US ARMY RDECOM

U.S. Army Research, Development and Engineering Command

J·S·S·A·P JOINT SERVICE SMALL ARMS PROGRAM

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Small Arms Weapons & Fire Control Demonstration Project

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Agenda

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- *Small Arms Weapons & Fire Control*
- *Technical Approach (Metrics & Objectives)*
- *Project Timeline*
- *Challenges to Target Tracking Success*
- *Challenges to Ranging Success*
- *Summary & Path Forward*

Introduction

- ***What is Fire Control?***
  - Science of offsetting the direction of weapon fire from the line of sight to the target in order to hit the target

- ***Fundamentally, fire control are variations of the same basic situation***
  - Launching a projectile from a weapon station to hit a selected target
  - Target or the weapon station or both may be moving

- ***Categorized as either tactical or technical***
  - Tactical fire control is the ability to optimally engage threats with their weapons and effects
  - Technical fire control is the ability to detect, identify and acquire targets, including range, and provide an updated ballistic solution determination

- ***Small Arms Fire Control***
  - Small Arms Weapons & Fire Control focus is technical fire control
  - Provides computational and mechanical operations required for weapon system to hit a specific target with a specific munition
  - Augment the soldier's capability, enabling the soldier to fire on more targets both more quickly and more accurately

Small Arms Weapons & Fire Control (SAW&FC) Demonstration Project

Purpose

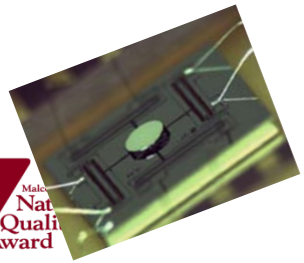
To demonstrate the integration of advanced fire control component technology which improves capability to determine range, track moving targets, and increase probability of hit. Components will be demonstrated with a day electro-optic sensor on relevant current Kinetic Energy (KE) weapons.

Challenges

- Moving targets prior to their seeking cover
- Unsupported firing position.
- Inaccurate ranging limits precision
- Weight near muzzle leads to poor aiming

How do we solve this problem

- Technologies for automatic multiple target detection
- Laser steering to increase the soldier's ability to accurately determine range to non cooperative moving targets
- Develop range determination to overcoming wobble associated with an unsupported firing position
- Improved lethality in unsupported firing positions



Payoff

- TRL 6 (System/Subsystem) component technologies demonstrated to show that they can meet the capability requirement
- Component technologies allow for integration into variety of weapon platforms, including legacy and developmental systems

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Technical Approach
(Metrics and Objectives)

Measure	Baseline/ Current Metric	Program Objective	Army Objective	Technology Readiness Level
Unsupported Range Determination	4+% to 15% of Range	3 Meters to Targets in Cover	2 Meters to Targets in Cover	Start: TRL 4 End: TRL 6
Missed Moving Targets	60%	20%	<20%	Start: TRL 4 End: TRL 6

- Metrics Extended from Previously Concluded Advanced Fire Control Technologies for Small Arms (AFC) Army Technology Objective – Research (ATO-R)
- Key Performance Parameters
  - Range: 1200m (T)
  - Simultaneous Targets Tracked: 3 (T)
  - Beam Steering Angle: 9 mR (T)

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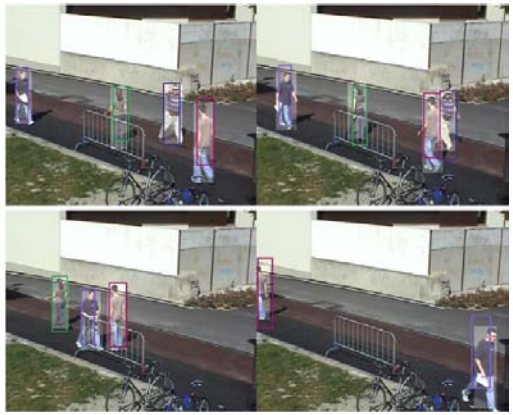
Project Timeline

- Two Contracts to be Awarded May 2012
- Down-select to Single Contractor for Demonstrator Unit Fabrication in 2QFY13
- Fabrication and Initial Testing to be Completed by End of FY14
- Demonstrator Optimization and Retest to be Completed by End of FY15
- Transition of Technology to Customer During FY16

Challenges to Target Tracking Success

- **Contrast Ratio of Imaged Targets**
  - Fusion of multiple wavelength bands may generate imagery with increased contrast ratios for target detection
- **Minimum Number of Pixels for Target Detection**
  - Optical design of sensor system so that target is represented by sufficient number of pixels for detection by algorithms
- **Multiple Targets & Targets Through Occlusions**
  - Algorithm must be able to track multiple targets simultaneously
  - Algorithm must be able to continue to track targets as they proceed through occlusions
- **Stationary Targets**
  - Motion tracking algorithms will not detect stationary targets
- **Image Processing & Tracking Latency**
  - Tracking components must be able to process input data and track targets for sufficient time prior to target going into defilade



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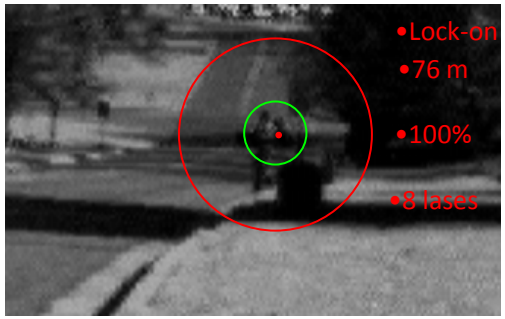
Challenges to Ranging Success

- **Off-Angle Laser Rangefinder Return Energy**
  - Off-angle ranging will be limited by the laser receiver
- **Minimization of Size, Weight and Power (SWaP) of Beam Steering / Laser Rangefinder Components**
  - Beam Steering / laser rangefinder components must fit within the available envelope of a small arms optical device
- **Capability of Steering Components to Withstand Shock and Vibration Associated with Small Arms Fire**
  - Steering components will have to be ruggedized to withstand short pulse duration, high G-load shock
- **Target Tracking / Beam Steering Interface**
  - Ability to track targets and steer laser beam to target in real-time / near real-time



Summary & Path Forward

- **SAW&FC Project Established to Address Accurate Range Determination to Moving Targets in an Unsupported Firing Position**
  - Four (4) year effort to mature component technologies of laser beam steering and target tracking from TRL 4 to TRL 6
  - Two contracts awarded for nine (9) month Phase I effort
  - Down-select to single contractor for Phase II and Phase III integration and fabrication of demonstrator unit
- **Component Technologies to Transition to Program Managers for Insertion into Legacy and Developmental Optical Sighting Systems**
  - Transition to PM in FY16

Path Forward?

- *We are getting answers from industry, academia and government*
- *Demonstration program components technology is maturing*
- *Take best component technology and start integrating onto weapons platform to support multiple missions!!*