Project Manager Soldier Equipment Briefing

on the

May 2006 Evaluation of
Pinnacle Armor SOV 3000 “Dragon Skin”
Executive Summary

Background

• Project Manager, Soldier Equipment (PM SEQ) conducted testing of Pinnacle Armor’s SOV 300™ Body Armor Vest (Dragon Skin) from 16 - 19 May at H. P. White labs near APG. (HP White is the National Institute of Justice certified ballistics lab used to test Army Body Armor)

• Since the inception of the IBA program in 1999, Pinnacle Armor has never responded to a full and open competition.

• Test was conducted using Enhanced Small Arms Protective Inserts (ESAPI) and Enhanced Side Ballistic Inserts (ESBI) First Article Test protocols.

• Prior to fielding, ALL ESAPI designs must pass a robust FAT protocol under a variety of environmental conditions including high (+160°F) and low (-60°F) temperature, diesel fuel, oil, and saltwater immersion, and a 14 hour temperature cycle from -25°F to +120°F.
Executive Summary

Background (continued)

• Pinnacle SOV 3000 level IV Dragon Skin suffered catastrophic failure of the ceramic disc containment grid adhesive at -60°F, 120°F and 160°F.
  • SOV 3000 design is sensitive to extreme temperatures and failed to maintain ballistic integrity at temperatures below summer ambient in OIF.
  • This failure mode caused discs to delaminate and accumulate in the lower portion of the armor panel, thus resulting in exposing the spine, vital organs, and critical blood vessels to lesser ballistic threats.

• Pinnacle SOV 3000 level IV Dragon Skin vests suffered 13 first or second shot complete penetrations, failing 4 of 8 initial subtests with ESAPI threat baseline 7.62 x 63mm APM2 Armor Piercing (AP) ammunition.

Bottom Line up Front:
Dragon skin does not meet required protection standards
Step 1: Configuration Analysis

- Receipt of vests
  - Establish initial accountability, storage, and security
- Conduct Configuration Analysis:
  - Label
  - Weight
  - Dimension
  - X-Ray
  - Photograph

Step 2: Ballistic Testing

- Prescribed series of live-fire tests
- Vests tested under varied conditions:
  - Weather extremes
  - Conditioned with oil / fuel
- After durability / drop test
- Record results
Configuration Analysis

Receive delivery of 30 “Dragon Skin” vests.

Identify, tally and label vest:
XL1 - XL10, L1 - L10, M1 - M10

Measure, weigh and photograph vests on scale.

Send vest to storage/appropriate conditioning area.

Analyze, correlate and print all list, measurements, photos and x-rays.

X-ray vests.
Key Findings

- Physical Characteristics
  - Weight
  - Area of Coverage
  - Thickness
  - Ballistic Protection Coverage

- Ballistic Performance
Weight / Coverage

**Interceptor Body Armor**

Size: L

- Weight: 28 lbs
- Thickness: ≤ 1.3 in
- Coverage: 720 in²

**Pinnacle SOV 3000**

Size: XL*

- Weight: 47.5 lbs
- Thickness: 1.7 in - 1.9 in
- Coverage: 743 in²

* Note, due to difference in sizing “Pinnacle SOV 3000” body armor extra large is equivalent to “Interceptor Body Armor” large in size and fit.

For equivalent area of coverage, weight is 46% - 70% heavier.
Ballistic Protection
# Test Flow Chart

## Day 1
- **Ambient Temp**
  - XL
  - APM2, VO

## Day 2
- **Oil**
  - M
  - APM2, VO
- **Diesel**
  - XL
  - APM2, VO
- **Salt Water**
  - L
  - APM2, VO

## Day 3
- **Impact (Drop)**
  - L
  - APM2, VO
- **Low Temp**
  - M
  - APM2, VO
- **High Temp**
  - XL
  - APM2, VO
- **Temp Cycle**
  - L
  - APM2, VO

## Day 4
- **Ambient Temp**
  - XL
  - M855, VO
- **M80, V_{50}**
- **LPS, V_{50}**

### 30 Vests Total
(27 Tested, 3 Control)
### Ambient Temperature

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>XL-01-Front</td>
<td>2d shot, complete penetration</td>
</tr>
<tr>
<td>XL-01-Back</td>
<td>OK</td>
</tr>
<tr>
<td>XL-01-Left side</td>
<td>OK</td>
</tr>
<tr>
<td>XL-01-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

**XL-01 FRONT Before Testing**

**XL-01 FRONT After Testing**
## Salt Water Exposure

### Vest/Panel Results

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-02-Front</td>
<td>OK</td>
</tr>
<tr>
<td>L-02-Back</td>
<td>OK</td>
</tr>
<tr>
<td>L-02-Left side</td>
<td>OK</td>
</tr>
<tr>
<td>L-02-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

- **L-02 FRONT Before Testing**
- **L-02 FRONT After Testing**
Motor Oil Exposure

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-01-Front</td>
<td>2d shot, complete penetration</td>
</tr>
<tr>
<td>M-01-Back</td>
<td>2d shot, complete penetration</td>
</tr>
<tr>
<td>M-01-Left Side</td>
<td>OK</td>
</tr>
<tr>
<td>M-01-01-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

M-01 BACK Before Testing

M-01 BACK After Testing
# Diesel Fuel Exposure

## Results

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>XL-02-Front</td>
<td>1st shot, complete penetration</td>
</tr>
<tr>
<td>XL-02-Back</td>
<td>2nd shot, complete penetration</td>
</tr>
<tr>
<td>XL-02-Left Side</td>
<td>OK</td>
</tr>
<tr>
<td>XL-02-Right Side</td>
<td>1st shot, complete penetration</td>
</tr>
</tbody>
</table>

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**XL-02 FRONT Before Testing**

**XL-02 FRONT After Testing**
## Impact/Drop

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-01-Front</td>
<td>OK</td>
</tr>
<tr>
<td>L-01-Back</td>
<td>OK</td>
</tr>
<tr>
<td><strong>L-01-Left Side</strong></td>
<td><strong>1st shot, complete penetration</strong></td>
</tr>
<tr>
<td>L-01-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

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**Impact (Drop)**

![Large Impact/Drop]

**L-01 Left Side Before Testing**

**L-01 Left Side Post Drop**

**L-01 Left Side After Testing**
Low Temperature (-60°F)

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-02-Front</td>
<td>OK</td>
</tr>
<tr>
<td>M-02-Back</td>
<td>OK</td>
</tr>
<tr>
<td>M-02-Left Side</td>
<td>OK</td>
</tr>
<tr>
<td>M-02-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

M-02 FRONT Before Testing

M-02 FRONT After Testing
# High Temp (160°F)

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>XL-03-Front</td>
<td>1st shot, complete penetration</td>
</tr>
<tr>
<td>XL-03-Back</td>
<td>1st shot, complete penetration</td>
</tr>
<tr>
<td>XL-03-Left Side</td>
<td>1st shot, complete penetration</td>
</tr>
<tr>
<td>XL-03-Right Side</td>
<td>1st shot, complete penetration</td>
</tr>
</tbody>
</table>

**XL-03 FRONT Before Testing**

**XL-03 FRONT After Testing**
# Temperature Cycle

(-25⁰ F to 120⁰ F)

<table>
<thead>
<tr>
<th>Vest/Panel</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-03-Front</td>
<td>OK</td>
</tr>
<tr>
<td>L-03-Back</td>
<td>1st &amp; 2nd shot, complete penetration</td>
</tr>
<tr>
<td>L-03-Left Side</td>
<td>OK</td>
</tr>
<tr>
<td>L-03-Right Side</td>
<td>OK</td>
</tr>
</tbody>
</table>

**L-03 BACK Before Testing**

![Image of vest before testing](image1)

**L-03 BACK After Testing**

![Image of vest after testing](image2)
Conclusion

- Test results
  - Total number of vests tested: 8
  - Total number of vests failed: 4
  - Total number of penetrations: 13 of 48

**Conclusion: Dragon Skin does not meet required protection standards for Soldier use.**