



U.S. Army Research, Development and Engineering Command



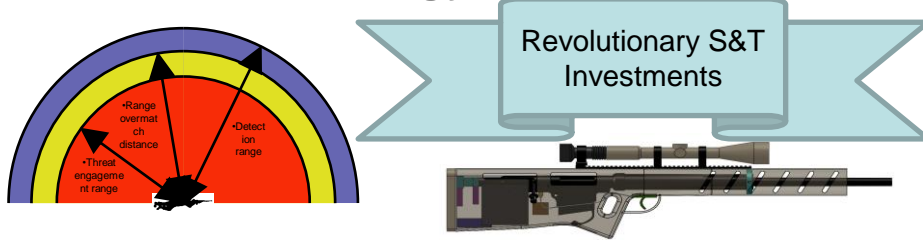
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**JSSAP Science & Technology Program Update
NDIA 2014 Joint Armaments Forum, Exhibition & Technology Demonstration
13 May 2014**



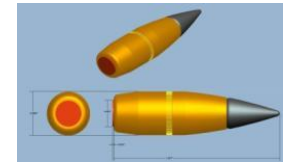
- ***FY 12- 15 Current Technical Approach***
- ***Progress To Date On JSSAP Programs***
- ***FY 16- 20 Technical Approach***
- ***FY 15 Small Arms & Accessories (SAA) Technology Areas***
- ***Deep Future Investments***
- ***Summary***

6.2 - Advanced Small Unit Small Arms Technology (ASUSAT)



Small Arms Capability Gap Linkage: Breaching and Threat Engagement

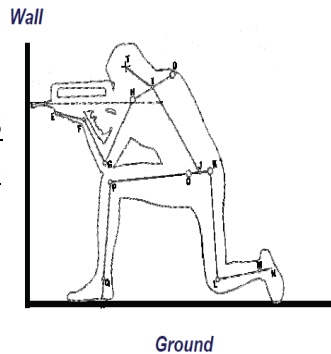
6.2 Small Arms Material Process Technology (SAM&PT)



Small Arms Capability Gap Linkage: Weapon Detection and Operational and Maintenance Issues

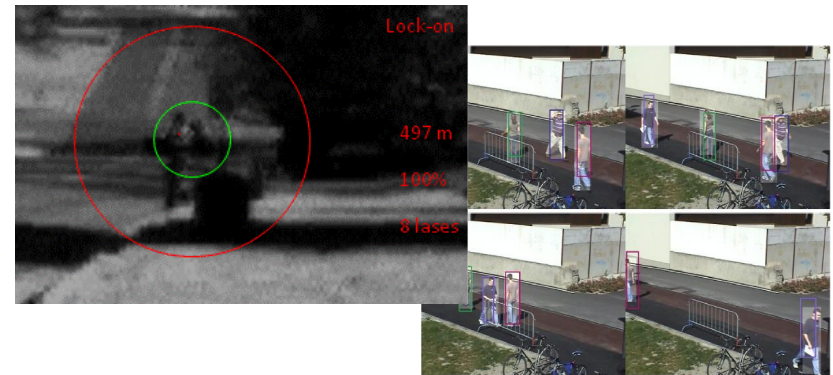
6.3 - Small Arms Grenade Munitions (SAGM)

Phase I: "Small Fuze" – Complete
Phase II: "Smart Fuze" contracts Awarded to both contractors
Phase III: "Integration" – Contract to be awarded Nov 13



Small Arms Capability Gap Linkage: Threat Engagement

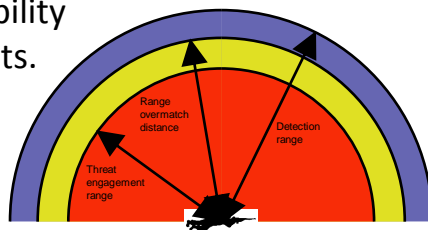
6.3 - Small Arms Weapons & Fire Control (SAW&FC)



Small Arms Capability Gap Linkage: Target Acquisition

Purpose:

Identify and advance technologies leading to the ability to improve Small Unit Level effectiveness. Utilize new small arms technological concepts to improve range overmatch capability against like-sized threat elements.



Payoff:

- Double maximum effective range of Door Breaching Munitions
- Double the maximum effective range for .50 Caliber Ammunition
- Increased Probability of Hit and Hard target Penetration
- Double Probability of Hit for rifles from 0-600m



How do we solve this problem:

Investments into non traditional approaches that :

- Combine advanced technologies
- Double the maximum effective range of current weapons and increase force protection



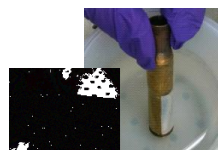
Current Efforts:

- Active Stabilization of Firearms by Optical Target Tracking
 - Phase II in progress
- 40mm Door Breaching Munitions (40-DBM)
 - Phase I completed
- .50 Caliber Long Rod Fin Stabilized Spin Decoupling Discarding Munitions
 - Transitioned
- Ammunition Improvements Program
 - Phase II in progress
- Super High Efficiency Re-Energized Ordnance
 - Phase I completed

Purpose:

Assess and develop State-of-the-Art material and process technologies to enhance the operability & maintainability of small arms weapons and to reduce weapon detection (sound and visual) ; for current and future war-fighters.

Small Arms Capability Gap Linkage: Weapon Detection and Operational and Maintenance Issues

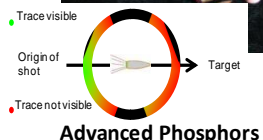
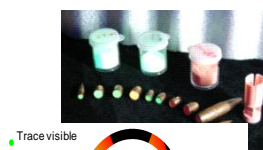


Super-Hydrophobic Surf. Treatment



Lubricious Surf. Treatment
ASL-DLC" (PECVD)

Suppressor Surf. Treatment "TBC"



M240/M249 Suppressor



Lubricious Surf. Treatment
"MER" –"PTA"

Payoff:

- Reduced weapon detection recognition to enhance survivability of the warfighter, lower barrel rise and dramatically increase accuracy.
- Decreased O&M for weapons leading to increased MRBF, weapon effectiveness and Increased Operational Availability (A_o)

Current Efforts:

Lubricious Surface Treatment (Durable Solid Lubricant)

- Completed Subscale Test Program
- Received PM-SW Endorsement

Superhydrophobic Surface Treatment (Anti Corrosion)

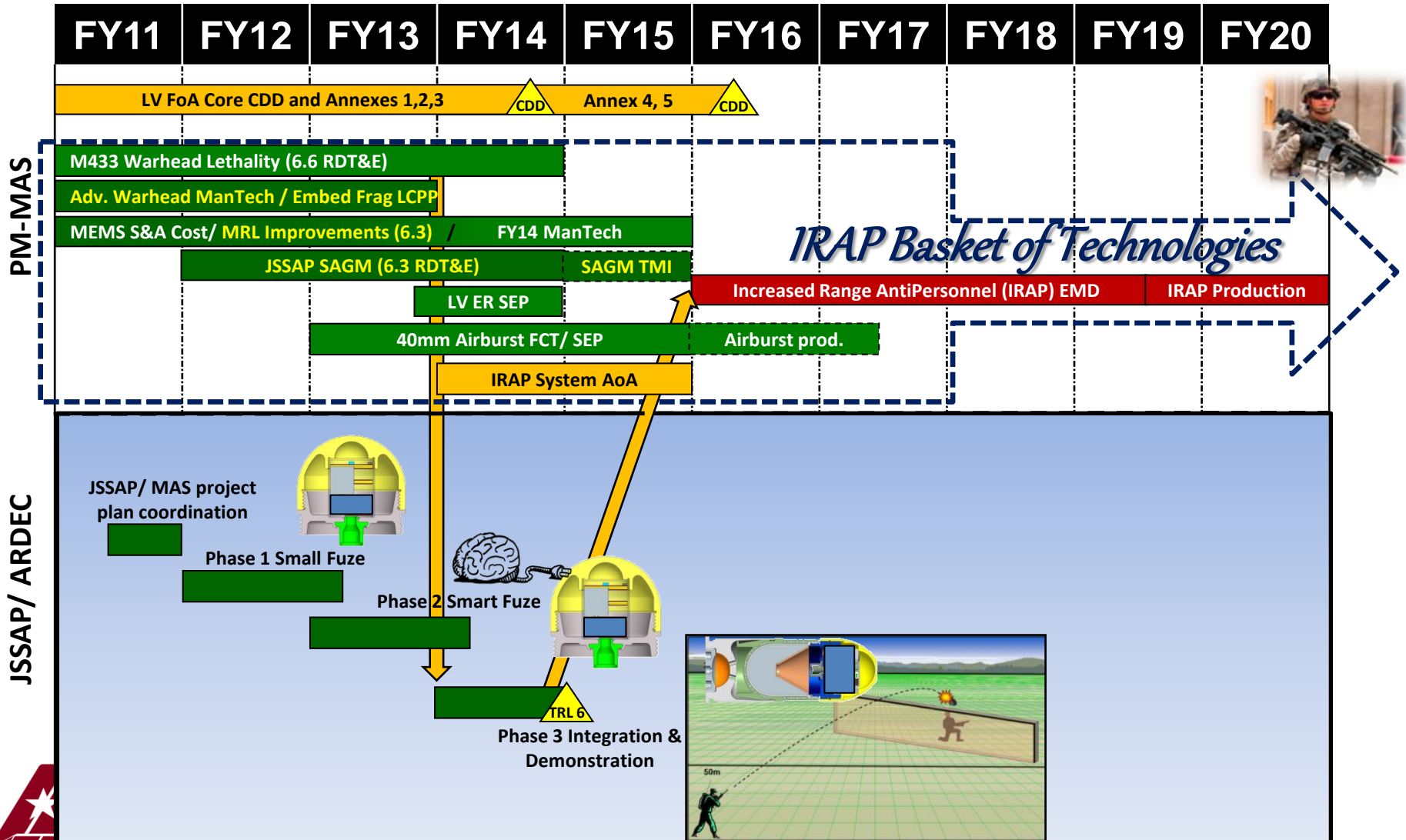
- Realigned Customer (Navy) Objective(s)
- Awarded Phase I Contract

M240 and M249 Suppressor Technology

- Interoperable M240/M249 kit
- Performed Prototype Testing to inform SASR CDD

One Way Luminescence (OWL) Full Day/Night Capability

- Awarded Phase III contract
- Completed PM-MAS Transition Agreement & developed Risk Mitigation Strategy





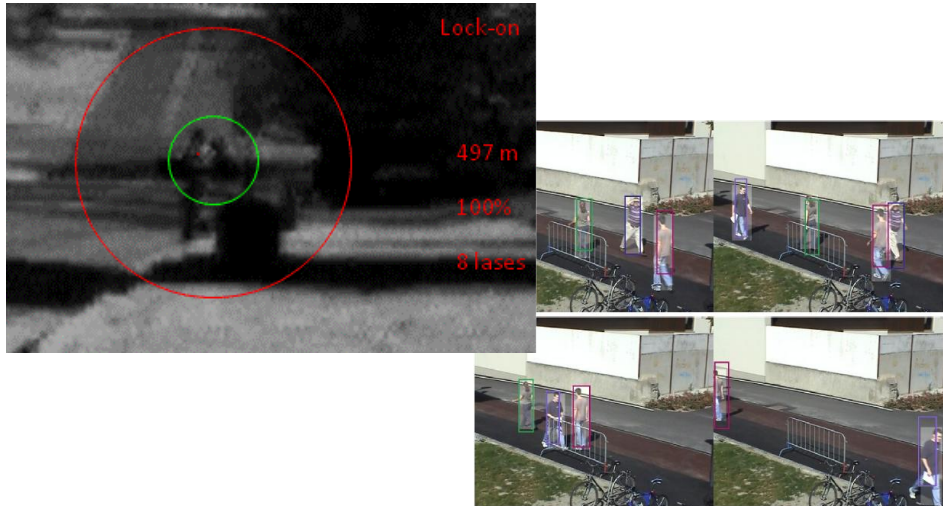
SAGM ATK 35 - Rear.wmv



SAGM 14 Tgt Tight.wmv



Small Arms Capability Gap Linkage: Target Acquisition



Measure	Current	Effort Obj	Army Obj	TRL
Unsupported Range Determination	4 - 15% of range	±2 m (targets in cover)	±2 m (targets in cover)	Start 4 End 6
Missed Moving Targets	60%	20%	<20%	Start 4 End 6

Awarded Efforts:

- Intelligent Automation, Inc – Phase II in progress



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.

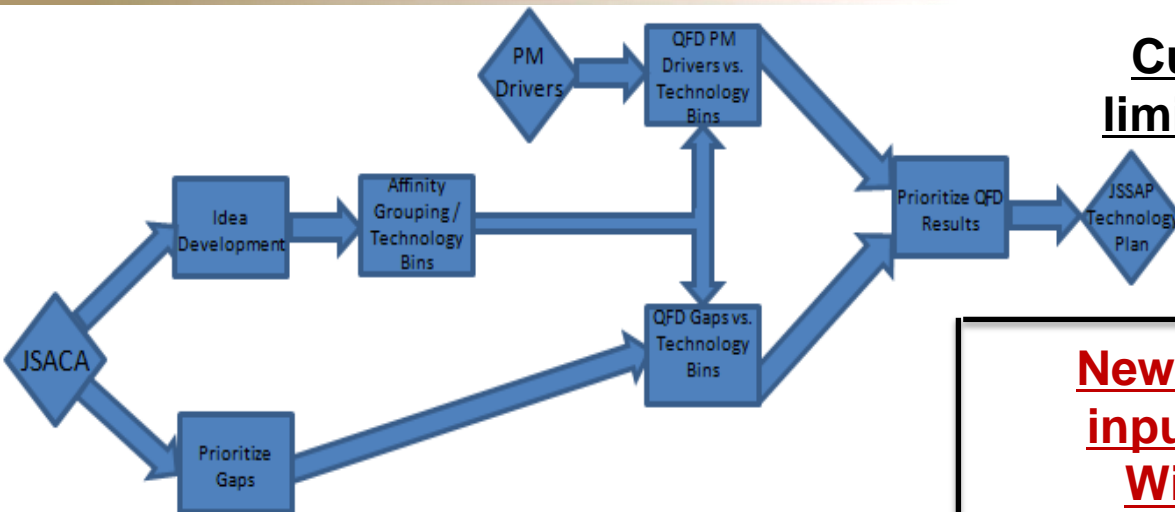
Results/Products:

Dynamic target tracking & range finding components that can be integrated into current inventory optics and Fire Control Systems for both KE and Grenade Systems

Payoff:

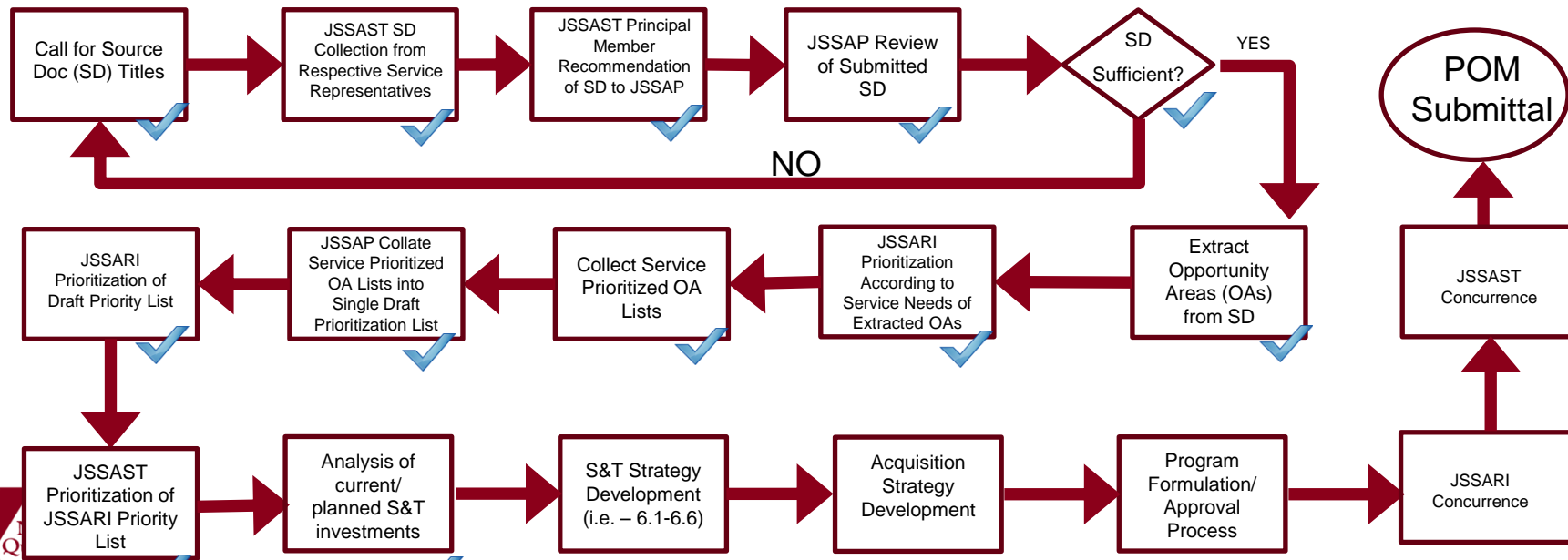
- 100% percent increase in hitting moving targets with accurate range determination of +/- 2m up to 1200m from the Soldier addressing small arms capability gaps for acquiring targets, determining range to target, and engaging threats in open and defilade.
- Transition to PM SW, PM SSL and/or PM IW (USMC)

- **Small Arms Weapons and Fire Control (SAWFC) is a 4-year Demonstration Project (2012-2015)**
 - Three Phase Approach:
 - Phase I - Mature Target Tracking Algorithm Software and Beam Steering Hardware Components to TRL 5
 - Phase II - Improve the Target Tracking Algorithm Software Performance and Integration of the Software and Hardware into a Demonstrator Unit
 - Phase III - Optimization
 - Phase I completed in February 2013 with a down-selection taking place and the Phase II Contract being awarded to Intelligent Automation Inc.
 - Phase IIA completed December 2013 with a re-evaluation of the Target Tracking Software to verify performance.
 - Phase IIB began February 2014 to further optimize the Target Tracking Software and begin porting the software to the intended embedded platform. This phase will be completed 31 October 2014.
 - Phase III is scheduled to begin in November 2014 for optimization, redesign (if needed) and TRL 6 testing and assessment



Current LSS process involved limited inputs to develop Project Portfolio, not Repeatable

New LSS process involves multiple inputs to develop Project Portfolio, Will be updated in 2 year cycles



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Rank	JSSAST Approved Top 10 Opportunity Areas
1	Engage Threat Personnel in Defilade from 15 to 500m
2	Engage Threat Personnel with Small Arms Fire from 0 to 50m
3	Engage Threats with Small Arms Volume Fire from 601 to 1200m
4	Engage Threat Personnel with Small Arms Fire from 51 to 200m
5	Engage Threats with Small Arms Volume Fire from 1201 to 2400m
6	Positively Identify Friendly Forces
7	Avoid Detection Caused by Weapon Signature by Reducing Nonfiring Weapon Profile Signature
8	Operate in Climate Extremes Ranging from Cold Weather to Tropical to Desert Environments
9	Operate and Maintain Weapons at an Operational Availability of 98% through the Range of Specific Conditions
10	Weapon System reliability $\geq .94$ Probability of No Class I or II Failures and $\geq .97$ Probability of No Class III Failures per OMS/MP



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FY15 Small Arms & Accessories (SAA) Technology Area

*Helping the Warfighter Maintain
Technological Superiority on the Battlefield*

Originally presented at the NAC GM Meeting
5 March 2014



SAA Vision and Mission

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Small Arms & Accessories

Vision: The continual development and demonstration of the technologies that will provide our Warfighters with enduring overmatch capabilities in all of our current and future small arms systems.

Mission: For Small Arms & Accessories (SAA), the objective is the research, development, and demonstration of technology for future lethal and non-lethal small arms weapon systems, accessories, and applications. Initiatives in the small arms domain will consist of all individual and crew-served related weapons (whether mounted or dismounted), ammunition, target acquisition, fire control and other ancillary devices as well as shoulder-fired systems and munitions. New technologies in this area will also include improved material applications, manufacturing techniques, and modeling and simulation methodologies relevant to the systems and sub-systems cited above as well as paradigm-shifting technologies supporting the close combat mission in traditional small arms applications. The training and simulation of small arms and accessories is imperative as well to improve shooter performance. Technologies will include live, virtual, and constructive training/ simulations along with developments of instructional approaches to increase shooter efficiency and capability.

Customer base:

JSSAP, ARDEC, CERDEC-NVL, PEO Ammo, PEO Soldier, PEO SOF Warrior, PEO STRI, Joint Non-Lethal Weapons Program/Directorate, Defense Threat Reduction Agency, Marine Corps Combat Development Center, Navy Crane, Office of Naval Research, Army Research Lab, Dept of Homeland Security, and Dept of Justice.

Requirements driven by Joint Service Small Arms Technology Plans and Service Lethality Roadmaps.



SAA FY14 Activities

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- **DOTC “out-of-cycle” Request for Ordnance Technology Initiatives (ROTI)**

- Opened: 16 SEP 2013; Closed: 5 NOV 2013
- Technical Areas (contract awards are in progress):
 - **One-Way Luminescence (OWL)**
 - 2 proposals received; 1 proposal to be awarded / 1 proposal placed in technology basket
 - **Non-Lethal 1 Assessment: Variable-Velocity man-portable weapon systems**
 - 3 proposals received; 2 proposals to be awarded / 1 proposal placed in technology basket
 - **Non-Lethal 2 Assessment: High Power Microwave Sub-systems**
 - 3 proposals received; 3 proposals to be awarded

- **SAA Requirements Collaboration and Review**

- 3-4 DEC 2013, Fort Belvoir, VA
- Annual Tech Plan Kick-off Agenda
 - Customer Briefs
 - Futures Brief/Emerging Results
 - Sub-Objectives Development
 - DOTC Education– How to navigate thru the DOTC process
 - Customer, Industry one-on-one exchanges

- **Active SAA Contracts**

- **Battelle:** 40mm Door Breaching Munition, Deep Future of Small Arms Study \$0.77M
- **Rocky Mountain Scientific Lab:** Active Stabilization of Firearms by Optical Target Tracking \$0.47M
- **Knight’s Armament:** Super High Efficiency Re-Energized Ordnance / Weapon Shock/Recoil Fixture \$0.92M
- **ATK:** 40mm Low-Velocity Airbursting Grenade (SAGM) \$3.2M
- **Intelligent Automation, Inc:** Integrated Small Arms Target Tracking \$2.9M



SAA FY15 Focus Areas

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FY15 Focus Areas

- **Fire Control, Optics, Electro-Optics, Enablers**
- **Modeling & Analysis, Technology Studies**
- **Weapons Technologies**
- **Effects, Lethality, & Utility**
- **Materials & Processes**
- **Smart Munitions**
- **Warheads & Energetics**
- **New Concepts & Applications**
- **Non-Lethal**
- **Training & Simulations**



SAA FY15 Customer Breakout

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- **Approximately \$10.5M* and 37 requirements**
- **% of Requirements by Customer**
 - **48% Joint Service Small Arms Program (JSSAP)**
 - **34% PM Soldier Weapons (PM SW)**
 - **9% PM Maneuver Ammunition Systems (PM MAS)**
 - **6% ARDEC**
 - **3% Joint Non-Lethal Weapons Directorate (JNLWD)**
- **% of Funding by Confidence Level (CL)**
 - **CL-1 (90%): 4% (\$0.5M)**
 - **CL-2 (50%): 85% (\$8.9M)**
 - **CL-3 (10%): 11% (\$1.1M)**

**Note: These are only estimates and actual funding allocations may vary significantly.*



SAA “Takeaways”

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Small Arms & Accessories (SAA Government POCs:)

- Mike Tauber, SAA Technology Area Lead
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- Terence F. Rice, SAA Technology Area Co-Lead
terence.f.rice.civ@mail.mil, 973-724-9714
- Dr. Barton H. Halpern, SAA Technical Board Chair
barton.h.halpern.civ@mail.mil, 973-724-6009
- Dr. Stephen Small, SAA Science Technology Engineering Mathematics (STEM) Liaison, stephen.c.small.civ@mail.mil, 973-724-7043

DOTC Integration Benefits

- SAA Technology Area would be the “point of entry” for Small Arms S&T
- Economies of scale (based on contract volume, acquisition by large entity)
- Contract award time after proposal(s) is/are selected (~ 45 days)

Approach

- Initial focus on most recent study
 - **Envisioning the Deep Future of Small Arms 2022 – 2042**
 - Engage SMEs, generate robust system statements
 - Utility rating and applicability assessment
 - Engineering/feasibility evaluation
 - Identify technical hurdles and limiting / pacing technologies.
- Later review of previous studies
 - Over 15 references from 1986 onward
 - Other S&T concepts to evaluate
 - Apply same engineering/feasibility evaluation approach

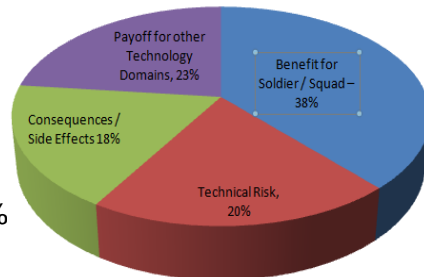
Concept Evaluation

- Define applicable performance characteristics and metrics
 - Which characteristics and metrics for consistent comparisons? (i.e. Weight, size, energy efficiency, other?)
- Define **utility and applicability rating** methodology from Deep Futures report
 - How to consistently and quantitatively rate performance characteristics and metrics?
- Apply utility and applicability rating method
- Define engineering assessment/evaluation factors
 - Based on the cost and time associated with developing the limiting technologies

Rating Methodology

Utility Rating

- Based on Weighted Criteria
- Each Scored 1 - 100
 - Benefit for Soldier / Squad, 38%
 - Technical Risk, 20%
 - Consequences / Side Effects, 18%
 - Payoff for other Technology Domains, 23%

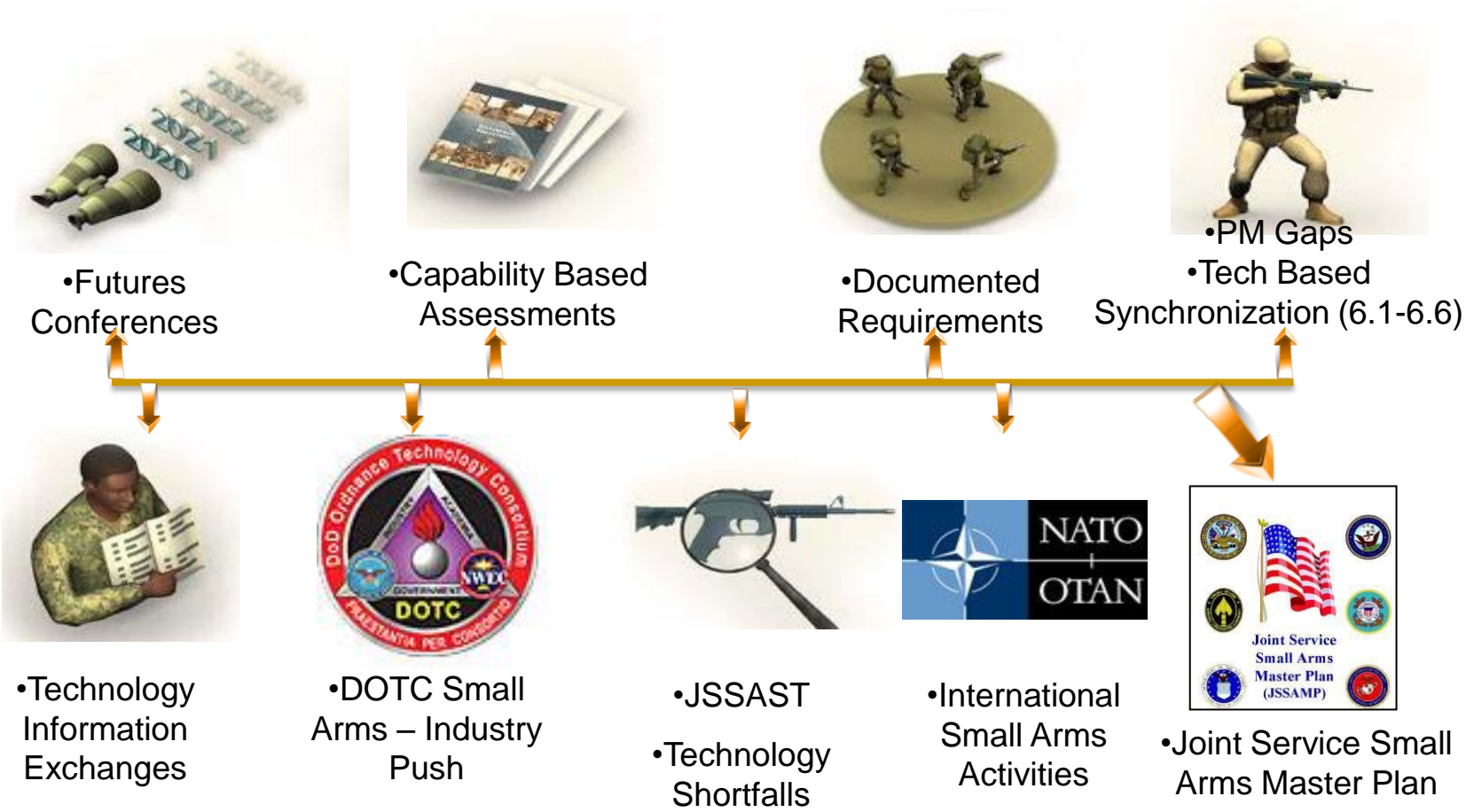


Applicability Rating

- Based on 4 Future Scenarios
 - Cold War II
 - Global Footprint
 - Turning Inward
 - Standing in a Tinderbox
- Presented using the deviation from the mean
 - Scored 1-7 (1= Low, 7 = High)

Down Selection

- Evaluate all Technologies / Ideas in the Current Futures Report
- List all Technologies / Ideas in Past Reports
 - Remove Redundant / Obsolete / Fielded Technologies
 - Rank order remainder
 - Deep Future Ranking- High Utility, Applicability
 - SME Input - Cost and time associated with developing the limiting technologies
- Final list of review technologies will be based on this ranking and input from JSSAP



JSSAP is providing Intensive management of the DoD small arms tech base

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