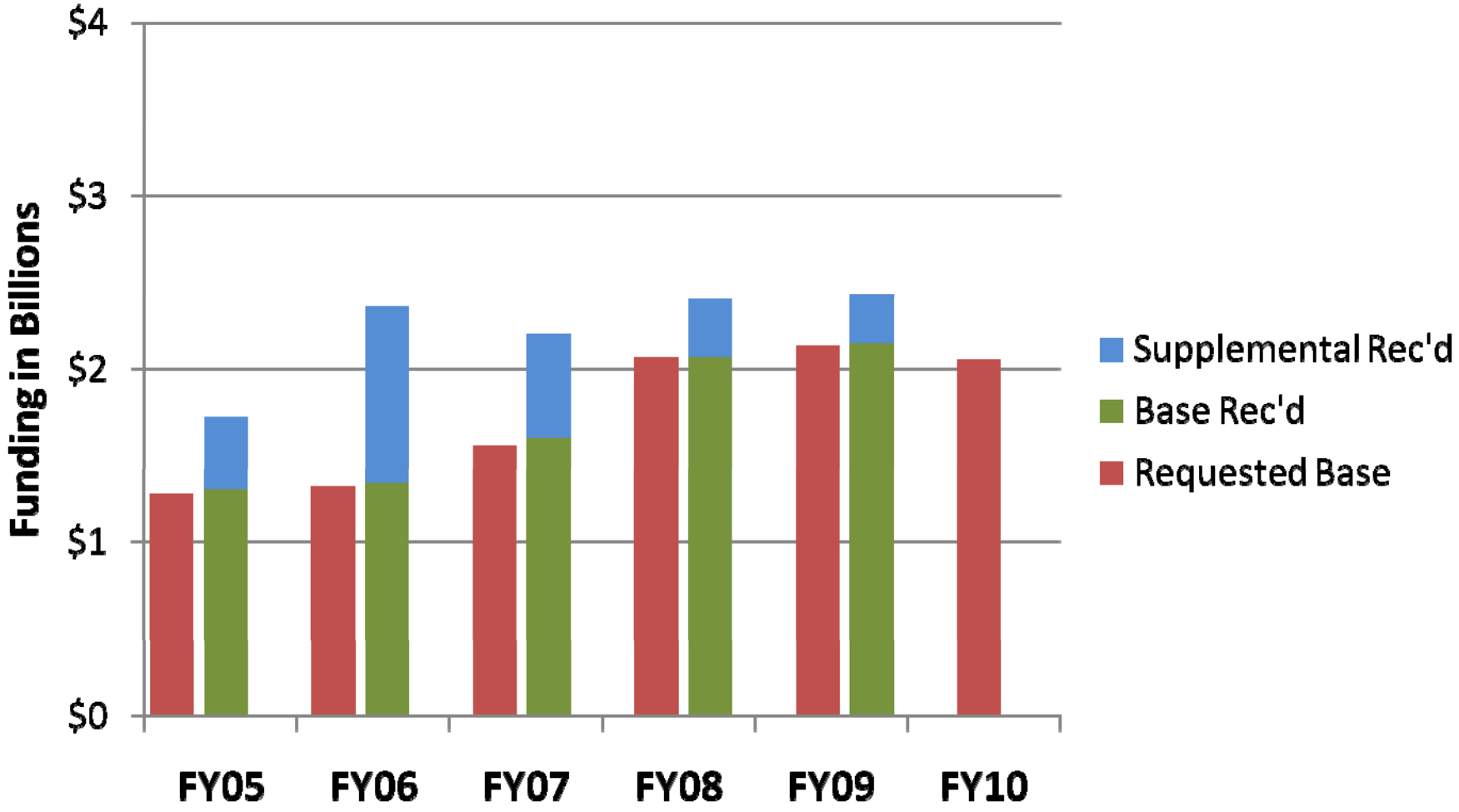
- Sustain Current Stockpile
- Reset Munitions
  - Repair
  - Repackage
  - Properly Locate
- Replace Munitions Consumed in Current Operations
- Demilitarize Excess, Obsolete and Unserviceable Munitions

Why Munitions Readiness?

Because not everyone has our standards:

Persistent Conflict,
Expeditionary
Deployment Cycles

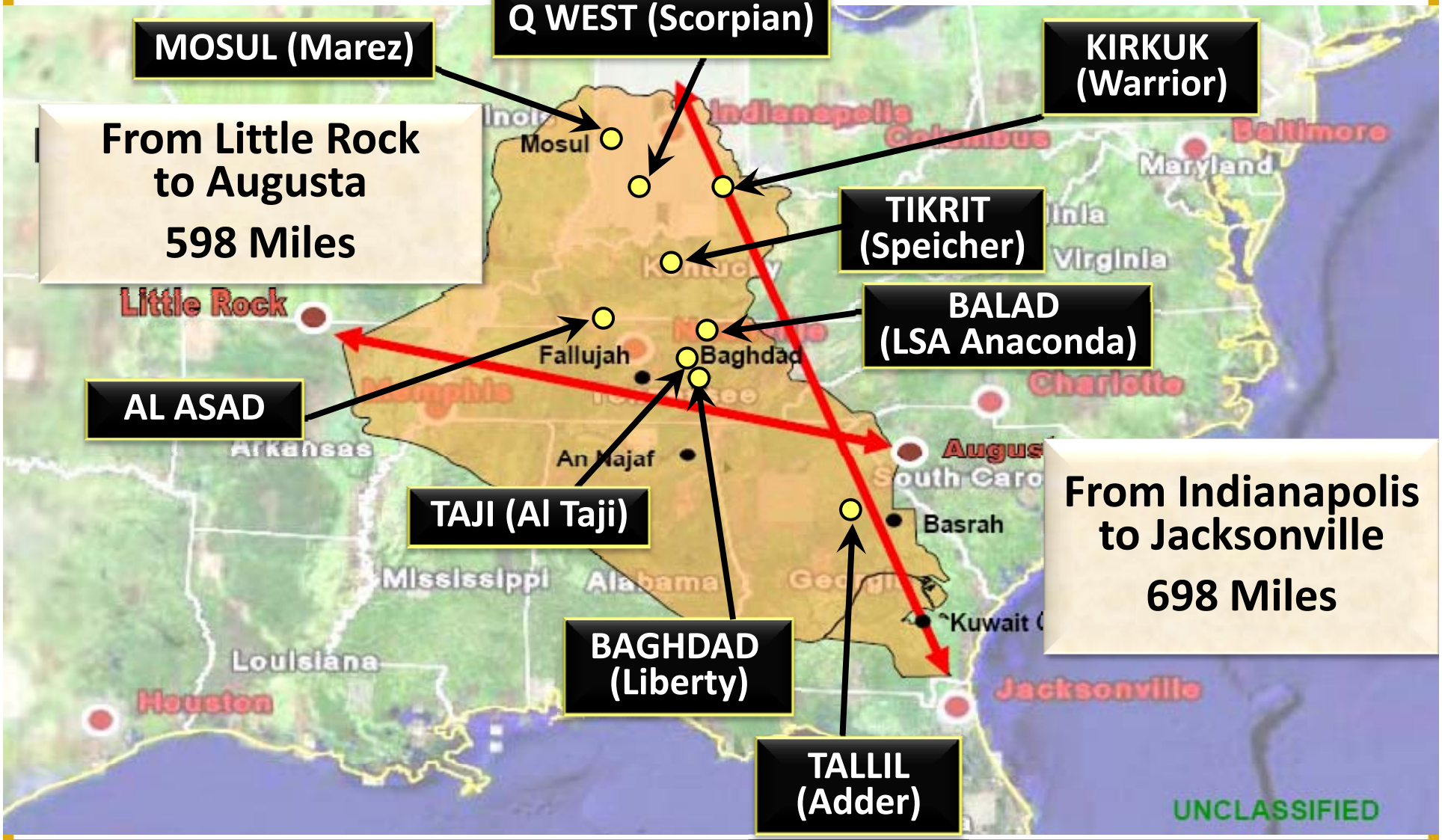
Army Ammunition Funding



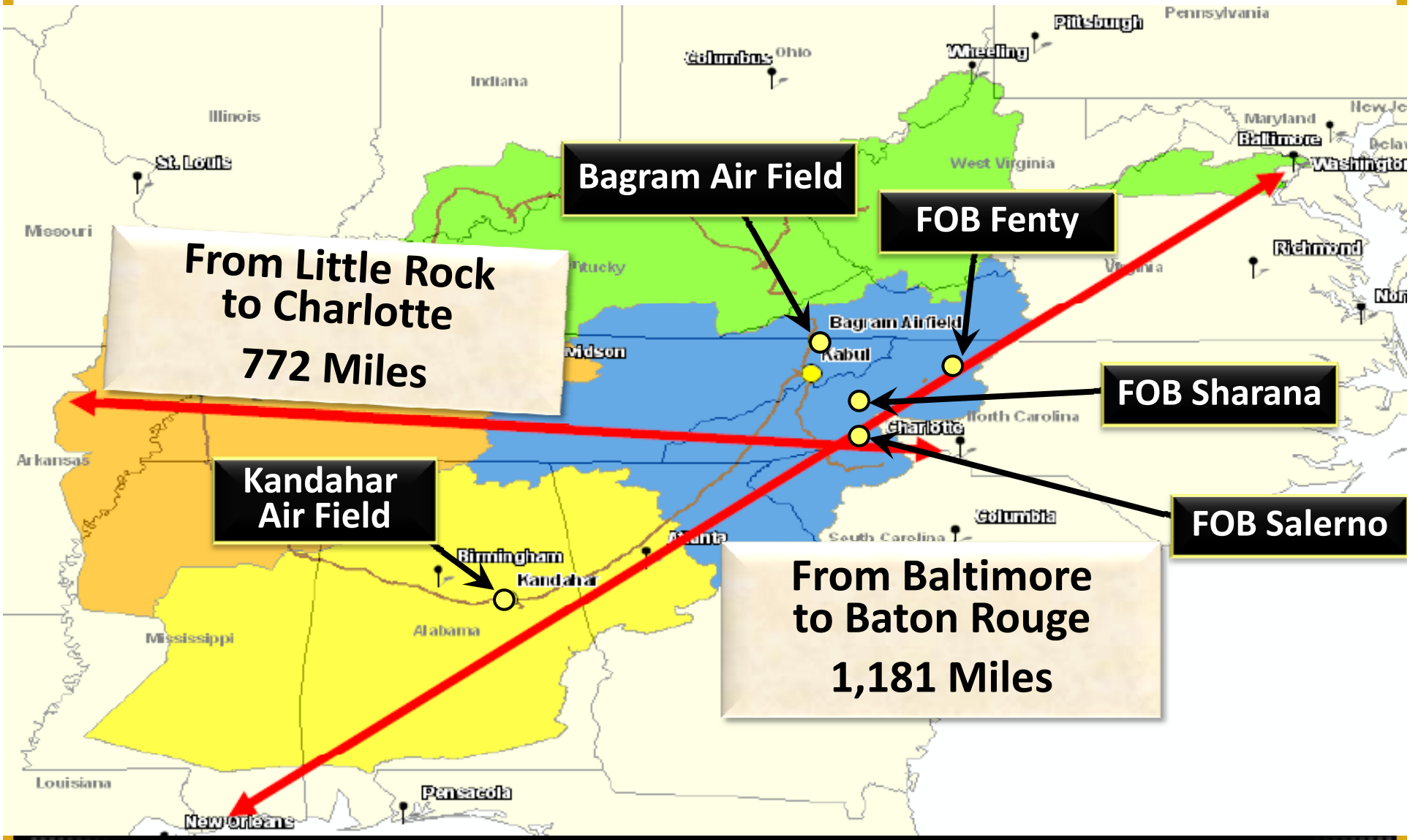
Numbers reflect only Army conventional ammo. Does not include missile funding

Logistics Operations Supporting Southwest Asia: Munitions Support

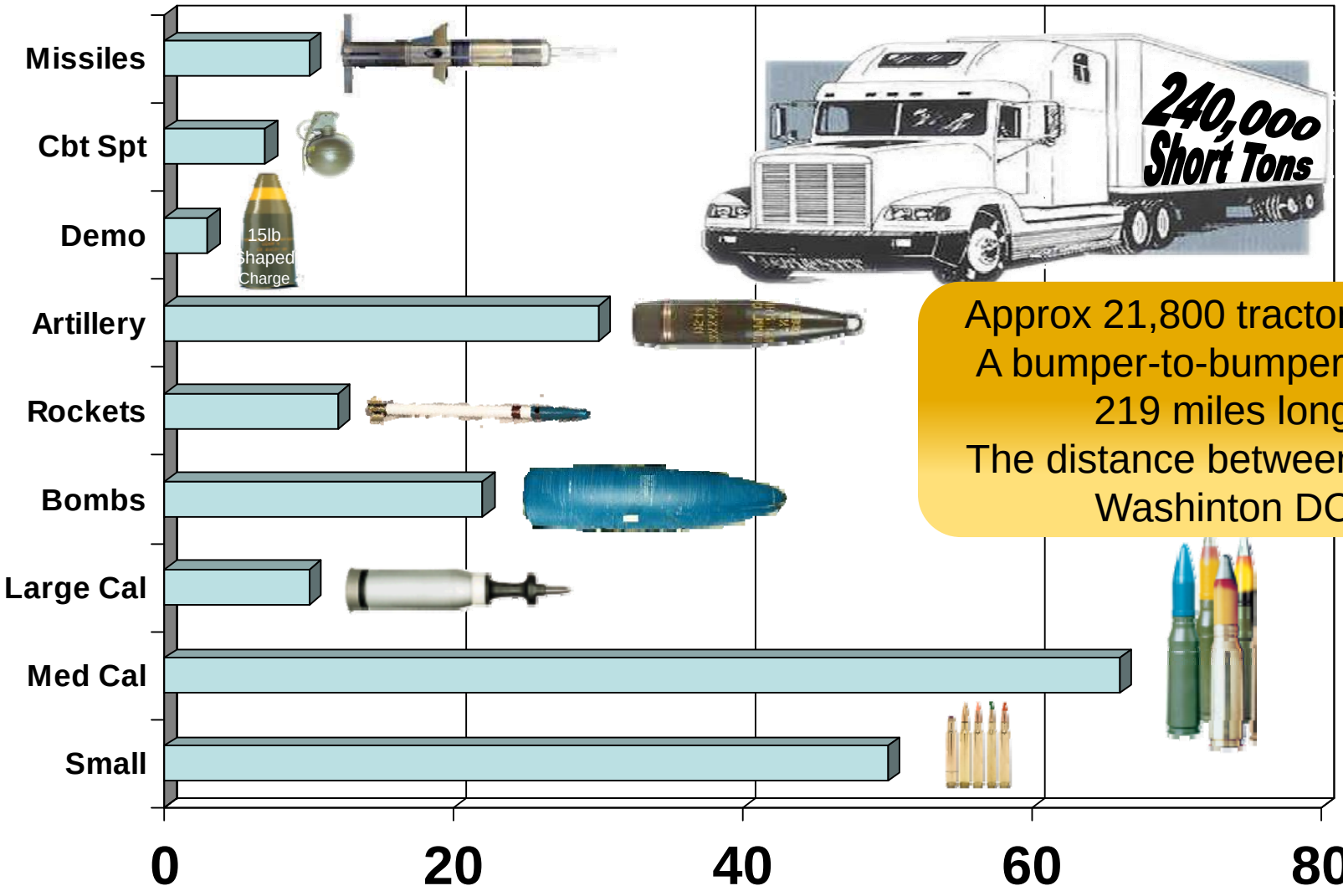
Ammunition Supply Points in Iraq



Ammunition Supply Points in Afghanistan



Munitions Provided to OEF/OIF: 2001 to 2009



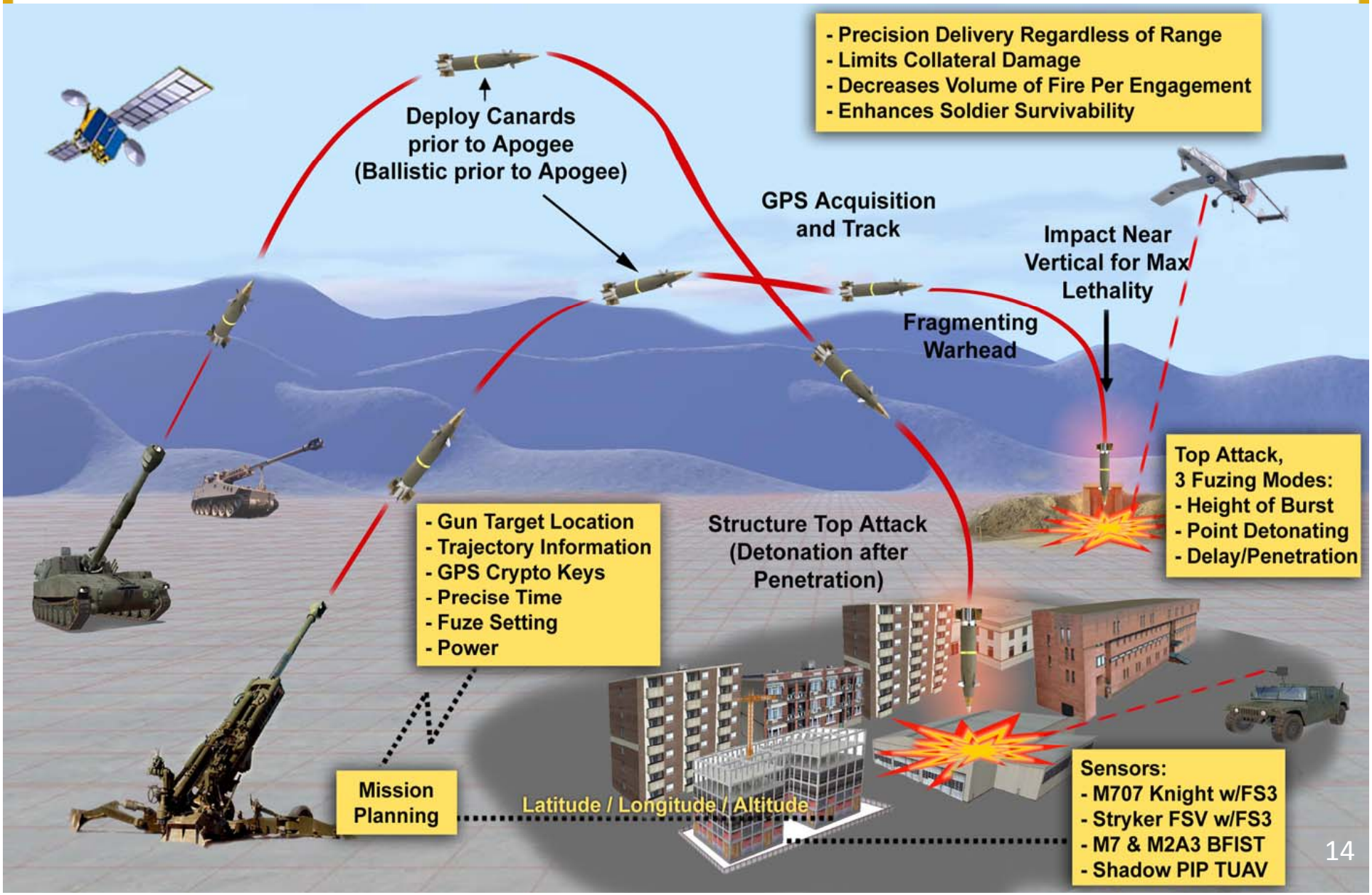
Approx 21,800 tractor trailers.
A bumper-to-bumper convoy 219 miles long.
The distance between NYC & Washinton DC!

Precision Munitions: Excalibur and Guided MLRS

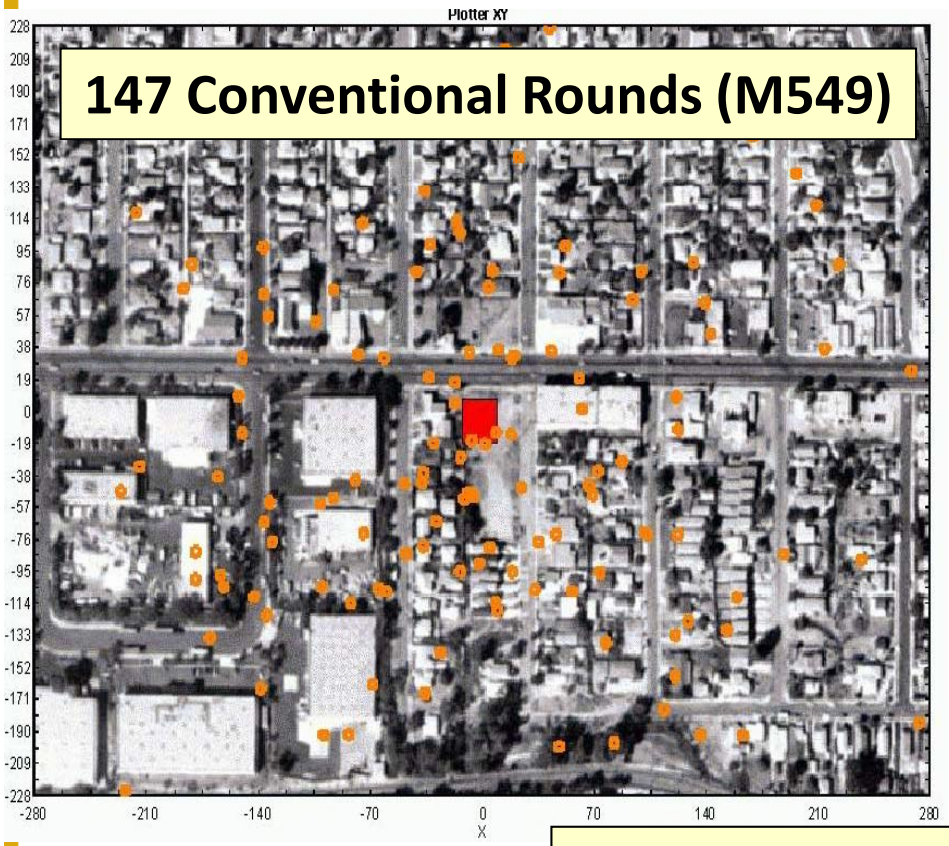
Why Precision Munitions?

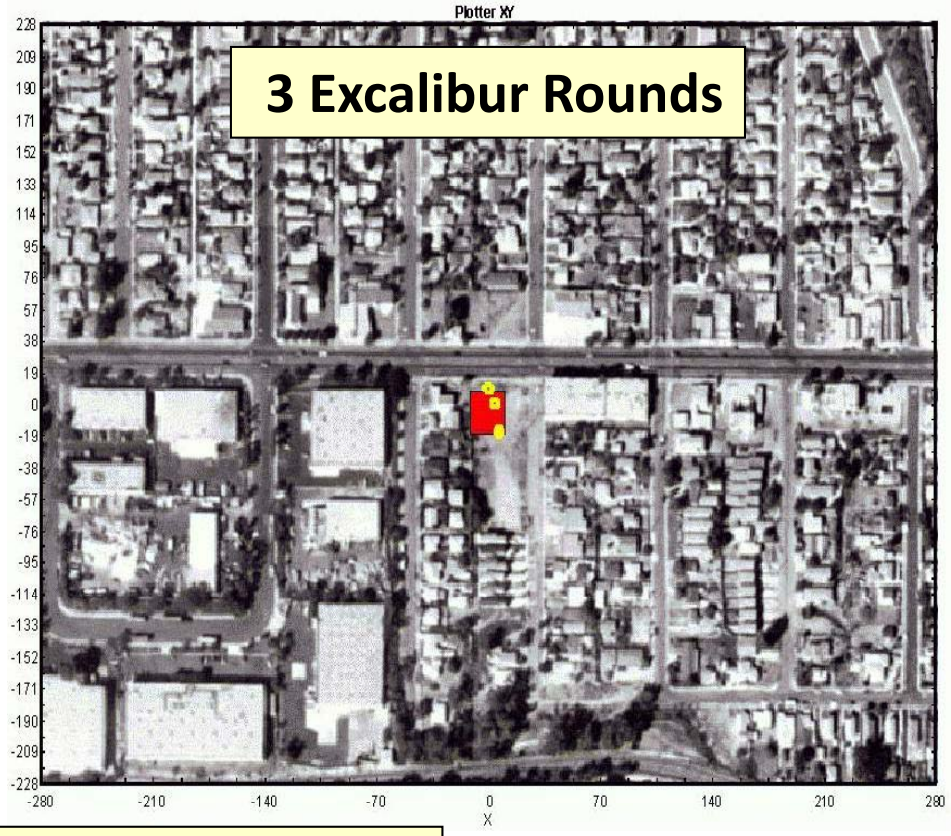
- Precision munitions improve lethality and tactical effectiveness
- Reduces collateral damage through precise targeting and warhead adaptation
- Reduces the logistical footprint
- Provides an answer to the Cluster Munitions capability gap

Excalibur Concept of Operations



Excalibur Accuracy





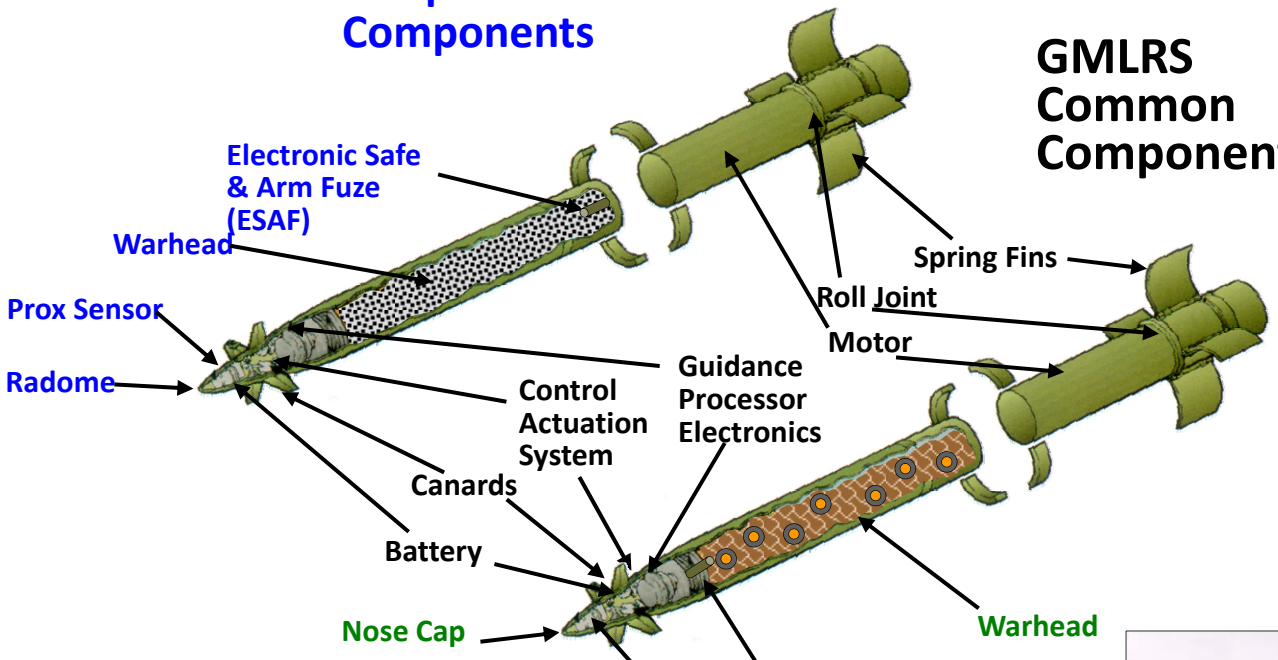
- Urban Command Post
- 20m X 20m Structure
- 10m Target Location Error (TLE)

Excalibur accuracy minimizes collateral damage and munitions required

Guided MLRS

Unitary Unique Components

GMLRS Common Components



Alternative Warhead Unique Components

Guided MLRS

- Precise targeting-reduces collateral damage
- Demonstrated 98% reliability, BDA shows high effectiveness
- Precision/effectiveness reduces the log tail – less munitions required to service targets
- First system to test Alternative Warhead concepts
  - Maintain area weapons capability
  - AW to comply with DOD Cluster Munitions policy

Hellfire Missile Development

HELLFIRE Warhead Coverage

Shaped Charge Warhead

Shaped Charge Warhead w/ Steel Frag Sleeve

Blast Frag Warhead w/ MAC

Integrated Blast Frag Sleeve (IBFS) Warhead

Main Battle Tanks (MBT)

Air Defense Systems

Commercial Vehicles (Pickups, SUV)

Small Boats

Patrol Craft & Ships

Heavy & Light Armored Vehicles

Personnel in Open

Transporter Erector Launcher

C2 Node

Buildings

Thin Skinned Vehicles

Artillery Systems

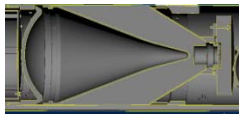
Bunkers & Caves

Pssk Against MBT

Range Of Targets

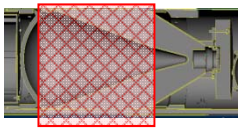
Pssi Brick over Block

Hellfire Warhead Development



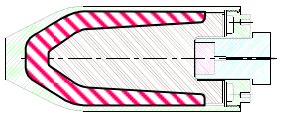
Anti-armor versions AGM-114 A, C, F, K, K-2, L, P, P++

Shaped Charge Warhead



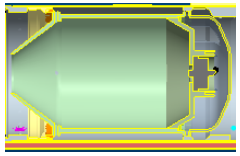
Anti- personnel versions AGM-114 F-A, K-2A, P-2A

Shaped Charge w/ Frag Sleeve



Blast version AGM 114M ,
Thermobaric version w/ Metal Augmentation Charge AGM-114N

Blast Fragmentation Warhead



Future All- purpose warhead for version AGM-114R IBFS

Integrated Blast Frag Sleeve Warhead

Other Topics

OIF Drawdown Challenges

OEF Plus Up

Diagnostics and Prognostics

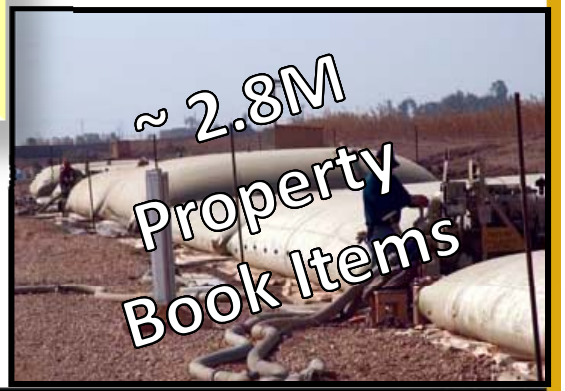
Missile Sustainment Science &Technology

OIF Drawdown Challenges

- 51 BCT Equivalents
- 143K US Military Personnel, Coalition and Civilians
- 147K Contractors
- 22 Supply Support Activities
- 240K Truckloads
- 8K Convoys
- 10K Truckloads Per Month
- 119 Shiploads
- 21K STONs of Supplies

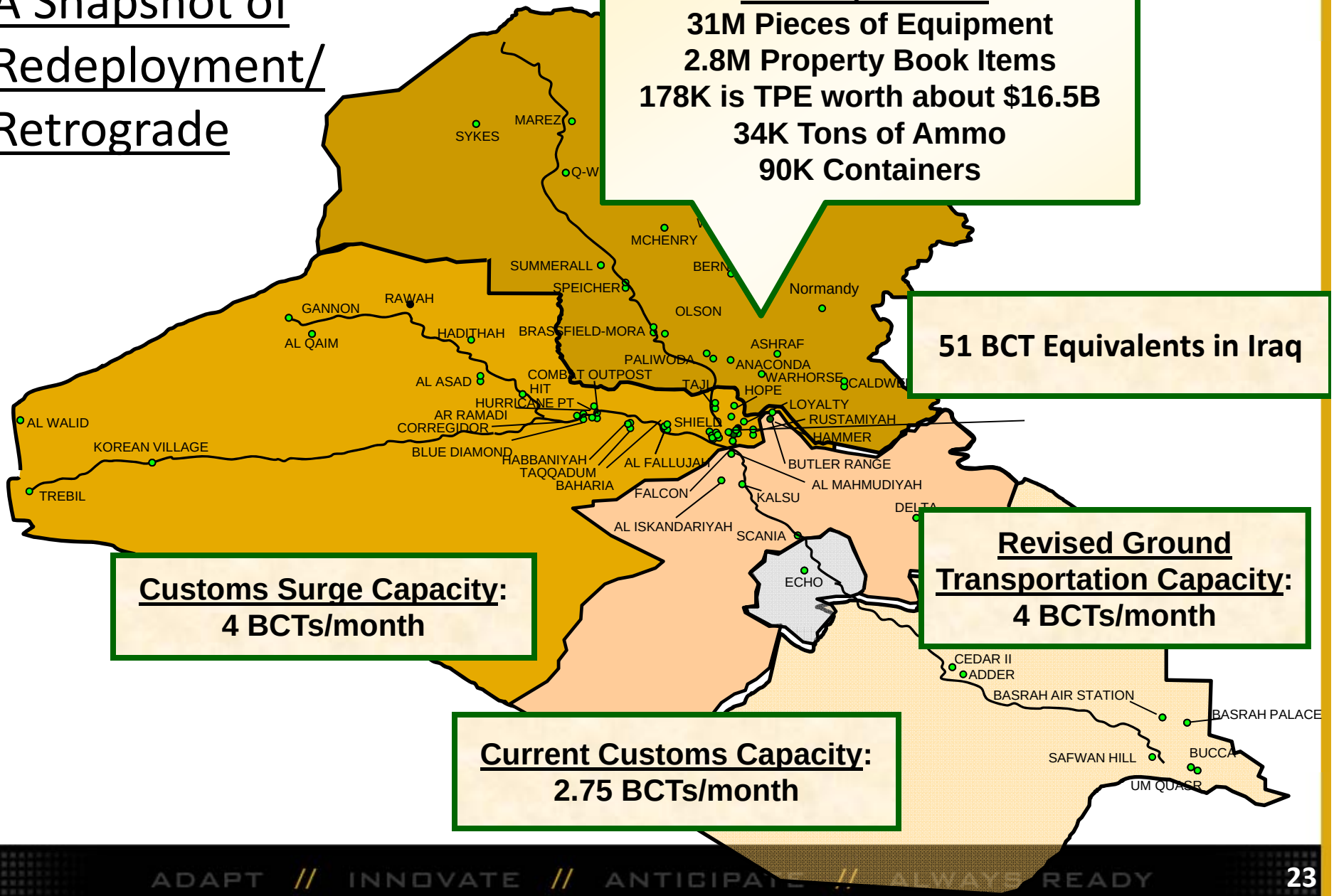
5-Step Process:

1-Consume
2-Redistribute
3-Transfer
4-Donate
5-DRMS Turn-In



A Snapshot of Redeployment/ Retrograde

The Requirement:
31M Pieces of Equipment
2.8M Property Book Items
178K is TPE worth about $16.5B
34K Tons of Ammo
90K Containers



51 BCT Equivalents in Iraq

Customs Surge Capacity:
4 BCTs/month

Revised Ground Transportation Capacity:
4 BCTs/month

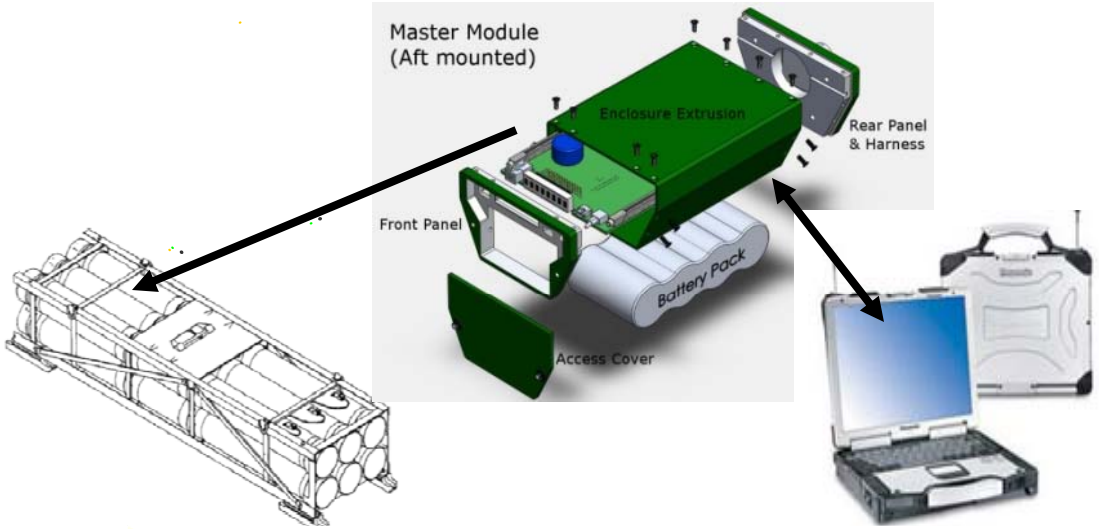
Current Customs Capacity:
2.75 BCTs/month

OEF Ramp-Up

- All Class V resupply is by air (ALOC)

- Environment requires munitions that can fire at higher angles
  - Excalibur 155 – working and used
  - 105mm Howitzer
  - 120mm Mortar
  - Hellfire Conversion (Blast Frag) and 30mm HE for Apache

Diagnostics and Prognostics for High Value Critical Munitions



Hellfire Captive Carry Health Monitor

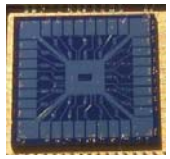
- Captive Carry and Power-On Hours
- Battery Usage, Temperature, Humidity

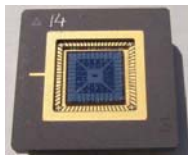
Guided Multiple Launch Rocket System Transportation and Handling Monitoring System

- 300 Hours Transport Vibration
- Temperature, Humidity
- Universal Prognostic/Diagnostic Interrogator

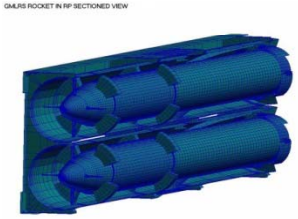
Continuous monitoring provides an accurate history of the environmental conditions the ammunition has been exposed to

Missile Sustainment Science &Technology

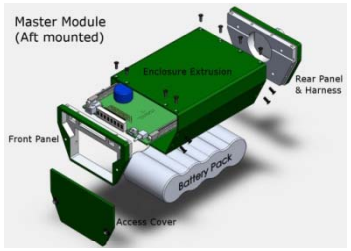




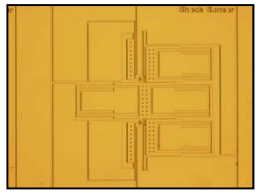
NASA Ames - Chemical Sensor (1cm x 1cm)



WDI – GMLRS Prognostics Studies

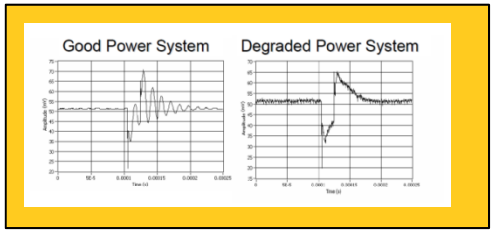


GMLRS Health Monitor



Morgan Stanley Assoc. - No-power shock MEMS, no-power humidity MEMS and module prototype

WDI- Min Smoke Propellant Aging Studies

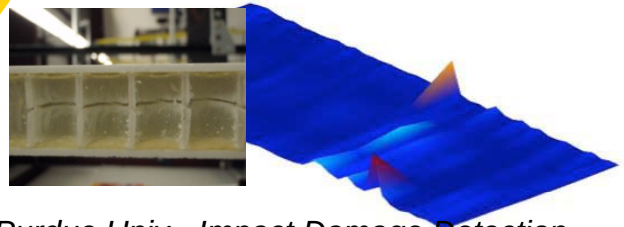


Ridgetop Group – Power Supply Prognostics

RTTC - HELLFIRE II Prognostics Studies

AATD - Flight Testing of HF Design Prototypes

Increment 1 HELLFIRE Health Monitor



Purdue Univ - Impact Damage Detection in Rocket Motor Composites

Army Transformation Done Right

Vision

- A fundamental change in how the Army does business
- Apply proven business principles to challenges faced by the Army

Desired Effects

- Maximizing return on taxpayer's dollar
- A culture that incentivizes good stewardship of Army resources
- A culture of continuous improvement

Payoff is an Army which *effectively and efficiently provides the necessary forces and capabilities* to the Combatant Commanders in support of National Security and Defense Strategies

Questions?

Precision Munitions: Way Ahead

- Army continues to develop precision munitions capabilities
- Scalable warheads/lethality; produce lethal effects while reducing collateral damage
- Modernize ammunition through product improvements, produce effective munitions that do not leave the "aftermath" of war behind
- Closing the capability gap caused by the policy on Cluster Munitions
- Address the increasing demilitarization stockpile

SFC Santiago Noel Acosta

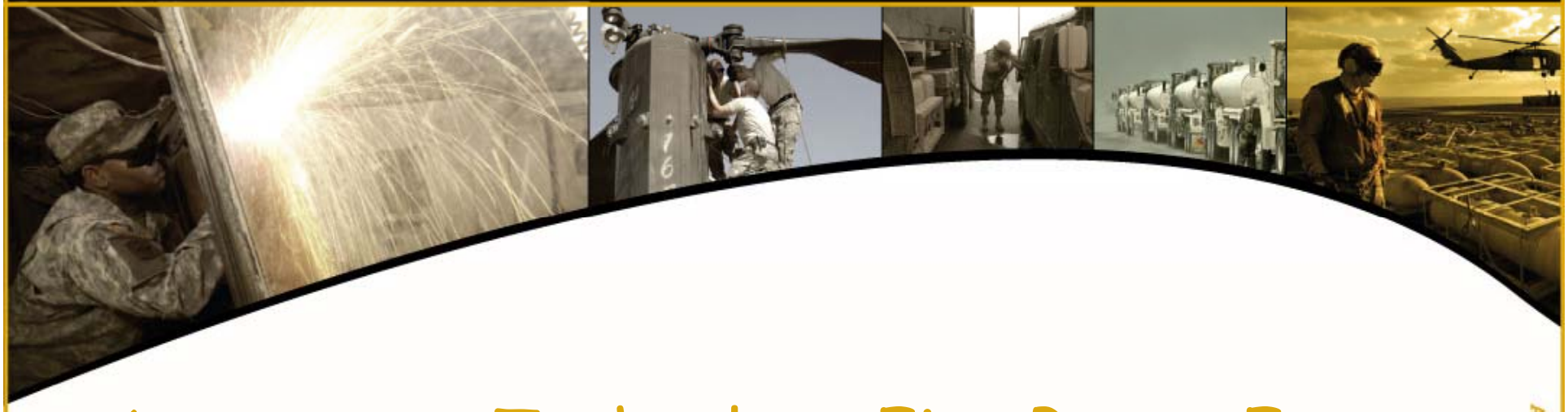
SGT Leo McWatt

SGM John Anderson

CSM Ted Helbing

CSM Tomas Erazo-Ramos

CSM David Stewart



Armaments Technology Fire Power Forum

10 Jun 09

Ms. Susan Carlson
Munitions Division
Deputy Chief of Staff, G-4
Headquarters, Department of the Army

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

MISSION

- Provide Army Staff responsibility and oversight for policy, plans, and resources for:
  - Conventional ammunition
  - Missiles
  - Toxic chemical storage
  - Ammunition surveillance
  - Demilitarization
  - Explosives safety and environmental compliance

- Specifics:
- Distribution of the Army's munitions stockpile.
- Perform ammunition and missile stockpile management functions.
- Develop policy for and monitor ammo surveillance and environmental compliance. Oversight on emerging missile, ammo and ammo information Mgt

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

Ammunition Readiness

- **What the program does:**
  - Provides National level management, procurement and sustainment of conventional ammunition for all Services (SMCA)
  - Provides for transportation, maintenance, ammo logistics RDT&E, Army ammo safety and management of Army ammunition and management of ammunition in the Pacific theater
  - Demilitarization of obsolete/excess conventional ammunition for all Services and the development of new demil technologies
  - Safe, secure, and environmentally compliant storage of the Nation's stockpile of toxic chemical munitions pending disposal

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

New Demilitarization Law Effective FY2007
Resource Recovery and Recycling (R3)

BEFORE

1. Installations execute demilitarization.
2. Salvageable material sold.
3. Proceeds sent to US Treasury.

AFTER

1. Installations execute demilitarization.
2. Salvageable material sold.
3. PM-Demil reinvest proceeds into R3 Programs.

THE LAW

The Law allows the Army to sell recyclable munitions materials resulting from demil and to reinvest the proceeds into demil Resource Recovery and Recycling (R3).

THE BENEFIT

Estimate $2-3M annually to support Demil R3 Program execution, RDTE and APE.

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

Challenges

- Funding
  - OMA
    - Taking Risk in Surveillance, Stockpile Mgmt
      - Limits flexibility to redistribute
      - Increases depot release time
  - PAA - Demil
    - Growing demil stockpile creates storage inefficiencies
    - Postpones Demil to out years, more expensive
    - Reduces ability to efficiently and effectively store munitions and increases time needed to outload

- Distribution Management
  - Planning/Coordination with TRANSCOM as the Distribution Process Owner
  - Asset distribution/Visibility

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

On-Going Initiatives

- Unit Level Munitions Visibility, Accountability, and Expenditures
- CL V Visibility in Logistics Information Warehouse (LIW)
- Retrograde of Class V
  - Former War Reserve Stocks for Allies – Korea (WRSA-K)
  - CENTCOM Theater Drawdown
- Monitoring and implementing the DoD policy on Cluster Munitions

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

One Thing Remains Constant

The Soldier –
the Centerpiece of the Army
Living the Warrior Ethos –
on duty protecting the Nation
and the society they serve.

AMERICA'S ARMY: THE STRENGTH OF THE NATION™

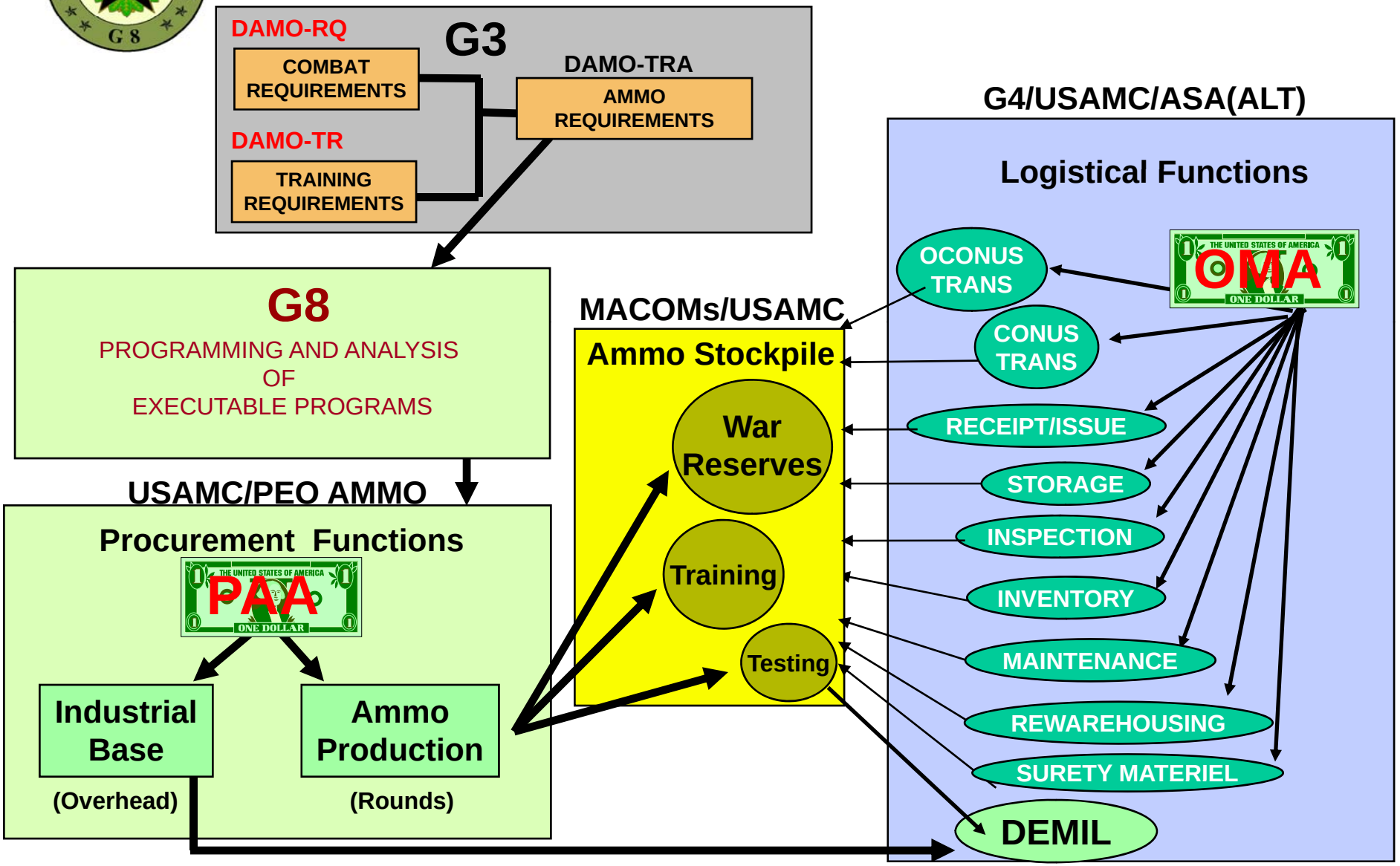
Thank you for all you do to support our Soldiers

AMMO FUNDING

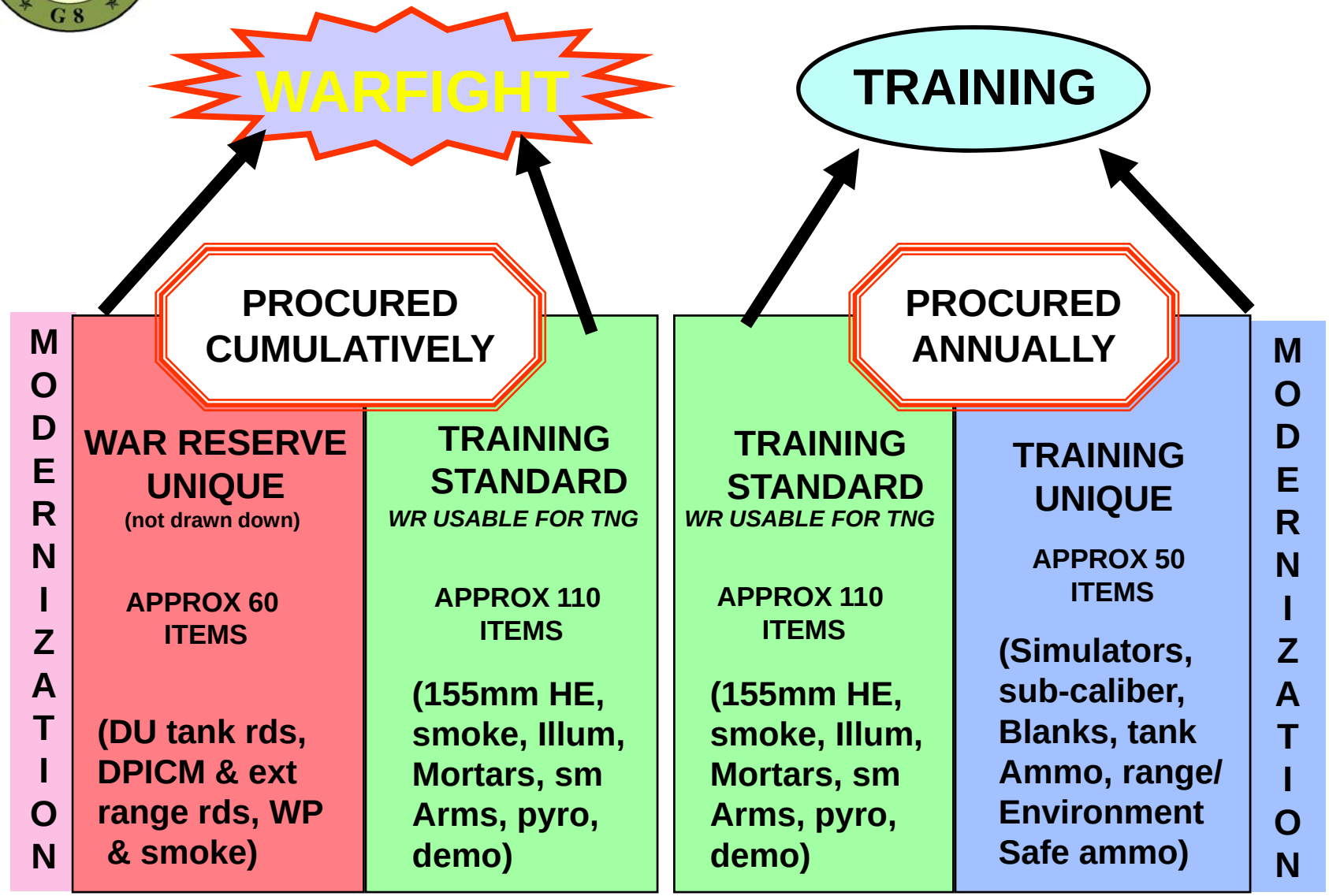
Mr. Don Chrans
Army G8 / FDX Munitions Division

June 2009

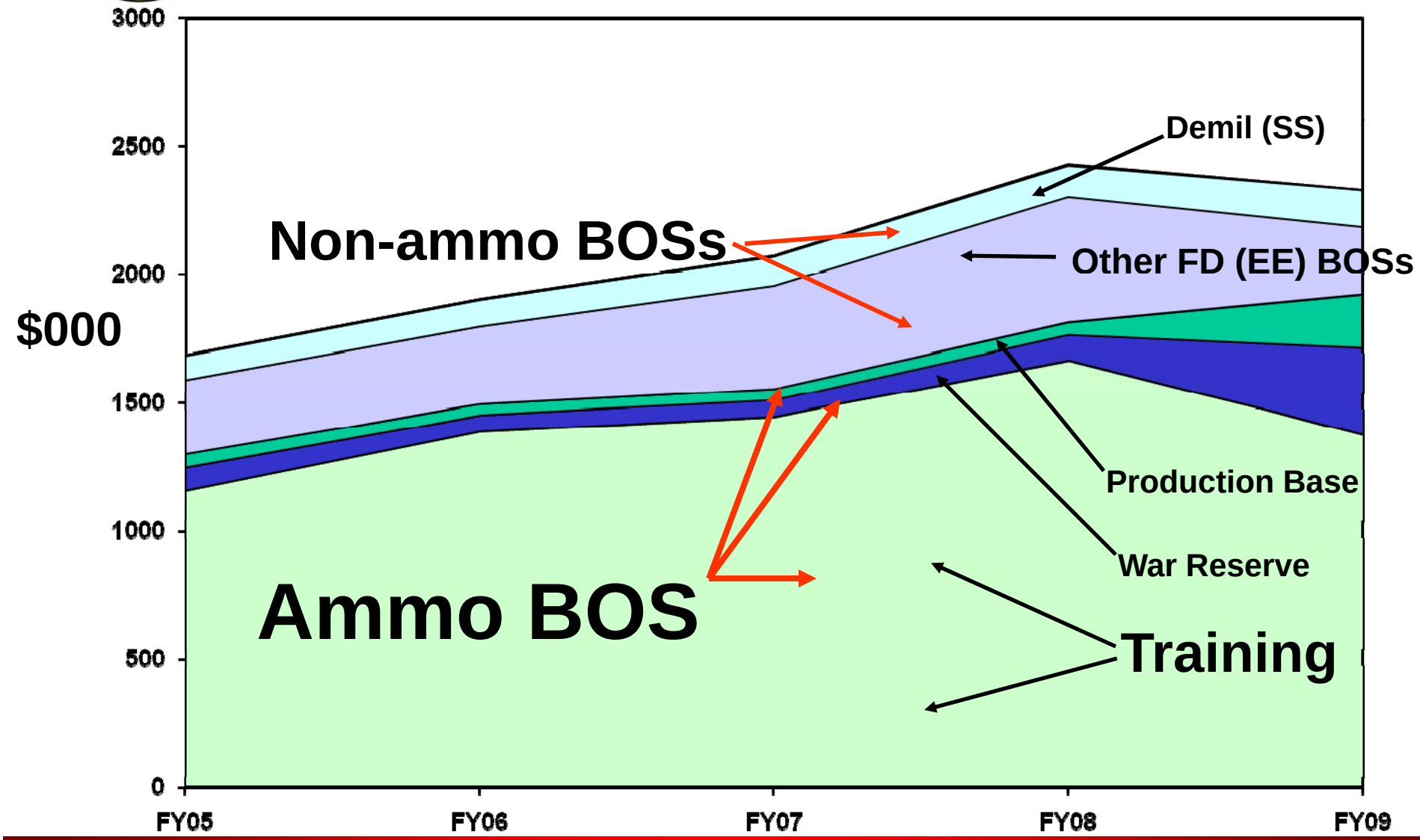
How Ammo Works



Ammunition Categories



Total Ammunition (PAA) Picture



What is PAA?

(Procurement of Ammunition, Army)

Two Activities:

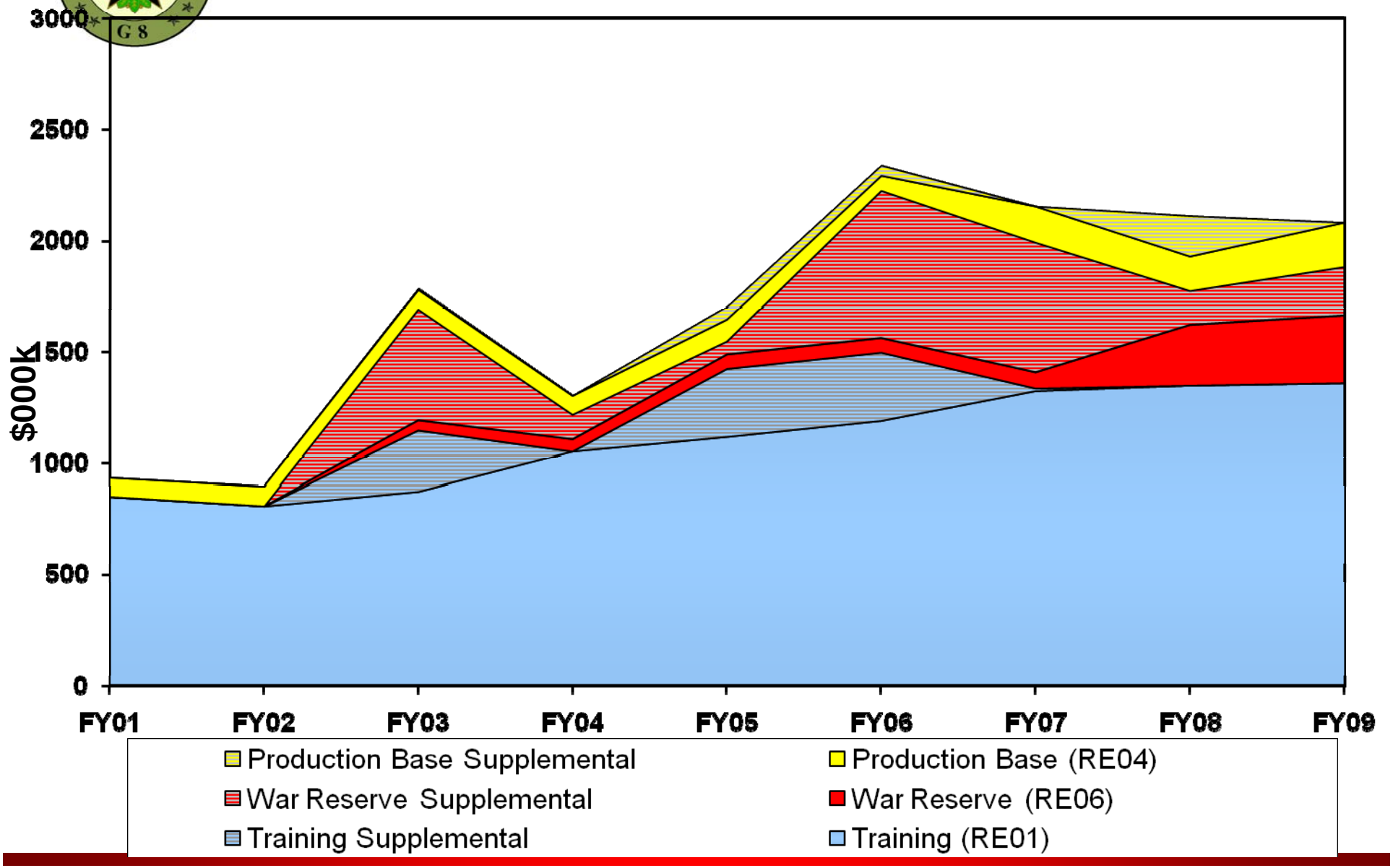
	FY09
• Activity 1 - Ammunition	$1978M
• Training/Test Ammo	$1376M - Ammo BOS
• War Reserve Fill	$337M - Ammo BOS.
• Hydra Rockets Training Ammo	$142M - Aviation BOS
• War Reserves/Modernization	$123M - Other FD BOSs.

Supplemental $230M

• Activity 2 - Prod Base Support	$349M
• Industrial Facilities	$202M - Ammo BOS.
• ARMS	$5M - Ammo BOS.
• Demil	$144M - SS PEG / G-4
• TOTAL	$2327M

Source: FY10 Budget Exhibit Book dated May 09

AMMO FY01-09 Funding by MDEP
Ammunition BOS - PAA



What is Ammo BOS?

Three Major Decision Packages (MDEPs)

		FY 09 $$
1. RE01	TRAINING AMMO	$1376M
2. RE06	WAR AND OPS AMMO	$ 337M
3. RE04	PRODUCTION BASE	$ 205M
	TOTAL	$1918M

- **Does not include non-Ammo BOS items (Hydra Rockets, Excaliber, M829A3, etc. in REO1 Or REO6, and does not include Demil in RE04)**

AMMO FUNDING
FY09 Base Budget Request

	Root	Request	Appropriated	Delta	Reason for Delta
BASE	AIRCRAFT LAUNCHED AMMO	79,066	75,766	-3,300	30mm Unjustified Cost Growth
	AMMO PRODUCTION BASE	201,106	207,526	6,420	Projects at HSAAP, SCAAP, RFAAP, and Blue Grass
	AMMUNITION SUPPORT	41,449	41,449		
	APL-A	52,000	52,000		
	ARTILLERY AMMO	177,598	179,198	1,600	155mm all types
	AVIATION FLARES	68,376	68,376		
	DEMIL	143,901	143,901		
	DEMOLITIONS	28,886	32,086	3,200	Rapid Wall Breaching Kit (RWBK)
	EXCALIBUR	34,220	34,220		
	GRENADES	71,608	77,208	5,600	Thermite Grenades, Smoke Grenades
	HYDRA ROCKET	142,521	142,521		
	MEDIUM CALIBER AMMO	308,064	306,364	-1,700	25mm Unjustified Cost Growth
	MGS-STRYKER AMMO	7,662	7,662		
	MINES	7,452	7,452		
	MORTAR AMMO	193,177	201,577	8,400	Various Rounds, $1.2M 105mm HEP
	PGK	15,633	15,633		
	NON-LETHAL AMMO	3,324	3,324		
	PROTECTIVE SYSTEMS	17,869	64,369	46,500	NLCS Bridge Supplemental
	SHOULDER FIRED ROCKETS	29,638	29,638		
	SIGNAL MUNITIONS	34,688	34,688		
	SMALL CALIBER AMMO	444,782	436,169	-8,613	.50 cal all types, Unjustified Cost Growth
	SPECIAL AMMUNITION	6,843	6,843		
	TANK MAIN GUN AMMO	125,151	125,151		
	TANK-ABRAMS AMMO	34,031	34,031		
Grand Total		2,269,045	2,327,152	58,107	

Ongoing Budget Actions

- **FY10 Base Budget and Overseas Contingency Operations (OCO) Requests at Congress**
- **Currently building FY11 Base Budget and OCO requests**
- **Incorporating changes based on SECDEF decisions on programs**
- **Quadrennial Defense Review underway**
- **Current year bills for Military Pay and Health Care**
- **TRADOC assessment of impacts of Cluster Munitions policy**
- **FY12-17 POM starts this Fall**

Ammo Procurement Summary

Ammo Funding is a Balancing Act

- **Training**
  - **Provide enough ammo for units to train**
  - **Buy enough ammo to replenish what is expended**

- **War and Operations**
  - **SUSTAIN SOLDIERS IN CURRENT OPERATIONS**
  - **Replenish stocks expended in operations**
  - **Build/Replenish War Reserve stocks**
  - **Modernize stocks in the process**

- **Industrial Base**
  - **Replace/Upgrade/Repair organic capabilities**
  - **Transition to efficiency upgrades**
  - **Ramp down production to avoid sharp changes**

Ammunition Stockpile and Service-life Reliability: *Improvement Efforts at US Army ARDEC*

Presented for Precision Strike Association Firepower Forum

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Jason L. Cook, Ph.D
Chief, QE&SA Sciences Division
OE&SA – ARDEC – RDECOM

The Problem

- Testing for reliability through the life of a smart-munition is not financially feasible
  - Firing 100+ rounds from each strata
  - Every 3-5 years
  - For the life of the item
- Waiting until the item is bad does not provide enough time to buy more
  - 2 to 6 year cycle time from need to field

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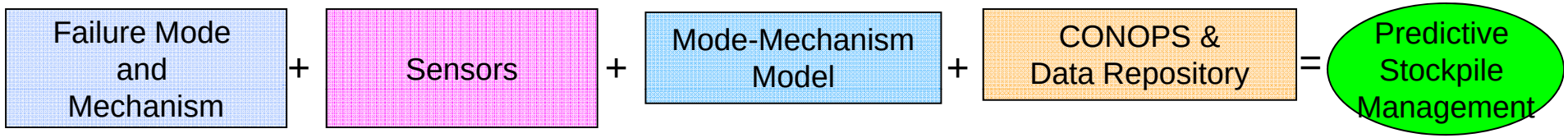
The Solution: Predictive Stockpile Management



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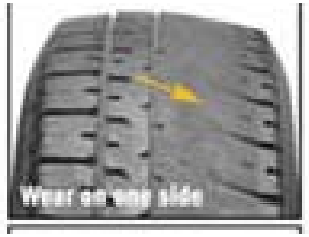
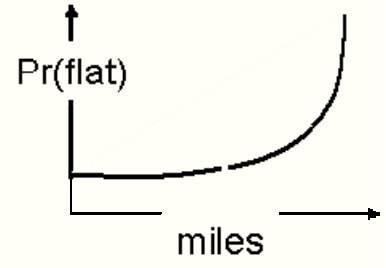
An Example…

- Identify Failure Mode
  - What fails?
- Identify Failure Mechanism
  - What causes the failure?
- Determine rate of degradation
  - How long does it take to fail?
- Correlate and synthesize
  - When will it fail?
  - When should I produce more?
  - Which items are at risk?
  - Which items are not?

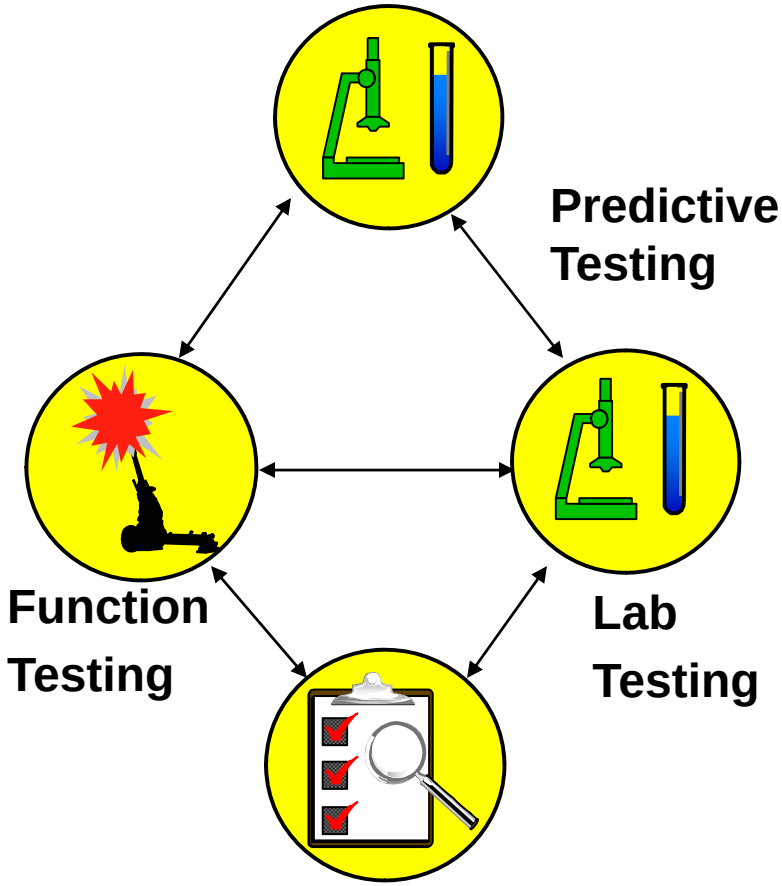




Ammunition Stockpile Reliability Program

Elements of the ASRP:

- ✓ Design for Storage Life
  - ✓ Predictive Engineering
- ✓ Ammunition Surveillance Program
- ✓ Function (Reliability) Testing
- ✓ Laboratory testing program



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Storage Life Predictions

- Proactive (Development Items)
  - Analogy based analysis to determine at risk, life limiting items
  - Accelerated life testing to predict storage life
    - Controlled
    - Uncontrolled
  - Determine design changes or mitigations to extend life

- Reactive (Fielded Items)
  - Perform function testing per ASRP Plan
  - Analysis of variance
    - Age
    - Lot
    - Manufacturer
    - Storage location/type
    - Design revisions
  - Detect reliability degradation trends
  - Predict breach of lower reliability threshold

Predictive Technology (ALT) can be used for fielded items also

Initiatives

- Policy – Army Regulations and local installation application policies
- Process – Lean Six Sigma Green Belt Project to refine methods
- Data - Predictive Summary Report and Benchmarking
- Application – Synergistic programs addressing multiple items or classes of items

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Goal – Enable Predictive Stockpile Management

ASRP Policy

- Memo documenting policy requirements
  - Ammunition Stockpile Reliability Program
    - AR 702-6
  - Ammunition Surveillance
    - AR 740–1, AR 702–12, and AR 700-142
  - Required at time of MR
- Key responsibilities of PM and ARDEC
  - Baseline performance and reliability
  - Identify life-limiting components
  - Identify acceptable limits of degradation
  - Design and build unique inspection/test equipment

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SSGB Project

- Objectives:
  - Develop process map for creation of ASRP Plan
  - Improve timeliness and value of the ASRP Plan and its execution
    - Completed at time of MR
  - Improve quality of plans to include:
    - Greater use of predictive engineering and accelerated life testing
    - More item and failure mode unique testing and inspections
    - Add Ammunition Peculiar Testing Equipment
    - Add detailed test procedures
  - Institute Configuration Management
    - Approval routing
    - Revision Management
    - Document Maintenance
    - Define how ECP and MIF information is added to ASRP Plan

- Approach:
  - Define current process
  - Measure and Analyze results of current process and adherence to AR
  - Improve and Lean process to provide more value and synergy across ammo classes
  - Institute Controls to ensure continual improvement

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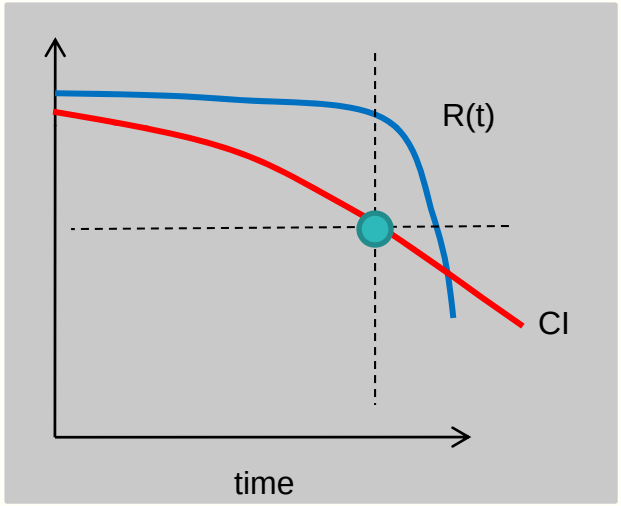
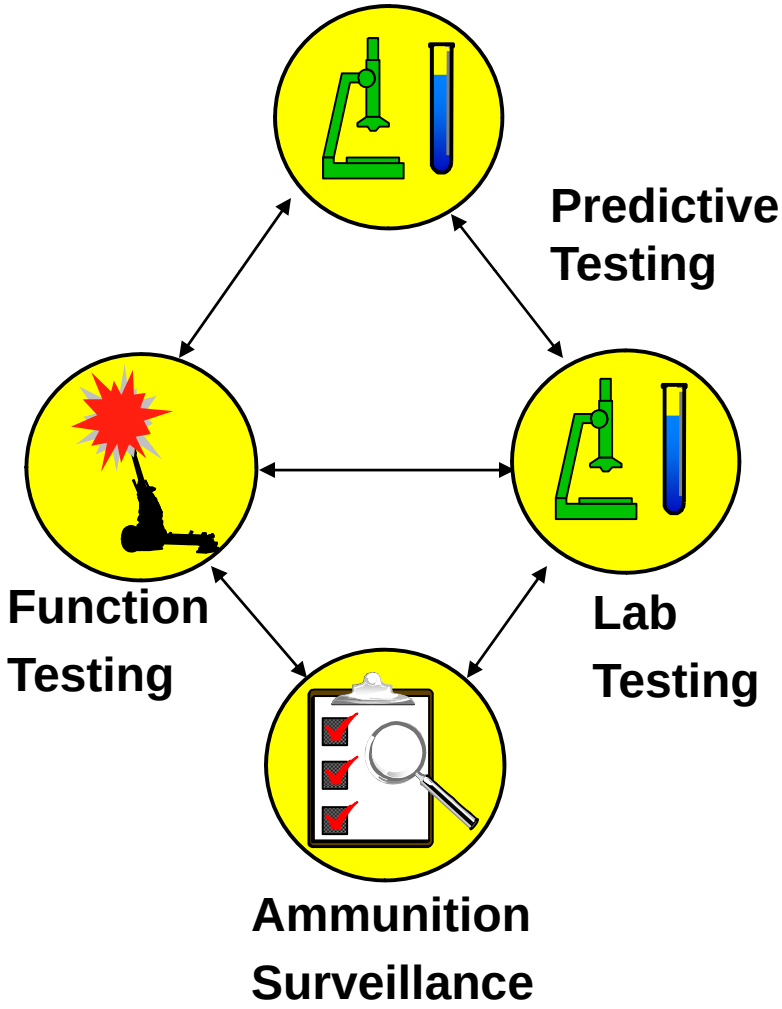
Unified ASRP Approach





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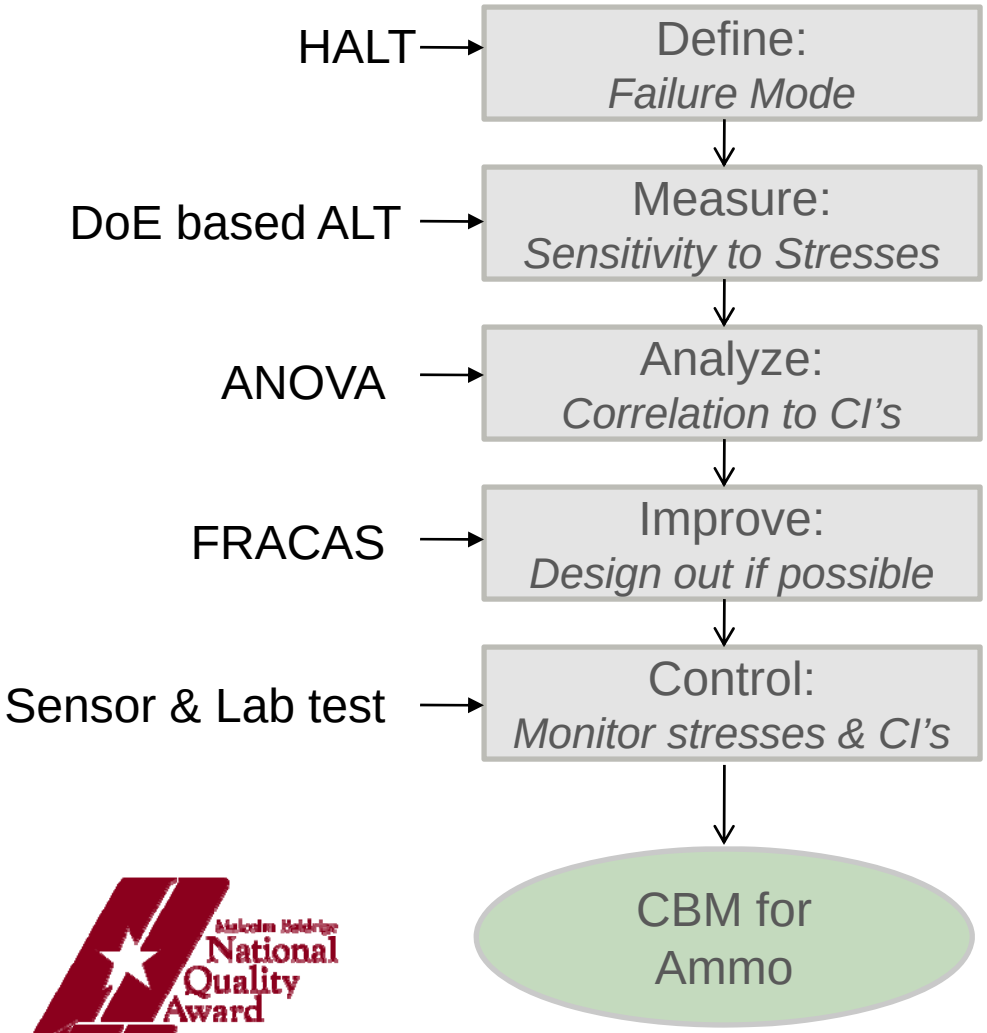
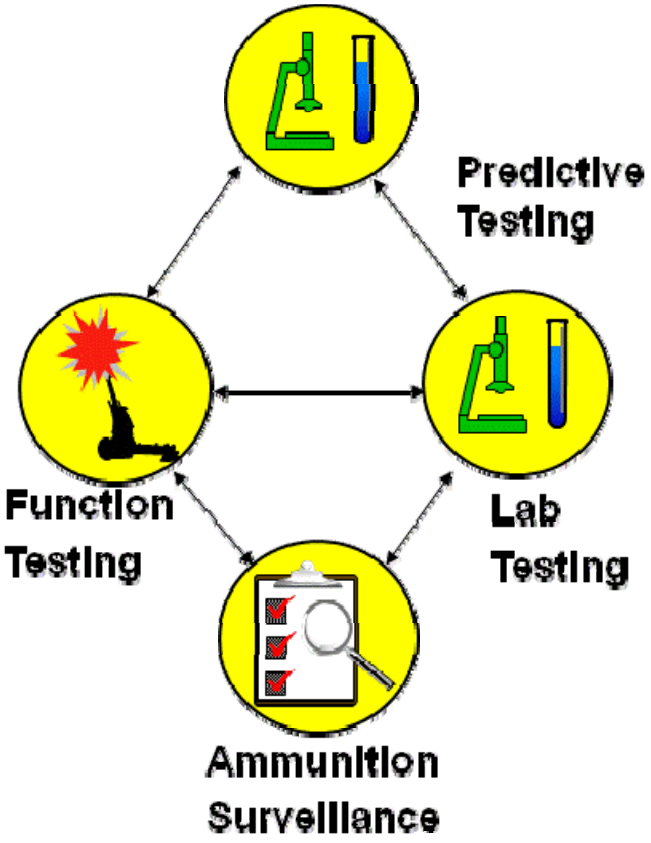
Practical ALT





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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Predictive Summary Report

- Compilation and update of tests and analyses capturing environmentally susceptible items and components
- Sources:
  - ASRP function testing
  - ASRP surveillance inspections
  - DIF/MIF reports
  - FAT/LAT results
  - Predictive Engineering/Aging Studies
- Motivation
  - Identify common causes and risk for LCMC managed items
  - Provide repository of data to expedite MR process and avoid duplication of effort
  - Determine candidates for further investment and investigation
    - Aging program
    - In-situ sensing
    - Telemetry
    - Additional functional, lab, or surveillance sampling

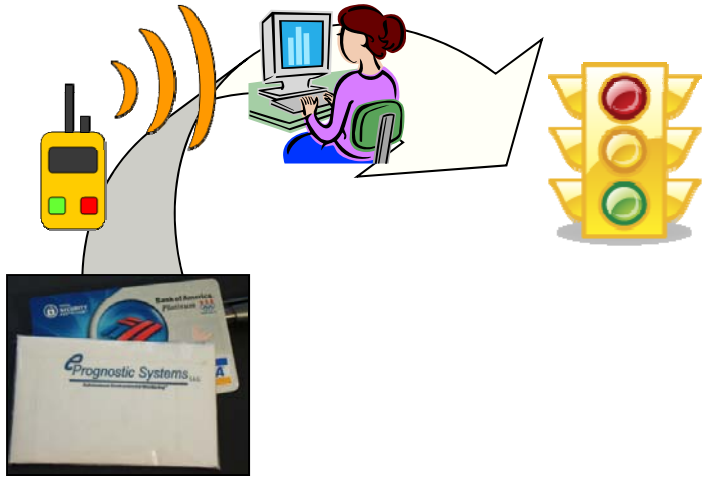
Sensor and Database Project

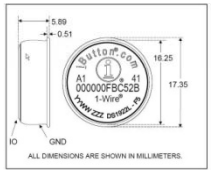
- Investigate COTS sensors
  - Literature review and continued work with UMD Consortium
  - Identify customer requirements (cost, size, IO, resolution)
  - Classes of sensors
    - Cheap and simple for cheap and simple
    - Ensure CBA/ROI is favorable

- Qualify one or more from each class
  - Durability - Sensor can't fail before round
  - Accuracy – Sensor data can't drift with time
  - Interoperability(E3) – Eliminate interference/safety concerns

- Data Analysis and Warehouse
  - Open Architecture
  - Tailorable
  - Self-definable models

- Application guidance
  - Common I/O and data collection methods
  - Coordination with JMC QASAS

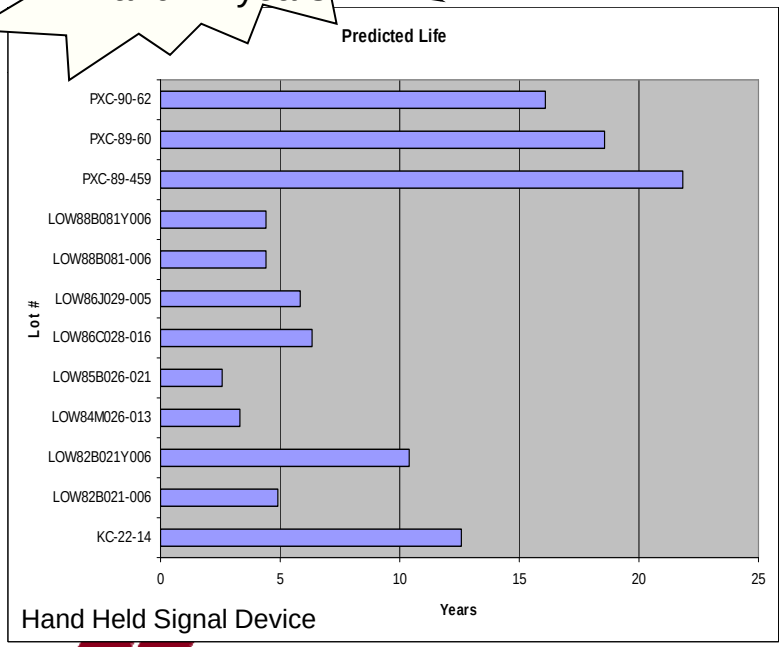




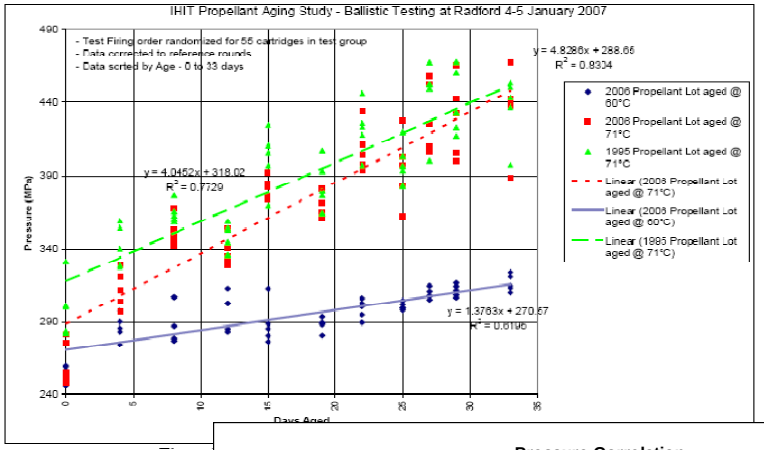
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

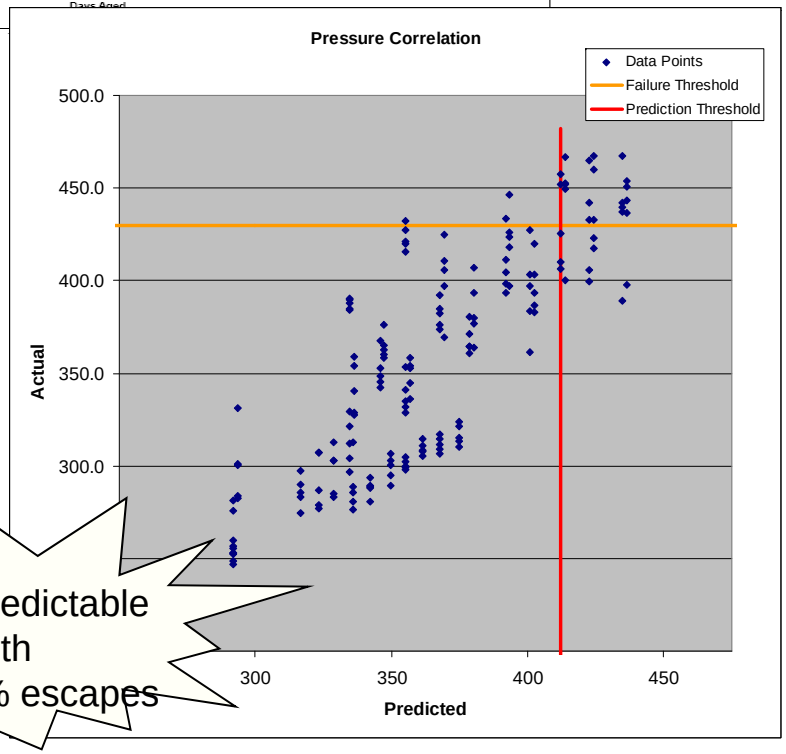
Value of Temperature Data

Life Estimate between 2 and 22 years



Hand Held Signal Device





Failure Predictable with Only 1.7% escapes

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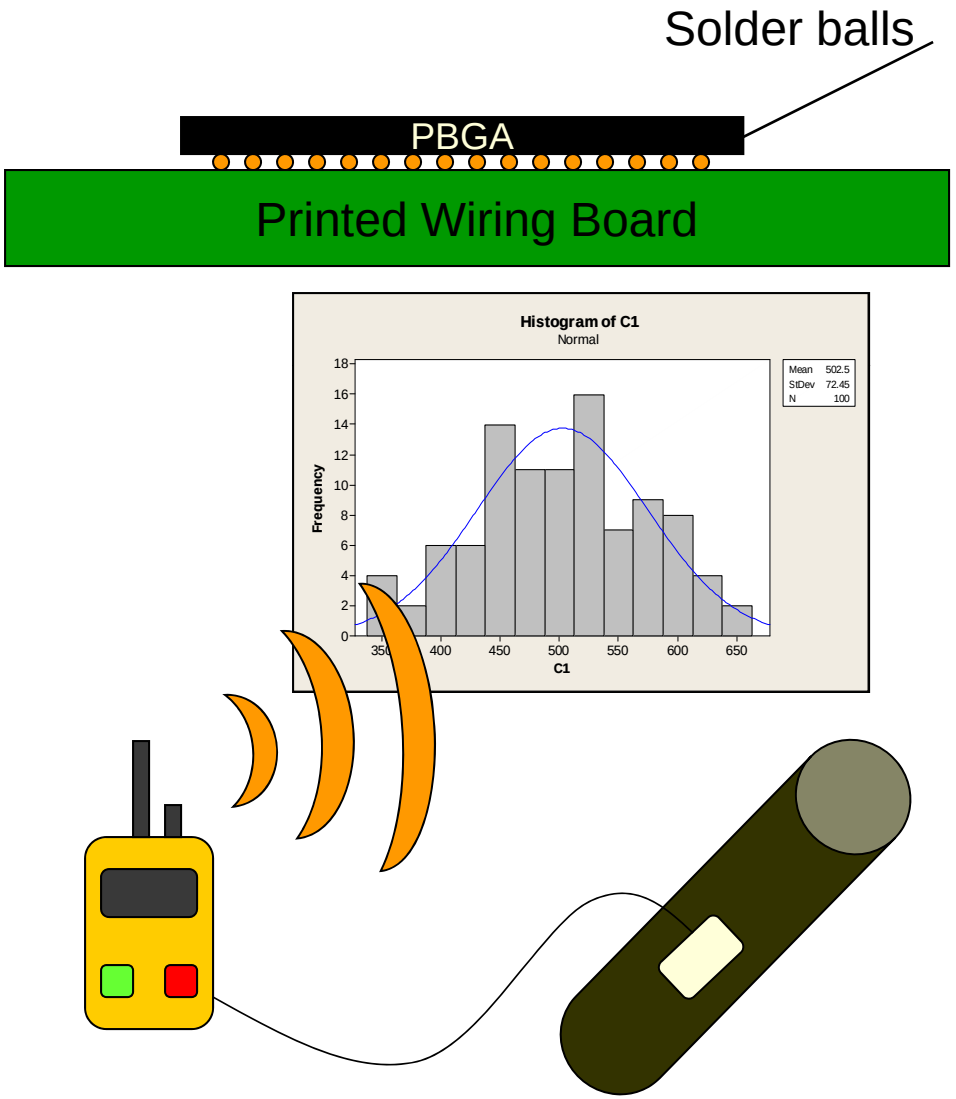
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Electronics Predictive Project

- Reliability Characterization of SMT components in temperature cycling environment
- Predictive algorithm development to identify incipient failures
- Demonstration sensor(s) from Low Cost sensor program (if funded)



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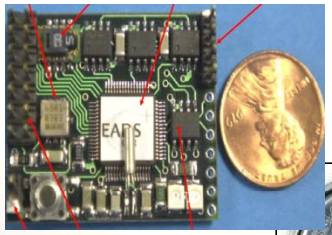
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Predictive Stockpile Mgmt. Roadmap

PSES

Low Cost Sensors



Failure Mode and Mechanism + Sensors + Mode - Mechanism Model + CONOPS & Data Repository = Predictive Stockpile Management

ASRP GB Project

PE Summary Report

PEO ALRD Sensor Program

TCG

Natick

PEO ALRD SMT Project

ASRP Data-mining

PE Programs

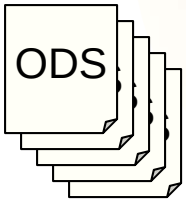
PSES

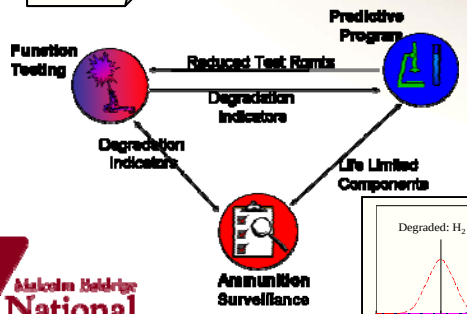
MHP

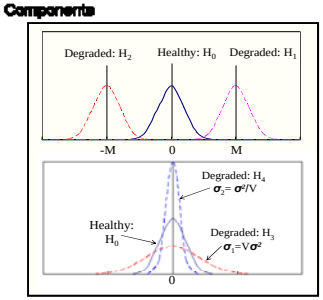
ASRP Online

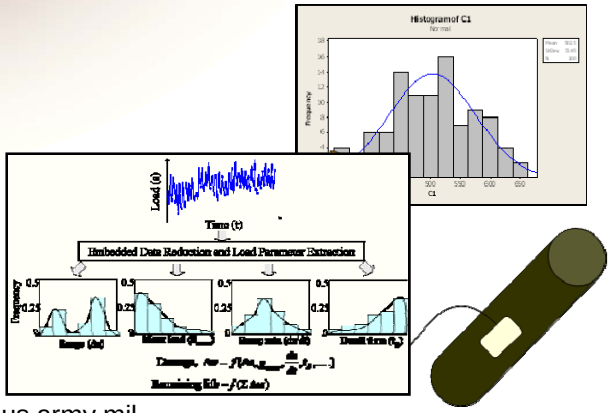
PE Summary

SMT Predictive Program









Malcolm Baldrige National Quality Award 2007 Award Recipient

POCs:
Jason.Cook1@us.army.mil
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Questions?

Malcolm Baldrige
National
Quality
Award
2007 Award
Recipient

U.S. Army Armament Research, Development & Engineering Center
Picatinny, NJ

Common Smart Submunition (CSS)

Pamela Ferlazzo
APO CSS
10 June 2009

DTO JC.69

RDECOM

Background

- Common Smart Submunition is an Army Technology Objective (ATO) that began in FY05 and was completed 31 Mar 09
  - CSS will provide an increased capability to the warfighter through a variety of platforms (missiles, projectiles and UAS)
  - Achieved TRL 5
- Textron (Prime Contractor) was awarded a 40 month contract to build prototype submunition

ATO Focus

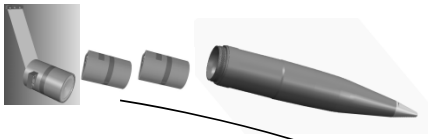
Requirements	Achievements
• Defeat T 90 armor	Met
• < 10 lbs	8.62 lbs
• < $10K/submunition	$7.5K/10,000/yr
• Probability of Detection >.95	>.85*
• <128mm	128mm
• Multiple platform applicability	Met
• UXO <1%	TBD**

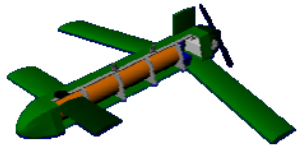
*This is an average from two tests

** All Systems are designed for meeting this requirement

CSS Concept of Operations

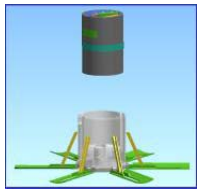
Dispense From Carrier

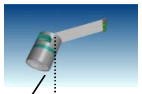


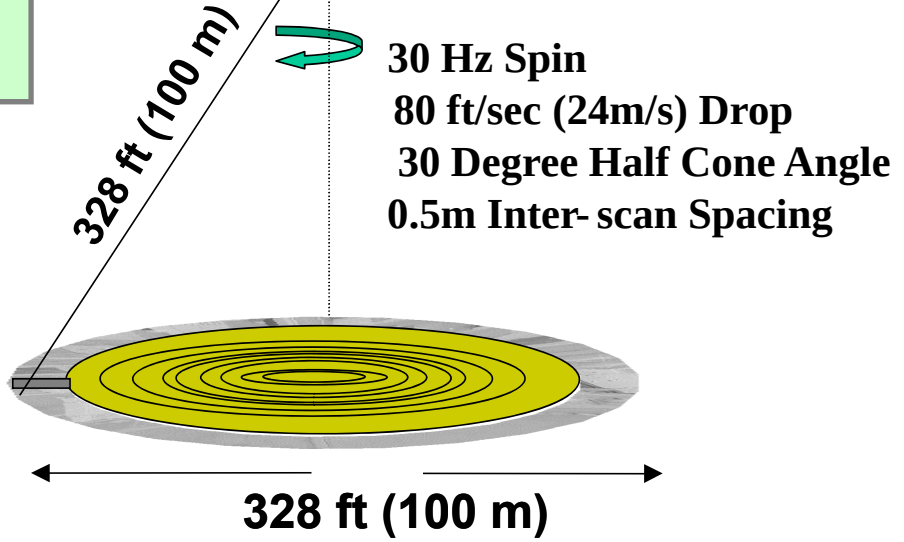


Search for Target;
Detect and Recognize Target;
Select Aimpoin; Target KIllt

Discriminating
Affordable
Lethal





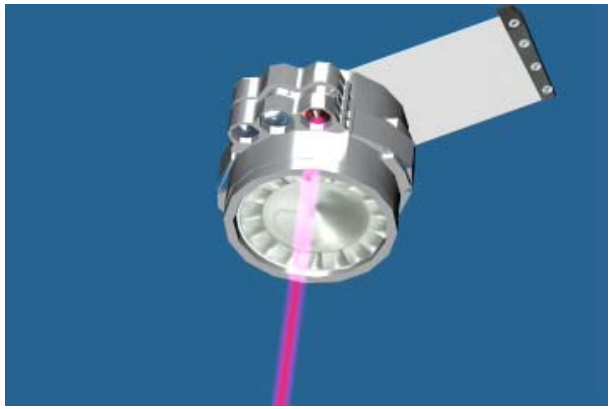


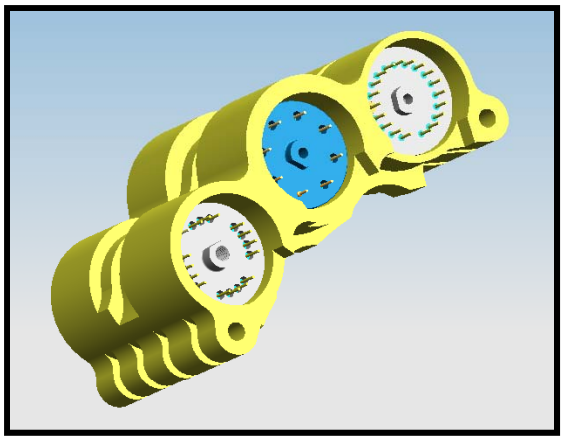
30 Hz Spin
80 ft/sec (24m/s) Drop
30 Degree Half Cone Angle
0.5m Inter- scan Spacing

Applications:
- Missiles
- UAS
- 155mm Projectiles
- Scorpion

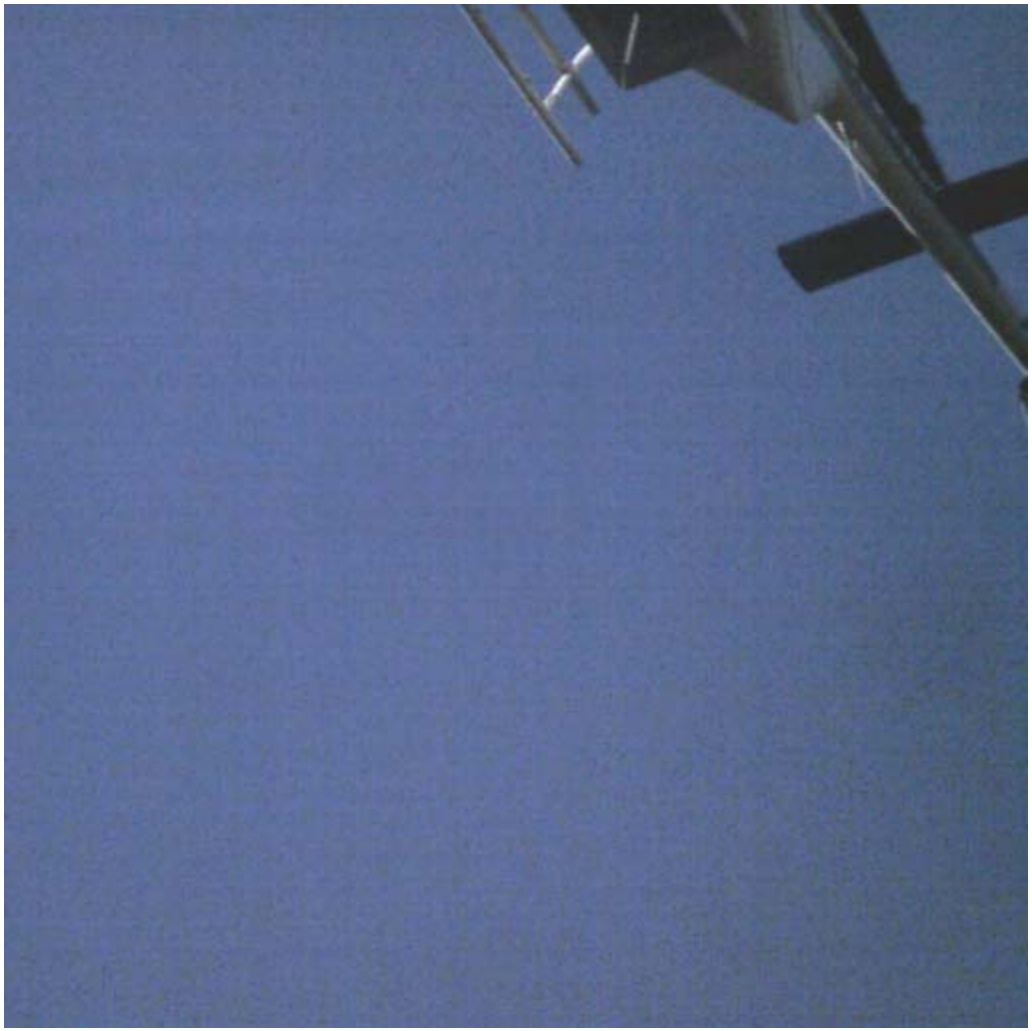
Technologies Explored

- Sensors
- Algorithms
- Warhead
- Orientation and Stabilization

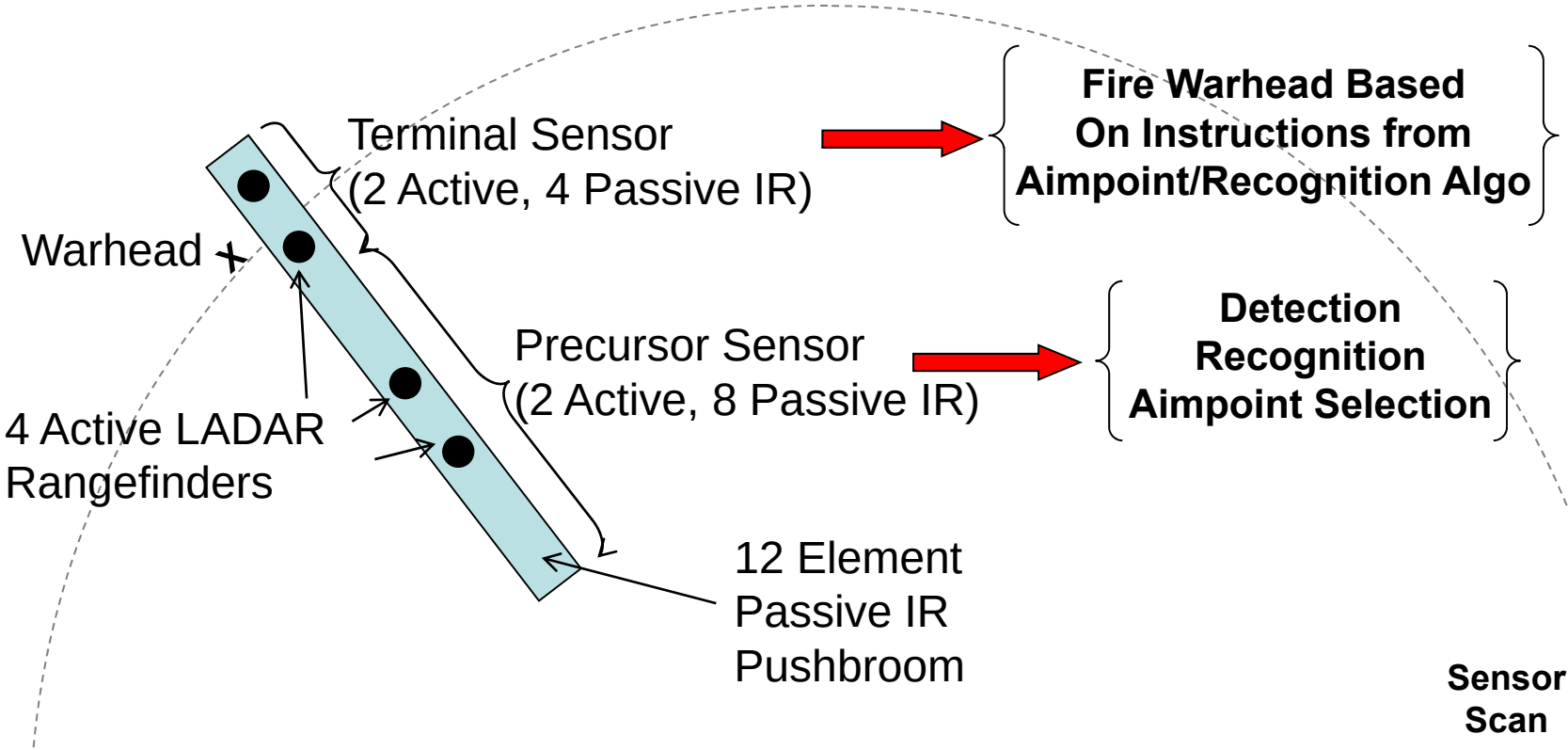




Orientation and Stabilization –helo drop



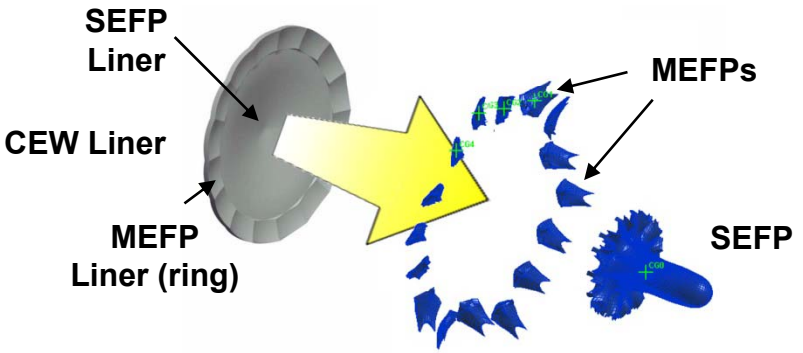
CSS Sensor Overview

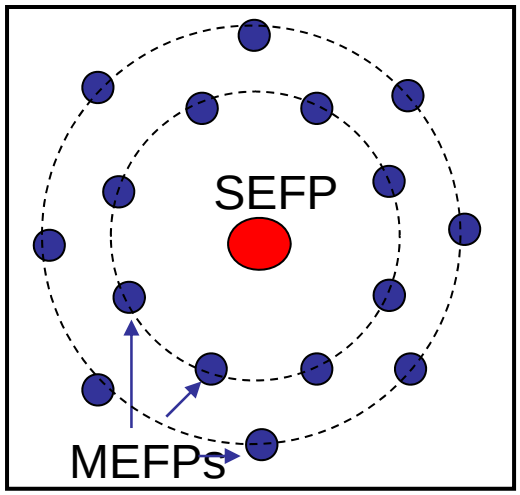


Captive Flight Testing

CSS Warhead Requirements

- Standoff: 100 m
- Dynamics: 30 hertz @ 30° angle
- Warhead Type: Combined Effects
  - SEFP
    - Accuracy: 50 cm @ 100 m
    - Penetration:
      - Proof Target: X
      - Semi-Infinite Penetration: Y
  - MEFP
    - Alternate spay angles (0.4° & 0.8° ± 0.4°)
    - Penetration: Z (70 m.)
    - Velocity at 100 m

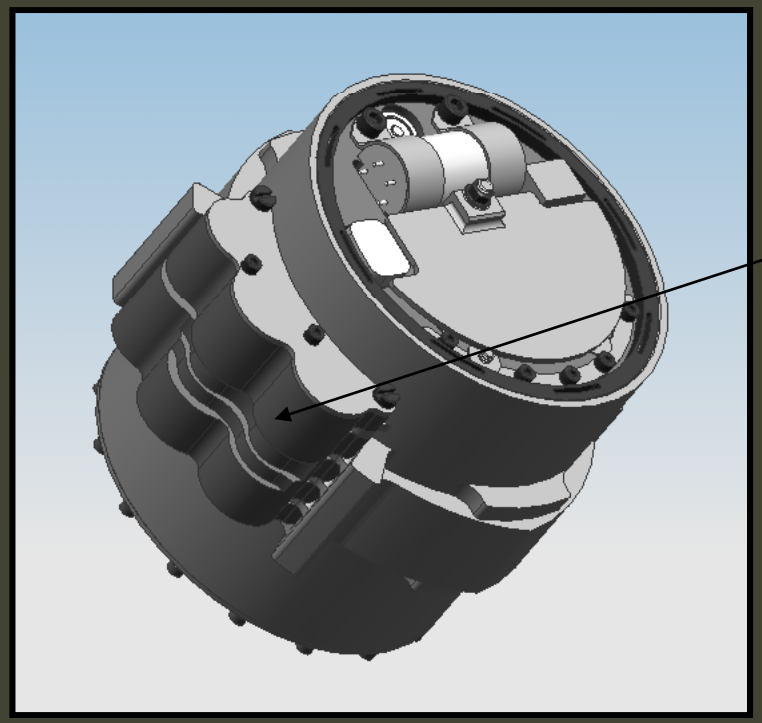




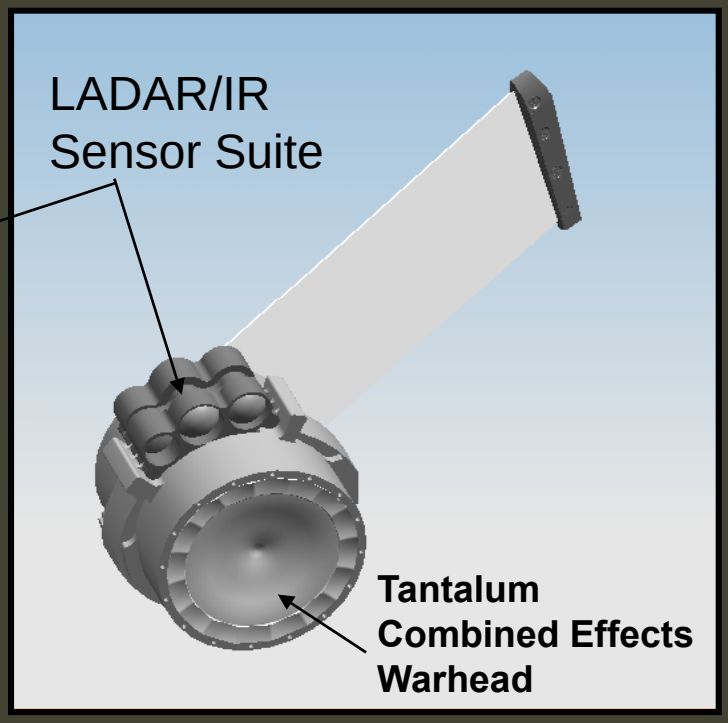
Desired on Target Pattern

CSS Current Design

Common Smart Submunition (CSS)



Before deploying Samara Wing and sensor suite

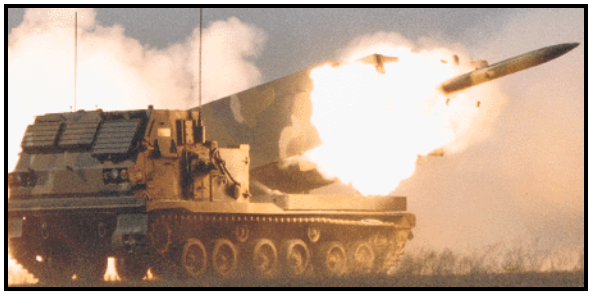


After deploying Samara Wing and sensor suite

- Nominal Length – 4in (102.4mm)
- Nominal Diameter – 5.1in (128mm)
- Nominal Weight – 8.6lbs (4.0kg)
- Nominal Cost - $7.5 k (10,000 MSRP)

Summary

- ATO completion March 09 TRL 5 achieved
- Continuing efforts for Scorpion, 155mm Projectile, NLOS-T and UAS
- Congressional program for UAS application



Armaments Technology Fire Power Forum

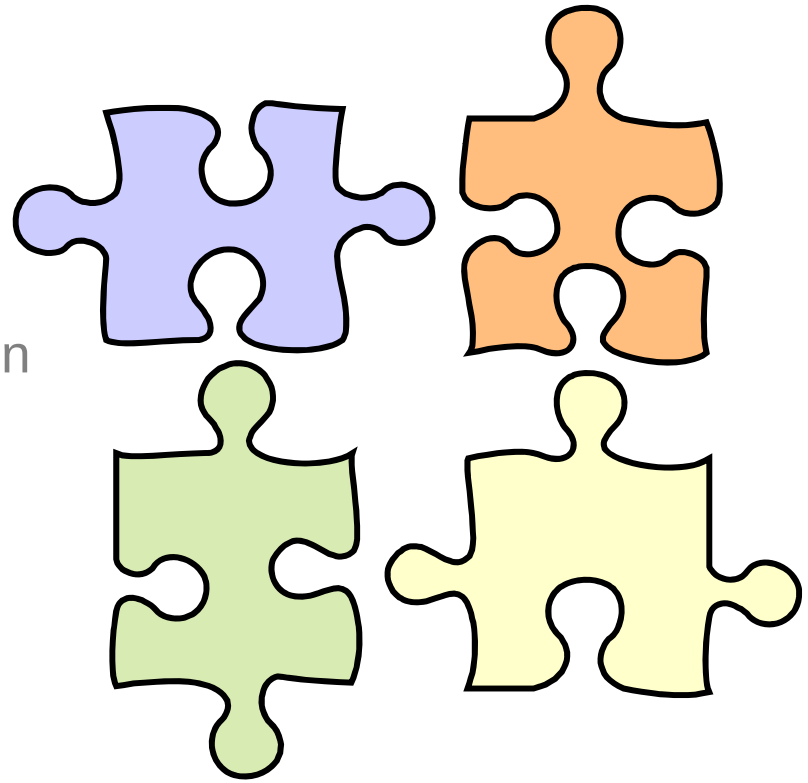
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Mr. Michael George
Weapon Systems and Technology
Small and Medium Caliber Armaments,
Remote Weapons Branch
US Army - ARDEC - WSEC
9-10 APR 2009

DISTRIBUTION A: Approved for Public Release.

Outline

- Fielded
  - Remote Weapon System (RWS)
  - Gun Fire Detection Integration
- Enabling Technologies
  - Platform Integration
  - Advanced RWS
  - Robotic Integration & Weaponization
- Challenges
- Summary



Remote Weapon Systems (RWS)

Description

- **Compatible with M2, Mk19, M240 and M249**
- **Readily integrated with multiple platforms (MRAP, Abrams, HMMWV)**
- **Three-Axis Vector Stabilization**
- **Auto Focus (Day and Thermal)**
- **Uncooled Thermal Imager**
- **Auto Track, - Lead, - Scan**

CROWS XM153

Protector M151

Warfighter Payoff

- **Warfighter protection (operates weapon under armor)**
- **Enhanced target acquisition, identification, and engagement**
- **Enhanced situation awareness - both day and night**
- **Shoot-on-the-move**

US Army has fielded Remote Weapon Systems

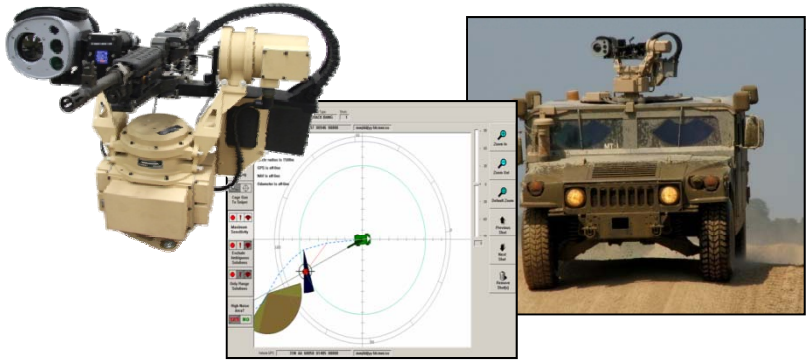
Gun Fire Detection Integration

XM154 Vanguard Counter Sniper System

Description

- Locate, Identify And Cue Up The Remote Weapon Station
- RWS integration with C2 system and Gun-fire Detection
- Counter Sniper ONS, fielding 679 systems, plus spares

CROWS Lightning / PD Cue



Warfighter Payoff

- User can operate the weapon from within the safety of the vehicle
- Provides passive gun fire detection while on the move, with hemispherical coverage
- Track detected shots while on the move and provide Slew-to-Cue capability
- Can be mounted on HMMWVs and MRAPs

- ARDEC is actively involved with sensors integration to address emerging warfighter requirements

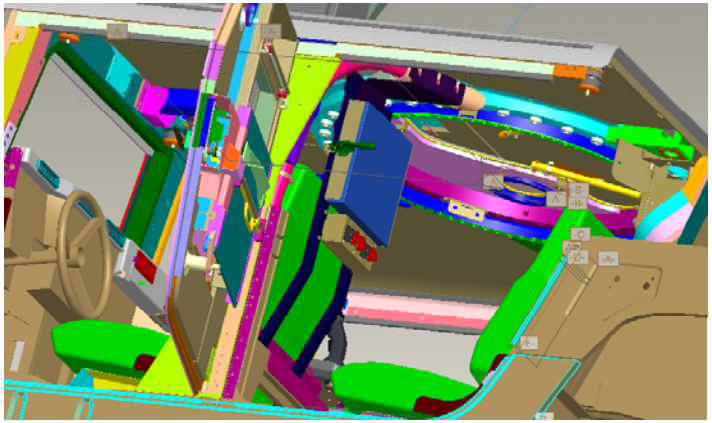
ARDEC Fielding Support To PM Soldier Weapons

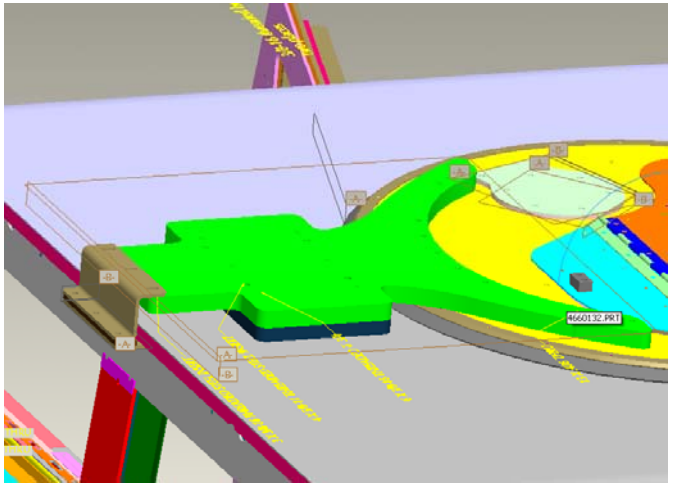
- Test support
  - In-house laboratory and firing tests
  - APG safety and performance tests
- System safety support
  - Identify and remedy potential failure modes
  - Hazard tracking
  - Quality Engineering Center
  - Human factors
- Weapon integration
  - Physical integration to mount
  - Monitor configurations for potential interferences
  - Ammo stowage and feed mechanisms
- Technical support
  - Mechanical and electrical subsystems
  - Platform integration
  - Software development and test
  - Configuration management
- Logistics support
  - Technical Manuals
  - Spare Parts
  - Reliability tracking
  - Diagnostic/repair equipment

Platform Integration

- Integrated systems on various manned and unmanned platforms
- Each platform presents unique issues
  - Power takeoffs
  - Interior space claims for ECUs, displays, etc.
  - Roof and internal structures
  - No fire zones / motion inhibits
  - Hatches
  - Vehicle dynamics
  - EMI

ARDEC Developed HMMWV Vehicle Integration Kit





PRO Engineer Models

Hardware

TECHNOLOGY DRIVEN. **WARFIGHTER FOCUSED.**

Vehicle Integration

Vehicle Integration

M151 on Stryker Platform

CROWS on RG31

•Platform requirements are consistently changing per mission and theater requirements.
Additional platforms targeted and fielded with CROWS:

- PM Light Tactical Vehicles – M1114, M1151
- PM Assured Mobility Systems - RG31, Buffalo, JERRV, MMPV
- JPO Mine Resistant and Ambush Protected - Caiman, MaxxPro (+), RG33L, Cougar, MATV
- JPM NBC Contamination Avoidance - Fox M93A1

Other Services: SOCOM, USAF, UMSC/DOE/JLTV

Advancement of RWS

Picatinny Lightweight RWS

- Weight: 160 lb
- Slew rates:
  - Azimuth: >200 deg/s
  - Elevation: > 160 deg/s
- El Range: -20 to 45 deg
- Az Range: Continuous 360 deg
- Weapons: M240, M249 and FN 303
- Sensor suite: Day camera
- Can be integrated:
  - FLIR
  - Laser range finder
  - Stabilization

Advance Remote/Robotic Armament System

- Remote weapon re-load and ammo type change
- Improved weapon reliability & safety
- Theft resistant weapon and ammunition
- Enables low energy propulsion munitions (non lethal)
- Design allows weapon super elevation to 90°
- Maximize internal ammo stowage (1500 - 7.62rds)

Ripsaw MS1

PLWRWS integrated on RIPSAW

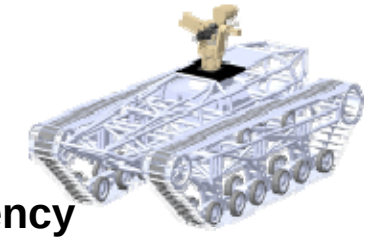
Command Center

System Description:

- Modular Common Platform that can support multiple mission profiles
- Tele-Operated via a Remote Command Center
- Large Class (payload of 2000 lbs)
- Fast - speeds up to of 60mph
- Agile - Zero Turn Radius
- All Terrain and Rugged

ARDEC Partnership

- Platform was developed by the Howe and Howe Technologies, Inc
- Teamed with TARDEC
- ARDEC has integrated
  - Picatinny Light Weight Remote Weapon Station (PLWRWS)
  - Modular Crown Control Munitions (MCCM)
  - Remote Reality 360° camera
  - Counter IED Sensors



•RF Link management, Weapon control, System latency, Emergency stop, Communication interference among other systems, Weapon safety in degraded modes,Operator interface

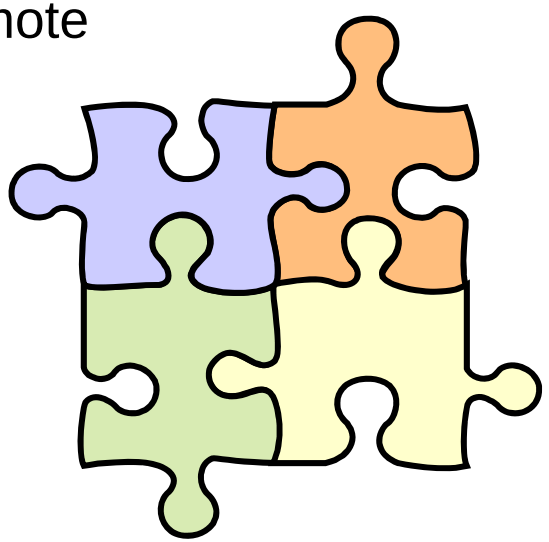
CHALLENGES

- Technical
  - Integrating state-of-the-art technologies to satisfy warfighter requirements
  - Improve secure communication bandwidth and range
- Safety
  - Eliminate single point failures
  - User in the loop
- Quality and Testing
  - Facilities and evaluation criteria required to test latest Armed Remote/Robotics technologies

In Summary…

Pulling the pieces together

- ARDEC is actively engaged in the integration of Remote Armament Systems on both manned and unmanned vehicles
- ARDEC has unique capabilities to provide remote armaments solutions for robotic platforms
  - Emerging technologies
  - Development programs
  - Network lethality
  - System Safety Certification
- ARDEC is partnering with OGAs and Industry
  - CRADAs – Foreign & Domestic



RDECOM

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Extended Area Protection and Survivability (EAPS) ATO

Fire Power Presentation

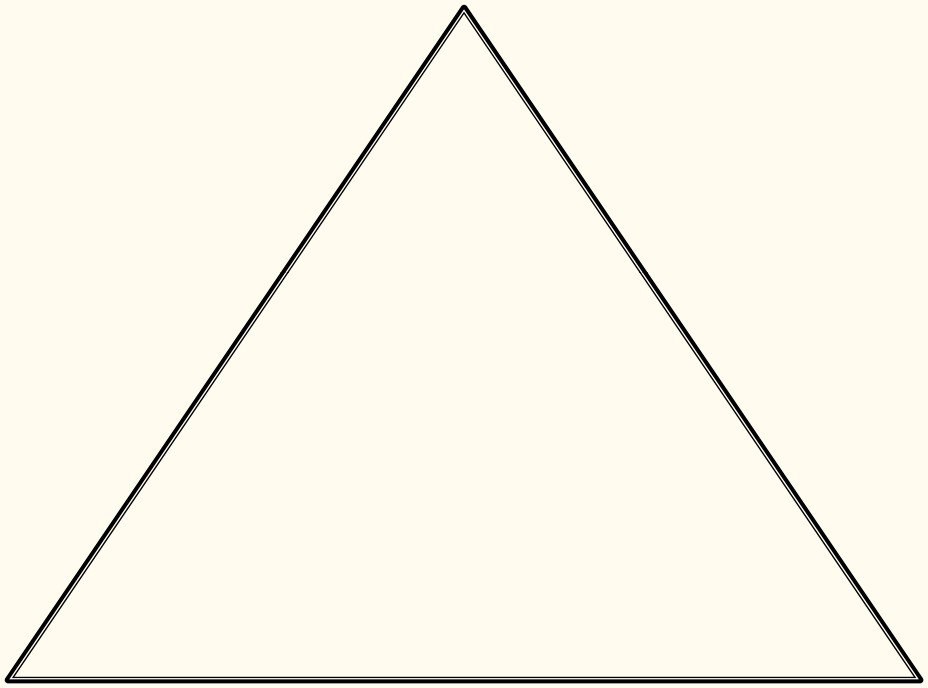
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Manfredi Luciano
973-724-3473
manfredi.luciano@US.army.mil
EAPS ATO Manager

10 June 2009

Briefing Themes

EAPS Development



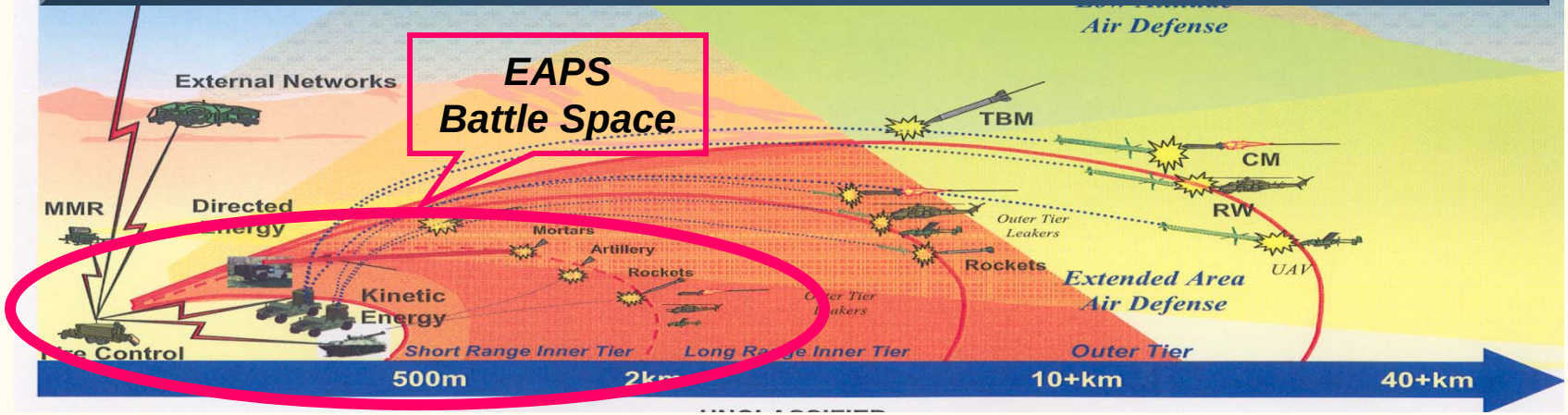
Air Defense

Command Guided
Direct Fire Ammo

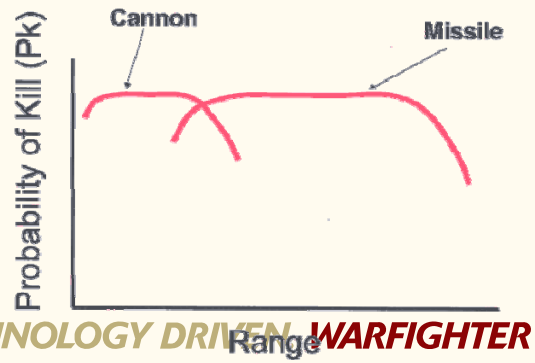
Special Thanks For Parts of This Briefing To:
Gary Moshier, Dan Ericson, & Lucian Sadowski

Program Goal and EAPS Battle Space

Develop and Demonstrate Critical Technologies for Bridging the Gap Between the Initial C-RAM Capability and the Objective EAADS Capability for Providing Mobile, 360-Degree Hemispherical Extended Area Protection from RAM Threats



- New Start Joint ATO with AMRDEC: FY09-13
- Goal is to Develop Technologies for 360 Degree Mobile Air Defense Against Rockets, Artillery and Mortars (RAM)
- ARDEC Pursuing Gun Based Solution for Short Range Inner Tier



EAPS Integrated Product Team

CONTRACTORS
- **ATK Mission Systems**
- **ATK Ammunition Systems**
- **Technovative Applications**

ARDEC
Assoc Dir Tech Base
Ms. Barbara Machak

PIO Office
C. Perazzo

CUSTOMERS
- **PM C-RAM: Mr. Van Rassen**
- **USAADA: Mr. Mike Cochran**
- **ASA(ALT): Ms. Mary Miller**
- **AMRDEC: Mr. Bill Nourse**
- **PM MAS: Mr. Ken Insco**

EAPS APO
M. Luciano
D. Tappe (ATK)

Systems Engineering IPT
SEL: D. Mao (Acting)
Systems Analysis:
D. Ericson and M. Knuteson
Planning: J. Martocci

EAPS DEL
G. Fleming
M. Danielson (ATK)

Weapon IPT
IPT Lead: Gary Moshier
ATK MCS COTR: A. Aeberli
(ATK): B. Glantz
Turret Design: B. McHugh,
Brian Forsberg
QA: Jorge Ruiz

Radar / FC IPT
IPT Lead: R. Shipe
(TA): D. Miller
Electronics: S. Khan
FC Consultant: M. Barbarisi
Instrumentation: J. Struck

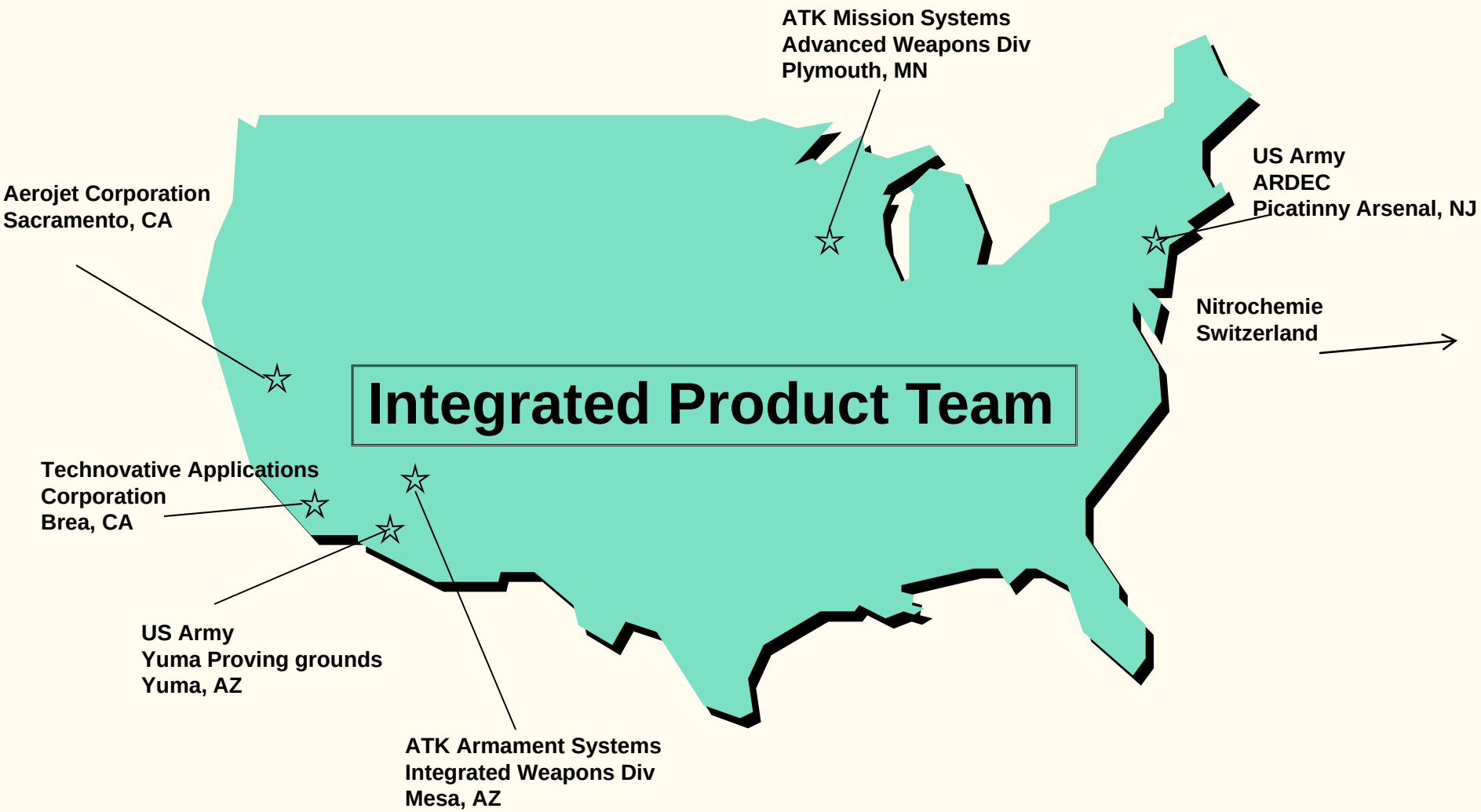
Projectile Design and
Warhead Integration IPT
IPT Lead: Phil Brislin
(ATK): J. Reynolds
Projectile Design: M. Ellis,
Fuze: A. Chebishev
Warhead Dev: S. Tang & J. Pincay
Propulsion Dev: D Keyser
Configuration Mgr: J. Wasserman

Course Correction IPT
IPT Lead: R. Bryan,
(TA): D. Miller
(ATK): J. Yost
Electronics: L. Vo
Telemetry: B. Flyash
C/C Consultant: L. Sadowski
Aeroballistics: J. Grau
Thruster Design: M. Horvath

Ammunition IPT Members:

Safety : C. Muhammad
QA (Mech): C. Brandt
QA (Elect): N. Eid
IHCs : A. Shankle
Pkg: G. Farbanish

EAPS Team Members



EAPS ATO Program

FY06	FY07	FY08	FY09

ARDEC Non ATO & MAAST C.C. ATO

EAPS ATO-R

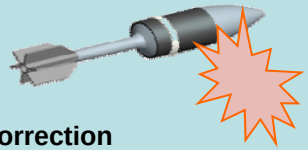
EAPS ATO-D

System Study

Proposed Subsystem Designs

MAAST Course Correction ATO

Development Tests
Warhead Performance
Course Correction
Maneuver
Command Communication
Radar & Fire Control
Integration



Command Course Correction Projectile

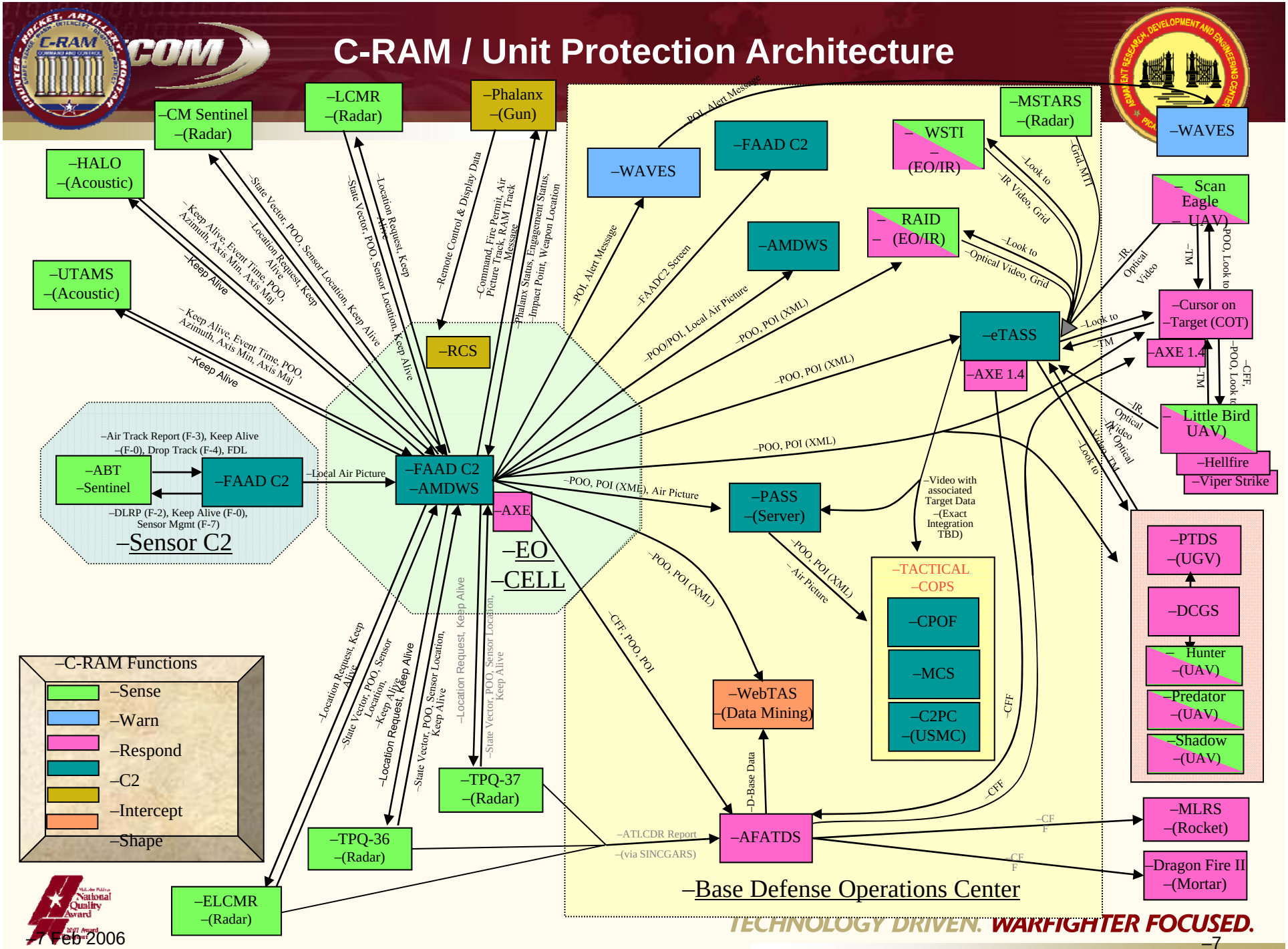
Ballistically Launched Defeat of Static Target

$17 M Total MAAST/EAPS for FY06 - 09

Demonstrate 50mm Auto Cannon on Hardstand Mount Firing EAPS Ballistic Simulants (Currently UFR)

Mid FY09 Demo

C-RAM / Unit Protection Architecture



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Army's Recent Air Defense Systems

1960s-1970s

–M163 VADS
–Vulcan Air Defense System

1980s

–M247 Sergeant York
–DIVADS

1990s-2000s

–Avenger Pedestal Mounted Stinger

1990s-2000s

–M6 Bradley Linebacker

2005

–Phalanx 20mm CIWS
–Adopted for C-RAM

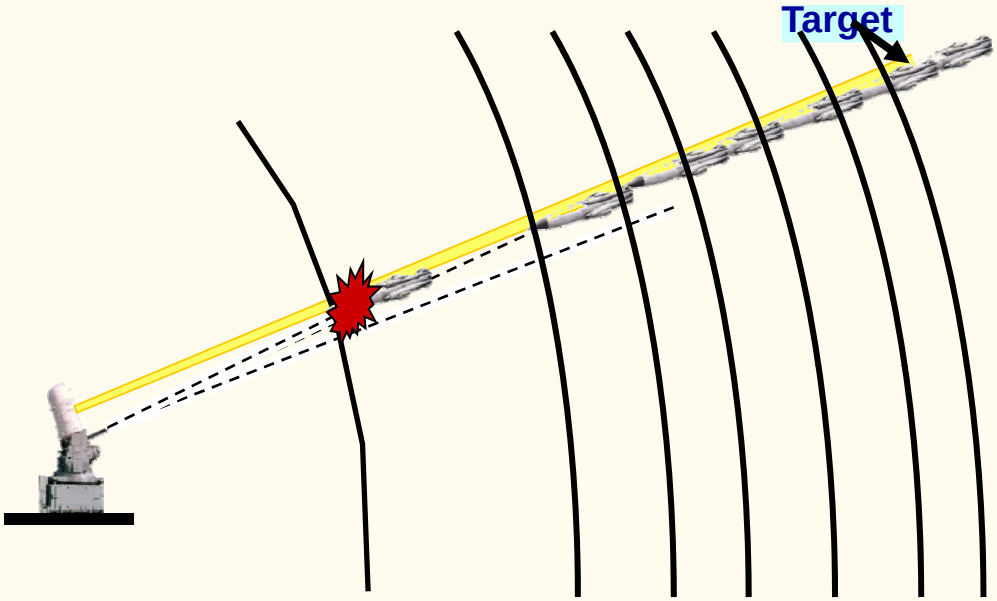
2014?

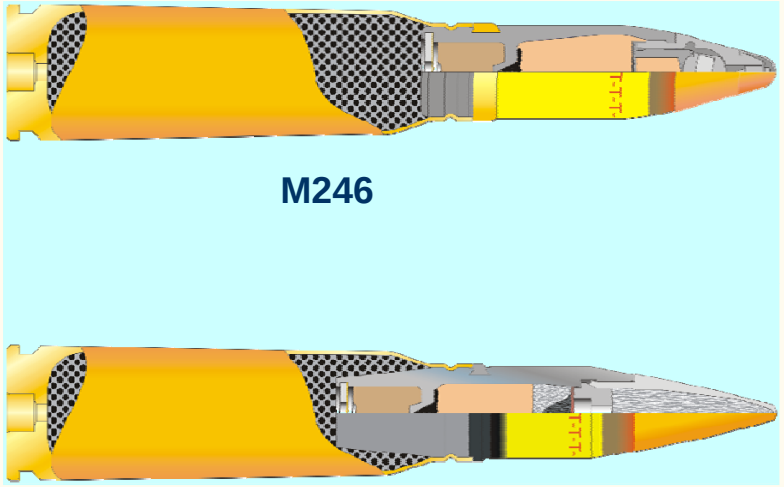
–?

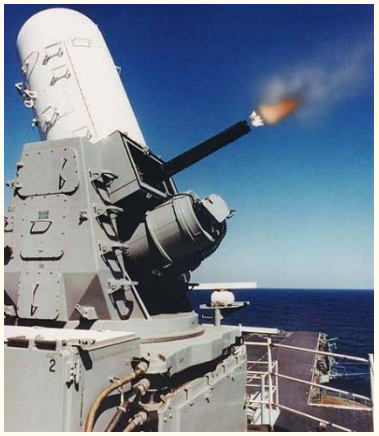
–EAPS

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Phalanx Weapon System







20mm M61A1 Gatling Gun, 6 Barrels
M246 and M940 Self-Destruct rounds
Up to 4500 rounds per minute
A Continuous Spray of Lead

Up To 400 Rounds Per Engagement

Threat Target Challenges

- Small Presented Areas
- Low RCSs
- Thick, Hard Warhead Cases
- Short Times of Flight
- High Rates of Fire
- Dual Purpose Improved Conventional Munitions (DPICMs)
- Helos, Lows and Slows, UAVs

Interceptor Lethality Criteria:

High Order Detonation Of Payload (Primary)

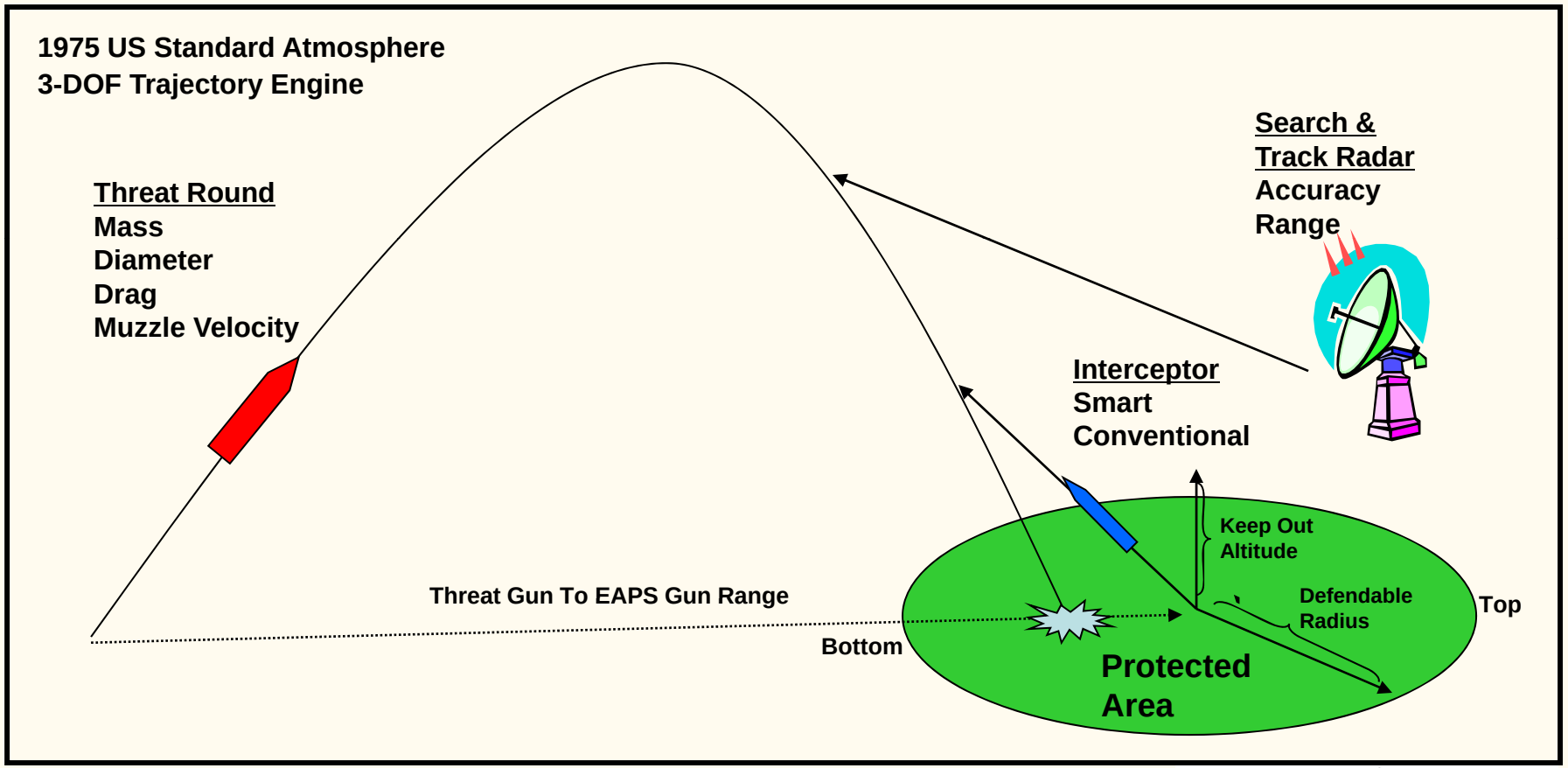
Destruction of Fuze (Secondary)

Target List

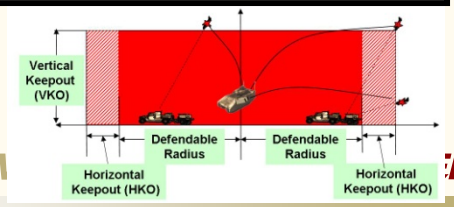
- **Mortars: 60 mm – 120 mm**
- **Rockets: 107 mm-240 mm**
- **Artillery: 122 mm-152 mm**

EAPS.F FORTRAN Gun Simulation

Basic Idea Is To Model The Event Timeline, Accuracy, & Lethality In Explicit Detail



Simulation Models A One (Or Many) On One Engagement Of Incoming Threat Round With EAPS Gun (Acoustics, Radar, Fire Control, Gun, Bullet)



TECHNOLOGY DRIV ED.

Engagement Options

Rapid Fire- Hit to Kill

- C-RAM Type Engagement
- 20-30mm Caliber
- High Rate of Fire
- KE or HEPD Kill
- Lowest Cost Ammo
- High Expenditure Rate
- Issues: Collateral Damage and Cost

Precision Fire- Burst to Kill

- 35-82mm Caliber
- Low- Mod Rate of Fire
- Advanced Warhead
- Prox/Advanced Fuzing
- Moderate Cost Ammo
- Issues: Adequate Ph and Lethality

Precision Fire- Guide to Hit

- 30-35mm Caliber
- Low- Moderate Rate of Fire
- Command Guided Course Correction
- KE Kill
- No Warhead, Fuze or S&A
- High Cost Ammo
- Issues: Burst Size, Cost and SD

Precision Fire- Guide to Burst

- 50-82mm Caliber
- Low Rate of Fire
- Command Guided Course Correction
- Advanced Warhead
- Prox/Advanced Fuzing
- Very High Cost Ammo
- Issues: Cost, Complexity, Size

Trade Study Results -
Characterization of Trade Space

Warhead	Guidance	20mm	25mm	35mm	50mm	75mm	82mm
KE-Sabot	No	PR~0.3R 40XShots	PR~0.3R 15X Shots	ROF Too Low	Similar To Smaller Calibers ROF Too Low		Velocity Too Low
	Yes	Too Small		PR ~0.6R >2x Shots	ROF Issues		
HE-Nat	No	PR~0.3R 40XShots	Not Done	Not Done – Appears to Have Low Promise Results Similar to KE Sabot			
	Yes	Too Small					
HE-PFF	No	Too Small			Not Done	PR > R ~0.6X Shots	PR~0.1R 0.4X-Shots
	Yes				Not Done	PR >R ~0.3X Shots	Not Done
CE-Unitary	No	Not Done – Appears to Have Low Promise Results should be similar to KE Sabot					Too Slow Likely To Be Ineffective
	Yes						
HE-EFP	No	Too Small			Not Done – Appears to Have Moderate Promise Results Should Be Similar To HE-PFF		
	Yes						
KE-Subs	No	Too Small		PR~0.2R >4X Shots	PR~0.6R ~3X Shots	PR~0.6R ~0.8X Shots	Too Slow Likely To Be In
	Yes			Too Small	PR~R ~X Shots	PR~0.9R ~0.8X Shots	
CE-Subs	No	Not Done – Appears To Be Too Small (Insufficient Number Of Submunitions)				Not Done – May Have Some Promise In Larger Calibers	
	Yes						

What Works
Required PR

Approach
Cost/Kill: <$10K
Weight/Kill: 31 lbs
Time/Kill: ~2 sec

Fuze Risk Too High

Logistic Burden Too High

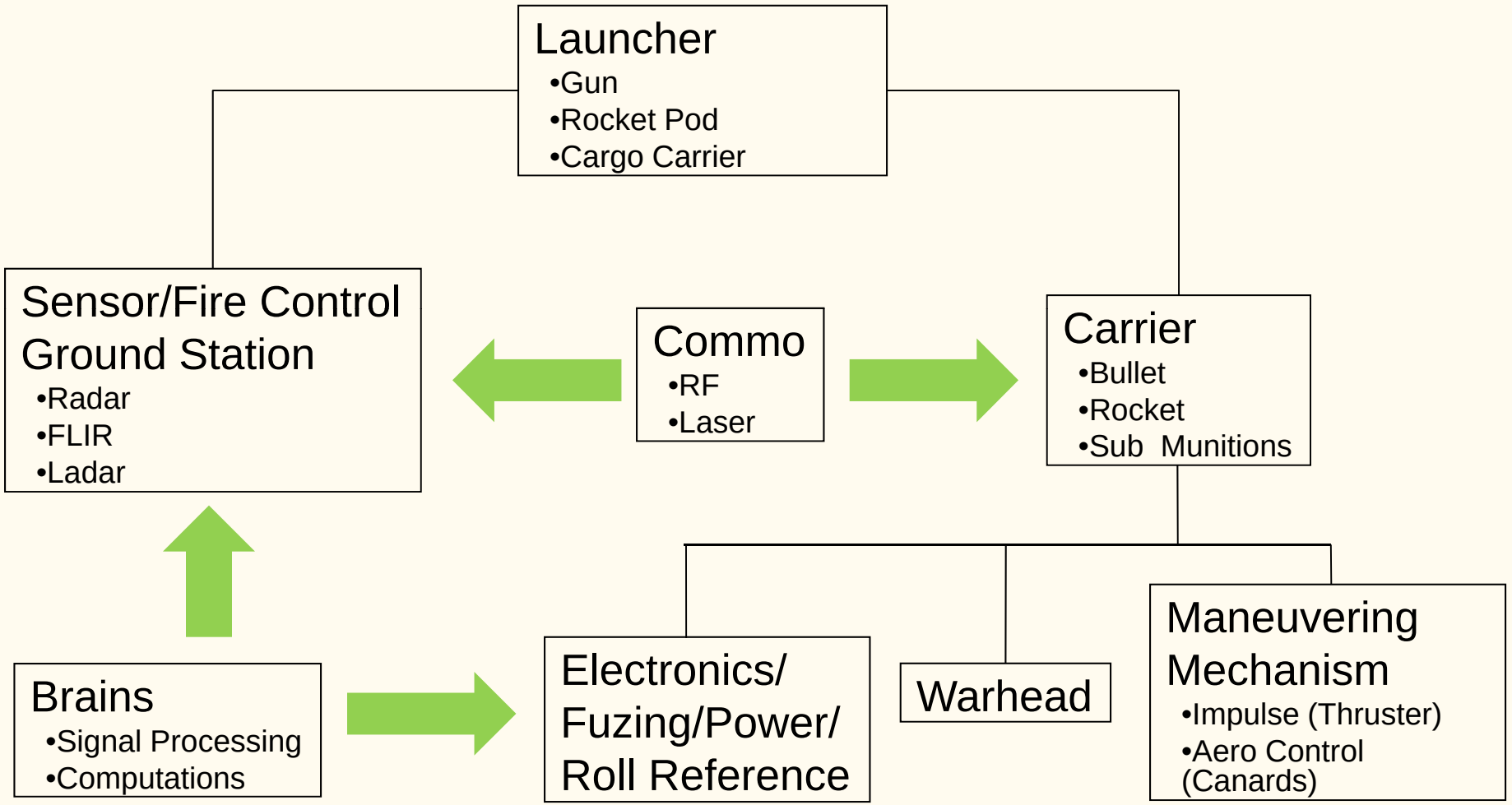
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Used M&S To Determine Technical Approach To EAPS

- Recommended Development of A Demonstrator Incorporating:
  - External Surveillance Radar With At Least Phalanx Range Capability
  - PTS/ATS Fire Control Radar For Tracking And Communication Link
  - 50mm Bushmaster III/IV Twin Guns for 400 rpm Rate
  - Interceptor Using Course Correction Technology From MAAST STO (Single Thruster, Guidance Instruments)
  - Transceiver Compatible With PTS/ATS Radar
  - Command Fuzed Forward Fragmenting Warhead Using Multiple EFPs

Launched EAPS Gun and Interceptor Development Using These Rough Guidelines As Most Likely Technical Approach To Meet C-RAM Needs

Command Guided, Direct Fire Basics



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Command Guided, Direct Fire History

Tube-Launched, Optically-Tracked, Wire-Guided (TOW) (1957-)

Launcher	Carrier	Sensor	Brains	Commo	Roll Ref	Maneuvering Mech
Rocket Tube	Rocket	FLIR	Ground Station	Wire Link	N/A	Canards

Cannon Cal Maneuver Munitions, Ford Aerospace (1979-84)

Launcher	Carrier	Sensor	Brains	Commo	Roll Ref	Maneuvering Mech
40mm Gun	Bullet	Radar	Ground Station	Radio Freq	Magnetometer	RAM Air Control

Command Adjusted Trajectory (CAT), LTV/Vought (1981-85)

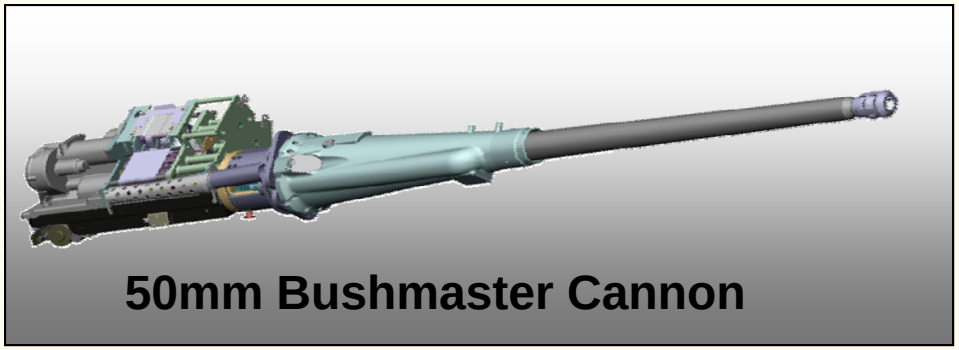
Launcher	Carrier	Sensor	Brains	Commo	Roll Ref	Maneuvering Mech
40mm Gun	Bullet	FLIR	Ground Station	Radio Freq	Magnetometer	Squibs

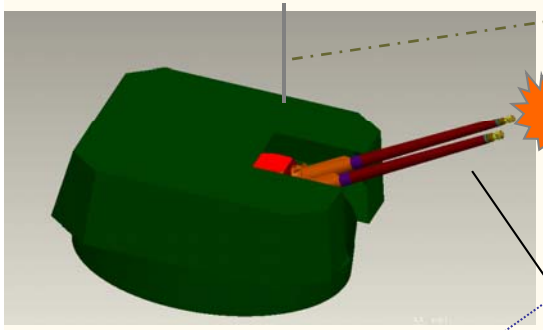
MAAST Course Correct, Gen Dynamics, ATK (2003-06)

Launcher	Carrier	Sensor	Brains	Commo	Roll Ref	Maneuvering Mech
120mm Gun	Bullet	FLIR	Ground Station	Radio Freq	Magnetometer	Thruster

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

EAPS Baseline Concept





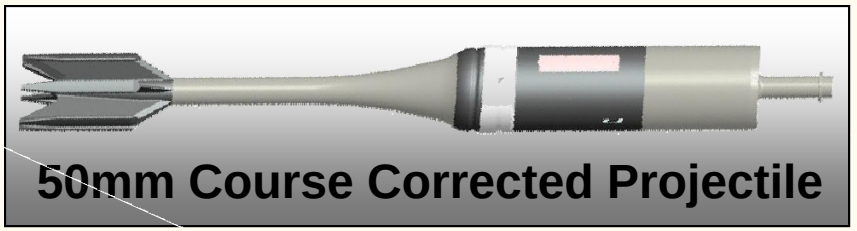
RF Data Link

Radar Track

Forward Fragmentation Warhead Detonation

Mid-Flight Course Correction

10 Round Burst at 500 Shots per Minute



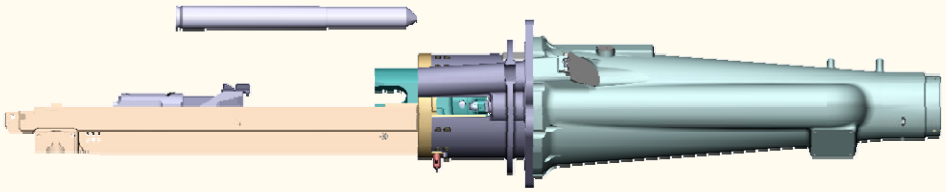
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

50mm Bushmaster Cannon

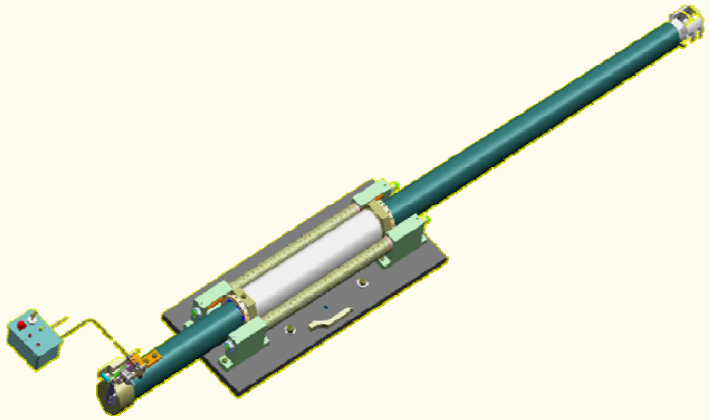
- Hybrid Bushmaster Cannon
- Accommodates EAPS 50mm Caliber and 538mm Cartridge Length
- No New Development Required
- Approx Cost: $400K for Modified BMIII Weapon and Conversion Kit
- Twin Guns in Common Turret for 400 SPM

50mm Bushmaster Specs

- **Caliber: 50mm**
- **Cartridge Length: 538mm (21”)**
- **Firing Rate: SS/200 spm**
- **Weight: 510 lbs**
- **Recoil Force: 14,000 lb**
- **Power Req’d: 3 HP**
- **Dispersion: .35 mils**
- **Manufacturer: ATK Med Cal Sys**



BMIV AFT RECEIVER with BMIII BREECH & FWD RECEIVER
Will accommodate up to 150.8 mm additional cartridge length
537.8mm vs. 387mm max overall cartridge length



MANN Barrel Test Fixture

PROJECTILE TRACKING SYSTEM (PTS)
NLOS-C RADAR

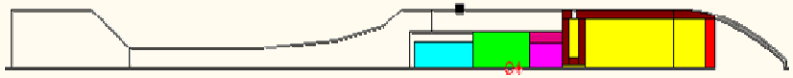
Interferometry is Most Accurate Technique Known for Measuring Angle of Arrival of a Radio Signal

- **Operating frequency: 15.7 – 16.2 GHz**
- **Active Electronically Scanned Antennas**
- **Transmit power 500W**
- **Angle accuracy (x,y,z) < 0.3 mils @ 20dB SNR**
- **Range accuracy < 0.2 meters**
- **Doppler accuracy v(t) < 0.02 m/sec**
- **Tracking range: Muzzle to 40000 meters**
- **Muzzle velocity determination < 0.05%**
- **Impact Prediction accuracies ~ 6 meters @ 20 Km**
- **Projectile communication capability**
- **Tracked six (6) long range projectiles > 10km simultaneously**

Modeling: Ongoing Process

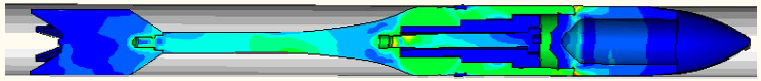
50mm System Study

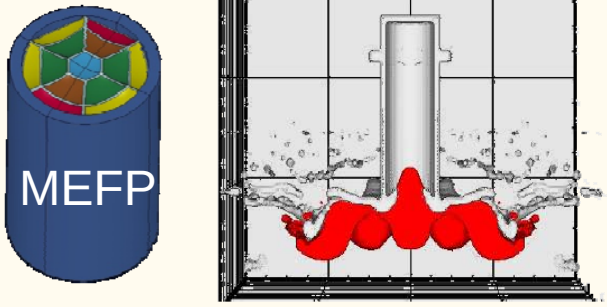
Projectile Configuration Study



M&S Design Loop

Detailed Modeling & Analysis



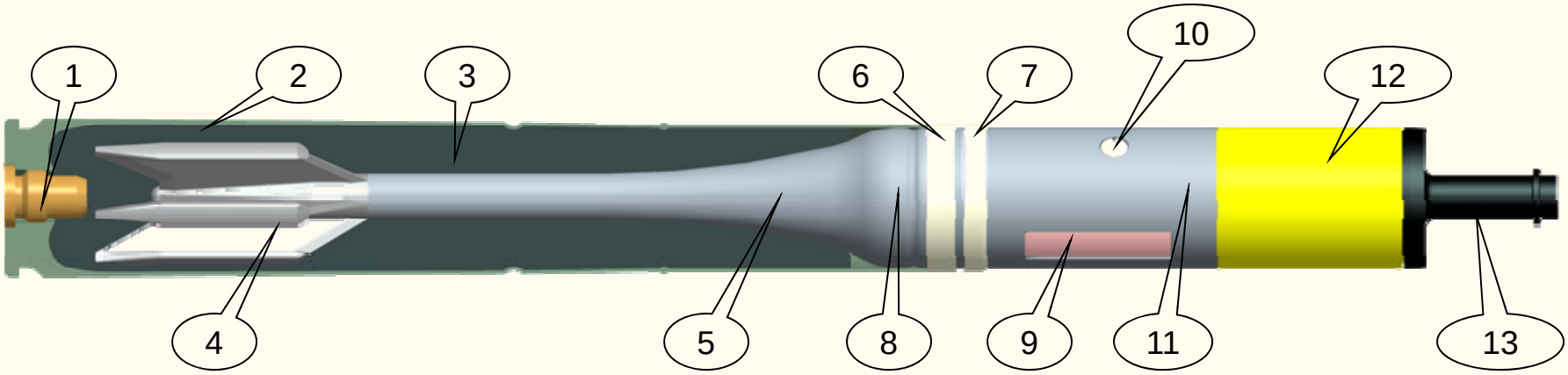


Test Data

Zone 1 Zone 2 Zone 3

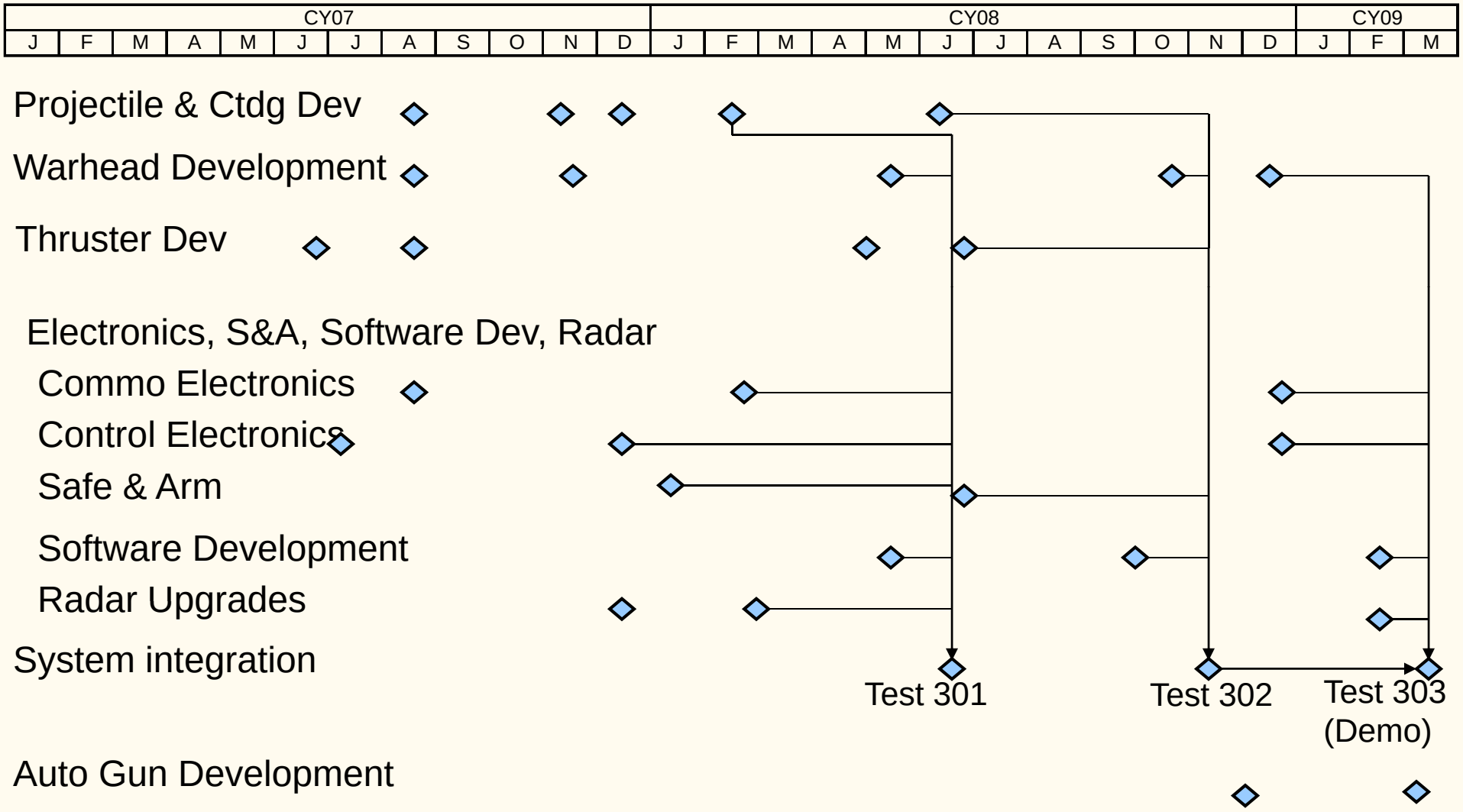
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

EAPS Tactical Concept
"Demo Configuration"



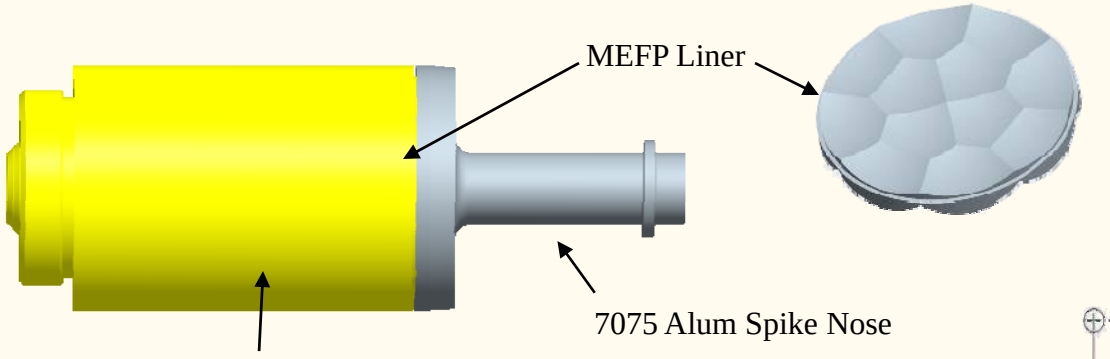
1. Primer
   M115 percussion primer
   Black powder flashtube
2. 328mm steel cartridge case
3. Nitrochemie ECL propellant
4. Aluminum 6 vane fin
5. 7068-T6 aluminum aft-body
6. Nylon obturator
7. Nylon rotating band
8. Set-back initiated battery
9. Electronics package
   TA transceiver
   ATK fuze electronics
10. Course correction divert thruster
11. ATK safe and arm device
12. Warhead
    4340 Steel body
    140g PAX-2A HE charge
    PBXN-5 booster
    Tantalum-tungsten 12 MEFP liner
13. Aluminum spiked nose

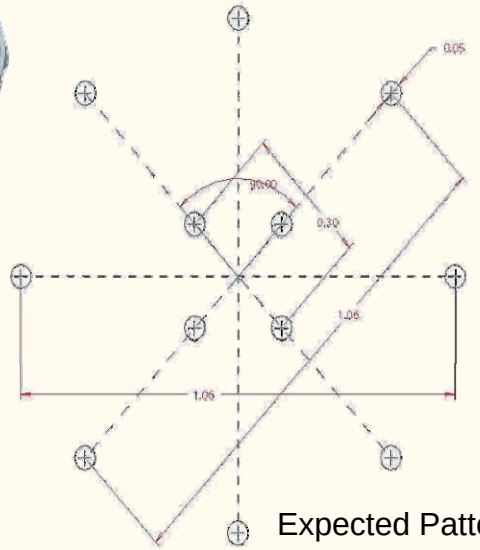
Program Development Plan



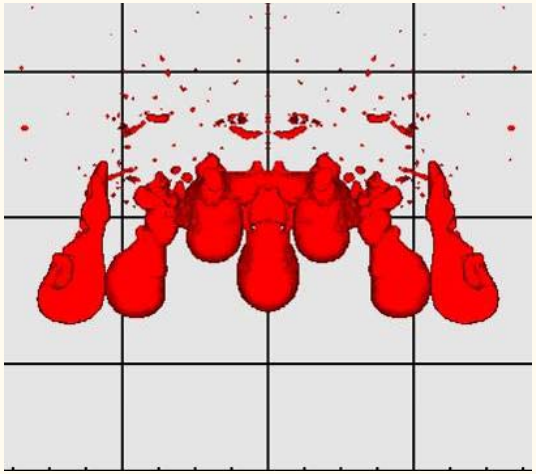
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Tactical EAPS Warhead Design & Test
12 MEFP Design

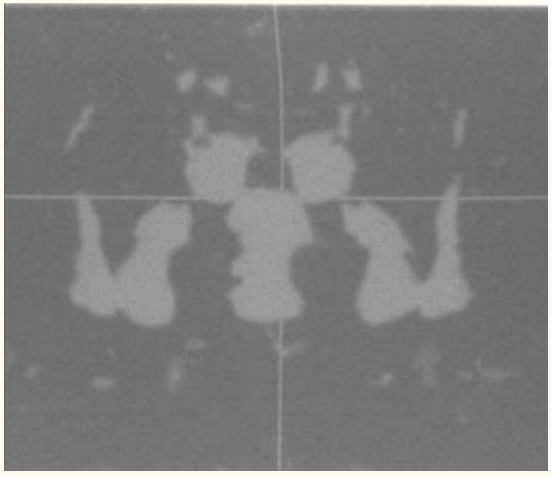




Expected Pattern & Velocity



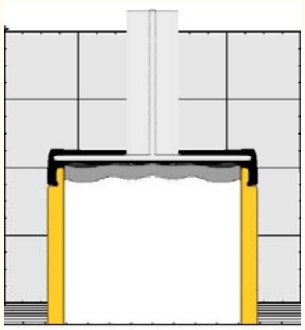
Modeled MEFP Formation

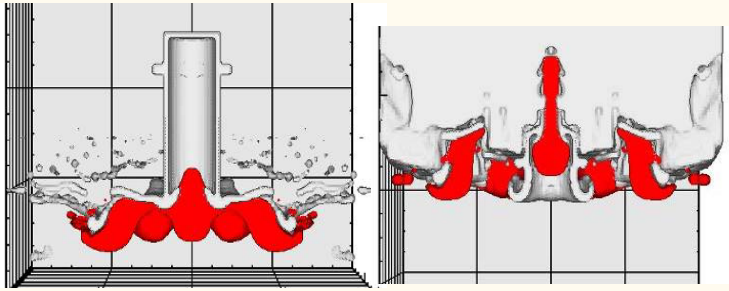


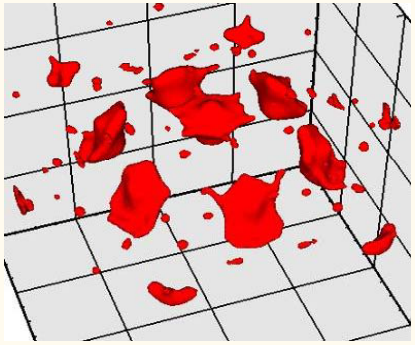
Bench Test X-Ray MEFP Formation

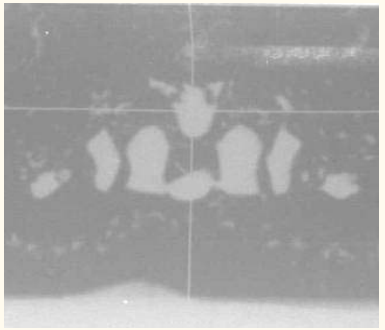
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

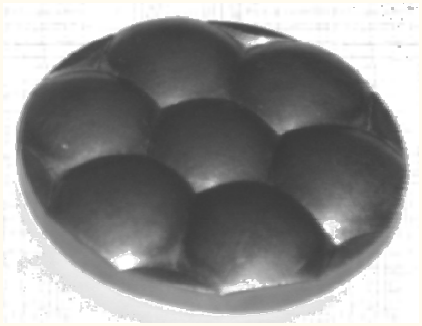
Warhead Development Summary











7 MEFP Liner

Thruster Development Summary

2007				2008					
May/Jun	Jul/Aug	Sep/Oct	Nov/Dec	Jan/Feb	Mar/Apr	May/Jun	Jul/Aug	Sep/Oct	Nov/Dec

Chg Est

Impulse#1

Heavy Wt

Welding Process Development
Clam Shell Design

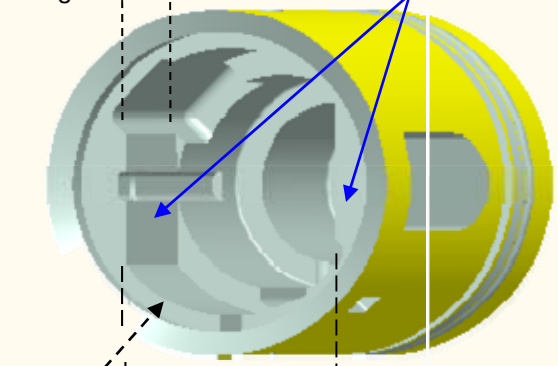
Threaded Design

Burst Integrity

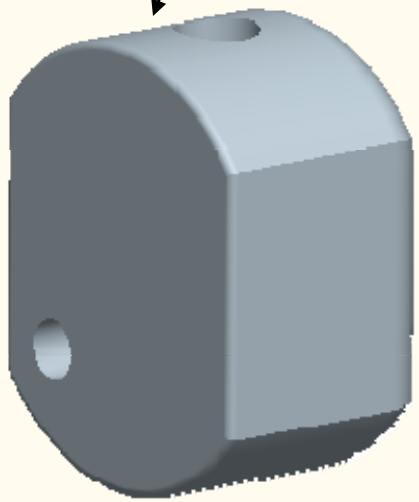
Impulse #2

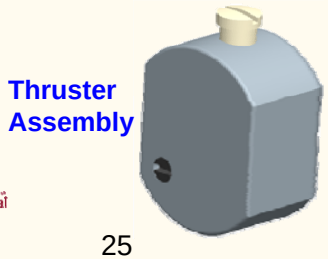
Tactical

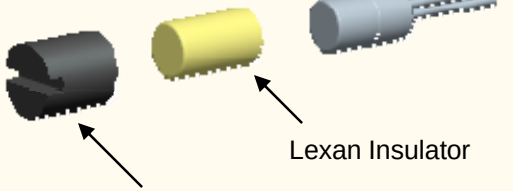
302



Thruster Assembles into Aft Body







TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

EAPS XCVR Design Verification

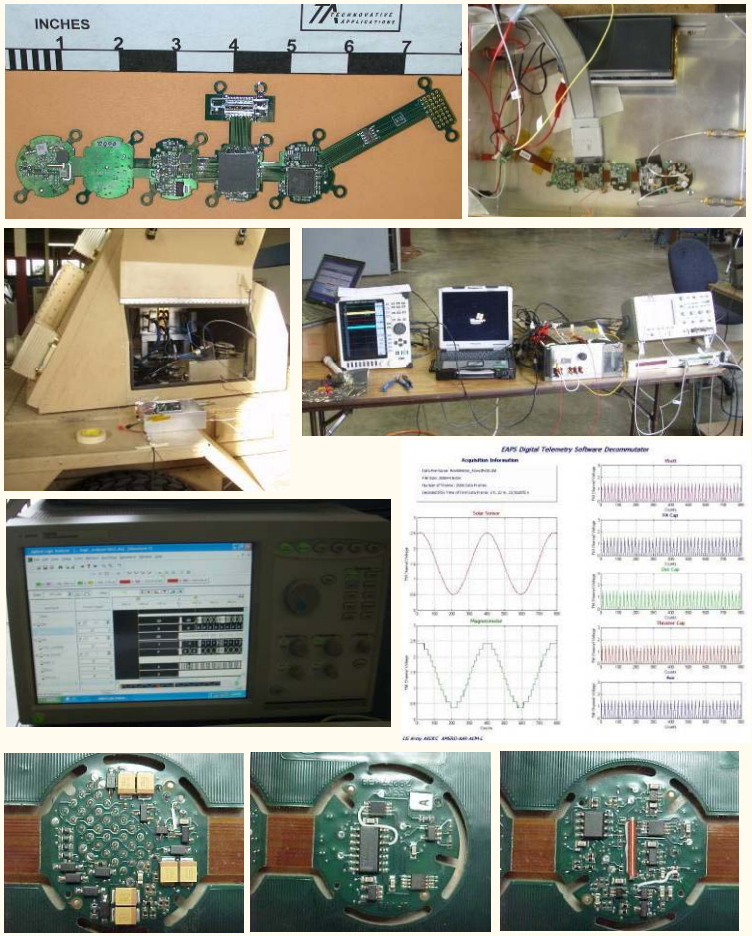
- **Design**

- **Verify Commo Hardwired**
  - a. Basic Commo
    - ✓ Up Link
    - ✓ Down Link
  - b. Mission Data
    - ✓ Up Link
    - ✓ Down Link

- **Verify Como Open Air Close Range**
  - a. Basic Commo
    - ✓ Up Link
    - ✓ Down Link
  - b. Mission Data
    - ✓ Up Link
    - ✓ Down Link

- **Verify Como Open Air Tactical Range**
  - a. Mission Data
    - ✓ Up Link
    - ✓ Down Link

- **Integration (X-cvr With Fuze/Control Electronics)**
  - ✓ Basic Interface – Flat Boards
  - ✓ Mission Data Exchange – Flat Boards
  - ✓ Mission Data Exchange – Potted Units

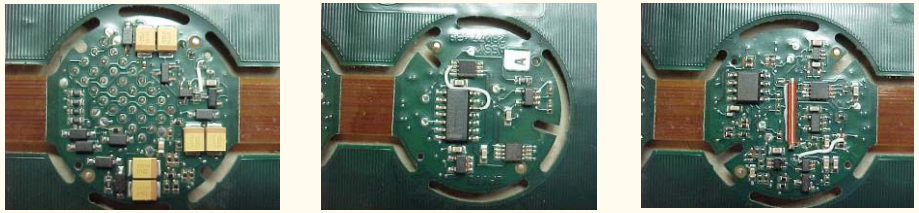


TECHNOL FOCUSED.

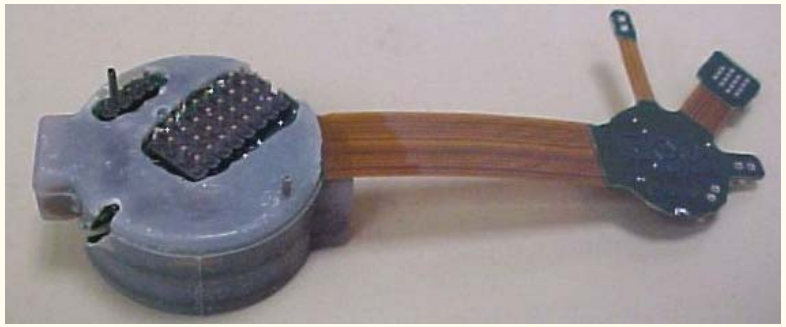
Control Electronics

Implemented Revised fuze electronics PCB

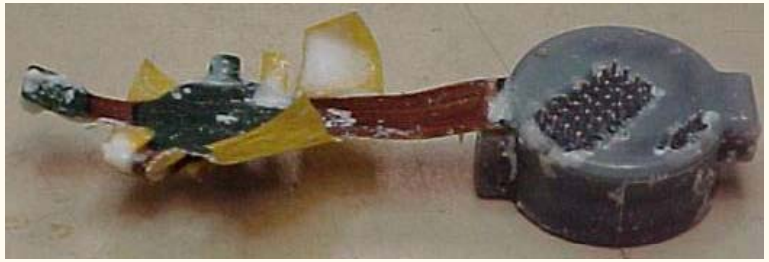
1) 2) 3)

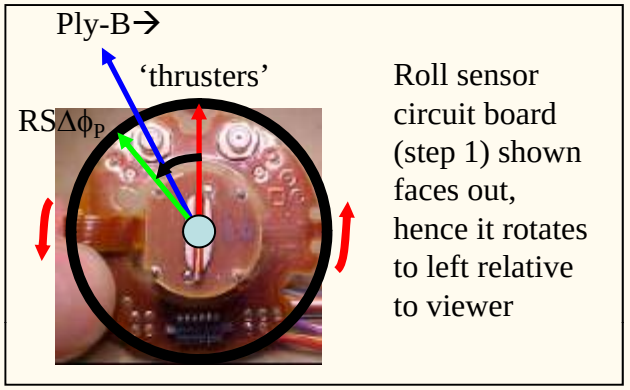


- Potting Rev-A Fuzes



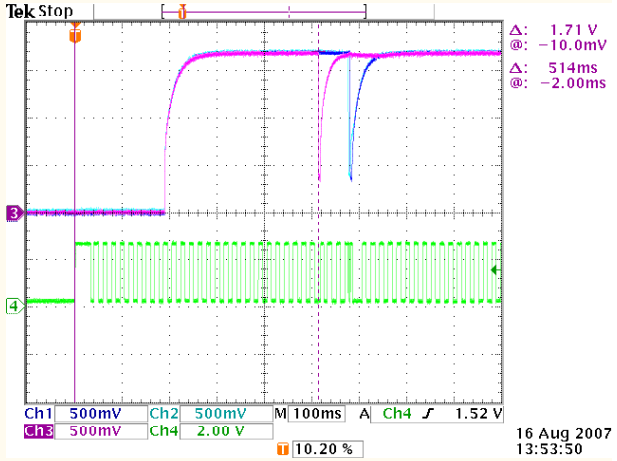
- Mated Rev-A fuze serial #1 with TA xcvr #3 for air-gun testing with good results





Roll sensor circuit board (step 1) shown faces out, hence it rotates to left relative to viewer

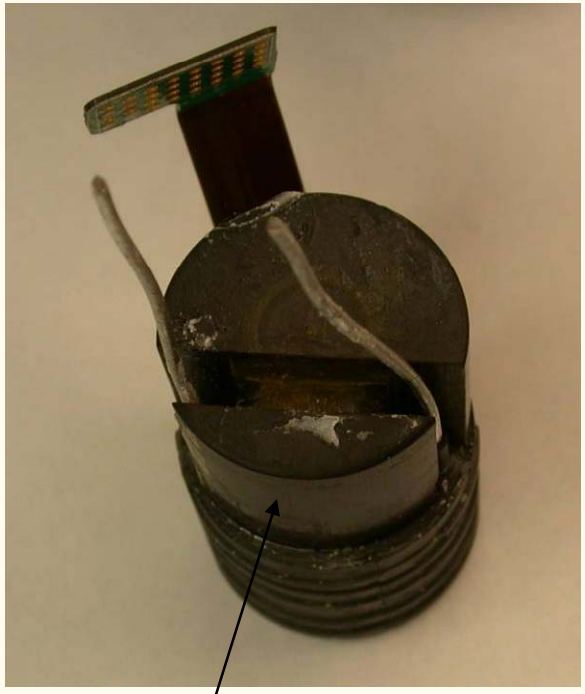
Magnetometer & Roll Sensing

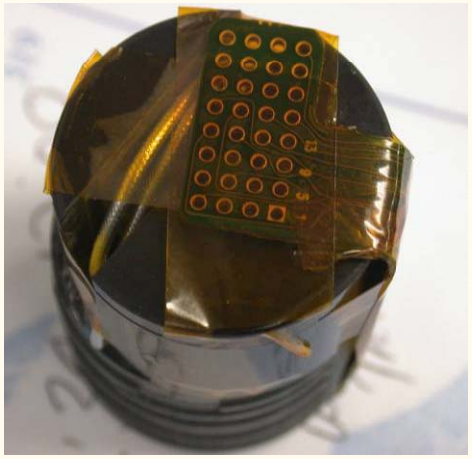


Post Air Gun Test Results

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Commo & Control Electronics Interface





- Spool support to wrap coaxial cable around (4” length of cable)
- Provides additional support to the cable even when potted in wax
- Loose wrap allows generous bend radius which when potted in wax eliminates sever bends and damage

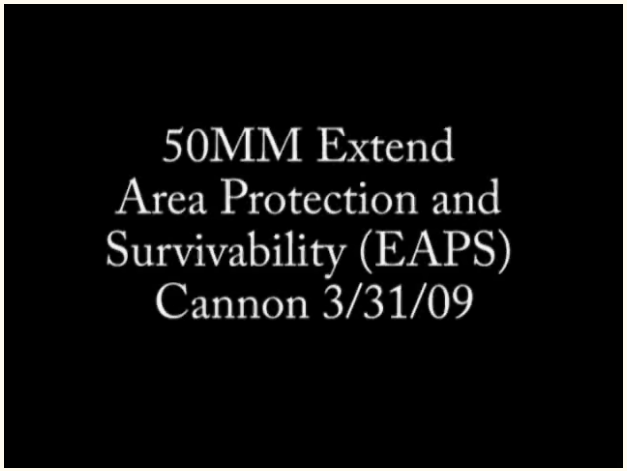
EAPS Test Videos

–EAPS Feasibility Demonstration

Test Plan:
Four Rounds for Command Course Correction
Five Rounds for Command Warhead Detonation
Six Rounds for Integrated Command C.C & W.D.

50mm Auto Cannon Test

- Alliant Tech systems – Medium Caliber Weapons Division (Mesa, AZ)
  - 50mm Cannon Designer
  - Contract W15QKN-07-C-0160
  - Proof round fired through cannon March 09
  - Feeder assembly completed 24 March 09
  - Dry cycle dummy rounds 26 March
  - Single shot firing of control rounds 30 March
  - Burst firing of 50mm control rounds 31 March
  - Addition test assets available for cannon reliability assessment



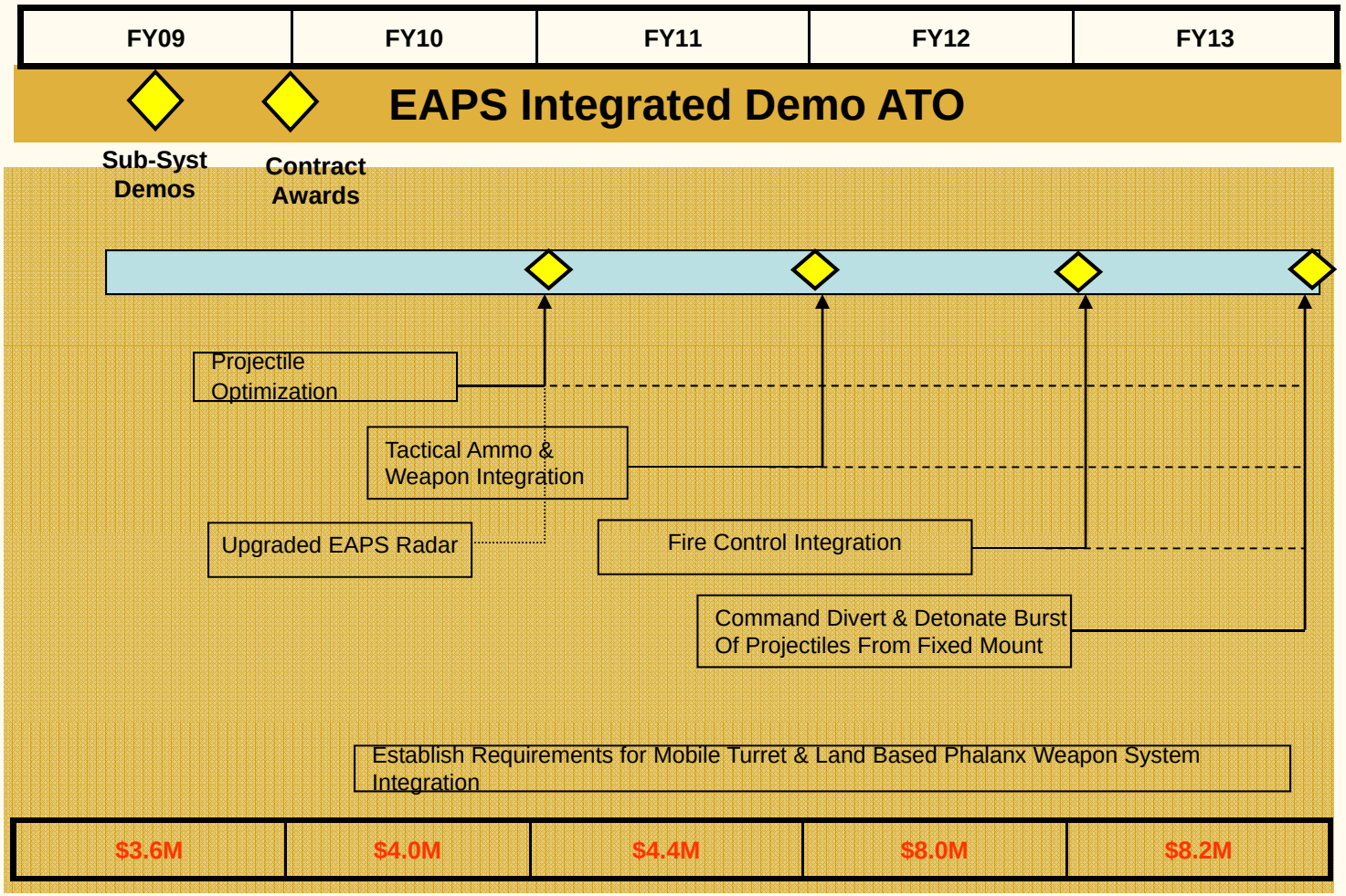
Program Goals and Objectives

- EAPS Phase 1 (ATO-R) Closeout Demonstrations (Sep 08):
  - ✓ EAPS Projectile Gun Launch, Interior Ballistic, and Exterior Ballistic Feasibilities.
  - ✓ Command Divert of a Course Correct Projectile.
  - ✓ MEFP Warhead Bench Test Functionality.
- EAPS Concept Demonstrations (March 2009):
  - ✓ Prototype EAPS 50mm Automatic Cannon on Hardstand Mount
  - ✓ 50mm Lethality “A” Round (Command Warhead Detonation)
  - ✓ 50mm Course Correction “B” Round (Command Course Correct)
  - ✓ ATS Radar Integration for Tracking and RF Communication
  - ✓ Component Level Tests to Demonstrate Fuzing, Warhead Lethality, Course Correction and Engagement Accuracy Against Static Targets to Demonstrate Performance

Exceeded Goals:

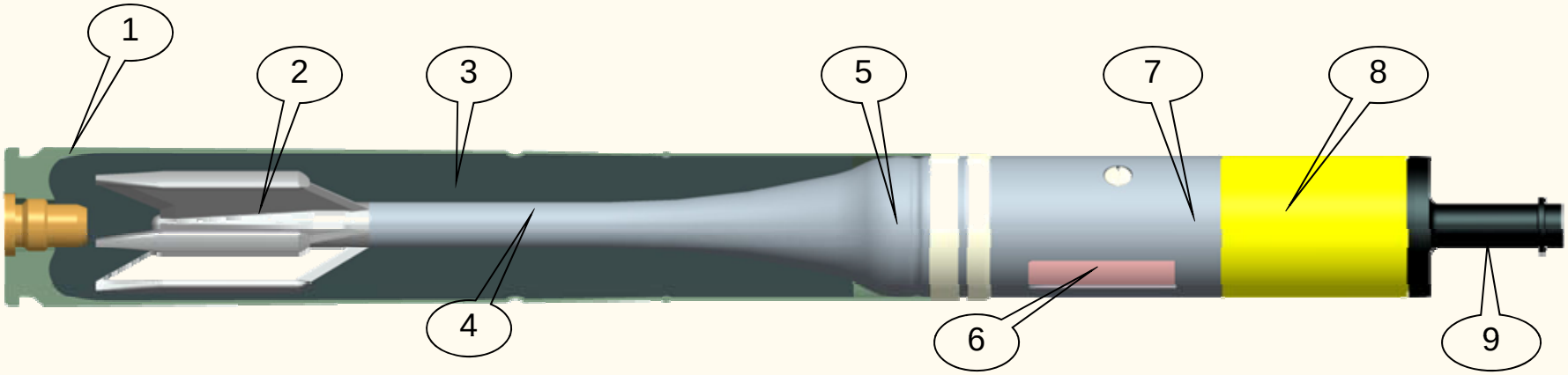
Demonstrated Integrated Lethality “A” & Course Correct ““B” Round

EAPS ID Road Map



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Follow On Technologies Maturation – Optimized Projectile

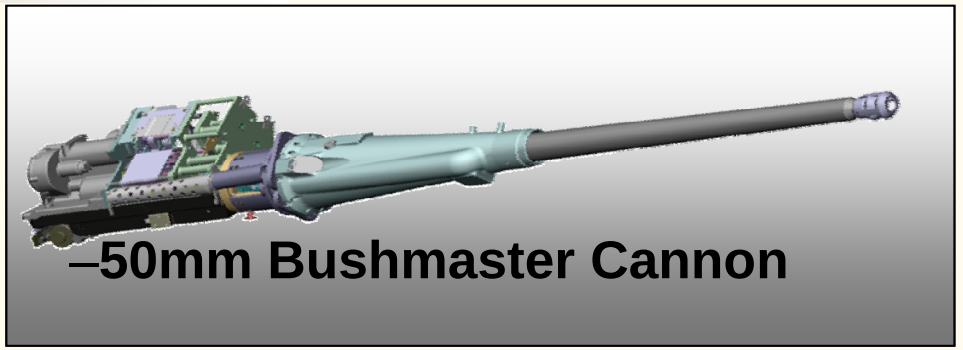


1. One piece cartridge case
2. Reduce fin cost
3. Propellant performance increase
4. Boom size reduction
5. Smaller thermal battery
6. Electronics size reduction and manufacturing improvements
7. Integration of MEMS S&A
8. Warhead explosive volume increase
9. Lower drag spike nose

Overall System Refinement Goals

- **Increase strike velocity on target**
- **Reduce frangible component size to limit collateral damage**
- **Increase producibility and lower cost**
- **Refine assembly procedures**

–Follow On Technologies
–Maturation of Autogun



–50mm Bushmaster Cannon

Goals and Objectives:

- Improve Gun Mounting
- Design and Develop a dedicated Feeder
- Increase Firing Rate & Reliability (mean rounds between stoppages)
- Conduct Dispersion Testing (Single Shot & Burst Fire)

Weapon Status		
Performance Parameter	Current	Completion of FY11
Firing Rate	112 spm	200 spm
Capacity	3 rounds	min of 10 rounds
Reliability	unknown	min of 1000 mrbs
Rd –to-Rd Dispersion (burst)	unknown	0.5mils
Feed System	Dual Feed	Single Feed

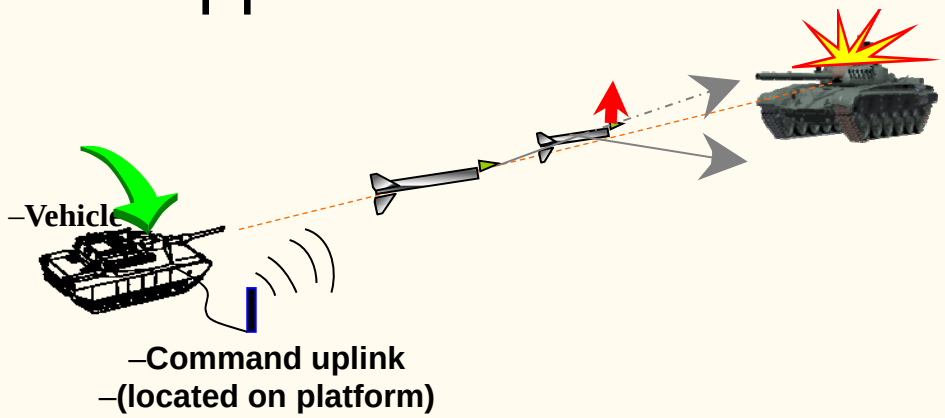
Follow On Technologies
Upgraded Radar

- **Power upgrade for multiple tracks & communication**
- **Antennas for E-Scan**

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Summary

- Command Guided, Direct Fire Munitions Have Made Significant Advances Based On EAPS Feasibility Demonstration
- EAPS Gun Concept Is A Go Forward Technology for Future Air Defense Options
- Exploring Other Possible Applications



U.S. Army Munitions
HQ DA G-3/5/7

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Agenda

- DA G-3/5/7 Munitions Mission
- Army Munitions Strategy
- Munitions Requirement Process (MRP)
- Major on-going Actions/Initiatives

Munitions “Team of Teams”

Validation, Prioritization, Resourcing, Policy

G-3/5/7

- CIC: **Capability Rqts**
- SSW: **War Plans**
- FM: **Force Structure**
- TRA: **Develop Requirements**
- CIR: **Develop priorities**

G-4

Sustainment

- Munitions Div

G-8

Programming & Budgeting

- BOS Div’s (Missiles)
- Ammunition Div

ASA(ALT)

Acquisition & Program Management

- Missile Systems & Ammunition Directorate

Requirement Generators

DoD
MRP

Joint Staff
JCIDS

Long-Term

TRADOC
STRAC, POI, CBT Loads

CAA
QWARRM

ATEC
TEST

AR2B

Near-Tearm

OTHER CMDS
ONS

Integration

Acquisition and Logistics

AMC

AMCOM LCMC

Life-Cycle Mgr of Acquisition & Production of Missiles, Logistics Readiness, and Sustainment

JM&L LCMC

Life-Cycle Mgr of Acquisition & Production of SMCA, Logistics Readiness, and Sustainment

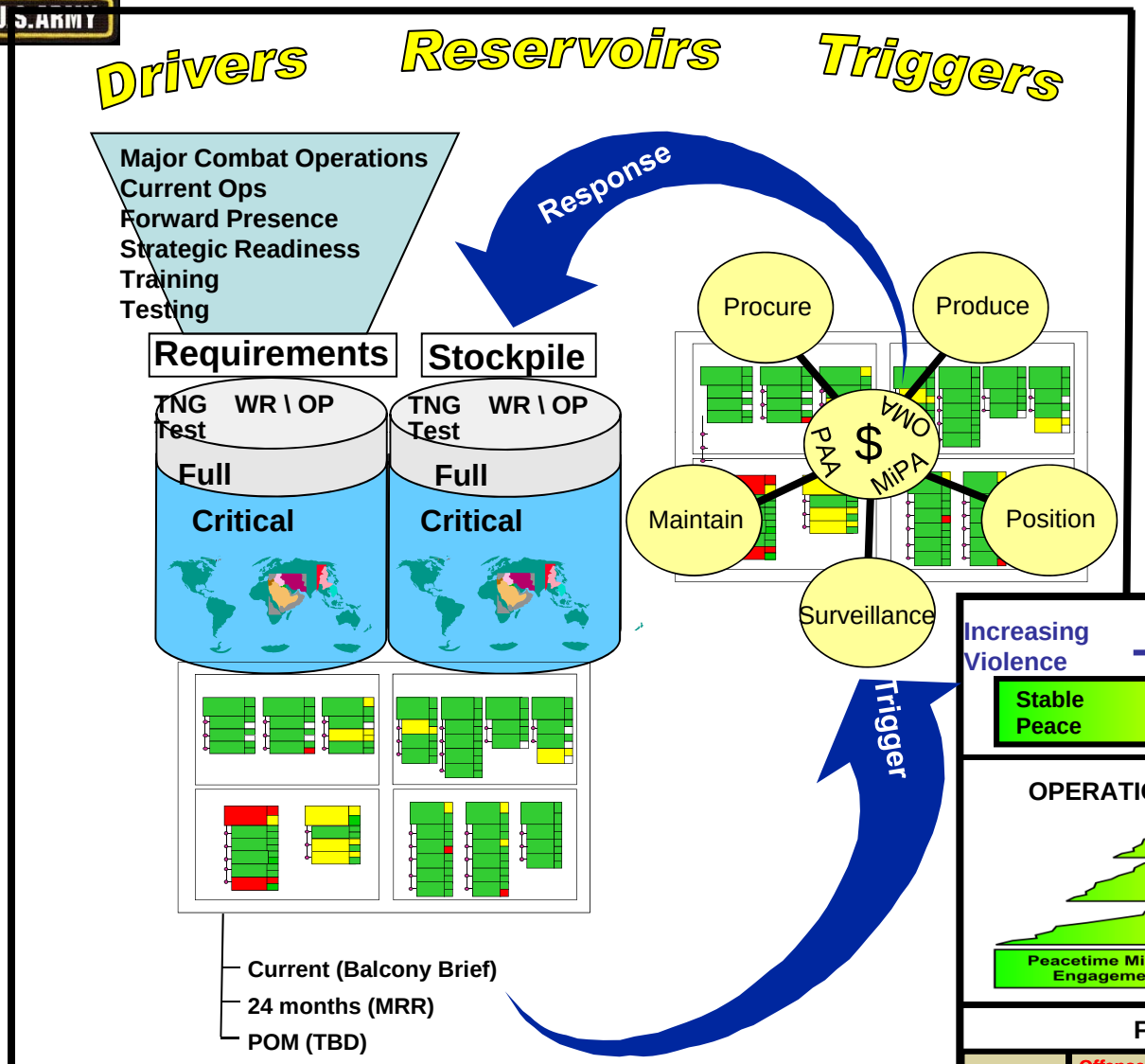
DA G3 Munitions Mission

- Serve as ARSTAF focal point for integrating munitions management.

- Where do we focus?
  - ✓Determine ALL munitions requirements
  - ✓Sustain the warfight
  - ✓ "Operationalize" munitions issues and recommend priorities
  - ✓Coordinate munitions resourcing strategy
  - ✓ Synchronize munitions policy
  - ✓ Oversee Army weapons training program
  - ✓ Monitor munitions and industrial base readiness

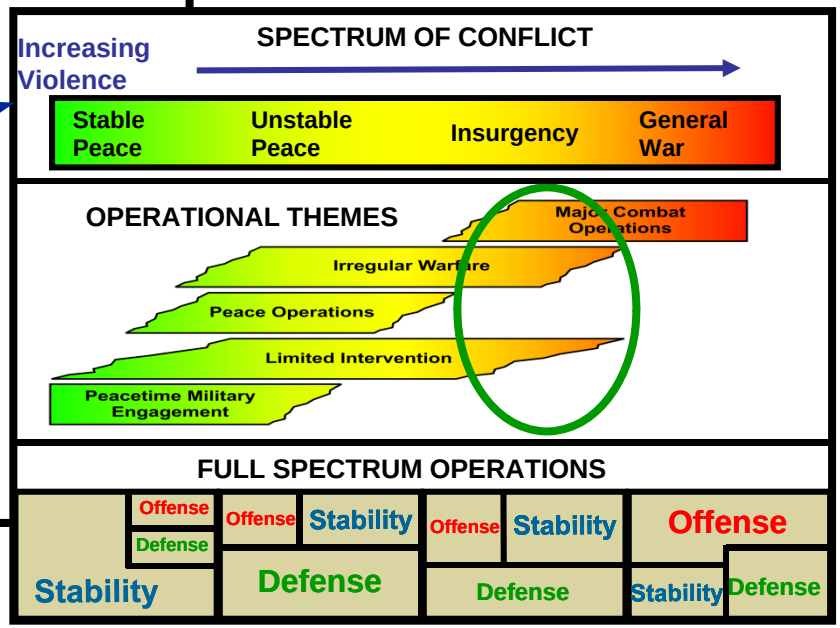
- Critical Tasks:
  - ✓Maintain Policy: DA PAM 350-38 (Standards in Training Commission, Jul 08) and AR 5-13 (Training Ammunition Management, Mar 05)
  - ✓Develop the Total Army Munitions Requirements (TAMR), to include war reserve, operational, training and testing requirements
  - ✓Authorize available operational and training munitions IAW G-3/5/7 priorities (Total Army Ammunition Authorization and Allocation Conference – TA4C)

Army Munitions Strategy



Endstate

- Generate steady-state capability while maintaining flexibility to surge.
- Be proactive versus reactive.
- Take a holistic, comprehensive, synchronized approach.
- Get operational issues in operational channels.
- Support Joint and Army capability- and readiness-based requirements and priorities across the spectrum of conflict.



Munitions Requirements Process (MRP)

➢ DoD Instruction 3000.4, Munitions Requirements Process (MRP), directs all Services to develop munitions requirements biennially.

➢ The MRP is a deliberate planning process that supports long-range POM planning and investments.

➢ As part of the deliberate planning process, we use the "Quantitative War Reserve Requirements for Munitions" (QWARRM) process to develop War Reserve / Operational requirements.

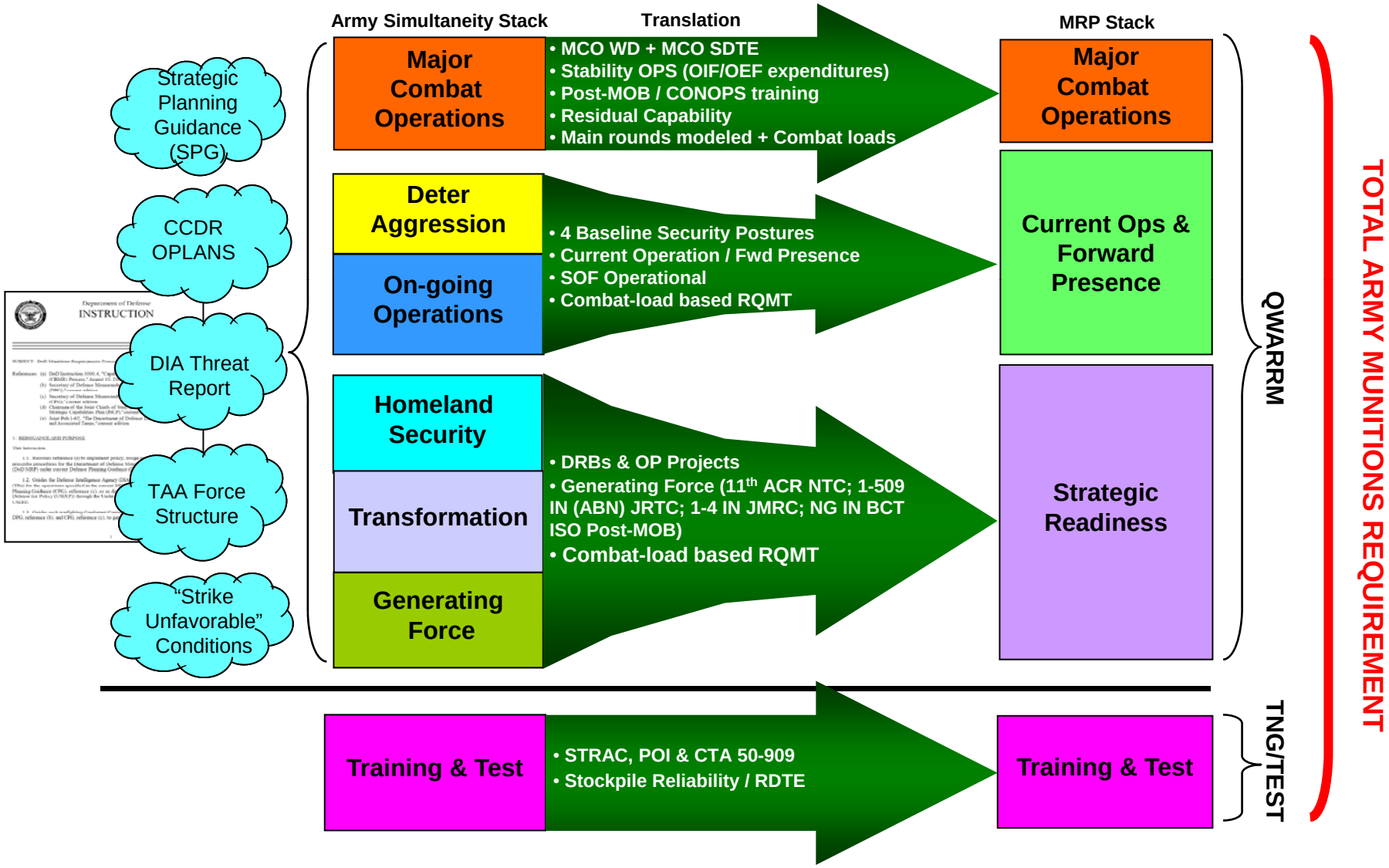
➢ The Center for Army Analysis (CAA) conducts theater-level modeling based on input from multiple sources including:

- Strategic Planning Guidance
- COCOM OPLANS
- DIA Threat reports
- Projected Force Structure
- Approved / projected munitions
- Munitions caps
- Approved Combat Loads (CL)
- Munitions / system performance data

➢ Training and test requirements are developed separately from the QWARRM process.

Total Army Munitions Requirements (TAMR)

Account for Everything; Double-count Nothing



Ongoing Actions/Initiatives

➢ Sustain the Warfight

- Transition between AOs – Changes in forces, and tactics, techniques and procedures (TTPs)
- New Munitions (UMR/FMR) – improved capabilities or ONS (eg. TOW, Spider, 5.56 LFS)
- Phase IV Ops and "Persistent Conflict" requires unique mix of munitions (demo, precision, non-lethal, etc)

➢ Manage Army Munitions Requirements and Prioritization

- Balance of Precision and Conventional Munitions – affordability/capability
- Integrating Capabilities verse Unnecessary Redundancy – Deployment of Force?
- Operational Needs Statements – Capability exist, Delivery timeframe, Enduring?
- Training Strategies - Evolving TTPs, Munitions Growth

➢ Cluster Munitions Dynamic

- Distinction between Oslo Accord and OSD Policy
- Joint Staff and TRADOC Ongoing Studies
- Balance between Precision and Area targets

➢ FY12-17 POM / TAMR

- QWARRM is our war reserve munitions requirements development process
- Developed IAW Department of Defense Instruction 3000.4, Munitions Requirement Process (MRP)
- OSD AT&L Implementation Guidance dictates Defense Planning Scenarios for use in MRP
- Training Ammunition requirements developed IAW STRAC and TRADOC POI's

Don Chrans DA G8
Programming and Budgeting

Reliable Precision Munitions- Providing the Decisive Edge on the Battlefield

Col Art "Junior" McGettrick

JCS/J-8 Force Application FCB Lead

Introduction

- **Precision munitions have proven themselves many times over on the battlefield during the past two decades**
- **Formerly used by exception, precision weapons are now the weapon of choice or a hard requirement**
- **Services and weapons developers continue to adapt munitions to meet the needs of the warfighter**
- **Effectively stating reliability requirements for these weapons early in the documentation process is vital to ensuring weapons can perform their intended mission**

Reliability impacts collateral damage, friendly fire, timely delivery of fires, and the volume of fires

Evolving Capability Challenges

- **Complex target environments**
  - Urban Environments
    - Collateral damage implications (CNN effect)
  - Hard and deeply buried targets
  - Time sensitive targets (theater and global)
  - Anti-access threats driving increased standoff ranges
  - Realistic Camouflage Concealment and Deception (CCD)
  - Mobile/re-locatable targets

- **Operational life attributes**
  - Weapons exposed to extended carriage times
    - Sustained cruise/cold soak times (internal heating, external cold)
  - Sand, dust, static discharge, moisture, open storage, vibration
  - Severe launch environment (i.e. Excalibur)

Increasing Weapon Complexity

- **Both air and surface delivered munitions have evolved on parallel paths**
  - Inertial guidance, laser guidance, imaging seeker, GPS and data-linked weapons
- **Next generation weapons combine precision delivery with:**
  - Data-links
  - Sophisticated and/or multiple sensors
  - Complex software
  - Standoff ranges and long time of flights
  - Signature reduction

Combined with challenging environmental factors

Other Considerations

- **Submunitions**
  - DoD policy requires <1% UXO from cluster producing weapons
  - What can we do to replace this required area munition capability?
- **Fuze Reliability**
  - Highly reliable fuzes
  - DoD S&T fuze effort
- **Political influence/constraints on weapons use**
  - What is the next land mine or cluster munition treaty?
- **Internal carriage constraints, collateral damage concerns, and increased range requirements driving smaller warheads**
  - Increasing requirement for precision
- **Simplicity – must be able to quickly employ in heat of battle**
  - CAS or other time-sensitive targets

Irregular warfare: Every bomb, bullet and mortar (and malfunction) can have strategic implications

Documenting Reliability in JCIDS

- **JCIDS Manual requires a Sustainment KPP (Availability) and two mandatory supporting KSAs for ACAT 1 programs**
  - **Availability (Mandatory KPP):** Two components (Materiel Availability and Operational Availability)
  - **Reliability (Mandatory KSA):** Must support the warfighting capability needed and support both Availability metrics
    - Most important measure for singe shot systems
    - Is the proposed reliability value consistent with the intended/expected operational use of the system?
    - Is the proposed reliability value consistent with the sustainment approach as presented in the operational availability metric?
    - Has the reliability metric been established at the system level?
  - **Ownership Cost (Mandatory KSA)**

For single shot systems the warfighter relies on munitions reliability to get intended effects on target

Defining and Measuring Reliability with Rigor

- **System-wide reliability metrics can mask munition reliability**
  - Reliability measures which include the supporting weapon system (platform or fire control system) often mask the capability of the munition itself (NLOS-LS)
- **Measures of Effectiveness (MOEs) can also disguise the true reliability of a weapon**
  - **Scenario Weapons Effectiveness (SWE) describes how a weapon will achieve a minimum Probability of a Single Shot Kill (PSSK) when averaged over a range of target types** (SDB-II KPP)
    - Weapons Effectiveness (WE) combines reliability, lethality and functionality (SDB-II KSA)
    - If lethality and accuracy are high, how much reliability can be traded?
  - **Missile Mission Effectiveness (MME) combines reliability, survivability and lethality** (JASSM KPP)
    - If survivability and accuracy are high, how much reliability be traded?

Multi variable MOEs can allow a weak variable to be masked

Adverse Effects of Reliability Requirements

- **Eliminating trade space drives cost and limits options/competition**
  - Producing highly reliable, low cost munitions will likely require an incremental approach
- **Reliability requirements also affect testing**
  - Integration
  - Captive carry (internal and external)
  - Number of test events
  - All drive cost/schedule

Conclusion

- **Current precision munition systems are demonstrating high reliability requirements under challenging conditions**
  - JDAM, GMLRS and Excalibur are recent examples in today's fight
- **JCIDS requirements documents must adequately address weapons reliability**
  - Must define reliability requirements early for complex weapon systems with demanding operational and test requirements
  - Precision munitions capabilities must balance requirements for both IW and high-end combat
- **Defining munitions reliability requires early and extensive collaboration between Services, JCS, OSD, acquisition and test communities**

Background

Sustainment KPP (per JCIDS Manual)

Sustainment consists of three key factors: Availability, ***Reliability***, and Ownership Cost. The Sustainment KPP (Availability) and two mandatory supporting KSAs (Reliability and Ownership Cost) will be developed for all ACAT 1 programs. For ACAT II and below programs, the sponsor will determine the applicability of the KPP. During the CBA, the relevant sustainment criteria and alternatives will be evaluated to provide the analytical foundation for the establishment of the sustainment KPP and KSAs.

(1) Additional guidance on the sustainment KPP is provided in Appendix B to this Enclosure and reference O.

(2) Exemptions. For ACAT II and below programs, the sponsor who determines the Sustainment KPP does not apply will include rationale in the CDD/CPD explaining why it is not appropriate. ***For a designated KPP to be considered as such within a CPD for a system at MS C, it must first have been required in the CDD at MS B.*** The sponsor must still identify the associated production sustainment metrics in the CPD for the system based on expected performance of the system whether the KPP existed in the CDD or not.

Availability KPP

(1) Availability will consist of two components: Materiel Availability and Operational Availability. The components provide availability percentages from a corporate, fleet-wide perspective and an operational unit level, respectively. The Operational Availability metric is an integral step to determining the fleet readiness metric expressed by Materiel Availability. The following provides guidance for development of both metrics:

(a) Materiel Availability. Materiel Availability is a measure of the percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition. This can be expressed mathematically as number of operational end items/total population. The Materiel Availability addresses the total population of end items planned for operational use, including those temporarily in a non-operational status once placed into service (such as for depot-level maintenance). The total life-cycle timeframe, from placement into operational service through the planned end of service life, must be included. This is often referred to as equipment readiness. Development of the Materiel Availability metric is a program manager responsibility.

(b) Operational Availability. Operational Availability indicates the percentage of time that a system or group of systems within a unit are operationally capable of performing an assigned mission and can be expressed as (uptime/(uptime + downtime)). Determining the optimum value for Operational Availability requires a comprehensive analysis of the system and its planned use as identified in the CONOPS, including the planned operating environment, operating tempo, reliability alternatives, maintenance approaches, and supply chain solutions. Development of the Operational Availability metric is a requirements manager responsibility.

(2) Reliability KSA. ***Reliability is a measure of the probability that the system will perform without failure over a specific interval***. Reliability must be sufficient to support the warfighting capability needed. Considerations of reliability must support both Availability metrics. Reliability may initially be expressed as a desired failure-free interval that can be converted to a failure frequency for use as a requirement (e.g., 95 percent probability of completing a 12-hour mission free from mission-degrading failure; 90 percent probability of completing 5 sorties without failure). Specific criteria for defining operating hours and failure criteria must be provided together with the Reliability. ***Single-shot systems and systems for which other units of measure are appropriate must provide supporting analysis and rationale***. Development of the Reliability metric is a requirements manager responsibility.

Reliability Review Criteria

Has the reliability metric been established at the system level? Is it traceable to the ICD, CDD, other JCIDS analysis, or other performance agreement?

Does the analysis clearly provide criteria for defining relevant failure?

Does the analysis clearly define how time intervals will be measured?

Does the analysis identify sources of baseline reliability data and any models being used? Is the proposed value consistent with comparable systems?

Is the proposed reliability value consistent with the intended operational use of the system (i.e., the CONOPs)?

Is the proposed reliability value consistent with the sustainment approach as presented in the operational availability metric?

Is the proposed reliability value consistent with the performance of existing or analogous systems?

For single-shot systems and systems for which units of measure other than time are used as the basis for measuring reliability, does the package clearly define the units, method of measuring or counting, and the associated rationale?