US ARMY RDECOM

U.S. Army Research, Development and Engineering Command

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

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ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Advanced Fire Control Technology for Small Arms

Eric R. Beckel, Ph.D.
US ARMY ARDEC
Joint Service Small Arms Program Office(JSSAP)
RDAR-EIJ
eric.beckel@us.army.mil

Joint Armaments Conference, Exhibition and Firing Demonstration

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Agenda

- *Introduction*
- *Advanced Fire Control Technology for Small Arms ATO*
- *Technical Approach (Metrics & Objectives)*
- *Project Portfolio*
- *Industry Status*
- *Industry Results*
- *Enabling Technology Status*
- *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*
  - Advanced Fire Control for Small Arms ATO 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

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Advanced Fire Control Technology for Small Arms (ATO)

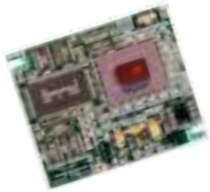
Purpose

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

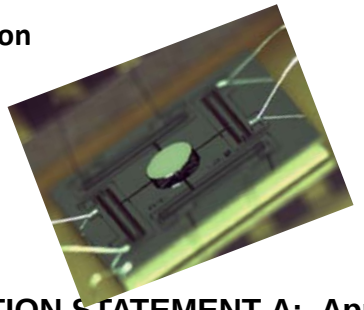
Challenges

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

How do we solve this problem



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



Payoff

- TRL 4 (Breadboard) component technologies integrated to establish that they will work together
- Component technologies demonstrate pathway for system development

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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 2 End: TRL 4
Missed Moving Targets	60%	20%	<20%	Start: TRL 2 End: TRL 4
Shared Power Weight Reduction	Multiple Batteries and Cables	Reduce Weight to One Battery	Reduce Weight to One Battery	Start: TRL 2 End: TRL 5

Measure	Baseline/ Current Metric	Program Objective	Army Objective	Technology Readiness Level
Volume Reduction	Extrapolate From Current Capability	Reduce by 20%	Reduce >20%	Start: TRL 2 End: TRL 5
Power Distribution/ Sourcing	Multiple Batteries and Cables	Remove Cables/Reduce Battery Load	Advanced Power Management/ Distribution	Start: TRL 2 End: TRL 5
Energy Recovery/ Harvesting	None	Reduce Power Cost by 5%	Reduce Power Cost >20%	Start: TRL 2 End: TRL 4

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Project Portfolio

Project Name	Technology Partner	Metrics		
		1	2	3
Laser Steering and Automated Target Tracking	L-3 Brashear	X	X	X
Multi-Spectral Sensor System	Stevens Institute of Tech	X	X	X
Target Tracking Laser Range Finder for Small Arms TA/FC	Intelligent Automation, Inc.	X	X	
Covert RF Sensor for Location and Tracking of Defiladed Human Targets	Penn State University	X	X	
Advanced Fire Control Power and Information Management	AAI			X
Optical Fiber Based Barrel Reference Sensor	Oak Ridge NL	X	X	
Adaptive Optical Zoom for Combat Rifles	Sandia NL	X	X	
MicroSight Technology	Idaho NL		X	
Small Arms Electrical Energy Harvesting	ARDEC			X
Concept & Numerically Modeling for Energy Harvesting	Los Alamos NL			X

RBDP Follow-on Funding for FY11

Metrics (Advanced Fire Control ATO)	
1	Unsupported Range Determination
2	Missed moving targets
3	Shared Power Weight reduction

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Industry Status

➢ Stevens Institute of Technology

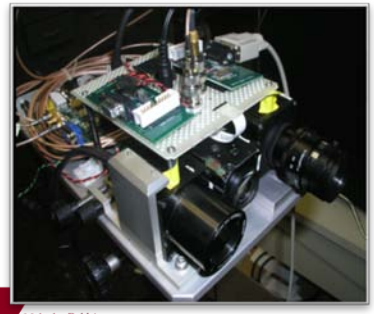
- **Project Title:** "A Standalone/Networked, Compact, Low Power, Image-fused Multi-Spectrum Sensor System for Target Acquisition, Tracking and Fire Control"
- **Status:** Phase II in-process; optical fusion and stabilization achieved; advanced target tracking algorithms being optimized (working to TRL 4)

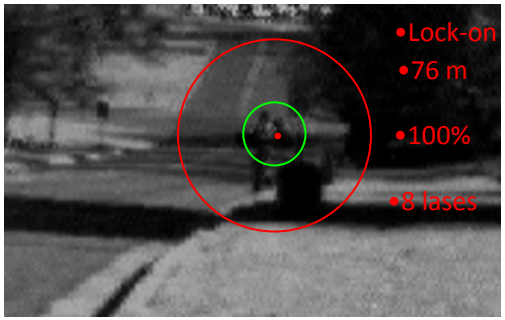
➢ L-3 Brashear

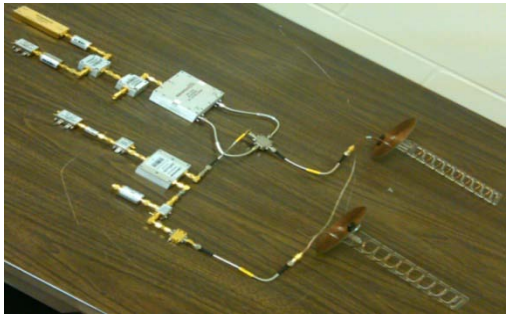
- **Project Title:** "Steering and Automated Target Tracking"
- **Status:** Phase II completed; beam steering technology selected; optical, electrical and mechanical design completed; TRL 3 achieved; Phase III initiated (working to TRL 4)

➢ Penn State University

- **Project Title:** "Covert RF Sensor"
- **Status:** Components received for microwave and millimeter-wave systems build; preliminary study of human activity characterization using Doppler radar completed (working to TRL 3)







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Industry Status

- **Intelligent Automation, Inc. (IAI)**
  - **Project Title:** "Automated Target Tracking Laser Range Finder for Small Arms TA/FC"
  - **Status:** Integration of enhanced beam steering mechanisms completed; development of target detection and tracking leveraging EO/IR completed; system demonstrated to meet TRL 4; FY11 follow-on effort initiated to robust beam steering mechanism and target tracking algorithms
- **AAI Corp.**
  - **Project Title:** "Power and Information Management System"
  - **Status:** FY10 award; developed robust ancillary power device power requirement matrix; performed power harvesting technology trade-off study; identified potential methods for reducing SWaP for small arms ancillary devices; TRL 2 achieved

Industry Status

Fire Control Technology Areas Addressed

- Multi-wavelength image fusion technologies
- Thermal (LWIR) image acquisition technologies
- Transmit/receive optics for DVO, night vision and range-finding
- RF sensor technology for through-wall sensing
- Integrated technologies for laser rangefinder, micro-display, thermal imager and control electronics
- Software target recognition, software trackers
- Laser transmitter, laser beam steering, laser receiver, laser signal processing, advanced optics
- Power management
- Power harvesting
- Minimization of size, weight and power consumption parameters

Industry Results

Sensor Fusion
(Stevens Institute of Technology/SRI International)

Enhanced Target Tracking Algorithms
(Intelligent Automation, Inc.)

Enabling Technology Status

- **Oak Ridge National Lab**
  - **Project Title: “**Optical Fiber-Based Barrel Reference Sensor”
  - **Status:** Successful laboratory demonstration at bench top level; successful qualitative test firing on 0.30 caliber system; successful qualitative test firing on 0.50 caliber system

- **Sandia National Lab**
  - **Project Title: “**Adaptive Optical Zoom for Combat Rifles”
  - **Status:** Developed novel actuator for faster switching speeds; system-level passive athermalization in progress

- **Idaho National Lab**
  - **Project Title: “**MicroSight Lens Technology”
  - **Status:** Produced and delivered three (3) distinct lens designs; conducted quantified evaluations of MicroSight use; significant increase in accuracy for vast majority of users

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Summary & Path Forward

- **ATO-R to conclude at end of FY11**
  - Final project report to be published on National Small Arms Center (NSAC) website for center members
    - Promote future collaboration efforts
    - Available early June 2011
- **Best-of-breed technologies to transition to FY12 - FY15 Small Arms Fire Control Component Integration and Evaluation Demonstration Program**
  - Mature technologies from TRL 4 to TRL 6
  - Integrate component technologies into system level technology
  - Open and fair competition for contract awards to be administered through the NSAC

Path Forward?

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