NIST Body Armor Research Initiatives

NIJ Body Armor Manufacturer’s Workshop
Annapolis, Maryland
June 20, 2013
Materials Research

Materials

• high-strength fibers: PPTA, UHMWPE, PBO, co-polymer aramids
• advanced fiber technologies: shear-thickening fluids, CNTs

Interests

• relationship between mechanical properties and performance potential
• artificial aging
• degradation mechanisms and damage evolution
• failure mechanisms
• material properties investigations of fielded armor

Methods

• spectroscopy, microscopy, single fiber and yarn quasi-static and high-rate mechanical properties
BALLISTIC-RESISTANT BODY ARMOR

Measurements
• backface signature (BFS) comparisons through NVLAP
• estimation of BFS measurement uncertainty
• development of a reference chronograph

Backing material
• clay rheology, thermal and mechanical properties
• modeling dynamic deformation and thermal behavior of Roma Plastilina #1 and other clays

Potentially new methods/requirements for assessing armor
• Blunt Trauma Torso Rig (BTTR)
• studies on armor size effects
• study unsupported and/or shaped armor regions

Emerging threats
STAB-RESISTANT BODY ARMOR

Measurements
• instrumented drop mass dev’t.
• development of proficiency test (spikes) with NVLAP

Backing material
• dynamic and quasi-static characterization of foam composite → improved specifications for materials
• development of options and refinement of female bust surrogate for consideration by STC

Potentially new methods/requirements for assessing armor
• study unsupported and/or shaped armor regions

Standard "threats"
• spike comparison studies
BODY ARMOR METROLOGY
DISSEMINATION STRATEGY

• Author technical documents, published by NIST, external peer-reviewed journals, and conference proceedings. Documents may include authors outside of NIST who contribute to the work.

• Communicate with standards development organizations, DoD, NIJ, Department of State, and other stakeholders to ensure they are aware of research.

• Transition work products to standards development organizations by leading and participating in various subcommittees and working groups.
ASTM INTERNATIONAL

Types of standards
- Terminology
- Practice
- Guide
- Classification
- Test Method
- Specification

Various committees
- F23 Protective Clothing and Equipment
  - F23.20 Physical
  - F23.30 Chemicals
  - F23.40 Biological
  - F23.50 Certification and PPE Interoperability
  - F23.60 Human Factors
  - F23.80 Flame and Thermal
- E54 Homeland Security Applications
  - E54.04 Personal Protective Equipment (PPE)
- D13 Textiles
  - D13.19 Industrial Fibers and Metallic Reinforcements
## Potential Subcommittee Membership (not all-inclusive)

<table>
<thead>
<tr>
<th>General Interest</th>
<th>Producers</th>
<th>Users</th>
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<tr>
<td>• National Institute of Standards and Technology</td>
<td>• Ballistic-resistant material manufacturers</td>
<td>• Department of Defense:</td>
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<tr>
<td>• National Institute of Justice</td>
<td>○ fiber producers</td>
<td>○ US Army, PEO-Soldier</td>
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<td>• Department of Defense:</td>
<td>○ textile manufacturers</td>
<td>○ Aberdeen Test Center</td>
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<td>○ US Army Natick Soldier RD&amp;E Center</td>
<td>○ suppliers of materials used in products, such as shields, car door</td>
<td>• Department of State</td>
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<td>○ US Army Research Laboratory</td>
<td>panels</td>
<td>• Federal officers (Federal Bureau of Prisons, Federal Bureau of</td>
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<td>• Universities and private researchers</td>
<td>• Ballistic-resistant armor manufacturers</td>
<td>Investigation, US Marshals Service, Secret Service, Federal</td>
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<td>• Commercial testing laboratories</td>
<td>Protective Service, US Park Police)</td>
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<pre><code>                                                                                                     |                                                                           | • State and Local law enforcement and corrections                  |
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Questions

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