Chris Gandy
US ARMY ARDEC
Joint Service Small Arms Program Office (JSSAP)
RDAR-EIJ
chris.gandy@us.army.mil

Advanced Lethal Armaments for Small Arms

Joint Armaments Conference, Exhibition and Firing Demonstration
23 May 2011
Purpose: Demonstrate component technologies that mitigate small arms capability gaps

Goal: TRL 4 (Demonstrate in Lab Environment)

Objective: Enhance effects on target

Primary: Deliver Effects On Target
Secondary: Mitigate Recoil
Tertiary: Program Terminal Effects Prior To Launch

Timeline: 2008-2011

Innovators: Government, Academia, and Industry

Payoff: When fully integrated in current and future systems, these components will act as force multipliers for the war-fighter and provide enhanced effects on target
## Technical Approach
(Metrics and Objectives)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Current</th>
<th>Threshold</th>
<th>Objective</th>
<th>TRL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Fragmenting Munitions - P(I)</td>
<td>Pi/Lethal Area</td>
<td>25% over current systems</td>
<td>&gt; 25% over current systems</td>
<td>Start: 2 End: 4</td>
</tr>
<tr>
<td>Control of Directionality of Fragments</td>
<td>None</td>
<td>Angle of Fall to Gravity</td>
<td>Optimize on Target</td>
<td>Start: 2 End: 4</td>
</tr>
<tr>
<td>Reduced Recoil / Weight</td>
<td>Extrapolate from current capability</td>
<td>Reduced by 20%</td>
<td>Greater than 20%</td>
<td>Start: 2 End: 4</td>
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<tr>
<td>Combined Lethal &amp; Non-Lethal Warhead</td>
<td>None</td>
<td>Less Lethal to Lethal</td>
<td>Optimize on Target</td>
<td>Start: 2 End: 4</td>
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<tr>
<td>Project</td>
<td>Innovator</td>
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<td>---------------------------------------------</td>
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<tr>
<td>40mm Precision Grenade</td>
<td>Georgia Tech Research Institute</td>
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<tr>
<td>40mm Directed Frag Munition</td>
<td>Battelle</td>
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<td>MEMS Set Back Generator</td>
<td>ARDEC/Adelphi</td>
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<td>Optically Fused Air-Burst Munition</td>
<td>Metal Storm</td>
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<td>40mm Combined Lethal/Non Lethal</td>
<td>Dindl Firearms Manufacturing Inc</td>
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<td>40mm Combined Lethal/Non Lethal</td>
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<td>Barrel Cooling</td>
<td>Oak Ridge National Lab</td>
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<td>Course Corrected Projectile</td>
<td>AAI</td>
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<tr>
<td>40mm Dynamically Reshaped Warhead</td>
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<tr>
<td>Enhanced Fragmentation Munition</td>
<td>AAI</td>
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<tr>
<td>Controlled Fragmentation by Laser Scoring</td>
<td>Los Alamos National Lab</td>
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<td>Advanced Warhead Effort</td>
<td>ARDEC</td>
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<td>FLUENT Gas Modeling</td>
<td>ARDEC</td>
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<td>40mm Selectable Warhead</td>
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<td>Cal .50 Barrel Stabilizer</td>
<td>Idaho National Labs</td>
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<td>Adv Recoil Attenuation</td>
<td>Knights Armament Company</td>
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<td>Recoil Reduction</td>
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<td>Cal .50 Limited Range Projectile</td>
<td>ARDEC</td>
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</table>
Objective
Improve M433 shape charge and fragmentation

Concept
Optimize shape charge and sidewall fragmentation

Progress: TRL 3

Objective
Combine lethal & non lethal capability into a single cartridge selectable at launch

Concept
12 Gage lethal/ non lethal cartridge

Progress: TRL 3

Los Alamos National Lab

Objective
Demonstrate controlled fragmentation by laser scoring

Concept
Improve fragmentation via metallurgical and mechanical fracture points

Progress: TRL 3
**Objective**
Demonstrate directional fragmentation & advanced fuzing

**Concept**
Initiate 40mm grenade via proximity sensor

**Progress:** TRL 4

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**Objective**
Deliver more fragments on target

**Concept**
Directed fragmentation

**Progress:** TRL 3
**Objective**
Improve 40mm P(I)

**Concept**
Dynamically reshape warhead before detonation

**Progress:** TRL 4

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**Objective**
Rapidly cool weapon barrels

**Concept**
Wrap barrels in graphite foam

**Progress:** TRL 4
- 2x Increase in Thermal Conductivity
- Technology Transitioned to Rapid Equipping Force & PM-SW

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**Dindl Firearms Manufacturing, Inc.**

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**Oak Ridge National Lab**
Georgia Tech Research Institute

Objective
Improve P(I)

Concept
Reduce delivery error

Progress: TRL 2

Knight’s Armament Company

Objectives
• Improve Recoil Measurement Techniques
• Assess Recoil Mitigating Devices

Concept
Design weapon fixture to assess recoil using alternate metrics

Progress: TRL 4
**Objectives**
Reduce Cal .50 Dispersion by 50%  

**Concept**
Gun Barrel Stabilizer

**Progress:** TRL 4 by 2012
- MEMS Setback Generator ➔ STAR-ATO
- Barrel Cooling ➔ Rapid Equipping Force & PM SW
- FLUENT Gas Modeling ➔ Enabling technology for ARDEC & SOCOM and DOE (Oak Ridge National Lab)
Summary & Path Forward

- **ATO-R to conclude at end of FY11**
  Final report to be published on National Small Arms Center (NSAC) website & DTIC
  - Promote future collaboration efforts
  - Available Summer of 2011

- **Best-of-breed technologies to transition to FY12 - FY15 Small Arms Grenade Munitions Integration and Evaluation Demonstration Program**
  - Mature technologies from TRL 3 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!*