



Armaments Technology Seminar & Exhibition

“ Joint Munitions and Lethality Life Cycle Management Command”

Parsippany, NJ

11-13 June 2007

Table of Contents

AGENDA

Tuesday, 12 June 2007

Welcome Address & JM&L LCMC Brief - *BG William N. Phillips, USA, Commanding General, Picatinny Arsenal, Program Executive Officer*

ARDEC Technology Overview - *Mr. Patrick Seroa, Senior Technical Executive, Armament Systems Integration Center, ARDEC*

Joint Munitions Command Overview - *BG James Rogers, USA, Commander, Joint Munitions Command*

ARDEC's LEAN Six-Sigma Program - *Mr. Paul Chiodo, Director QESA, ARDEC*

Industry Perspective on JM&L LCMC - *Mr. Tim Bagniefski, Vice President for Business Development, GD-OTS*

Lethality R & D Overview - *Ms. Barbara Machak, Associate Director for Systems Concepts and Technology, ARDEC*

Towed Artillery Digitization - *Mr. Harvey Goldman, Deputy PM, Towed Artillery Digitization*

Arming Robotic Systems - *Ms. Kim Jones*

Scorpion Program - *Dr. Peter Plostins, Supervisory Aerospace Engineer, US Army Research Laboratory*

Army EM Gun Program - *Mr. Harry Fair, Director Institute for Advanced Technology University of Texas*

Integrated Technology Transition - *Ms. Vickie Williams, NSWCC Crane*

Wednesday, 13 June 2007

Rapid Fielding for Coalition Forces - *Mr. Lu Ting, International Office, US Army ARDEC*

Ground Vehicle Systems Modernization - *Mr. Kevin Fahey, PEO GCS*

Mr. Dennis Carroll, Vice President, Business Development, Raytheon

Ms. Karen Davies, ATK LCAAP

CCS Technology Programs - *Mr. Ross Benjamin, PM CCS*

CAS Technology Programs - *COL Ole Knudsen, USA, PM CAS*

Solider Weapons Modernization - *COL Carl Lipsit, USA, Project Manager Solider Weapons, PEO Solider*

Armaments Technology Firepower
Symposium & Exhibition

Armaments Technology - Focusing on “Joint Munitions and Lethality Life Cycle Management Command”



Symposium Agenda



Hilton Parsippany ~ Parsippany, NJ
June 11 - 13, 2007
Event #7600

conference description

The **Army** recently established the Joint Munitions and Lethality Life-Cycle Management Command at Picatinny Arsenal which brings together the three branches of the Armament Development Community (Acquisition, Research and Development, Logistics and Sustainment) into one **Powerful** organization. The synergy of the three organizations, working as a unified command, will enhance the Army's development of armaments by ensuring that all stages of the life-cycle are addressed when fielded. The Symposium seeks to give the entire armaments community an overview of what benefits the formation of the JM&L LCMC will provide, as well as how the new Command is positioned in the overall Army support to the **Warfighter** through quality lethal systems.

who Should Attend

The Armaments and Technology Firepower Symposium & Exhibition is targeting the weapons and ammunition research, development and acquisition communities and will attempt to tie in the end user with both government and industry personnel to discuss future needs and current programs.

benefits of Attending

Symposium attendees will get a direct perspective on the future direction of DoD lethality and better understand the exciting new command that is enhancing the way armament systems are developed and supported.

"The Department of Defense finds this event meets the minimum regulatory standards for attendance by DoD employees. This finding does not constitute a blanket approval or endorsement for attendance. Individual DoD component commands or organizations are responsible for approving attendance of its DoD employees based on mission requirements and DoD regulations."

hotel information



Hilton Parsippany
One Hilton Court
Parsippany, NJ 07054
(973) 267-7373
(877) 671-5746
Fax: (973) 984-2896

For Double/Single Occupancy
Government Rate: \$121.00*
Industry Rate: \$172.00

A block of rooms have been reserved at the Hilton Parsippany. Please call the hotel directly in order to make your reservation. In order to ensure the discounted NDIA rate, you must make your reservations early and ask for the NDIA room block. Rooms will not be held after May 20, 2007, and may sell out before then. Rates are also subject to increase after this date. The government per diem rate is available only to active duty or civilian government employees. ID will be required upon check-in. Retired military ID's do not qualify for the government per diem rate.

* or current government per diem rate at the time of the Symposium.

registration fees

Registration Dates	Early (Before 5/1/07)	Regular From 5/1/07 to 6/1/07)	Late (After 6/1/07)
Government/ Allied/ Academia	\$450	\$500	\$550
Industry NDIA Member Non-NDIA Member	\$650 \$700	\$715 \$775	\$790 \$850

Registration Information: To register online for this Symposium, please visit the following link: <http://www.ndia.org/meetings/7600>. Online registration will close after June 1, 2007. You must register onsite after this date. You can also download the registration form from the NDIA website or complete the form contained in this brochure. Fax the completed form to (703) 522-1885 or mail to: Event #7600, National Defense Industrial Association, 2111 Wilson Boulevard, Suite 400, Arlington, VA 22201-3061. Please do not fax or mail registration forms after June 1, 2007. You will need to register onsite after this date. Payment must be made at the time of registration. Registrations will not be taken over the phone.

CANCELLATIONS REMINDER: Cancellations received before May 1, 2007 will receive a full refund. Cancellations received from May 2, 2006 until June 1, 2007 will receive a refund minus a cancellation fee of \$75.00. REFUNDS WILL NOT BE GIVEN FOR CANCELLATIONS RECEIVED AFTER JUNE 1, 2007. Substitutions are welcome in lieu of cancellations.

Symposium information

Identification Badges: During Symposium registration and check-in, each participant will be issued an identification badge. Please be prepared to present a picture ID. Badges must be worn at all Symposium functions.

Proceedings: Proceedings will be available on the web through the Defense Technical Information Center (DTIC) one to two weeks after the Symposium. You will receive notification via e-mail when proceedings are posted and available on the web.

Promotional Partnership Opportunities: Increase your company or organization's exposure at this premier event by becoming a Promotional Partner. A Promotional Partnership will add your company name on the on-site brochure as well as main platform recognition throughout the Symposium, signage at all events including the opening reception, a 350-word organization description in the on-site brochure, and a hotlink from the Symposium webpage to your company website. For more information, please contact Sam Campagna at (703) 247-2544 or scampagna@ndia.org.

Attire: Appropriate dress for this Symposium is business casual for civilians and Uniform of the Day for military.

ADA: NDIA supports the Americans with Disabilities Act of 1990. Attendees with special needs should call (703)522-1820 and refer to Event #7600 prior to June 1, 2007.

National Defense Magazine: Advertise in National Defense and increase your company's exposure at this Symposium! National Defense will be distributed to the attendees of this Symposium and all other NDIA Symposiums. For more information, please contact Dino Pignotti at (703) 247-2541 or via email at dipignotti@ndia.org.

Inquiries: For questions regarding the Symposium, please contact Britt Bommelje, CMP, Associate Director, Operations at (703) 247-2587 or at bbommelje@ndia.org. For questions regarding Exhibits, please direct your questions to Alden Davidson, Exhibits & Sponsorship Manager at (703) 247-2582 or adavidson@ndia.org.

For more information on the Symposium, or to register online, please visit the Symposium website at: www.ndia.org/meetings/7600.

Symposium agenda

Monday, June 11, 2007

10:00am - 4:00pm

Exhibitor Move-In

10:00pm - 5:00pm

Registration

5:00pm - 6:00pm

Evening Reception in Exhibit Area

Tuesday, June 12, 2007

7:00am

Registration & Continental Breakfast

7:55am - 8:00am

Administrative Remarks

- *Mr. Sam Campagna, Director, Operations, NDIA*

8:00am - 8:30am

Welcome Address & JM&L LCMC Brief

- *BG William N. Phillips, USA, Perspective*

Commanding General, Picatinny Arsenal, Program

Executive Officer

8:30am - 9:00am

ARDEC Technology Overview

- *Dr. Joseph Lannon, Director, ARDEC*

9:00am - 9:30am

PEO Ammo Role in JM&L LCMC

- **Mr. Jim Sutton, Deputy Program Executive Officer,**
PEO Ammo (Invited)

9:30am - 10:00am

Joint Munitions Command Overview

- *BG James Rogers, USA, Commander, Joint
Munitions Command*

10:00am - 10:30am

Morning Break in Exhibits Area

10:30am - 11:00am

ARDEC's LEAN Six-Sigma Program

- *Mr. Paul Chiodo, Director QESA, ARDEC (Invited)*

11:00am - 11:30am

Industry Perspective on JM&L LCMC
GDOTS (TBD)

11:30am - 12:15pm

LCMC Vision

- *TDB*

12:15PM - 1:30PM

Luncheon

1:30pm - 2:00pm	Lethality R & D Overview - Ms. Barbara Machak, Associate Director for Systems Concepts and Technology, ARDEC
2:00pm - 2:30pm	Towed Artillery Digitization - Mr. Harvey Goldman, Deputy PM, Towed Artillery Digitization
2:30pm - 3:00pm	Arming Robotic Systems - Mr. Leon Manole, Mechanical Engineer, ARDEC

3:00pm - 3:30pm	Afternoon Break in Exhibit Area

3:30pm - 4:00pm	Scorpion Program - Mr. Peter Plostins, Supervisory Aerospace Engineer, US Army Research Laboratory
4:00pm - 4:30pm	Army EM Gun Program - Mr. Harry Fair, Director Institute for Advanced Technology University of Texas (Invited)
4:30pm - 5:00pm	Future Naval Capabilities - Ms. Vickie Williams, NSWC Crane (Invited)
5:00pm - 6:00pm	Reception in Exhibits Area
6:00pm	Conference Adjourns for the Day

Wednesday, June 13, 2007

7:00am	Registration & Continental Breakfast
8:00am - 8:30am	Naval Lethality Programs - TBD
8:30am - 9:00am	Ground Vehicle Systems Modernization - Mr. Kevin Fahey, PEO GCS, (Invited)
9:00am - 9:30am	Army Sustainment Command Vision - Mr. C. Redding Hobby, III, ASC G3/G4 (Invited)
9:30am - 10:00am	Future Threats and Solutions - LTC (P) Keith Edwards, USA, TRADOC Futures Center (Invited)

10:00am - 10:30am	Morning Break in the Exhibit Area

10:30am - 11:00am	Industry Briefer

11:00am - 11:30am	ARDEC Systems Engineering Initiative - Dr. Dinesh Verma, Stevens Institute (Invited)
11:30am - 12:00pm	ATK Brief (TBD)
12:00pm - 1:00pm	Luncheon
1:00pm - 1:30pm	PM CCS Technology Programs - COL John Koster, USA PM CCS (Invited)
1:30pm - 2:00pm	PM CAS Technology Programs - COL Ole Knudsen, USA, PM CAS (Invited)
2:00pm - 2:30pm	PM MAS Technology Programs - Mr. William Zanville, Deputy Program Manager, Maneuver Ammunition Systems
2:30pm - 3:00pm	Afternoon Break in Exhibits Area
3:00pm - 3:30pm	PM Solider Weapons Modernization - COL Carl Lipsit, USA, Project Manager Solider Weapons, POE Solider (Invited)
3:30pm - 4:00pm	PM Joint Services Mission - COL Andre Kirnes, USA, Program Director Joint Services, US Department of the Army (Invited)
4:00pm	Conference Adjourns



CH-47 Chinook Helicopter, Operation Swarmer, Iraq

exhibits information

NDIA invites you to exhibit at the Armaments Technology Firepower Symposium & Exhibition. The Symposium will examine the technological thrust of the US Joint Services and principal Allies towards enhancing capabilities in support of current and future military operations. The Symposium will focus on the joint munitions and lethality life cycle management command and ARDEC engineering issues.

Cost to Exhibit:

- Exhibit fees are \$2,300 for each 8' x 10' booth space for Corporate Members and Bona-fide government agencies
- Exhibit Fees are \$2,800 for each 8' x 10' booth space for Non-Corporate Members

Exhibit Rate includes:

- Networking social functions in the exhibit area
- Two full conference registrations
- Conference attendee list
- Standard booth package of: side and back drape and company ID sign
- 24-hour security

Exhibit Personnel Registration:

For each exhibit space that your company occupies at this year's event, your organization will be entitled to 2 complimentary full Symposium registrations.

Complimentary badges must be assigned online before June 4, 2007. After June 4, any unused complimentary badges not assigned will be converted to regular attendee registration and will be available at the onsite rate of \$450.00 each. After your allotment of two badges per 100 square feet is filled, you must register all additional personnel as conference attendees, at Symposium attendee rates.

After June 4th, you cannot transfer attendee registrations to unused exhibitor registrations.

To register your exhibit staff, go to the "Manage Badges" section of your account. You will need the login name and password that you received when the booth was originally purchased. If you have questions about logging into your account, your user name or password, please contact Alden Davidson, Exhibits and Sponsorship Manager at adavidson@ndia.org or (703) 247-2582.

Exhibit Hours:*

*This schedule is subject to change

Exhibits Move-In

June 11, 2006: 10:00am - 4:00pm

~Exhibitors must be set up by 4 pm, June 11~

Exhibits Open

June 11, 2006: 5:00pm - 6:00pm Reception

June 12, 2006: 7:00am - 6:00pm

(Reception 5:00pm - 6:00pm)

June 13, 2006: 7:00am - 3:00pm

Exhibitor Move-Out

June 13, 2006: 3:00pm - 7:00pm

Membership Discount:

To qualify for the member rate on booths, you have to join NDIA as a Corporate Member. Please contact Elaine Kash at ekash@ndia.org or (703) 247-2566 for membership information.

Payment Information:

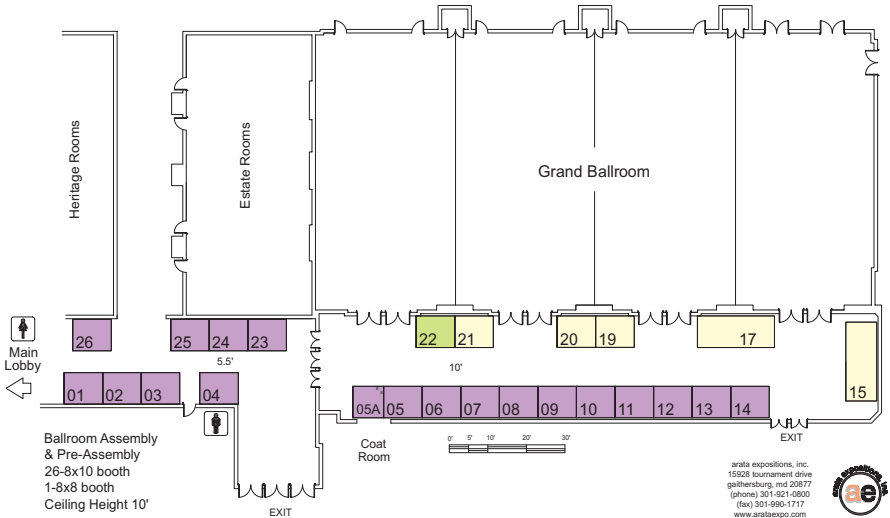
Please make checks Payable to NDIA, Event #7600. Mail Checks to: NDIA, Event#7600, Attn: Alden Davidson, Exhibits and Sponsorship Manager, 2111 Wilson Blvd., Suite 400, Arlington, VA 22201. To ensure that your payment is applied to the proper account, please make sure you include the event number on your check!

Decorator Information:

The official decorator of the show is Arata Exposition, Inc. The Exhibitor Service Kit will be mailed to the Exhibitor Point of Contact 60-90 days prior to the show. You can also download the complete service kit at www.arataexpo.com. If you have any questions regarding your decorating needs, please call the decorator at (407) 422-3636.

Please remember to submit all the appropriate paperwork and payment information early so you can take advantage of any discounts. If you have any questions regarding electricity, internet connections, etc, please contact the appropriate vendor found in the service kit.

Armaments Technology Firepower Symposium & Exhibition
June, 2007
Hilton Parsippany
Parsippany, New Jersey



exhibitors registered

As of April 5, 2007

COMPANY NAME	BOOTH #
AAI Corporation	20
ATK	17
General Dynamics-OTS	15
Mechanical Solutions, Inc.	21
Textron Systems	19



*Picatinny Chapter 32nd Annual Firepower Benefit
Registration Form
14 June 2007*

☐ Government ☐ Industry: (Company Name) _____

POC: _____

Telephone: _____ Fax: _____

Email address: _____

Banquet Participation - Birchwood Manor, Whippany, NJ

6:00P Cocktails 7:00P Banquet/Raffle

_____ of tables requested @ \$900 = \$ _____ (9 seats per table)

_____ of individual seats @ \$90 = \$ _____

VIP Tables - For each table purchased please clearly print the name & title of the corporate senior representative (President, CEO, Vice President, etc.) joining us for the Benefit Banquet.

1. _____
2. _____
3. _____
4. _____

☐ **Golf Participation** - Farmstead Golf & Country Club, Lafayette, NJ
<http://www.farmsteadgolf.com> 7:00A Registration / 8:00A Shotgun Start (includes breakfast, lunch, cart, greens fees and goodie bag)

1. _____	Total # of golfers _____
2. _____	@ \$100/p = \$ _____
3. _____	
4. _____	

(Please list your intended foursome; if you are single we'll be happy to match you!)

☐ **Trap/Skeet Participation** - Thunder Mountain Trap & Skeet, Ringwood, NJ
<http://www.claytargetsonline.com> 8:30A Registration / 9:00A Start (includes breakfast, lunch, ammunition and goodie bag)

1. _____	Total # of Shooters _____
2. _____	@ \$100/p = \$ _____
3. _____	
4. _____	

Payment Options

☐ Check payable to Picatinny Chapter, NDIA

☐ Credit Card number _____ Exp. Date _____

Accepting Visa *Master Card *American Express only

Name as it appears on the card _____

Any questions regarding registration for the 32nd Annual Firepower Benefit, please contact:

Jane Smith VP Firepower

Phone (973) 442-6412 ✧ Fax (973) 442-6406 ✧ jane.l.smith@us.army.mil

FPB07 c/o UTRS ✧ 3159 Schrader Road, Ste 137 ✧ Dover, NJ 07801

Armaments Technology Firepower Symposium & Exhibition

"Joint Munitions and Lethality Life Cycle"
Hilton Parsippany • Parsippany, NJ
June 11-13, 2007 • Event #7600

National Defense Industrial Association
2111 Wilson Boulevard, Suite 400
Arlington, VA 22201-3061
(703) 522-1820 • (703) 522-1885 fax
www.ndia.org



3

- Ways to sign up:
1. Online with a credit card at www.ndia.org
 2. By fax with a credit card — Fax: 703-522-1885
 3. By mail with a check or credit card

☐ Address change needed

By completing the following, you help us understand who is attending our meetings.

NDIA Master ID/Membership # _____ Social Security # _____
(if known—hint: on mailing label above your name) (last 4 digits – optional)

Prefix _____
(e.g. RADM, COL, Mr., Ms., Dr., etc.)

Name First _____ MI _____ Last _____

Military Affiliation _____ Nickname _____
(e.g. USMC, USA (Ret.) etc.) (for Meeting Badges)

Title _____

Organization _____

Street Address _____

Address (Suite, PO Box, Mail Stop, Building, etc.) _____

City _____ State _____ Zip _____ Country _____

Phone _____ ext. _____ Fax _____

E-Mail _____

Signature* _____ Date _____

Preferred way to receive information

Conference information ☐ address above ☐ Alternate (print address below) ☐ E-mail

Subscriptions ☐ address above ☐ Alternate (print address below)

Alternate Street Address _____

Alternate Address (Suite, PO Box, Mail Stop, Building, etc.) _____

City _____ State _____ Zip _____ Country _____

* By your signature above you consent to receive communications sent by or on behalf of NDIA, its Chapters, Divisions and affiliates (NTSA, AFEI, PSA, NCWG, WID) via regular mail, e-mail, telephone, or fax. NDIA, its Chapters, Divisions and affiliates do not sell data to vendors or other companies.

Primary Occupational Classification. Check ONE.

- ☐ A. Defense Business/Industry
☐ B. R&D/Laboratories
☐ C. Army
☐ D. Navy
☐ E. Air Force
☐ F. Marine Corps
☐ G. Coast Guard
☐ H. DOD/MOD Civilian
☐ I. Gov't Civilian (Non-DOD/MOD)
☐ J. Trade/Professional Assn.
☐ K. Educator/Academia
☐ L. Professional Services
☐ M. Non-Defense Business
☐ N. Other _____

Current Job/Title/Position. Check ONE.

- ☐ A. Senior Executive
☐ B. Executive
☐ C. Manager
☐ D. Engineer/Scientist
☐ E. Professor/Instructor/Librarian
☐ F. Ambassador/Attaché
☐ G. Legislator/Legislative Aide
☐ H. General/Admiral
☐ I. Colonel/Navy Captain
☐ J. Lieutenant Colonel/Commander/Major/Lieutenant Commander
☐ K. Captain/Lieutenant/Ensign
☐ L. Enlisted Military
☐ O. Other _____

Year of birth _____
(Optional)

Registration Fees

	Early (Before 5/1/07)	Regular (From 5/1/07 to 6/1/07)	Late (After 6/1/07)
Government/ Academia/Allied:	☐ \$450	☐ \$500	☐ \$550
Industry NDIA Member:	☐ \$650	☐ \$715	☐ \$790
Industry Non-NDIA Member:	☐ \$700	☐ \$775	☐ \$850

Cancellations received before May 1, 2007 will receive a full refund.
Cancellations received from May 1, 2007 to June 1, 2007 will receive a refund minus a cancellation fee of \$75. No refunds for cancellations received after June 1, 2007. **Substitutions are welcome in lieu of cancellations.**

Questions? Contact Meeting Planner, Britt Bommelle

(703) 247-2587
email: bbommelle@ndia.org

Mail to: NDIA, Event #7600
2111 Wilson Boulevard, Suite 400
Arlington, VA 22201

Fax to: (703) 522-1885

Payment Options

☐ Check (payable to NDIA - 7600)

☐ Cash

☐ Government PO/Training Form # _____

☐ VISA

☐ MasterCard

☐ American Express

☐ Diners Club

If paying by credit card, you may return by fax to (703) 522-1885.

Credit Card Number

Exp. date

 /

Signature _____

Date _____



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Suite 400
Arlington, Virginia 22201
www.ndia.org

Armaments Technology Firepower Symposium & Exhibition
Armaments Technology - "Joint Munitions and Lethality Life Cycle"
June 11-13, 2007



Industry Perspective on the Joint Munitions and Lethality Life Cycle Management Command

Armaments Technology Firepower
Symposium & Exhibition

June 12, 2007

Historical Underpinnings



IOC
ARDEC



Army FSC

2000



PEO-Ammunition
ARDEC

PEO, Armaments

1990

OSC

JMC

2007

JM&L LCMC
ARDEC

TRIAD

TACOM-ARDEC

GCSS



Change Has Been Constant



- Right solution – finally !
- Common voice for ammunition issues
- Increased visibility - standing
- Cohesive consolidation of responsibilities

**The new JM&L LCMC
checks a lot of boxes**

**Addresses critical issues that have historically plagued
the US munitions enterprise**

What We Know



- The JM&L LCMC is designed to address the entire life cycle management of munitions
- Integrates primary functional responsibilities
 - Logistics, Acquisition, R&D
- Optimizes managerial span of control
- Provides holistic approach to future defense readiness
- Balances individual authorities and interests

+

+

+

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+ / -

What We Think We Know



- More prominent and effective SMCA role
- Critical mass to execute long-term strategies
- No “Sea Change” in organizational responsibilities
- Improved communications with industry
- More wherewithal to drive jointness
- Consistent priorities



Way Forward



Industry is hopeful of continuing down this path of success . . .

- Operational continuity
 - Timing
 - Transitions / hand-off of responsibilities
- Continued partnering / dialogue with industry
- Defense of ammunition budgets
- Fostering of USG-Industry trade organizations
- Alignment of existing / new priorities
- Industrial base focus & strategies



How can industry work with the JM&L LCMC to confront the future challenges that face our munitions enterprise?

- What role will industry play in framing future JM&L strategies aimed at:
 - Ensuring a “soft landing”
 - Optimizing Industrial Readiness
- Future viability of the commercial supplier base
 - Prevailing market conditions in a draw-down environment ?
- Consistent acquisition strategies and practices
 - Balanced protection mechanisms (commodity fluctuations, un-defined reqmts)
 - Industrial base impacts – ingrained into acquisition strategies
- Fielding timelines
 - Affordable and timely fielding of precision munitions

Summary



- Industry overwhelmingly supports and embraces new JM&L LCMC
- Significant expectations
- Positive change is envisioned
- Partnership between Industry and the JM&L LCMC is an imperative

The US Ammunition Enterprise has undergone continual evolution since the 1980s – the new JM&L LCMC is the right answer . . .

What can industry do to assist in the success of the JM&L LCMC?

Systems and Enterprises: Education & Research

ARDEC Systems Engineering Initiative

Dr. Anthony Barrese

Distinguished Service Professor

Director of the Global Institute for Systems Engineering, Architecting, and Test

School of Systems and Enterprises

Stevens Institute of Technology, USA



**Systems Engineering Program
at
Stevens Institute of Technology**

- **Program Launched in 2000**
- **Within Schaefer School of Engineering.**
- **Systems Engineering and Engineering Management Department**

Systems Engineering at Stevens

- ❖ **First course taught in April of 2001**

- **10 participants sponsored by OSD - from across the various DoD components.**
- **10 participants sponsored by Lockheed Martin MS2.**

- ❖ **Since this first course:**

- **Program has evolved into one of the largest Systems Engineering Programs in the United States**
 - ✓ **Over 400 graduate students**
 - ✓ **Approximately 50 doctoral students**
- **Within the US government, Stevens has been chosen as the exclusive provider of SE education within the National Security Agency (NSA), FAA, and NASA. Many such agreements also exist with our industrial partners.**

Systems Engineering Program at Stevens Institute of Technology

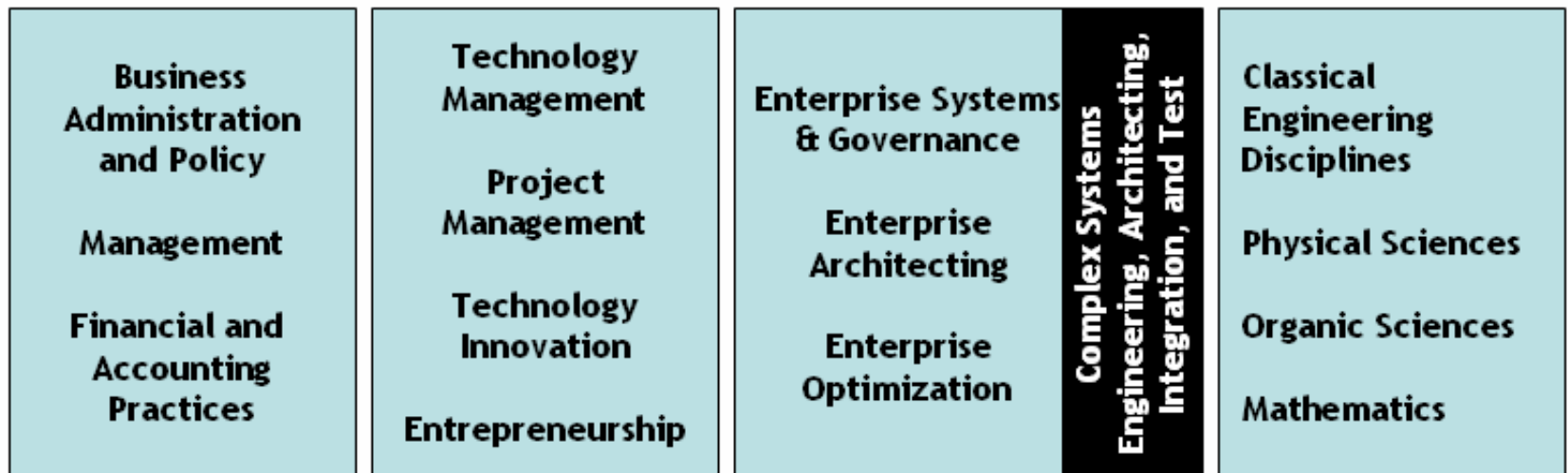
- Program Launched in 2000
- Within Schaefer School of Engineering.
- Systems Engineering and Engineering Management Department
- **New School of Systems and Enterprises launched on March 12, 2007.**

School of Systems and Enterprises: Positioning

Business, Management, and
Policy Foundations,
Principles, and Practices



Physical and Organic Sciences,
Traditional Engineering Disciplines,
Mathematics: Foundations and Principles

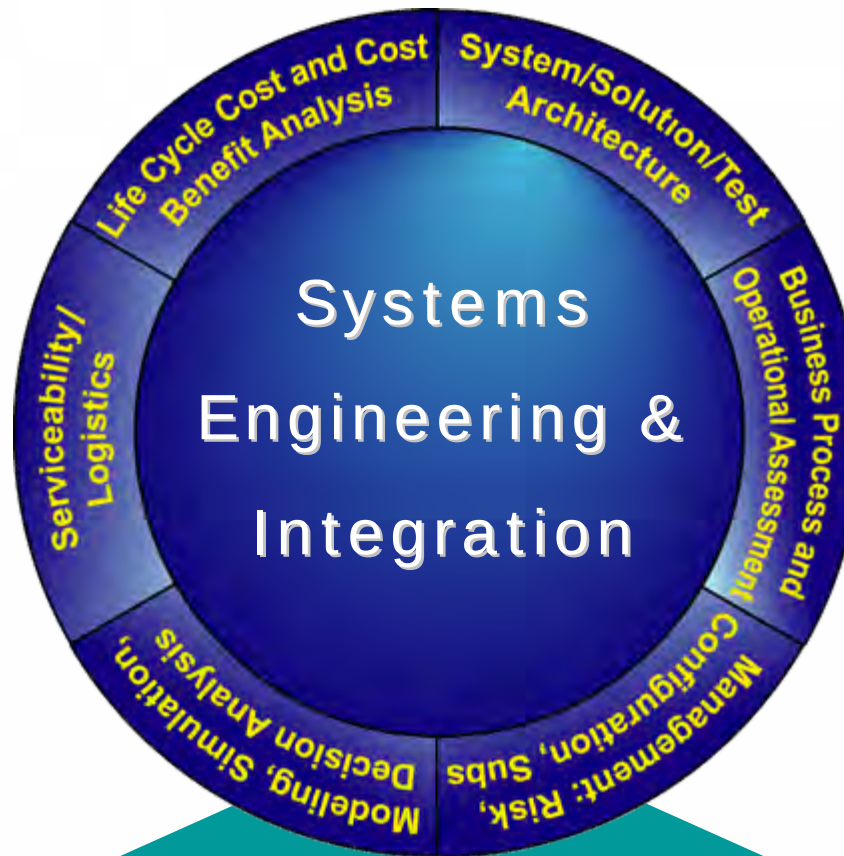


**Emphasis of the
School of Systems and Enterprises**



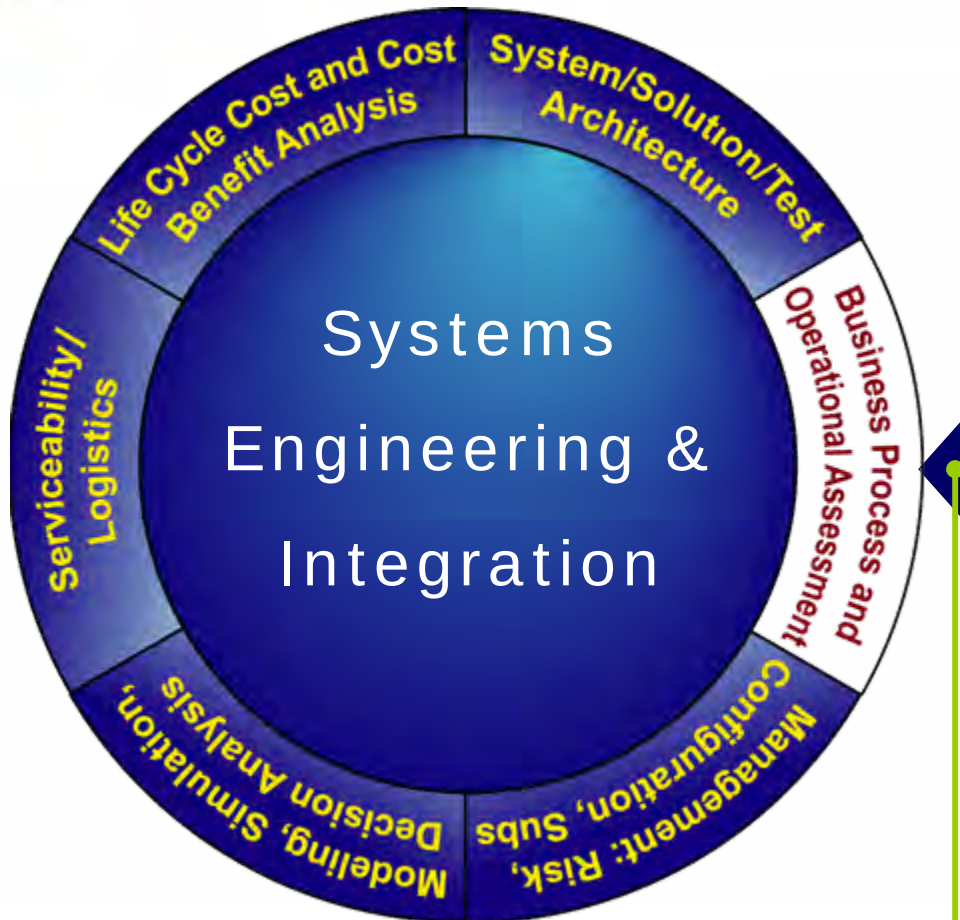
Emphasis on “complete life-cycle” of complex systems resulted in our curriculum “architecture”...

Systems Engineering and Integration: Curriculum Architecture



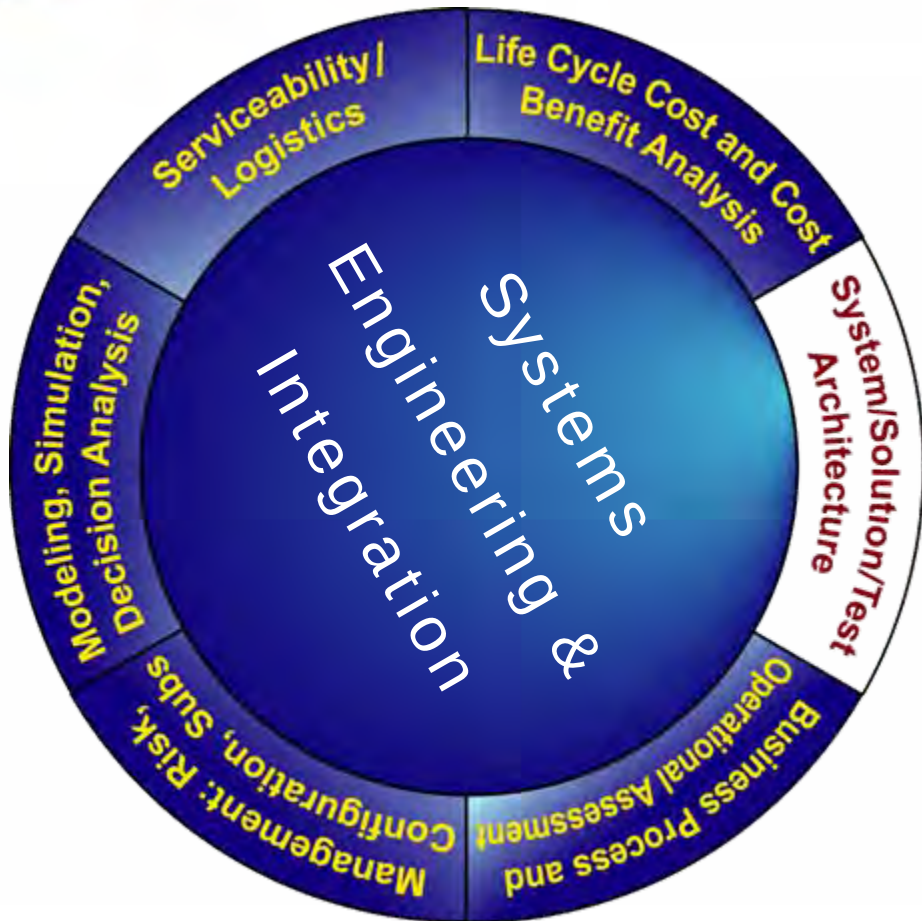
**Supported by Mature and Proven Methods,
Metrics, Tools and Templates for Low Risk and
Efficient Implementation**

Systems Engineering and Integration: Business Process and Operational Assessment



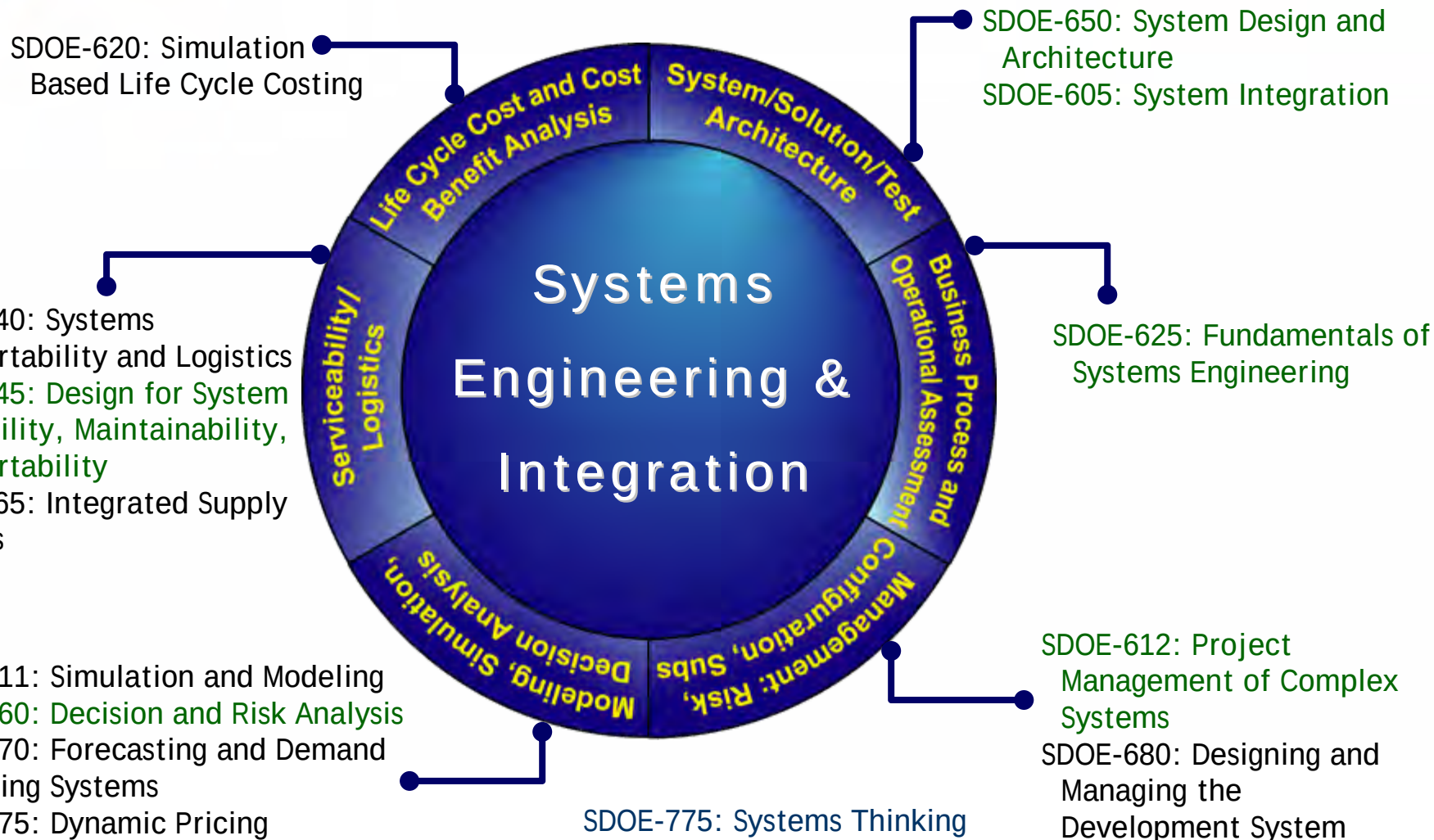
- Support Customers/Stakeholders in Identification of Business & Operational Shortfalls
 - Elicit, Gather, & Confirm Business and Mission Intent and Requirements
- Translate Shortfalls (Business and Mission Requirements) into Solution/System Requirements
- Generate, assess, and evaluate system concepts and technologies
- Identify and Manage System Operational, Functional and Operational Baselines
- Identify what is Achievable within the Cost and Schedule Envelope

Systems Engineering and Integration: System/Test/Solution Architecture



- Identify Preferred Implementation Approach
 - Implementation Approach Trade-Offs vis-à-vis Business/Mission Requirements
- Develop System, Solution and Test Architectures
 - Adhere Guidelines to Ensure Scalability, Modularity, and Future Upgrades and Enhancements
 - Adhere to Consistency with OMI & System Management
 - Adhere to Consistent Testing, Validation & Verification Approach
- Determine and Manage Impact to Currently Fielded Solutions

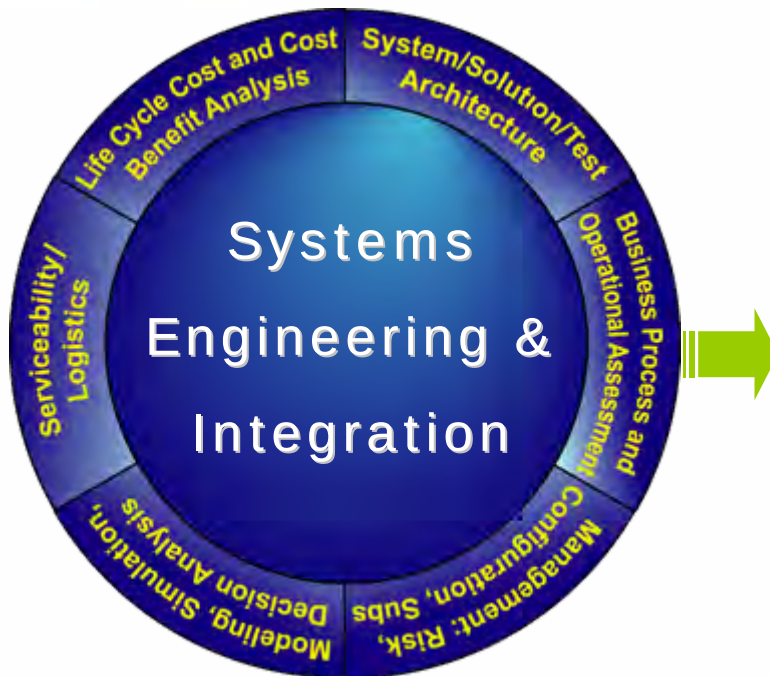
Systems Engineering and Integration: Evolving Portfolio of Courses



Leading to a Coherent Programmatic Structure

Doctoral Degree in Systems Engineering

Masters Degree in Systems Engineering



Systems
Engineering &
Architecting

Systems and
Supportability
Engineering

Systems
Engineering
Management

Engineering
Management

Graduate Certificate Programs

**This has been recognized
by our sponsors...**

Systems Engineering and Enterprises at Stevens Institute of Technology

Doctoral Degree (60 additional credits, after a Master's Degree)

Master's Degree (30 credits)

Core course requirements must be satisfied along the way towards a Master's Degree:

ALL students must take:

SYS/SDOE 625: Fundamentals of Systems Engineering
SYS/SDOE 650: System Architecture and Design

PLUS →

PLUS, two of the following five options:

SYS/SDOE 611: Modeling and Simulation or SYS/SDOE 670 Forecasting & Demand Modeling Systems
EM/SDOE 612: Project Management of Complex Systems
SYS/SDOE 660: Decision and Risk Analysis or SYS/SDOE 675 Dynamic Pricing Systems
SYS/SDOE 605: Systems Integration
ES/SDOE 675: Systems Thinking or ES/SDOE 678 Engineering of Agile Systems and Enterprises

At least 3 credits must be applied towards a project (SYS/SDOE 800), or 6 credits towards a thesis (SYS/SDOE 900).
Multiple choices of electives exist. Selections must be approved and coordinated with the faculty advisor.

Graduate Certificate – Focus Areas (12 credits or 4 courses)

Agile Systems & Enterprises

ES/SDOE 675: Systems Thinking
ES/SDOE 678: Engineering of Agile Systems and Enterprises
ES/SDOE 679: Architecting the Extended Enterprise
ES/SDOE 683: Design of Agile Systems and Enterprises

Systems Engineering & Architecting

SYS/SDOE 625: Fundamentals of Systems Engineering
SYS/SDOE 650: System Architecture and Design
EM/SDOE 612: Management of Complex Systems
SYS/SDOE 605: Systems Integration

Systems & Supportability Engineering

SYS/SDOE 625: Fundamentals of Systems Engineering
SYS/SDOE 650: System Architecture & Design
SYS/SDOE 645: Design for System Reliability, Maintainability, & Supportability
SYS/SDOE 640: System Supportability & Logistics

Systems Engineering Management

EM/SDOE 612: Project Management of Complex Systems
SYS/SDOE 625: Fundamentals of Systems Engineering
SYS/SDOE 660: Decision & Risk Analysis
EM/SDOE 680: Designing & Managing the Development Enterprise

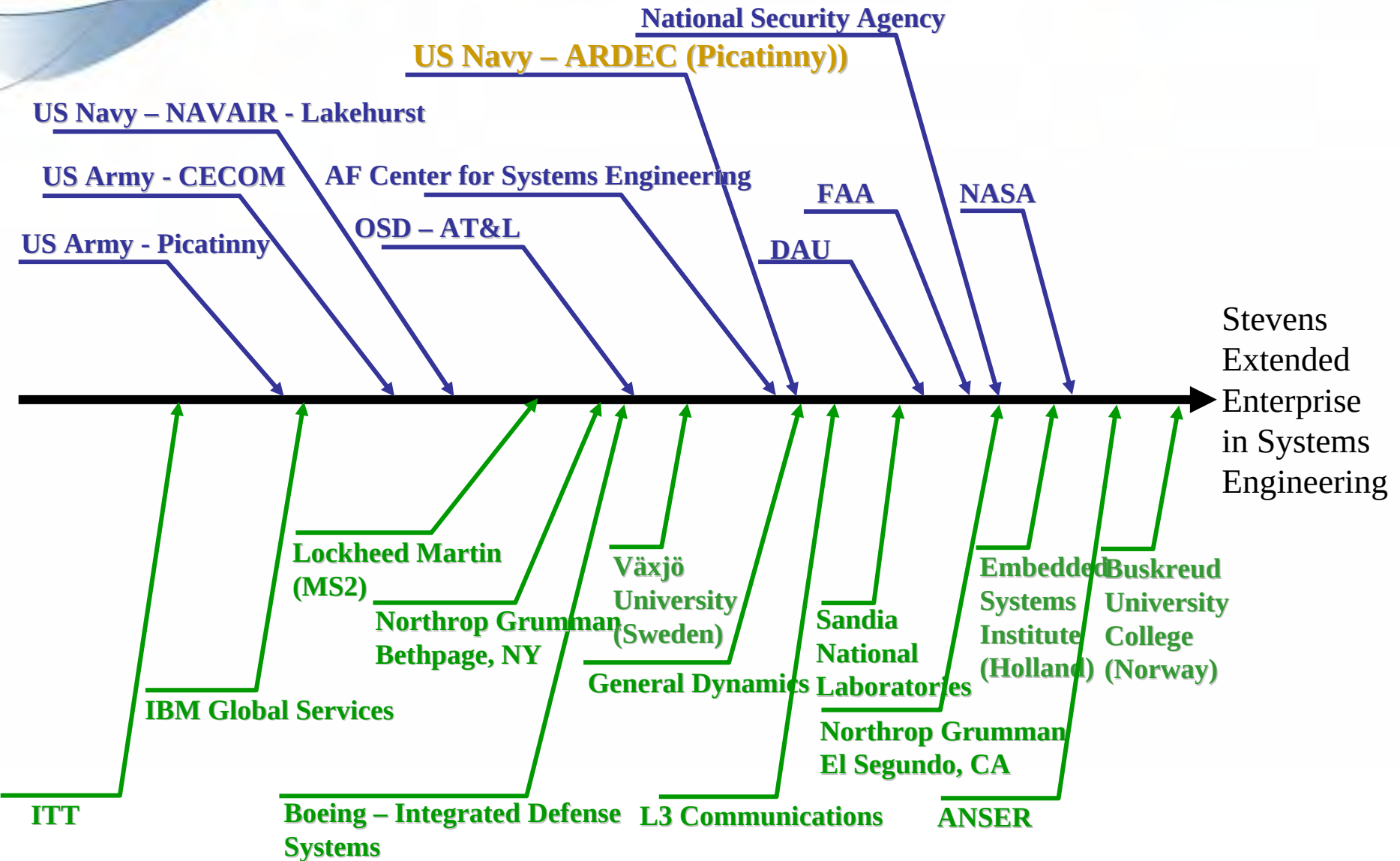
Logistics & Supply Chain Analysis

EM/SDOE 685: Integrated Supply Chain Management
SYS/SDOE 670: Forecasting & Demand Modeling Systems
SYS/SDOE 675: Dynamic Pricing Systems
SYS/SDOE 640: System Supportability and Logistics

Enterprise Architecture & Governance

ES/SDOE 679: Architecting the Extended Enterprise
ES/SDOE 678: Engineering of Agile Systems and Enterprises
SYS/SDOE 681: Dynamic Modeling of Systems & Enterprises
ES/SDOE 677: Enterprise & Organizational Governance

- 
- ❖ **Open Academic Model** in the spirit of the Technogenesis Initiative at Stevens Institute of Technology
 - To blur the boundary between Academia, Industry, and Government; To conduct academically rigorous yet industrially relevant research and education
- A collaborative culture is an underlying philosophical anchor...**





US Army ARDEC Stevens Institute of Technology

- Collaborating on System Engineering Competency Development since FY'04
- Research
- Methodologies & Tools
- Training



US Army ARDEC

Stevens Institute of Technology

Systems Engineering Competency Development

- Training Development & Delivery
 - Systems Engineering Lead Training
 - System Engineering Overview Training for Non-practitioners
- ARDEC Systems Engineering Process Workshops
 - Requirements Management
- ARDEC Systems Engineering Process Development
 - SEP Guidance & Template Update Support
 - System Engineering Process Document Peer Reviews

A stylized world map is positioned in the top right corner of the slide. It is a light blue and white graphic showing the continents and major lines of latitude and longitude. The map is partially obscured by the blue wavy lines that sweep across the top of the slide.

US Army ARDEC Stevens Institute of Technology Systems Engineering Competency Development

- System Engineering Maturity Metrics
 - System Maturity Forecasting
 - Lean System Integration
- Community of Best Practices
 - SE Fellowship Program
 - Research Knowledge into Practice Programs

An Education and Research Initiative that...

- **Is Limited to the United States in terms of** << case studies, professors, students & sponsors and partners & course delivery >>
- Is Limited to a single (or limited number) of market domains;
- Does not leverage “departments within the university systems”, and even other universities...
Is by definition, sub-optimal for its stakeholders...

We must be willing to “Cross the Boundaries” at all levels of abstraction... The OPEN ACADEMIC MODEL – Knowledge Creation and Management through Practice, Research and Education...

The NOKIA Architect Program

Overview

The NOKIA Architect Program is a collaborative partnership between NOKIA and Stevens Institute of Technology, created to develop and enhance the architectural culture within NOKIA. The program is conducted over a twelve month period and builds architectural competency through:

Four One-Week Sessions

- Identifying Requirements
- Developing an Architecture
- Integrating and Testing
- Planning for Implementation

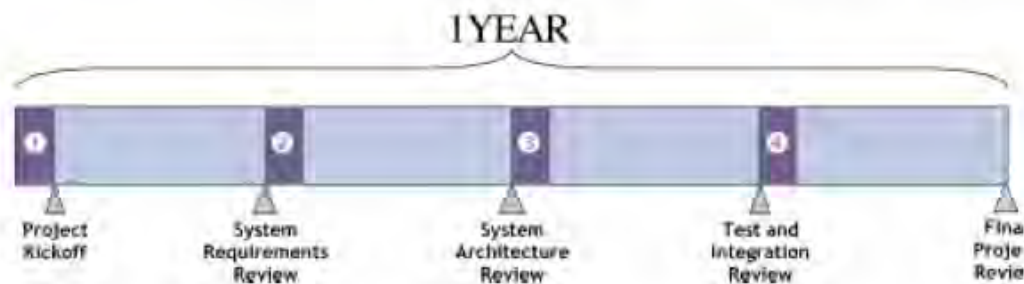
Four Project Assignments:

Participants apply what they learn in each session on a real project of importance to NOKIA during the three months between each session and the ensuing project review.

Four Project Reviews

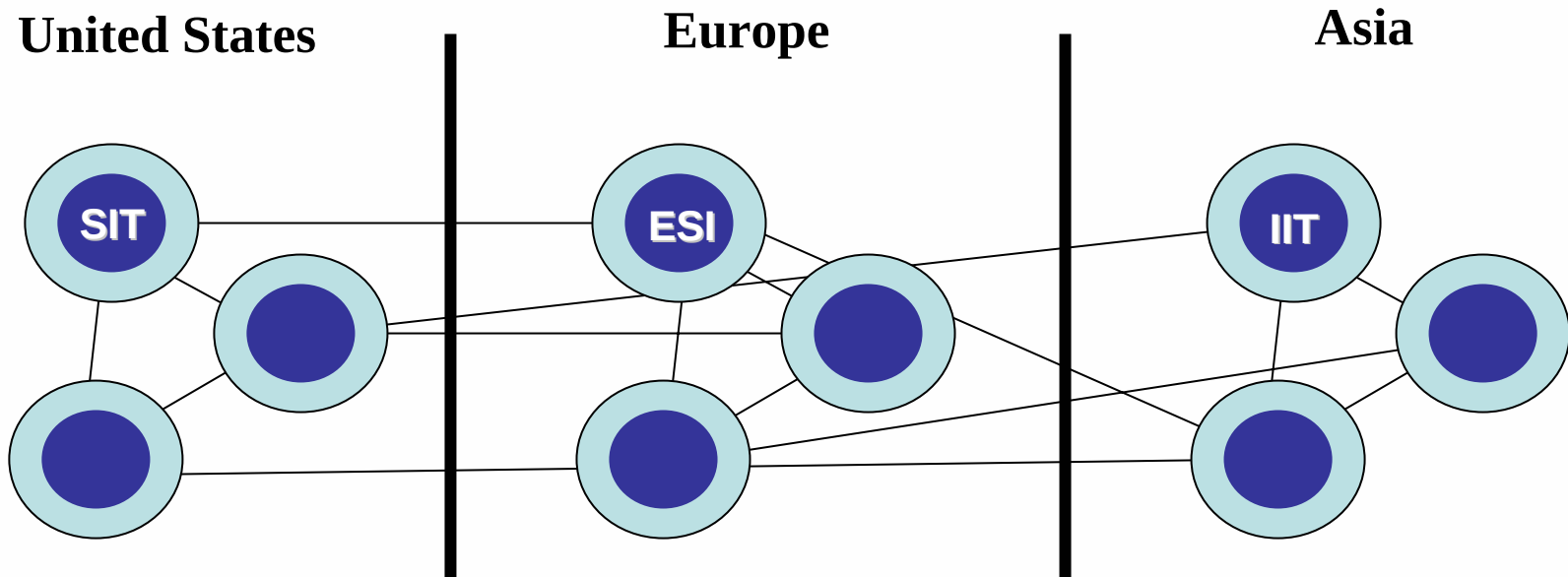
Specific deliverables are required for each review; the overall deliverable is a Technical Data Package and associated Management Plan (including Cost and Schedule)

Participants become change agents, with an understanding of how to think about systems and products from an architectural perspective and the knowledge and skills to translate that thinking into superior systems, products and platforms. The program is conducted with the full participation of senior NOKIA architects and managers who help define the project applications and who take part in the formal reviews. It is overseen by an Advisory Board made up of five senior NOKIA architects, five Stevens faculty members and a representative of NOKIA Learning Solutions.



Global Institute for Systems Engineering, Architecting, and Test

- 2 or 3 Universities in each region (US, Europe, and Asia)
- Each University comes with its own “eco-system” comprising local industries, domain emphasis, functional emphasis, and its educational and research community.

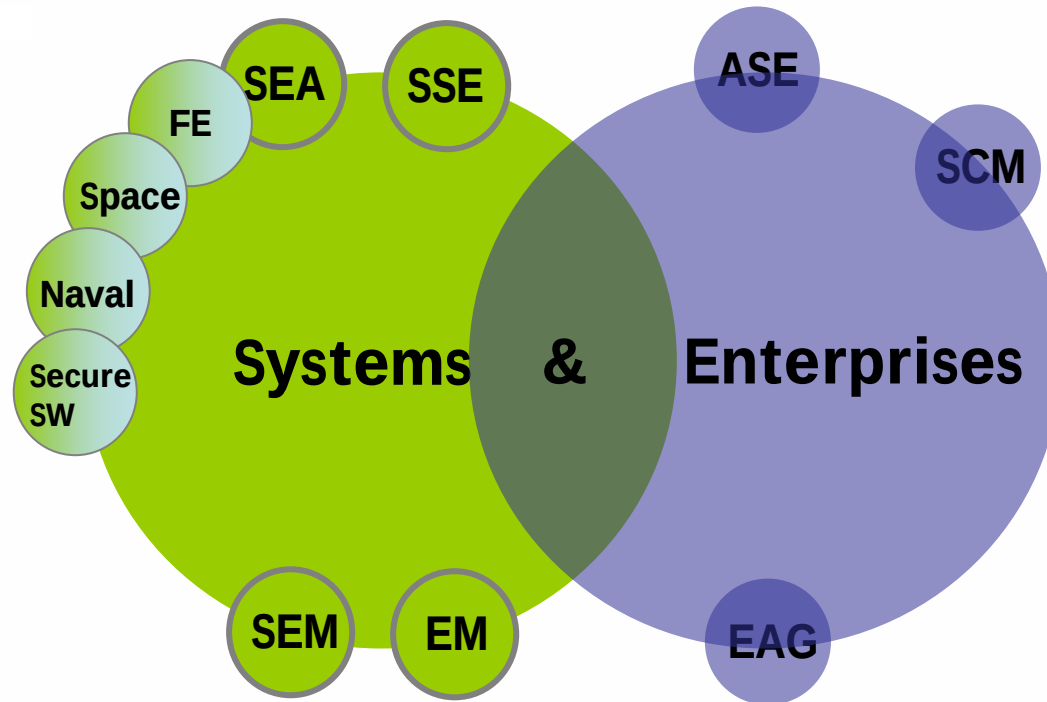


An Open Source Type Community of Academic Collaborators to allow the necessary Global Perspective, and Curriculum Enrichment to provide competency development solutions to multinationals such as: IBM, NOKIA, General Motors, Airbus

Academic Strategy

**Engineering, Engineering Sciences,
and Sciences Center of Gravity**

**Domain Oriented Systems:
In Collaboration with
Schaefer School of
Engineering, and other
Academic Partners (e.g.,
TU/Delft)**



**Management, Leadership, and
Policy Making Center of Gravity**

Research Focus From Systems to Enterprises

- **Enterprise Architecting**
 - The Language to represent Systems Thinking; Enterprise Simulation
 - Enterprise Profiling and Semantic Interoperability
- **Enterprise Optimization**
 - Risk Based Multi-Resource Allocation and Optimization
 - Stochastic System Modeling and Optimization
 - Mobile Ad-Hoc Wireless Network Reliability Analyses
 - Information Mining and Data Fusion
- **Systems and Enterprise Management**
 - **Managing for Systems Engineering - Technical Planning**
 - System Readiness Levels (SRLs)
 - **Resilient Enterprise (Collaboration: Systems, Engineering, & Management)**
- **Systems Engineering, Architecting and Test**
 - Networked Requirements Modeling
 - Risk Based Architecting
 - **Architecture Patterns and Reference Architectures**
 - **System Integration Assessment**



ASysTTM

INSTITUTE

Applied Systems Thinking Institute

A collaboration between:







PM-CCS

Technology Insertion Opportunities

NDIA Firepower Symposium

13 June 2007

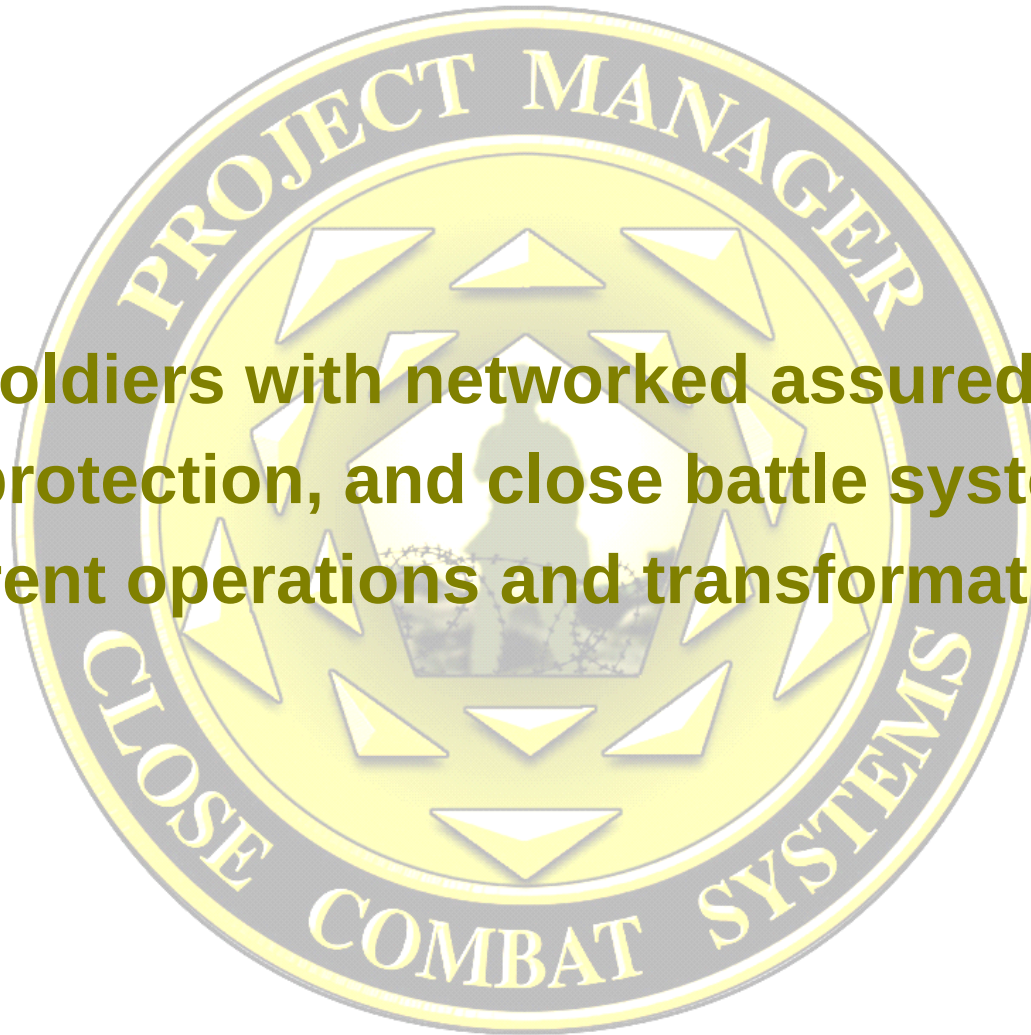
Mr. Ross Benjamin
Chief Systems Engineer
(973) 724-7854
rbenjam@pica.army.mil



Mission Statement

PM CLOSE COMBAT SYSTEMS

“Equip soldiers with networked assured mobility, force protection, and close battle systems for current operations and transformation.”





PM CCS Product Lines

- Networked Munitions/Legacy Mines
- Countermine
- Demolitions
- Grenades
- Pyrotechnics
- Shoulder-Launched Munitions
- Non-Lethal Systems & Munitions
- Special Projects (for SOCOM)
- EOD Equipment
- IED Defeat



Organization & Programs Managed

**200+ Products
Managed in FY07**

PM CLOSE COMBAT SYSTEMS

Business Management
Bob Wisser

COL Ray Nulk
Project Manager

Patti Felth
Dep. Project Manager

Chief System Engineer
Ross Benjamin
Technology Associate
Harold Schliesske

PdM IMS
LTC Jim Winbush
Joe Pelino DPdM

(IMS) Intelligent
Munitions
System*
(ACAT II,
FCS Incrmt. 1)

**PdM Countermine
& EOD Equipment**
LTC Pete Lozis
Phil Purdy DPdM

Standoff Mine
Detection Systems:
- GSTAMIDS*
- ASTAMIDS*
- AN/PSS-14
AMCS FCT
-Aardvark Med Flail
-Hydrema Flail
AMDS
Husky MDS
VOSS
Interrogation Arms
EOD Equipment

**PdM IED Defeat/
Protect Force**
LTC Karl Borjes
Robin Gullifer DPdM

IED Mine Rollers
Rhino
FSEP
Non Lethal
Capability Set
VLAD
PVAB
Taser
ADS, AHD
ISNLS

OVERSIGHT:
Bloodhound
Rattlesnake
Sparrow
Cache Detection

**Networked/
Demolitions**
Doreen Chaplin

Spider Networked
Munitions System

Legacy Mines
- Claymore
- MOPMS
- Volcano

Demolitions
- Block Explosive
- Sheet Explosives
- Bangalore Torpedo
- MDI
- Det. Cord
- Blasting Caps
- Fuzes

APOBS
CAD/PAD
EOD Ammo

**Pyrotechnics &
Shldr-Launched
Munitions**
Santo Lombardo

Pyrotechnics
- Flares
- Signals
- Simulators

Shoulder-
Launched
Munitions
- AT4 Family
- BDM
- LAW
- Indiv. Assault
Munition

Force Application
Kevin Wong

Grenades
- Lethal Grenades
- Smoke Grenades
- Launcher Grenades

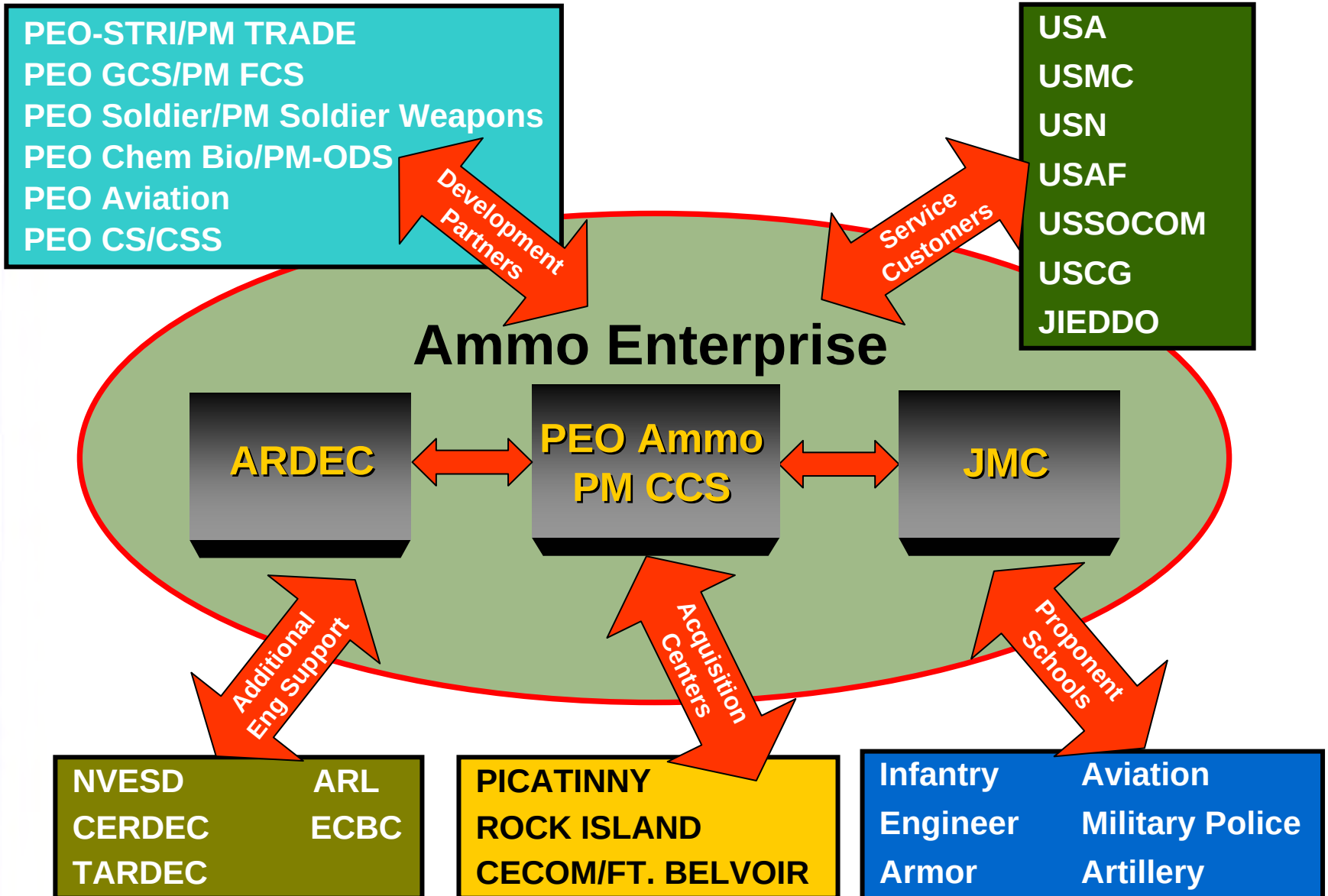
Non Lethal Ammo
- MCCM
- 40 mm
- 12 gauge
- NL Grenades
- Mk19 Munitions

Special Projects
- RAMS
- MI RAMS
- GDS
- TD-SYDET
- SOF Demo Kit
- RWBK



PM CCS Life Cycle Management

Programs managed through IPTs supporting JM&L LCMC Philosophy



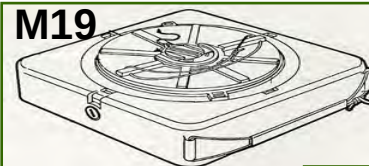
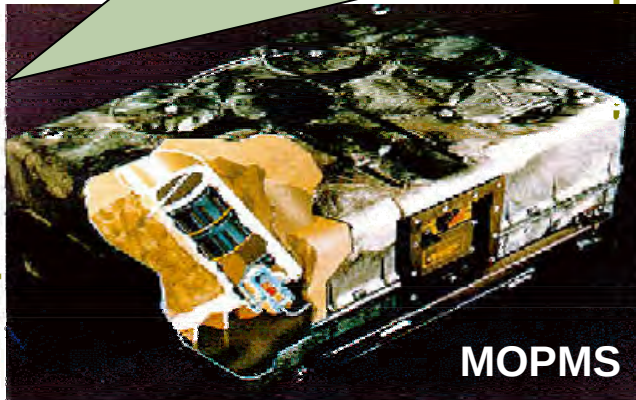


Legacy Mines

LEGACY

Technology Insertion Opportunities

- Mini Modular Claymore
- Vehicle-Mount Modular Claymore
- Low-Cost wireless initiators





Networked Munitions Systems

Intelligent Munitions System

• COMMAND & CONTROL

Technology Insertion Opportunities

- Better target identification in urban environments
- Improved battery life
- Control of scaleable effects
- Ability to deploy systems remotely
 - Sensor networks for surveillance
 - Near real-time battle damage assessment

SPIDER





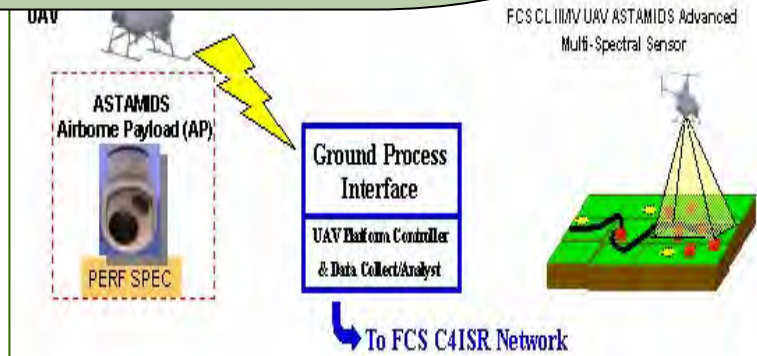
Countermine

GSTAMIDS

ASTAMIDS

Technology Insertion Opportunities

- Improved, less expensive detection sensors
- Small, lightweight unmanned ground and air vehicle payloads
 - Mine detection
 - Mine marking
 - Mine neutralization
- Automated mine identification/analysis
- Minefield breaching at extended standoff



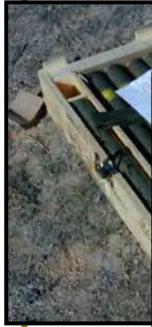


Demolitions

DEMOLITION MUNITIONS

Technology Insertion Opportunities

- More powerful demolitions
- Single stage cratering device
- Insensitive munitions compliance



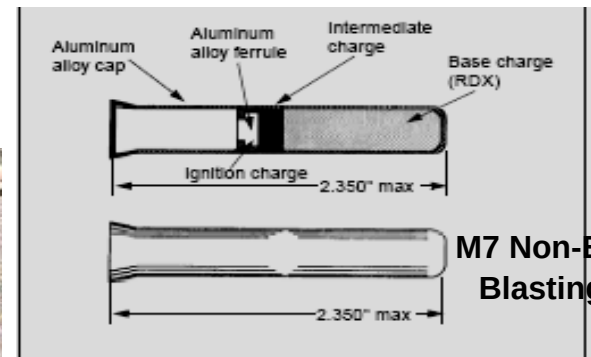
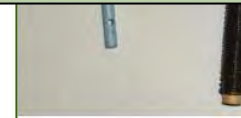
Modernized Demo Initiators (MDI)



15lb Shaped Charge



M6 Electric Blasting Cap



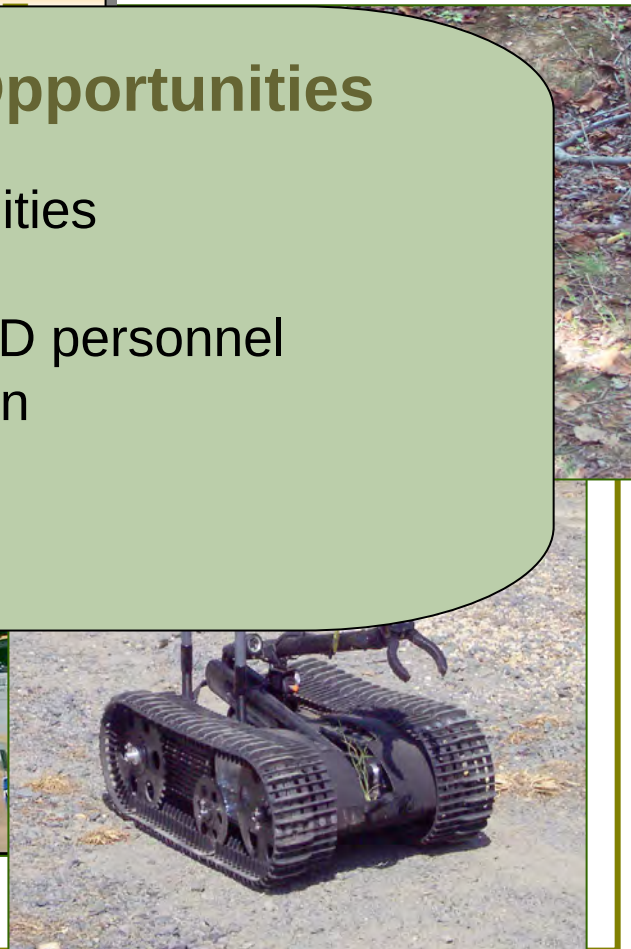
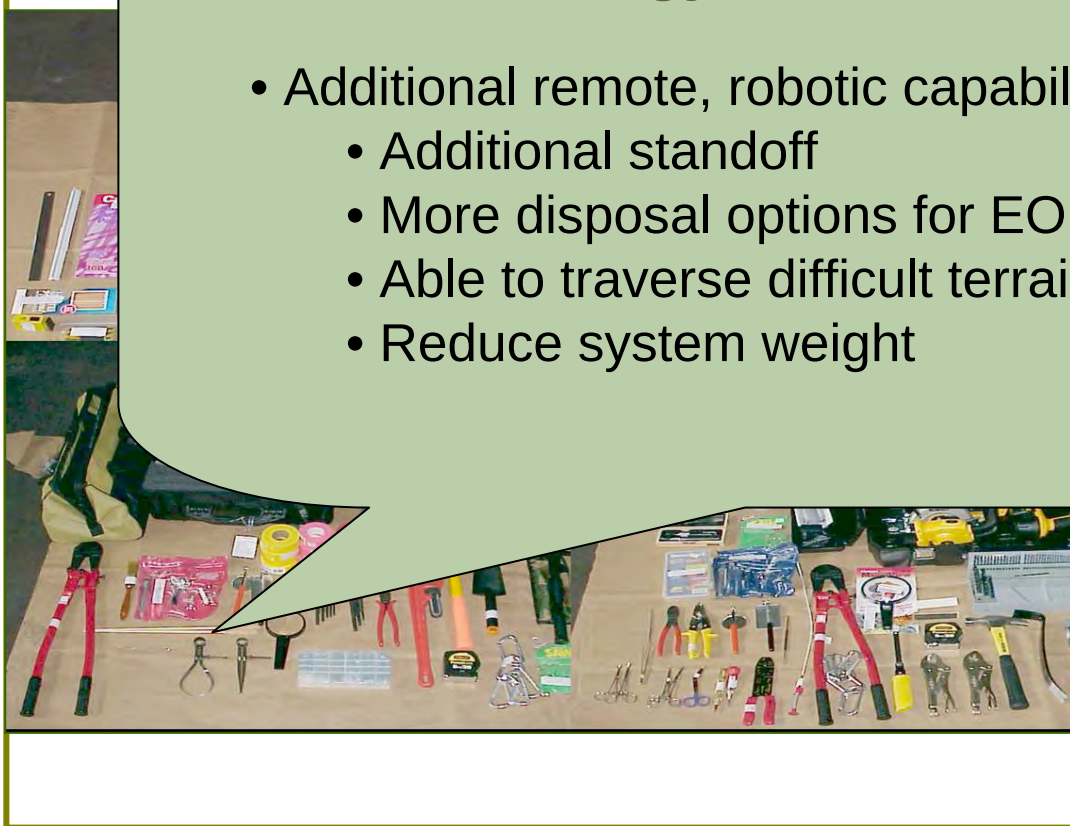
M14/M15



Explosive Ordnance Disposal Equipment

Technology Insertion Opportunities

- Additional remote, robotic capabilities
 - Additional standoff
 - More disposal options for EOD personnel
 - Able to traverse difficult terrain
 - Reduce system weight





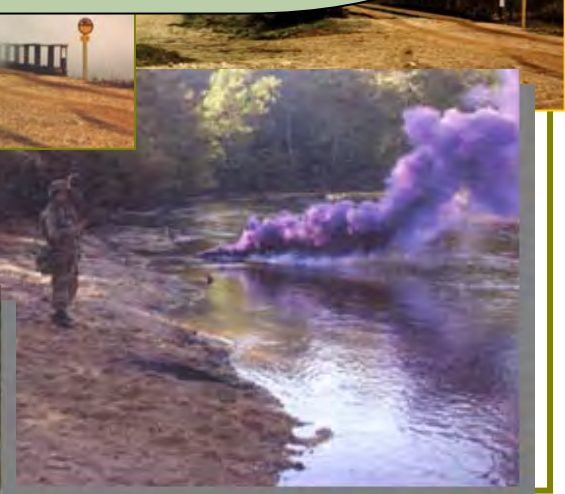
Grenades

HAND GRENADES

SMOKE GRENADES

Technology Insertion Opportunities

- Additional smoke colors
- Multiple smoke options in one item
- Enhanced incendiary device
- Replacement of environmentally unfriendly materials
- Insensitive munitions compliance





Pyrotechnics

FLARES

Technology Insertion Opportunities

- Next generation of counter measure flares
- New and improved simulators
- Pocket sized hand held signals
- Replacement of environmentally unfriendly materials
- Improve pyrotechnic characteristics with nanotechnologies

SIGNALS



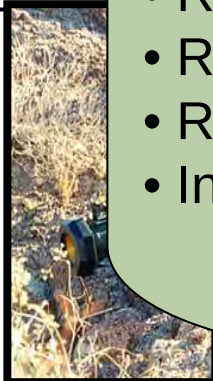
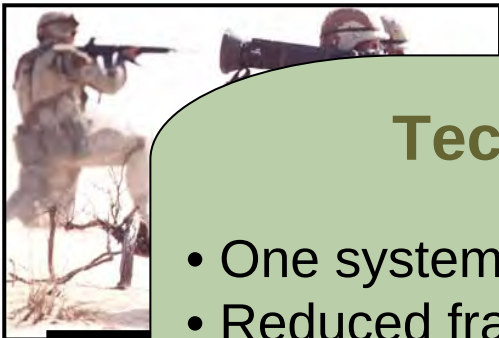


Shoulder Launched Munitions

PM CLOSE COMBAT SYSTEMS

Technology Insertion Opportunities

- One system that defeats bunkers and light armored vehicles
- Reduced fragmentation toward the user at short ranges
- Reduce weight and size
- Reduce visual signature
- Insensitive munitions compliance



AT4-CS





Non-Lethal Systems

RIOT CONTROL GEAR

FAMILY OF VEHICLE ARRESTING DEVICES

Technology Insertion Opportunities

- Scalable effects
- Increased range
- Single net solution for light and heavy vehicles
- New non-lethal capabilities

NON-LE



LAUNCHER GRENADES

MODULAR CROWD CONTROL MUNITION



12 gauge



66mm



STUN GRENADES



Special Projects

Technology Insertion Opportunities

- Ability to breach concrete and the rebar in a single shot
- Smaller, lighter systems
- Single RF/MI transmitter
- Better antennas

SOF De



MI RAMS
Transmitter
XM27



Type "A" Receiver
XM39



Type "B"
Receiver XM40



MI RAMS Transmitter
w/ Auxiliary Battery
Pack (M6)



TD SYDET





IED Defeat

Technology Insertion Opportunities

- Mature IED Defeat technologies
- Looking for modular plug and play capabilities for platforms



MINE ROLLERS
Self Protection Adaptive Roller Kit



Summary

- PM CCS is fully engaged in JM&L Life Cycle Management:
 - Accelerated acquisition/fielding of key systems/items for war fighting
 - Developing New Systems
 - Rapid Fielding of Non-Developmental Capabilities
 - Modernization & acquisition improvement of large number of current force ammo items
- New Warfare ➡ New Challenges
 - Decreasing effectiveness of older products
- Many opportunities for technology insertion



Precision Munitions for Close Combat



Raytheon Missile Systems

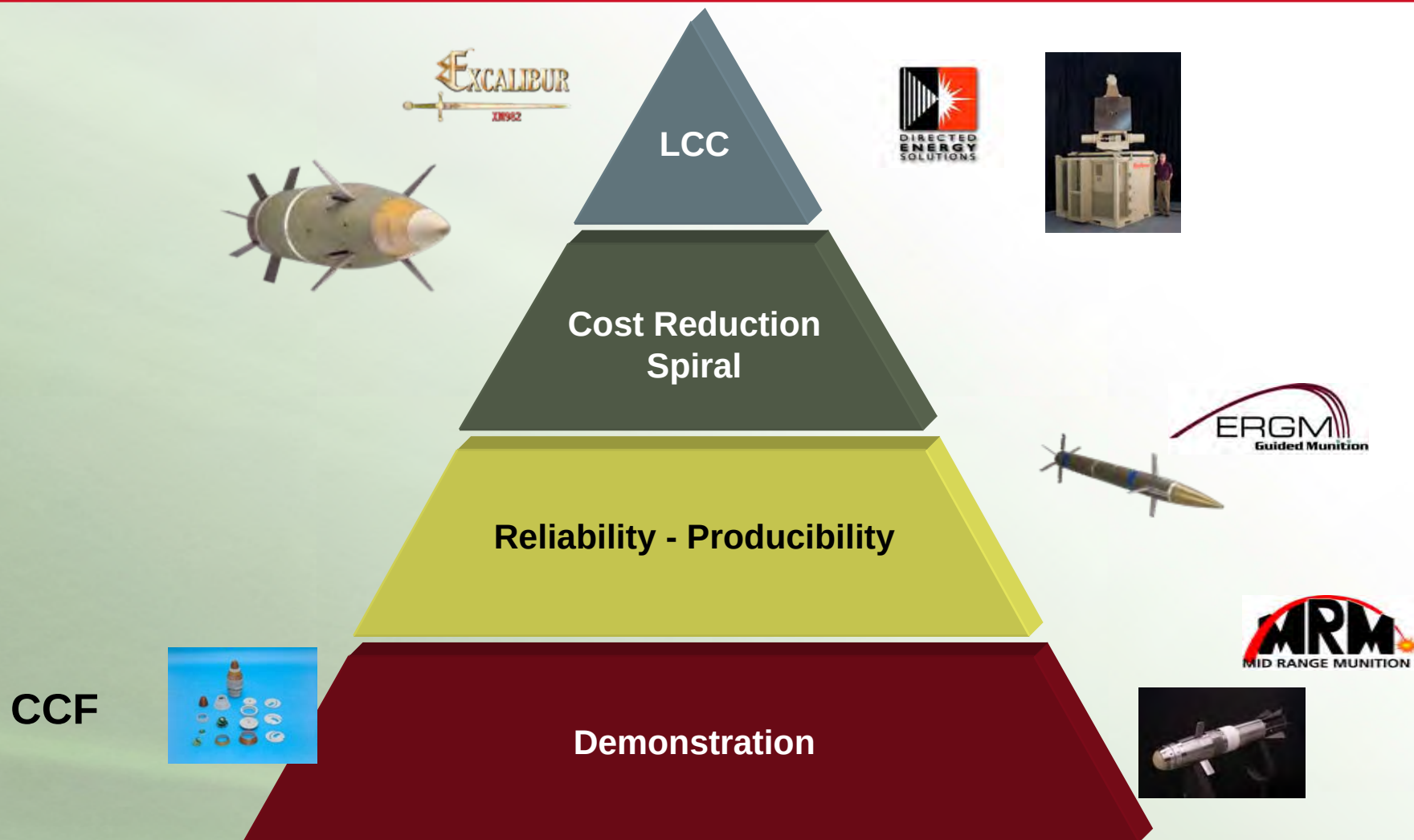
Mr. Dennis Carroll

VP, Business Development



June 2007

Leveraging Results

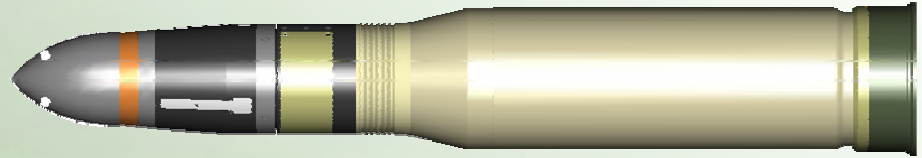
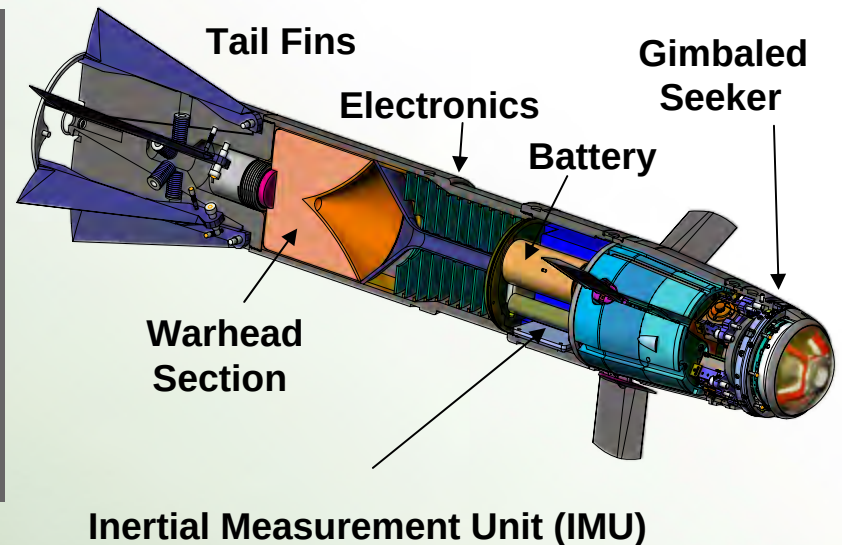


Lessons learned at every step are applied to emerging requirements

Mid-Range Munition (MRM)

- Provides MCS and Abrams with Precision BLOS Capability
- Increases Survivability versus Long Range Weapon Systems

- Autonomous Dual Mode Seeker
- Range From 2 to 12 Km
- MBTs, Light Armor, Self Propelled Howitzer, Walls, and Bunkers
- Includes Adaptation of Combat Proven Tracker and Warhead



Proven technology, Mature design, Multi purpose lethality

Excalibur Combat Success – HOOAH!



“Never in my wildest imagination as a field artilleryman did I expect to see two consecutive rounds go through a roof into a house and have the effects that we needed to destroy that particular target.”

LTC Martin Clausen
Commander
1st Battalion, 82nd Field
Artillery Regiment
Inside the Army
28 May 2007

America’s First Team First-ever to Fire Excalibur Precision Munition in Combat

Story by Spc. Jeff Ledesma Posted on 05.23.2007 at 10:27AM. Soldiers of the 1st Brigade Combat Team, 1st Cavalry Division fired the round from their M109A6 Paladin howitzer on Camp Taji, Iraq. The event marked the first-ever operational firing of the XM982 Excalibur projectile.

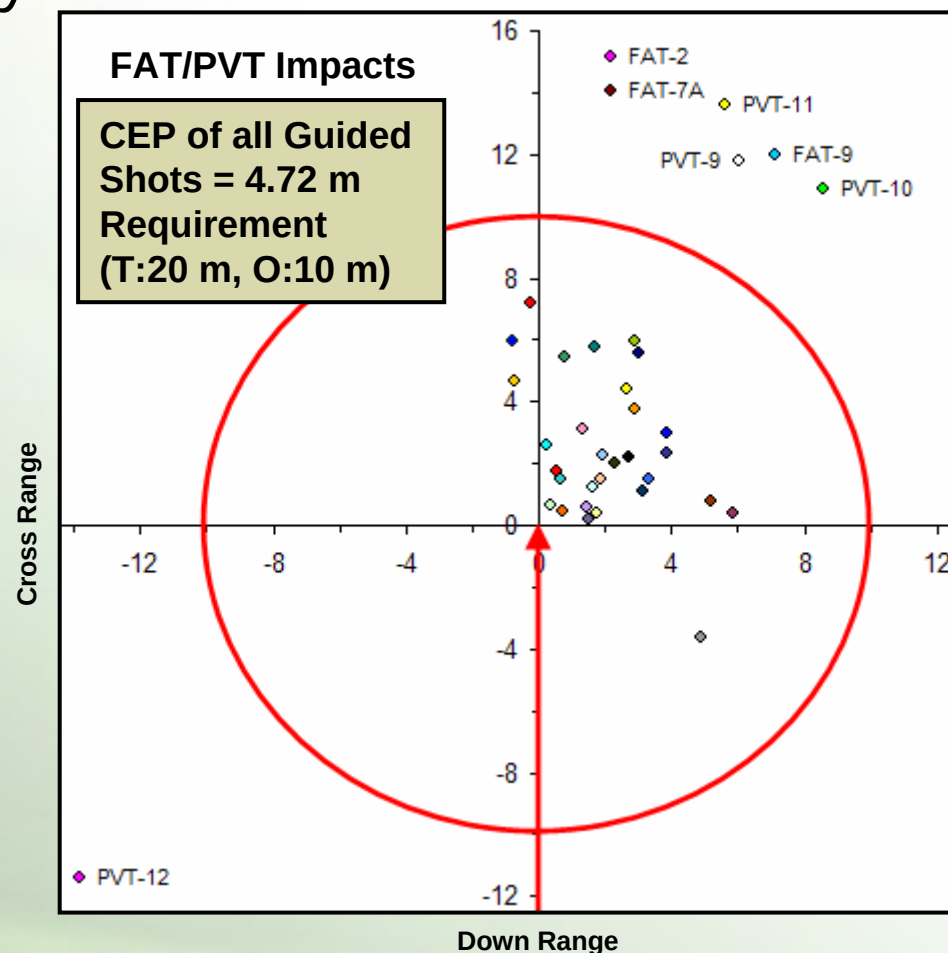
Excalibur Fielding

■ Excalibur's Operational Utility Expanded

- Increased Accuracy
- Fail Safe Arming
- Terminal Arming Criteria

■ ORD Requirements Exceeded

- 40 Km Range
- 6 Meter CEP



Danger close employment from “down-the-street”

ERGM Builds on Excalibur Success

- Life Cycle Costing
 - Precision Common Guidance
 - Common Development Environment
 - Common Factory Environment
- ERGM Progressing with Reliability/Producibility
 - Engineering tests to verify redesign activities
 - Reliability Growth Test Rounds Reliability verification
 - Land Based Flight Testing
 - End-to-End Testing



ERGM range and accuracy proven

Counter Rockets, Artillery & Mortars

- Positive Command & Control
- Positive Target Identification
- Quick Response
- Capability Against a Large Target Set
- Programmable Engagement and Safe Approach Zones
- Limit Collateral Damage

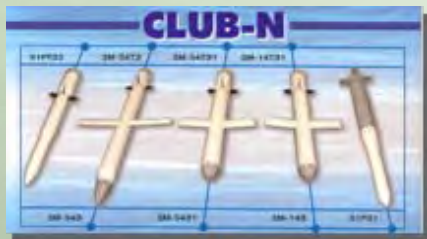


Phalanx can provide high value site defense

Demands a system which can neutralize multiple threats & types in a single engagement

SeaRAM – Cruise Missile Defense

Anti Ship Missile Threats



Helo Air Surface (HAS) Threats



The Silent Guardian Protection Systems

- Less-than-lethal Protection System
 - “Active denial” repel effect against people
 - Demonstrated safe and effective in over 10,500 lab and field engagements
 - Max effective range > 250m
- Integrated sensors provide additional situational awareness capability
- Video display and joy stick control
- 360° coverage



Silent Guardian Demonstration

Active Denial System Advanced Concept Technology Demonstration Media Day



**Associated Press reporter Elliott Minor
participated in the Active Denial System
Advanced Concept Technology Demonstration
Media Day at Moody Air Force Base, GA, on
24 January 2007.**

New Capabilities and Old Lessons

- Test Early – Test Often
- Requirements Impact Cost
- Rate Yields Savings
- Spirals Facilitate Fielding
- Reuse Lowers Cost
- Requirements will Change



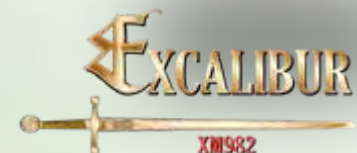
SeaRAM



**CRAM High Value
Site Defense**



CCF





AMC



ARDEC's Lean Six Sigma (LSS) Program

TO

NDIA

Armaments Technology Firepower Symposium & Exhibition

PAUL E. CHIDO

**Director, Quality Engineering & System Assurance,
RDECOM-ARDEC**

Chair, AMC Quality Federation

Certified Lean/Six Sigma Master Black Belt

12 June 2007

ARDEC Lean/Six-Sigma Program

- LSS has Proven Fundamental to ARDEC Satisfying Army Objectives in the Acquisition and Sustainment of Armament & Munitions Systems
 - ✓ Institutionalizing a culture of “Fact & Data Based Decision Making”
 - ✓ Instilling Lean Six Sigma into Workforce Daily Activities for a Continuous Improvement “Way of Doing Business”
 - ✓ Evolving from DMAIC/DMALC to Design for Lean Six Sigma
 - ✓ Provides the tools for improving all our processes

Why Did ARDEC Change to “LSS Way of Doing Business”?

➤ Original Burning Platform:

The Army could not Afford to have Ammunition with Critical Defects Escaping into the Battlefield

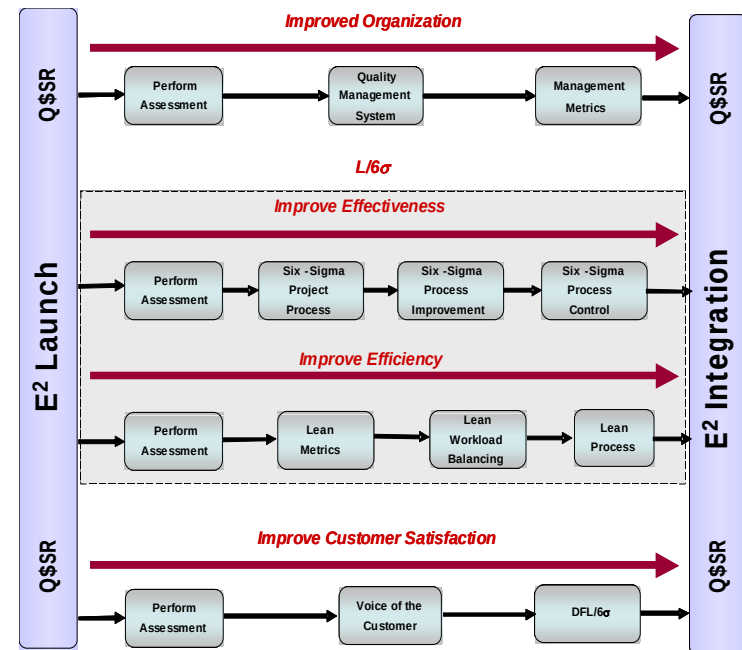
ACAT I Program Producibility Issues

➤ Current Burning Platform:

Continuous Process Improvements to Better Serve Warfighter Needs - Quality, Cost, Schedule & Risk (Q\$SR)

➤ Provide a Framework to Achieve Enterprise Excellence (QMS, L/6σ, VoC)

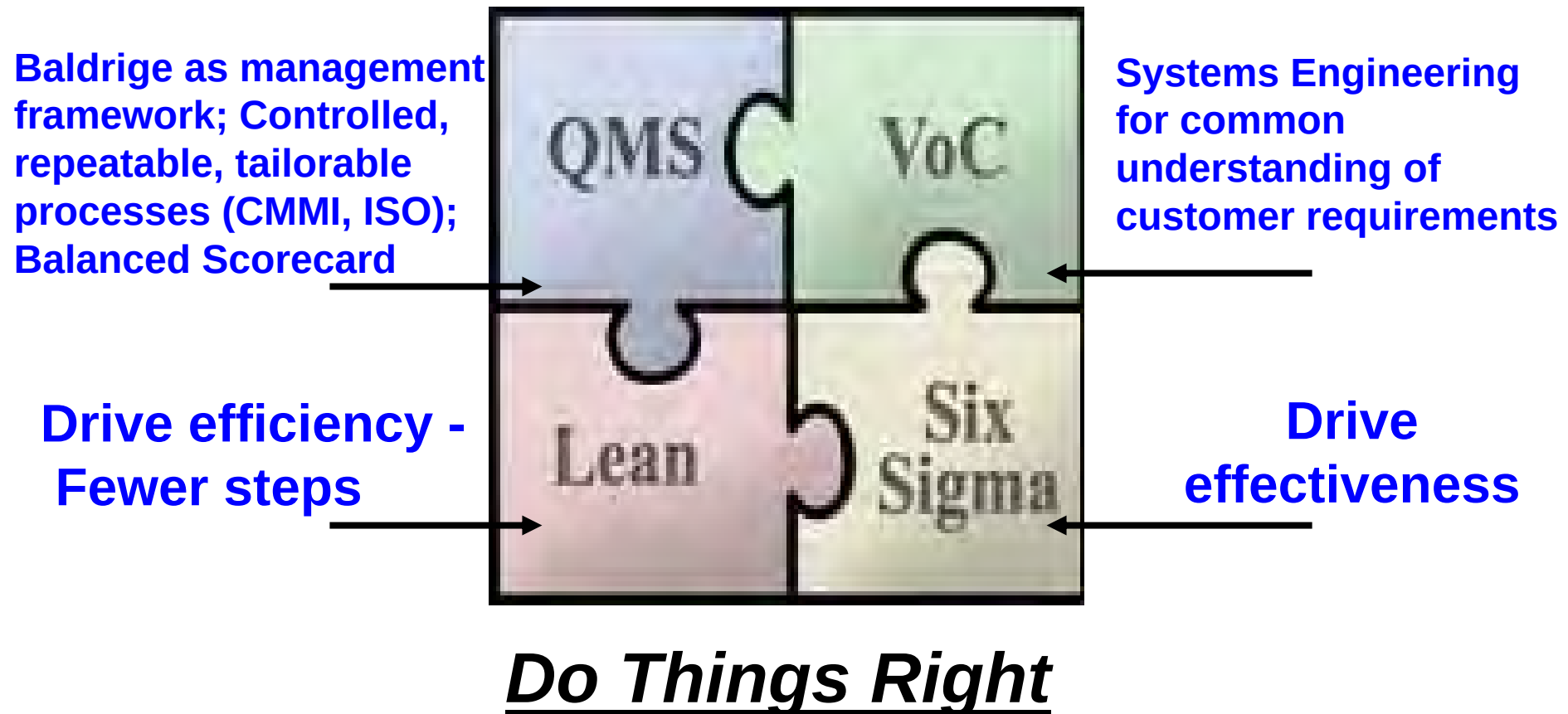
- ✓ A disciplined, structured approach for process and product optimization that is focused on the effectiveness and efficiency bottom line of the organization



ARDEC ENTERPRISE EXCELLENCE

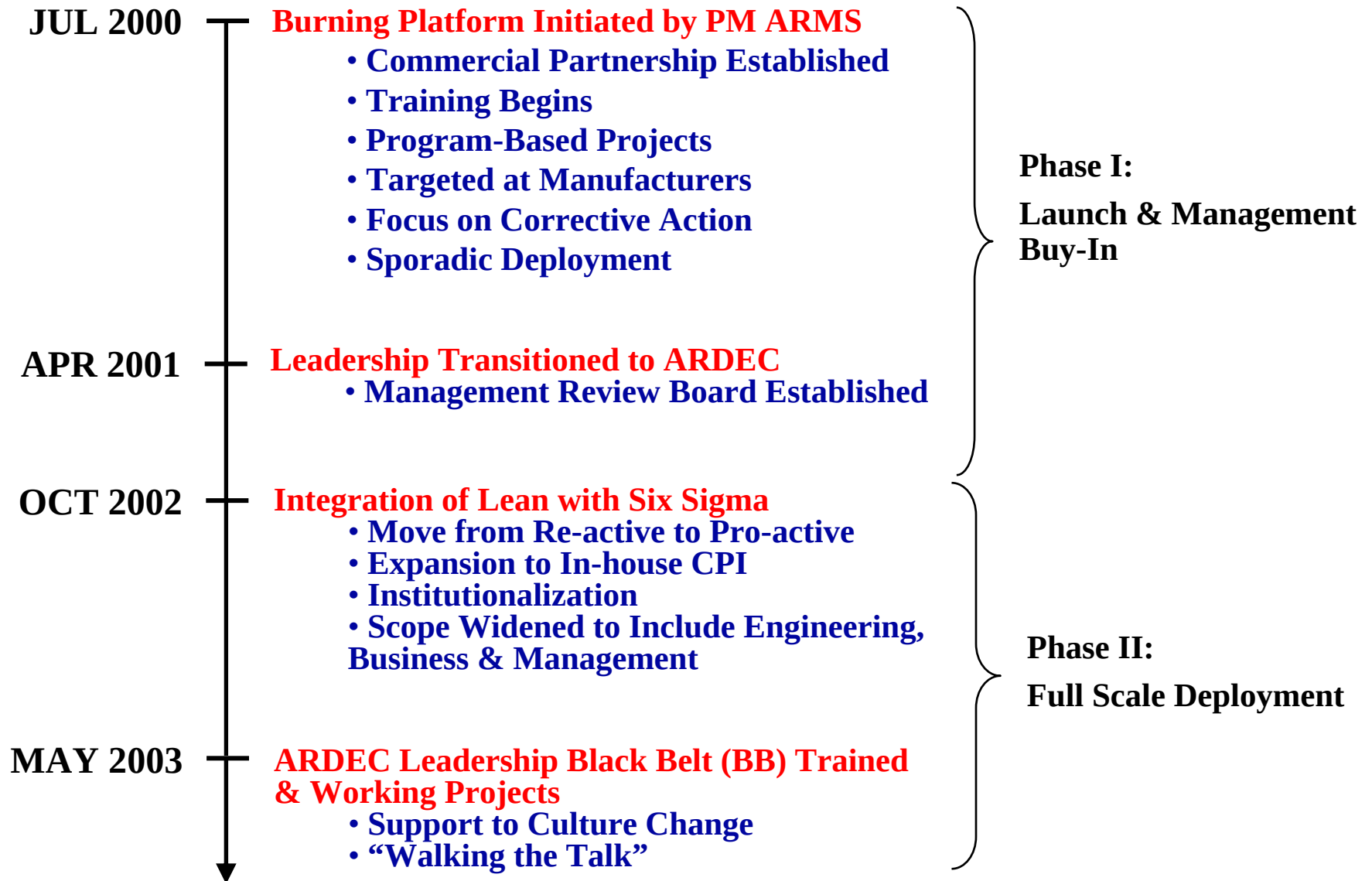
Do Things Consistently

Do the Right Thing

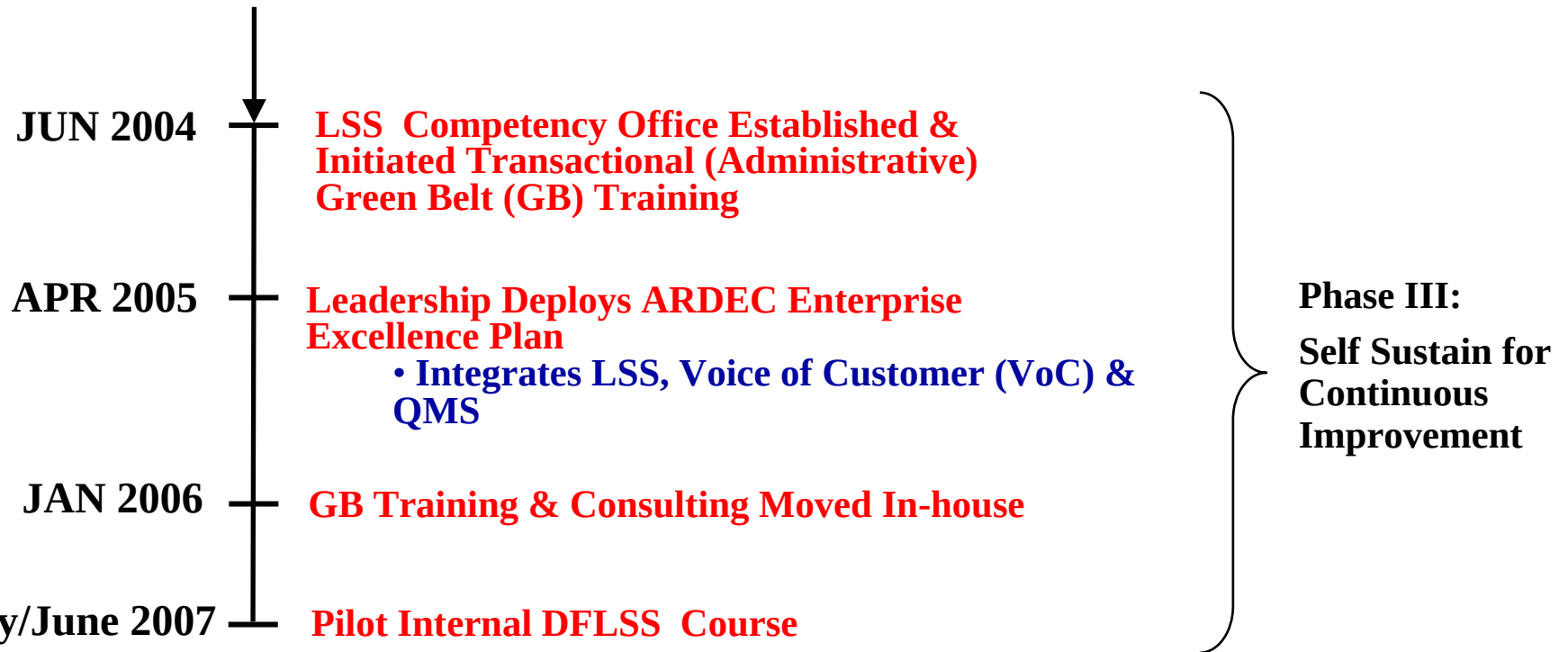


Integrates best practices

ARDEC LSS Deployment Timeline



ARDEC LSS Deployment Timeline (Cont)



Gold Army Performance Excellence Award Winner
"[ARDEC] is one of the Army leaders in Lean Six Sigma and serves as a benchmark for other Army organizations to emulate."
– Francis J. Harvey, Secretary of the Army,
16 December 2005

DA Business Transformation

LTG N. Ross Thompson III is the Director of the Army Acquisition Corps (AAC) and the lead office of the Assistant Secretary of the Army for Business Transformation. LTG Thompson oversees the deployment of Lean Six Sigma across the Army.

“Together we will constantly evaluate the way we are doing business in order to streamline our business practices”

“Integrate and apply Lean Six Sigma (LSS) and the Balanced Scorecard approach into all of your business practices at every level”

Army Material Command (AMC)



**General Benjamin Griffin,
Commanding General,
U.S. Army Materiel Command**

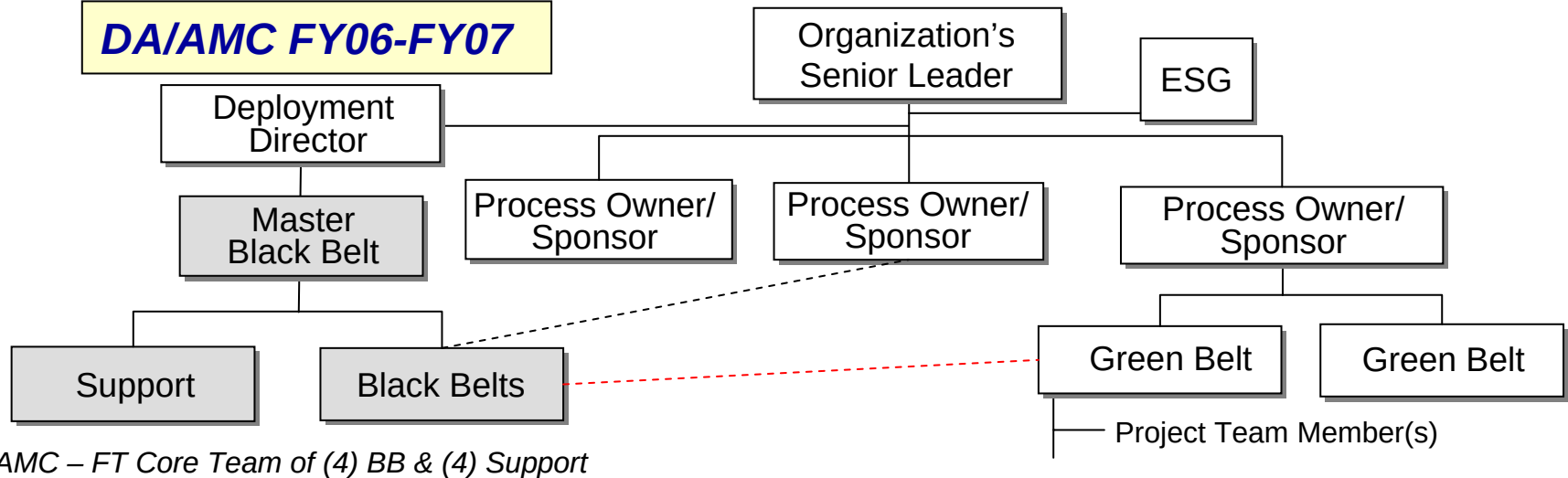
**Lean Six Sigma Policy Signed by
General Griffin – 22 May 2005**

*“Need to be faster, more agile, less bureaucratic...
better support to the Warfighter. AMC will
continue aggressive implementation of Lean Six
Sigma ... leaders who are willing and able to
change the way we are doing business.”*

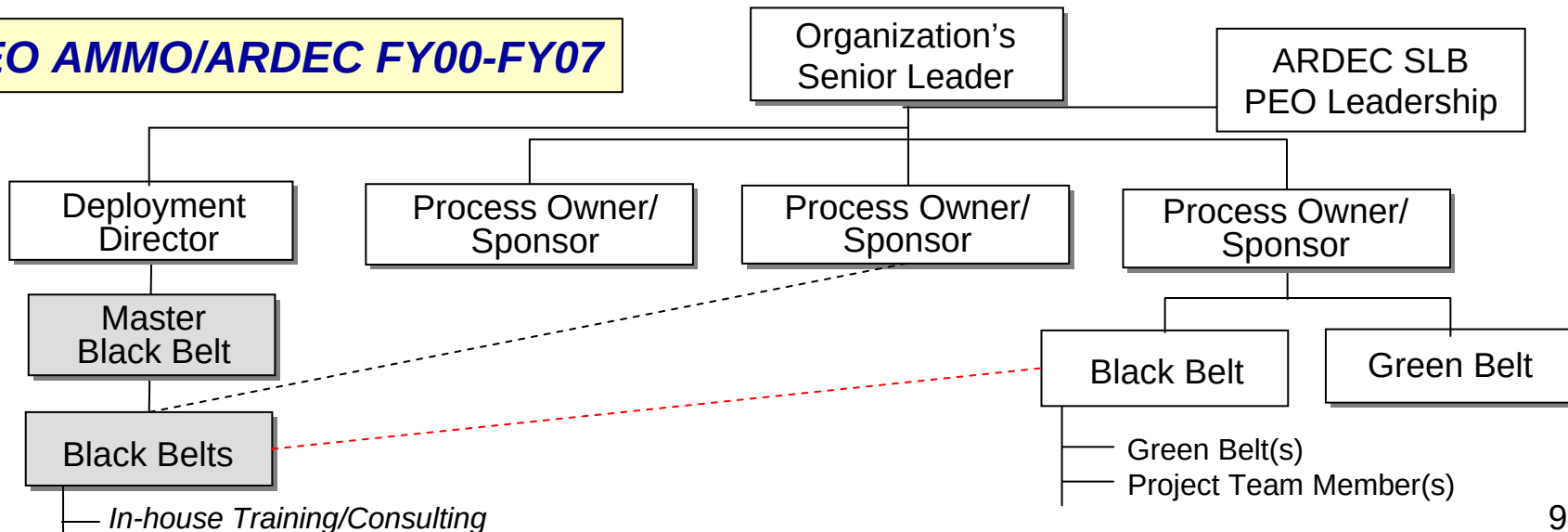
LSS Alignment

 Fulltime Position
 Project Support
 - - - - - Mentor/Consult

DA/AMC FY06-FY07

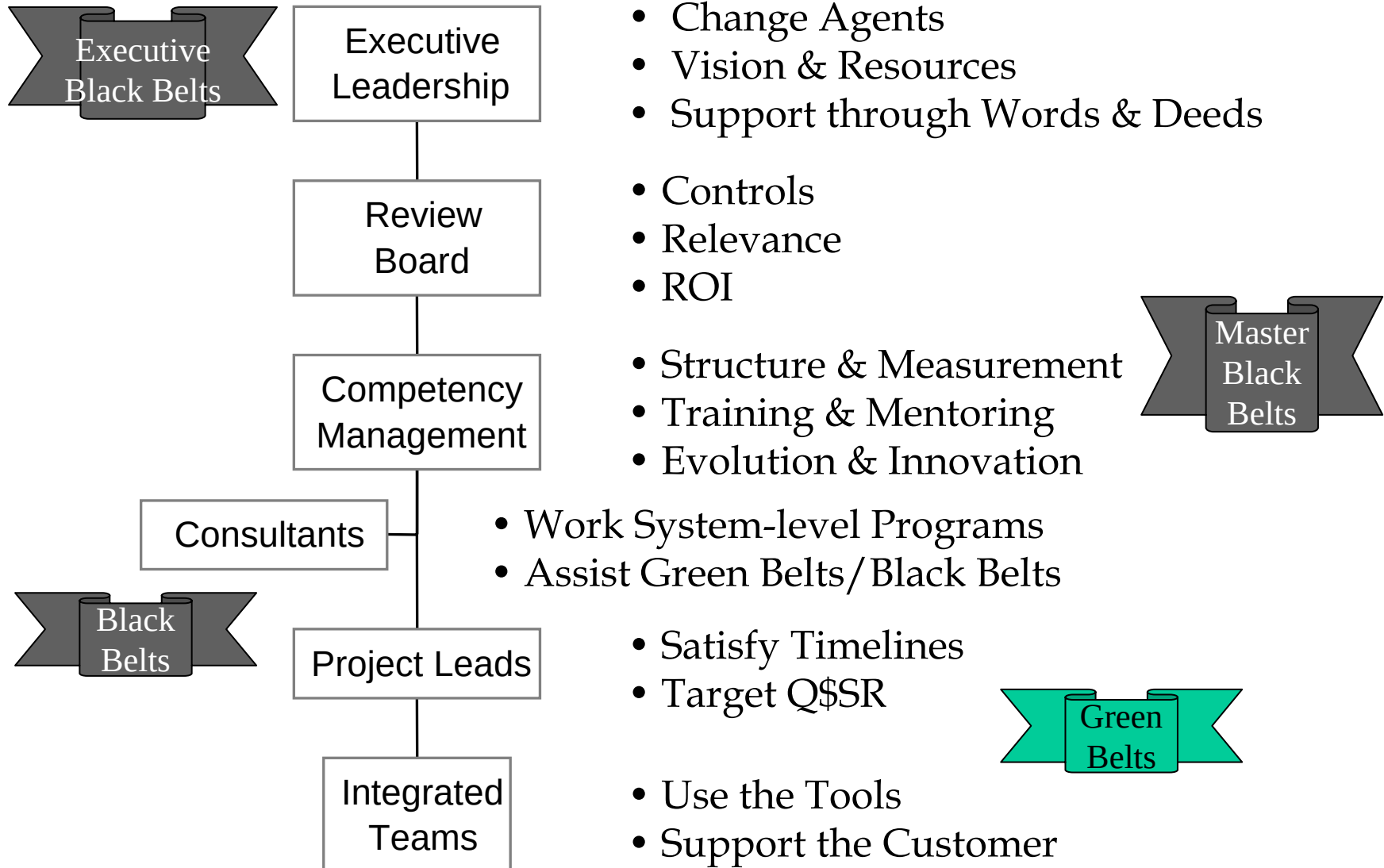


PEO AMMO/ARDEC FY00-FY07



ARDEC – FT Office of (8) MBB/BB & (1) GB

ARDEC LSS Implementing Infrastructure



Lean Six Sigma

Continuous Benchmarking

GE

Textron

**The Toyota Way
Dr. Jeffrey Iker**

IBM

**Naval Supply
Systems Command**

Caterpillar

**The George
Group**

**Booze Allen
Hamilton**

3M

Honeywell

ASQ

Raytheon

**PDSS
Ship Creveling**

**Enterprise Excellence
VSE Corp.**

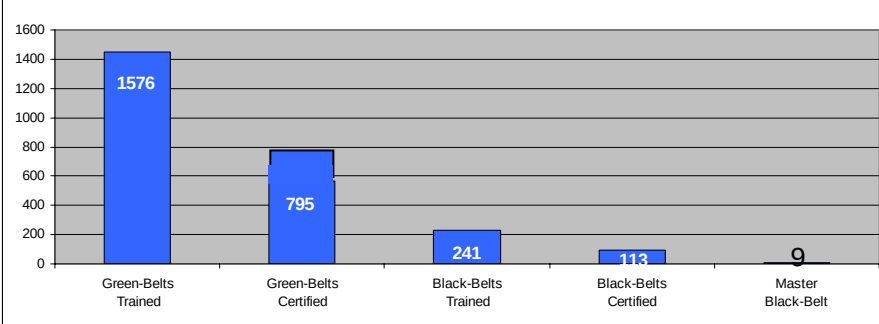
Books

- *Achieving the Competitive Edge*, Jackson Jr., H.K., et al
- *Design for Six Sigma in Technology and Product Development*, Creveling, C.M., et al
- *Lean Six Sigma Pocket Toolbook*, George, Michael L., et al
- *Service Design for Six Sigma*, EL-Haik, Basem, et al
- *Six Sigma for Technical Processes*, Creveling, C.M., et al

Continuously Learning from Industry Leaders

ARDEC LSS Metrics (1Q07)

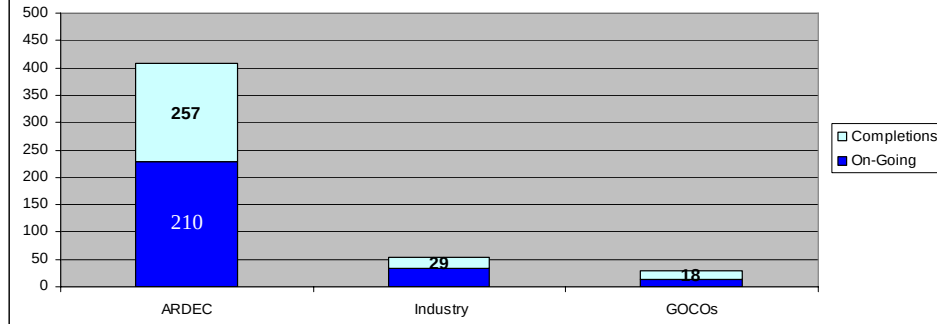
Training & Certification



Over 55% ARDEC Community Green Belt Trained!

ARDEC LSS Metrics (1Q07)

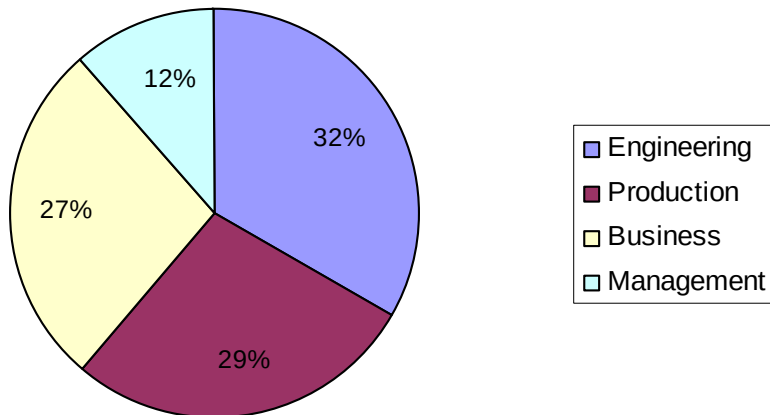
Projects



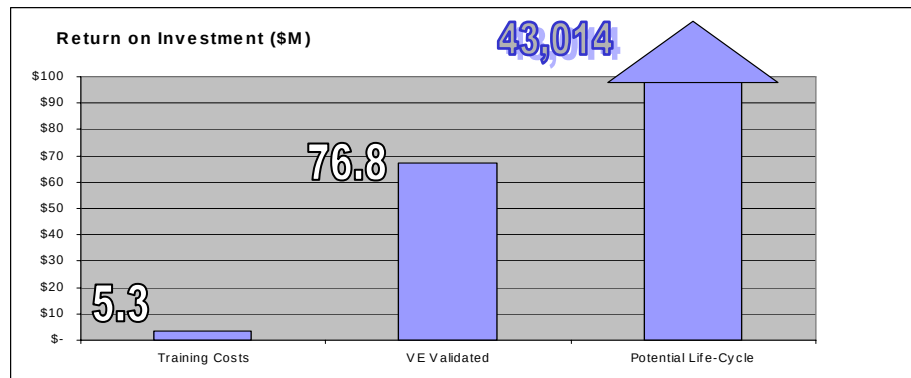
257 Completed Projects

LSS Project Disciplines

Processes Impacted by LSS Projects



ARDEC LSS ROI



\$43,014B Savings/Avoidance

15:1 VE Validated Returns

- Value Engineering Adds Rigor
- Recognized Standard
- Independent Verification
- Hard Numbers Only

Q\$SR Improvements:

- ✓ Quality (92%)
- ✓ Co\$t (68%)
- ✓ Schedule (72%)
- ✓ Risk (87%)

How We Change “Way of Doing Business”?

➤ Leadership Commitment/Involvement

- ✓ Leadership Communication to the Workforce
- ✓ Leadership Involvement to Prioritize Workforce Projects
- ✓ Project Accountability through Management Chain to Align with Mission Objectives

➤ Overcoming Resistance to Change

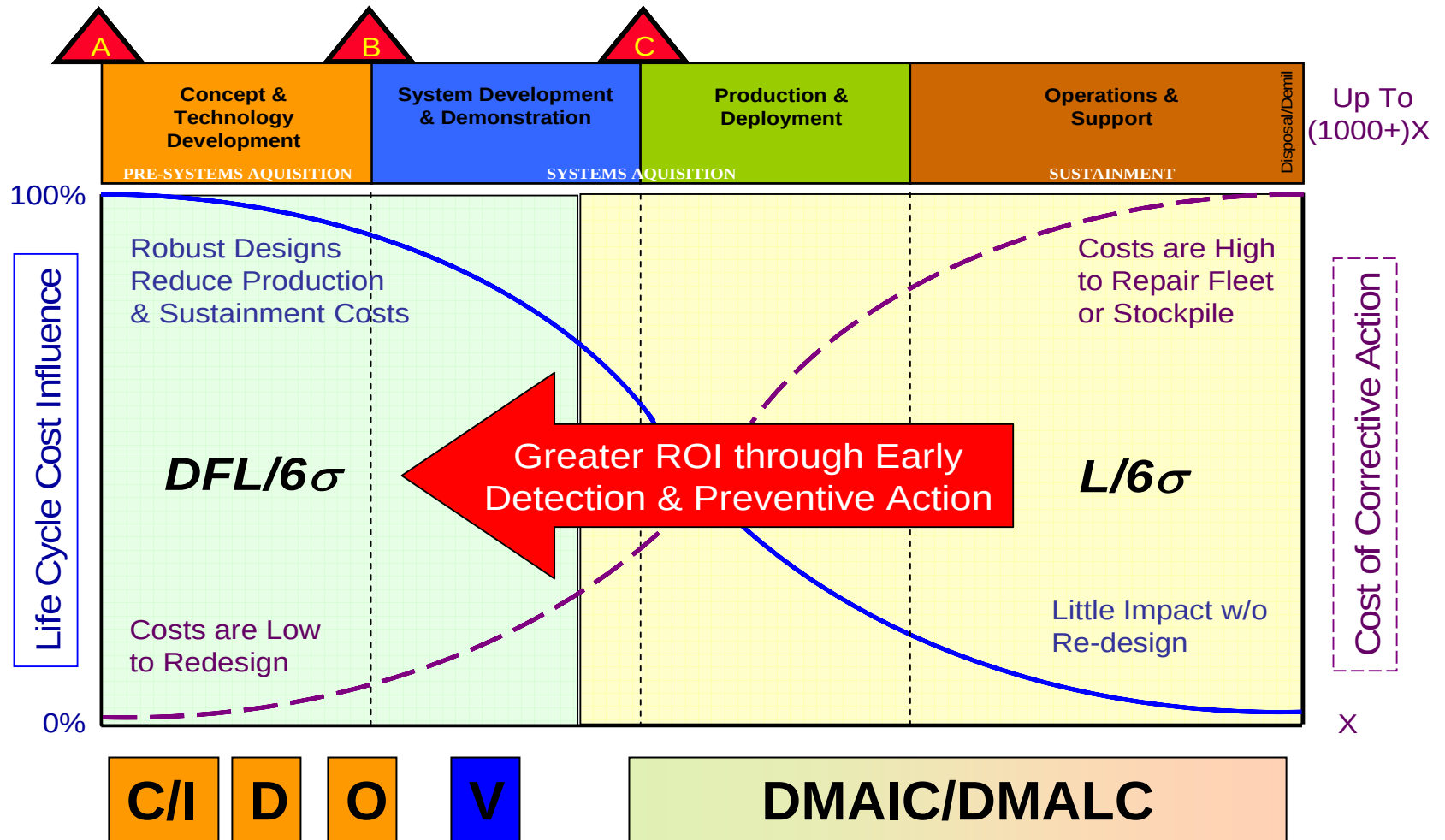
- ✓ Show how employee participation “makes a difference”
- ✓ Consistent message between upper level and mid-level management
- ✓ Convince employees not to fight change by making them part of the process, listening to their concerns and addressing issues as they arise

The ARDEC Journey Continues ...

- **Design for Lean Six Sigma (DFLSS)**
 - ✓ Innovative, Quality Products Meeting Customer Requirements
- **Probabilistic Technology**
 - ✓ Systematic Processes for Smarter Decisions in Situations of Insufficient Data
- **Process Integration & Improvement**
 - ✓ Manage and Improve Processes across Enterprise Using Enterprise Excellence (LSS, VoC and QMS)



DFLSS Influencing the Product Life Cycle



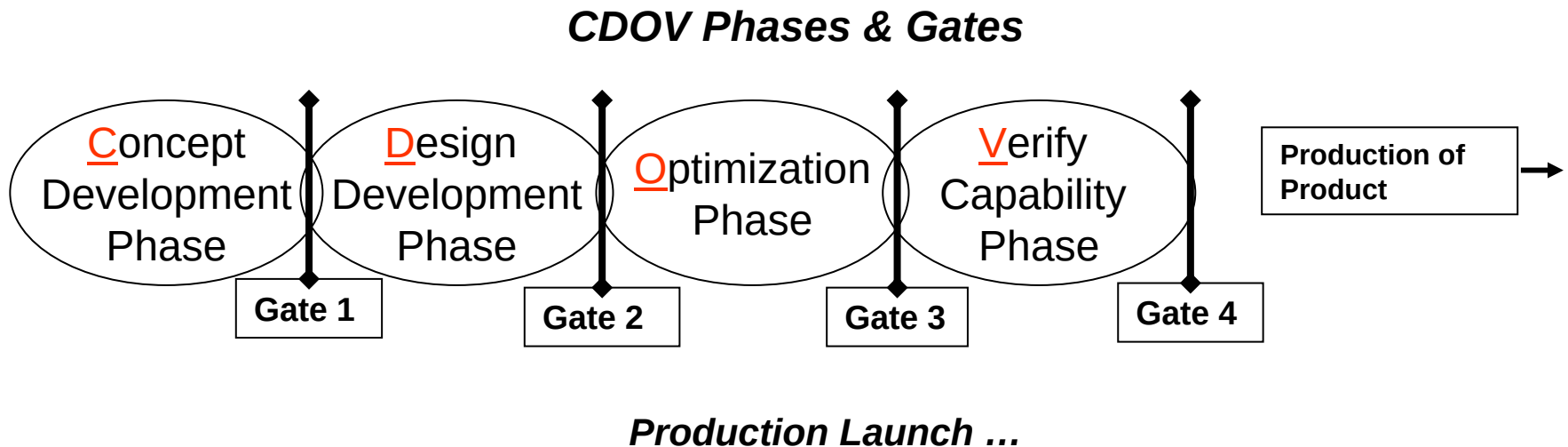
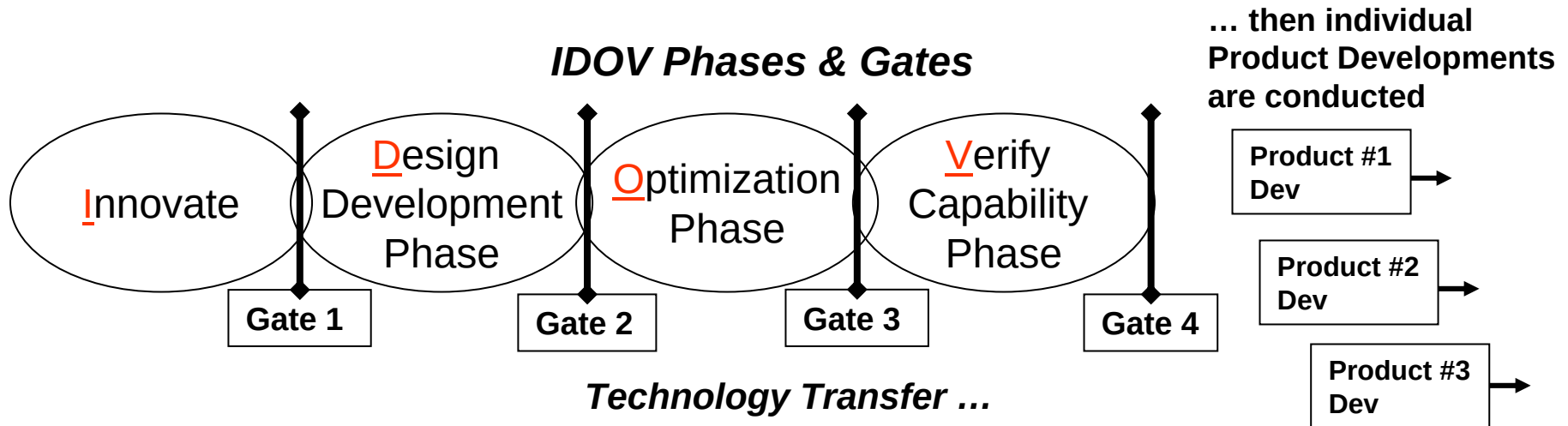
"An Ounce of Prevention is Worth a Pound of Cure" – H. De Bracton

Operational Definition of DFLSS

- Disciplined, Structured, Data-Driven Approach to Technology and Product Design, focused on Customer Requirements
- Integrate Probabilistic Technology tools when addressing uncertainties
- Focus on Critical Parameter Management (CPM)
 - ✓ Identifying Critical-to-Quality (CTQ) Requirements
 - ✓ Optimizing Robust Performance (S/N and σ)
 - ✓ Certifying Capability (C_p and C_{pk})
 - ✓ Considering Manufacturing & Life Cycle Support Processes
- Integrates Three (3) Major Elements:
 1. Clear & Flexible Technology/Product Development Cycle built upon Systems Engineering Principles
 2. Portfolio of Tools & Best Practices and Defined Exit Criteria for each Phase/Gate
 3. Disciplined Project Management

DFLSS is about preventing problems and providing breakthrough solutions to well defined requirements and not about fixing problems created in earlier phases

Phase – Gate Process Using DFLSS

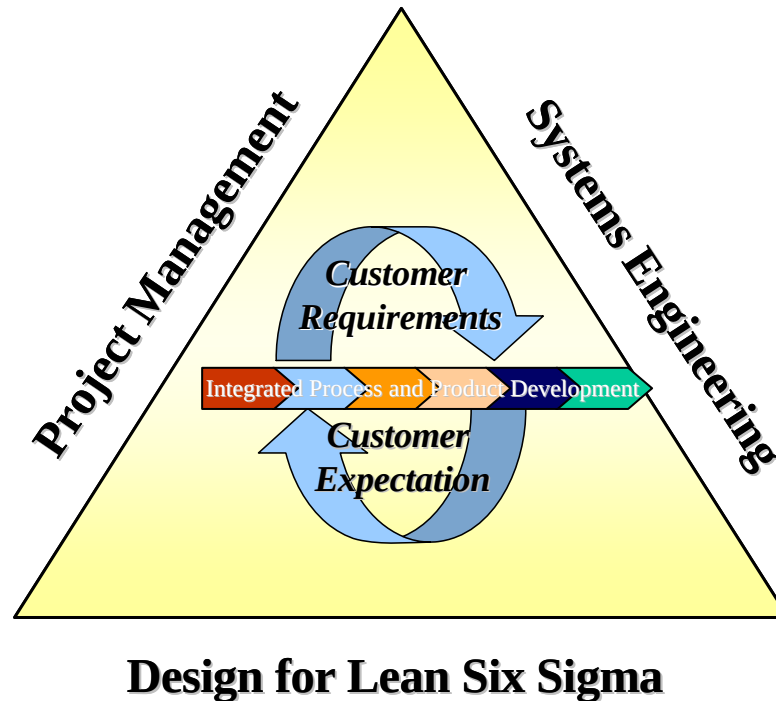


Probabilistic Technology

- Probabilistic Technology is a **Generic, Systematic, And Quantitative** Approach for Making Reliable, Cost Effective **Business or Technical** Decisions for All **Products and Services** In Any Industry Or Domain
 - ✓ Considers and Incorporates **Uncertainties** in Decision Process
 - ✓ Minimizes Costs Associated With Change
 - ✓ Identifies And Eliminates Waste Effectively
 - ✓ Complements Existing **Design For Lean Six Sigma** Tools
 - ✓ Provides Critical Information at **Early Phases of Decision Making** When **No Or Limited Data Is Available**
 - ✓ Predicts Reliability, Failure Probability, and Risk at All Stages of Decision Making.

ARDEC Challenge

- **Develop and Utilize a Disciplined ARDEC Process that Integrates Project Management, Systems Engineering and Design for Lean Six Sigma Tools as a Framework for Technology & Product Development**



ARDEC LSS Take-a-Ways

- **ARDEC Initiated LSS Over 6 Years Ago to get “Eyeballs on the Process” and to Deliver Quality Products to the Soldier in the Field**
 - ✓ **LSS Provides ARDEC a Mechanism to Solve Problems in an Effective and Efficient Manner and to Achieve Continuous Process Improvement Across the Entire Enterprise**
 - ✓ **ARDEC is Providing the Army with Meaningful Savings...Every Quality, Reliability and Process Improvement Equates to Real Dollars**
 - ✓ **ARDEC’s LSS Success has been Driven by Leadership Commitment to Cultural and Business Transformation**
 - ✓ **Workforce Applies LSS Tools for Fact Based Decision Making on a Daily Basis**
- **ARDEC’s Enterprise Excellence Journey Continues through Deployment and Integration of DFLSS, QMS, Systems Engineering and Project Management Best**





LCAAP Modernization

LCCM's Program to Reduce Risk of Interrupted Supply

Presented to:

NDIA Armaments Conference
Karen Davies
ATK Lake City Ammunition

13 June 2007





Lake City Delivered Its First Round 65 Years Ago **ATK**



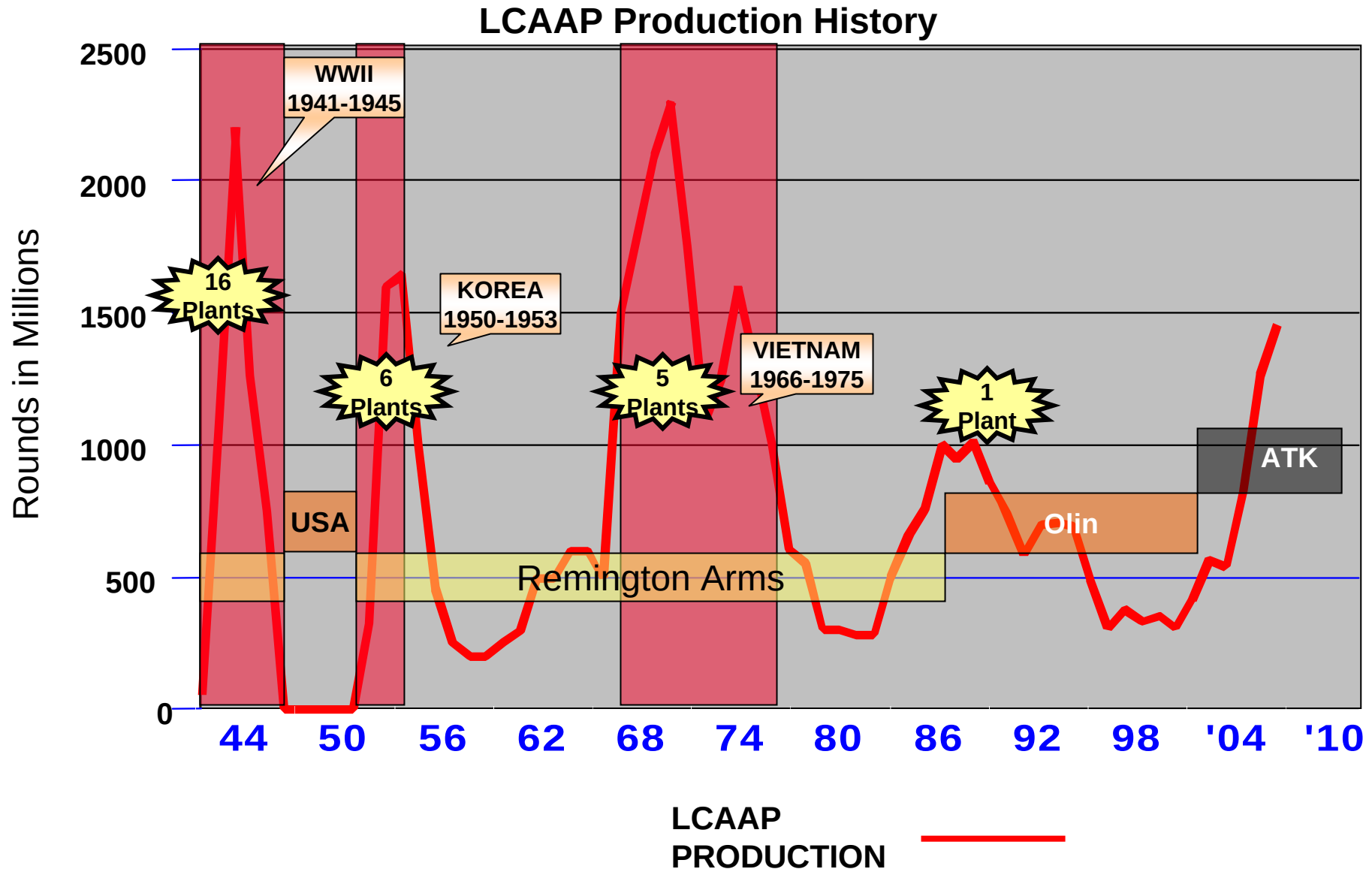
- Senator Harry Truman broke ground Dec. 1940.
- Started production Sept. 1941.



And most of the equipment is in use today!

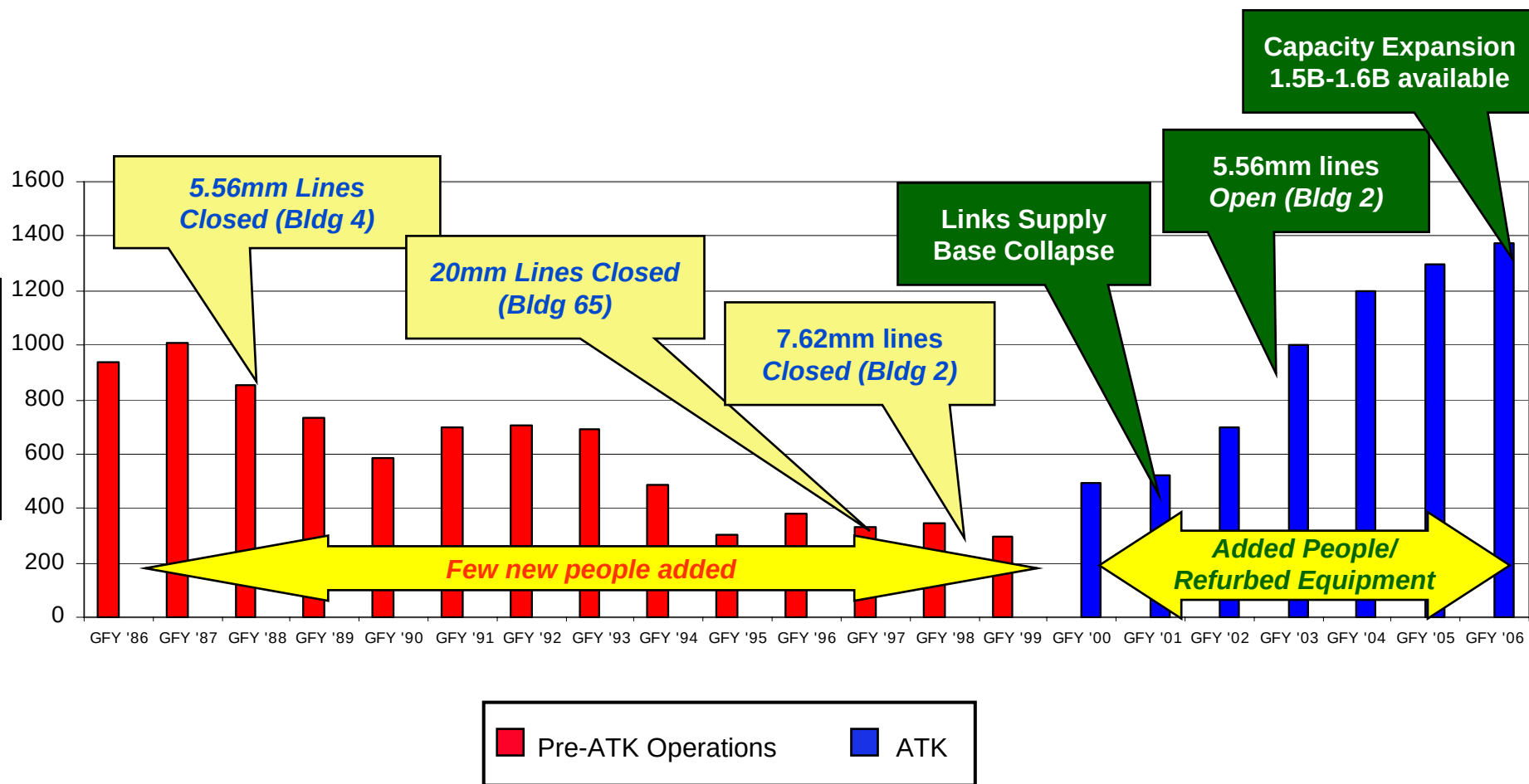


Ammunition Demand History is Cyclical





"Investment" During 1990s Reduced Capacity



Production at Vietnam Era levels with smaller footprint



Vintage Equipment Creates Risk



- **5.56mm High-Speed Production--SCAMP**
 - 1970s Electronics and Mechanical Parts
- **7.62mm and .50 Cal. Production**
 - 1940s Equipment - No Feedback to Operators
 - Complicated Process Flow
 - Capacity Consolidation in 1990s
- **“Anti-Lean”**
 - No Flexible Manufacturing Capability
 - Cumbersome Material Handling
 - Batch and Cue Operations

1970s Electronics



WWII Final Inspection Equipment



Manual Primer Charging

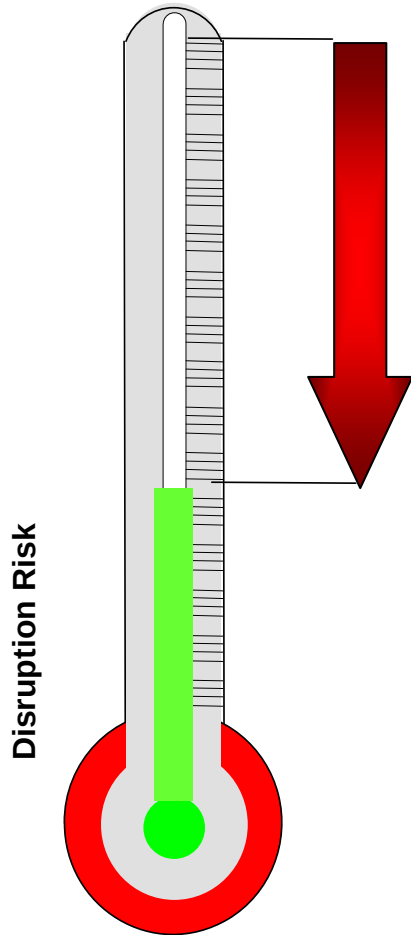


Wheelbarrows

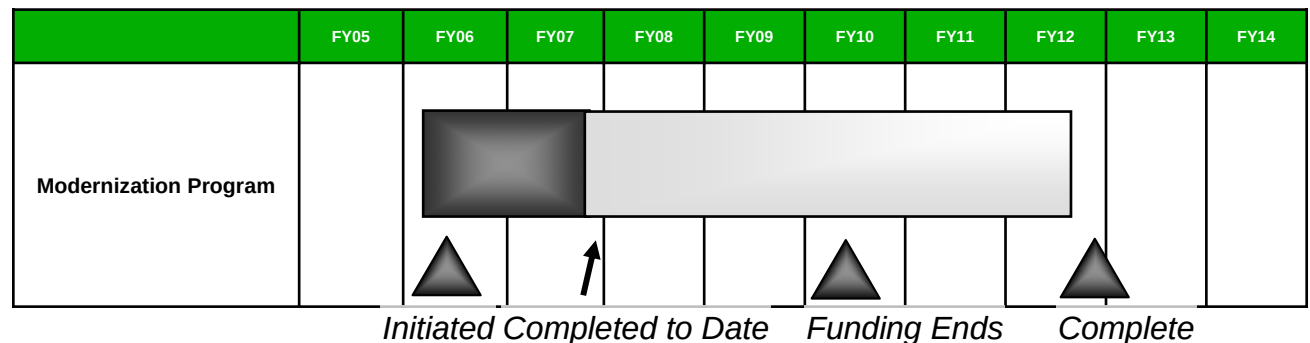




LCMC Created Modernization Program to Address Supply Risk

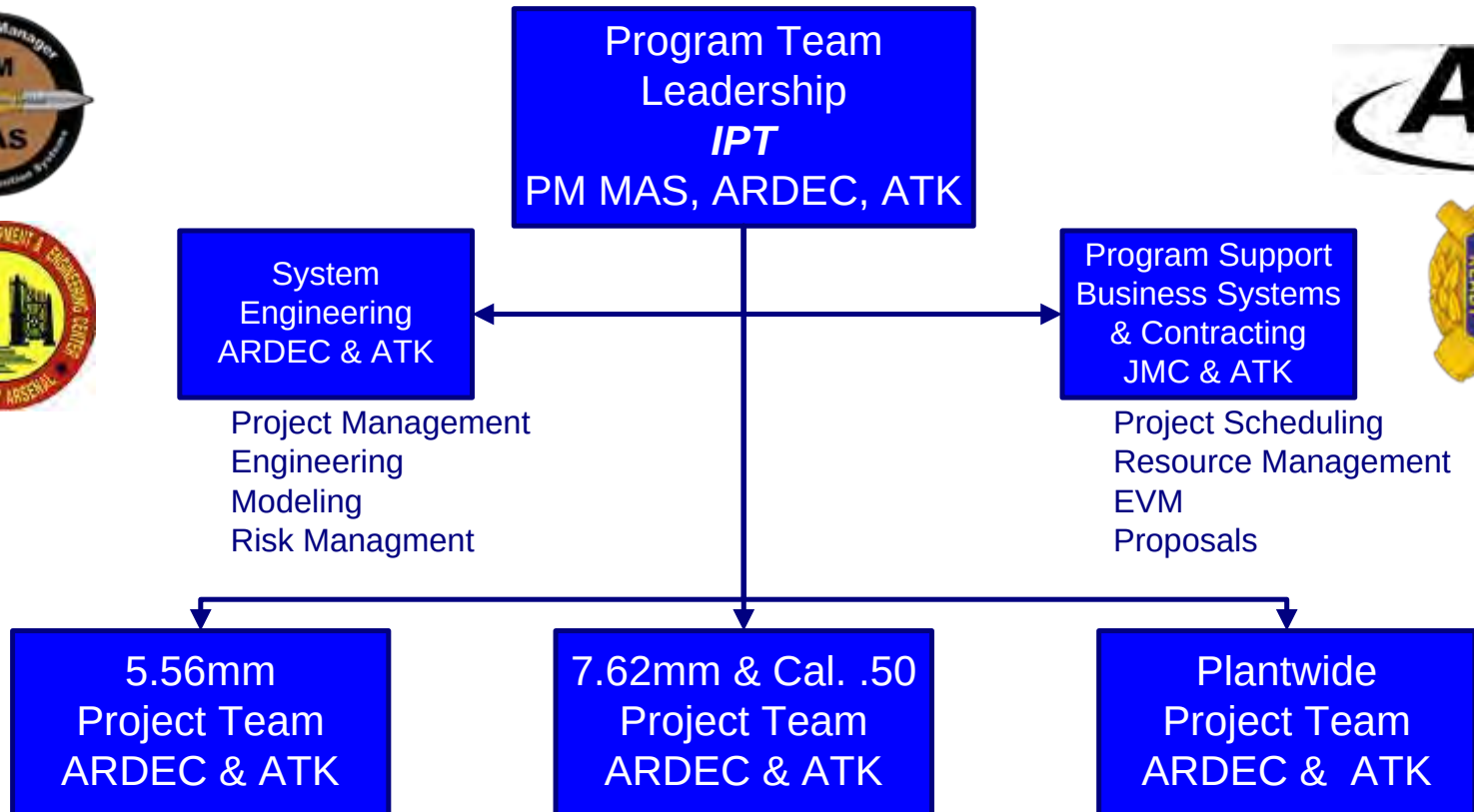


- Maintain capability to deliver 1.2 billion rounds per year
- Maintain deliveries during modernization execution
- Reduce single-point failures
- Increase reliability / availability / maintainability, productivity and quality
- Incorporate “Lean Thinking”
- Incorporate in-process inspection consistent with MIL-STD-1916
- Integrate improvements with ROI < 5 years
- Increase production flexibility between and within calibers
- Reduce potential for injuries & environmental emissions

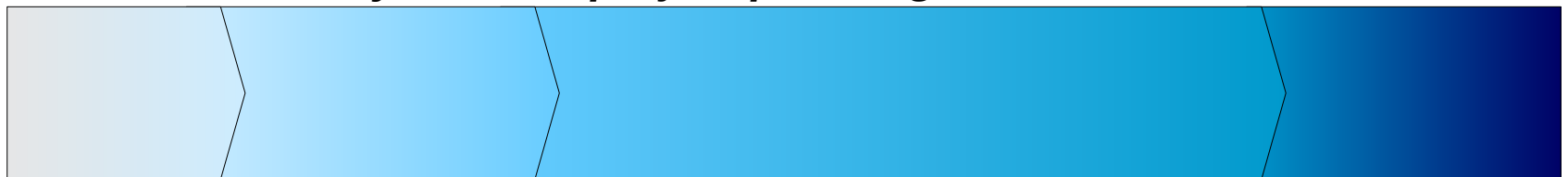


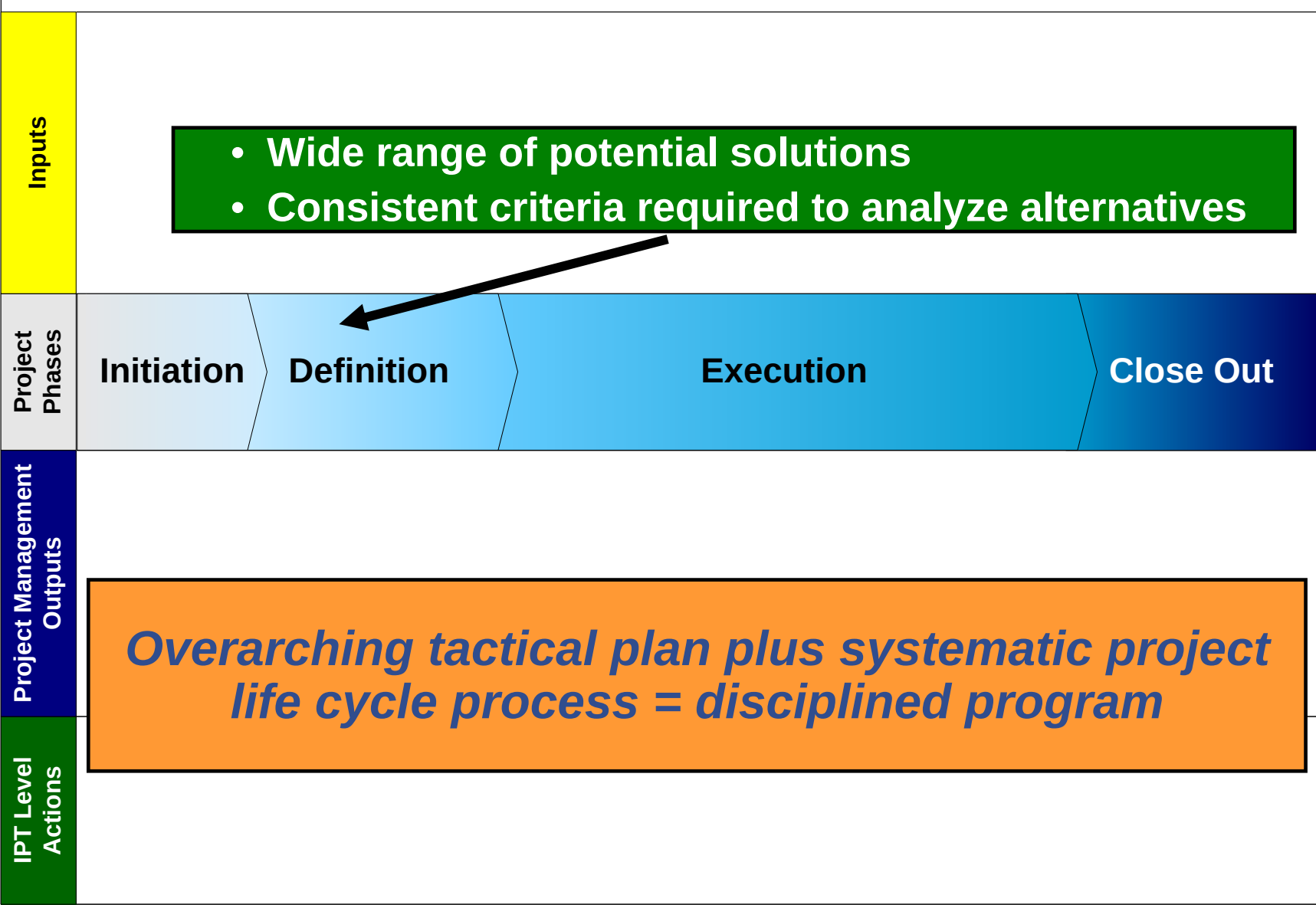


Strong Team Using Disciplined Systems



Systematic project planning and execution







➤ **Quality Function Deployment (QFD)**

- Interactive process led by PM MAS
- Criteria taken from Modernization objectives
 - Criteria weighted against objectives
- Agreement on scoring weights and standards
- Mod IPT scored current and anticipated projects

Structured process used to rank projects



QFD Evaluation Used to Prioritize Between and Within Projects



System Level Requirements	Weight	B1 SCAMP Loading P&A		B1 556mm Bandoleer Replacement Program		B1 556mm Commercial Pack Improvements		B1 556mm Pallet Strapping System Replacement		B1 SCAMP Priming Mech & Elec Upgrade	
Sustain 5.56mm production Capacity @ 997 million (long term readiness)	10	9	90	1	10	1	10	3	30	9	90
Sustain 7.62mm production Capacity @ 160 million (long term readiness)	10	0	0	0	0	0	0	0	0	0	0
Sustain 50 Cal production Capacity @ 60 million (long term readiness)	10	0	0	0	0	0	0	0	0	0	0
Risk of Single Point Failures	8	3	24	0	0	0	0	9	72	3	24
Improve production reliability through improvements in equipment Operational Availability	6	1	6	3	18	0	0	1	6	3	18
Improvement in process efficiency (lean)	5	0	0	9	45	3	15	0	0	0	0
Increase product quality (six sigma) (ex. Acceptance testing)	7	3	21	0	0	9	63	1	7	1	7
Decrease inherent scrap rate (Machine Scrap)	1	0	0	0	0	0	0	0	0	0	0
Increase production flexibility (type)	5	0	0	0	0	0	0	0	0	0	0
Reduce incremental staffing demands for changes in production requirements and reliance on special skills (scalability)	4	0	0	1	4	3	12	9	36	3	12
Improvement in ROI (\$)	5	1	5	3	15	1	5	1	5	1	5
Reduction or elimination of safety and environmental hazards	8	0	0	9	72	0	0	3	24	3	24
Score Totals		146		164		105		180		180	
Additional Factor		1		1		1		1		1	
Overall Scoring		146		164		105		180		180	
Ranking Within Family		11		9		14		6		6	
Overall Ranking		28		24		33		17		17	

Result = Prioritized List for Modernization Projects

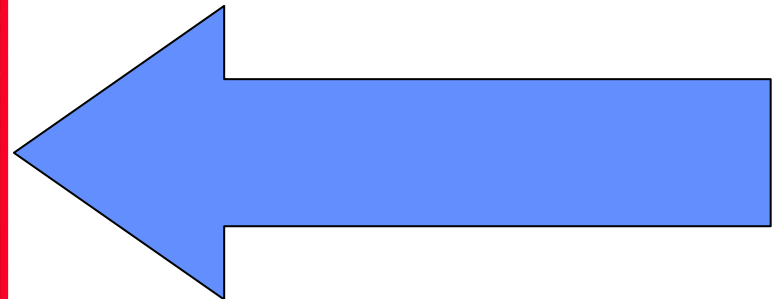


Modernization Upgrade 5.56mm SCAMP Equipment



- Upgrade to new electronic controls
- Foundation reconstruction
- Mechanical refurbishment

- Completed first of 5 priming lines



- Demonstrates upgrade capabilities



- **Manufacturing modernization for 7.62mm & Caliber .50**
 - 60% new equipment
 - 40% refurbished equipment
- **Following Lean/Six Sigma principles**
- **Significant improvements to material handling**



Lean/Six Sigma Principles Driving Process Redesign



	Current	Reset Equip.	COTS Systems	Team Results
Distance moved (feet)	1,758	495	197	122
Cups/Cases in process	4,579,050	375,000	43,000	13,000
Operations	24	16	10	10
Handling	4	17	1	1
Transport	77	7	16	24
Inspection	0	0	1	3
Delay	1	2	3	2
Storage	16	8	0	0
Variation Paths	1,290,240	36	2	2
Cycle time (minutes)	6,185	1,562	179	52
Changeover time (hours)	NA	NA	16	

4.3
Days

3
Hours

New lines give greatest impact for long-term process, efficiency & quality improvement, and manufacturing agility.



Refurbishing & Upgrading Existing Equipment



Case Equipment--Taper/Final Trim

Before



After





Adding Key New Equipment



New 7.62mm/Caliber .50
Palletizer/Bander Machine

New Caliber .50
Final Wash System





Modernization Supports PEO Ammo Industrial Base Strategic Plan Objectives



FINAL DRAFT



Single Manager for Conventional Ammunition (SMCA)

Industrial Base Strategic Plan: 2015

Goal 4. Modernize required manufacturing and logistics capacity.

Objective 4.1.a: Increase manufacturing and logistics readiness to meet current and future requirements.

Industrial Base Strategic Goals and Objectives

I 1. Balance industrial base & acquisition management risk.

- Objective 1.1.a: Ensure critical core competencies and capabilities are available to meet requirements.
- Objective 1.1.b: Balance cost, schedule and performance with need to have capability.
- Objective 1.1.c: Establish right-sized ammunition industrial base.

I 2. Transform to meet current and future requirements.

- Objective 2.1.a: Optimize acquisition planning, industrial base preparedness, and logistics capabilities to support Joint and Expeditionary Warfighting requirements.
- Objective 2.1.b: Reduce GOCO/GOGO conventional ammunition facility operating costs/footprint and pursue use of or dispose of excess capacity.
- Objective 2.1.c: Develop and ensure manufacturing/logistics capability and readiness.

Strat

FINAL DRAFT

communications with all Services and

Lake City will be positioned for several decades



Armament Technology – Focusing on “Joint Munitions and Lethality Life Cycle Management Command”

Program Executive Office
Ground Combat Systems

Acquisition Excellence

Kevin Fahey
Program Executive Officer,
Ground Combat Systems
June 2007



Program Executive Office Ground Combat Systems

Program Executive Office
Ground Combat Systems



Stryker Brigade
Combat Team



Heavy Brigade
Combat Team

- Abrams Tank
- Bradley Fighting Vehicle
- Paladin / FAASV
- M113



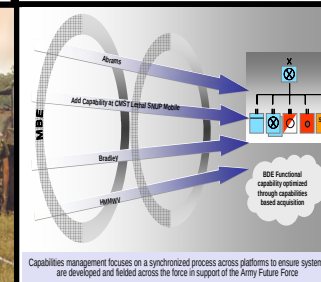
Joint Robotics
Systems
(Army & Marine)



Joint
Lightweight
Howitzer 155mm
(Army & Marine)



Modular
Brigade
Enhancements



PEO GCS maintains a total Army perspective in managing the development, acquisition, testing, systems integration, product improvement, and fielding that places the best ground combat systems in the hands of our soldiers

Acquisition Excellence



PM Heavy Brigade Combat Systems

Program Executive Office
Ground Combat Systems

8,453
Abrams FoV



3,962
Fire Support
Platforms



13,943 M113
6,452 Bradley



29,373 in Active Use

Acquisition Excellence



Stryker Family of Vehicles

Program Executive Office
Ground Combat Systems



Infantry Carrier Vehicle (ICV)



Commander's Vehicle (CV)



Fire Support Vehicle (FSV)



Reconnaissance Vehicle (RV)



Medical Evacuation Vehicle (MEV)



Engineer Squad Vehicle (ESV)



Anti Tank Guided Missile (ATGM)



Mobile Gun System (MGS)



NBC Reconnaissance Vehicle
(NBCRV)



120mm Mounted
Mortar Carrier (MC-B)

Commonality

Common Operating Picture

Common Chassis & Drive Train

Common KPP's

Common Survivability

**Common TMDE, Spare Parts,
Tools & Skills**

Acquisition Excellence

Note: Red – LRIP



PM Joint Lightweight 155



M119

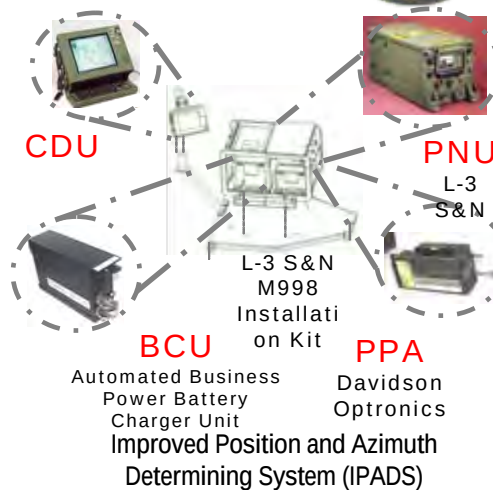
M198



M777E1 Howitzer



Joint Programs US Army & USMC



Gun Laying and Positioning System



Projected End State Total (FY09) (AAO):

M777A1:	273 Army / 380 USMC
M198:	741 Production Complete
M119:	389 Production Complete
IPADS:	327 Army / 60 USMC
GLPS:	511 In Final Production



PEO GCS Robotic Systems JPO

Army & USMC Programs



Abrams Panther (6)



Mini-Andros (20)



Matilda (35)



Small Unmanned Ground Vehicle (SUGV)



Multifunction Utility /
Logistics &
Equipment (MULE)



Assault Breaching Vehicle
(ABV) (33)



Joint Programs US Army & USMC



FCS Programs



DOK-ING MV-4 (21)



Urbot (2)



Mini-Flail (21)



Armed Robotic Vehicle (ARV)



Vanguard (58)



Gladiator (2)



PackBot (22)



Autonomous Navigation System (ANS)

Acquisition Excellence



MRAP Vehicle Categories



MRAP CAT I

Support operations in an urban environment and other restricted/confined spaces; including mounted patrols, reconnaissance, communications, and command and control

- 4x4
- 6 pax
- GFE Integration
- Curb Wt: 21,000 – 32,000 lbs
- GVWR: 31,300 – 52,000 lbs
- Reserve Payload*: 0 – 6,000 lbs

All services and USSOCOM



MRAP CAT II

Provide a reconfigurable vehicle that is capable of supporting multi-mission operations such as convoy escort, troop transport, explosive ordnance disposal, ambulance, and combat engineering.

- 4x4 and 6x6 variants
- 10 pax
- GFE Integration
- Curb Wt: 26,600 – 40,000 lbs
- GVWR: 31,300 – 52,000 lbs
- Reserve Payload*: 0 – 7,000 lbs

Army includes Ambulance variant



MRAP CAT III

Provide mine/IED clearance operations, giving deployed commanders of various units, and EOD/Combat Engineer teams survivable ground mobility platforms.

- 6x6
- 12 pax
- Curb Wt: 45,000 lbs
- Cmbt Wt: 80,000 lbs
- Payload: 38,000 lbs

Navy and Marine Corps only

Acquisition Excellence

* Reserve Payload = avail payload after full compliment of personnel, gear, and GFE



Some Thoughts on Life Cycle Management Execution

- **Set Priorities**
- **Link priorities to Army campaign Plan**
- **Execute in an A,L&T integration construct**
- **Execute in a disciplined and deliberate way**
- **Good Systems Engineering/Lean Six sigma**
- **Army Force Generation Model is a good synchronization model**
- **Need to be brigade and capability focused**



Program Priorities

- **Support our Soldiers and GWOT**
- **Modularity, Reset, Recap**
- **Spiral Integration**
- **Ground Combat Investment/Modernization and Sustainment Strategy**
- **Balance long-term goals and objectives and near-term challenges**

NONE OF THESE ARE MUTUALLY EXCLUSIVE



What Drives us. . .Army Requirements

Army Campaign Plan

PEO GCS Campaign Plan

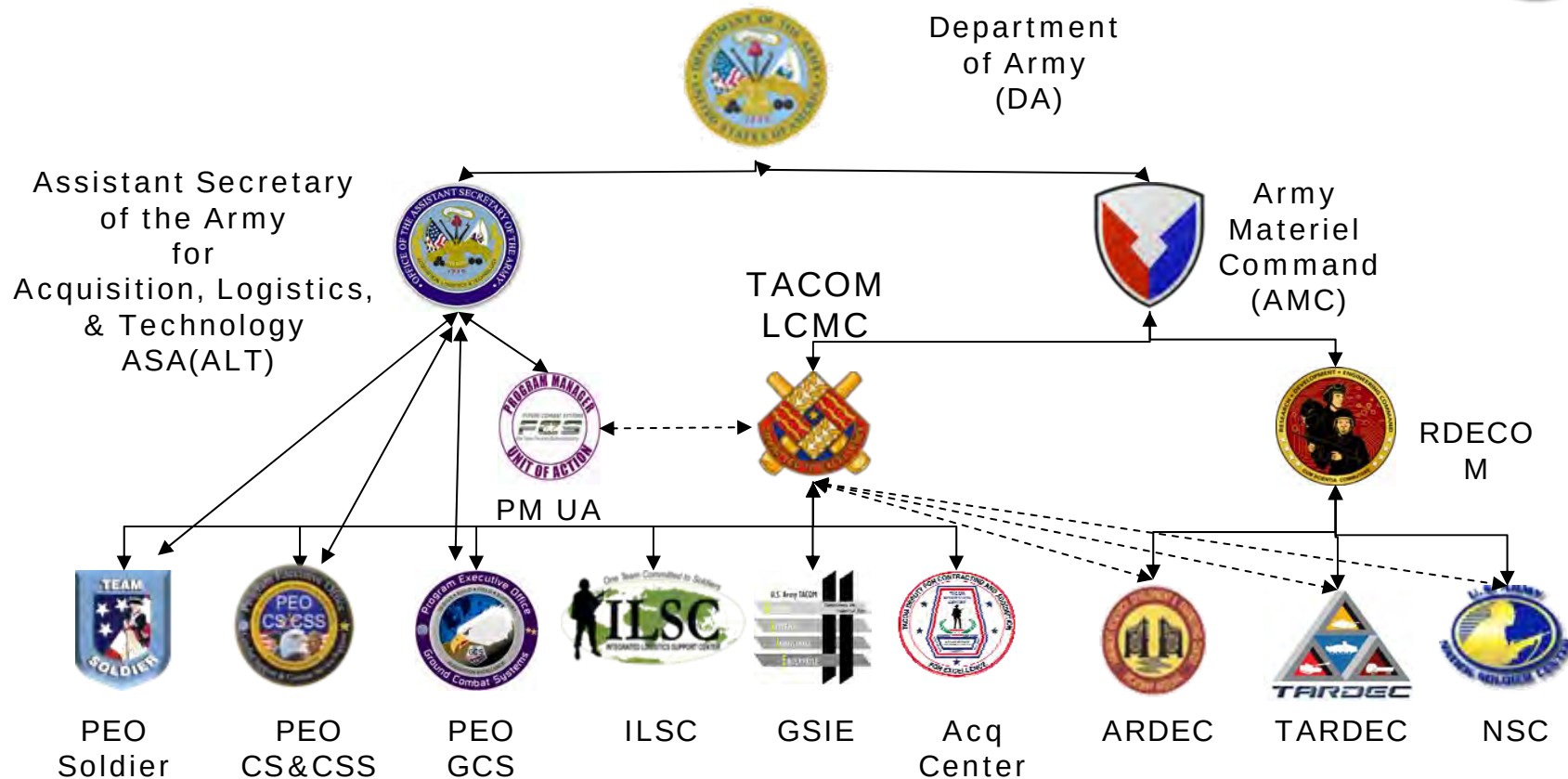


- Build the Formation – Not the Platform
- Focus on The Army's Campaign Plan and the Desired Endstate
- Support the Fight
- Sustain BCTs
- RESET and Recap – Are They Working?
- Integrated Management-OEM partnership
- Build the Future
- Establish RDTE
- Obsolescence
- Commonality
- Training Devices
- Formation Health Management
- FCS and FCS Spin-outs

Nested Requirements Mapped to ACP Drive Objective Fleet



TACOM LCMC

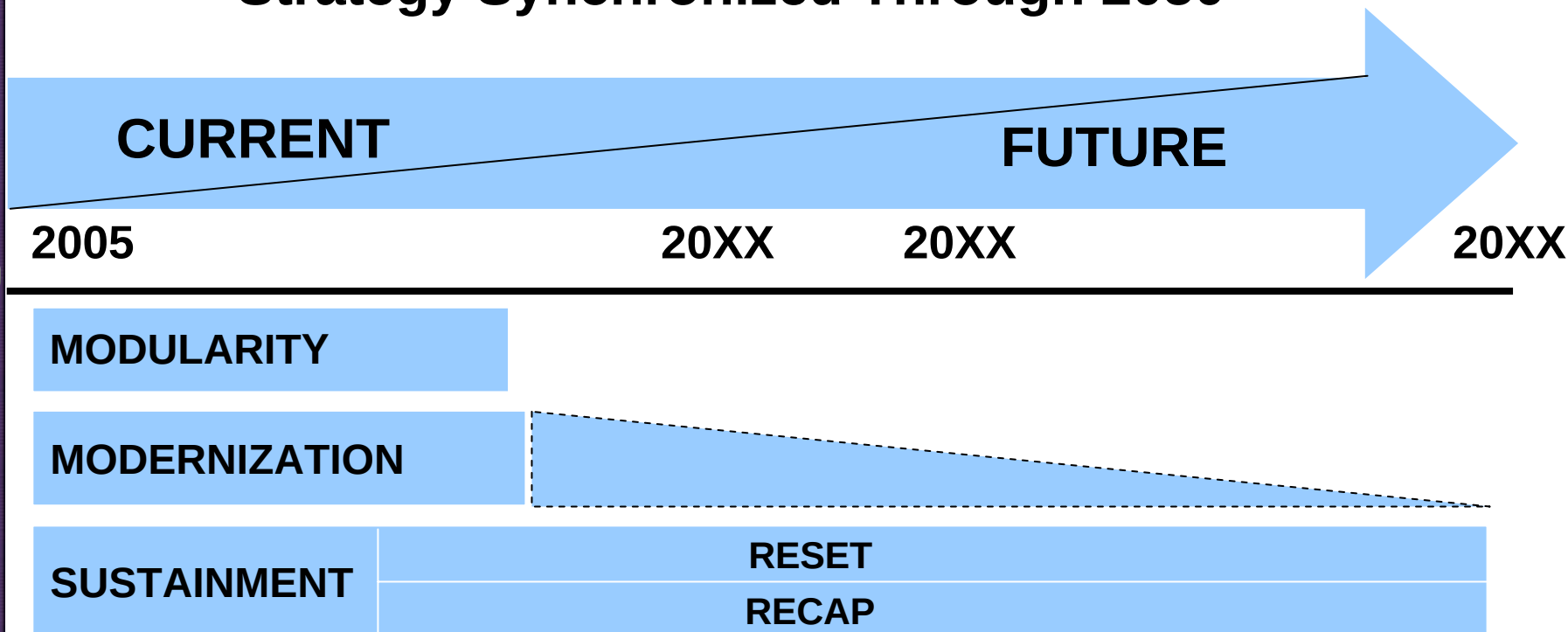


The TACOM LCMC unites all of the organizations that focus on Soldier and Ground Systems. The PEOs and PMs are able to work as an integral part of the Logistics and Technology efforts of the LCMC, while enterprise level partnerships are maintained with the Research, Development, and Engineering Centers (RDECs).



Notional Fleet Management Strategy Synchronized Through 2050

Program Executive Office
Ground Combat Systems



- Requires Partnerships with Industry and RDECOM
- Requires Centralized Management and Oversight
- Requires Balance between Current and Future
- Requires Centralized Funds Management (OMA and PAA)

Acquisition Excellence



PEO GCS Approach to Fleet Management

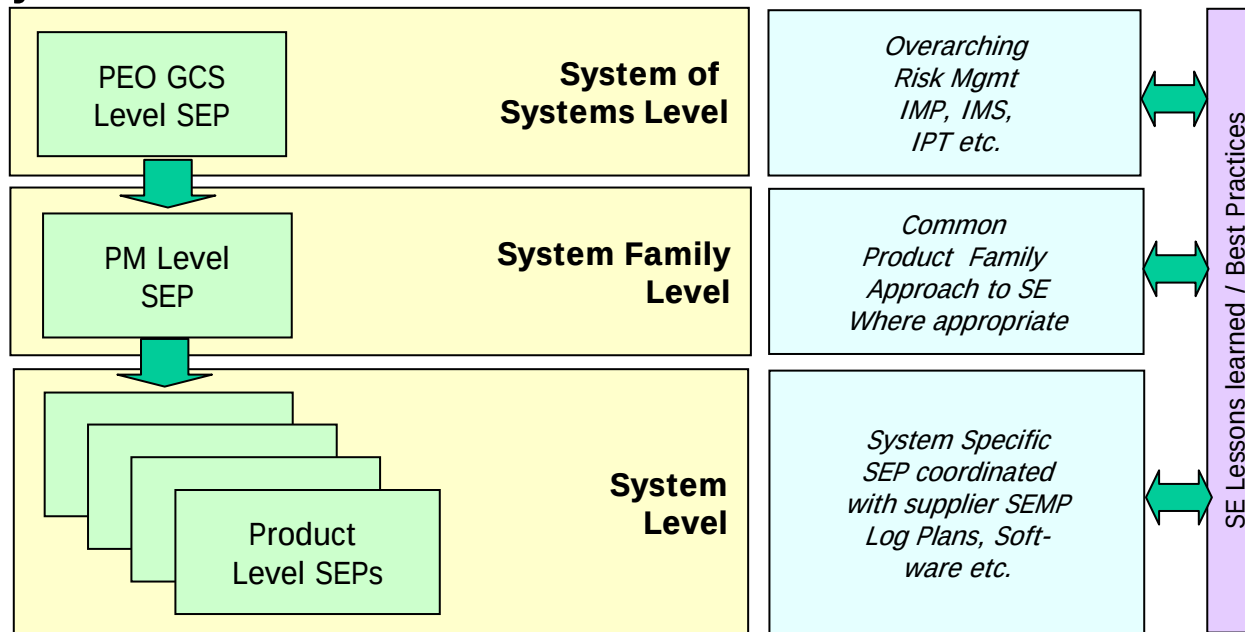
- **Balanced Across the Fleet of Systems**
- **Requirements/Capabilities Based Submission**
- **Linked to Army Goals for Transformation**
- **Approached from a Life Cycle Perspective**
- **Business Case/Fact Based Analysis of Alternatives**
- **Tempered by Affordability Constraints**
- **Tied to Force Operational Cycle**
- **Seamlessly Links Modernization and Sustainment**
- **Focused on System Relevance through 2050**
- **Types of Initiatives Considered in Scope for Most Systems (Modularity, FCS Spin Outs, RECAP, RESET, Systems Rearchitecture, Technology Insertion, Sustainment/Overhaul, Army Policy Mandates)**



PEO GCS Systems Engineering (SE) Approach

... *Overarching SEP Development Status*

- Delivering an overarching PEO GCS SEP
- Developing Product Level SEPs
- Identified SE gaps are being closed with Green Belt Projects

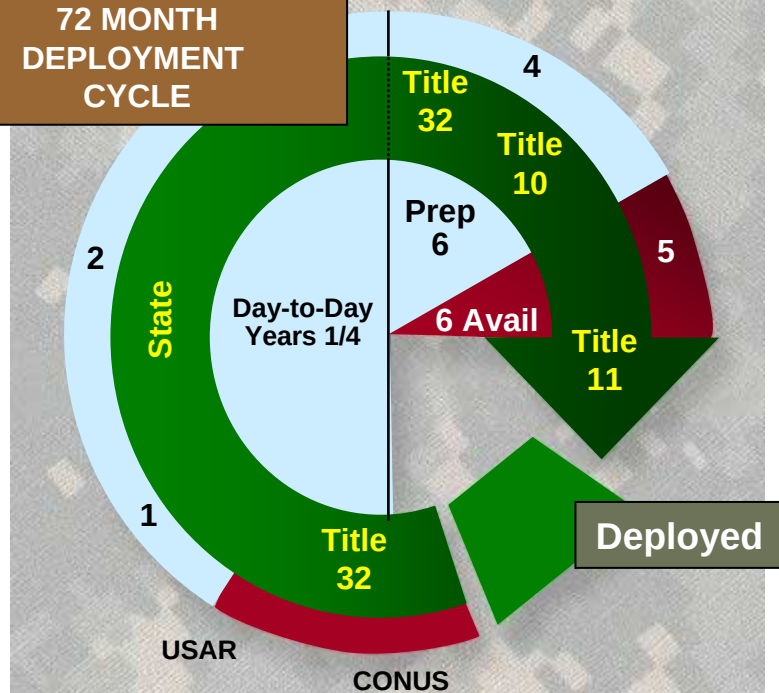




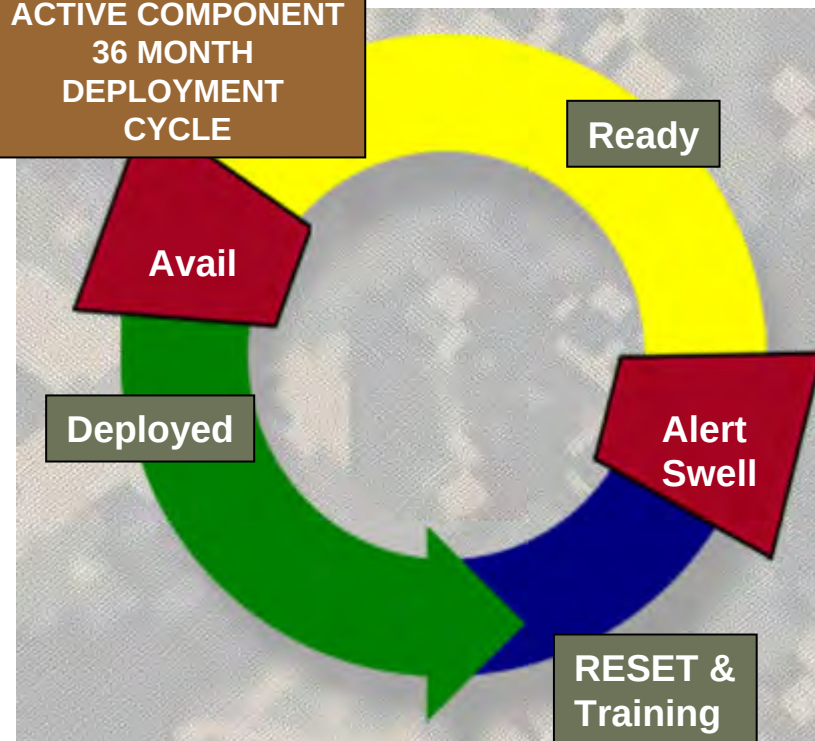
Army Forces Generation Model ARFORGEN

Program Executive Office
Ground Combat Systems

RESERVE COMPONENT
72 MONTH
DEPLOYMENT
CYCLE



ACTIVE COMPONENT
36 MONTH
DEPLOYMENT
CYCLE



Synchronizes the Right Force Mix with the Right Equipment Mix
at the Right Time
PM Objective is to "ONLY TOUCH THE UNIT ONCE"



Army Force Generation Model

MACRO... Synchronize G8 Priorities, FORSCOM Priorities and AMC Priorities to Support Dynamic Theater Environment

MACRO... Establish Planning and Execution Baselines that serve as BCT Horse Blanket for All to Follow

MICRO... Synchronizes LCMC Major Item Management Business Process and Life Cycle Management with Combat Vehicle Fleet Strategies

MICRO... Improves Support to Unit ARFORGEN Cycles (Reset, Train and Deploy)



ARFORGEN cont...

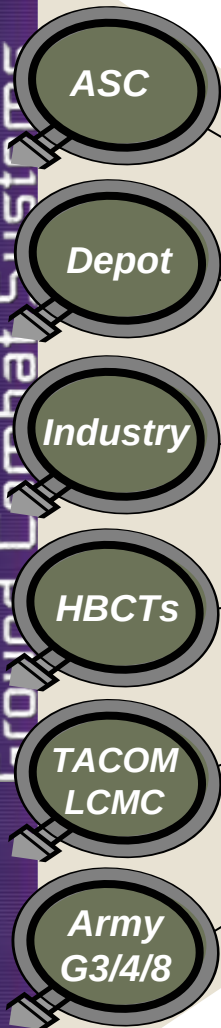
PMs (Life Cycle Managers) have the Best View of the Battle Field...

- ✓ **SA on available Resources to Execute all Elements of LCM**
- ✓ **Develops and Negotiates Reset Schedules (TPF, NET, LBE, equipment swap)**
- ✓ **Determines Depot and OEM Workloads through P3 (Reset and Recap)**
- ✓ **Determines and applies Modernization, Sustainment and Modifications**
- ✓ **Works with G8 and User to determine ONS Impacts...(AR2B Decisions)**
- ✓ **Clearing House with G8 and G3/G4 for Synchronization of Reset and Recap Dollars (OMA and Procurement)**
- ✓ **Serves as a feeder to Army Field Support Commanders**



Supporting the BCT Through ARFORGEN Viewing the Battlefield

Program Executive Office
Ground Combat Systems



Modularize

Support
the Fight

Sustain

Modernize



Acquisition Excellence



LCMC Major Item Management for the Brigade Combat Team

Desired End State

One Fleet, One Life Cycle
Full Implementation across the Formation

Program Executive Office
Ground Combat Systems

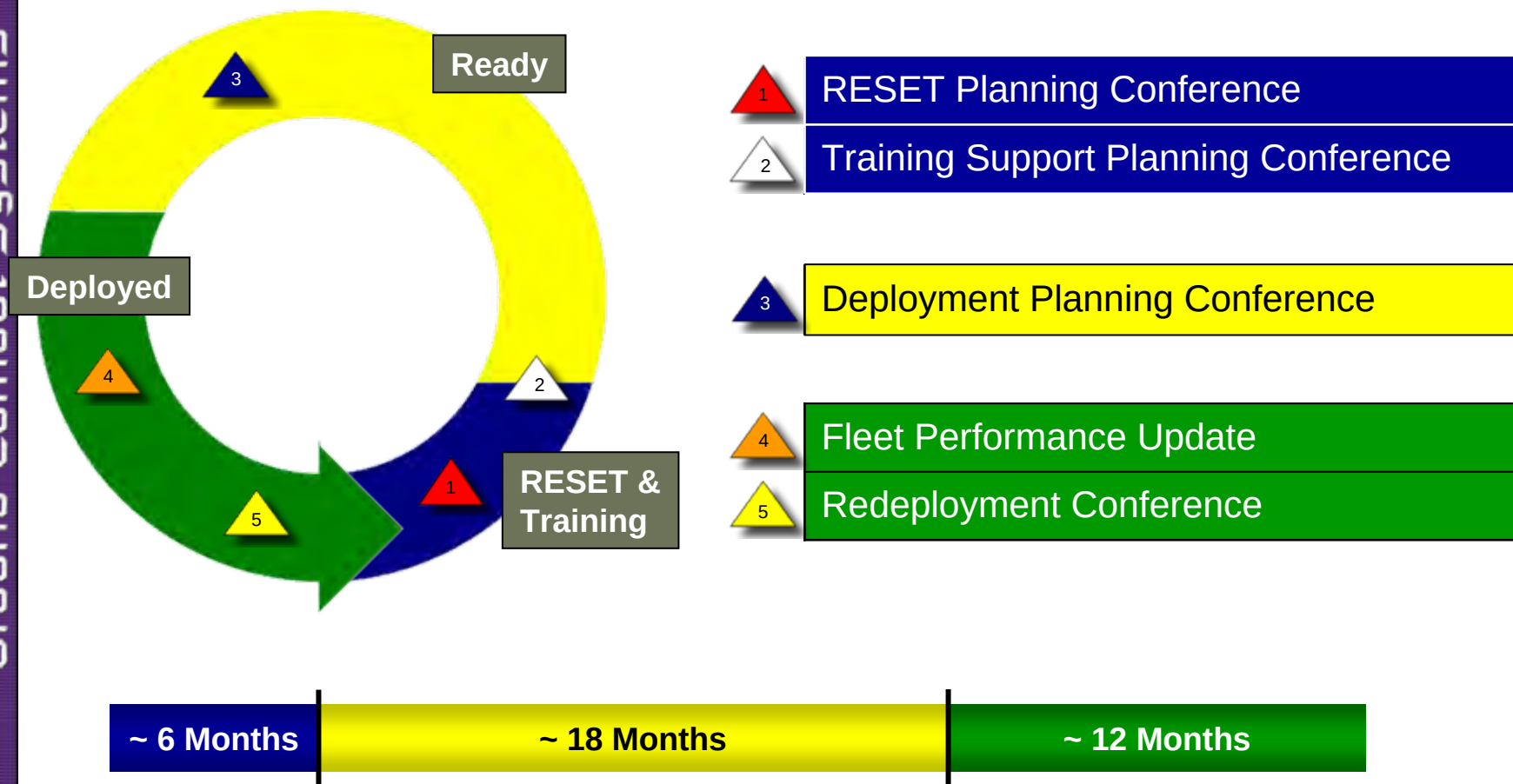




ARFORGEN Support Cycle

Touch Points Overview

Program Executive Office
Ground Combat Systems



Five Critical Interactions between PM, Divisions and BCTs

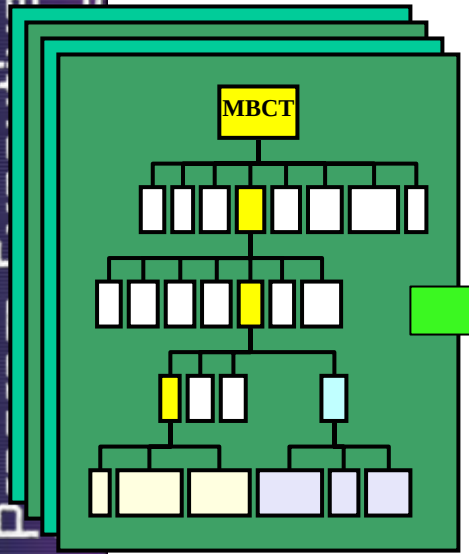


PEO Fleet Management and Modernization Analysis Framework



Current Force vs. Future Force Req. Capabilities

**Current Force BCT
Structures &
Platform Functional
and Capability
Decomposition**



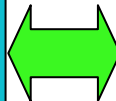
Current Force Capabilities (CF)

1. ID Capability Diff / Gaps
 - CF/FF Difference Assessment
 - Integrate TRADOC Gap Analysis
2. Prioritize Gaps -> Create Index
3. Identify Options/Alternatives

4. Evaluate Alternatives
 - Simulate capability
 - Optimize objectives
 - Rank Alternatives
 - Alternatives vs. Budget Constraints
5. Select/Prioritize Alternatives
6. Develop Evolution Strategy

Required Capabilities (FF)

**FCS KPPs,
Specs, O&O
Missions,
Force
Operating
Capabilities
(FOCs), CNA**



Capture Info in SoSAT/CASTFOREM

BCT vs. Mission

Drill Down – Qualitative and Quantitative Assessments

Acquisition Excellence



Abrams Projected Improvements

Improved Combat Identification

Improved Target Recognition

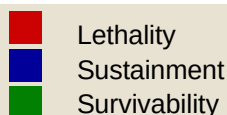
Improved Ammo

Improved Fire Suppression System

Improved Accuracy

Active Protection and Threat Warning System

Improved Ballistic Protection



More Reliable Power Train

More Reliable Track and Road-wheels

Embedded Vehicle Health Management System

Improved Silent Watch

Dismounted Soldier Battery Charger

Integrated JTRS / FCS Spinouts

Improved Frontal Armor

Improved Side and Rear SA

Improved CRBN System

Improved IED Survivability

Develop an Integrated Fighting System that will Overmatch Future Threats Across the Full Spectrum Warfare



My View of the Acquisition Landscape

- We have to figure out how to really partner with industry while maintaining competition integrity
- We have to be process and data focused and force fact based decisions
- Good discipline and sound systems engineering is critical throughout the acquisition life cycle
- We have to figure out how to make life cycle management a reality and partner with industry consistent with that construct
- Use data and contract performance to dictate long-term partnerships
- Every portfolio will have a hard time when the funding begin to decline
- We have to figure out how to establish requirements and manage acquisition by BCTs and not individual programs



Major Challenges

- Many Priorities, but the war is number one with everything else a distant second. This makes it extremely hard to strategically look towards the future.
- Things to ponder
 - What happens after the war, are we prepared. . .NOT
 - We always prepare for the next war based on the last and we are in a non-kinetic, close quarters, urban environment.
 - Funding amounts and priorities will change, just not certain when or how
 - The worst thing we all do is downsize in a logical disciplined way
 - Politics. . .
 - We all do a terrible job telling the leadership what is important
 - My plan is to focus on establishing a sound process and baseline data so that I can help leadership make fact based decisions. My OEMS are part of this effort, it is not progressing to my satisfaction, but on the right track!!!



Summary

- We are working hard to re-energize Systems Engineering and institutionalize Lean/Six sigma in the way we are doing business, already seeing results
- We are trying to look at acquisition management by brigades and across brigades from a life-cycle management perspective
- Spending significant effort of managing the fleet of vehicles and being as prepared as possible for after the war and budget reductions



Program Executive Office Ground Combat Systems



Acquisition Excellence



BACKUP

Program Executive Office
Ground Combat Systems

Acquisition Excellence



Bradley Projected Improvements

Program Executive Office
Ground Combat Systems

Increased Lethality
Commander Self
Defense Weapon
Combat Identification
Improved Ammo

Target Designation
Aided Target
Recognition

Carry 9 Combat
Equipped
Soldiers

IED Electronic
Counter Measures
JTRS/ FCS Spinouts
Signature
Management

Improved IED
Survivability
Improved Crew and
Soldier Protection

Improved Rear
Ballistic Protection
External Fire
Suppression

Overhead Wire
Protection
Spotlight

Active Protection
Threat Warning
System



■ Lethality
■ Sustainment
■ Survivability

Environmental
Conditioning
Battery Charger

Improved Vehicle
Health MGT &
Embedded Electronic
Technical Manuals

Improved Mobility

Rearward and Side
Looking Vision
Systems

Acquisition Excellence



Paladin Projected Improvements

Armament

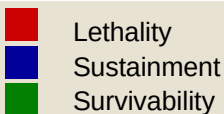
Ammunition Storage

**Improved Fire Control
and Ammunition**

**IED Electronic
Counter Measures
JTRS/ FCS Spinouts
Signature
Management**

**Improved Crew
Survivability**

**Active Protection
Threat Warning
System**



Driver Compartment

New Chassis

**Improved
Suspension & Track**

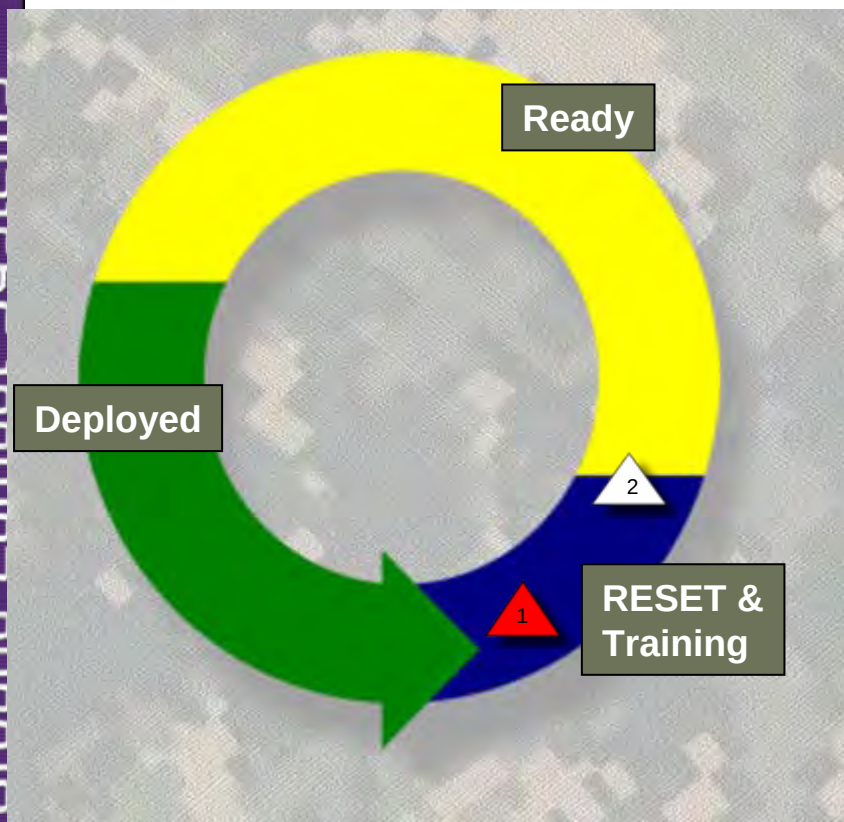
**Improved Vehicle
Health MGT &
Embedded Electronic
Technical Manuals**

**Improved
Electrical System**

Improved Power train

Acquisition Excellence

RESET and Training Phase



1

RESET Planning Conference

- Review Unit and PM HBCT ARFORGEN Cycles and **Training Calendars**
- Review Modularity Requirements & Impacts
- Conduct **RESET Overview** & Status Briefing
- **Coordinate Fielding & Training Schedules**
- Review ARFORGEN Activities Next 6 Months

2

Training Support Planning Conference

- Review Unit and PM HBCT ARFORGEN Cycle & **Training Calendars**
- Review Equipment RESET Status
- **Coordinate Support During Ready Phase**
- Review ARFORGEN Activities Next 12 Months



PM's R-Date is when 85% of the Unit's Equipment Arrives at the RESET Location

Ready Phase

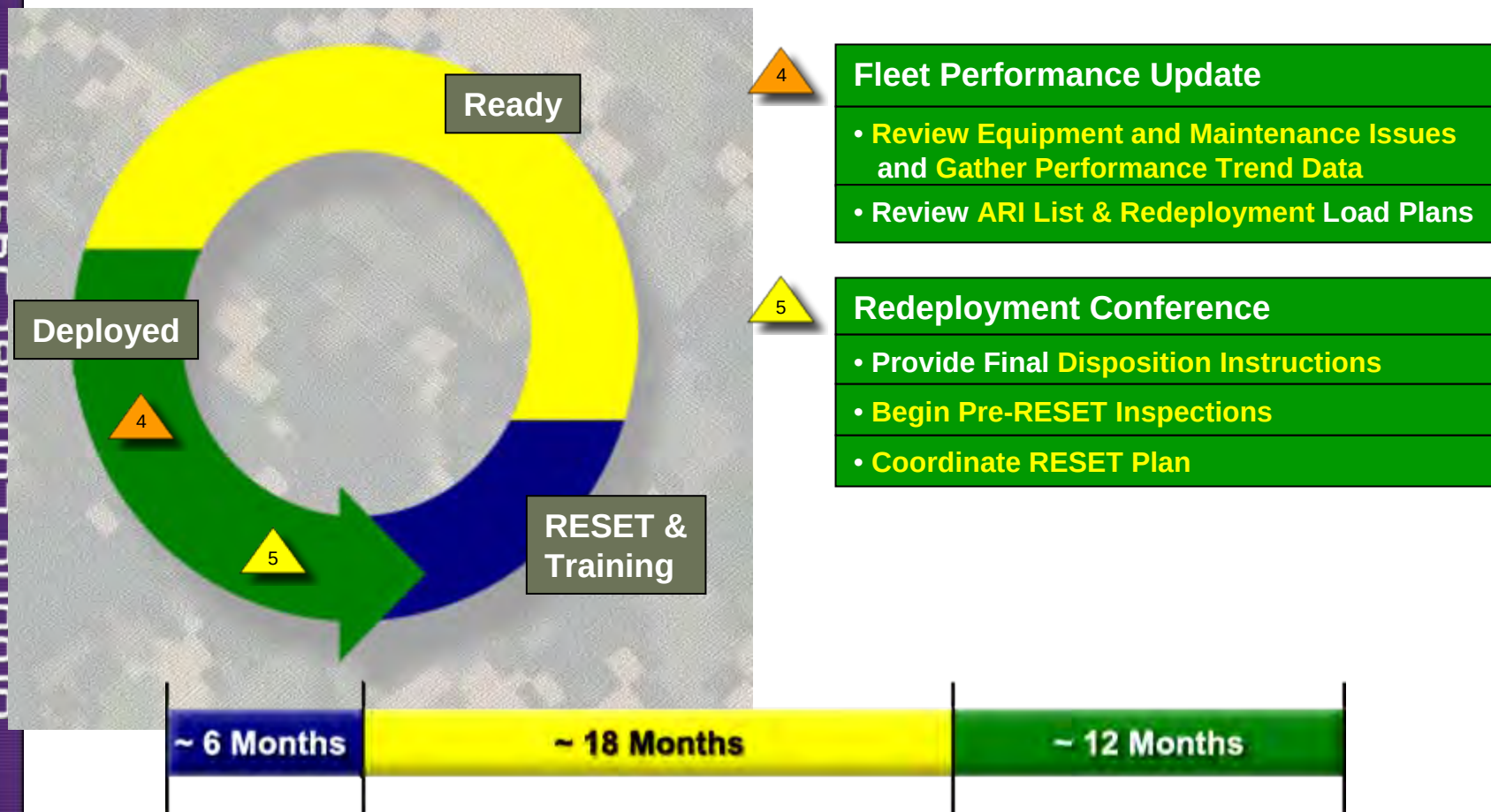


Deployment Planning Conference

- Brief Deployment Support Available
- Identify MWO and Retrofit Requirements
- Discuss Theater Provided Equipment (TPE)
- Discuss Leave Behind Equipment (LBE)
- Discuss HBCT / LCMC Support Capability in Theater
- Discuss the Roles of FSRs & LARs and Link them up with the Unit
- Review ARFORGEN Activities Next Six Months

R-Day Marks the Transition from the RESET & Training Phase
To Ready Phase
Collective Training Becomes the Focus

Deployed Phase



Fleet Performance Update

- Review Equipment and Maintenance Issues and Gather Performance Trend Data
- Review ARI List & Redeployment Load Plans

Redeployment Conference

- Provide Final Disposition Instructions
- Begin Pre-RESET Inspections
- Coordinate RESET Plan

Redeployment Planning and Execution Requires Most Improvement



The University of Texas at Austin



Eraser



Transitioning EM Railgun Technology to the Warfighter

**Dr. Harry D. Fair, Director
Institute for Advanced Technology
The University of Texas at Austin**

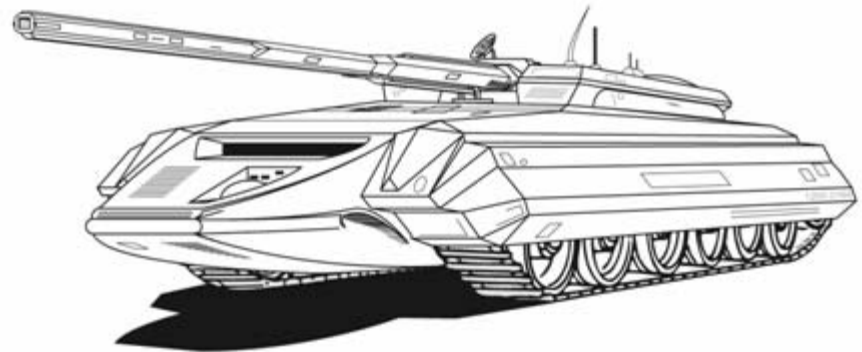


The Governorator is correct!

- At the IAT, we are harnessing large quantities of electric energy to enable radically new capabilities for the warfighter.
- These new electric weapons are capable of accelerating high energy hypervelocity projectiles from electric railguns on land, sea, and air platforms,



Electric guns are real.



and are capable of protecting these platforms by electromagnetic protection systems.

Hypervelocity Electromagnetic Railguns

What are they?

How do they work?

Why change to electromagnetic energy?

How can we use them?

When can we have them?

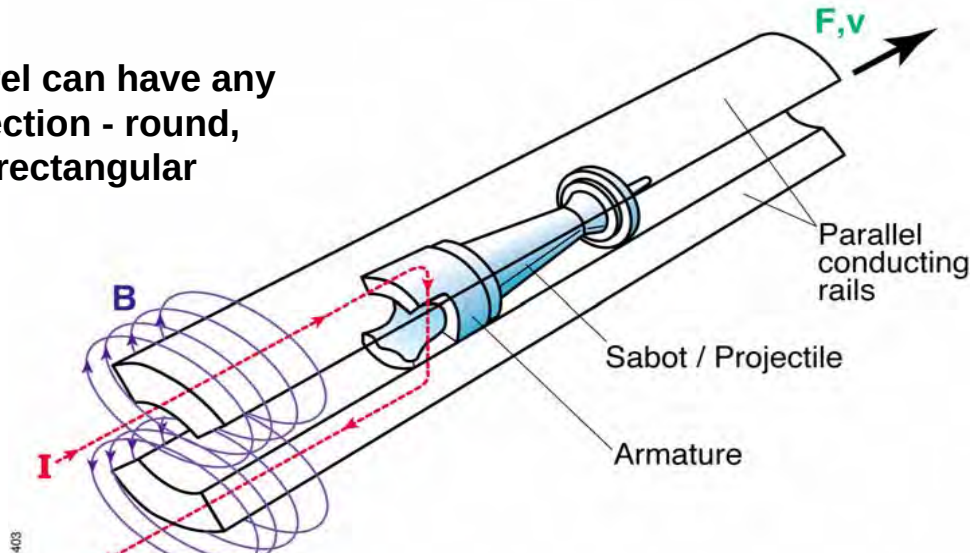
What are the implications for the Army and the Navy?



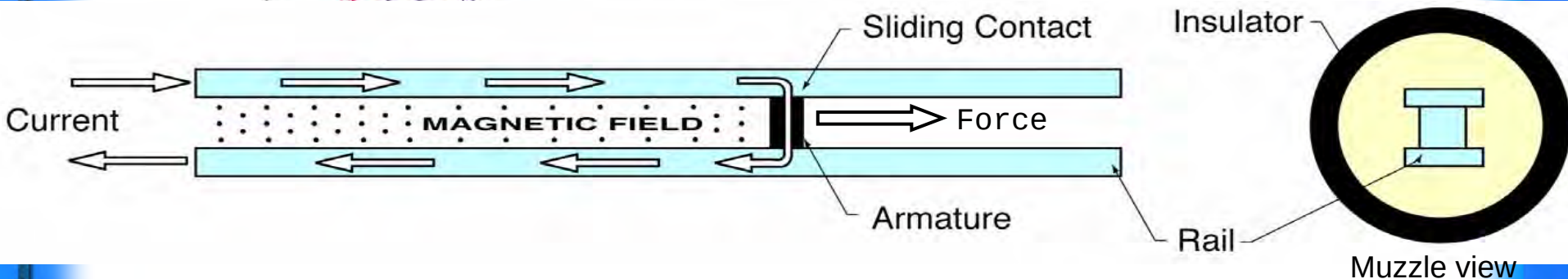
What is an Electromagnetic Railgun?

Converts Electricity to Kinetic Energy

The barrel can have any cross section - round, square, rectangular



The accelerating Force is provided by Electromagnetic Forces and can accelerate projectiles to very high velocities

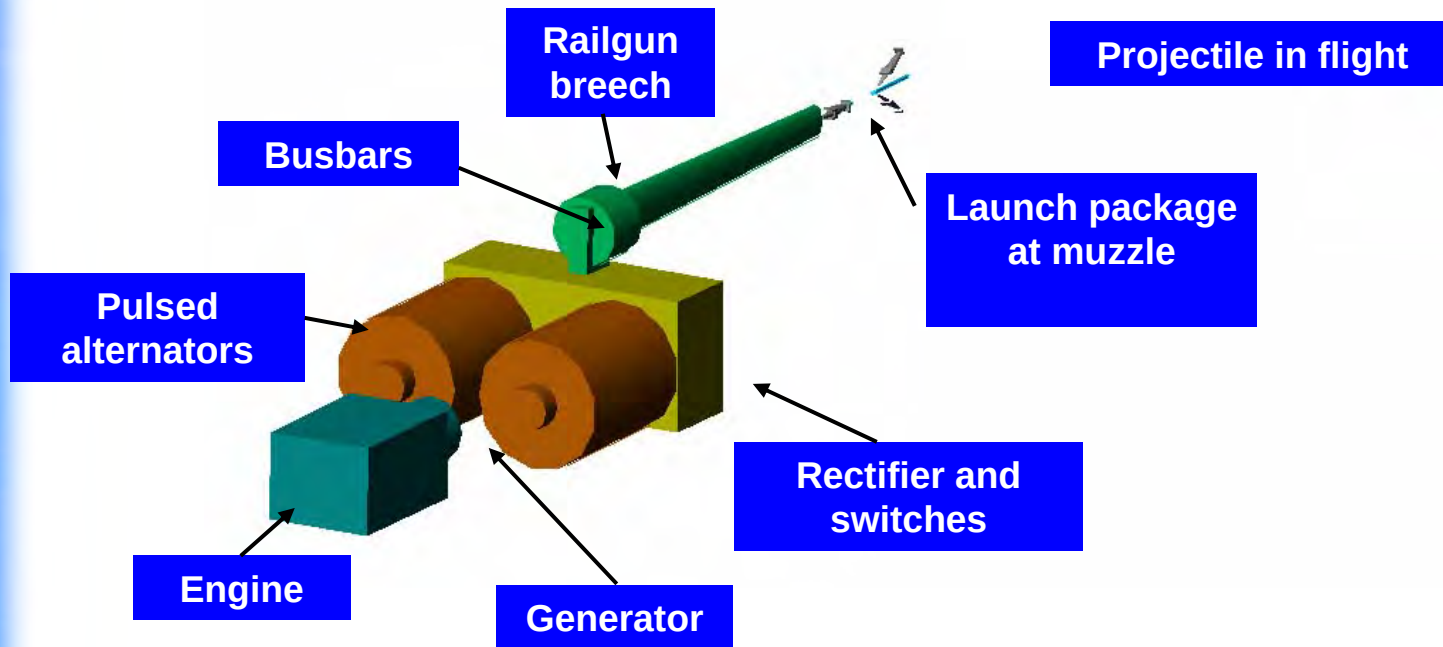


We routinely launch projectiles to hypervelocities (from 2-6 km/sec) in our laboratory.

What is an Electromagnetic Railgun System?



Target defeat



The IAT addresses the critical issues for all of these components for direct and indirect fire

Why Transform to Electromagnetic Energy?

- **Controlled/Precise/Variable Lethality** – Non lethal to overwhelming lethality (1 to 1000 km)
- **Increased Battle Space** – Capable of extremely long ranges
- **Survivability** - No hazardous propellants and possibly no explosives on board
- **Logistics** - Smaller ammunition (8% of mass – 10% of volume for direct fire) - Eliminate propelling charges for NLOS/long range fires
- **Operational Flexibility**
 - Convert fuel to kinetic energy
 - shorter time of flight
 - Multi role, multi mission
 - Minimum / controlled collateral damage
- **Entirely New Missions** – ultra long range precision strike(up to 1000km)

Positions DoD industrial base to more accurately reflect changes in U. S. economy.

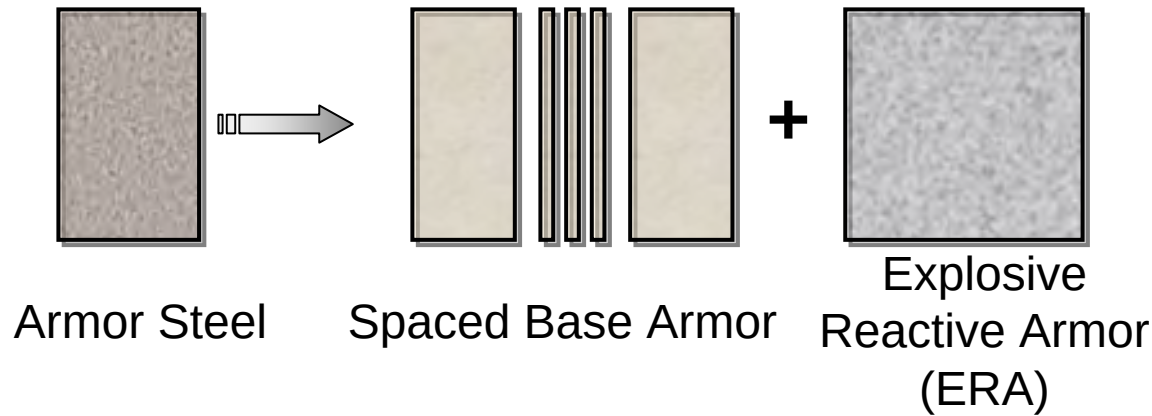


What are the Critical Science & Technology Challenges?

- **Hypervelocity Lethality**
 - Defeat of Modern Armor
 - Hypervelocity Guidance and Control
- **Electromagnetic Railgun Lifetime**
- **Electric Power**
- **Power Conditioning/Switching**



Greatest Lethality Challenge



Explosive Reactive Armor defeats shaped charge warheads and kinetic energy rods and can be retrofitted to combat vehicles



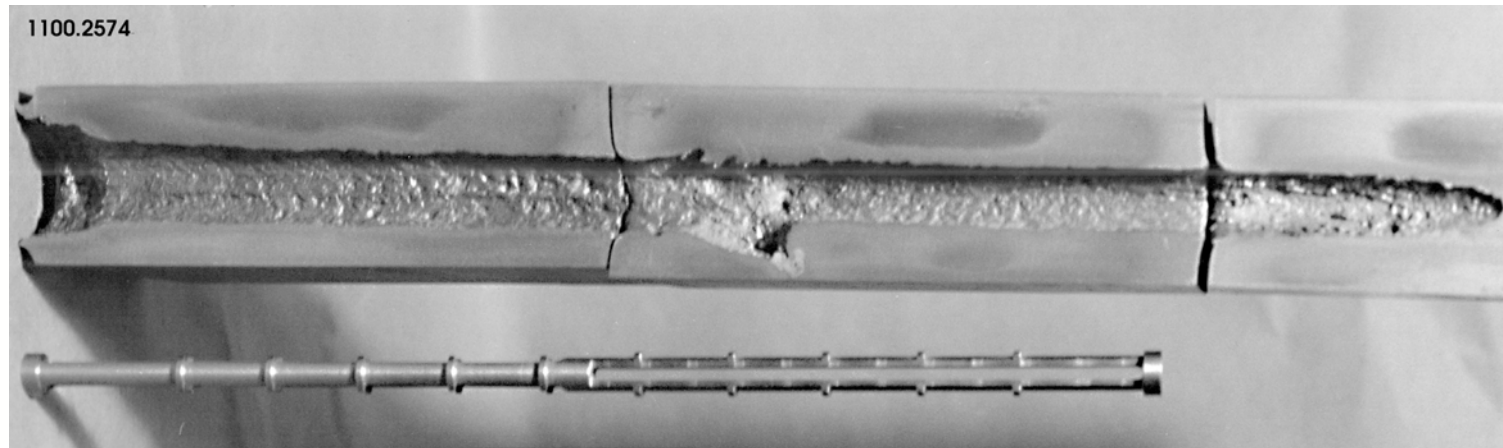
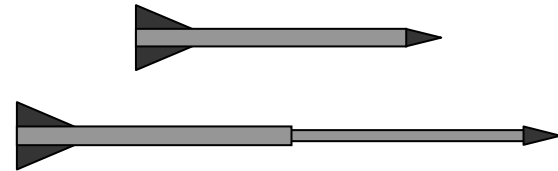
$$\frac{P}{L} \approx \sqrt{\frac{\rho_P}{\rho_T}} f(V)$$


Hypervelocity Provides Important New Capabilities

IAT Extending penetrators:

$$P=L \sqrt{\frac{\rho_P}{\rho_T}} f(V)$$

- Launch and fly long rod to target
 - Extend before impact
- Impact in extended configuration



Hypervelocity Lethality



- Understanding the physics at impact has enabled us to develop hypervelocity novel penetrators which can provide the

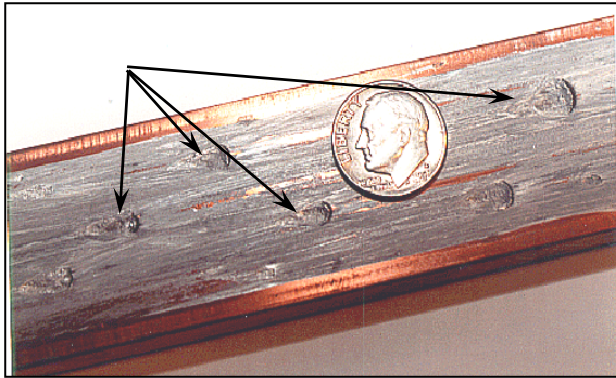
- Lethality overmatch

And more importantly

- The necessary lethality with significantly **reduced launch energy**



Railgun Lifetime Challenges



Gouging

- Surfaces rub past each other at high speed



Muzzle Blast

- High temperature muzzle arc (20,000 K)
- Severe damage to ends of rails and insulators
- Large optical/thermal signature



Arc Transition

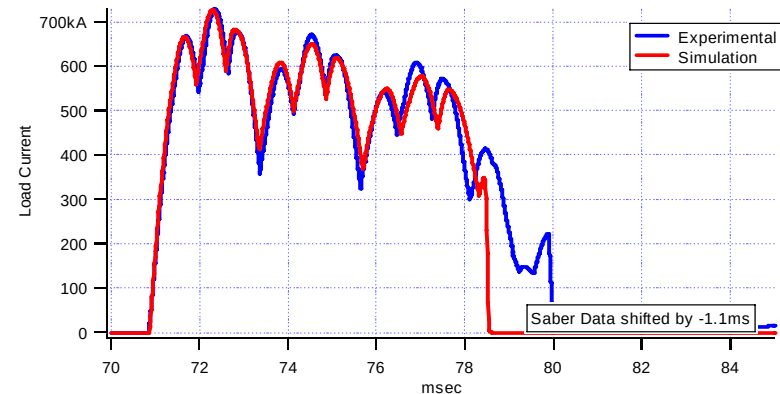
- 20,000 K arc at rail/armature interface

All of these critical challenges are resolved

Power Source - The Major Technical Challenge for Army Applications



- IAT developed a simulation for a new type of pulsed alternator – providing an independent validation tool for Government and industry
- Pulsed alternator technology transitioned from UT Center for Electromechanics to Industry (Curtiss-Wright)



Combines flywheel and pulsed alternator technologies

In the past several years, all of the critical “showstoppers” have been resolved

• Hypervelocity projectiles:

- Tungsten nose tips **survived** hypervelocity flight up to 3 km/sec.
- Hypervelocity rods **penetrate** more because **target strength is overwhelmed**.
- Novel hypervelocity projectiles have been fabricated with **low parasitic mass**
- Electronic components for guidance, navigation and control have been tested above **100kgees**

Railgun Bore Life:

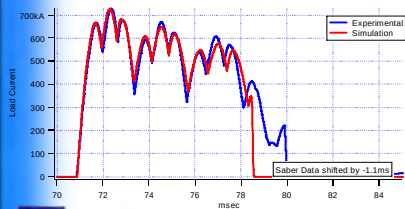
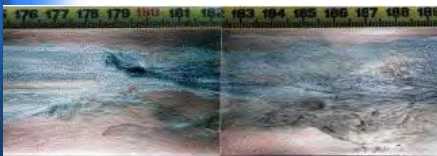
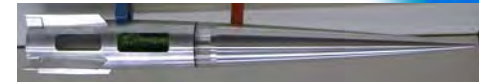
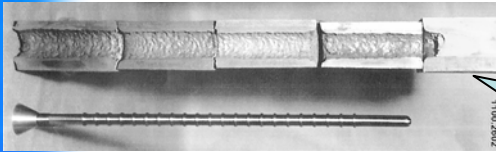
- Hypervelocity **gouging eliminated** by proper choice of materials
- **Transition** to arcing contact at hypervelocity **eliminated** by novel E M Gun designs which also eliminate contact and damage to insulators
- **Multiple shots** on single set of rails (60 shots for Navy-similar test series underway for Army)

• Signature

Muzzle shunt **reduced muzzle blast** by 3 orders of magnitude

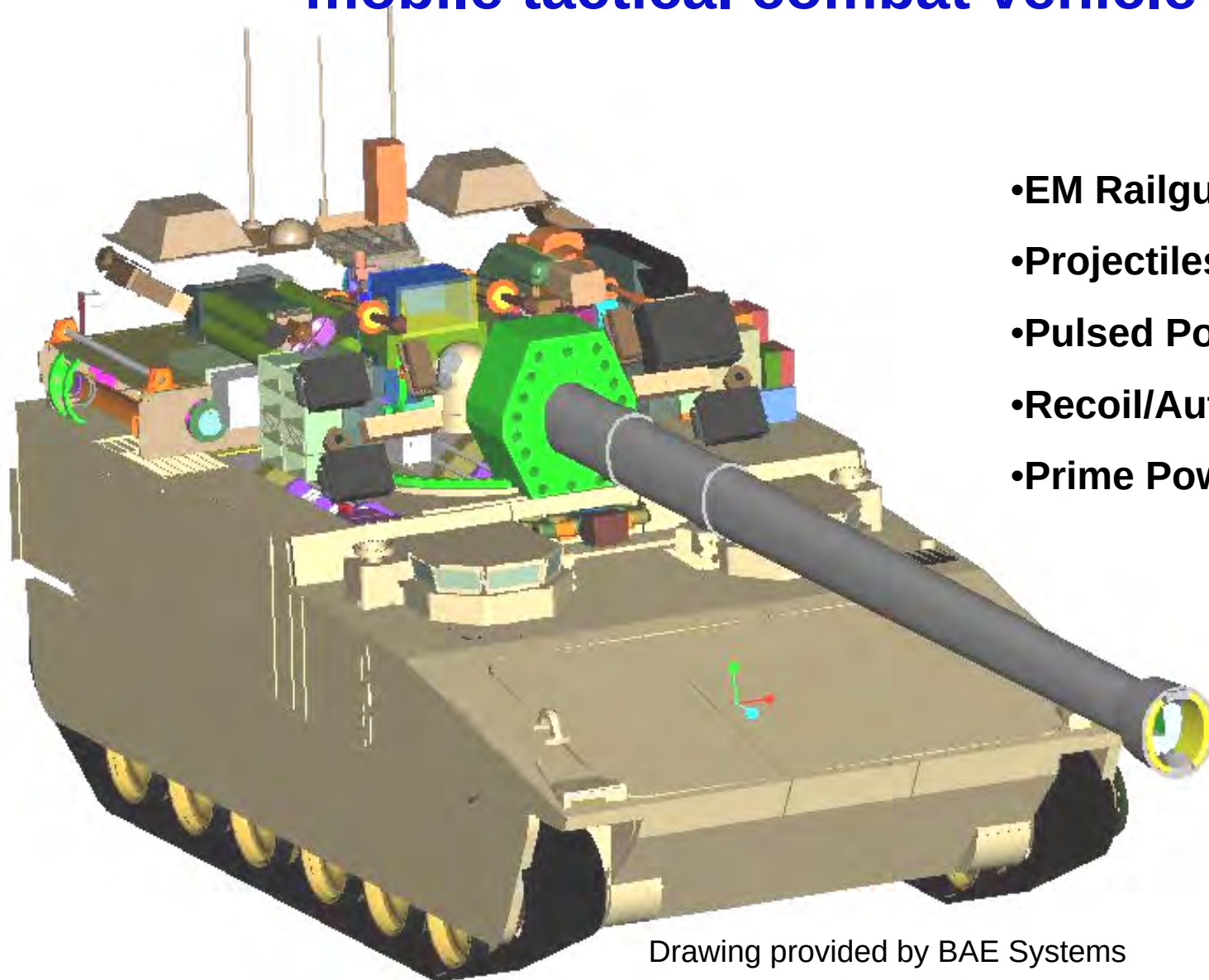
• Pulsed Electromagnetic Power

- A **simulation** for a new type of pulsed alternator provided an independent validation tool for Government and industry
- **Pulsed alternator** technology transitioned from UT Center for Electromechanics to **Industry**



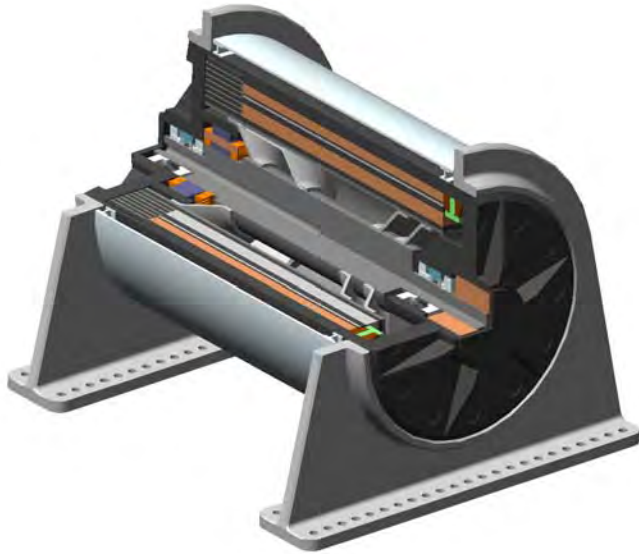
Can EM technology be integrated into a mobile tactical combat vehicle?

- EM Railgun
- Projectiles
- Pulsed Power Supply
- Recoil/Auto Loader
- Prime Power



Drawing provided by BAE Systems

New Types of Electric Pulsed Power Sources are Required



- A pulsed alternator stores kinetic energy in the rotor and converts kinetic to electric energy to power the railgun.

- The pulsed alternator incorporates an integral flywheel to store energy for a number of shots without recharge.

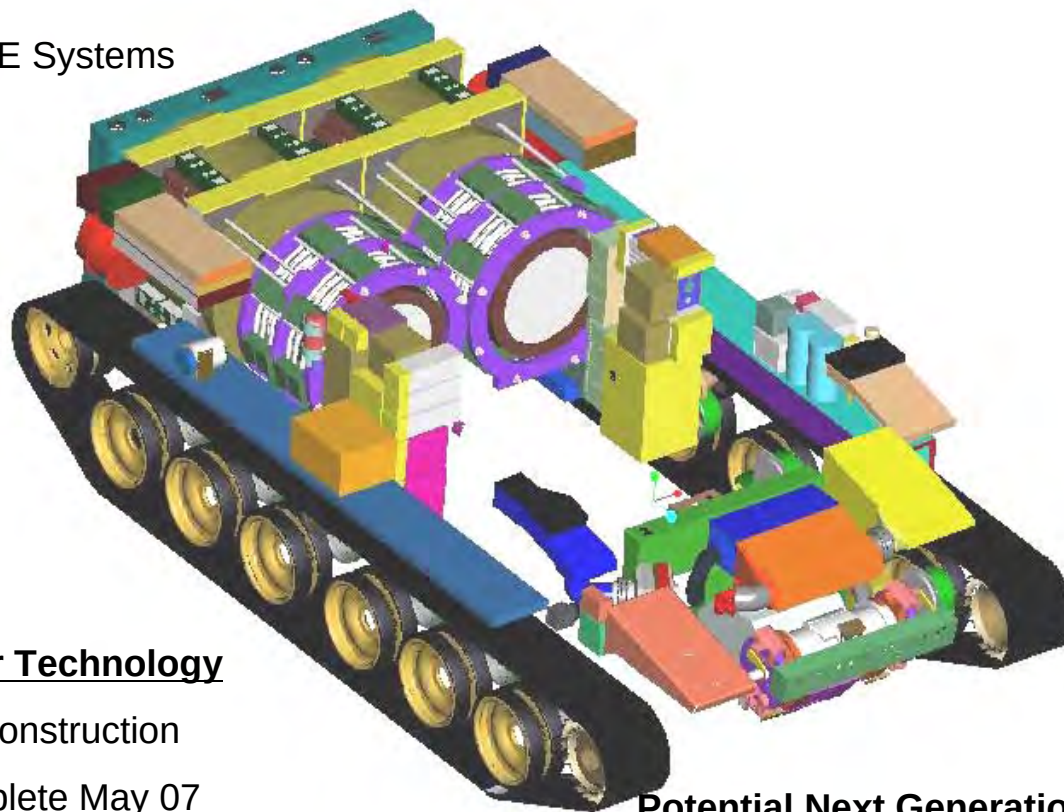
- Recharge occurs with an electric motor powered from the hybrid vehicle engine/generator/battery.



- ARDEC has contracted with Curtis-Wright to build a power source to provide 2-5MJ kinetic energy at railgun muzzle.

Direct Fire – Pulsed Alternators and Low Energy Hypervelocity Projectiles are the Enabling Technologies

Drawing provided by BAE Systems



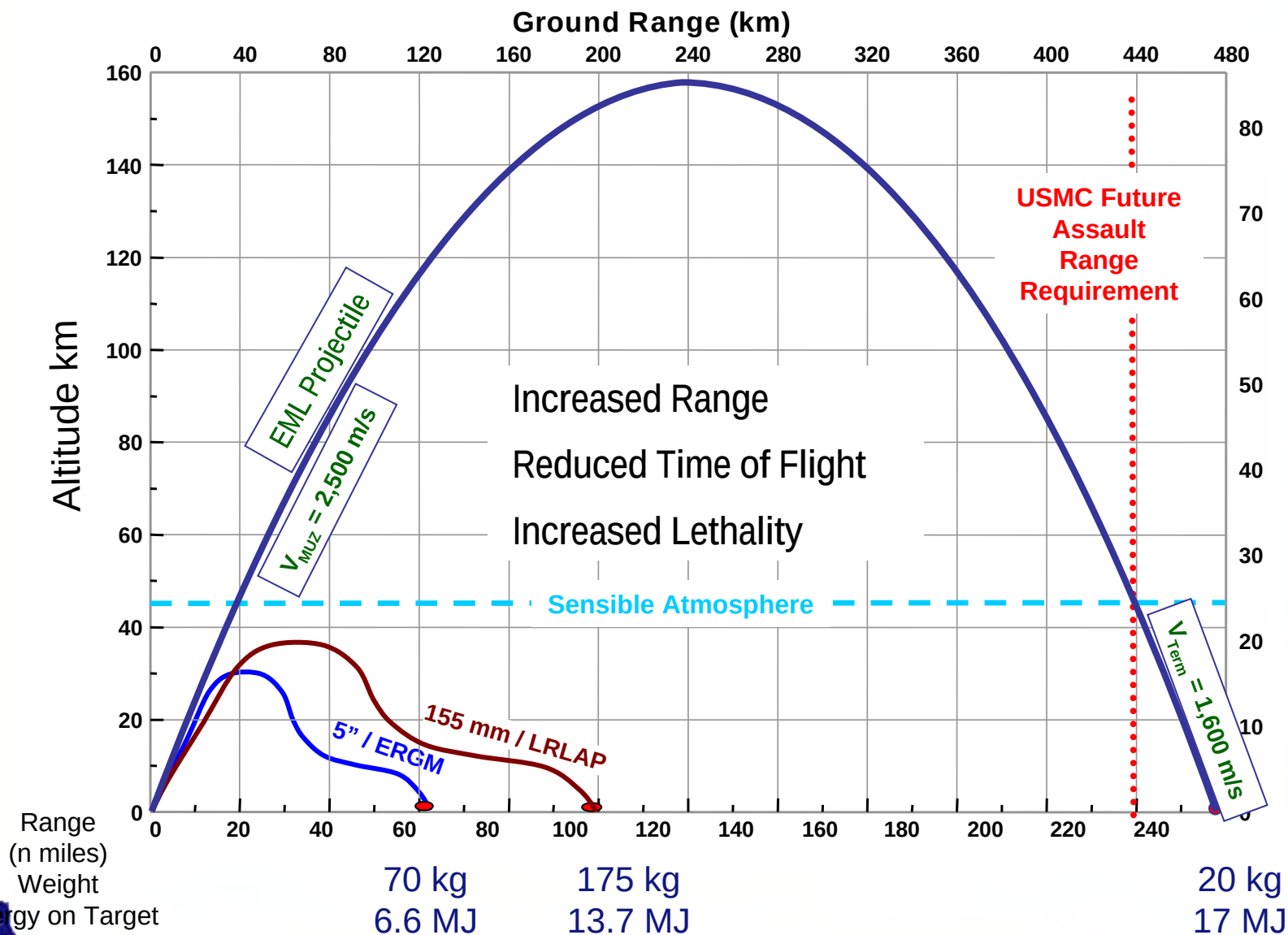
Current Pulsed Alternator Technology

- Pulsed alternator under construction
 - First alternator complete May 07
 - Alternator system complete FY08
- 2-5MJ muzzle KE
- Volume 1.9 m3
- Mass 7000 kg

Potential Next Generation Power Source

- Pulsed alternators completion FY(10-11?)
- 8-10MJ muzzle KE
- Volume 1.5m3
- Mass 4000kg

DARPA challenged IAT to evaluate Electromagnetic Launch to provide Unprecedented Gun Ranges



Innovative Naval Prototypes

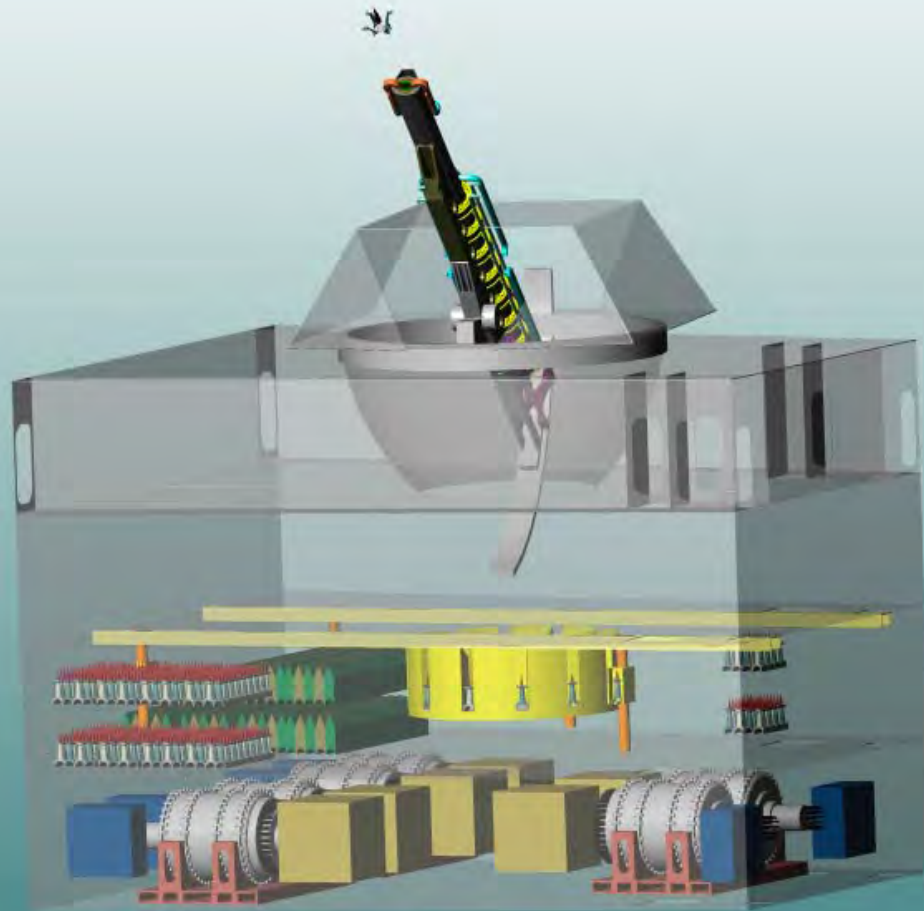
- **Disruptive technologies** that for reasons of high risk or radical departure from established requirements and concepts of operation are unlikely to survive without **top leadership endorsement**.



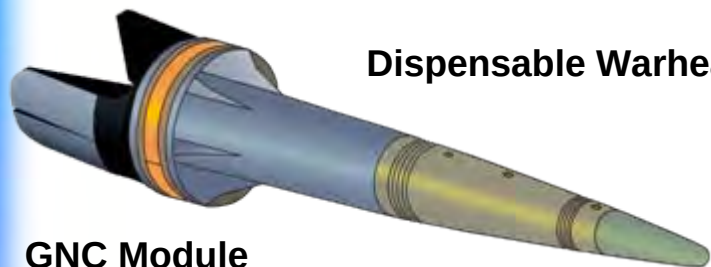
Admiral Michael G. Mullen USN. - CNO

**The Electromagnetic Railgun has been selected
as the First Innovative Naval Prototype**

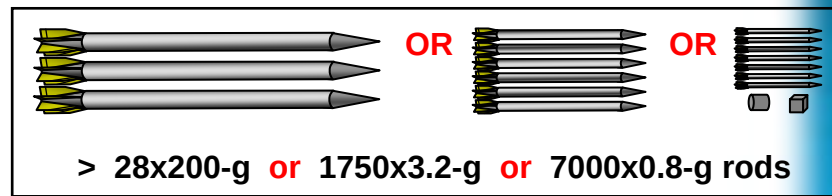
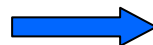
Sea-based Long Range Precision Fires



Lethality: In-Direct Fire KE Provides Rain of High Velocity Rods

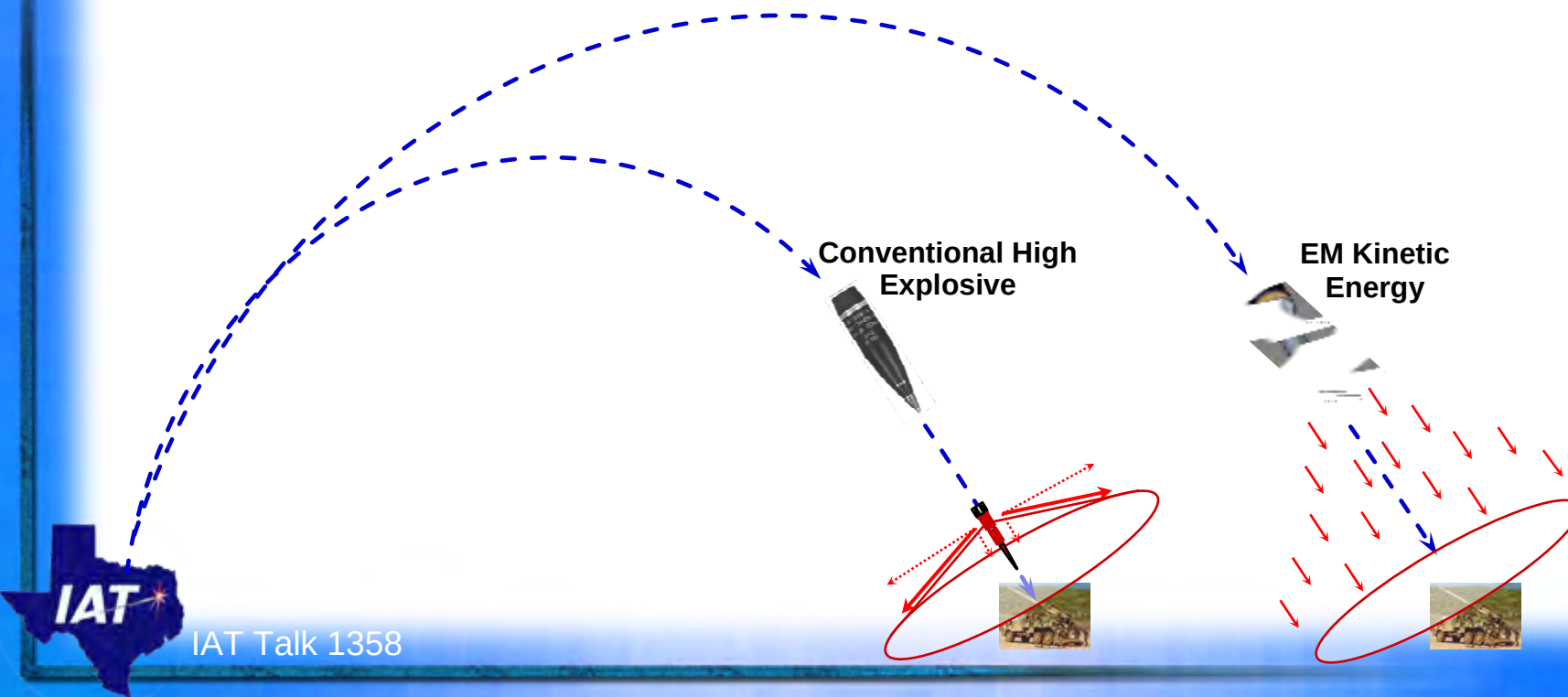


Dispensable Warhead



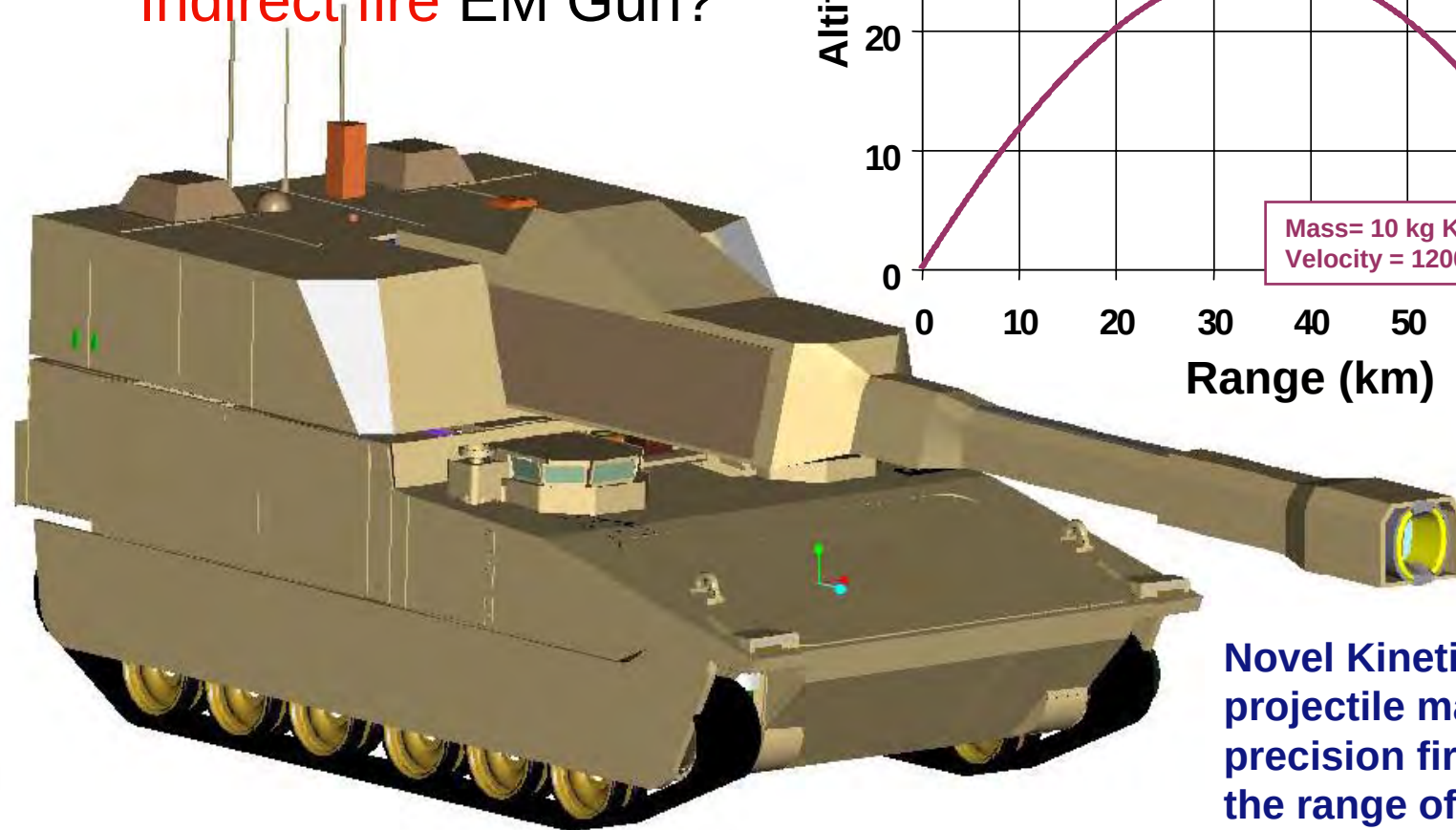
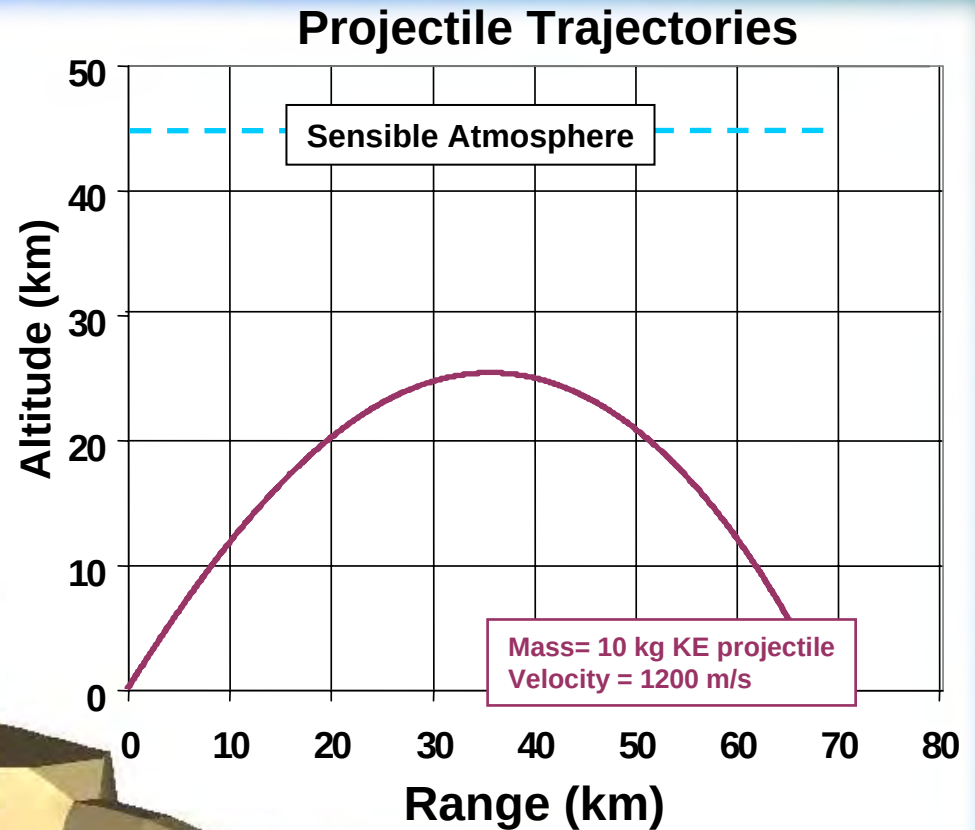
Lethal Tungsten rods

- Inert tungsten rods
- Uniform lethality over impact area
- Control impact area by height of dispersal
- Minimum collateral damage



Long Range Precision Fires:

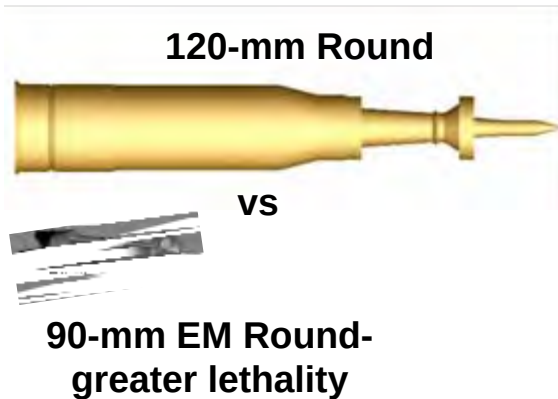
What is the expected performance of an
Indirect fire EM Gun?



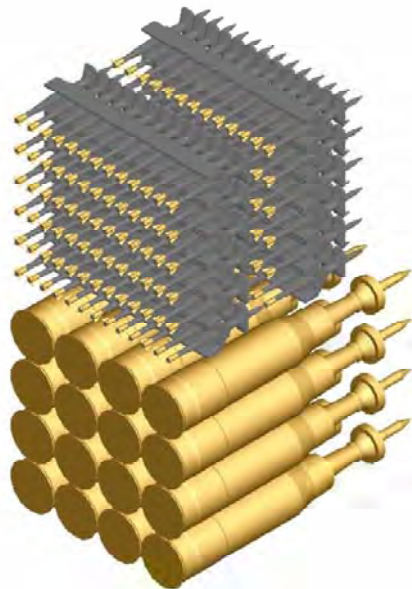
Novel Kinetic energy projectile may provide precision fires at 2-3 times the range of conventional artillery munitions.

Survivability and Logistics Implications

Precision Direct Fire

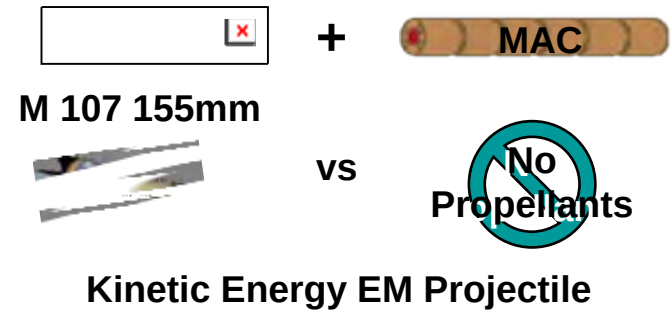


150 Inert EM KE
Projectiles
packaged in
same space as
16 M829s



8% the Volume
10% the Weight

Precision In-Direct Fire



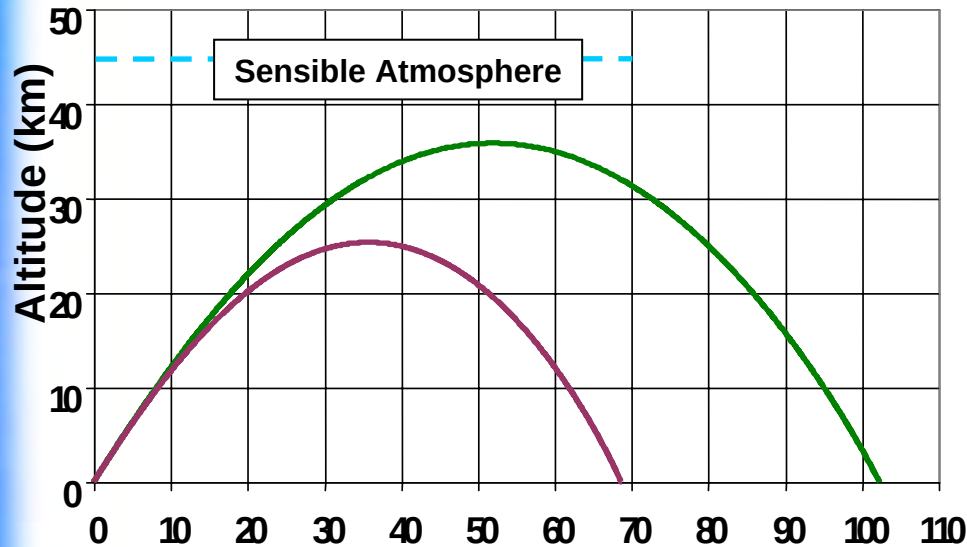
Eliminate/Reduce:

- Propellants and propellant charges
- Army propellant manufacturing facilities
- Army loading facilities
- Army propellant lifetime assessment
- Shipping and storage of hazardous materials

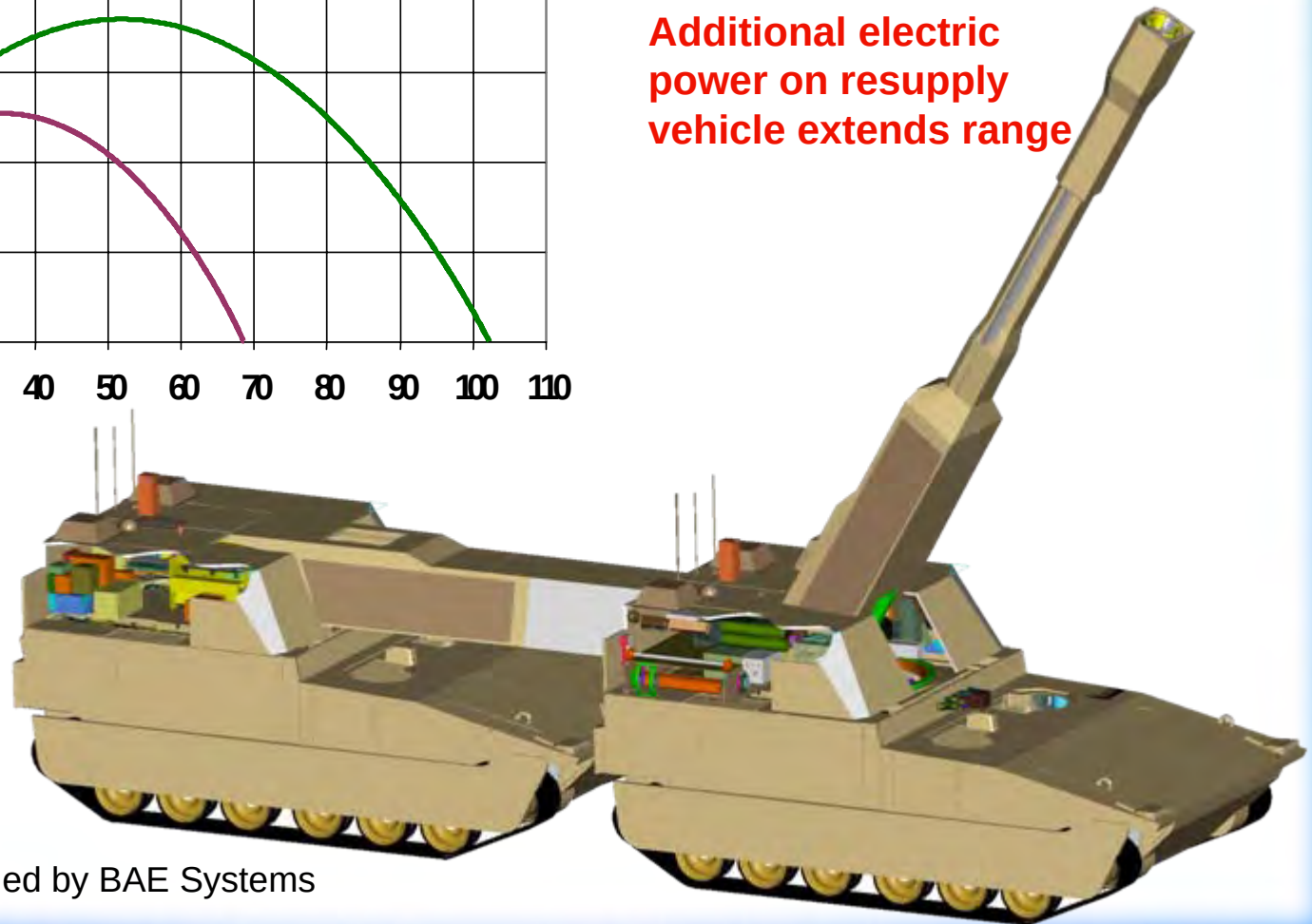
Reduction of:

- Trucks
- Truck drivers } convert to warfighters
- O&M costs

The elimination of propelling charges (MACs) provides space for additional electric power in the resupply vehicle.



Additional electric power on resupply vehicle extends range



Summary

- **We have been successful in achieving major advances** in the fundamental science and technology of EM Railguns
- The Army and Navy are actively pursuing ground and sea-based EM Railgun **applications**
- The implementation of EM Railgun technology will not only provide the opportunity to **replace** or significantly **enhance** existing weapon capabilities, but will provide the National leadership **revolutionary new tactical and strategic** options
- The **IAT commitment** is to ensure that when EM Railguns are employed, they will be in the hands of U.S. Forces.
- **We are seeking your help** to provide insight and manufacturing, engineering and integration competence so that unmatched revolutionary capabilities are available to our warfighters



LW155 Howitzer

Towed Artillery Digitization



Presented by:

Harvey I. Goldman

DPM Towed Artillery Digitization

973-724-8715

hgoldman@pica.army.mil

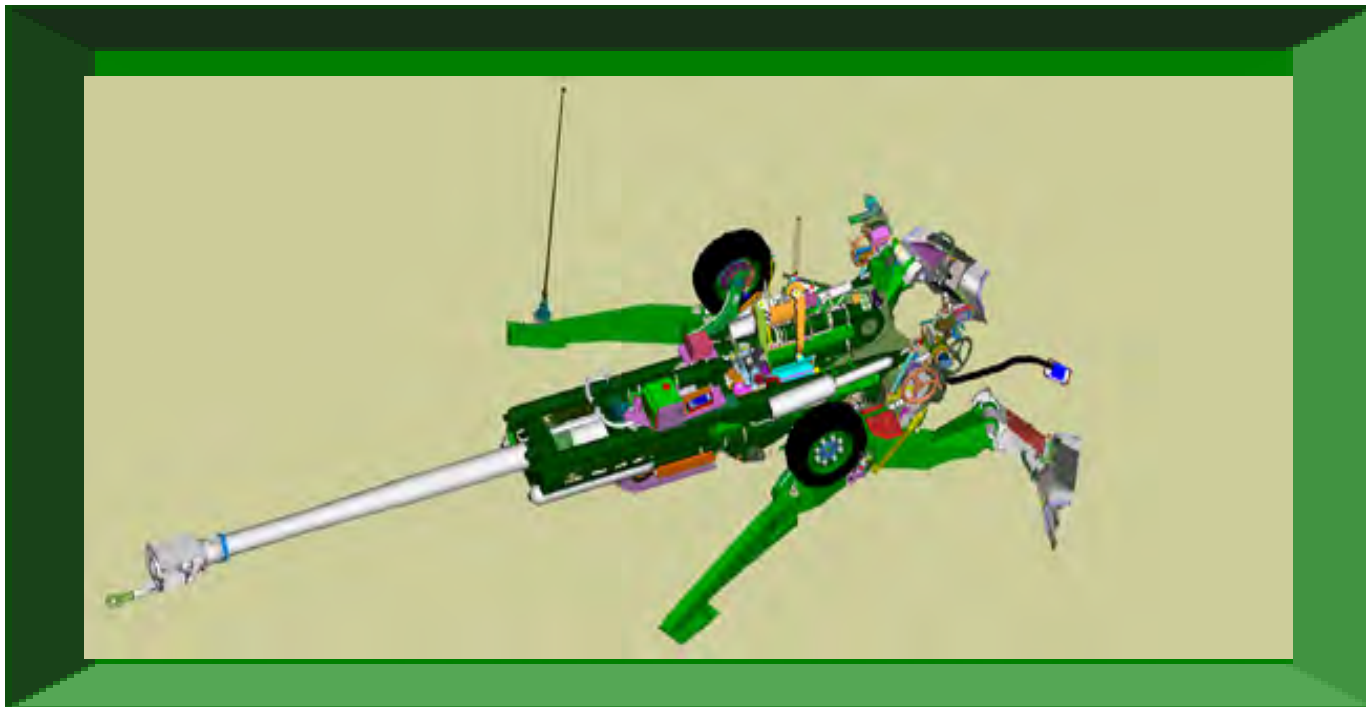
Presented to:

**NDIA Armaments Technology
and Firepower Symposium**

12 June 2007

What is **Towed Artillery Digitization** (TAD)

*An Evolutionary Acquisition Program to develop and integrate a **Digital Fire Control System (DFCS)** onto the new M777 Lightweight 155mm Howitzer*



Program Overview (1 of 2)

- **The Lightweight 155mm Howitzer (LW155) Is A Joint Program With The Marine Corps And The Army**
 - The Marine Corps Developed the Basic Howitzer
 - The Army Developed the Towed Artillery Digitization (TAD) Digital Fire Control System

- **The Marine Corps Is The Lead Service But All Milestones And Documents Are Joint**
 - ASN(RDA) is Milestone Decision Authority (MDA) for Basic Gun
 - PEO Ground Combat Systems is The MDA for TAD
 - USADTC Lead for Basic Gun and TAD Developmental Testing
 - MCOTEA Lead for Basic Gun and TAD Operational Testing

- **TAD Major Contractors**
 - Lead System Integrator – **BAE, Barrow, UK**
 - Major Subcontractor for DFCS – **GDATEP, Burlington, VT**



Program Overview (2 of 2)

- **Operation Desert Storm AAR: M198 Too Heavy, Too Slow, Aging**
- **LW155 Program Was Initiated by USMC and Army in 1996**
- **M777 Low Rate Initial Production (LRIP) Decision in Nov 2002**
 - Authorized production of 94 M777 Howitzers with Optical Fire Control for Marine Corps
 - Currently Fielded to USMC (IOC – Oct 05) and Canada (Afghanistan)
- **M777A1 used for Multi-Service Operational Test and Evaluation**
- **M777A1 Full Rate Production (FRP) Decision February 2005**
 - Authorized 495 M777A1 Howitzers with Digital Fire Control System (DFCS) for Marine Corps and Army
 - Authorized production of additional 94 DFCS for retrofit onto the 94 LRIP Marine Corps Howitzers
- **Joint Service Multiyear FRP Contract Awarded March 2005**



TAD Evolutionary Acquisition Strategy

M777

With Optical Fire Control

94 Produced for USMC

Retrofitting to M777A2



**Towed Artillery Digitization
M777A1 (Hardware & Software)**

**Aiming &
Pointing,
Navigation**

On-Board Power Supply, Radio,
Computer, GPS, INU, VMS

**GDU Protocol
Messaging**



Chief Of
Section Display



Gunner & AG
Displays

**Towed Artillery Digitization
M777A2 – Software Upgrade**

- **Limited Two-Way Joint Variable Message Format Messaging**
- Howitzer Status Message
- Becomes **Excalibur Capable** With Installation of EPIAFS Platform Integration Kit & Fuze Setter

**Towed Artillery Digitization
Objective Capability**

- **On-Board Ballistic Computation**
- Integrated Muzzle Velocimeter
- Ammo Inventory
- Full Joint Variable Message Format Messaging

The Future of Towed Cannon Artillery



M777A2 Howitzer... The Operational Benefit

M777A2 is More Mobile, Rapidly Deployable, Survivable and Accurate than the current heavy and aging M198

	<u>M777A2</u>	<u>M198</u>	<u>Improvement</u>
Weight	9,800 lbs.	16,000 lbs	39%
Emplaces	2:10 min	6:35 min	304% ¹
Displaces	2:23 min	10:40 min	448% ^{1 & 2}
Terrain Trafficable	83%	63%	32%
C-130 Load	2	1	100%
Digitized	Yes	No	70% ²
Excalibur Ready	Yes	No	One Round Kill

¹ Contributes to 5 Times the Kills

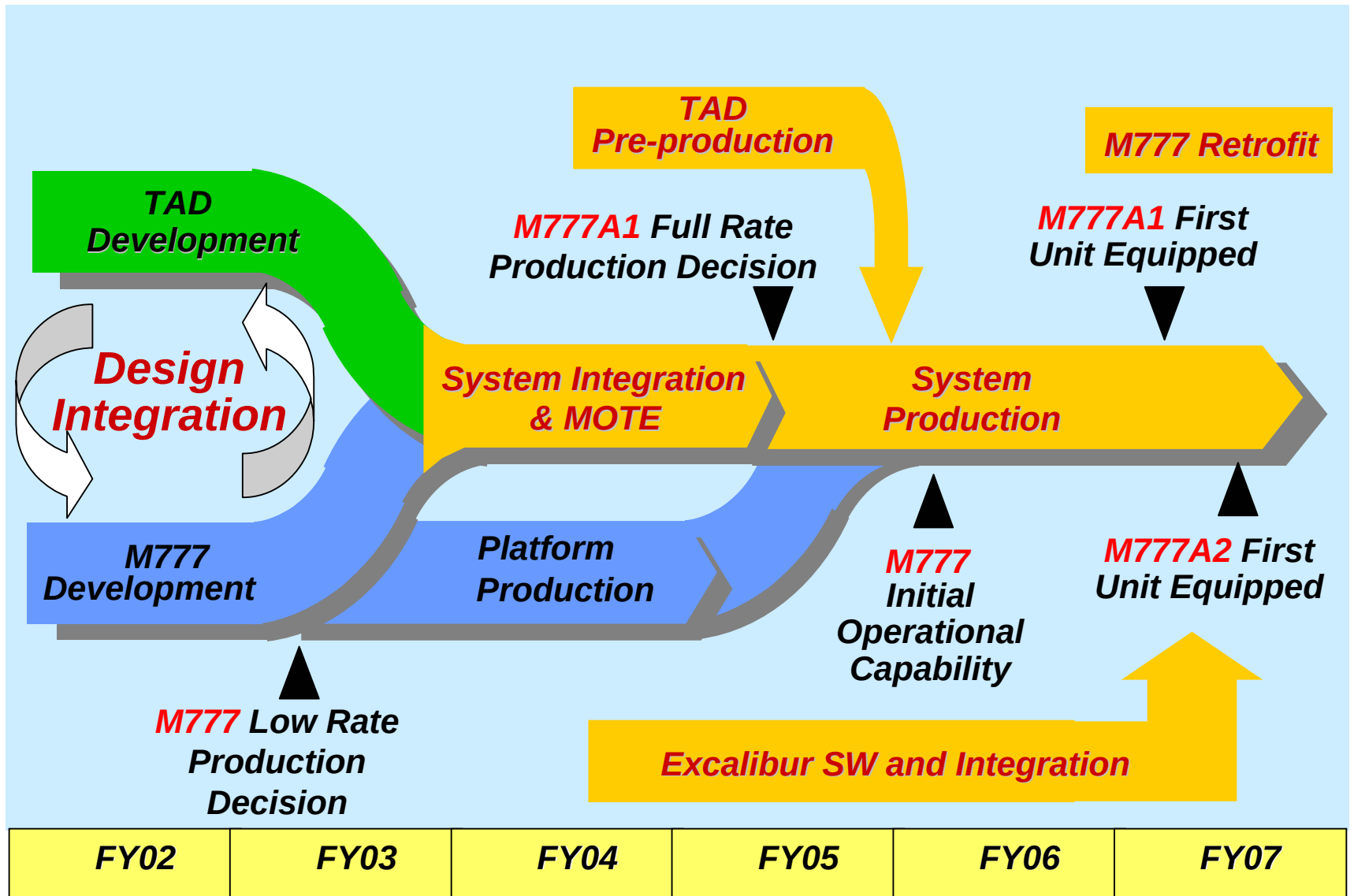
² Contributes to 70% Increase in Survivability



MERGING OF Multiple DEVELOPMENT PATHHS

M777A1 = M777 Howitzer + Towed Artillery Digitization

M777A2 = M777A1 + Software Upgrade



LW155 Howitzer Program

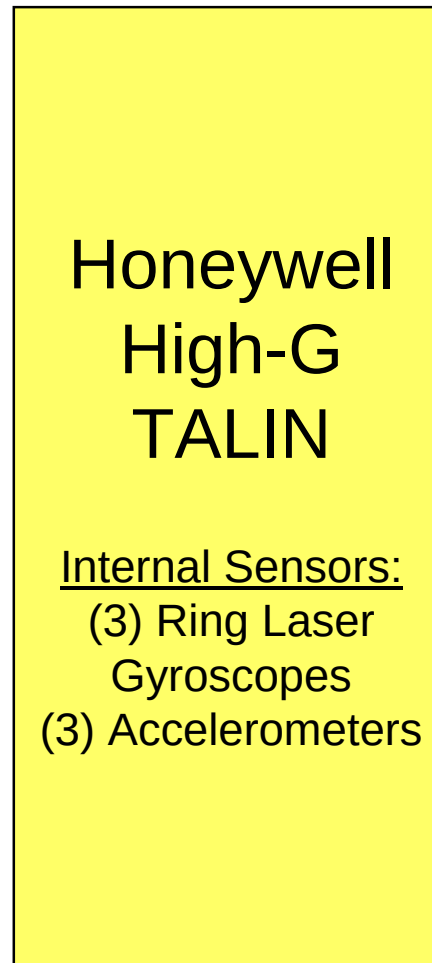
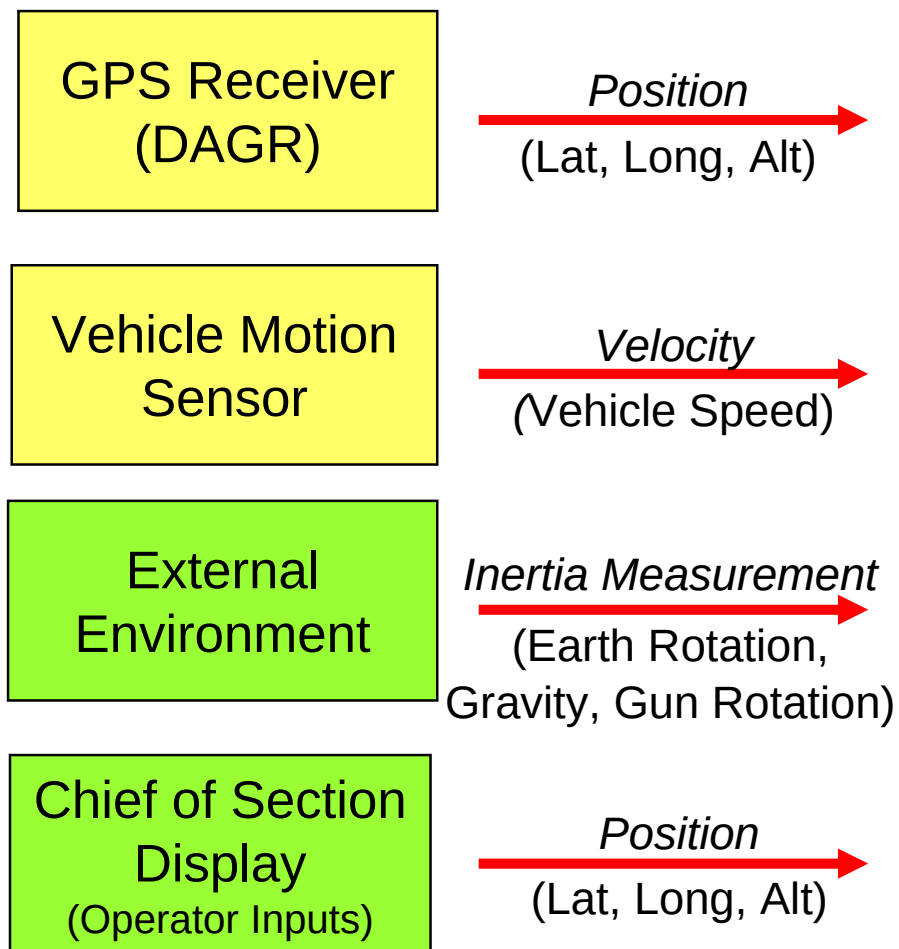
**Total Procured : USMC – 356
Army -- 233**

	<i>FY07</i>	<i>FY08</i>	<i>FY09</i>	<i>FY10</i>	<i>FY11</i>
Procure	94 – Retrofit Kits 78 - Army 34 - USMC	120 - Army 53 - USMC	0 - Army 0 - USMC	0 - Army 0 - USMC	0 - Army 0 - USMC
Prior to FY07 - 304					
Field	36 - Army 106 - USMC 94 Retrofit	78 - Army 103 - USMC	120 - Army 53 - USMC	0 - Army 0 - USMC	0 - Army 0 - USMC
Prior to FY07 - 94					
Support	Interim Contractor Support		Transition to PBL	Performance Based Logistics	
Equipment Upgrade	M777A2 – SW Upgrade Excalibur Capability		SW Block Upgrade	TAD Objective Capability	

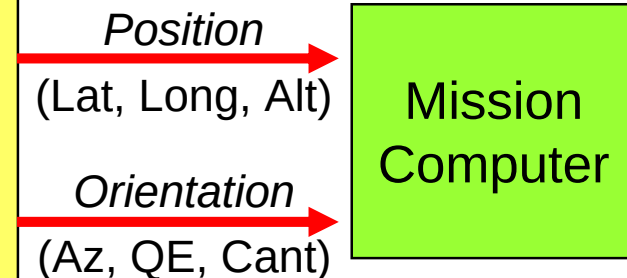


The “Heart” of TAD Position Navigation System

INPUTS



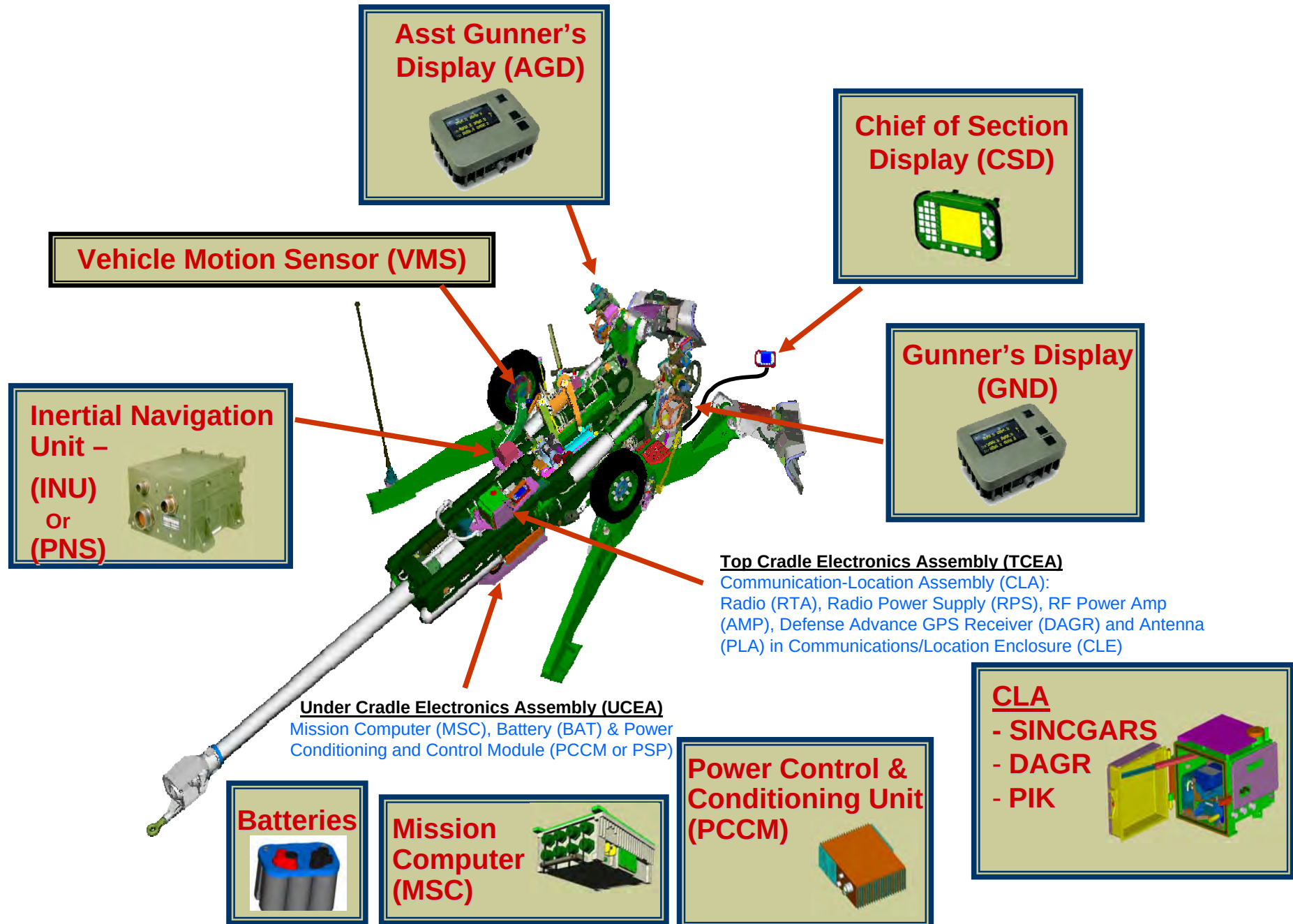
OUTPUTS



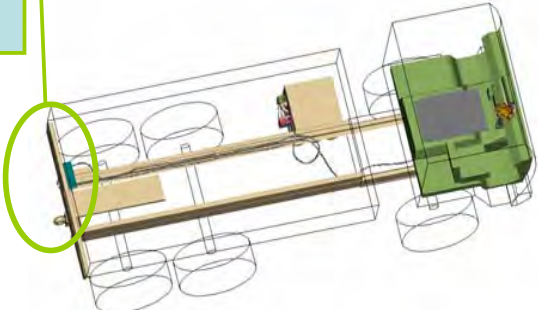
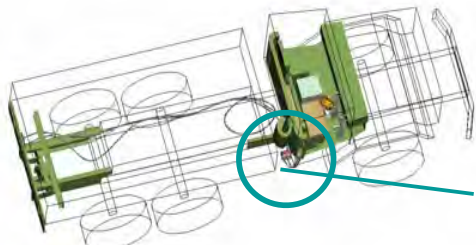
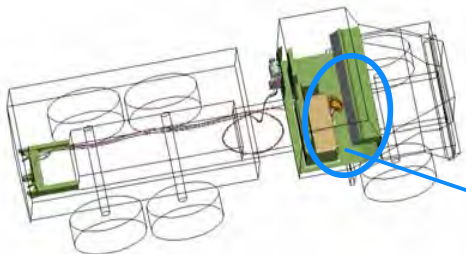
 Indicates PNS Component



M777A2 Towed Artillery Digitization (TAD)



LW155 Howitzer Prime Mover Integration

Applicable Prime Mover Families	<u>FMTV</u> M1083 M1083A1 M1093 	Rear Connectors 
	<u>M939</u> M925 M925A1 M925A2 	 Power Hookup
	<u>MTVR</u> MK 23 	 CAB Mount for CSD

LW155 & TAD – “The Challenges”

- **Joint Program** – *2 MDA's...ASN(RDA) & Army PEO*
- **Decision to Merge TAD & M777** - *Risk to execution*
- **Consolidation of 2 Prime Contractors** – *BAE and GD*
- **Multi-Service Operational Test** – *2 Independent Evaluators*
- **Joint Full Rate Production Milestone** – *Tailoring the Process*
- **Transitioning Development to Full Rate Production**
 - *Pre-production in parallel with Production Planning*
 - *Incorporating Lessons Learned from MultiService Oper Test*
 - *Obsolescence Management*
 - *Integrating Excalibur Capability in mid-stream*
- **Planned Retrofit of TAD Concurrent with Initial Fielding**
- **Moving from M777A1 to M777A2 with Initial Fielding**
- **Managing the Changing Interfaces**



LW155 Howitzer Bottom Line

- ✓ RDTE and LRIP Complete...Program is in Full Rate Production
- ✓ M777 Initial Operational Capability (IOC) Dec 05 with USMC
- ✓ Initial fielding of Digitized M777A1 Howitzers to Army Jan 07
- ✓ Retrofit program to digitize LRIP Guns Almost Complete
- ✓ M777A2 (Excalibur Capable) Howitzers issued Apr 07

***Fielding of Digitized LW155 Underway...
Time to Start Thinking about Refresh***



Firepower Symposium

Arming Robotic Systems

12 June 2007

***Ms. Kim Jones/Mr. Leon Manole
Armed Unmanned Vehicle & Remote Armament System Business
Area Manager (acctg.)
Armaments Research, Development and Engineering Center
(ARDEC)
973-724-5072***

- Introduction
- Armaments for Unmanned Ground Systems
- Armaments for Unmanned Air Systems
- Network Lethality
- Future Needs for Armed Unmanned Systems
- Summary

- Remote Armament Systems (RAS) is one of ARDEC's Key Investment Initiatives
- ARDEC's RAS Market Development Team (MDT) is the Focal Point for this Initiative
- The MDT is Focused on the Development and Integration of RAS (i.e. Munition, Weapon, Fire Control, Energetic, Fuze and Precision Armament Systems) onto all Platforms (manned and unmanned systems).
- Today's Briefing will Focus on ARDEC's Innovative RAS Technologies



Armaments for Unmanned Ground Systems

Special Weapons Observation Remote recon Direct Action system (SWORDS)

- First U.S. Army Armed Unmanned Vehicle to Receive a Safety Confirmation
- Presently Performing Surveillance/Guarding Facilities
- Light Class Approximately 200 pound Armed Unmanned Ground System
- Ultralight Remote Armament System TRAP Mount



Pyrotechnic Devices for Anti-Tampering

- Providing Non-Lethal Mechanisms To Protect The Unmanned System
- Flash-bang, Smoke, Noise, etc Devices Being Designed and Demonstrated
- Applicable to All Classes of Unmanned Ground Systems



Weaponization of Medium Weight Class Tactical Amphibious Ground System (TAGS)

- ARDEC is Integrating various, Unique Remote Armament Systems Onto Medium Class UGS
- Teamed with TACOM/TARDEC to Weaponize Various Platforms Including TAGS
- Illustration below shows Picatinny Lightweight Integrated Onto TAGS



Weaponization of Large Weight Class Unmanned Ground Systems (UGSs)

- ARDEC is currently Developing/Testing Unique Armament Systems for Large Weight Class UGS
- Illustrated Below is Robotic Mortar Being Developed for Manned and Unmanned Platforms



Developing Various Non-Lethal Technologies

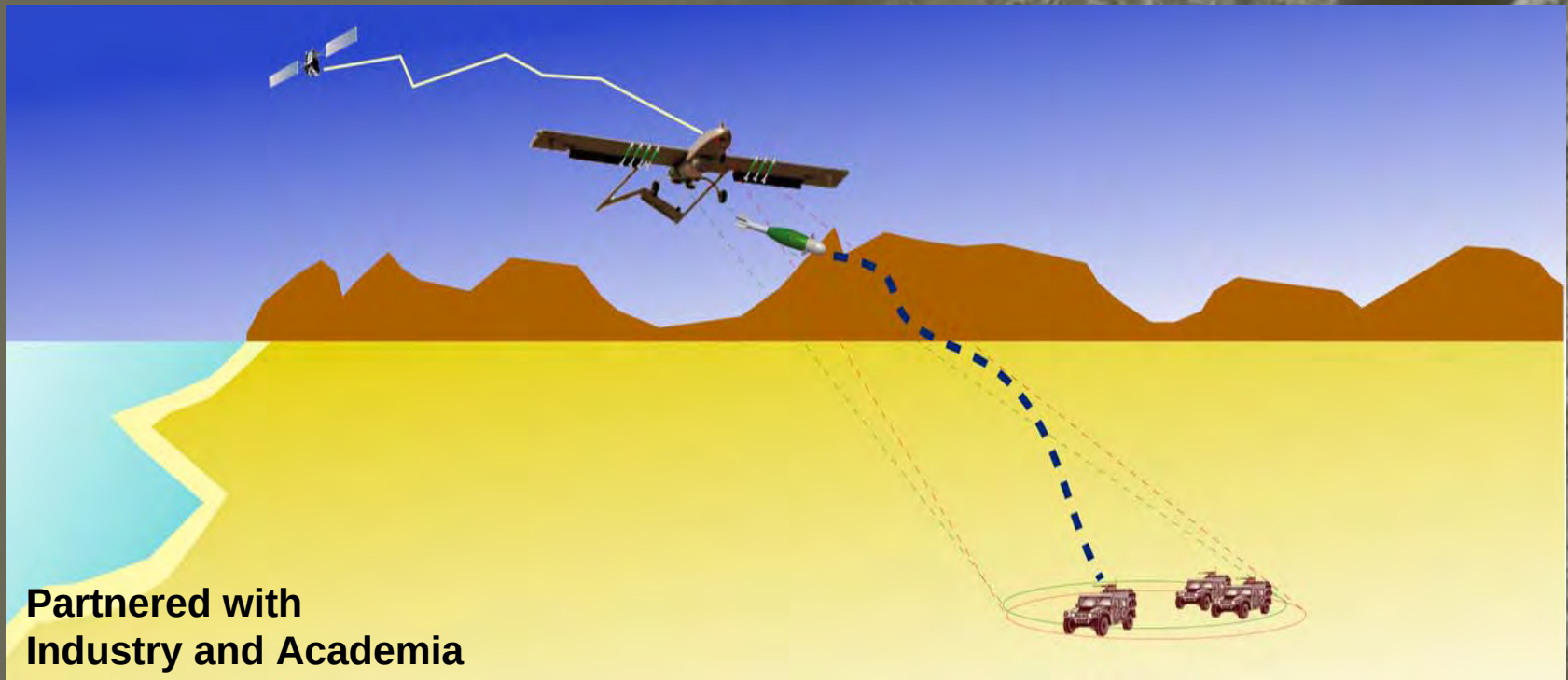
- Modular Crowd Control Munition (MCCM) for UGV's
- Self-Protection/Anti-Tampering for All Weight Classes UGVs



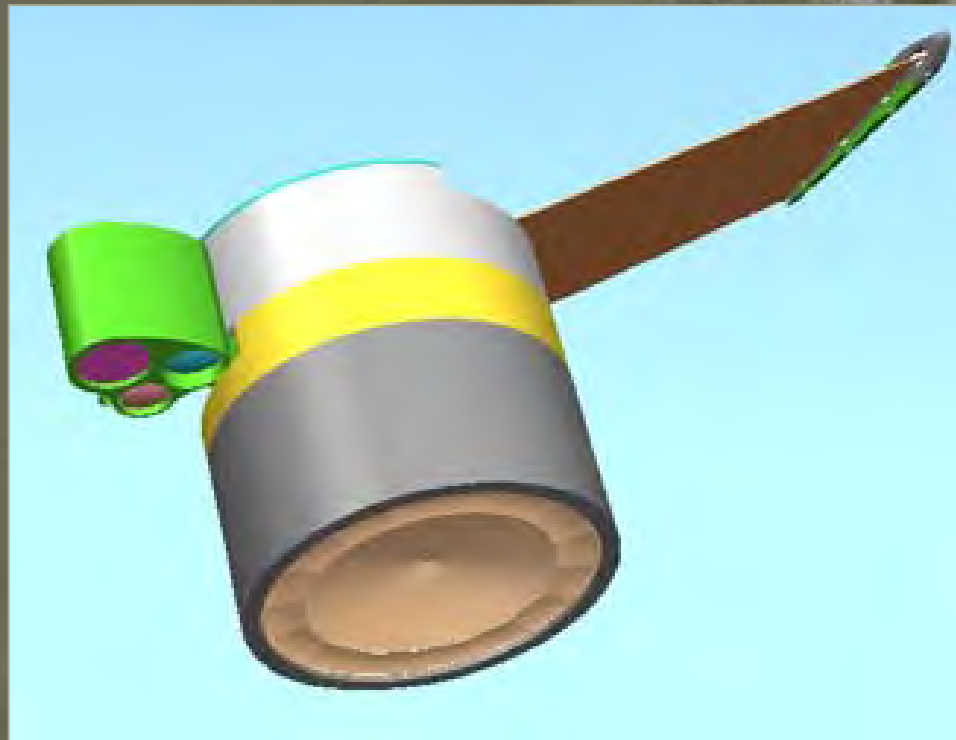
Armaments for Unmanned Air Systems

UAS Dropped Guided Mortar

- GPS-seeker Guidance Solution for 60-120 mm Dropped Mortar
- Providing UAS with Low Cost/Collateral Damage Capability to Defeat Targets



- Developing Unique Payloads
- Pictured Below is the Common Smart Submunition



Unique Energetic Solutions for UAS

- Showcases ARDEC Novel Energetics
- Various Munitions and Energetic Capabilities are Being Developed for UAS
- Capability to Weaponize From Ultralightweight To the Largest Weight Class UAS



Defense Against Autonomous Air, Water & Ground (DA3WG) Devices

- Defining Ways to Counter Unmanned System Threats
- Working on Detection and Defeat of Swarms of Unmanned Systems Utilizing ARDEC Armaments





Network Lethality

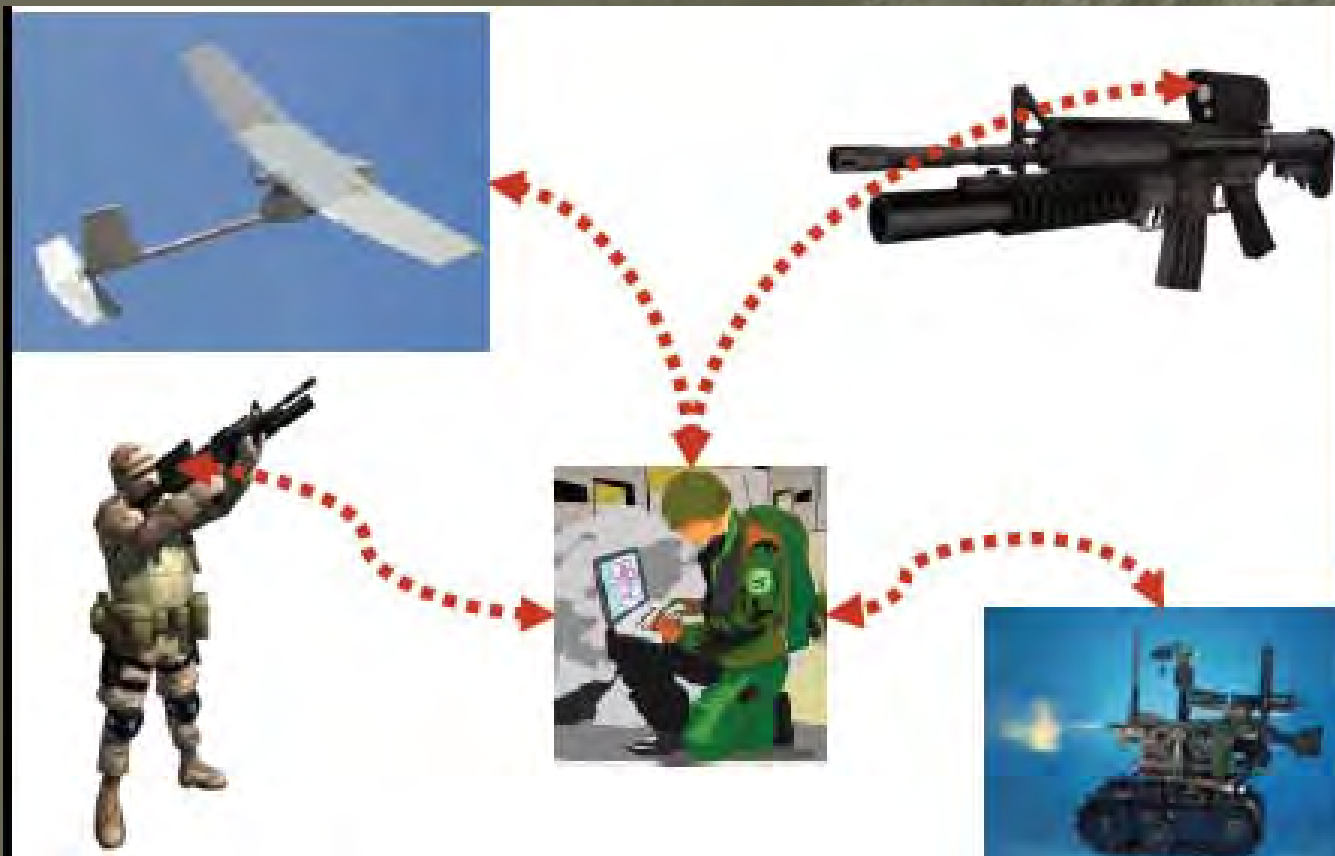
- ARDEC is Teamed With OGAs and Private Industry To Incorporate Network Lethality Solutions for UGS/UAS/Manned Systems as a Force Multiplier
- ARDEC's Role is Developing Weapon Systems that are Networked Capable and Providing the Proper Weapon Solutions/Fire Control During an Encounter
- Currently ARDEC is Demonstrating a Network Lethality Scenario Consisting of Armed Manned and Unmanned Systems with the Soldier-In-The-Loop





Networked Smart Sight

- Fire Control Sight System for Networking to all Platforms
- Manned/Unmanned Targeting/Engagement



Future Needs for Armed Unmanned Systems

- Safety
 - Testing
 - Certification
 - Release
- Requirements
 - Identification
 - Generation
- Networking
- Soldier-In-The-Loop

- **ARDEC actively working Remote Armament System Solutions.**
- **ARDEC Foresees Lethality Options for Unmanned Vehicles. Future needs:**
 - Networking
 - Safety
 - Requirements
- **ARDEC Strongly Desires to Develop Joint Technology Programs with OGA, Industry and Academia.**

NDIA Firepower Conference



13 June 2007

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



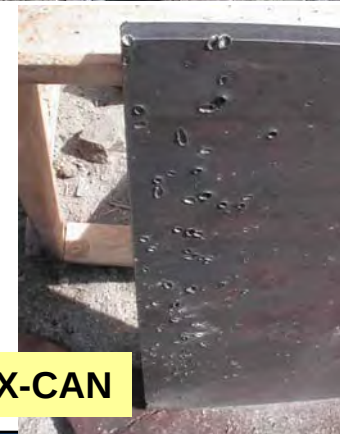
IM Formulations for Artillery 50mm Shaped Charge Impact Test



MCX8



OSX-CAN





IM Formulations for Artillery

81mm Shaped Charge Impact Test



MCX8



OSX-CAN





The Soldier: America's Most Deployed Combat System



Project Manager Soldier Weapons Overview

For the

Armaments Technology Firepower Symposium and Exhibition

National Defense Industrial Association

BG R. Mark Brown
Program Executive Officer Soldier

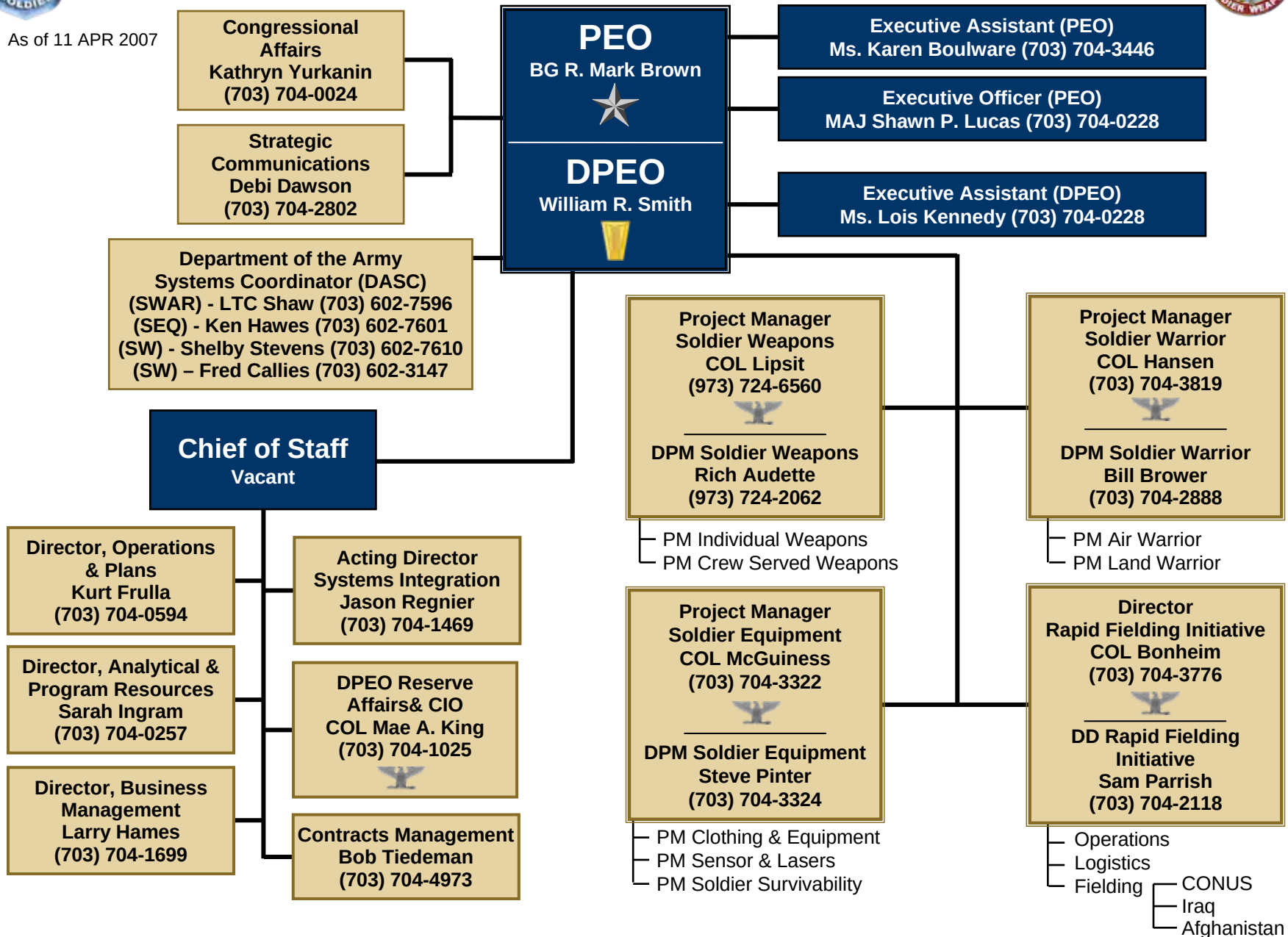
13 June 2007

COL Carl A. Lipsit
Project Manager Soldier Weapons



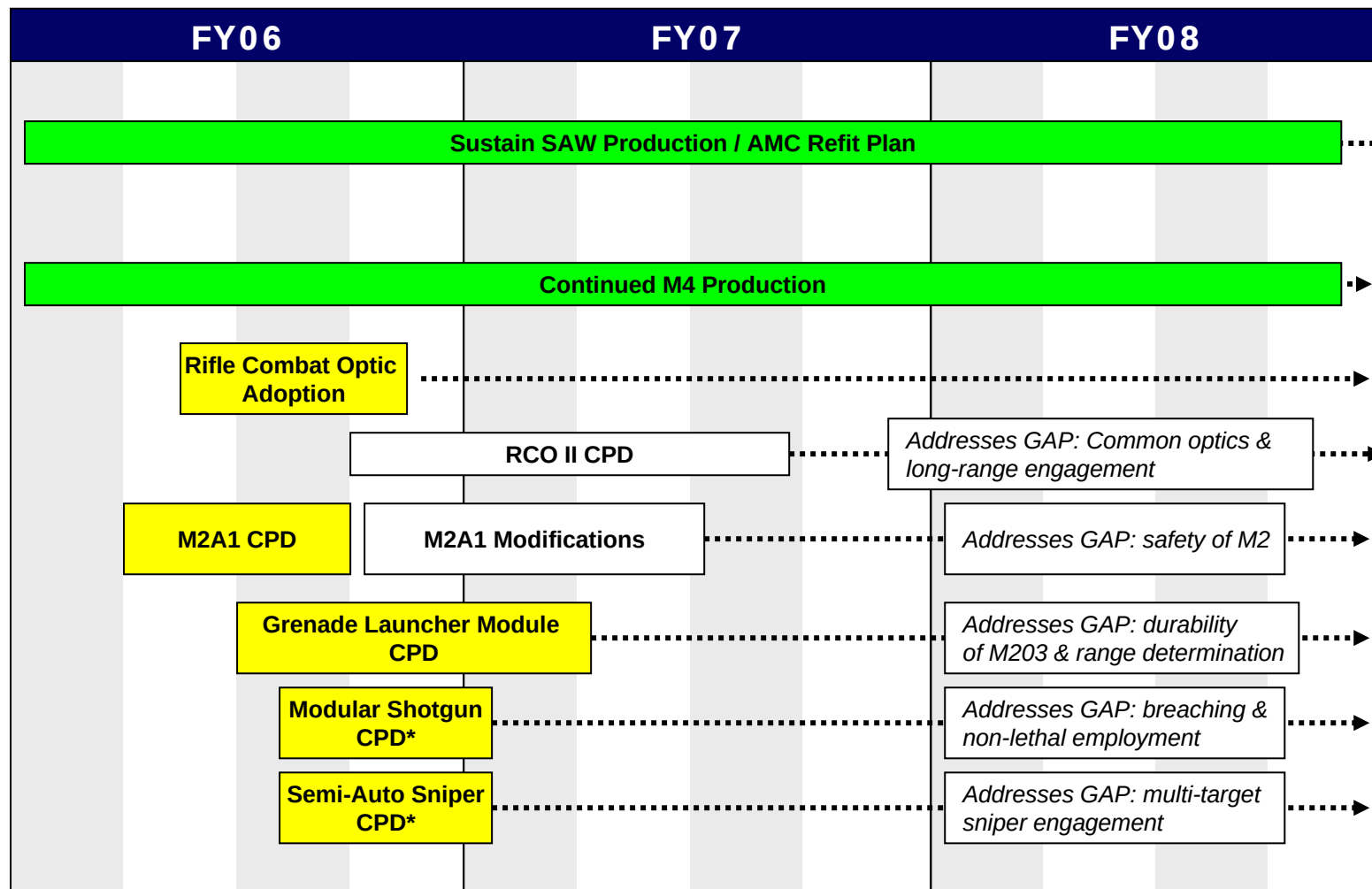
As of 11 APR 2007

Program Executive Office Soldier





Near-Term Strategy Implementation

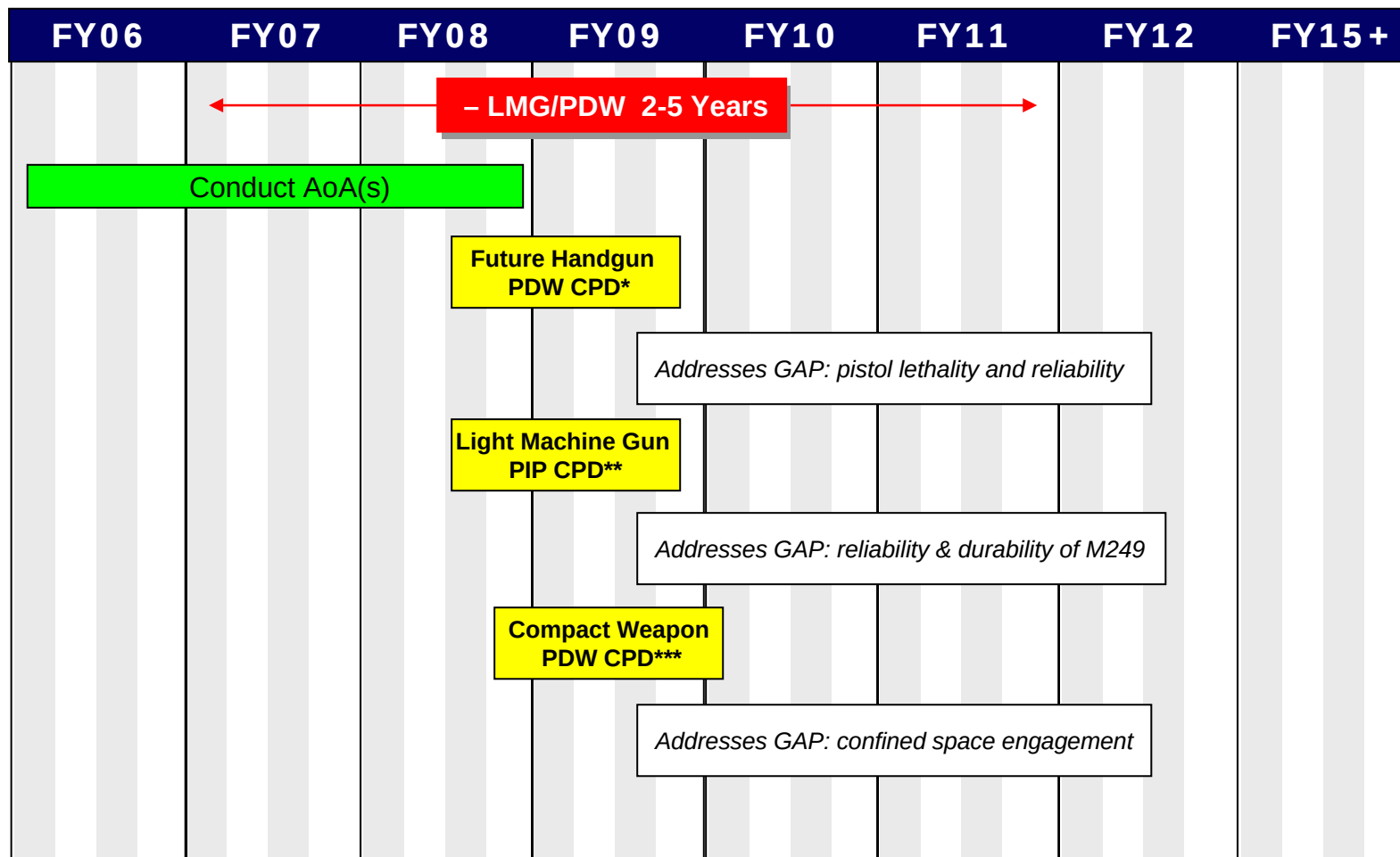


* JROC Validated ORD with Joint Independent Designator
Other SEP accessory efforts not shown.

**Sustains Current Force And Addresses
Some Gaps Through PIP/COTS Solutions**



Mid-Term Strategy Implementation



- * Pending outcome of SOCOM Combat Pistol Staffing
Source document: SaaS ICD, GSS CDD (PDW Attribute)
- ** Source document: SaaS ICD, GSS CDD, SAW JSOR
- *** AoA to determine configuration.
Source document: SaaS ICD, GSS CDD (PDW attribute)

Addresses Key Current Force Gaps With Specific Solutions



Soldier Weapons Mission



Individual

Crew Served



M16A4 Rifle



M16/M203



M4 Carbine

Individual Weapons



XM320
40mm
Grenade
Launcher

Carbine



Designated
Marksman

Family of Weapons



Compact



Light
Machine Gun

25mm Ammo
High and Low Velocity



Airburst



Armor
Piercing

M249
Squad Automatic
Weapon (SAW)



XM25
Individual
Air Burst Weapon



Counter
Defilade



XM29
Integrated Airburst
Weapon System

XM110
Semi-Automatic
Sniper System
(SASS)



M240B
Medium Machine Gun



MK19
Grenade
Machine Gun

Crew Served Weapons



M2 .50 CAL
Machine Gun



M107
Long Range
Sniper Rifle

Common Remotely
Operated Weapon
Station (CROWS)



XM307
Crew Served
Airburst Weapon





PM Soldier Weapons Programs List



DEVELOPMENT

WEAPONS

1. XM25, Individual High Explosive Air Burst Weapon System Technology Demonstration
2. XM101, Common Remotely Operated Weapon Station (CROWS)
3. Advanced Crew Served Weapon (ACSW) Programs

SOLDIER ENHANCEMENT PROGRAMS

4. XM26, 12 Gauge Modular Accessory Shotgun System (MASS)
5. Future Handgun System
6. Family of Small Arms Suppressors (FoSASS)
7. M68 Close Combat Optics Re-competition
8. XM1116, 12 Gauge Extended Range Non-Lethal Cartridge
9. XM1022, Sniper Ammunition For M107
10. XM110, 7.62 Semi-Automatic Sniper System (SASS)
11. Close Quarters Battle (CQB) Kit
12. XM1041/XM1042/XM1071 - Close Combat Mission Capability Kit (M4/M16/M249/M9/M11)
13. Advanced Sniper Accessory Kit (ASAK)
14. XM320, Grenade Launcher Module (GLM)
15. M2 A12 Quick Change Barrel Kit Program

BLOCK MOD PROGRAMS

16. CROWS-Lightning Remote Weapons Station
17. XM150, Rifle Combat Optic (RCO)
18. M2E2 Machine Gun Lightweight Tripod Program
19. Swing Arm Mount For HMMWVs
20. HMMWV Improved Auxiliary Weapon Mount
21. XM240E6, Medium Machine Gun Weight Reduction Program
22. M249 SAW 200 Round Soft Pack

AMMO BLOCK MOD PROGRAMS

23. XM1037, Short Range Training Round For M4, M16 and M249
24. Lightweight Small Caliber Ammunition
25. Proximity Fuzed Door Breaching Cartridge
26. 40mm Day Night Training Cartridge (FCT)

RFI FY05 ITEMS

- TA31F - 4X ACOG
- Weapon Light
- M24 Small Binoculars
- M122/A1 Tripods
- M249/M240B Spare Barrel Bag
- Three Point Sling
- Improved Spotting Scope With Tripod
- Improved Cleaning Kit
- Improved Buttstock For M4 Carbine
- Forward Grip Bipod
- M203 Day/Night Sight
- Back Up Iron Sight
- M249 Rail
- M240B Rail
- M249 Ammo Soft Pack
- M240B Combat Ammo Pack
- M192 Lightweight Tripod
- M249 Short Barrel
- M249 Collapsible Buttstock
- M4/M5 Modular Weapon System
- M145 Machinegun Optic
- M68 Close Combat Optic

PROCUREMENT

27. M151E1 & M151E2 Protector Remote Weapon System (RWS)
28. MK19, Grenade Machine Gun
29. MK19 MODS
30. Mod Kit
31. Lightweight Adjustable Sight Bracket
32. Tactical Engagement Simulator (TES)
33. M107 Semi Automatic Long Range Sniper Rifle
34. M240B/H/E6, 7.62mm Medium MG
35. M240B MODS
36. M192, Light Weight Ground Mount For MG
37. Improved Bipod
38. M240B Collapsible Buttstock
39. Improved Flash Suppressor
40. Combat Ammunition Pack
41. M240B Short Barrel
42. M240B Improved Buttstock
43. Sling Assembly For The M240B
44. M249, 5.56mm Squad Automatic Weapon
45. M249 MODS
46. M192, Lightweight Ground Mount For MG
47. MG Front Rails
48. Improved Bipod
49. M249 Improved Collapsible Buttstock
50. Short Barrel For The M249
51. Sling Assembly For M249
52. M16A4 5.56mm Rifle
53. M16 Rifle Mods
54. M68 Close Combat Optics (CCO)
55. Close Quarters Battle (CQB) Kit (Production)
56. M4, 5.56mm Carbine
57. M4 Mods
58. M145 Machine Gun Optics
59. M25 Stabilized Binoculars
60. M24 Mini Binocular

AMMO PRODUCTION PROGRAMS*

61. M903/M962 Cal .50 SLAP/SLAPT
62. M1001, 40mm Canister Round
63. M100, Grenade Rifle Entry Munition (GREM)
64. M862 5.56mm Short Range Training Ammunition
65. M1030 12 Gauge Breaching Round
66. M973/M974, 7.62 Short Range Training Ammo
67. M992 IR Illumination Cartridge
68. M281 40mm Target Practice Cartridge

* Programs Managed By PM Soldier Weapons
For PEO Ammunition In Accordance With MOA



Individual Weapons





XM25

Demonstrated Counter Defilade Capabilities



High Explosive
Air Bursting



Training



**Current
25mm
Low Velocity Ammo**

Anti-
Personnel



Door
Breaching



Armor
Piercing



Non-Lethal
(Blunt)



Non-lethal
(Airburst)



**Future
Development**

- Semi-automatic Rifle
- Family Of 25mm Ammunition
- Defeat Defilade Targets
- 500 Meter Point Targets
- 500-700 Meters Area Targets
- Fully Integrated Target Acquisition/Fire Control
 - 2x Thermal Sight With Zoom
 - 2x Direct View Optic
 - Laser Rangefinder
 - Ballistic Computer
 - Digital Compass (Cant, Bearing, Tilt)
 - Fuze Setter
 - Internal Display
 - Environmental Sensors



XM320 Grenade Launcher



Description:

- Grenade Launcher
(Mounts To M16/M4 Series Of Weapons)

Capabilities:

- Improves Squad Level Indirect/Direct Grenade Launching Capability Out To 400 Meters
- Greater Reliability And Safety Than M203
- Greater Target Acquisition (Day And Night)
- Capable Of Being Fired As A
*Stand-Alone Weapon
- Able To Fire Wider Array Of Munitions

Status:

- Contract Awarded To Heckler & Koch Defense
5 March 2007
- CPD Approved Feb 07 (Designated "Army" Only)
- I&KPT Completed May 07
- IOT & E Planned For 4QFY07



*Stand-Alone



XM26, 12 Gauge Modular Accessory Shotgun (MASS)



Description:

- A Lightweight Shotgun System That Attaches To The M4

Capabilities:

- Provides The Capability To Fire Lethal, Non-lethal And Door Breach 12 Ga. Rounds
- Shotgun Can Be Zeroed To The Sighting System Of The Host Weapon
- Provides The Lethality Equivalent Of A Stand-Alone 12 Ga. Shotgun
- Capable Of Being Fired As A *Stand-Alone Weapon



*Stand-Alone

Status:

- Vertu Corporation Is Prime Of SDD Contract
- MS C/LRIP Approved Mar 07



XM150, Rifle Combat Optic (RCO)



Description:

- A 4 Power Magnified Optic That Will Attach To M4s, M16s And M249s And Will Improve The Soldier's Ability To Recognize And Engage Targets From 0-600 Meters

Capabilities:

- Improved Capability To Recognize And Engage Targets 0-600m
- Allow Soldier To Rapidly Transition Between Close Quarter And Long-Range Engagements

Status:

- This Capability Will Be Procured Through Full And Open Competition
- Army Adopted USMC RCO CPD On 09 Aug 06
- Program Is Partially Funded
- Full And Open Competition Ongoing



4x Rifle Combat Optic



Crew Served Weapons





XM307



Description:

- The XM307 Is A Lightweight 2-man Portable Crew Served Weapon Which Will Provide Enhanced Capabilities To The Soldier Improving Lethality And Survivability

Capabilities:

- Lightweight, 2-Man Portable, Crew Served Weapon
- System With 25mm Air Bursting Munitions
- Subsystems Include:

- Weapon
- Target Acquisition/Fire Control (TA/FC)
- 25mm High Explosive Air Bursting And Armor Piercing Ammunition
- Lightweight Tripod





Mobility

Heavy Firepower For The Close Combat Fight



System	40mm MK19 Mod 3	Cal .50 M2HB	7.62mm M240	25mm XM307	Cal .50 XM312
Weapon Weight lbs	75.6	84.0	24.2	28.0	34.0
Tripod Weight lbs	65.4	46.1	19.2	13.0	18.8
Fire Control lbs	N/A	N/A	N/A	6.5	N/A
Unloaded System Weight lbs	141.0	130.1	43.4	47.5	52.8
Peak Recoil lbs	800	1000	80	250	250



- **Low Recoil Burden On Weapon Station**
- **Quickly Dismountable From Vehicle Platform**
 - Portable Over Rough Terrain
- **Light & Compact**
 - 80-90 lb Weight Savings

Enhances Close Combat Employment Flexibility



XM240E6, Medium Machine Gun Weight Reduction Program



Description:

- This Program Will Evaluate High Performance, Lightweight Material Alternatives And Alternate Manufacturing Methods In Fabricating Major M240B Components

Capabilities:

- Reduces The Soldier's Combat Load
- Allows Easier Handling And Movement Of Weapon
- Reduced Weapon Weight By 4.5 lbs



Status:

Past Events:

- Completed Coating Confidence Test – Sep 06

Current Events:

- Developmental Testing – Jan 2007

Next Milestone:

- Type Classification Standard – Aug 2007



M240H 7.62mm MG (Aviation Version)



Description:

- 7.62mm Aviation Machine Gun Which Improves The Self Protection Capabilities Of The UH-60 And CH-47 Helicopters



Capabilities:

- Demonstrate Reliability Equal To The M240B
- Removable/Employable In A Ground Role

Pre-Planned Product Improvements (P3I):

- Hydraulic Buffer Added To Spade Grip
- Lightweight Aluminum Ammo Can
- Lightweight Receiver



High Capacity Feed System:

- Provides Two Minutes Of Continuous Suppressive Fire (UH60 Flight Tests May 06)



2,309 Systems Fielded To Date, Fielding Complete End Of FY07



M151 Protector Remote Weapon System



Weight:

- Above The Roof Including (4) M6 Smoke Grenade Launchers: 279 lbs (w/o M6 Smoke Grenade Launchers: 245 lbs)
- Total Weight: 372 lbs (w/o M6 Smoke Grenade Launchers: 338 lbs)

Supported Weapons:

- MK19, M2, M240 (Deferred)
- Growth To XM307/XM312, MK47 & Javelin

Sensor Suite:

- Color 27x Day Sight
- Dual FOV Night Sight (w/2x E-Zoom)
- Auto Focus
- STORM - Laser Range Finder
- IR Pointer (Low And High)
- Visible Pointer
- Low Ammo Sensor



Block II Features:

- Stabilized
- Four-Axis Independent System – Automatically Corrects For Super Elevation And Drift
- Embedded Training & Diagnostics

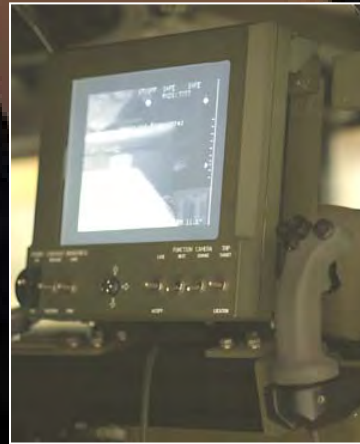




Common Remotely Operated Weapon Station (CROWS) Description



- Provide Soldiers With Capability To Acquire And Engage Targets At Maximum Effective Range While Protected By Vehicle Armor
- Supported Weapons
 - MK19 GMG, Cal .50 M2 MG, M249 SAW, M240B MG
 - Growth To M230 & XM307
 - Weapons Can Be Quickly Interchanged By Soldier
- Sensor Suite Supports Day/Night Engagements
- Can Zoom Optics On Target Independent Of Gun Super Elevation
- Two-axis Stabilized Mount, Laser Rangefinder & Fire Control Software Support On-the-move Target Acquisition & First Burst Target Engagements



Provides Extended Range Surveillance And Detection Of IED Emplacements



CROWS-Lightning Description



- **Lightweight Application For Various Wheeled & Tracked Vehicles (From HMMWVs & Heavy Trucks To Armored Personnel Carriers)**
 - 180 lbs Above Roof Including M240 & Ammo (200 Rds)
- **Moves Unprotected Gunners Into Vehicle Interiors**
- **Day/Night Capability To Identify & Defeat Targets Out To Max Effective Range Of Weapons While On-The-Move**
- **M240 Or M249 Machine Guns With Growth To Advanced Crew Served Weapon (XM307)**
- **Powered By Current Vehicle Capability**
- **2-Axis Stabilization**
- **Traverse: 360° Continuous**
- **Range Of Elevation: -15° To +45° (Objective: -20° To +60°)**
- **Azimuth Slew Rate: 60°/sec**
- **Elevation Slew Rate: 60°/sec**
- **Safety Features:**
 - Programmable Stops In Traverse
 - Manual/Emergency Back-Up Operation Of Weapons Through Top Hatch





XM110, 7.62mm Semi-Automatic Sniper System (SASS)



Description:

- Effective Against Personnel Targets And Light Materiel Targets
- Supplements Sniper's Role In Combat Operations
- Greater Firepower & Possible Standoff Ranges To Improve Sniper Survivability

Capabilities:

- Rapid Fire/Rapid Reload
- Suppressed Sniper Rifle
- Exceeds Rate Of Fire And Lethality Of M24 SWS
- Primarily Anti-personnel Ranges $\geq$ M24 SWS
- Enhanced Sniper Spotting Scope (XM151) And Bipod

Status:

- Preparing For MS C/LRIP
- UMR Fielded To 10th Mtn.





Grenade Rifle Entry Munition (GREM)



Description:

- The GREM Uses An Explosive Warhead With A Standoff Rod, Has Little Back Blast, Is Effective Between 15 And 40 Meters, And Is Aimed And Fired In The Same Manner As A Rifle Grenade

Capabilities:

- Effective Against All Types Of Doors Without Endangering Troops Or Sacrificing The Element Of Surprise
- Can Quickly Destroy A Multitude Of Door Materials, Including Steel
- GREM Has A Maximum Range Of 40 Meters (~130 ft)

Status:

- Urgent Materiel Released (MR) In Support Of OIF
- Full MR In 2Q FY07
- In Iraq Today



**“Every Soldier is a
Rifleman First”**

GEN Schoomaker





Back Up Slides



XM1041/XM1042, XM1071

Close Combat Mission Capability Kit



**Pistol
XM1041**



**Rifle
XM1042**



**SAW
XM1071**



Description:

- Mission Rehearsal Exercise (MRE) System Consisting Of The M16/M4/M249/M9/M11 Family Of Weapons, Marker Munitions, And Personal Protective Gear
- Used To Rehearse Force-On-Force Close Range Marksmanship Techniques, Tactics, And Procedures (TTP)
- Fires 5.56mm And 9mm Dye-Marker Munitions Through Standard Military Issue Weapons

Capabilities:

- Allows for Realistic Force-On-Force Training
- Identify Shooter And Shot Placement
- Operator Installed
- Must Not Penetrate Skin Thru Hot BDU At 5m(T) And 0M(O)
- Must Not Fire Service Ammo
- Must Not Fracture SWD Goggles At 12 Inches





Weapon System Components



- 7.62mm SR-M110 Match Rifle
- 20-Round Magazine (4 each)
- 10-Round Magazine (4 each)
- 600 Meter Backup Iron Sight
- Harris Bipod LM-S
- Bipod Rail Adapter
- Leupold 3.5-10x Scope With TMR® Reticle
- Padded Scope & Crown Cover
- Zippered Scope Soft Case
- Scope Caps
- One-Piece Long Range Scope Mount
- Tan Leather Competition Sling Assy
- Military Sling Swivels Installed On Sling
- SASS 7.62mm Sound Suppressor
- Magazine Pouches
- System Transport & Storage Case
- Weapon & Optic Cleaning Kits
- Weapon Deployment Kit
- Dewey Special 35.5" Coated Rod
- Bore Rod Guide for Dewey Rod
- DMR Flex Rod Kit

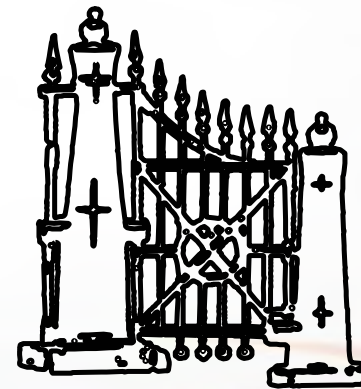
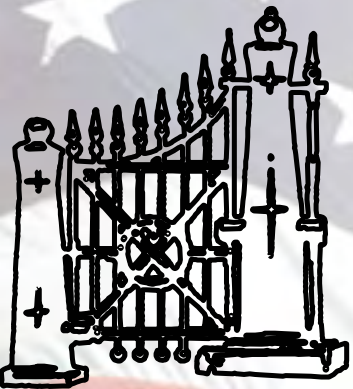


US ARMY ARMAMENT RESEARCH DEVELOPMENT, AND ENGINEERING CENTER (ARDEC)



ARDEC Tech Base Overview

12 June 2007



TM

Ms. Barbara Machak
Associate Technical Director for Tech Base/MANTECH

INNOVATIVE ARMAMENTS SOLUTIONS FOR TODAY AND TOMORROW



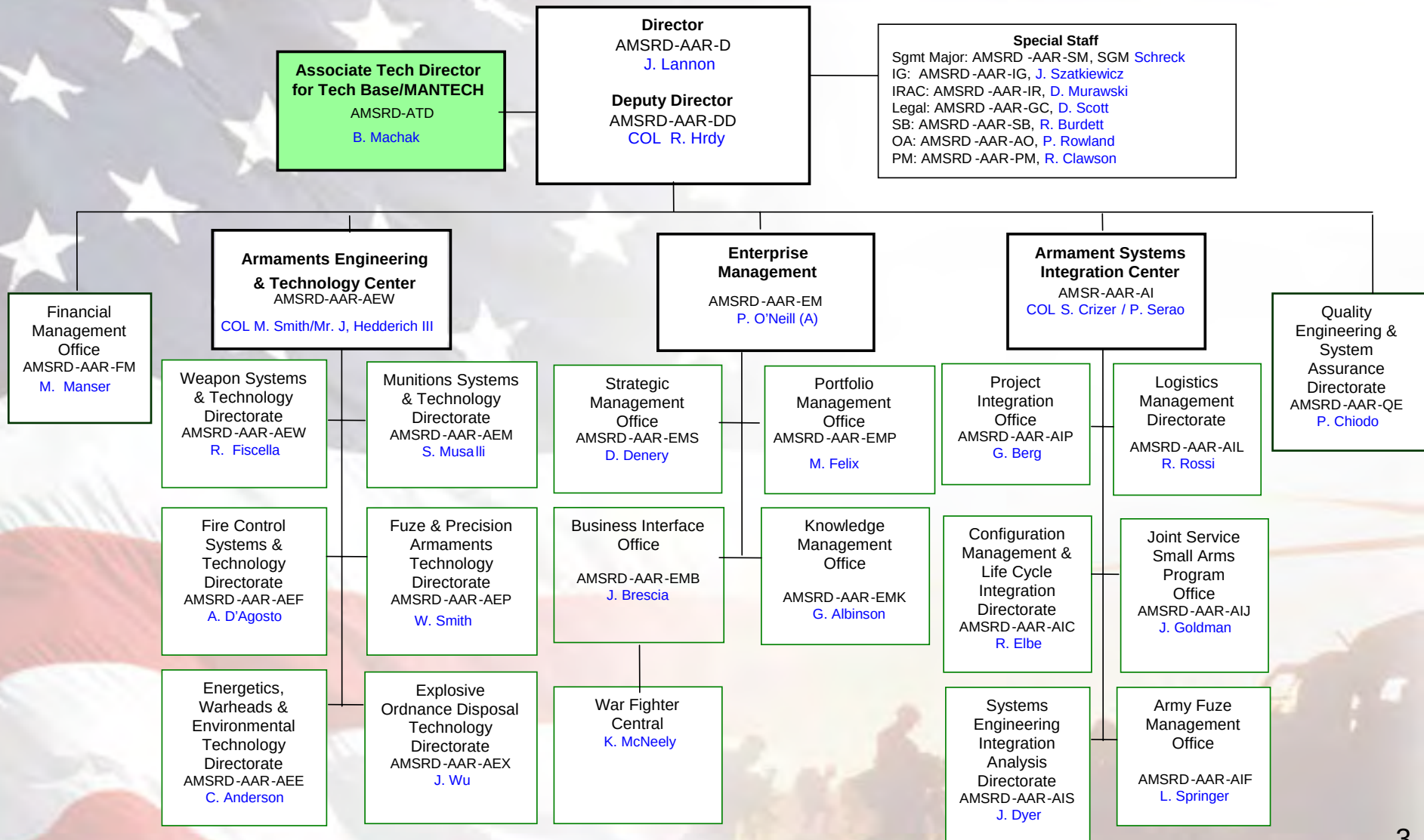
Bottom Line Up Front



- **We are a nation at war – ARDEC seeks to partner with PEOs and industry to accelerate fielding of advanced technologies in support of current operations**
- **ARDEC in maintaining investments in Future Force technologies**
- **ARDEC is applying weapons, munitions/effects, and fire control expertise to emerging technologies including Active Protection Systems, Counter Rockets, Artillery and Mortars, and Countermine/Counter IED**
- **ARDEC has a strong desire to develop joint technology programs with Army, other service, coalition, and industry partners**



ARDEC Organization Chart





Key Initiatives



- ▲ **Partnering is our strongest asset**
 - Brought in key stakeholders into S&T investments
 - Joint Armament programs becoming reality
- ▲ **Transitioning technology to PMs**
 - Executive Black Belt project
 - Tough problem as we don't control requirements or funding
- ▲ **Balance portfolio between current and future force needs**
 - 42% Current Force vs 58% Future Force (based on when we transition)
 - As well as conventional and “disruptive”
- ▲ **Dispel Myth that Army/DoD has “Enough Lethality”**
 - PBD 753 lost 10% over FY06-11 POM
 - Lethality is Survivability

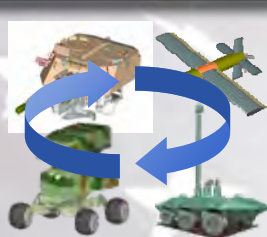
.....Continued Dialog to Ensure ARDEC understands Priorities



Major Lethality Technology Investments



Extended Area Protection & Survivability



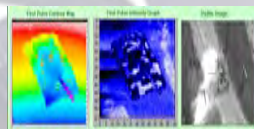
Networked Lethality



Acoustic/Seismic Sensors



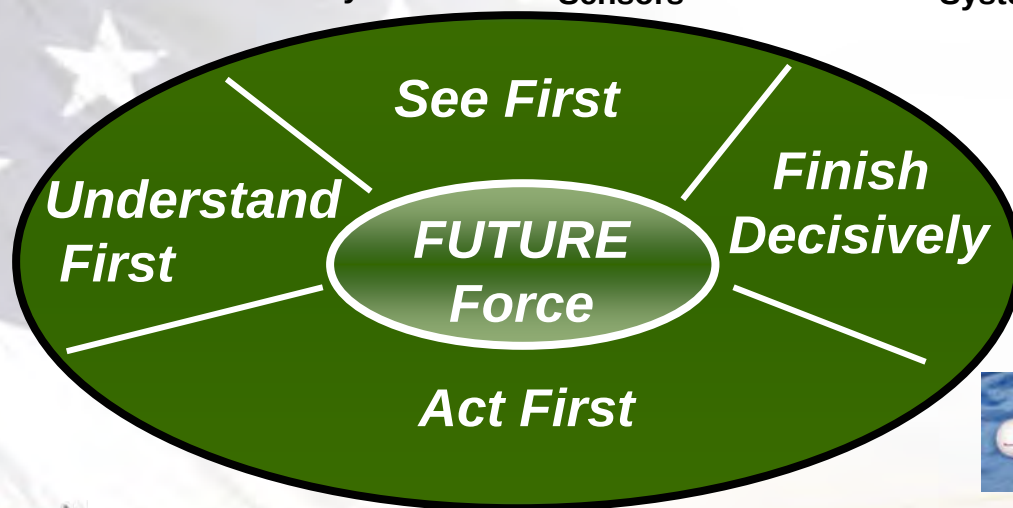
KE Active Protection System Interceptors



Common Smart Munitions



EM Gun



Multi-Mode Warheads



MEMS IMU



MEMS S&A Fuze & Power



SWORDS w/Remote Armament System

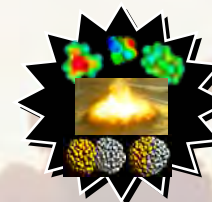
Mid-Range Munition



LtWt Dismounted Mortar



Scaleable Effects



Novel/Nano-Structured Energetics



LtWt Small Arms Technologies



Technology Investment Strategy



CURRENT MUNITIONS

Small/med cal
25mm
Javelin
TOW
Tank
2.75" Rocket
Mortars
Howitzers
Hellfire
MLRS
ATACMS

COMMONALITY PLAN

Near Term

Mid Term

Far Term

Munitions with Common Sub-Components

Common Propellants

Common Fuzes

Common Sub-munitions

Common Guidance

Common Warheads

Munitions with Common Sub-Components

ENDSTATE

Common Short-Range Munitions

Common Mid-Range Munitions

Common Deep Range Munitions

.....Low Cost Common Components for all Joint Conventional Munitions



FY07 Non-ATO Portfolio

Non ATO Tech Base:

- Light Weight Small Arms Technology
- High Power Microwave, Non-Lethal
- MOUT Technologies
- G-Hardened Sensor Tech for Munitions
- Dual-Use Composites
- Reliability for the Future Force
- Nanotechnologies for the Future Force
- Future Force Gun and Munition Technology

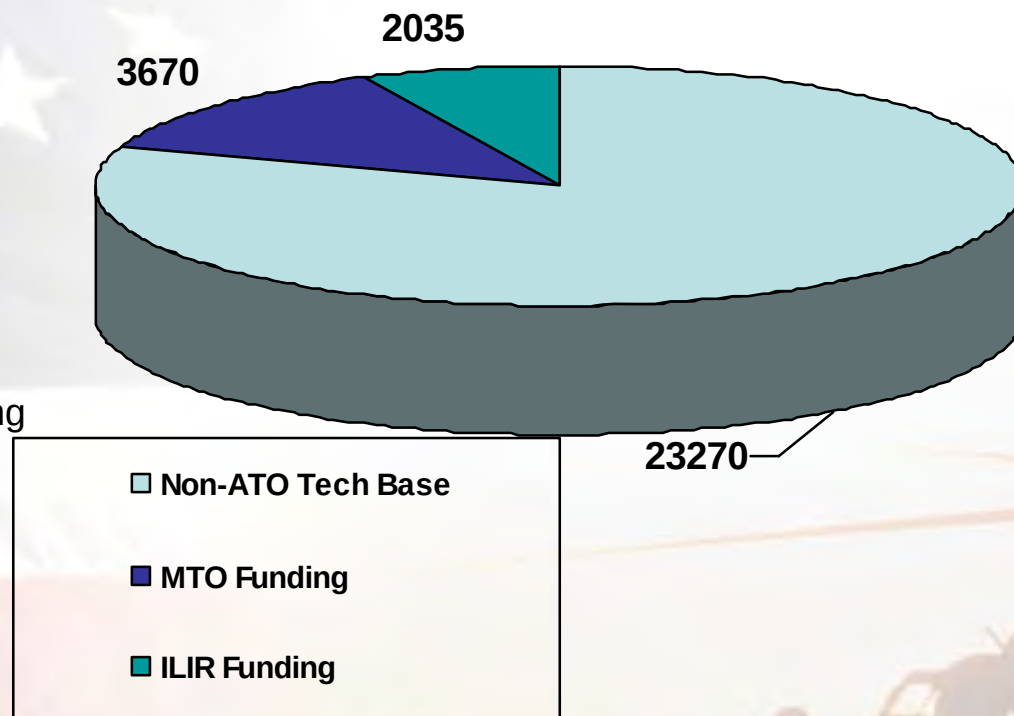
MTO:

- MEMS/IMU for Common Guidance
- MEMS S&A
- Optimization of PAX-41 Formulation and Loading

ILIR:

11 Projects:

- Nano-tech-3
- Sensor-tech-5
- Energetics/Lethality-3



Total: \$28,975



FY07 ATO Portfolio



LOS/BLOS:

- EM Gun Technology Maturation & Demo (USN)
- MCS Ammunition System Technologies (ARL)
- Hardened Combined Effects Penetrator Warhead (AMRDEC/ARL/ERDC)
- MEMS Inertial Meas. Unit for Com. Guidance (AMRDEC)
- Novel Energetics for the Objective Force (ARL)

NLOS:

- Fuze and Power for Advanced Munitions (AMRDEC/ARL/ERDC)
- Common Smart Submunition (USAF)
- Non Lethal Payloads for Personnel Suppression
- Insensitive Munitions Technologies (ARL)
- Near Autonomous Unmanned Systems (TARDEC)

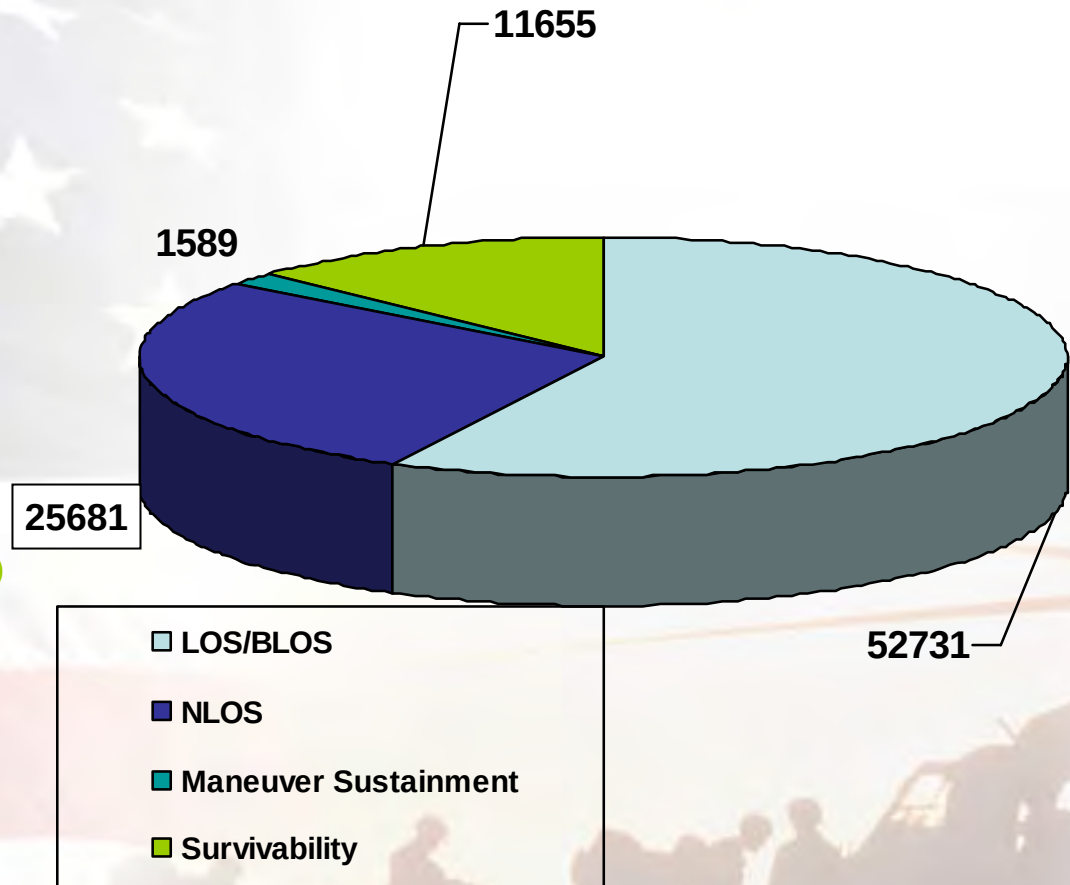
Maneuver Sustainment:

- Joint Modular Intermodal Distribution System JCTD
- Prognostics & Diagnostics for Operational Readiness (ARL)

Survivability:

- Kinetic Energy APS (RDECOM)
- Countermine/ IED Neutralization (CERDEC)
- Extended Area Protection (AMRDEC)

Total: \$91,665





FY08 Start - Scalable Technology for Adaptive Response - STAR



Scaleable/Adaptive Lethality

Fuze/Power

Energy Management

Weapons Technology Thrusts

Controlled Response

Accurate & Precise

Low Collateral



Purpose:

- Provide capability for scalable, selectable, and adaptive lethal effects against platforms and personnel to selectively destroy target function and/or neutralize attributes while limiting damage to surrounding structures/personnel

Products:

- Demonstration of agile technologies for scalable, selectable & adaptive lethal effects in large, medium, and small diameter munitions & missiles
- Development of controlled lethal effects, multi-purpose energetics & formulations, reactive materials and advanced fuzing and power technologies

Payoff:

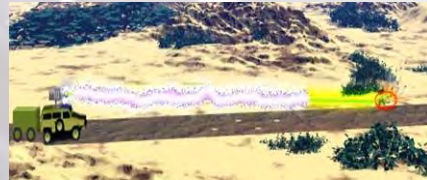
- Demos: 250mm (GMLRS), 155mm (Excalibur), 30mm (M789/Mk238)
- Improved weapon effectiveness/lethality
- Reduced collateral damage
- Rapid mission execution with less ammunition expended (reduced logistics)
- Tech transition to PEOs, AMMO, M&S, Soldier: Javelin, TOW, JAGM, XM1069, MAPAM, M430

Schedule & Cost

MILESTONES	FY08	FY09	FY10	FY11	
Multi-output explosive and Advanced Dynamic Propellant development		3	4	5	
Reactive Material development		3	4	5	
Advanced fuze & power development		3	4	5	
Warhead scaleable/selectable performance against multiple targets			4	5	6
Integrated Demos of Prototype Adaptive Munitions			4	5	6
Total					



FY08 Start - Multimode HPM and Laser Induced Plasma Channel Technology



Laser Induced Plasma Channel

Solid State HPM Source Technology

Multi-Mode Directed Energy Armament System

Schedule & Cost

MILESTONES	FY08	FY09	FY10	FY11	FY12	FY13
• Design Multi-Mode Directed Energy						
• High Power Microwave						
• RF source Development						
• Antenna/Transmitter						
• Power Source Development- Modulation/Pulsed power						
• DE Armament System Integration/ Portable IED system development						
• Transition to Vehicle Integration/ Portable IED Defeat system						
Total						
Army 6.2 (\$M)						
Army 6.3						
ARL 6.2						

Purpose:

Demonstrate Laser Induced Plasma Channel (LIPC) guiding HPM/High Voltage/RF. Reduce the size and weight of Solid State power sources. Optimize steering and control of various HPM/High Voltage effects.

Product (s): TRL 6 :

- Multi-mode Directed Energy Weapon Demonstrator
 - Defeats/Neutralizes full spectrum of materiel threats at stand off
 - Portable/mobile IED defeat system
- ARL will provide technical expertise in design and development of pulse power and antenna technology.

Warfighter Payoff:

- Multi-mode DE effects from one platform for anti-personnel and anti-material
- Automated and Portable Checkpoint IED neutralization system
- Sized for FCS class vehicles
- Scalable effects from non-lethal to lethal



FY08 Start - MOUT/Urban Lethal Technologies



MOUT Target Set

Advanced Warhead Designs

Schedule & Cost

	FY08	FY09	FY10
Wall Breacher (WB)			
Wall Target Effects Perf. Modeling/Eval			
Subsystem Development (Energetics, Fuzing, Timing)	4		
Breaching Sys Optimization		5	
Lightweight, single shot explosive wall breaching system eval and demo			6*
Demo remote emplacement			5**
Shoulder Fired (SF)			
Baseline initial charge design			
Opt forward charge for MOUT targets		5	
Follow through charge development for tandem configuration			5
Multimode fuze dev and eval			
Final munition and Target Demo			6
Total			
	ARDEC		
	ERDC		

Purpose:

WB) Improve the Rapid Wall Breaching Kit (RBWK) by providing a single shot demolition device to create a Soldier size entry hole in a spectrum of walls, cut all rebars when present and minimize collateral damage

SF) Provide a single Shoulder Launched Munition for the individual Soldier capable of incapacitating / defeating personnel inside urban structures & light armored vehicles

Product:

WB) Demonstrate state of the art warhead technologies for Rapid Wall Breaching that can create a man-sized hole in double-reinforced concrete wall in a single step, reduce time on target and enhance soldier survivability

SF) Demonstrate a multi-purpose Shoulder Fired Munition which can incapacitate personnel within Bunkers, behind 12" Triple-Brick and 8" Double Reinforced Concrete Walls, and within light armored vehicles

Payoff:

Wall Breacher (WB)

- Improved survivability by reducing time on target
- Reduced overall system weight

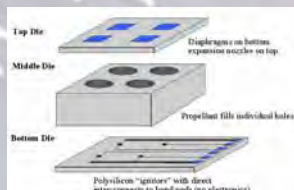
Shoulder Fired (SF)

- Single shoulder-launched weapon system with increased lethality and survivability for all required targets
- Reduced logistics burden & unit training requirements
- Reduced Soldier's combat load

Transition both technologies to PM-CCS for SDD



FY08 Start - Advanced Lethal Armament Technology Small Arms



Note: Modeling & Simulations Activities are coincident with efforts

Schedule & Cost

Milestones	FY08	FY09	FY10
<u>Advanced Lethality Component</u>			
• Concept small warheads with modeling.	2		
• Experiment geometric & directionality warheads			
• Breadboard lethal & frag concepts comp.			4
• Miniature Proximity fuze electronics	3		
• Demo critical electronic comp.		4	
• Develop adv. recoil concepts	2		
• Tradeoff materials and recoil absorption technology. Experiment with recoil absorption		3	
• Critical breadboard of weapon launch survivability			4

Purpose:

To demonstrate advanced lethal armament component technology for providing improved munition effectiveness to targets.

Product:

- Demonstrate advanced lethality components spiraling to weaponization includes terminal fragmentation effectiveness trades.
- Miniaturize Proximity electronics for 40 mm application. Integration of improvement to SWAP of proximity fuze for small arms.
- Demonstration of technical material components improving durability, reliability and weight to include Recoil attenuation technical advancement components
- Modeling and Simulation assessments integrated with critical technology demonstrations

Payoff:

Multiple critical technology demonstrations enabling maturity measurement coupled with cross integration analysis fulfilling broad small arms capability gaps for spiral transition.



FY08 Start - Advanced Fire Control Technology for Small Arms



Target Tracker &

Laser steering



Note: Modeling & Simulations Activities
are coincident with efforts

Schedule & Cost

Milestones	FY08	FY09	FY10
<u>Laser Steering / Adv. Range Finding</u>			
• Concept Studies			
• Component Experimentation			
• Component analysis/define parameters			
• Critical breadboard proof of concepts			
• Selection for breadboard fabrications			
• Integration of breadboard components			
• Component banding/maturation			

Purpose:

To demonstrate advanced fire control component technology determining correct range to moving targets and further power sharing within weapon for current and future warfighters.

Product:

- Harvest and target, for small arms, the technologies of automatic target detection, laser steering to increase the soldier's ability to accurately determine range to non cooperative moving targets. Improved lethality in direct and indirect fire situations for unsupported firing positions.
- Develop range determination overcoming man machine 1.5 hertz wobble human hold.
- Investigate weapon wireless net centric access coincident with power sharing mounting rails.

Payoff:

Critical technology demonstrations enabling maturity coupled with cross integration analysis fulfilling broad small arms capability gaps defilade and covered targets for spiral transition.



Emerging Investment Areas

- ARDEC expertise applies to emerging capability gaps.
- ARDEC is leveraging S&T for current and future threats:

**Remote Armament
Systems**

**POC: Leon Manole
(973) 724-6753**

**IEDs /
Asymmetric Threats**

**POC: Ray Carr
(973) 724-5010**

**Novel Power &
Energy Systems**

**POC: Maria Allende-Pastrana
(973) 724-2278**

Networked Lethality

**POC: Norm Coleman
(973) 724-6279**

**Rapid Prototyping
For the Current Force**

**POC: Bernie Rice
(973) 724-8501**

Nanotechnology

**POC: Mark Mezger
(973) 724-8535**

**Industrial Base/
Mfg Science**

**POC: John Blackmer
(973) 724-8519**

Homeland Defense

**POC: Floyd Ribe
(973) 724-6165**

.....ARDEC is Actively Seeking Investment Partners in These Areas



Issues/Concerns



- ▲ Industry/Government Tech Base investment must be **focused on warfighter requirements** – both from Combat Developer (TRADOC) and Materiel Developer (PEO/PM)
- ▲ “Best of Breed” low-cost, multipurpose munition components are needed – **IP concerns must be not impede this and must be negotiated up front**
- ▲ Industry proposals must be timed to support Army budget process - **Out-of-cycle proposals by exception only**



Teaming with ARDEC



- ▲ **ATOs/Tech Base – POC: Allan Aprea, (973) 724-5015**
- ▲ **Test Agreements/IR&D/CRADA – POC: Tim Ryan, (973) 724-7953**
- ▲ **Rapid Prototyping – POC: Bernie Rice, (973) 724-8501**
- ▲ **DOTC – POC: Ray Pawlicki, (973) 724-3386**
- ▲ **Small Arms Consortium – POC: Frank Puszycki, (973) 724-6081**



In Summary...



- **We are a nation at war – ARDEC seeks to partner with PEOs and industry to accelerate fielding of advanced technologies in support of current operations**
- **ARDEC in maintaining investments in Future Force technologies**
- **ARDEC is applying weapons, munitions/effects, and fire control expertise to emerging technologies including Active Protection Systems, Counter Rockets, Artillery and Mortars, and Countermine/Counter IED**
- **ARDEC has a strong desire to develop joint technology programs with Army, other service, coalition, and industry partners**

Symposium agenda

Monday, June 11, 2007

10:00am - 4:00pm

Exhibitor Move-In

10:00am - 6:00pm

Registration

5:00pm - 6:00pm

Evening Reception in Exhibit Area

Tuesday, June 12, 2007

7:00am

Registration & Continental Breakfast

7:55am - 8:00am

Administrative Remarks

- *Mr. Sam Campagna, Director, Operations, NDIA*

8:00am - 8:45am

Welcome Address & JM&L LCMC Brief

- *BG William N. Phillips, USA, Commanding General, Picatinny Arsenal, Program Executive Officer*

8:45am - 9:30am

ARDEC Technology Overview

Mr. Patrick Serao, Senior Technical Executive, Armament Systems Integration Center, ARDEC

9:30am - 10:15am

Joint Munitions Command Overview

- *BG James Rogers, USA, Commander, Joint Munitions Command*

10:15am - 10:45am

Morning Break in Exhibits Area

10:45am - 11:15am

ARDEC's LEAN Six-Sigma Program

- *Mr. Paul Chiodo, Director QESA, ARDEC*

11:15am - 11:45am

Industry Perspective on JM&L LCMC

Mr. Tim Bagniefski, Vice President for Business Development, GD-OTS

11:45am - 12:15pm

Exhibit Visit

12:15PM - 1:30PM

Luncheon

1:30pm - 2:00pm

Lethality R & D Overview

- *Ms. Barbara Machak, Associate Director for Systems Concepts and Technology, ARDEC*

2:00pm - 2:30pm

Towed Artillery Digitization

- *Mr. Harvey Goldman, Deputy PM, Towed Artillery Digitization*

2:30pm - 3:00pm

Arming Robotic Systems

- *Ms. Kim Jones*

3:00pm - 3:30pm

Afternoon Break in Exhibit Area

3:30pm - 4:00pm

Scorpion Program

- *Dr. Peter Plostins, Supervisory Aerospace Engineer, US Army Research Laboratory*

4:00pm - 4:30pm	Army EM Gun Program - Mr. Harry Fair, Director Institute for Advanced Technology University of Texas
4:30pm - 5:00pm	Integrated Technology Transition - Ms. Vickie Williams, NSWC Crane
5:00pm - 6:00pm	Reception in Exhibits Area
6:00pm	Conference Adjourns for the Day

Wednesday, June 13, 2007

7:15am	Registration & Continental Breakfast
8:15am - 8:45am	Rapid Fielding for Coalition Forces - Mr. Lu Ting, International Office, US Army ARDEC
8:45am - 9:15am	Ground Vehicle Systems Modernization - Mr. Kevin Fahey, PEO GCS
9:15am - 10:00am	Concepts to Required Capabilities - COL Steve Bullimore, TRADOC, Army Capabilities Integration Center
10:00am - 10:30am	Morning Break in the Exhibit Area
10:30am - 11:00am	Mr. Dennis Carroll, Vice President, Business Development, Raytheon
11:00am - 11:30am	ARDEC Systems Engineering Initiative - Dr. Dinesh Verma, Stevens Institute (Invited)
11:30am - 12:00pm	- Ms. Karen Davies, ATK LCAAP
12:00pm - 1:00pm	Luncheon
1:00pm - 1:30pm	PM CCS Technology Programs - Mr. Ross Benjamin, PM CCS
1:30pm - 2:00pm	PM CAS Technology Programs - COL Ole Knudsen, USA, PM CAS
2:00pm - 2:30pm	PM MAS Technology Programs - Mr. William Sanville, Deputy Program Manager, Maneuver Ammunition Systems
2:30pm - 3:00pm	Afternoon Break in Exhibits Area
3:00pm - 3:30pm	PM Solider Weapons Modernization - COL Carl Lipsit, USA, Project Manager Solider Weapons, PEO Solider
3:30pm	Conference Adjourns



Supporting the Warfighter

***NDIA Armaments Technology
Firepower Symposium***

***“Joint Munitions and Lethality
Life Cycle Management Command”***

**Presented By:
BG Bill Phillips**

12 June 2007

“Need to be faster, more agile, less bureaucratic... Need to fight this every day”





Mission, Vision, Objectives

Mission:

To execute integrated life cycle management through a team of dedicated professionals who provide effective, available, and affordable munitions and lethality for the joint warfighter.

Vision:

Battle space dominance for the joint warfighter through superior munitions.

Objectives:

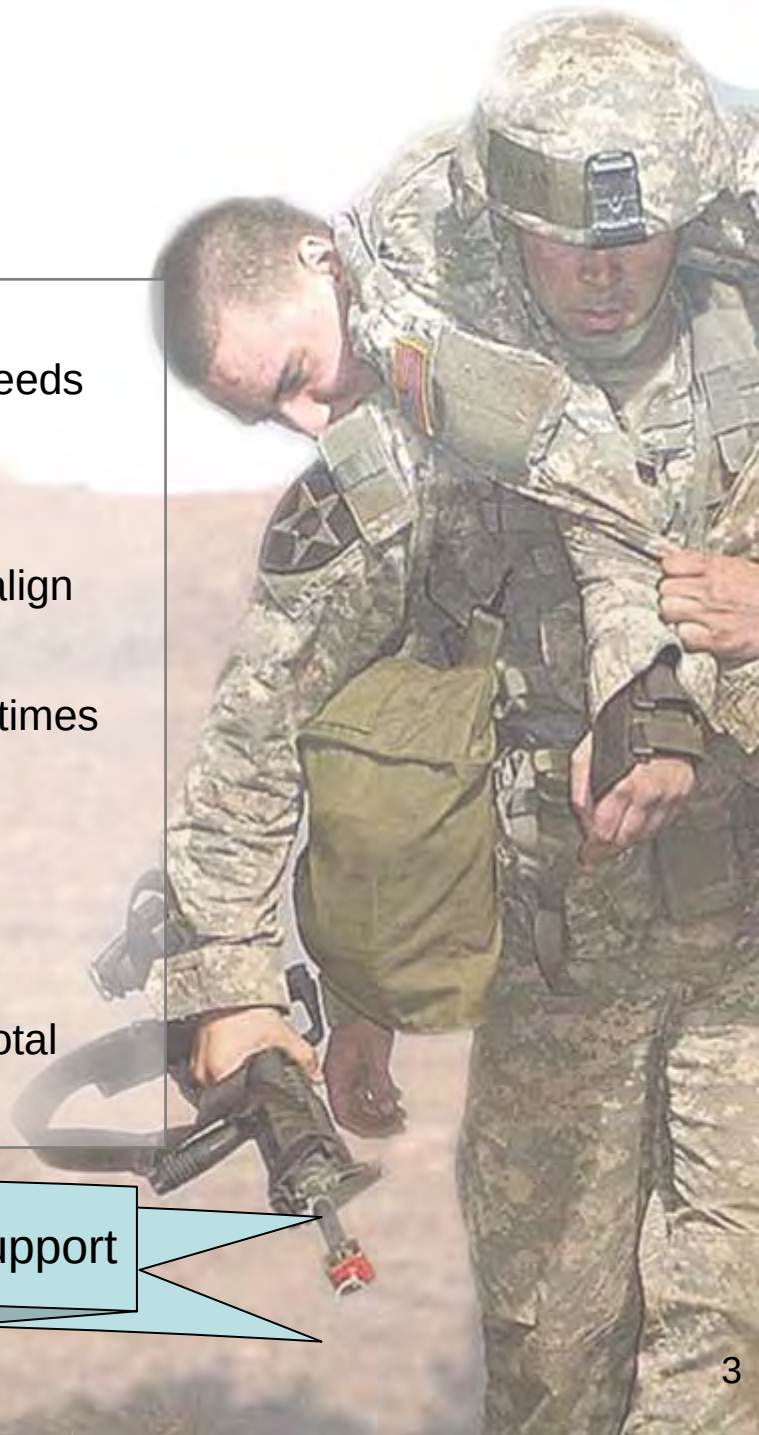
- Joint warfighter and coalition support
- Munitions Readiness
- Reliable, high performance munitions



What is an LCMC?

- A way of **thinking and acting** that considers the needs of the Army and war fighter above the needs of individuals or organizations in the process
- A confederation of organizations that strategically align their operational processes to create greater effectiveness and efficiency which results in better products, shorter cycle times, and faster response times to satisfy the war fighter's needs
- A collection of processes that support the Defense Acquisition Life Cycle Management Framework
- The Army's implementation of the OSD Directed Total Life Cycle Systems Management (TLCSM)

Soldier Focused Technology, Logistics & Support





Life Cycle Management Commands



- Reduce Burden on the Soldier
- Cradle-to-Grave Materiel Solutions to Warfighter
- Improved Responsiveness and Support to the Field
- Better Product, Delivered Quicker at Reduced Cost to the Warfighter





JM&L LCMC Process



*Meeting Warfighter requirements
Successfully working challenges*



JM&L LCMC Strategic Partnership

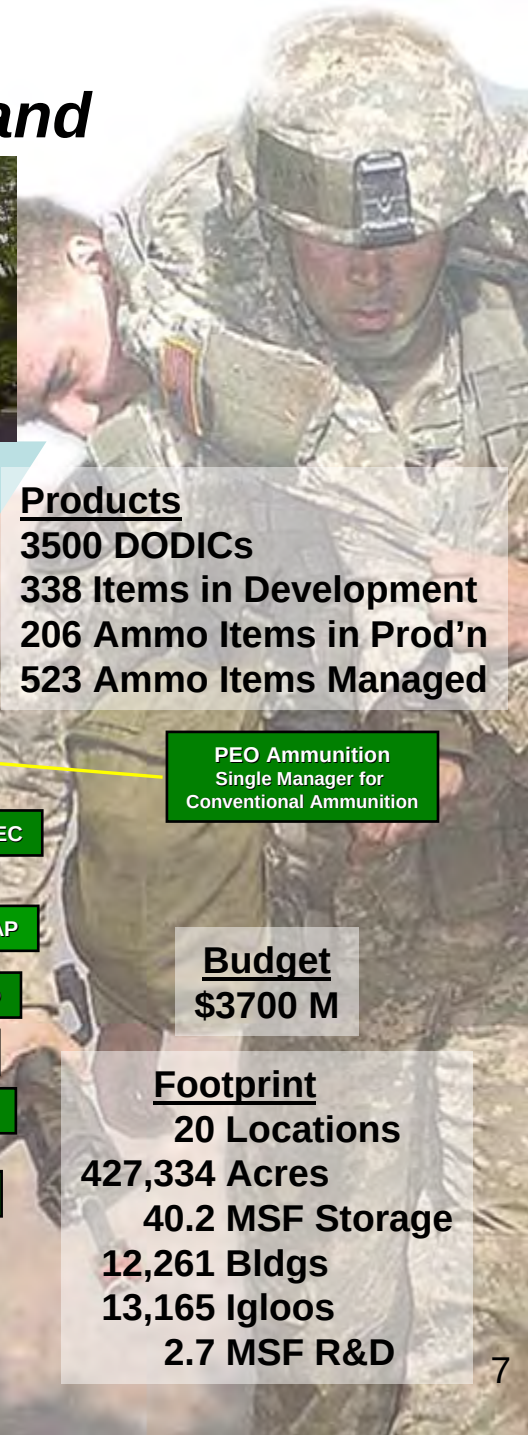
“One Team...One Fight”



The JM&L LCMC executes integrated Life Cycle Management through a team of dedicated professionals who provide effective, available and affordable munitions for joint warfighters.



Joint Munitions & Lethality Life Cycle Management Command



Joint Munitions Command
Munitions & Log Readiness Center
Defense Ammo Center

Lake City AAP

Iowa AAP

Crane AAA

Letterkenny AD

Scranton AAP

Tooele AD

Hawthorne AD

Riverbank AAP
(to Rock Island Arsenal)

Kansas AAP
(to McAlester, Milan, Iowa, Crane)

McAlester AAP

Red River AD

Lone Star AAP
(to Milan, Iowa, Crane)

Mississippi AAP
(to Rock Island Arsenal)

Anniston AD

Milan AAP

Holston AAP

Bluegrass AD

Radford AAP

Armament RDEC

PEO Ammunition
Single Manager for
Conventional Ammunition

What We Do

- Integrate Acquisition, Logistics, & Technology (AL&T)
- Single Manager for Conventional Ammunition (SMCA)
- Small, Med, Large Cal. Munitions
- Countermine Systems & EOD
- Demolitions
- Non-Lethal Systems
- Grenades
- Pyrotechnics
- Shoulder Launched Systems
- Fuzes & Fuze Setters
- Mortar & Mortar Fire Control Systems
- Smart Munitions
- Networked Munitions
- Unique Conventional Munitions
- Demilitarization

Products

3500 DODICs

338 Items in Development

206 Ammo Items in Prod'n

523 Ammo Items Managed

Budget
\$3700 M

Footprint

20 Locations

427,334 Acres

40.2 MSF Storage

12,261 Bldgs

13,165 Igloos

2.7 MSF R&D

JM&L LCMC Team

6641 Government Employees

8090 Contractor Employees



Single Manager for Conventional Ammunition

\$ 2.8B Executed on behalf of all Service Customers

SMCA Mission: Manage DoD conventional ammunition, and personnel and training functions (DoDD 5160.65)



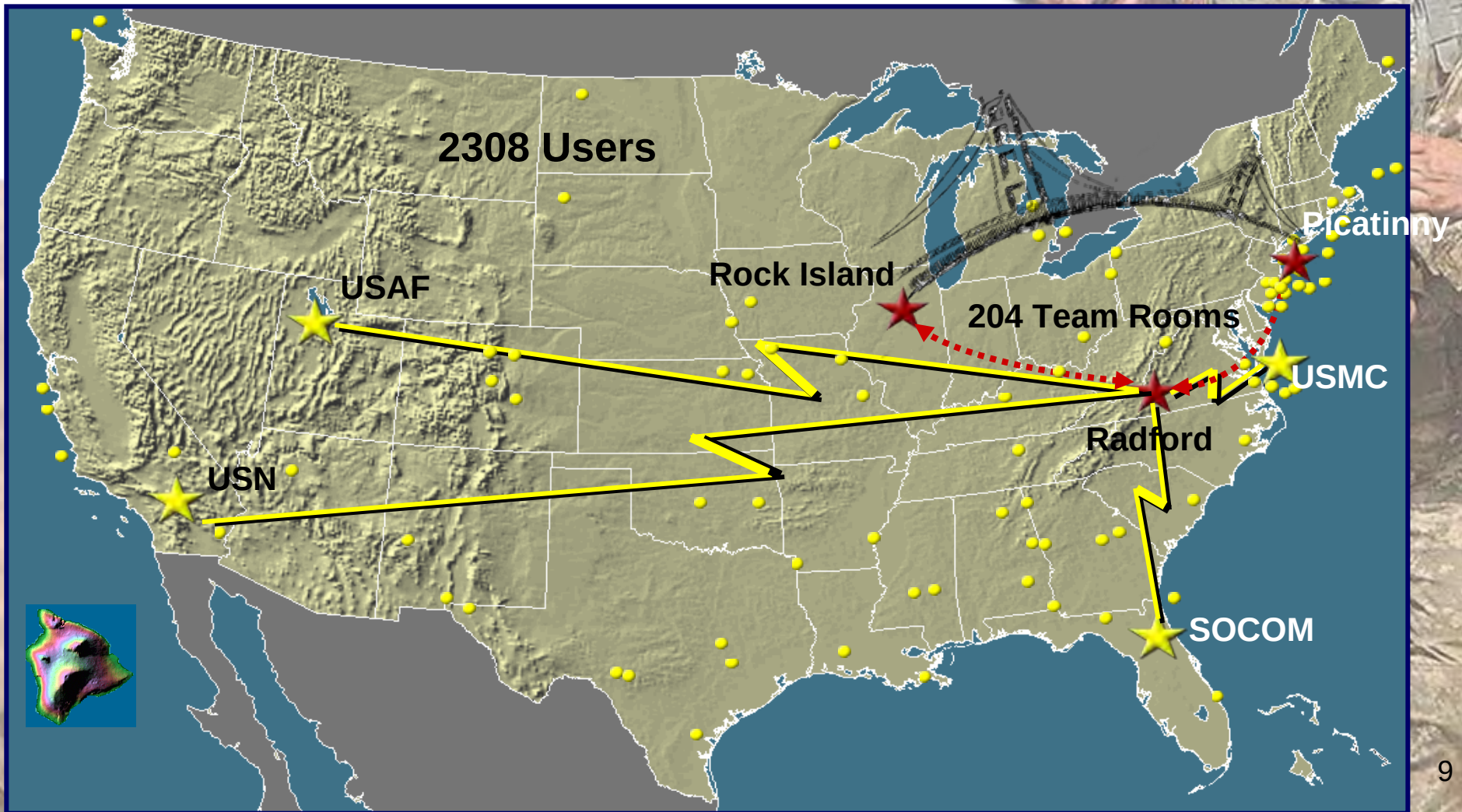
Objectives: Achieve the highest possible degree of efficiency and effectiveness in the DoD operations required to acquire top quality conventional ammunition for U.S. Forces





Ammunition Enterprise Portal

- ✓ Bridge Across Ammunition Enterprise Sites
- ✓ Face to Joint Customers
- ✓ Cross-functional user base of 2308 with 105 different organizations represented

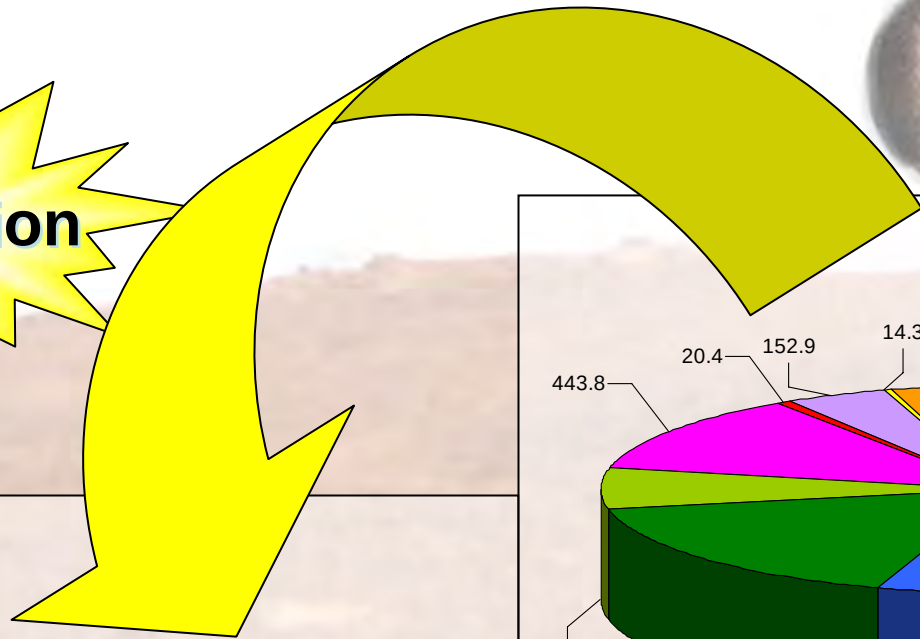




JM&L Funding

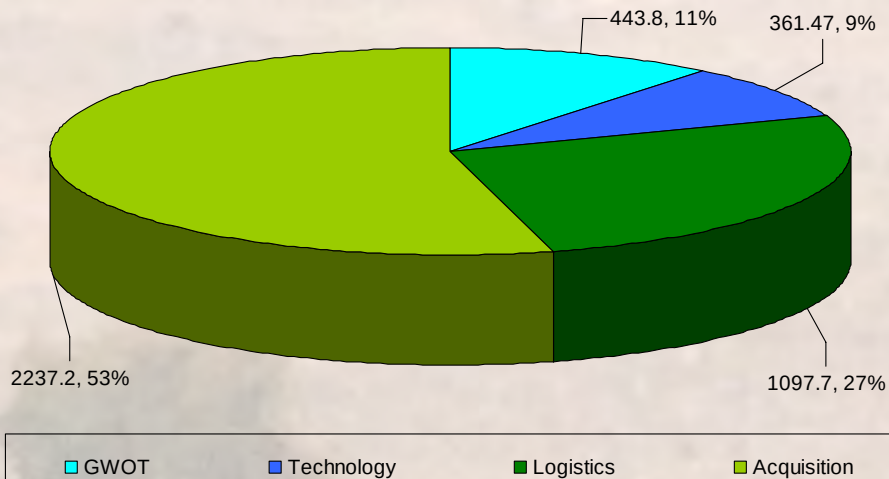
(Direct, No Customer Orders)

\$3.7 Billion



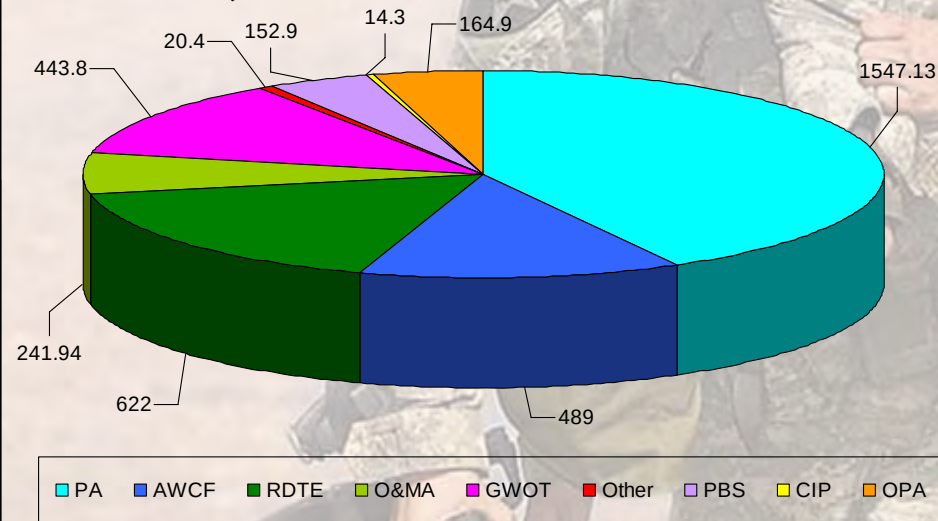
\$ in Millions

A-L-T



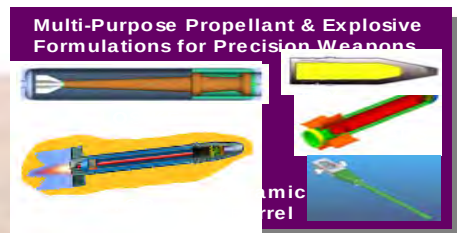
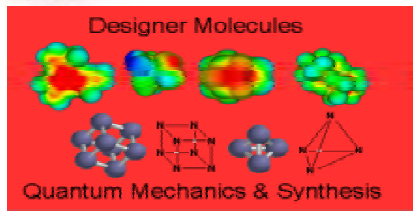
JM&L

\$ in Millions





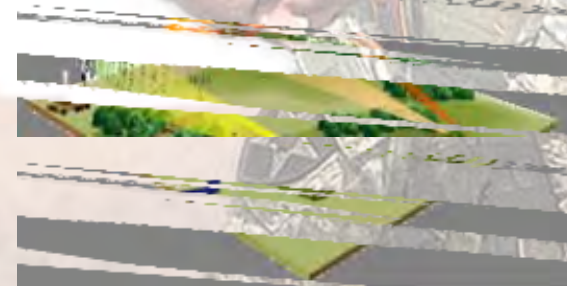
Technology



Novel Energetic Materials for the Future Force



Kinetic Energy Active Protection System (KEAPS)



Multimode HPM and Laser Induced Plasma Channel Technology

Multiple EFP Cache Recoveries

Recovered from cache
September 15, 2005
Diwaniyah

Recovered from emplaced EFP
arrays on January 20, 2006 in
Baghdad

Explosives Filler
Body
Liner

Force Protection



Acquisition



Excalibur



MRM

IMS

**Networked
Remote
Control
Station**

Dispensing Module

Gateway Node

1500-3000 m

**Anti-Personnel Effects
Anti-Vehicle Effects**

By the way...

- Small Caliber
- Medium Caliber
- Large Caliber
- Mortar Systems
- Pyrotechnics
- Flares
- Smart Munitions
- 30mm

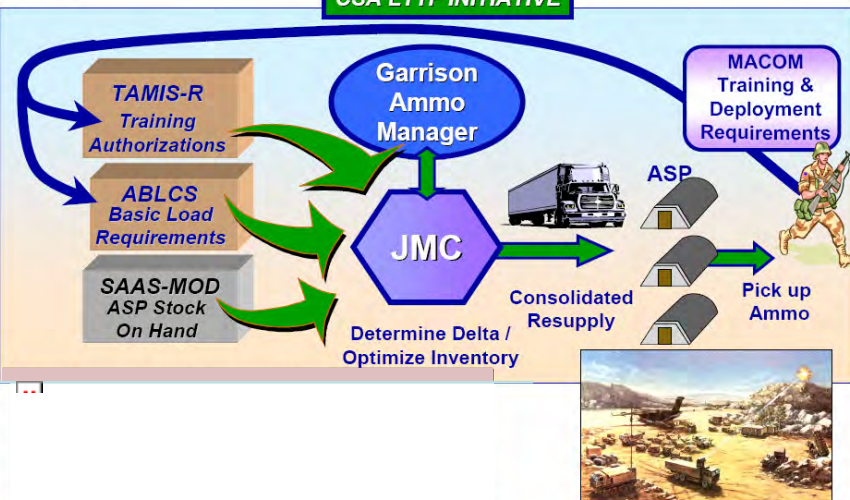


Logistics

Centralized Ammunition Management

Concept of Operations

CSA LTTF INITIATIVE



Joint Modular Intermodal Container (JMJC)

Joint Modular Intermodal Platform (JMIP)

Embedded Automated Information Tracking

- Interlocking
- Intermodal
- Re-configurable
- Joint Compatibility



JM&L Operational Results

Type Classifications (MS C App'd for Service Use) 02-Pres	40
Materiel Releases 02-Pres	112
Urgent Materiel Releases	47
Tons of Ammo for OEF/OIF	194,000
Programs in Development (A)	338
Programs in S&T (T)	223
Ammunition DODICS Supported	3500
Small Caliber Rounds Delivered	1.6 B
Artillery Rounds Delivered	320 K
155mm Excalibur Fielded & Fired	May 2007
Ammo Plant Modernization (last 5/next 5 years)	\$503 M Invested \$530 M Planned
Lean 6-Sigma	\$84 M Saved

Ammo In-Theater All Types – “Green”



Production Backlog Reduction Over the Years

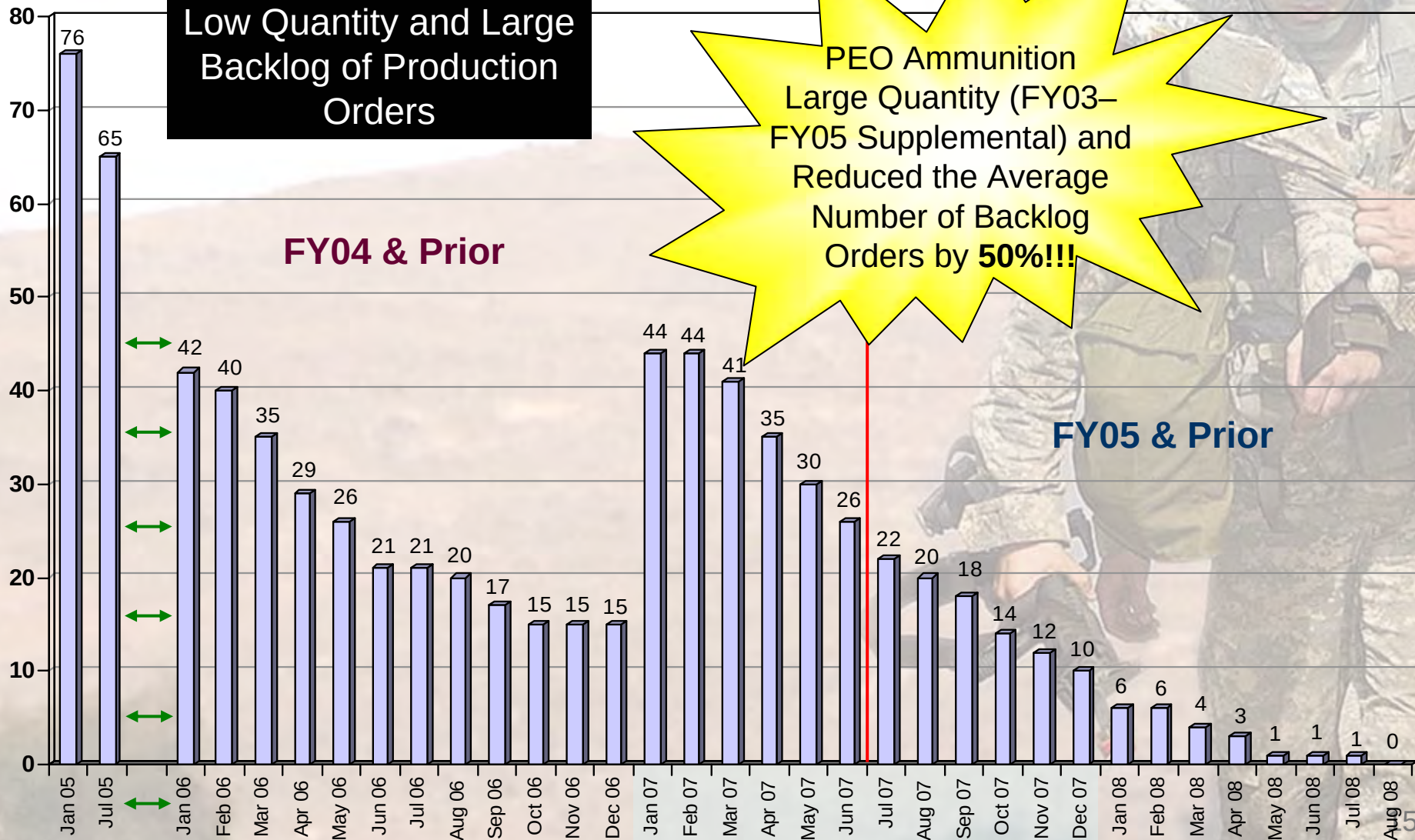
Pre-PEO Ammunition
Low Quantity and Large
Backlog of Production
Orders

PEO Ammunition
Large Quantity (FY03–
FY05 Supplemental) and
Reduced the Average
Number of Backlog
Orders by **50%!!!**

FY04 & Prior

FY05 & Prior

Outstanding Orders





Challenges

- Industrial Base
- Ammo OPTEMPO Requirements
- Ammunition Demil

LCMC Strategic Implementation



At the End of the Day . . .



We're Meeting Warfighter's Needs !





Back-up





PEO Ammunition Organization

BG Bill Phillips
Mr. Jim Sutton

PEO
DPEO

APEO Programs

Mrs. Seham Salazar

APEO Business

Mr. Pete Vauter

Human Resources

Ms. Celeste Goodhart

CIO/IAVA

Mrs. Heather Vimba

ASAALT Cell

Mr. Jeff Brooks

PM Maneuver Ammo Systems

COL Jack Koster, PM
Mrs. Patti Felth, DPM

PM Large Caliber

LTC Ken Tarcza, PM

PM Small & Medium Cal

LTC Eric Fletcher, PM

PM Medium Cannon Cal

LTC Christopher Seacord, PM

PM Combat Ammo Systems

COL Ole Knudson, PM
Mr. Rene Kiebler, DPM

PM Excalibur

LTC Joe Minus, PM

PM Mortars

LTC John Lewis

PM Close Combat Systems

COL Mark Rider, PM
Mr. Bill Sanville, DPM

PM Countermine & EOD

LTC Peter Lozis, PM

PM IMS

LTC James Winbush, PM

PM IEDD/PF

LTC Carl Borjes

PD Joint Services

COL Andre Kirnes, PD
Mr. Matthew Zimmerman, DPD

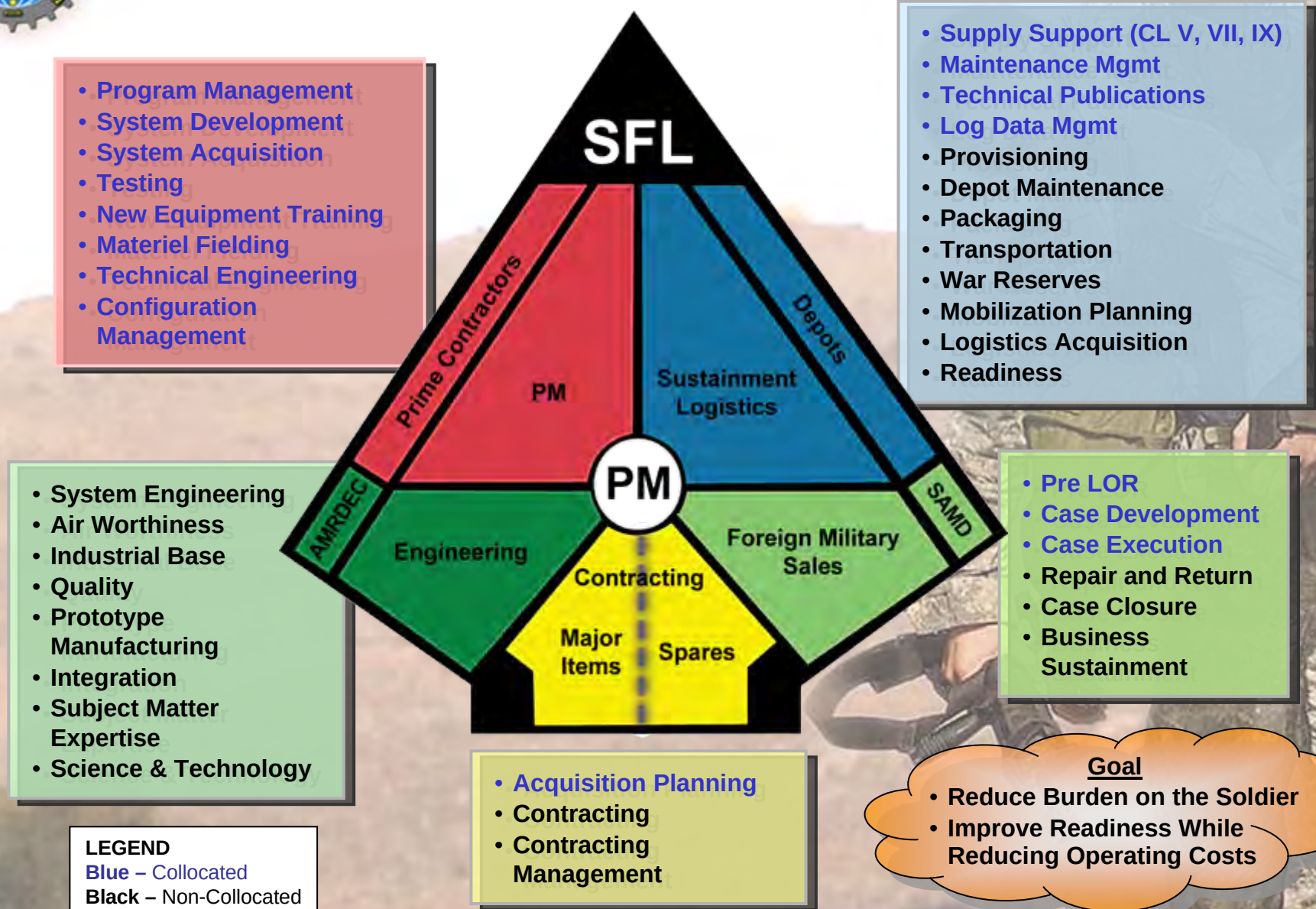
PM DEMIL

LTC Brian Raftery, PM



PM Is the Total Life Cycle Manager

"One Voice to the Field and Industry"





Mission / Product Lines / Magnitude

What we do (Core Competencies):

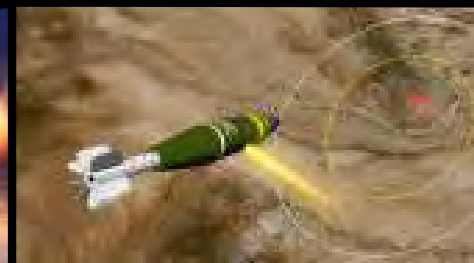
- Research, Development, Engineering
- Acquisition / Program Management
- Logistics, Industrial Operations, and Contracting
- SMCA Executor & Field Operating Activity
- Demilitarization and Disposal
- Industrial Base Management & Transformation
- Munitions Readiness Reporting
- Manage World-Wide Assets
- Centralized Ammunition Management
- Integrated Lethality Solutions

The Magnitude:

- Meet all ammunition requirements for all services
- Integrated Joint Ammunition Management

The JM&L LCMC Product Lines:

- Networked Munitions
- Countermine Systems & Explosive Ordnance Disposal Equipment
- Demolitions
- Non-lethal systems and Munitions
- Grenades
- Pyrotechnics
- Shoulder-Launched Munitions
- Small Caliber Direct Fire
- Medium Caliber Direct Fire
- Large Caliber Direct Fire
- Smart Munitions
- Precision Guided Munitions
- Artillery Munitions
- Mortar Munitions
- Mortar Weapons Systems
- Mortar Fire Control Systems
- Fuzes and Fuze Setters



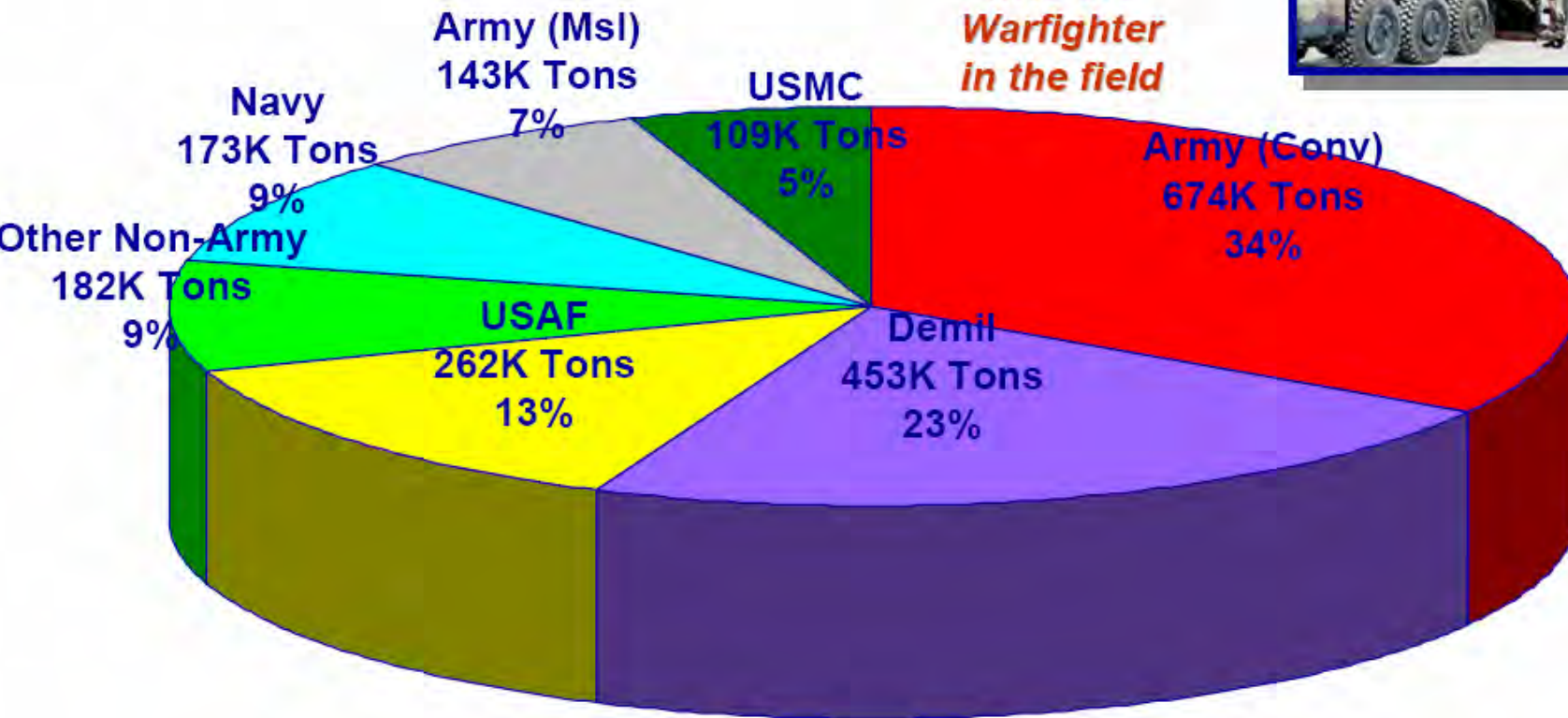
Develop, acquire, field, and sustain Value-added Ammunition for the Joint Warfighter through the integration of effective and timely Acquisition, Logistics, and cutting-edge Technology

Logistics

From Production in the Industrial Base...



...to the Warfighter in the field





Challenge: Modernize the Industrial Base

1942!



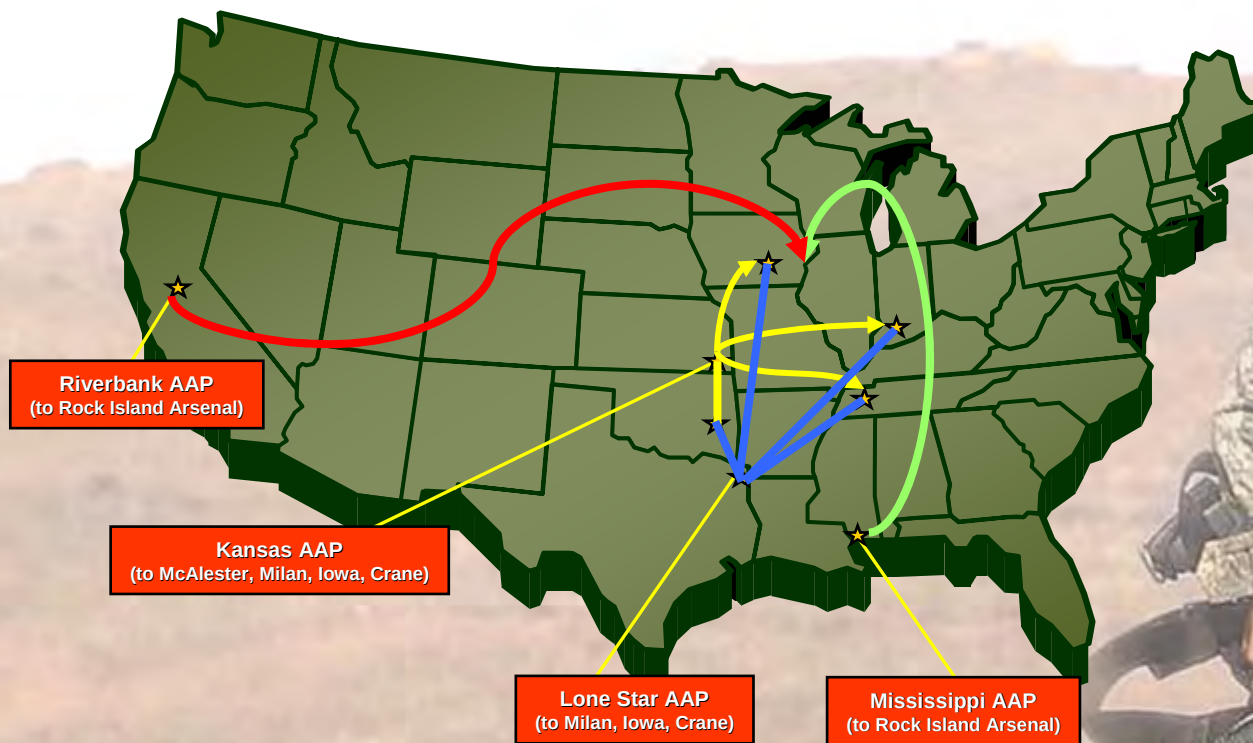
- Environmentally Compliant Facilities
- Increase Production Capacity
- Improve Production Flexibility
- Upgrade Critical Infrastructure
- Increase Production RAM
- Enhance Facility Utilization
- Support Next Generation Munitions



**\$127M Essential Mods FY 08 Shortfall
Improved Ability to Sustain Warfighter**



Challenge: BRAC Closures and Mission Moves



4 Plants – Transfer of Mission
FY 07-11 BRAC \$ Required

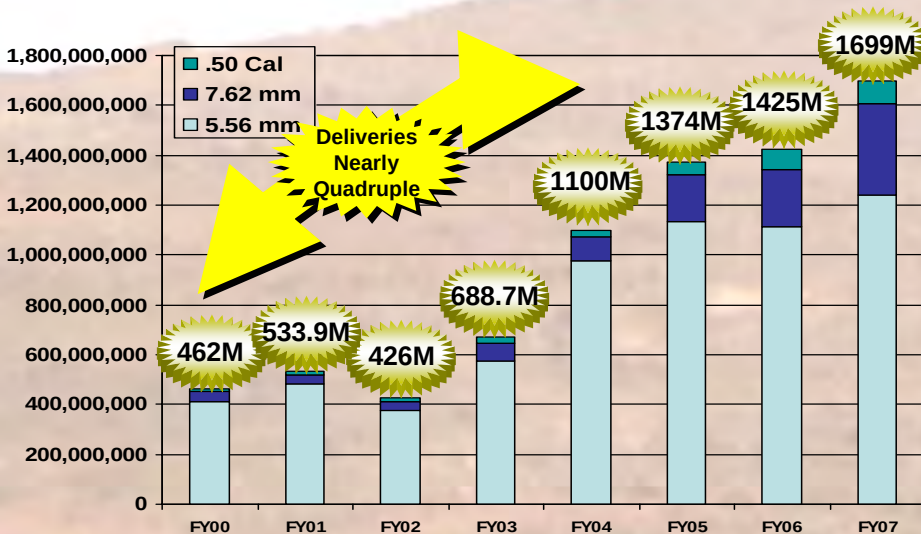




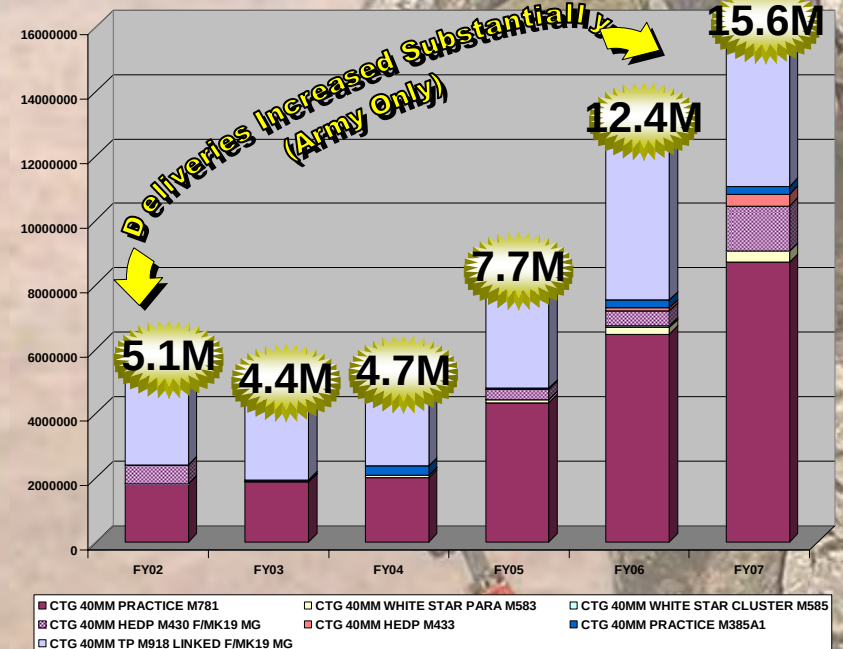
Challenge: Dramatically Increased OPTEMPO Ammo Requirements

Small Caliber Ammunition Deliveries

(All Services, All Sources)



40mm Army Deliveries

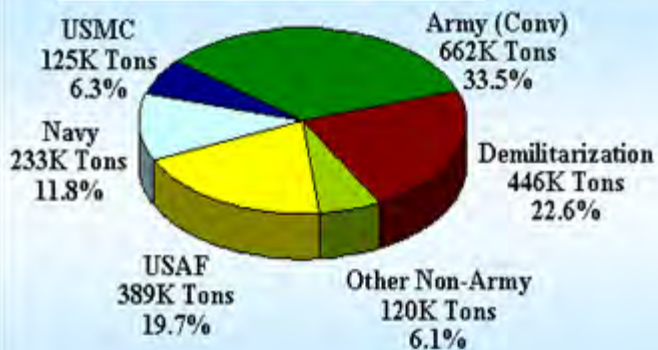




Challenge: Ammo Demil

Percent of Stockpile in Conventional Ammo Demil Account

CONUS Stockpile - Today



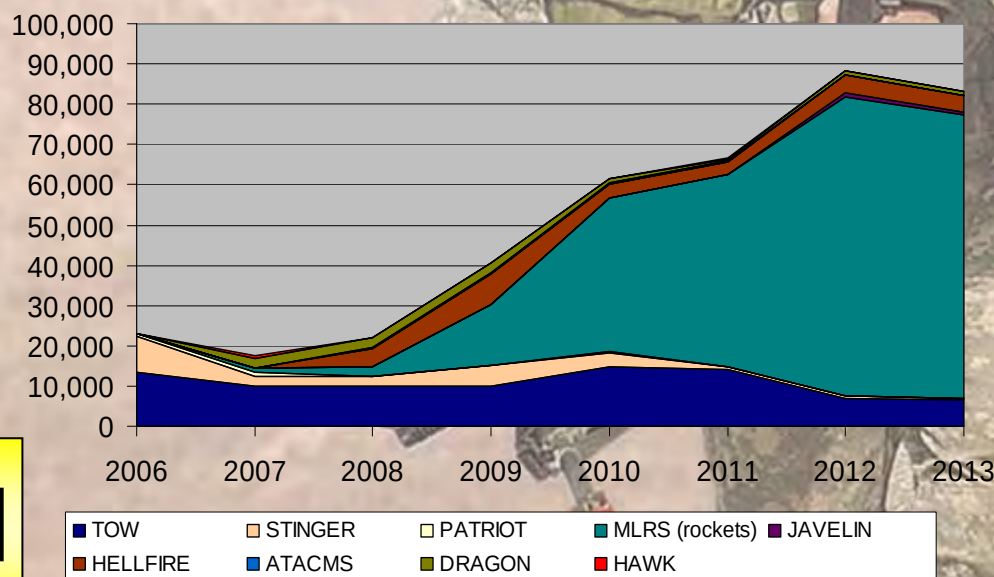
CONUS Stockpile - FY2013



\$

Tactical Missile Demil Requirements

A GROWING PROBLEM





Aviation Sustainment Challenge

BLACKHAWK



1577 UH-60
32% OIF/OEF
6% Ft Rucker

APACHE



714 AH-64
34% OIF/OEF
9% Ft Rucker

KIOWA WARRIOR



355 OH-58D
28% OIF/OEF
10% Ft Rucker

KIOWA



439 OH-58A/C
23% Ft Rucker

HUEY



486 UH-1
186 (Flying)
48 (FMS Storage)
240 Storage for Army

COBRA



106 AH-1
Parked at Ft Drum

CHINOOK



459 CH/MH-47D/E/F/G
16% OIF/OEF
7% Ft Rucker

UAS



1333 UAS
65% OIF/OEF
11% Ft Huachuca

OIF/OEF

- Pre-Deployment
- Deployed
- RESET

261 Fixed Wing (PM Managed)
36 Fixed Wing (Non PM Managed)



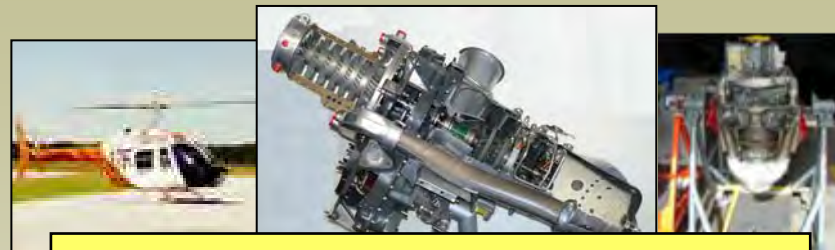
ACLC Lean/Six Sigma Accomplishments

UH-60



**Reduced Phase Cycle Time
From 50+ to 14 Days**

C-20J Engine



**Reduced Repair Turn Around Time
From 78 to 33 Days**

Maintenance Process Improvements

- Reduced Scheduled Maintenance Time
- Improved Quality
- Reduced Phase Maintenance Time

- 
- Returned 3 UH-60s
 - Saved \$40.2M



Condition Based Maintenance (CBM)

- **Maintenance to Improve Operational Availability and Reduce Maintenance Burden on Soldier by:**

- Enhancing Diagnostics
- Evolving to Predicting Remaining Component Life
- Then Evolving to Proactive Supply Transactions

- **Derived From Near Real-time Assessment & Analysis of Data From:**

- Embedded Sensors
- Platform Maintenance Environments
- Aircraft and Supply Historical Data

Key CBM Enablers

- Embedded Sensors
- Plane Side Diagnostics
- Data Fusion

Current

Transition

**AMCOM
Goal**

2011

**DA
End State**

2015

- Reactive
- Time Based Overhauls / Inspections

- Inspection & Maintenance Action Interval Extension
- Platform Diagnostic / Prognostic Equipment Installation

- Proactive
- Condition Based Overhauls / Inspections



CBM-related Fieldings

3rd Infantry Div
Deploying With Fully
DSC-Equipped CAB

Digital Source Collector (DSC) Equipped Aircraft			
Aircraft Type	Total # Aircraft	DSC Equipped	Percent Complete
AH-64	686	194	28%
CH-47	452	41	9%
UH-60	1630	194	12%
TOTAL	2768	429	15%

Unit Level Logistics System – Aviation (Enhanced) [ULLS-A (E)] Fielding*		
Battalions Fielded	Total # Battalions	Percent Completed
68	136	50%

* Includes Active, Reserve, and National Guard Units

Field 1+ Combat Aviation Brigade (CAB) A Year



Direct Comparison

DSC Equipped vs. Non-equipped UH-60 Battalions (Bns)

30 Aircraft Per Bn	Non-equipped (Bn 1)	Non-equipped (Bn 2)
Fully Mission Capable (FMC)	65%	77%
Total Flt Hours	10,331	11,844
OPTEMPO (Hrs/Year/Acft)	334	395

30 Aircraft Per Bn	DSC Equipped (Bn 1)	Non-equipped (Bn 2)
FMC	87%	82%
Total Flt Hours	21,819	20,388
OPTEMPO (Hrs/Year/Acft)	727	680

Advantage of DSC Equipped Aircraft (05-06 Rotation)

- 5% Increase in FMC Gives You 1.5 More Aircraft
- 1,431 Increase in Hours Flown = 2 More Aircraft at Optempo
- Units OPTEMPO Demonstrates 2 Aircraft Increase vs. 1.5 Expected

03-04 OIF Rotation

05-06 OIF Rotation

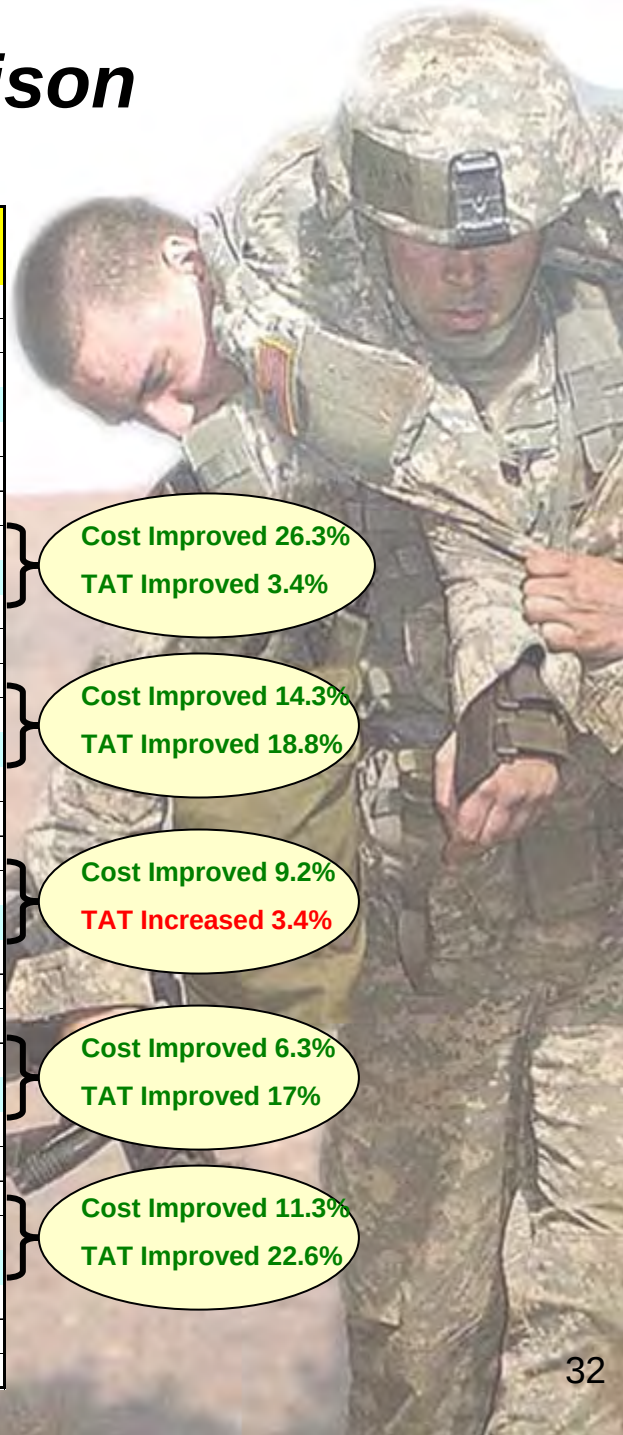
Both Units Operating in OIF Under Same Command Climate

DSC Equipped Unit Had An Increase In Combat Power Equivalent To 2 Additional Aircraft



Cost and TAT Comparison

Rotation	MDS	# Acft	Avg MHRS	Avg Cost	Avg TAT
OIF I	AH64A	39	4494	\$1,029,290	103
OIF II	AH64A	19	5251	\$1,491,290	93
OIF 0406	AH64A	16	4848	\$1,527,468	95
OIF 0507	AH64A	0	0	\$0	0
OIF I	AH64D	104	4432	\$935,092	104
OIF II	AH64D	23	3738	\$868,018	84
OIF 0406	AH64D	91	4069	\$1,047,299	87
OIF 0507	AH64D	29	4531	\$771,295	84
OIF I	CH47D	141	9020	\$1,566,112	153
OIF II	CH47D	47	10866	\$1,998,333	131
OIF 0406	CH47D	57	9768	\$1,963,877	122
OIF 0507	CH47D	4	8295	\$1,683,236	99
OIF I	OH58D	138	2608	\$373,164	130
OIF II	OH58D	83	2508	\$454,930	92
OIF 0406	OH58D	45	2559	\$457,370	87
OIF 0507	OH58D	11	2135	\$415,308	90
OIF I	UH60A	147	4820	\$890,598	115
OIF II	UH60A	103	5074	\$1,207,207	109
OIF 0406	UH60A	157	5534	\$1,278,378	100
OIF 0507	UH60A	23	5587	\$1,197,330	83
OIF I	UH60L	232	4269	\$790,738	107
OIF II	UH60L	81	4766	\$824,015	85
OIF 0406	UH60L	125	4850	\$1,103,184	93
OIF 0507	UH60L	51	4855	\$977,942	72
TAT based on total completed					
Avg Cost based on total completed with audited -18 data					
0507 Total Completed is completed aircraft with audited -18 data					



Cost Improved 26.3%
TAT Improved 3.4%

Cost Improved 14.3%
TAT Improved 18.8%

Cost Improved 9.2%
TAT Increased 3.4%

Cost Improved 6.3%
TAT Improved 17%

Cost Improved 11.3%
TAT Improved 22.6%



Scorpion Technology Program Overview

DARPA

POC: Dr. Steve Walker
swalker@darpa.mil

GTRI

POC: Dr. Jim McMichael
jim.mcmichael@gatech.gtri.edu

ARL

POC: Dr. Peter Plostins
plostins@arl.army.mil
POC: Mr. David Lyon
lyon@arl.army.mil

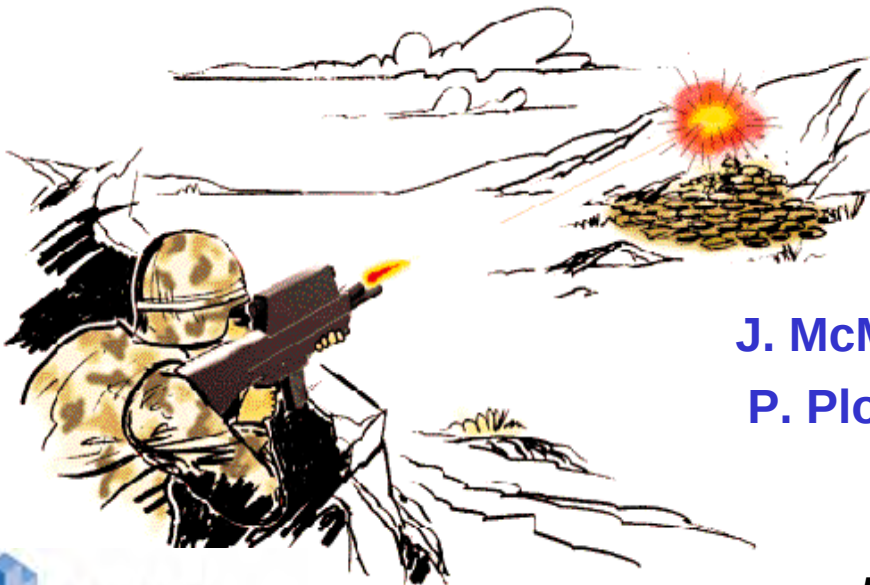


NDIA Fire Power Symposium

Parsipanny, NJ, 12 June 2007

“Micro Adaptive Flow Control Applied to a Spinning Projectile”

SCORPION
Self-Correcting Projectile
for Infantry Operation



J. McMichael, A. Glezer and A. Lovas, GTRI
P. Plostins, G. Brown and J. Sahu, USARL

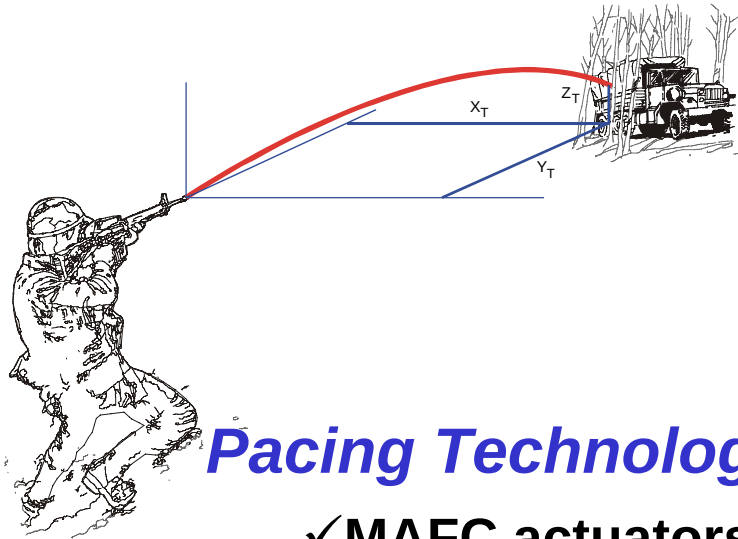
in collaboration with:

Mike Heiges, Kevin Massey, GTRI

Dave Lyon, Dave Hepner, Tom Harkin, USARL

Mark Allen, Brian English, Chris Rinehart, Georgia Tech

GOAL: Demonstrate a Guided Spinning Projectile using MAFC Technology



Pacing Technologies:

- ✓ MAFC actuators
- ✓ Flow control concept for spinning projectiles
- ✓ Flight control algorithm
- ✓ Initialization and INS for spinning projectile
- ✓ Compact, g-hardened electronics and packaging
- ✓ Design Tools: Integrated CFD and Flight Dynamics

Objectives:

1. Demonstrate MAFC control authority and guidance algorithm for a medium caliber munition
2. Provide a suite of validated advanced design tools
3. Establish technology transitioning pathways for tactical systems

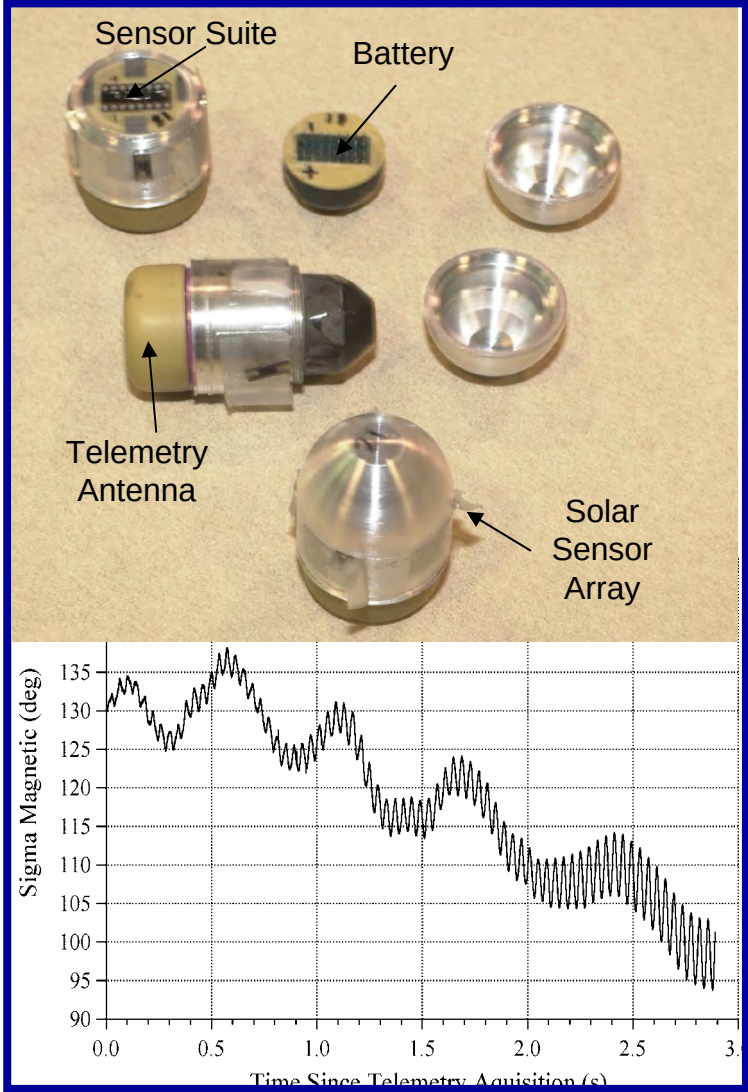
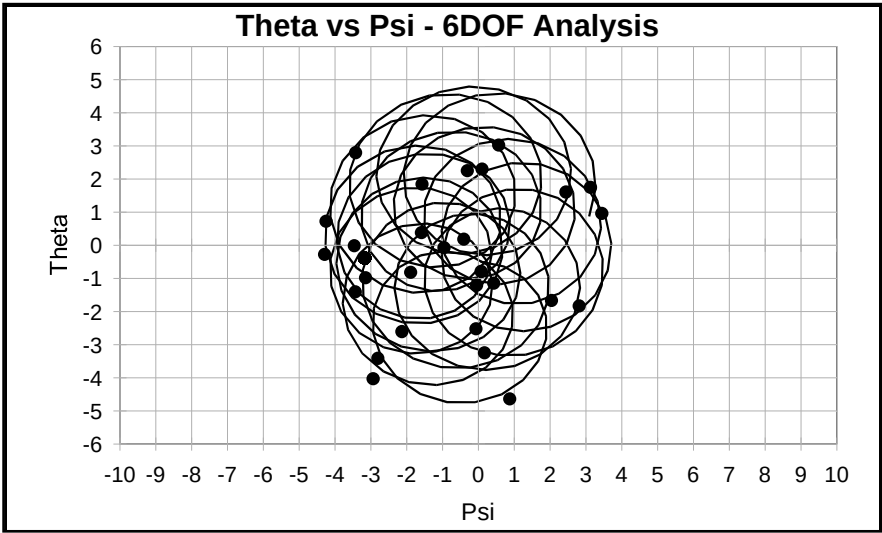
Grenade

Simulator

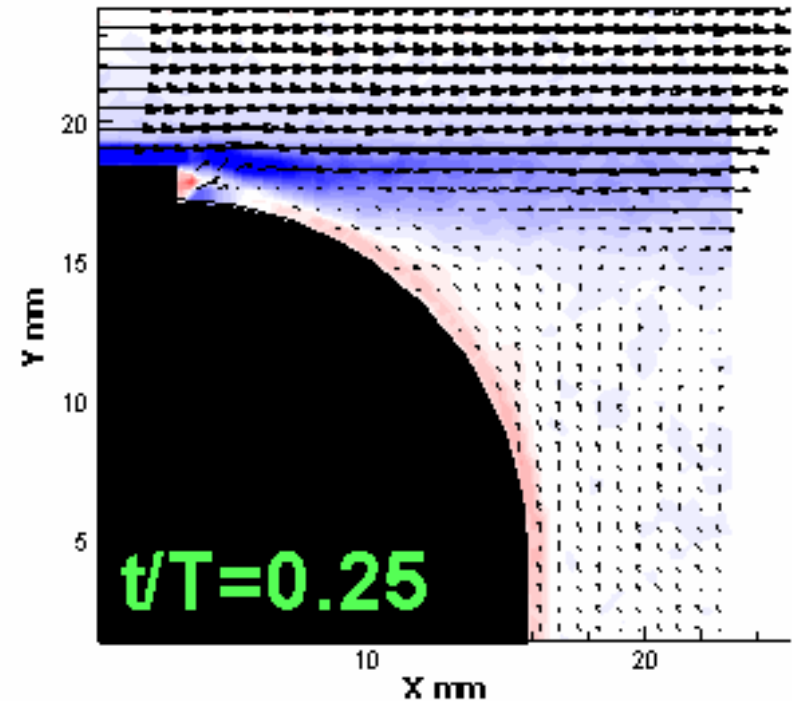
Predicted Mass properties
Mass: 171 grams
cg from nose: 44 mm
Iaxial: 354.7 g*cm²
Itrans: 806.4 g*cm²



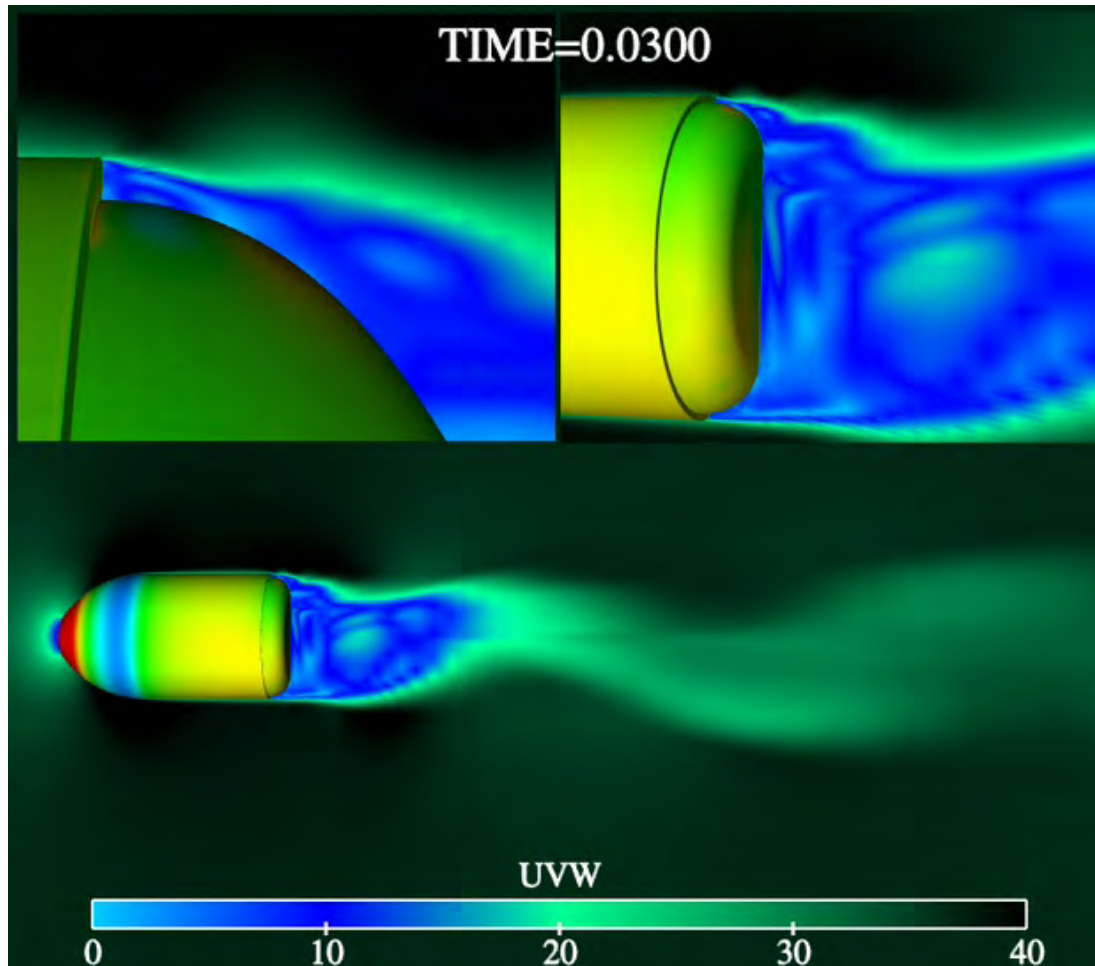
Classic Spin Stabilized Yaw Helix
Looking Down Range



Phase-locked PIV images acquired
over first 12 milliseconds
($T_{act} = 1$ msec)



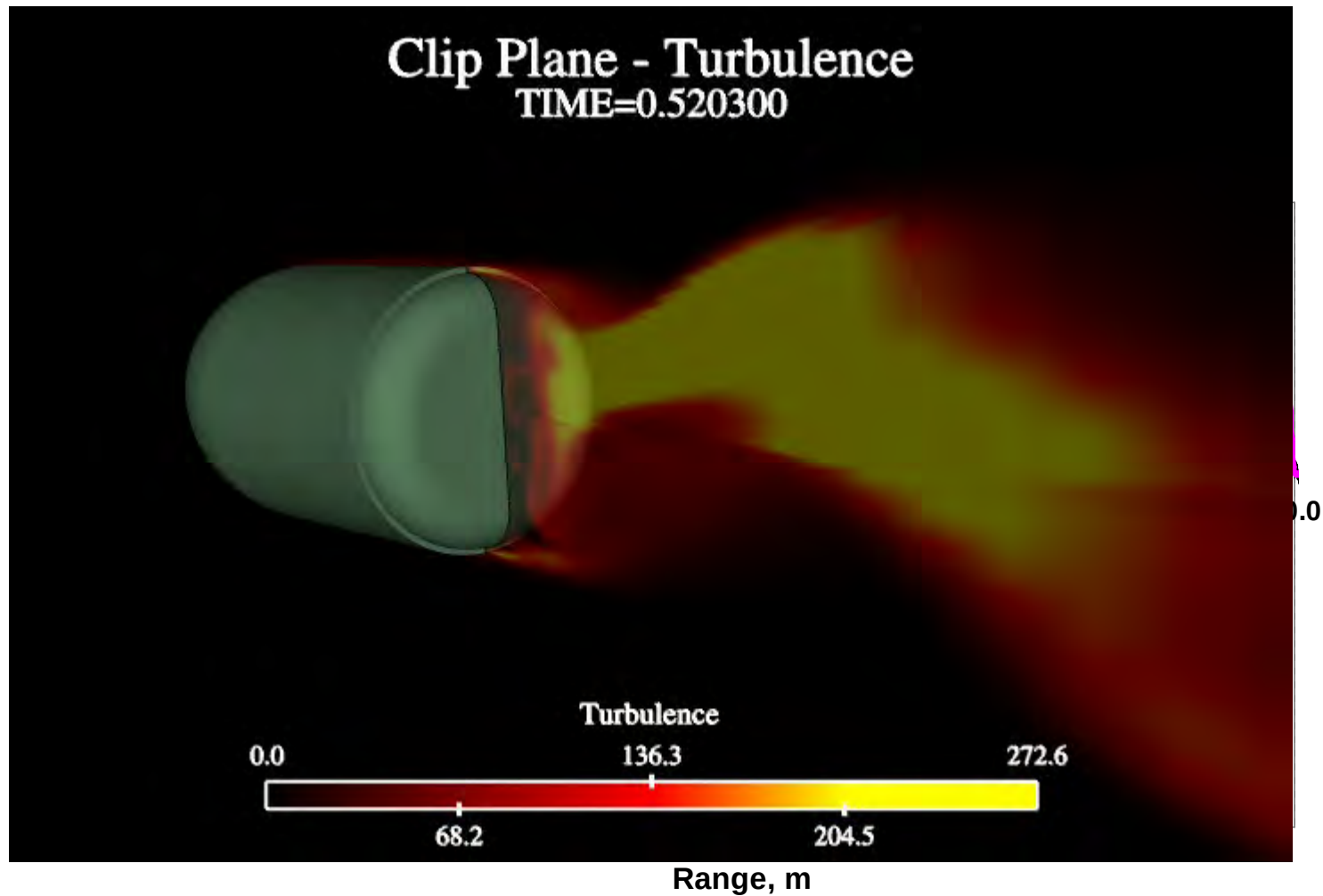
- Actuator runs for 6 cycles
- Starting vortex shed on first cycle
- Flow turning nearly complete after a few cycles
- Global effects completely developed in 1-2 convective time scales

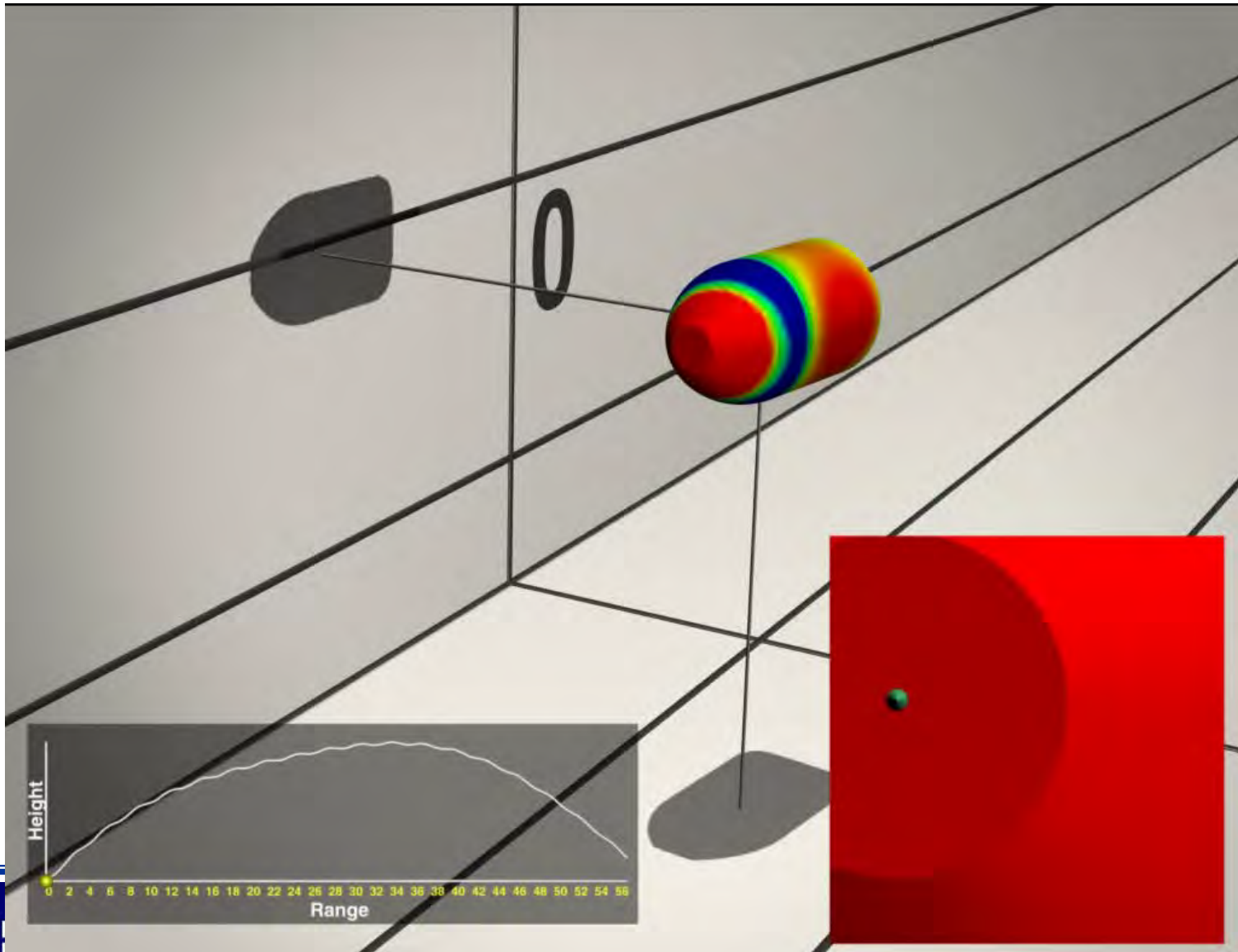


$D = 80 \text{ mm}$
 $U_0 = 37 \text{ m/s}$
 $\alpha = 0^\circ$
 $U_j = 31 \text{ m/s}$
 Without Spin
 $f = 1000 \text{ Hz}$



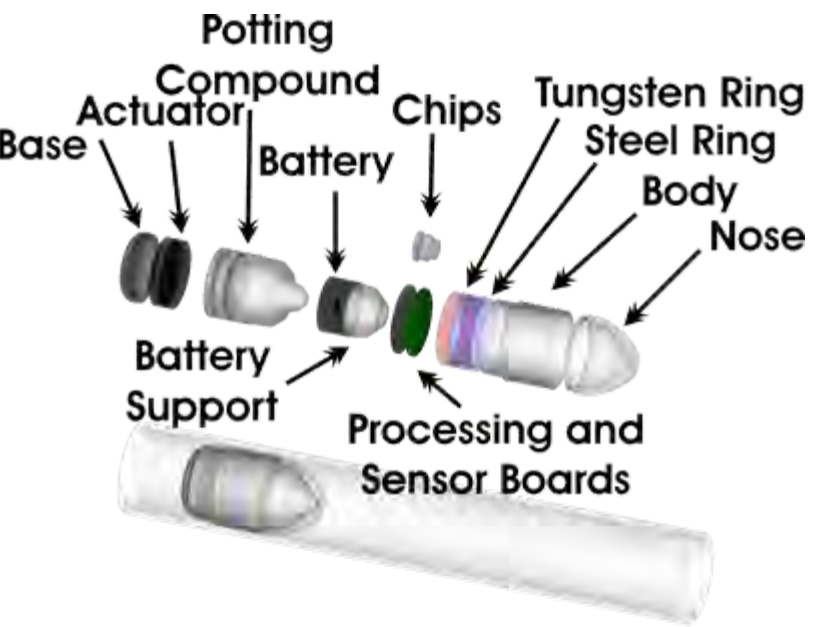
Simulation by
Jubaraj Sahu, ARL



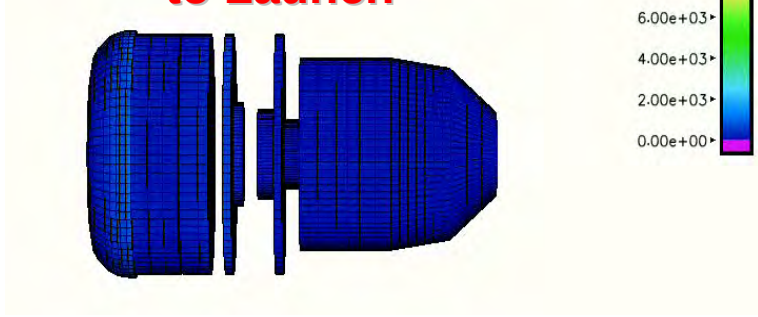




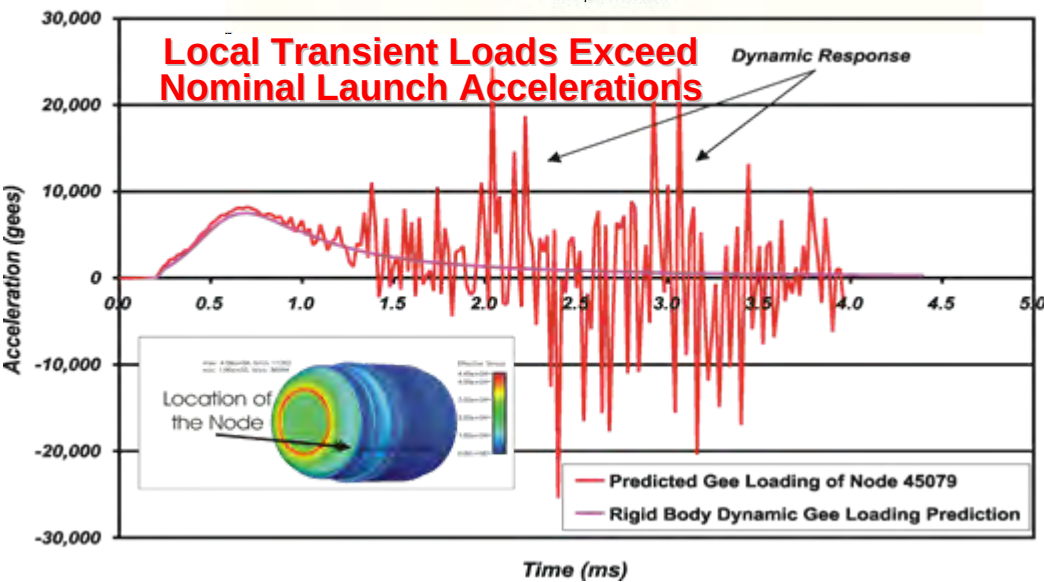
Full 3-D Dynamic Structural Analysis of SCORPION Projectile During Launch



Dynamic Stress Waves Due to Launch



Dynamic Response During Launch



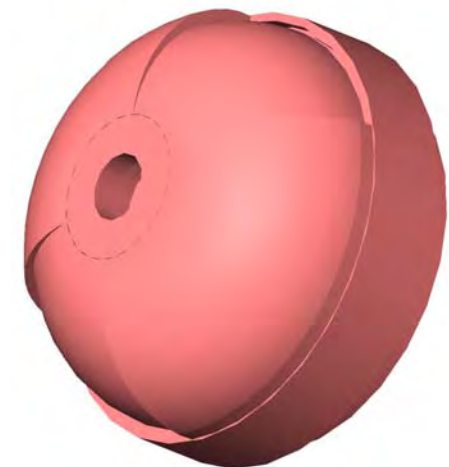
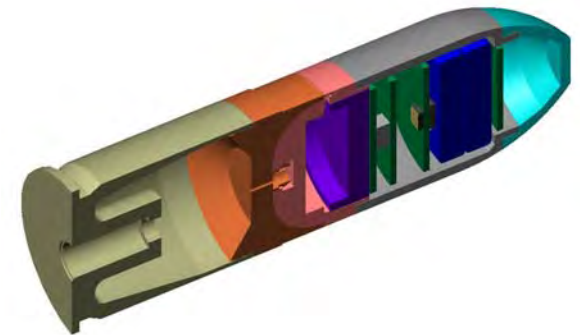
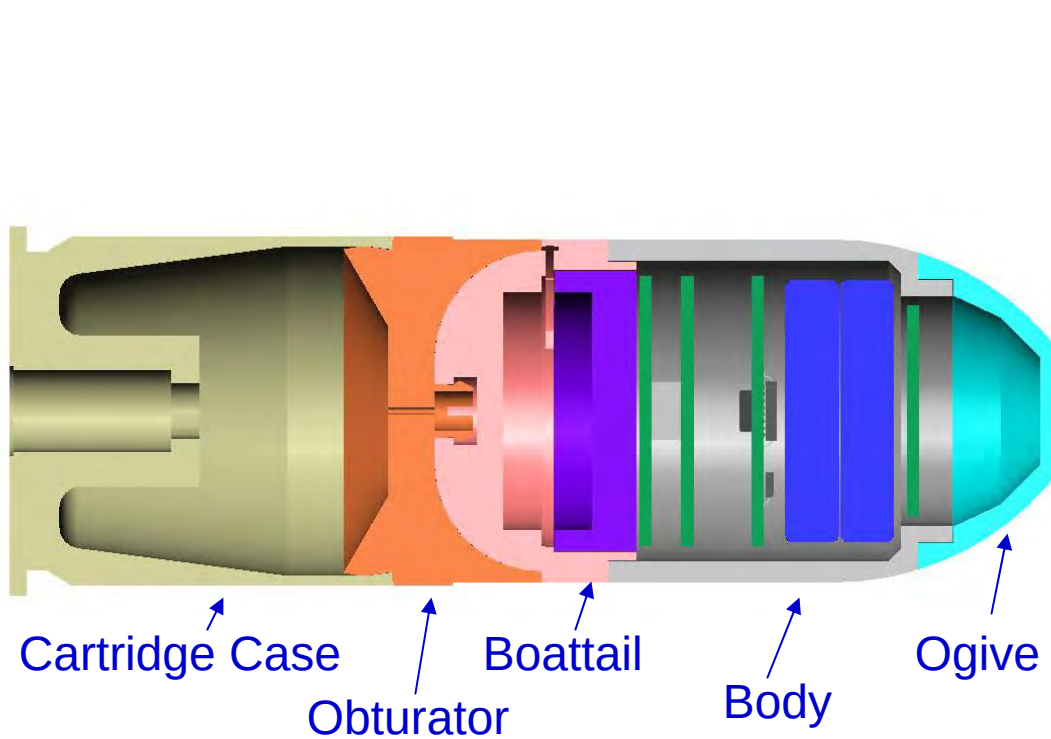
3-axis Mag

4 Radial Accels (AO)

1-axis Axial Accel

2-axis Radial Accel

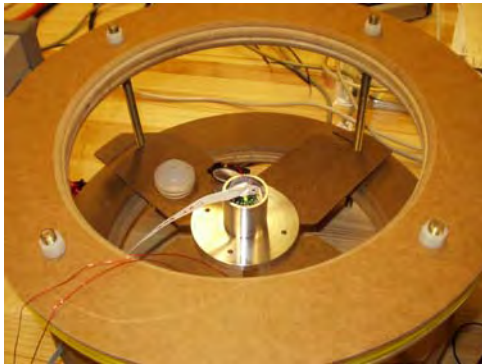




strake-like fences

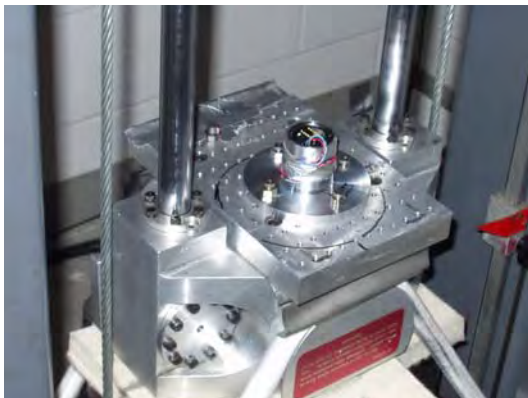


Control Electronics Calibration and High-G Ground Experiments

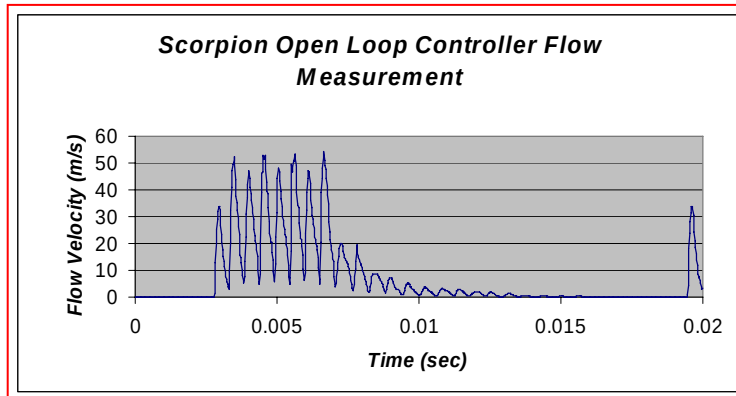


Spin simulated to initiate maneuver

Simulating Magnetic Field



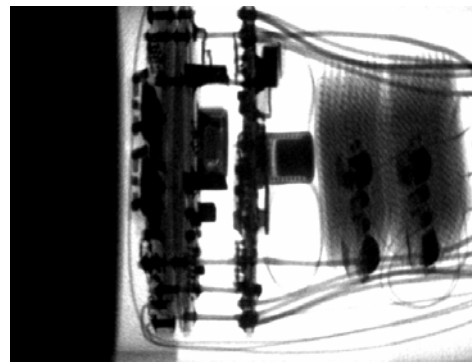
High-G Shock (8,000 G's)



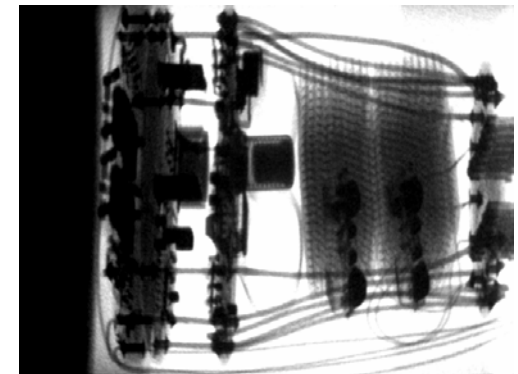
Hot Wire Flow Measurements

Assembled Jet Velocity 34 m/s

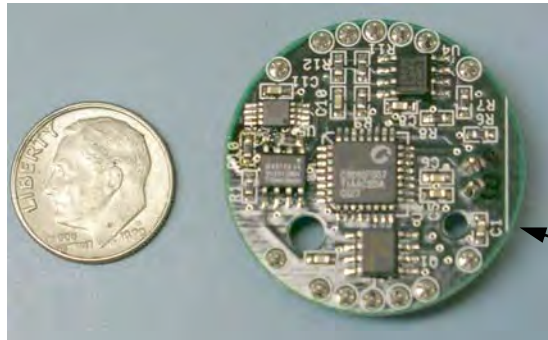
- **Developed High-G packaging to survive launch acceleration. GTRI-supplied electronic boards.**
- **Unit functioned appropriately after shock**



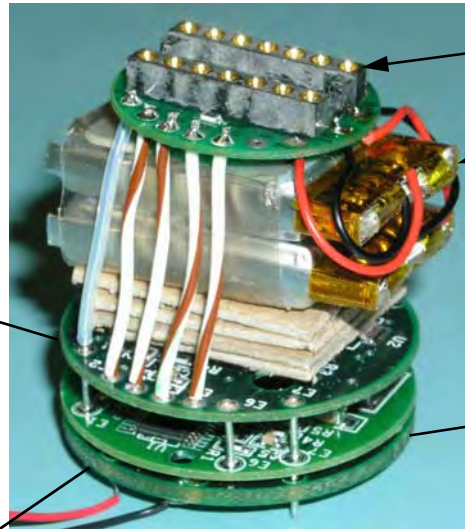
Before Shock



After Shock



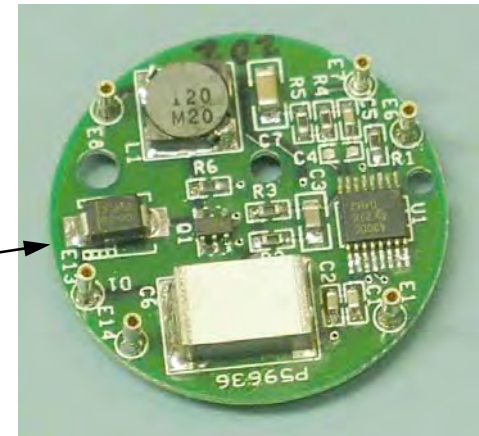
Processor Board



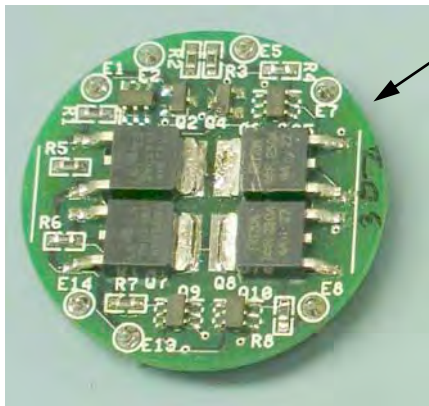
Open Loop
Electronics Assembly

Interface Connector

Battery



Boost Converter



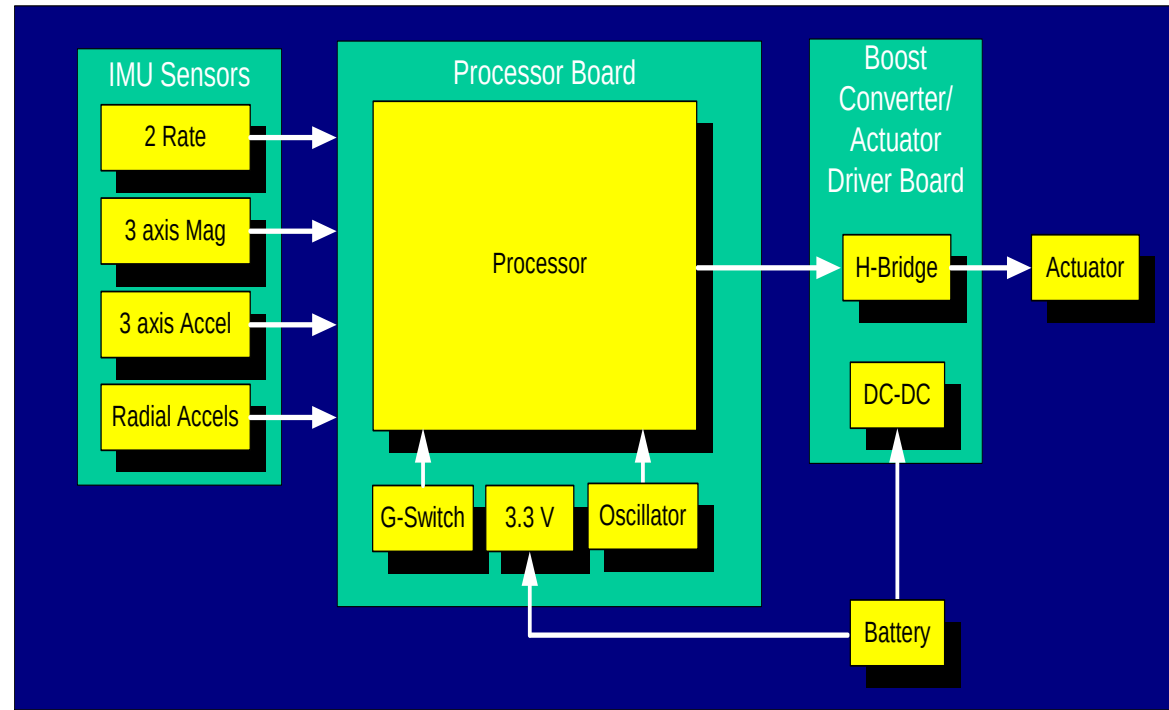
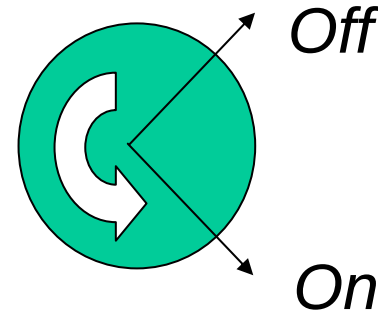
Driver Board



Flight
Hardware



- After launch, wait 0.5 seconds, then activate at maximum voltage at same roll angle each revolution.
- Activate for 1/4 revolution (about 4 diaphragm cycles) such that force generated will be horizontal (left or right, as selected)
- On approximately 4 ms, and off 12 ms each revolution

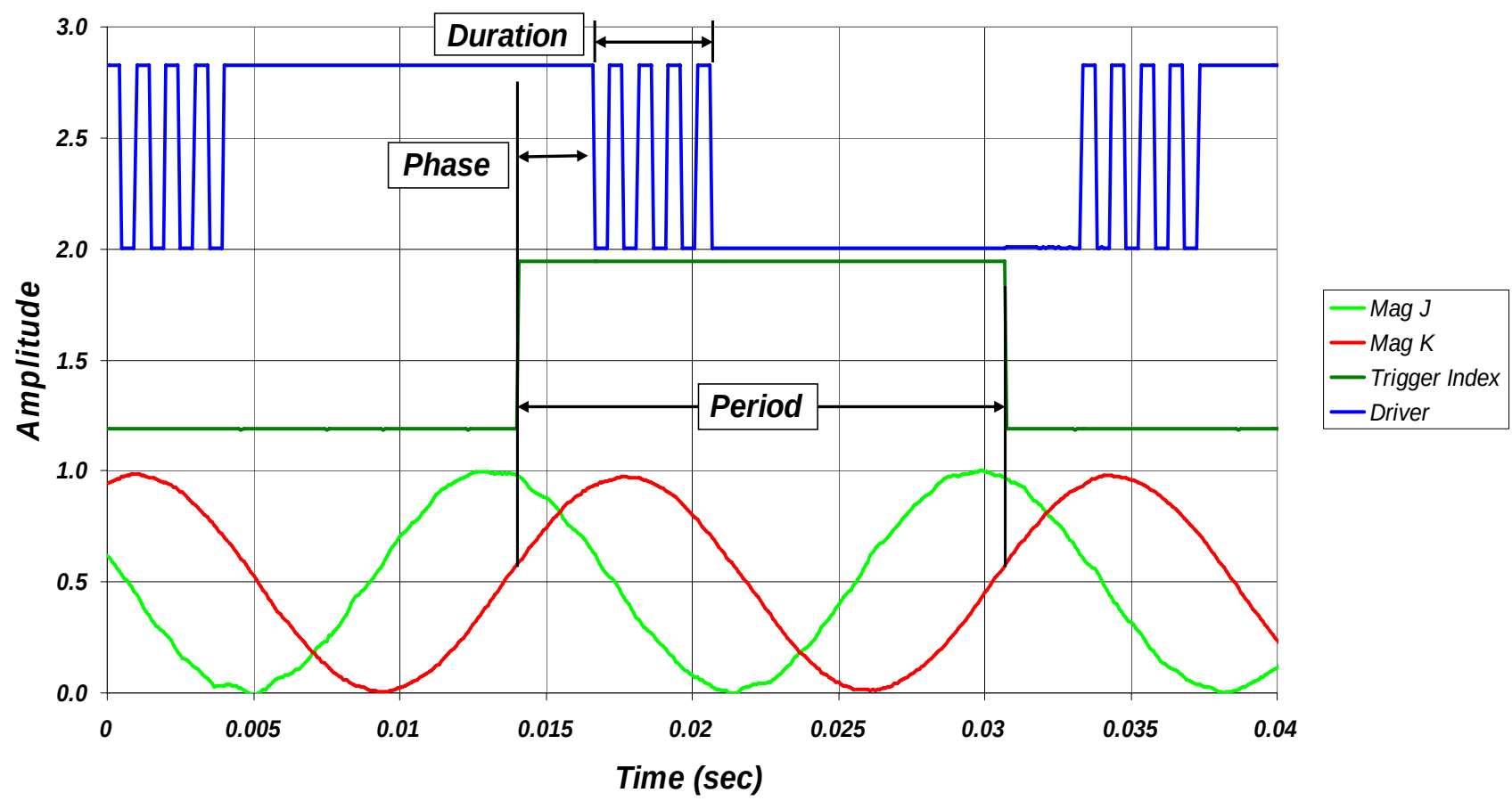




Divert Flight Test Firing Protocol



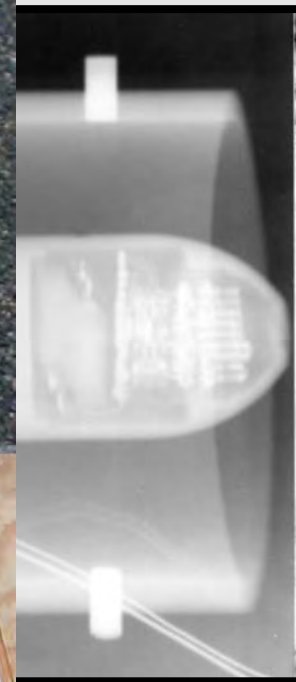
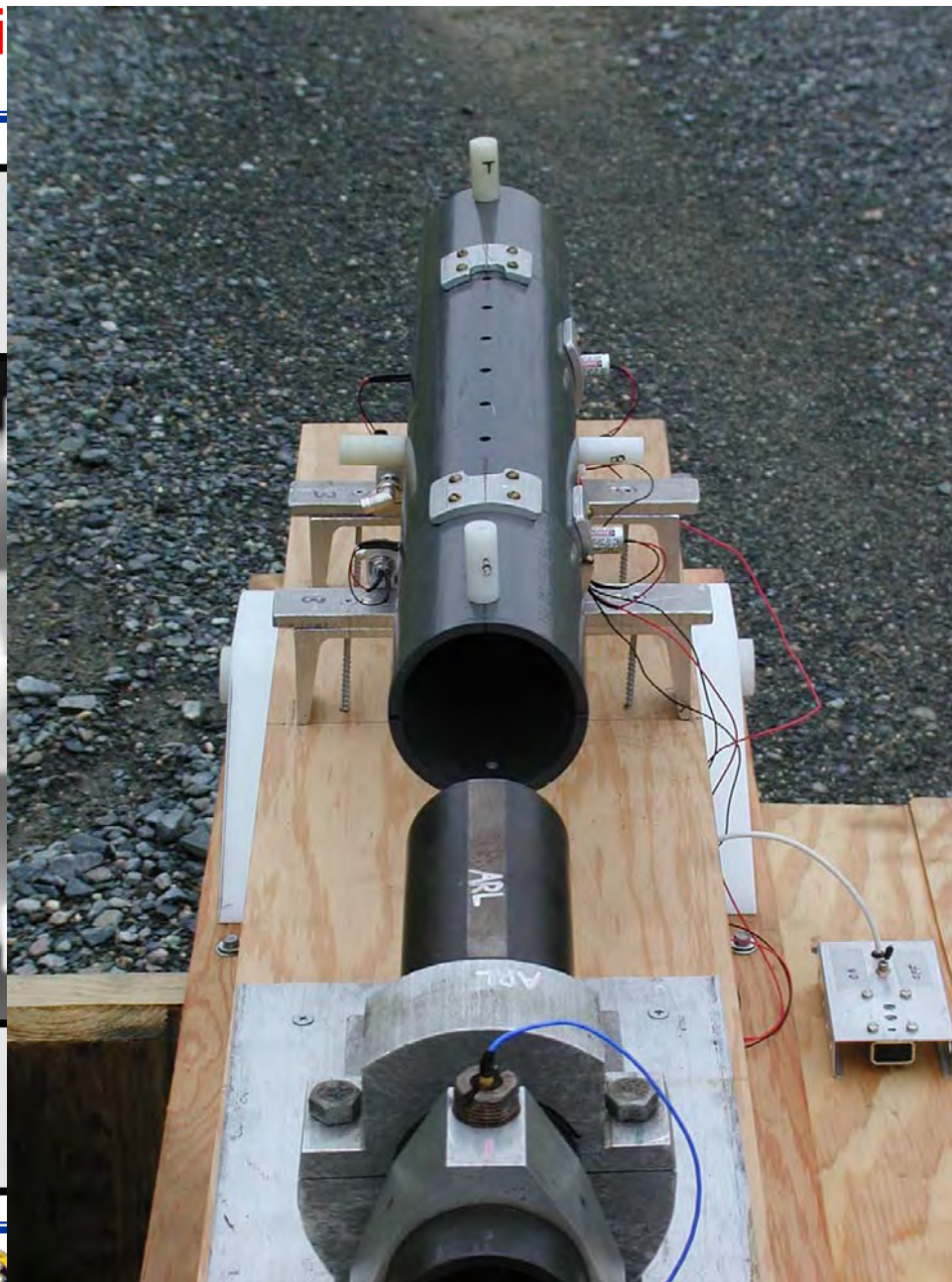
Actuator Timing

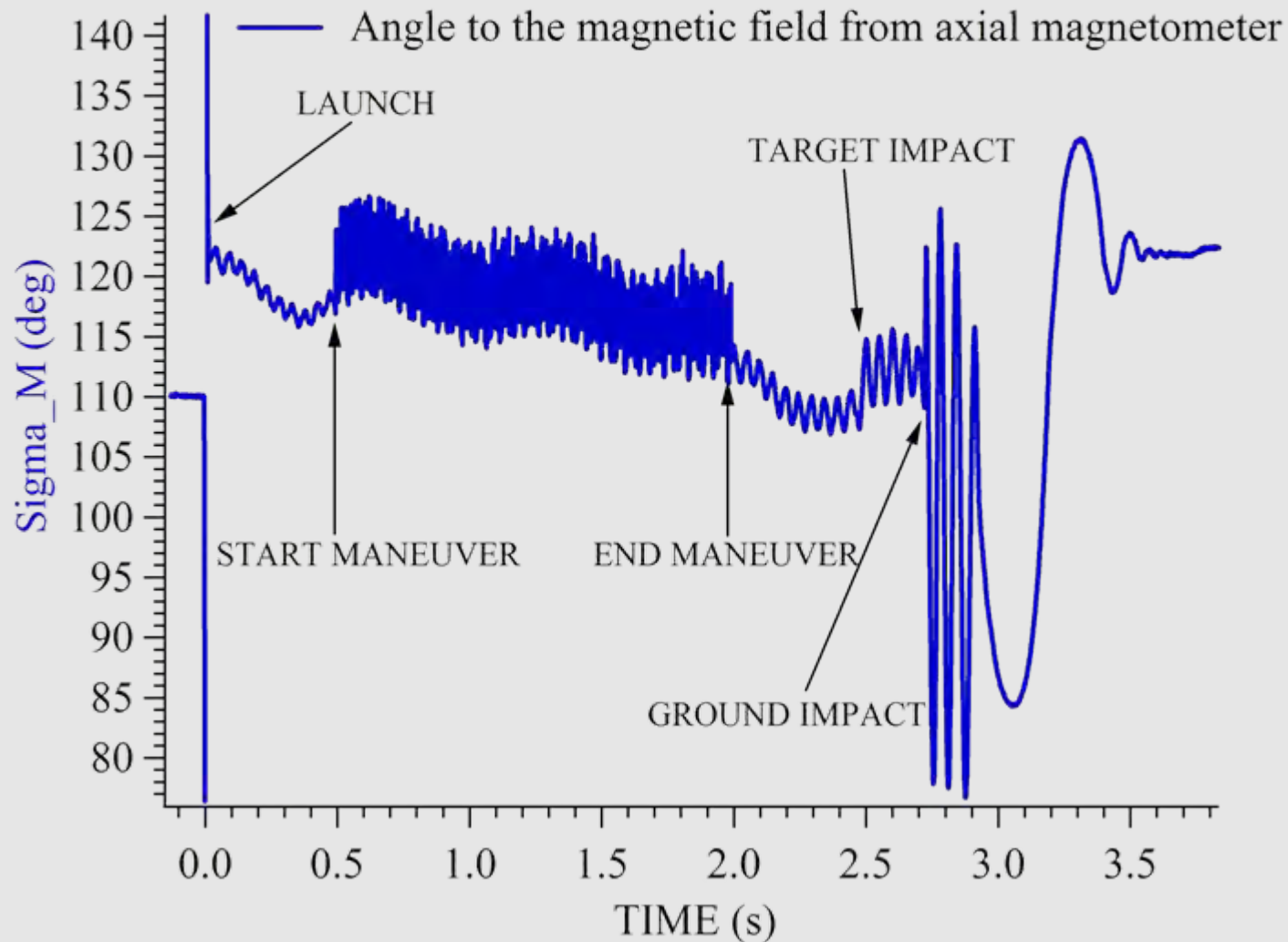




Ini

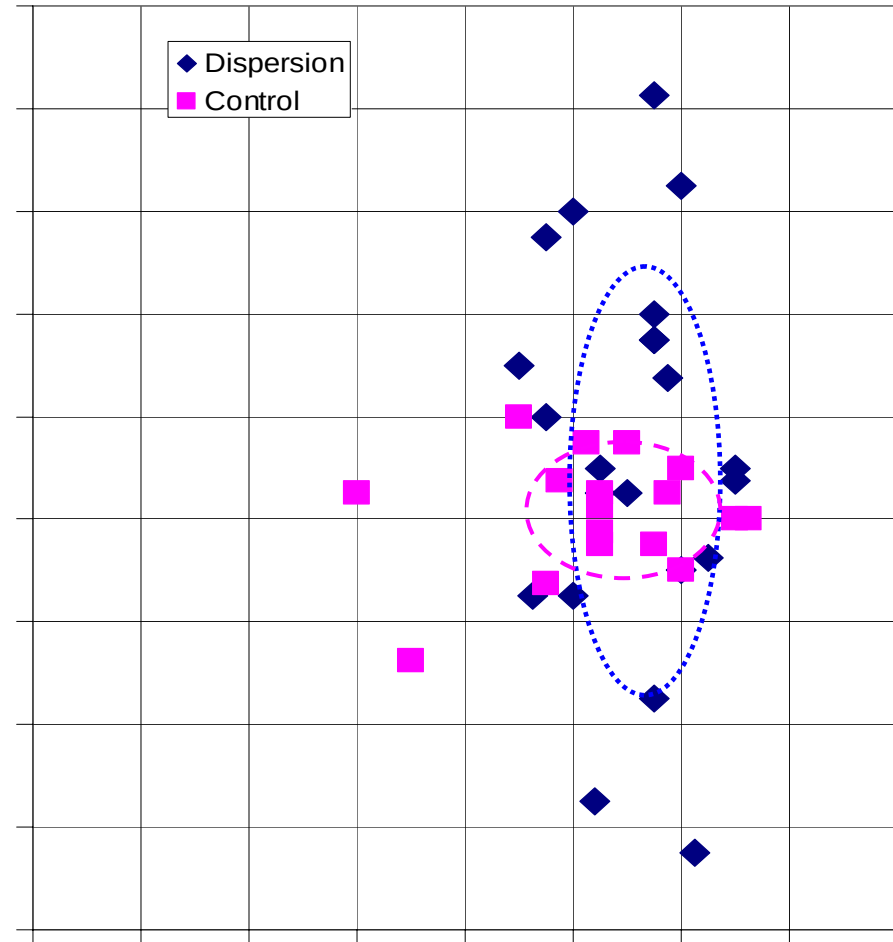
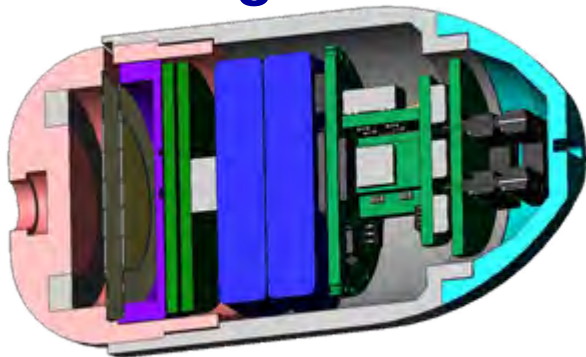
System





Scorpion Test Results With Closed Loop Muzzle Velocity Control

Flight Configuration

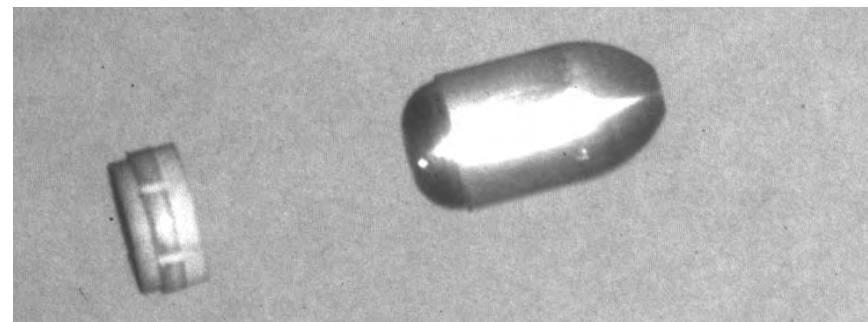
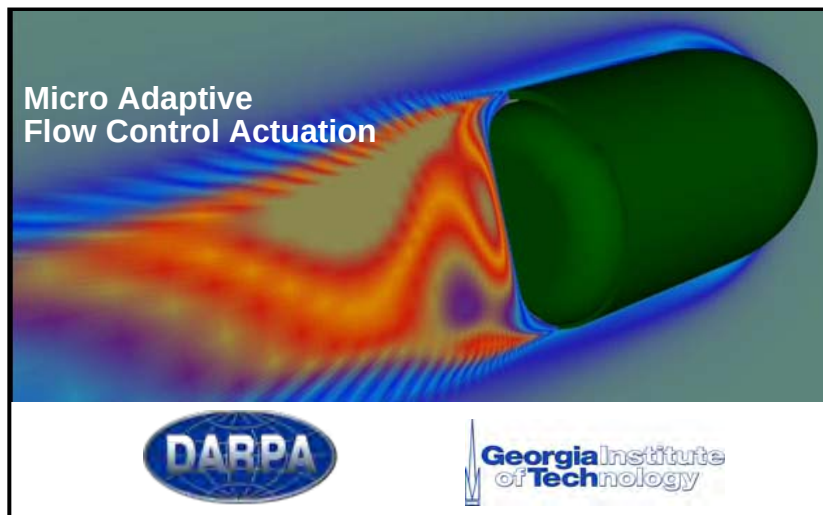




Scorpion Technology Program Accomplishments



- Demonstrated Micro-Adaptive Flow Control for divert of subsonic guided 40 mm grenade
- Demonstrated Multi-disciplinary physics modeling – flew munition through the computer using High Performance Computing
- First divert ever of a spin stabilized munition system at 60 hertz spin rate
- Developed a miniature, G hard, on board flight control system
- Demonstrated initialization at muzzle exit – Velocity - Orientation
- Demonstrated open loop divert
- Demonstrated closed loop guidance to the target on major error source - Velocity
- Cut on target dispersion due to muzzle velocity variation to one third of the system value

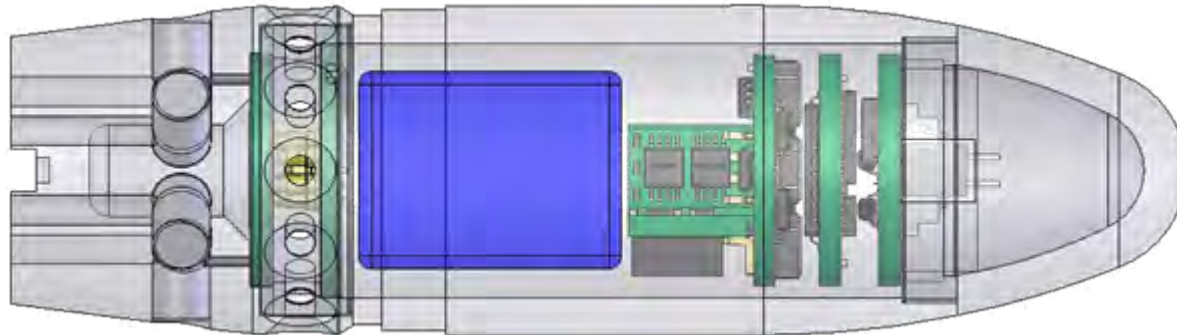


Experimentally Demonstrated Novel
Aerodynamic Control Methodology Capable
of Diverting Medium Caliber Munitions

25mm Scorpion

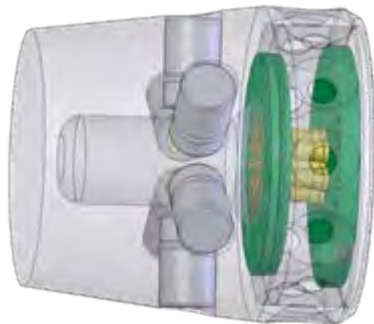
**Control
Mechanism
Module**

**Inertial Sensor
and Control
Module**



**25mm
Scorpion
Projectile**



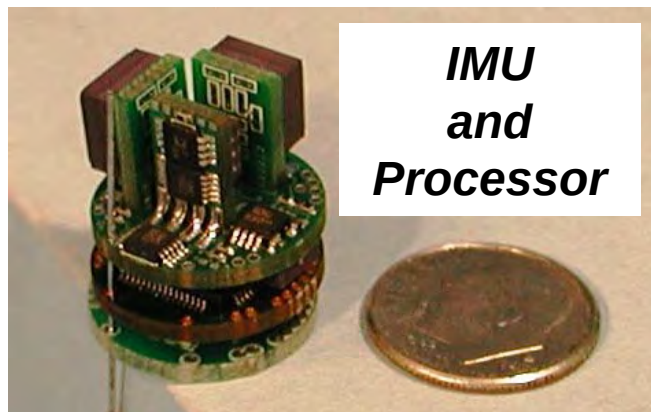
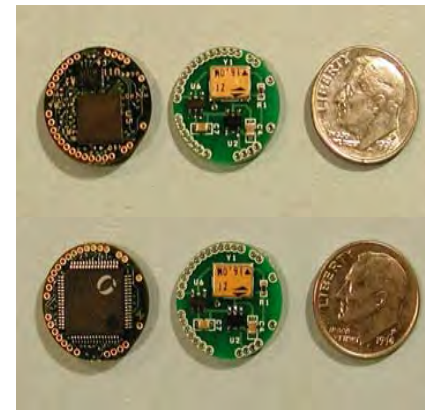


**Removable
Micro-Squib
Control Mechanism
Module**

**17mm IMU (ARL)
tightly integrated with
processor (GTRI),
power management
(ARL/GTRI), interface
hardware (GTRI), and
control mechanism
module (ARL)**

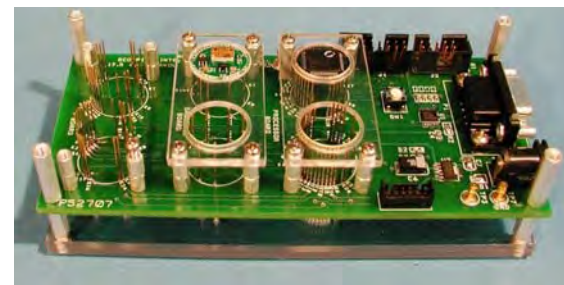


**Tightly Integrated
IMU and
Processor**



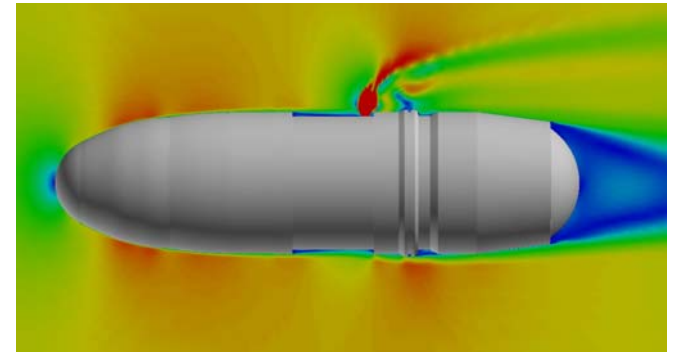
**IMU
and
Processor**

Interface Electronics

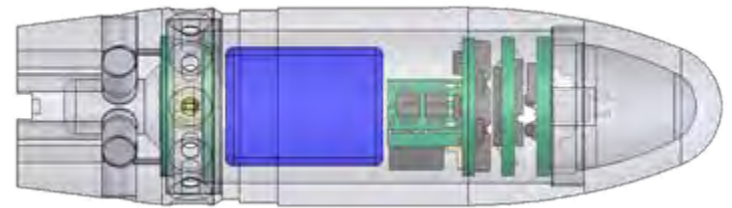




- 25 mm Scorpion Completed
- 25mm instrumented projectile
- Driver board design
 - Addresses 6 actuators (limited by size)
- Single actuator maneuver
- Multiple actuator initiation
- Projectile recovery
- Reduced state flight software
 - Utilizes magnetometer and axial accelerometer
 - Algorithms need to develop and mature
 - Tradeoff between functionality (research instrumentation and control guidance...) and practicality (size, processor capability, & time/cost).



*25mm ACSW With
Combustion Actuator*





Scorpion Technology Future Technology Insertions



- Designated and Moving Targets
- Munition Dispersion Control
- Designated and Moving Targets Long Term



XM307ACSW

Long Term

Dispersion Control

Laser Designation

Point Burst Kill

Multiple Burst Optimization

Swarming Munitions

Other Transition Opportunities

Sub-munition flight control

Smart Fuzing

Warhead dynamic orientation

BDA platform stabilization

Subsonic micro-missile roll control

Future R & D Areas

Laser Designation

Micro-Technology for Prox - Fuzing



Joint Munitions Command Overview

**BG James E. Rogers
Commanding General
AMSJM-CG
(309) 782-4475**

12 Jun 07



Joint Munitions Command

Mission Statement: *Execute Acquisition Support, Readiness, and Logistics sustainment through a Team of dedicated Professionals who Provide Effective, Available, and Value Added Munitions for the Joint Warfighter*

Vision: *Battlefield Dominance for the Warfighter with Superior Munitions*



JMC Core Competencies

- DOD, Foreign Military Sales & Other Government Agencies Common Service Provider for Munitions
- Global Contingency Operations Support
- Joint Worldwide Asset Posture
- Munitions Readiness Reporting
- Industrial Base Management & Transformation
- Centralized Ammunition Management
- Munitions Logistics Assistance

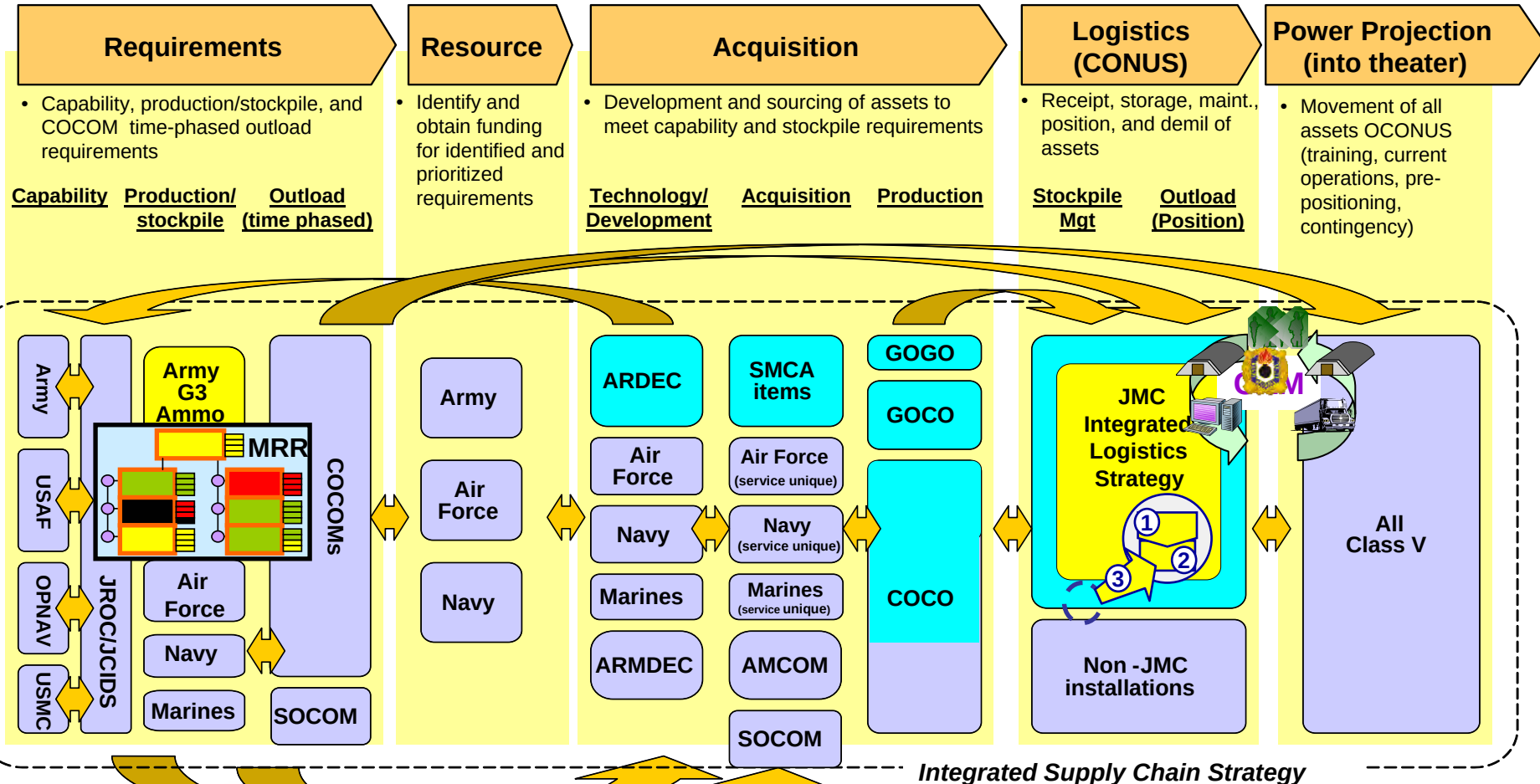
Single Logistics Provider for JOINT Munitions Readiness

Initiatives

- **Integrated Logistics Strategy**
- **Lean Six Sigma**
- **Reset**

JMC Strategic Initiatives

Joint Munitions Prime Value Chain



Integrated Logistics Strategy is one of our Strategic Initiatives that supports the Joint Munitions Prime Value Chain

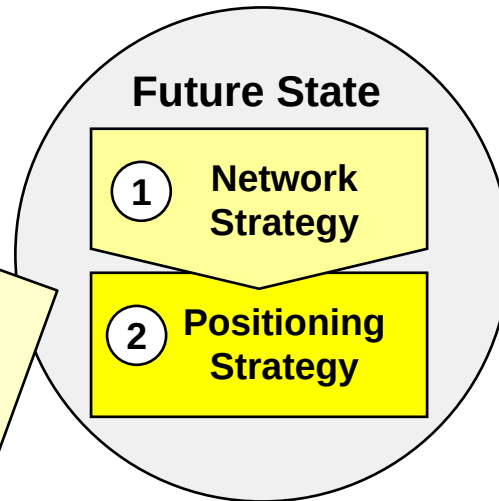
Integrated Logistics Strategy

Network, Positioning, & Transition Strategies

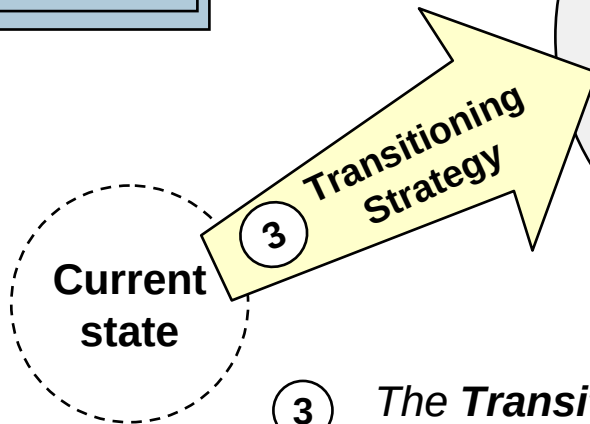
(The Network and Positioning Strategies define the future state; the Transitioning Strategy lays a path toward that state)



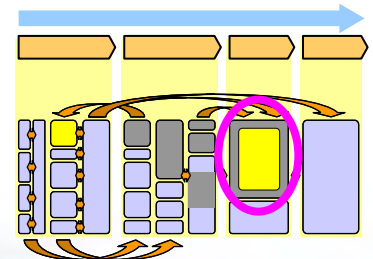
① The **Network Strategy** addresses how to best employ the current installation base in carrying out the wholesale logistics function



② The **Positioning Strategy** addresses how much of each DODIC should be stored (located) at each depot

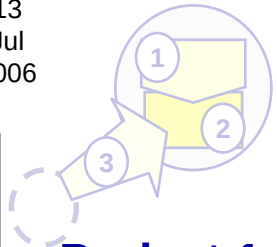


③ The **Transitioning Strategy** prescribes actions that over time move the current state toward the target future state balanced and coordinated manner



Integrated Logistics Strategy Implementation

13
Jul
2006



Project 1

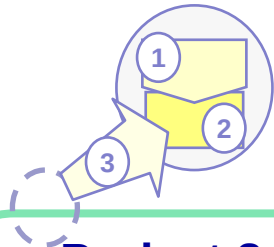
"Scrimmage Play"
(50-60% Solution)
(5-4-5-7)

Army (B14) Focus

Historical
AMCOM and
Other Services

Other Issues:
-COCOM Rqmt
-Other Service
G3 Rqmts

30
Nov
2006



Project 2

"First "Play"
(80-90% Solution)
(2-4-4-7)

Refine Army (B14)

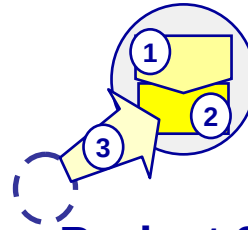
Incorporate Other
Services, AMCOM

Focus here is to make sure
the Services understand the
ILS methodologies and how
the data is used in the
analysis.

For the Army the focus is to
better understand the
expected Services' Logistics
Demands on the Network and
configure it to optimize the
Joint solution.

Incorporate Continuous
Improvement / Sensitivity
Analysis

31
May
2007



Project 3

Refinement
(90-95% Solution)
(?-?-?-?)

Refine Integrated Solution

Link/Integrate Individual
Service OM POM Input

Focus here is to strengthen
Ammunition Logistics from a
Joint perspective. Establishing
an integrated approach we will
be able to show how the
Programming/Budgeting
decisions contribute to a
stronger Joint Logistics
solution. It also will make clear
within Service hierarchies how
failure to Program/Budget one
Services will have an adverse
affect on Other Services.

Incorporate Continuous
Improvement / Sensitivity
Analysis

30
Nov
2007

Project 4

Refinement
(95-99% Solution)

Identify/Integrate
IT Interfaces

Link/Integrate Individual
Service PA POM Input

Focus here is to identify
logical IT interfaces that
mesh with Services'
Enterprise solutions, yet
provide the necessary
information for determining
optimal Joint Ammunition
Logistics solutions.

Incorporate Continuous
Improvement / Sensitivity
Analysis

31
May
2008

Etc.

Lean Six Sigma Deployment Model for Success

Self-sustainment and beyond



Six Sigma Successes

A075

5.56mm Blank, Linked



- ❑ Smallest condition code 'H' DODIC in quantity and SQ FT stored at CAAA
 - ✓ 3,600 SQ FT reduced to 204 SQ FT
 - ✓ Several magazines consolidated to 1 magazine
 - ✓ Number of Magazine Data Cards and Barcodes reduced from 92 to 3

Six Sigma Successes

- Inert bomb lines
 - reduced 12 work positions from process
- Production acceptance process
 - reduced flow time by 64%
- Navy bomb line
 - reduced material cost and downtime
- Navy Bomb Maintenance Program
 - 250% increase in production
 - 10% Reduction in Labor Costs
 - \$596K Cost Avoidance Savings



Six Sigma Successes

- Improve B5A Ammo Distribution

- Result: Improve Economic Retention of Munitions Stock/Potential Reutilization and Disposal Stock Requirements for B5A Ammo Reduction of Required Surveillance of line items by 75%

Cost Avoidance \$1.6 Million Over 4 Years



- BGAD 120mm Maintenance Process

- Goal: Reduce cost & increase prod to 480 rounds/day
- Discontinued clearing the bays at the end of each day
Result: 20 minutes of additional production per day

One year cost avoidance of \$90,440



The background of the slide is a close-up, slightly blurred image of the American flag, showing the stars and stripes in a wavy pattern. The text is centered in the middle of the slide.

SWA Ammo Assessment In Support of Reset

Purpose

- Execute DA Retrograde Policy
- Assessment in Theater

To get us from here...



to here



Reset Objectives

- Optimize ammo turn-in process
 - Assist Commanders in their ammo ops
 - Determine packaging condition
 - Identify serviceable vs unserviceable
 - Ensure safe storage at FOBs



- ✓ Recommend disposition
 - Retain in theater as is serviceable/issueable
 - Retain for repack or maintenance
 - Demilitarize
 - Retrograde to CONUS

Where We Are

Situation:

- ✓ Theater ammo in storage ~ 60,000 tons
- ✓ A significant amount of ammo forward of ASPs
- quantity, packaging, and condition of ammo unknown
- ✓ AMC is Executive Agent for Reset

FY02 - FY05: AMC reset > 13,000 tons valued in excess of \$850M
.....Potential to reclaim over \$1B after drawdown

Summary

- ***Lessons learned: Upfront planning critical***
 - Segregate and process ammo before retrograde
 - Cost higher to sort in CONUS
 - Funding priority in CONUS historically low
- **AMC is Executive Agent for Reset**
 - Potential to reclaim over \$1B in ammo

Thoughts I want to leave you with...

- We are committed to the Integrated Logistics Strategy
- We are leading the way in Lean Six Sigma – and sharing our information
- Beginning the critical planning for ammo reset

The background of the slide features a large, wavy American flag. The stars and stripes are clearly visible, with the flag appearing to flow across the frame. At the bottom of the image, there is a dark silhouette of a group of soldiers. They are wearing helmets and carrying gear, and their forms are backlit by the bright light of the flag, creating a glowing effect around their edges. The overall composition suggests a theme of military service or national identity.

Questions?



U.S. Army Armament Research, Development, and Engineering Center (ARDEC) Update

Presented to

NDIA Armaments Technology Seminar & Exhibition

12 June 2007

Patrick A. Serao

U.S. Army Armament Research, Development,
and Engineering Center (ARDEC)

pserao@pica.army.mil

973-724-7912

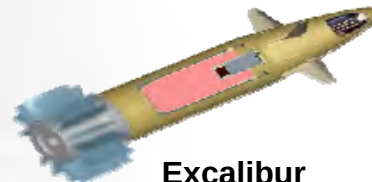


ARDEC Mission

Life Cycle Engineering & Support



Lightweight Dismounted Mortar



Excalibur



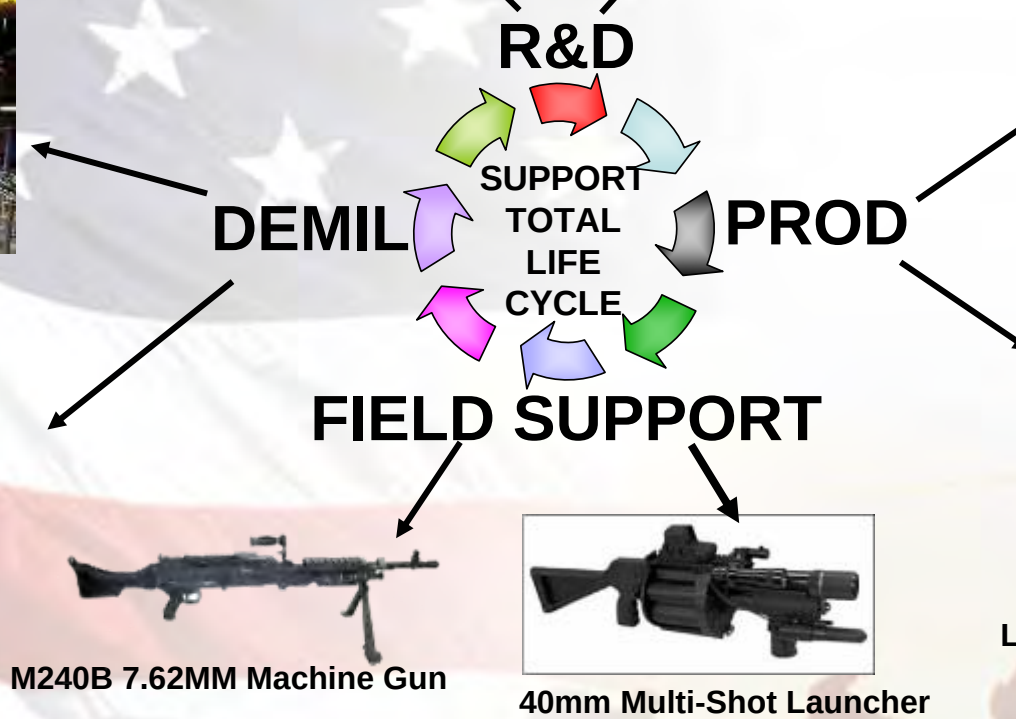
Lightweight Handheld Mortar
Ballistic Computer, XM32



Plasma Arc Furnace



Supercritical Water
Oxidation



M240B 7.62MM Machine Gun



40mm Multi-Shot Launcher



Lake City Army Ammunition Plant
5.56/7.62

...Providing Over 90% of the Army's Lethality



ARDEC at a Glance

- Established “Center of Mass” for Armament Systems and Munitions for Joint Services
- Proven track-record supporting transition of technologies to the field; since early FY 05.....
 - >28 Material Releases (MR) (>40 since early FY03)
 - >34 Urgent MR (>50 since early FY03)
- ARDEC Personnel ~ 3000; ~900 new hires since FY99
- >\$100M invested in “World Class” experimental R&D facilities since mid-90’s; Additional \$75M planned
- Strong partnerships with Industry, Academia, and other Government agencies.
- In-house rapid prototyping initiatives demonstrating new desired capabilities, supporting production prove-out and initial fielding demands
- >\$125M Tech Base portfolio addressing Joint needs



2004 & 2006 Army Large R&D Lab of the Year



R&D and Experimentation Facilities

Major Examples



Davidson Advanced Warhead Development Facility

Opened
1996

\$11.7M



- Maximum 50 TNT equivalent capability
- 100m indoor warhead test range

Precision Armaments Lab

Opened
2000

\$8.8M



- 2 Lab grade elevators for sensor dev
- 3 Target locations; 150m, 400m, & 1500m

Armament Technology Facility

Opened
2003

\$8.4M



2nd 100m range
opening FY09

- 100 & 300m indoor ranges
- Environmental chambers

Armament Software Engineering Cntr

Opened
2005

\$15.5M



Level 5 CMMI
Certified

- Integrated S/W & H/W development/integration
- Multi-platform SOSI highbay capability



New Facilities Under Construction

Breaking "Old" Grounds



Soft Recovery System (SRS)

Opening
Summer
FY07

\$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

High Energy Propellant Formulation Facility

Opening
FY08

\$17.7M

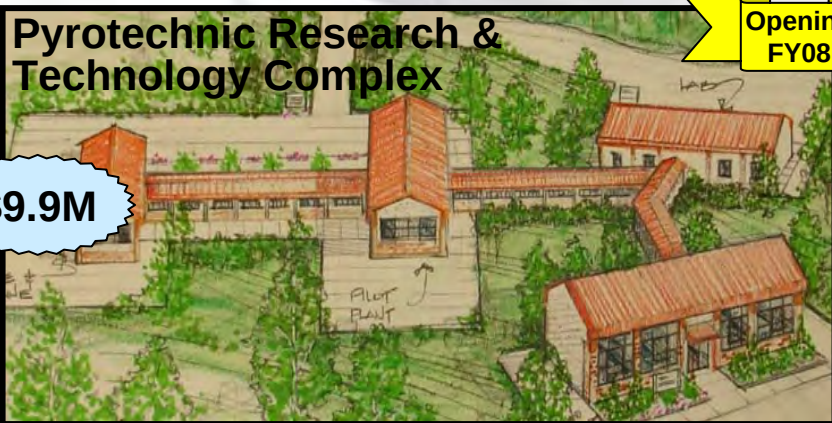


- 45,000 ft² Propellant Pilot Plant
- Characterization Laboratories
- Magazine Storage / Offices

Pyrotechnic Research & Technology Complex

Opening
FY08

\$9.9M



- 33,000 ft² Engineering Offices & Laboratories
- Pilot manufacturing facility
- Energetic stowage

Explosives R&D Loading Facility

Opening
FY09

\$8.0M



- 28,000 ft² Melt Pour Operations & Engineering
- Climate Controlling Machining
- Explosive Pressing, Cast Cure, & X-Ray

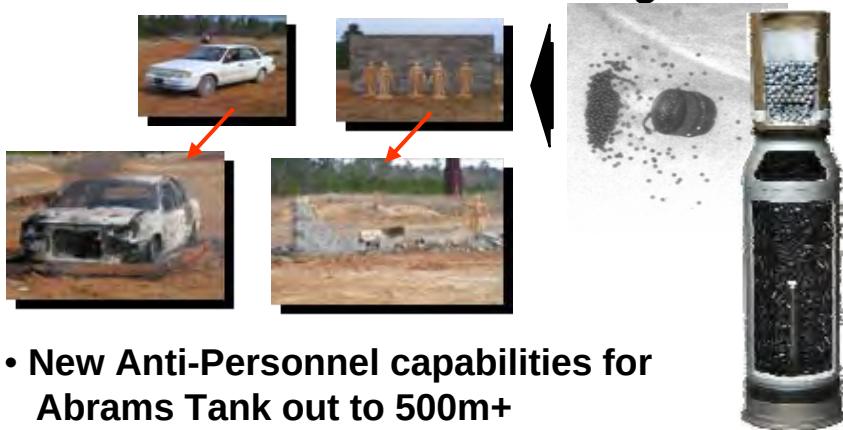


Urgent Fieldings

Some Recent Examples



M1028 120mm Canister Cartridge



- New Anti-Personnel capabilities for Abrams Tank out to 500m+
- >15,000 rounds fielded to Army/Marines.

M113A2 Rapid Entry Vehicle (REV)



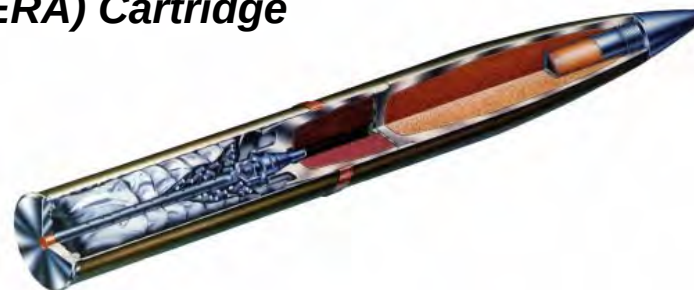
- Non-lethal response under armor with
 - 4 modified M870 shotguns
 - 6 Modular Crowd Control Munitions
- 4 vehicles fielded

M100 Rifle Launched Grenade Munition



- Door Breaching Munition fired from M16A2 and M4 with standard 5.56mm M855 rounds.
- 300 tactical/1250 training rounds fielded

M927 105mm High Explosive Rocket Assist (HERA) Cartridge



- Extended range capability to 16km+ to meet critical mission need
- Combination new production and M913 conversion yielded ~3600 cartridges
- ~700 cartridges fielded



Rapid Prototyping Initiatives

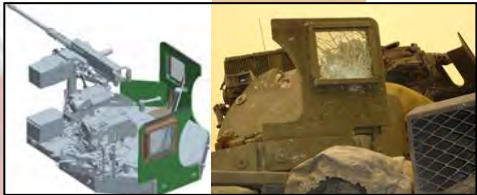
Examples of “Tech Push” for Early User Demo’s AND
Support to Production Requirements

Gunner’s Protection Kits (GPKs)



M1114 Objective GPK (O-GPK)

- Concept Demo in 6 Months
- ARDEC Level III TDP
- Depot Production for >15K GPKs



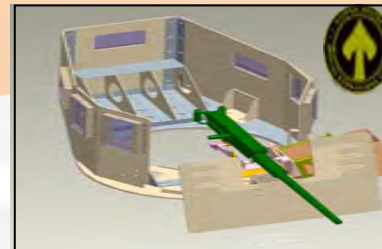
Stryker Cupula Shield

- PM Request
- Concept Demo in 90 days
- ARDEC LRIP to OIF (7 Brigades)



RG31 GPK

- Modified O-GPK
- ARDEC LRIP underway



SOCOM GPK

- Expanded Requirements
- ARDEC LRIP underway



Sculpted Transparent Armor

- Curved Transparent Armor
- Enhanced Situational Awareness
- Concept demo planned May 07



Engineering Boat (MK1)

Survivability Enhancements

- Baseline Design Complete
- Prototype Demo Planned May 07
- LRIP Quantity Planned 3rdQ FY07

MAJOR DESIGN GOALS

- Maximize **protection level & area**
- Minimize **weight**
- Maintain **situational awareness**
- Use existing **attachment points**
- Utilize proven ballistic **materials**
- Minimize number of **components**
- **Interface** with standard weapon mounts
- **Modularity**

Close Coordination with Customers Key to
an Integrated Solution for Survivability,
Lethality, and Situational Awareness

Initial Production
Prove-Out and
Fielding Support

Concept
Design



Rapid Prototyping Initiatives

Examples of “Tech Push” for Early User Demo’s AND
Support to Production/Fielding Requirements

Remote Armaments for Unmanned Platforms



Tactical Amphibious
Ground System (TAGS)

Picatinny LtWt Mount on TAGS

- ARDEC in-house developed mount
- <200lb weight class with M240/M249
- 3 mounts supporting customer demos



“I’m ready to
deploy with this
unit and SWORDS”

- SGT, 1-3 Cavalry,
3BDE/3ID

Special Weapon Observation-Reconnaissance Direct Action System (SWORDS)

- Safety Confirmation Jun 06
- 3 Deployed to 3rd ID
- Urgent Material Release Underway

Initial Production
Prove-Out and
Fielding Support

Key Design Challenges:

- Weight/Cube/Power
- Weapon Re-arm/Automation
- Integration on COTS platforms
- Communications
- Roof and internal structures
- No fire zones / motion inhibits
- Vehicle dynamics
- EMI

Valuable Lessons Learned on Design and
Safety Considerations to Apply to Remote
Armament Programs



Obj NLOS Mortar Technology

- Elevating automated turret concept
- Demo on surrogate platforms FY07-09



New Integrated
Weapon/Platform
Interface Design

Remote Armament Sys Tech

- Weapon designs specifically for unmanned platforms
- Ease of integration/functionality
- Concept demos FY08/09

Concept
Design



Engineering Analysis/Evaluation

Example of evaluation of system technology performance



Evaluation of Acoustic Sniper Detection Systems

• **PURPOSE:** Validate accuracy of vehicle mounted gunfire detection systems, both statically and on the move against vendor stated performance specifications

- Verify performance of system's ability to detect/locate sniper fire under various conditions
- Verify system robustness to false alarms

• **Three-Phase Test at APG:**

- Stationary – Open Field (Completed)
- On the Move – Open Field (Completed)
- Stationary – Urban Environment (May - Jun)

• **Emerging Results:**

- System tested provide varying degrees of detect and locate capabilities
- In general, discrepancies exist between vendor claimed performance specifications and test results

• **Specific platform testing requested by customers underway**



SYSTEMS	MANUFACTURER
PD-Cue® 4 Corner	AAI
PD-Cue® Tetrahedral	AAI
Ferret	MacDonald Detwiller & Associates
VM-GDS	01dB, Metravib
Boomerang v2.5	BBN Technologies
SNIPPOS	Axcess Technologies
VAAPS/LWAS	Land Warrior Acoustic Systems
Red Owl	iRobot

Testing Critical for Requirements Generation and Establishing TTPs

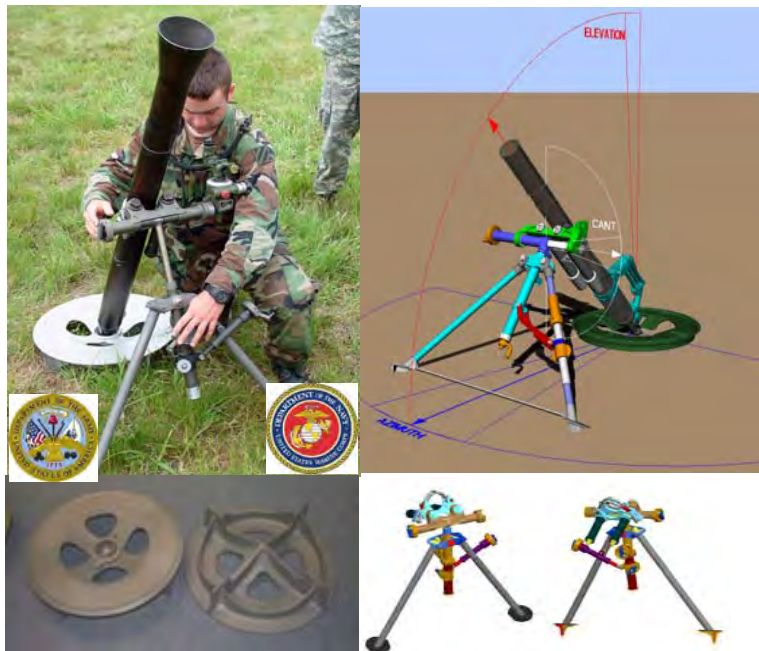


Recent Tech Base Transitions

Major Examples-Weapons

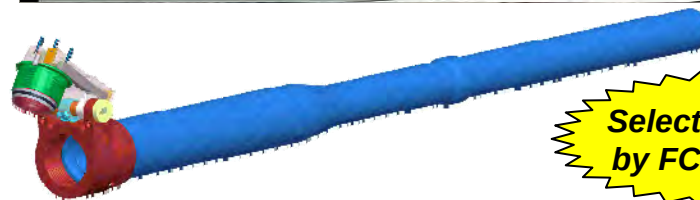


LtWt 81mm Dismounted Mortar



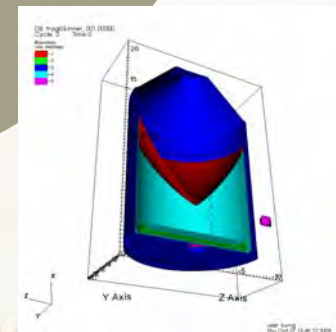
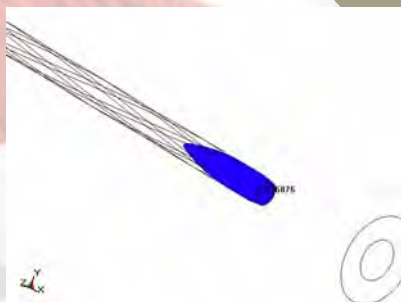
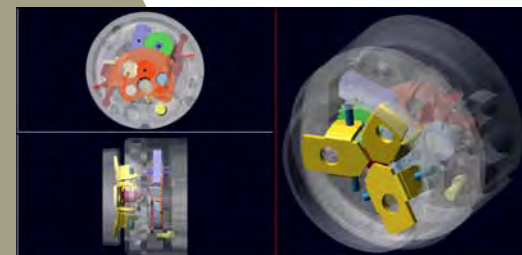
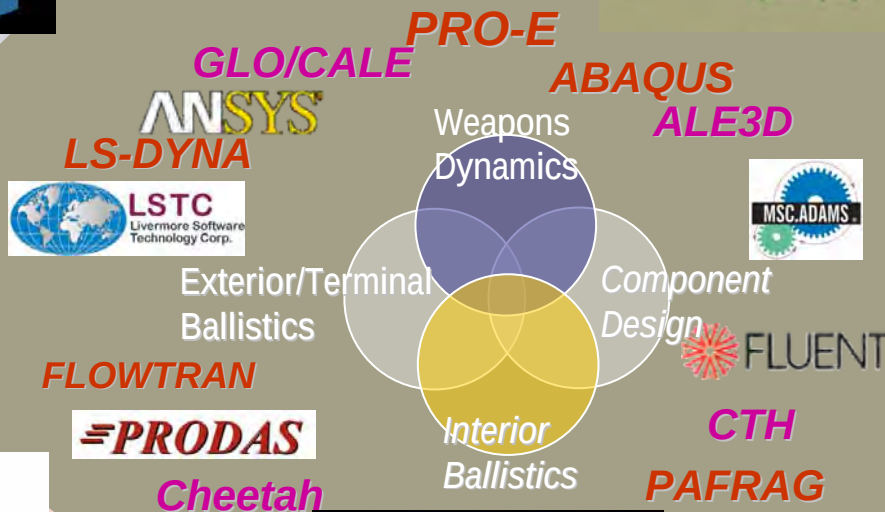
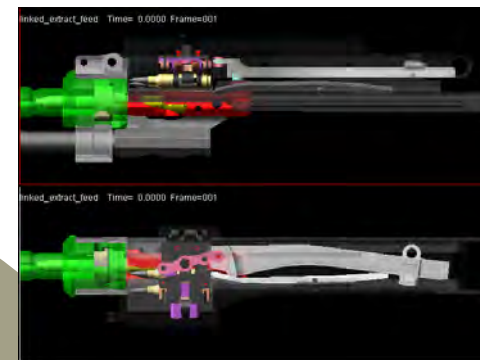
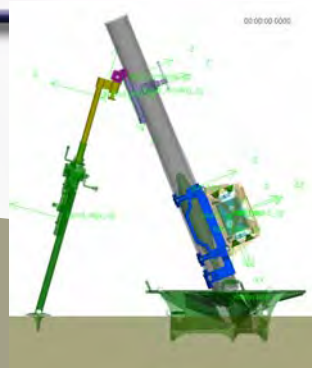
- Joint Army/Navy Funded
- ~30% weight reduction (to <70lbs)
- New Inconel Tube Mat'l & Process
- Simpler, More Ergonomic Bi-Pod
- ~50% UPC reduction
- Transitioning to Prod ECP FY07

XM325 120mm Mortar Cannon



**Selected Cannon
by FCS Program**

- 3 meter tube with screw block breech
- 8 km range with M900 series ammo
- Demonstrated 12 rpm firing rate (FCS Threshold Requirement)
- Transitioned to FCS Program at TRL 6



Application of World-Class M&S Tools is Dramatically Enhancing the Way We Design and Assess Products/Processes



Recent Tech Base Transitions

Major Example-Ammunition



Line-of-Sight-Multi-Purpose (LOS-MP)

Current



Future- 1 Round



• Enhanced Lethality with One-Round against:

- Concrete Wall
- Earth and Timber Bunker
- Lt Armor
- Personnel

• LOS-MP TRL6 Exit Criteria met:

- Defeated Double reinforced concrete wall with Hole size 30"x50" in <3 shots
- Demonstrated greater than threshold range (700m) with potential to meet objective capabilities (40-2000m)

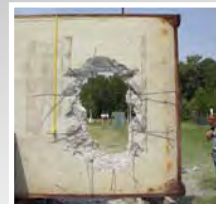
• Transitioned to PM-MAS



30 Man
Platoon
Defeated >
1000m



1-Shot T-55 Defeat



2 Shots- Defeat DRC



1 Shot Bunker Defeat

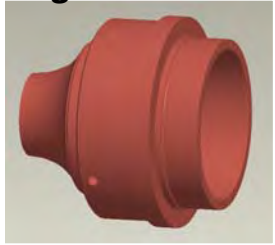


LOS-MP Design Process

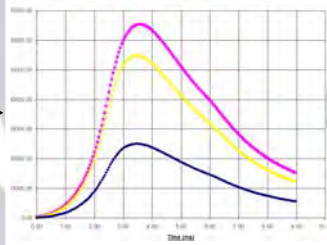
**Enabled TRL 6
Demo in 2 Years**

- Initial conceptualization to meet requirements
- Definition of high risk process and long lead items
- Define shortfalls of M&S: Fill gaps with test, experience

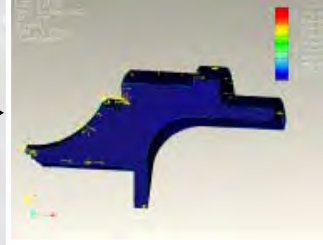
**Modeling/
Configuration Pro
Engineer/ Intralink**



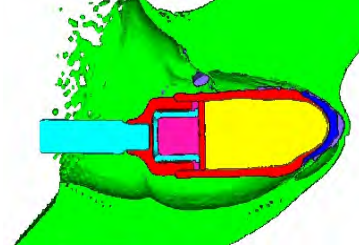
**IB Simulation
IBHVG2**



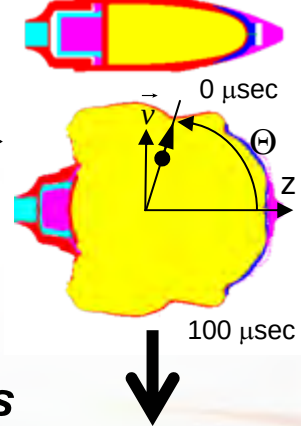
**Structural analysis
FBD/ ANSYS**



**Target penetration
CTH**

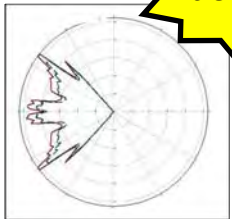


**Fragmentation
CALE/PAFRAG**



Failure in any model reiterates design process

**No iteration of
design during
testing !**

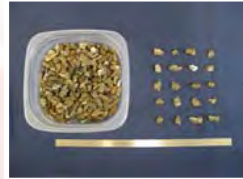


**Lethality Models
CASRED/MPR3D/
AJEM/MUVES**

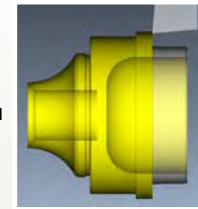
**Flight
Performance**



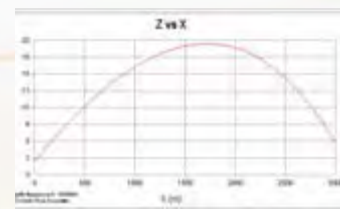
Fragmentation



**Verify
Models**



**3D numerical control
Pro Manufacture**



**Flight
performance
PRODAS**



DR concrete wall

Modeling and Simulation Saved \$6.8M and 27 Months



MCS and Abrams Ammunition System Technologies (MAAST)





In Summary....ARDEC/Picatinny...

- Established “Center of Mass” for Armament Systems and Munitions for Joint Services
- Proven track record of rapid transition of technology to the field
- Modernizing R&D facilities maintaining world-class capabilities
- Developing new concepts/technologies to enhance warfighter capabilities
- Demonstrating future warfighting capabilities today!

ARDEC/Picatinny.....

Products, people, and processes enabling our ultimate customer, the soldier, to “take care of business” throughout the spectrum of conflict!



International
Cooperation



Rapid Fielding for Coalition Forces

Mr. Lu Ting

US Army ARDEC International Office

Major Allan Finney

Canadian Forces Liaison Officer

Captain André Savard

Canadian Forces Exchange Officer

13 June 2007



International
Cooperation

International Armaments Cooperation in Support of U.S. Forces for Current War on Terrorism

- Data Exchange Program (DEA): Technologies to Counter Asymmetric Threats
- Cooperative R&D Projects: for IED Defeat
- Foreign Technology Assessment Support Program (FTAS): GPS-denied Navigation and Tracking Technology
- Foreign Comparative Testing (FCT): Belgium FN Herstal FN303 Less Lethal Launcher
- Rapid Acquisition: Rapid Entry Vehicles



International
Cooperation



Rapid Entry Vehicles REV2

Captain André Savard

Canadian Forces Exchange Officer

Deputy Technology Manager
ARDEC Rapid Prototyping Office



International
Cooperation

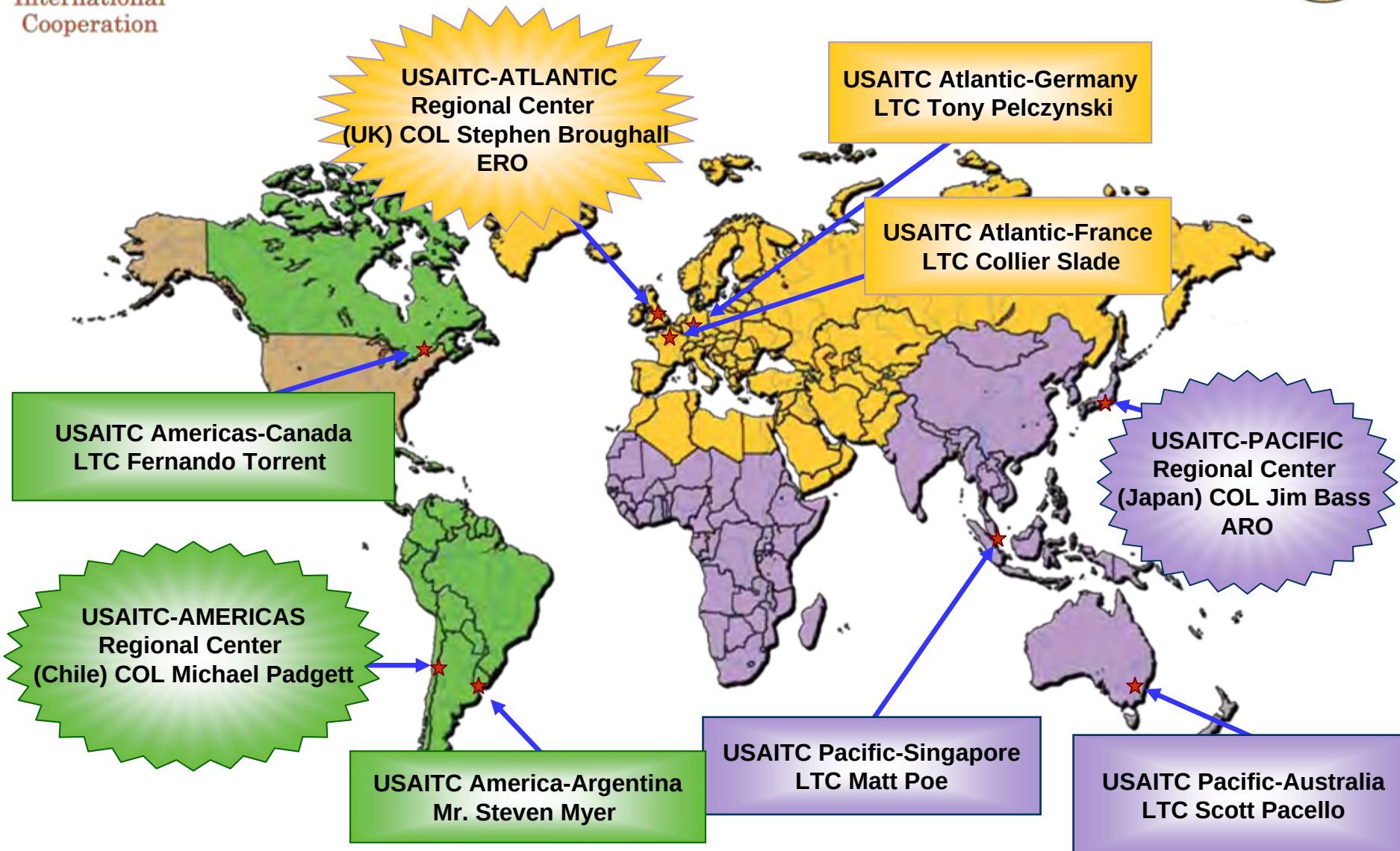
Rapid Entry Vehicles REV2





International
Cooperation

RDECOM International Technology Centers





International Armaments Cooperation in support of Coalition Forces for Current War on Terrorism

- Actively pass on our lessons learned to our Coalition Partners
- Actively involved in Rapid Acquisition of U.S. Capabilities by our Coalition Partners



International Security Assistance Force



ISAF REGIONAL COMMANDS & PRT LOCATIONS

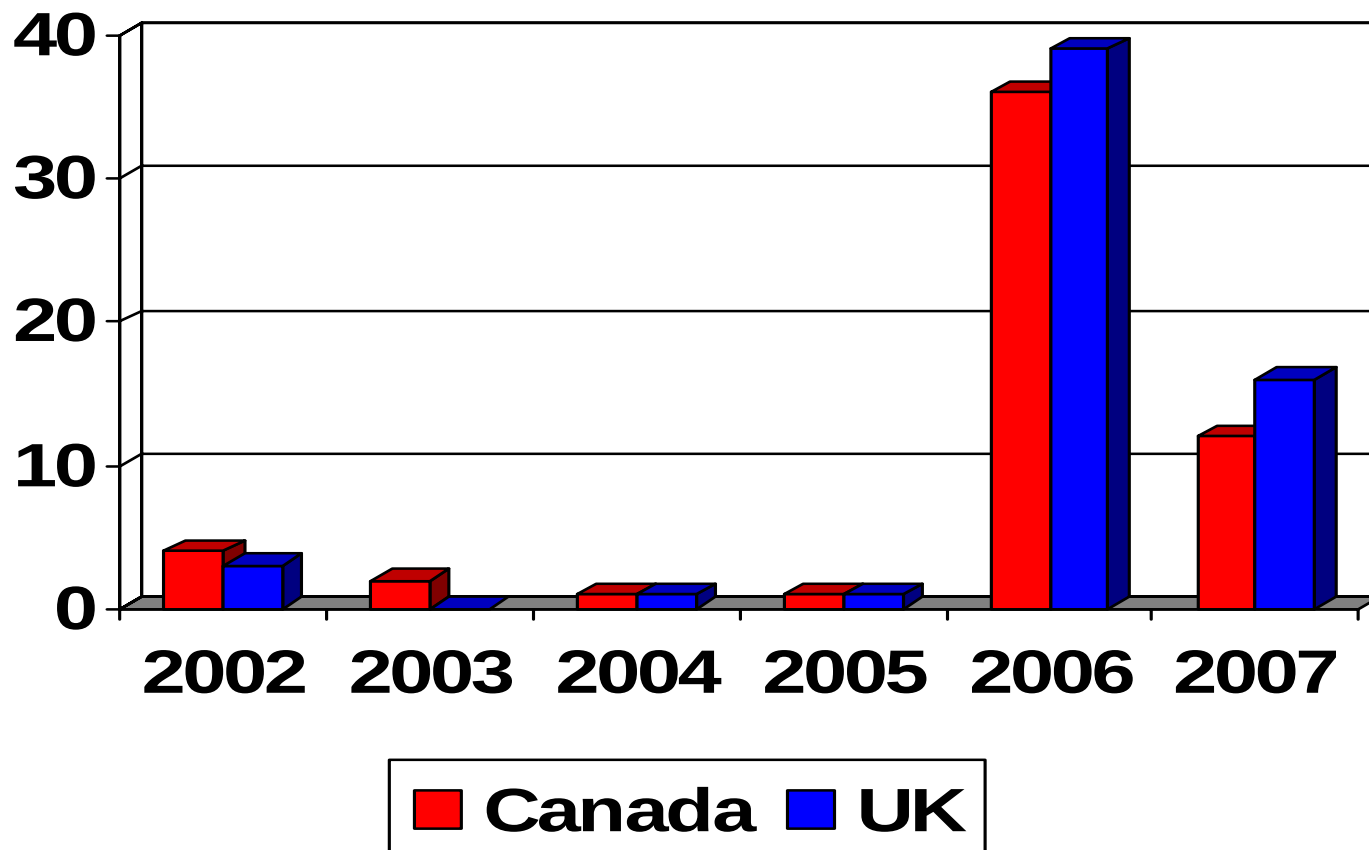


Mission: Conduct military operations in the assigned area of operations to assist the Government of Afghanistan in the establishment and maintenance of a safe and secure environment with full engagement of Afghan National Security Forces, in order to extend government authority and influence, thereby facilitating Afghanistan's reconstruction and contributing to regional stability.



International
Cooperation

Coalition Casualties



1. Canada's Casualties: from CBC News
2. UK's Casualties: from UK MOD



International
Cooperation



Canada – US Cooperation for Rapid Fielding in Afghanistan

Major Allan Finney
Canadian Forces Liaison Officer



International
Cooperation

Rapid Fielding for Canadian Forces in Afghanistan



Task Force Afghanistan

M777

XM982

Ammunition

Protection Shields





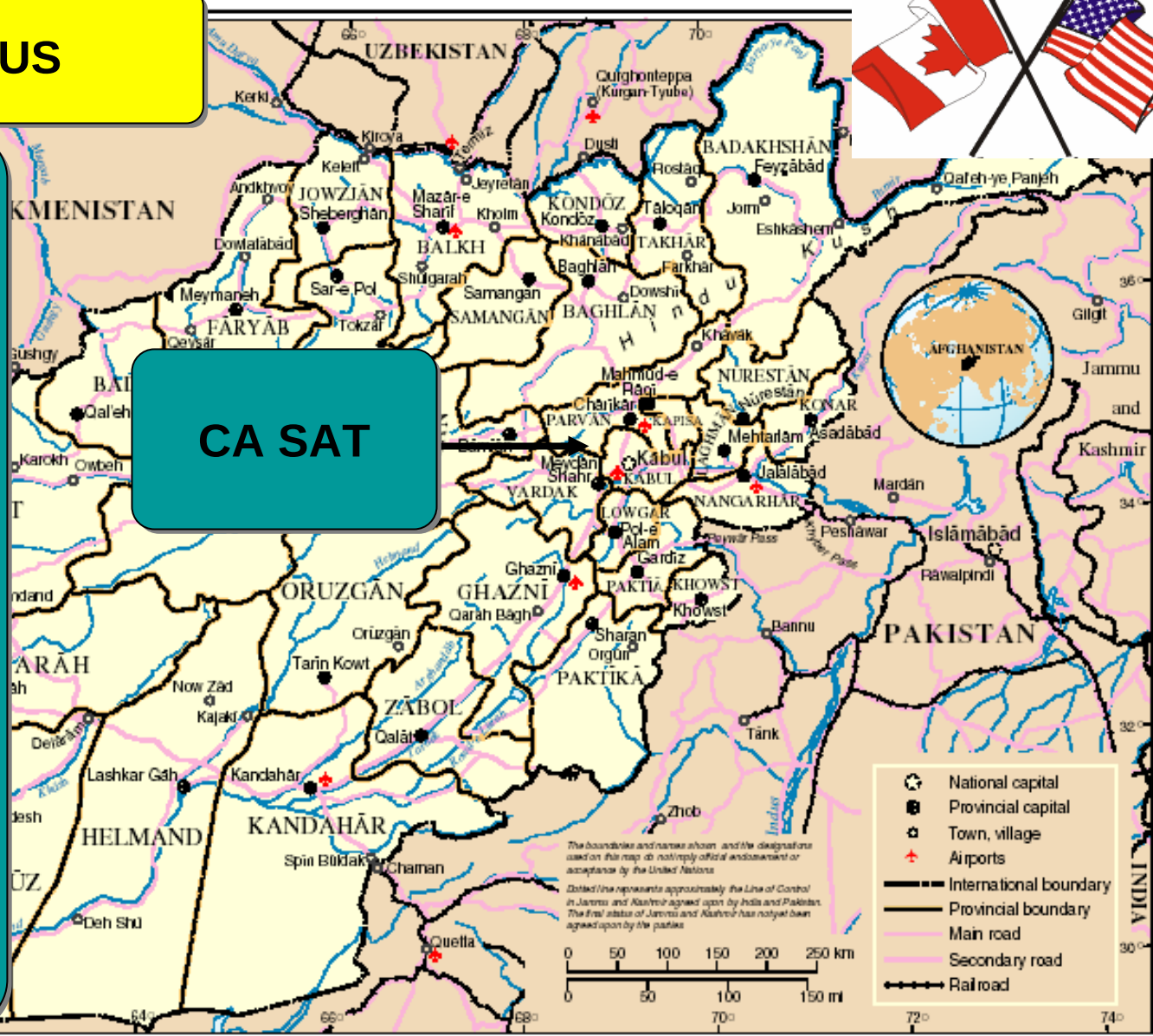
Op ARGUS

International
Cooperation

Canadian Strategic Advisory Team

The Govt of Afghan
(GOA) has accepted
the CF offer
to deploy, under a
Bilateral
Agreement,
a planning
capability to assist
in Afghan
Strategic Planning

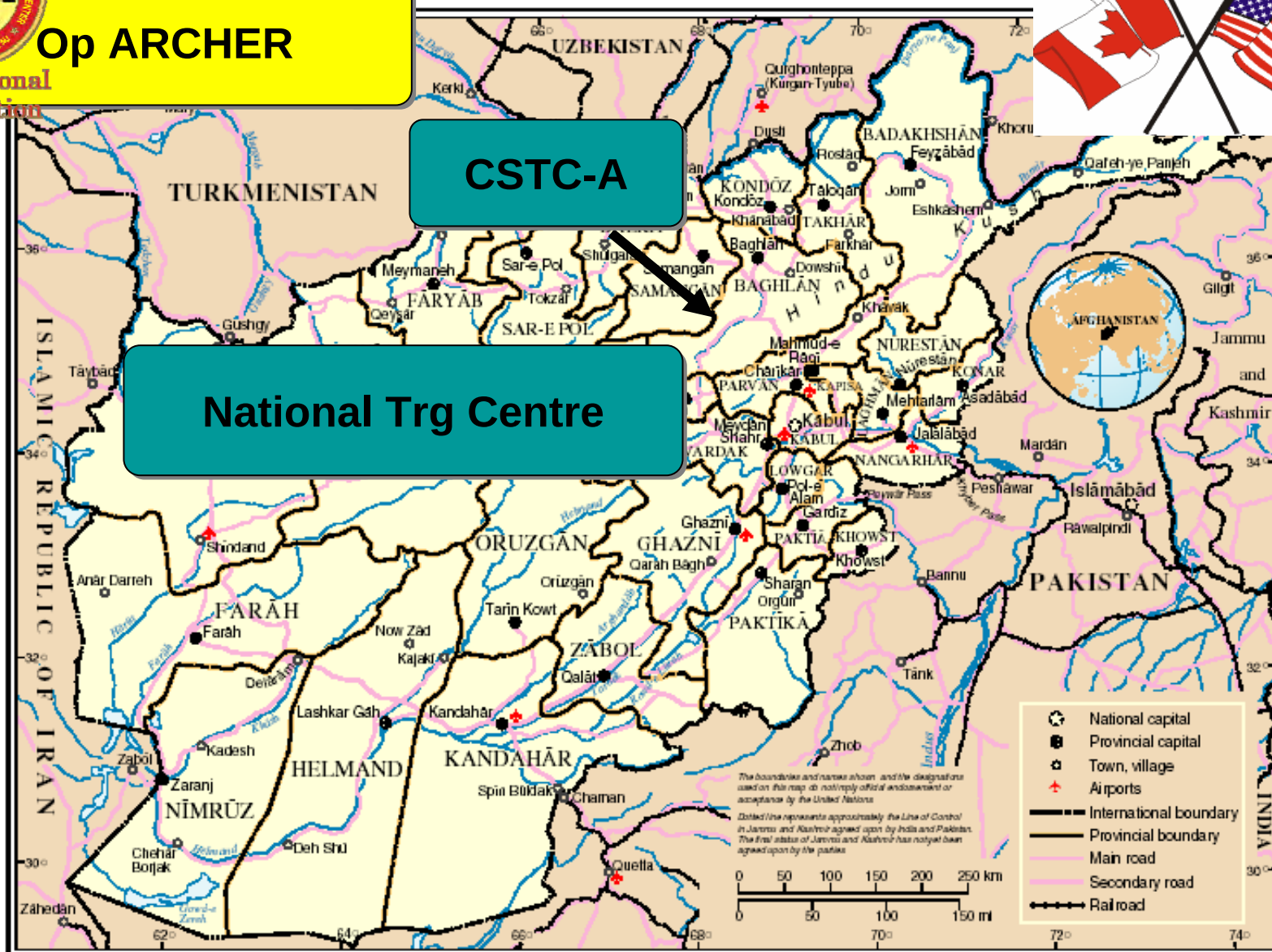
CA SAT





Op ARCHER

International
Cooperation





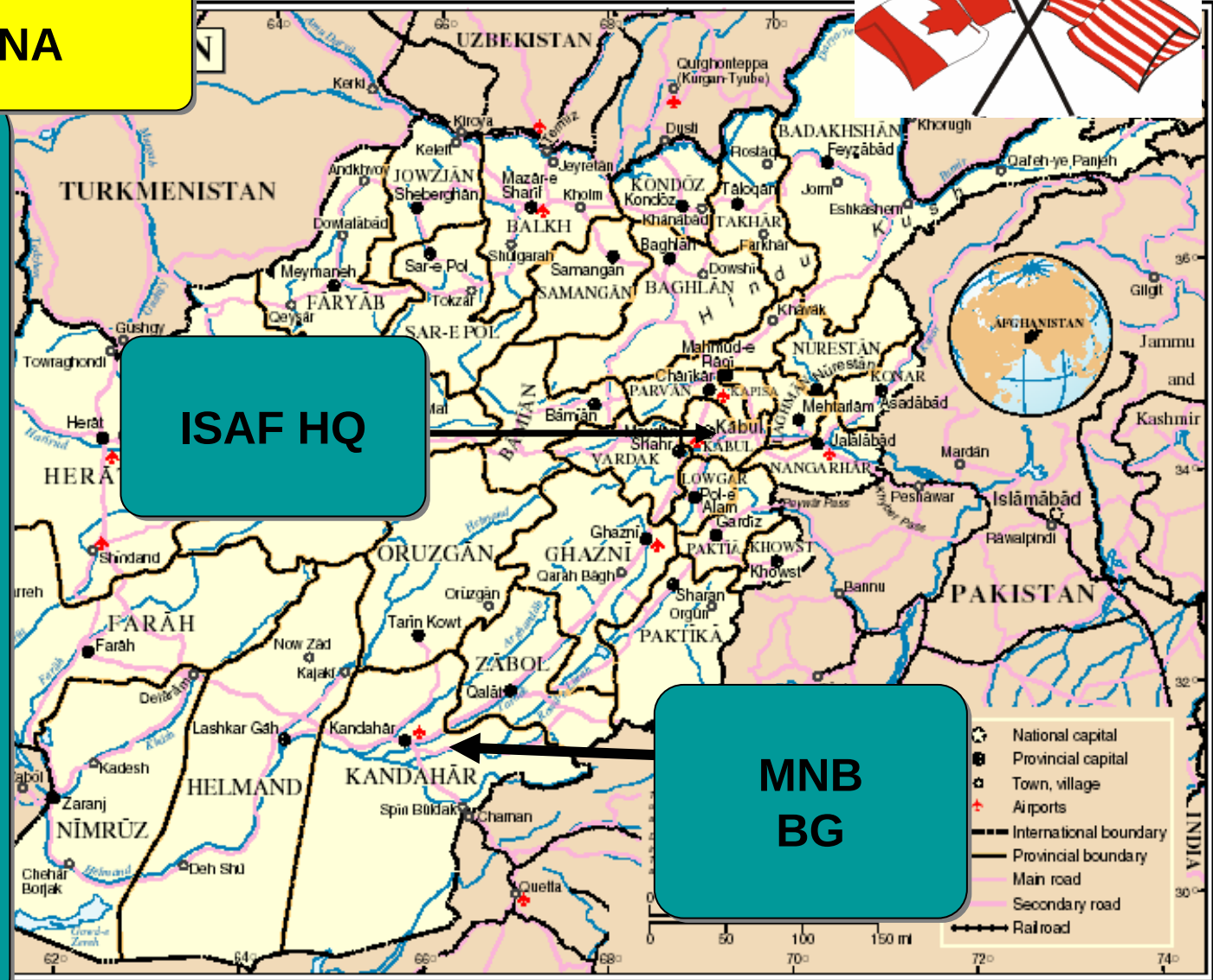
Op ATHENA

International
Cooperation

ISAF

Mission

Conduct military operations in the assigned AOO to assist GOA in the establishment and maintenance of a safe and secure environment with full engagement of ANSF, in order to extend GOA authority and influence, thereby facilitating AFG's reconstruction and contributing to regional stability



ISAF HQ

MNB
BG



International
Cooperation

Task Force Afghanistan Contribution



25mm Cannon – LAV III



105mm Cannon – Leopard C2
(soon to be Leopard II)



155mm Cannon – M777



25mm Cannon – LAV Coyote



International
Cooperation

M777 Lightweight Howitzer (PM JLW)



- Canadian purchase of M777 initiated July 2005
- Coordinated meetings and teleconferences that allowed for the FMS case approval Sept 2005 and delivery of initial guns Nov 2005
- First guns deployed to Afghanistan Jan 2006
- Initial purchases were from the Marine Corps, Follow-on purchases were from BAE





International
Cooperation

XM 982 Excalibur (PM CAS)



- Involved with Canadian purchase of Excalibur as lead LO since day one (July 2005).
- Attended US test firings in Yuma, AZ (Aug and Nov 2006).
- Attended the Canadian Training and test firing of Excalibur in Yuma, AZ (Feb 2007).
- Responsible for acquiring all documentation for Excalibur (TTPs, BIP Templates, Maintenance, EOD, test data, and docs for the ASSB)
- Will be deploying to Afghanistan (June 2007) to monitor Canadian usage of Excalibur to include storage, transportation, TTPs, record fire mission data, target effects, etc.
- Future enhancement Base Bleed and SAL





International
Cooperation

Ammunition (PM MAS and CAS)



New FMS Case

105mm Tank Ammunition – M1040 Canister.

120mm Tank Ammunition – M1028 Canister

155mm Artillery Ammunition - M795 HE and M549
RAP and MACS propellant. FMS approved Oct 05 all
ammunition delivered Mar 06.

These purchases also included all the necessary firing
tables and data required for the ASSB





International
Cooperation

Picatinny Blast Shield (ARDEC Warfighter Central and Rapid Prototyping Office)



- Cdn interest in PBS began Sept 06
- Examining additional protection for exposed crew
- Tested initial design in Oct 06, DREV
- PBS chosen for our vehicles (LAV III and Coyotes)
- FMS case underway to buy commander and gunner shields





International
Cooperation



Questions?

A collage of military-related images. On the right is a large, close-up portrait of a soldier wearing a helmet and looking through tall grass. On the left is a grid of smaller images showing various military equipment and personnel, including a helicopter, a tank, a fighter jet, and soldiers in combat.

Vickie Williams
Technology Transition Manager
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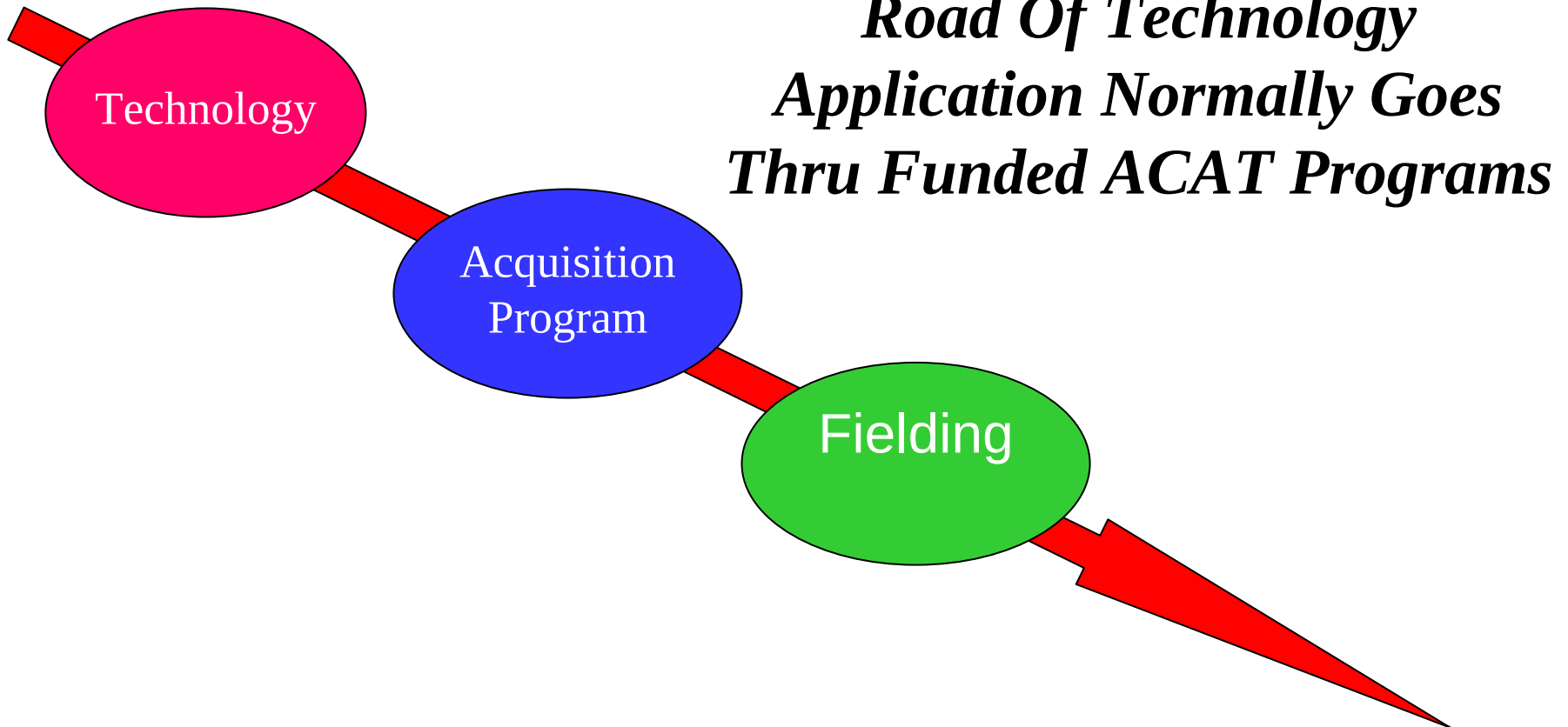
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- Technology Transfer
 - Partnership Between Government & Industry
 - Technology Developed by One Entity Use by the Other
 - Developer Usually Retain Residual Rights
- Technology Transition
 - Products of Government Developed S&T
 - Evaluated for Operational Suitability
 - Provided to a New or Existing Acquisition Program to Obtain Enhanced Capability for the Warfighter

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Outline

- The Situation
- The Problem
- Some Suggestions
- Some Examples



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The Situation

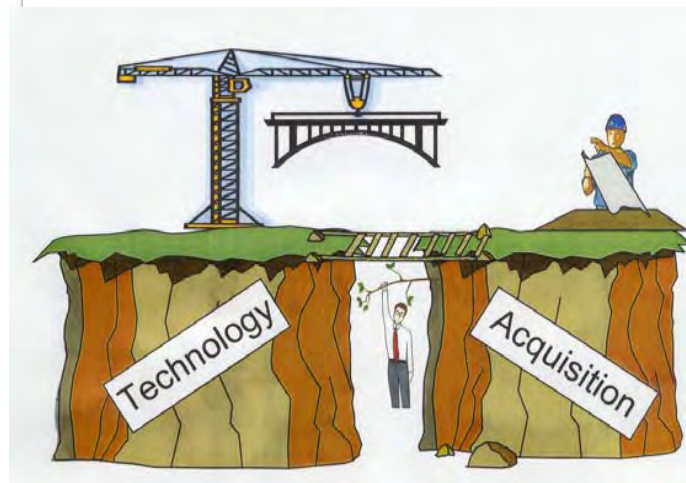
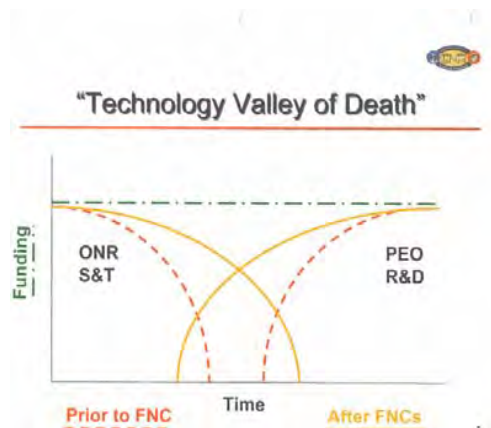
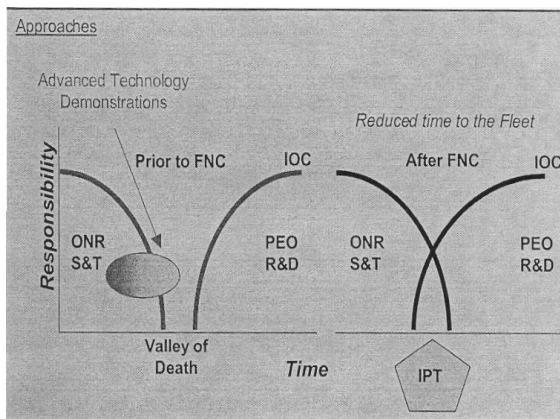
Long-Standing Emphasis
on Rapid Transition of Technology
to the Warfighter

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The Situation

Long-Standing Recognition of the Valley of Death





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The Situation

- Large DoD Investment in Technology Development
 - Navy \$1.6B
 - Army \$1.7B
 - USAF \$2.1B
 - DOD Agencies \$5.6B
 - TOTAL \$11.0B*
- But.....Perception is that the ROI is Small
- So.....It Gets A Lot of Outside Attention

* Source: OMB R&D Data, Budget of the U.S. Government FY 2007

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The Situation

The Study-a-Year Program

GAO



DoD IG



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The Situation

Recent Studies

Year	Report	Title
2006	GAO 06-883	Stronger Practices Needed to Improve Technology Transition
2005	GAO 05-480	Management Practices Could Be Strengthened for New Technology Transition Programs
2004	DoDIG D-2004-078	Military Department's Transition of Advanced Technology Programs to Military Applications
2003	DoDIG D-2003-132	Air Force Transition of Advanced Technology to Military Applications
2003	DoDIG D-2003-053	Navy Transition of Advanced Technology to Military Applications
2003	GAO 03-52	Factors Affecting Outcomes of Advanced Concept Demonstrations
2002	DoDIG D-2002-107	Army Transition of Advanced Technology to Military Applications
2001	GAO 01-943	Defense Manufacturing Program, More Joint Projects and Tracking of Results Could Benefit Program
1999	GAO-99-162	Better Management of Technology Can Improve Weapon System Developments
1997	DoDIG 97-120	Advanced Concept Demonstration



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The Situation

Lots of “Non Traditional” Programs

- Advanced Concept Technology Development
- Defense Acquisition Challenge
- Defense Production Act
- Defense Transformation Program
- Foreign Comparative Testing
- Independent Research & Development
- Joint Test & Evaluation
- Coalition Warfare Program
- Dual Use S&T Program
- Quick Reaction Fund
- Future Naval Capability
- NATO Comparative testing
- Small Business Innovative Research
- Small Business Technology Transfer
- Disruptive Technology Opportunity Fund
- Manufacturing Technology
- Joint Warfighting Program
- Technology Transition Initiative
- Joint Capability Technology Demonstration

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The Situation

But Even The Best Laid Plans.....





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The Problem

- Many Communities Involved
- Each with Defined Mission
- Each with Own Unique Processes

BUT....

- All Must Work Together to Achieve Transition



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The Problem

Communities

- Capability Needs
- Science & Technology
- Research & Development
- Systems Acquisition
- Sustainment
- Test & Evaluation
- Financial
- Security
- - - -
- Operational

Processes

JCIDS Process
Scientific Methodology
Systems Engineering
Systems Acquisition
LCM Process
T&E Procedures
PPBES
IA Process

DOTMLPF Integration



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The Problem

In Traditional Programs

- These Communities Engage Serially

In Accelerated / Non-Traditional Programs

- The Engagement Becomes Parallel
- New Project Teams Don't Have Time To Learn All The interfaces They Are Required To Manage

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The Problem

The Warfighter Needs Total Solutions

A Quick Solution That
Can't Be Supported.....
Doesn't Cut It In The Long Run





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The Problem

- “Knowing / Doing Gap”
- Collectively, We Know What To Do
 - Study Findings / Recommendations
 - DSMC Publications
 - DAWIA Career Field (SPRDE (S&T)) Training
 - Experienced From Past Efforts
- We Just Have a Really Hard Time Achieving the Required Integration to Pull-Off Accelerated Technology Transition



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Some Suggestions

Manage the Program

- Principles of Program Management and Systems Engineering Apply
- Employ Gated Reviews
- Employ Collaborative Tools
 - Technology Roadmaps
 - Technology Transition Agreements



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Some Suggestions

Manage Expectations

- Continually Reinforce what the Program is.....
- And what the program is not.....



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Some Suggestions

Begin With a “Technology Transition Risk Assessment”

Analyze the Risk to Transition From
Each of the Involved Communities

- Capability Needs
- Science & Technology
- Research & Development
- Systems Acquisition
- Sustainment
- Test & Evaluation
- Financial
- Security
- Operational



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Some Suggestions

Select Mature Technology

- The S&T Portion of Transition Risk Assessment Should be a Technology Readiness Assessment
- Guidelines from DoD Technology Readiness Assessment Deskbook

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Some Suggestions

Work the Money

- Keep Funding Sponsors Happy
- Work the POM for:
 - RDT&E
 - Procurement
 - O&M
 - Personnel
 - Facilities
 - Ammunition





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Some Suggestions

Conduct Adequate Testing

- Adequate testing will eventually be needed to
 - Obtain Safety Release
 - Obtain Fielding Decision
- Joint Test and Assessment Activity (JTAA)
Provides focused Test Resources

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Some Suggestions

IPTs Are Good!!

- Promote Mutual Understanding
- Vehicle for Collaboration
- Should Include System Prime Contractor
- Measure of Commitment





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Some Suggestions

Individual Performance Goals

- Ensure Transition Goals are in PM's and Transition Manager's Performance Objectives
- This Helps Align Individual's Personal Objectives With Goal of the Project



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Some Suggestions

Maintain Software Integrity

- Software is “Relatively Easy” to Transition as it Requires no Procurement Funds, but.....
- It must be designed to standards of Network or Targeted System (Rapid Prototype Software usually doesn't meet requirements for fielding)



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Some Suggestions

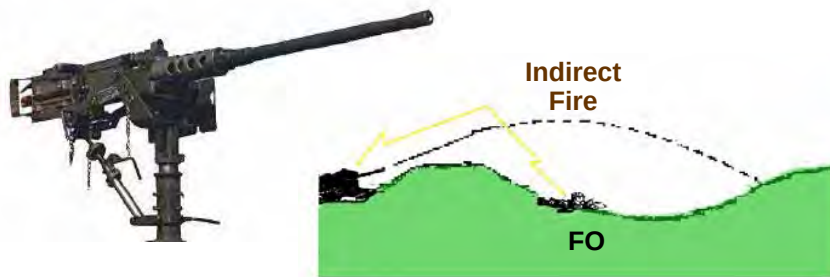
Engage the DOTMLPF Pillars

- Operational Commanders are reluctant to use Materiel lacks accepted doctrine & tactics, that the troops have not trained with, and has questionable supportability
- Use IPTs--Have a Relationship Manager
- If Necessary.....Assist Combat Developer

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Some Examples



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Conclusion

- I think we know how to do all the things we need to do
- We often slip into “The Knowing, Doing Gap”



It Ain't Rocket Science, but.....

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But It is a Contact Sport





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