



## WHITE PAPER

# CHALLENGES FACING THE INTRODUCTION OF ALTERNATIVE TECHNOLOGY TRAUMA PLATES INTO THE GOVERNMENT MARKETPLACE CURRENTLY DOMINATED BY THE CERAMIC TECHNOLOGY CENTERED TRAUMA PLATE

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## ***Introduction***

Current government procurement of trauma plates is awarded on meeting minimum performance criteria, the weight of the plate, and the cost (prioritized in that order). The minimum performance criteria can include ballistic criteria as well as durability and space concerns. Since current procurement is based on ceramic inserts as the standard, space efficiency, durability, and ballistic multi-hit performance minimums are based on the capabilities of those systems. This explains the ESAPI use and care instructions for ceramic trauma plates:

"Before insertion, check for rattling pieces, flexing or delamination. Turn in if these occur... To preserve ESAPI ballistics DO NOT drop, throw, stand on, sit on, use to pry or hammer, or otherwise abuse."

The problem with the above model is:

- Real life durability requirements exceed that offered with the current technologies;
- Current threats are taking advantage of the current technologies weaknesses;
- Current procurement strategies fail to reward technologies which substantially improve multiple performance criteria at the expense of a competing criteria (for example, improved multi-spectrum ballistics, improved space efficiency, improved durability, and improved total cost vs. slight weight penalty will not be evaluated).

It is suggested by the authors that the government's procurement strategy for trauma plates should shift from minimum performance criteria built around the current ceramic technology to a matrix system based on the weighted needs of the soldier.

## ***The Matrix Methodology with Multipliers***

This matrix outlined above should include factors such as:

1. Ballistics
  - 1.1. Minimum Projectile Performance Standards (Pass or Fail)
  - 1.2. Multi-Hit Ability (Scaled Performance)
  - 1.3. Blunt Projectile (Scaled Performance)
2. Durability
  - 2.1. Normal Wear and Tear (Pass or Fail)
  - 2.2. Expected Combat Abuse (Scaled Performance)
3. Weight and Thickness
  - 3.1. Weight of Total System, Trauma Plate with Vest (Scaled Performance)
  - 3.2. Thickness of System (Scaled Performance)
4. Total Cost Per Soldier
  - 4.1. Procurement Cost (Scaled Performance)
  - 4.2. Replacement and Upkeep Costs (Scaled Performance)

Each of the scaled performance factors could then be multiplied based on the needs of the soldier. The use of this type of matrix will now be demonstrated by comparing the current ceramic trauma plates to DefensTech's™ Defend-X™ Trauma Plate (See Table 1). The ceramic trauma plate technology was given a rating of 3 in each category since it is the current standard. All competitive products would then be compared against this current standard.

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## ***Ballistics***

All trauma plates should meet minimum ballistic performance criteria. In addition, performance above and beyond the current capability should also be considered. Ceramic plates defeat their threat by shattering the incoming projectile and, as a result, the ceramic tile also shatters. Due to this, an individual ceramic plate does not have multiple hit capabilities. To combat this, the current ceramic plate technology uses smaller ceramic tile sizes as the method to take multiple hits. A great deal of energy is spent on determining what happens when multiple tiles are hit at once (triple points) or how many tiles are effected by the original hit. The more tiles that are affected, the less multiple hit capability the trauma plate has. Current specifications are written assuming all trauma plates have these weaknesses. Technologies which do not have these inherit weaknesses and eliminate these concerns should be rewarded.

In addition, recent combat experience has shown that soldiers are more likely to be involved with a fragment threat, such as Improvised Explosive Devices (IEDs), versus traditional armor piercing threats. In a fragment event, many blunt projectiles have to be absorbed in a very small area (taking advantage of ceramic armors natural weakness). Newer technologies which inherently can absorb these threats with a very tight spacing should be encouraged.

In the ballistic portion of the proposed matrix method in Table 1, both of these additional capabilities are evaluated. For this example, a total of 4 of the 12 available multiplication factors were given to the ballistics category.

## ***Durability***

General durability requirements for trauma plates have been based on the capability of the ceramic plates and not the general needs of the soldier. This can be seen in the ESAPI instructions outlined in the introduction of this white paper. It is the authors' experiences that combat in an urban environment involve activities which will violate these general instructions. Activities such as diving to the ground during combat, banging into a tank turret, or being involved in a concussion from a near miss explosive all will put this ceramic plate in risk. In addition, soldiers are well known for sitting on protective equipment, like these plates, when being transported by helicopter.

Competing technologies that do not have these restrictions should be encouraged and would be through the matrix methodology shown in Table 1. A total of 2 of the 12 available multiplication factors were given to this category.

## ***Weight and Thickness***

Weight and thickness in a trauma plate is not a soldier's friend in combat. Weight causes the soldier to become fatigued and thickness reduces his/her upper body mobility. Due to these, weight was given the single highest multiplication factor (3X) and thickness was given a lesser factor (1X). A total of 4 of the 12 available multiplication factors were given to this category.

In addition, total possible weight of a system should be considered. Ceramic trauma plates require the carrier to supply some ballistic performance for the system to operate correctly. Competing technologies, like the Defend-X™ system, do not require the carrier for full performance and thus could have a lighter carrier design lowering the total system weight.

## **Cost**

Since the other three factors effect the life of the soldier, the cost of the trauma plate system should be weighted the lowest. But even with this, the cost must always be considered and should be calculated for both the initial procurement cost and replacement/upkeep costs. Due to the inherit fragileness of a ceramic plate, replacement and upkeep costs are high.

Competing technologies with lower initial procurement and replacement costs (due to their durability) should again be encouraged. A total of 2 of the 12 available multiplication factors were given to this category.

## **Conclusion**

Examination of Table 1 leads to many interesting conclusions. First, it shows that a matrix approach highlights new technologies that may be available to the modern war fighter. In the example, the current ceramic trauma plates did very well in weight savings, but were out performed in the other six categories by the Defend-X™ system. This is especially seen in the final multiplied score where the current technology received a score of 36 out of the possible 60 and the Defend-X™ system had a 48 out of the possible 60.

Second, this methodology shows how competing technologies to the current standard could easily be ignored if only one factor is considered. In the example, this difference between the two systems was still evident even when the weight of the system was multiplied by the single highest multiplying factor.

In conclusion, it is the authors' opinion that the current procurement strategy for trauma plates should be revisited and revised to include a scaled matrix as shown in this example.

Table 1: Comparison Matrix for Comparing Trauma Plates\*

	Ballistics			Weight & Thickness		Durability		Total Cost per Soldier		Totals
	Projectile Min.	Multi Hit	Blunt Projectile	Weight of Total System	Thickness of Total System	Normal Wear & Tear	Combat Abuse	Original Procurement	Replacement & Upkeep	
<b>Rating</b>	Pass or Fail	1 - None 2 - Less 3- Same as Current 4 - Better 5- Much Better	1 - None 2 - Less 3- Same as Current 4 - Better 5- Much Better	1 - Much Heavier 2 - Slightly Heavier 3- Same as Current 4 - Lighter 5- Much Lighter	1 - Much Thicker 2 - Slightly Thicker 3- Same as Current 4 - Thinner 5- Much Thinner	Pass or Fail	1 - Very Fragile 2 - Fragile 3- Same as Current 4 - Drop-able 5- Can Be Abused	1 - Much More 2 - Slightly More 3- Same as Current 4 - Lower 5- Much Lower	1 - Much More 2 - Slightly More 3- Same as Current 4 - Lower 5- Much Lower	Score / Total Available Points
<b>Multiplier (Factor)</b>	N/A	2x	2x	3x	1x	N/A	2x	1x	1x	12 Total Multiplier Points
<b><u>Product</u></b>										
Ceramic Plate										
Score	Pass	3	3	3	3	Pass	3	3	3	<b>27/35</b>
Multiplied Score	N/A	6	6	9	3		6	3	3	<b>36/60</b>
Defend-X™ Plate										
Score	Pass	5	4	2	4	Pass	5	5	5	<b>30/35</b>
Multiplied Score	N/A	10	8	6	4		10	5	5	<b>48/60</b>

N/A = Not Applicable \*Table Courtesy of: Peter Thompson, Product Application Engineer, Carpenter Special Alloys, Reading, PA

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## Enhanced Small Arms Protective Insert (ESAPI)

### Use & Care Manual

#### PROTECTION:

An Enhanced Small Arms Protective Insert (ESAPI) is placed in both the front and back pockets of the Outer Tactical Vest (OTV). Wearing ESAPI upgrades OTV protection to specific 5.56mm and 7.62mm Ball and AP rounds. To maintain protective properties do not mishandle or abuse.

#### USE:

1. ESAPI size must be the same size as your OTV.
2. **BEFORE** insertion, check for rattling pieces, flexing or delamination. Turn in if these occur.
3. Position ESAPI so the markings of "Top" match the top of the pocket and "Strike Face" faces to the **outside** of the vest when inserted. Slide ESAPI into pocket. Securely close pocket flap.
4. ESAPI Extraction Strap: The front emergency extraction strap will retract properly when the strap is fully extended and passed through its keeper before the ESAPI is placed in the front pocket. For emergency front ESAPI removal, pull the end of strap.



### Maintaining Your ESAPI Plate

- To preserve ESAPI ballistics **DO NOT** drop, throw, stand on, sit on, use to pry or hammer, or otherwise abuse.
  - Clean your insert.
1. Remove loose dirt and lint from the outer cover surface using a cloth or soft to medium-soft bristle brush. Wet the insert with warm (not hot) water.
  2. Apply soap or detergent to the soiled areas and scrub only long enough to remove the soil.
  3. Heavy grease and oil stains may be pre-spotted with a dry cleaning solvent.
  4. Rinse the insert with warm water until the suds are completely gone.
  5. Let the insert dry, away from heat or open flame.
- If the cloth covering of ESAPI starts to peel, apply riggers tape over area to prevent further peeling.
- Turn In Your Inserts When:
1. **Your insert is hit and damaged by a projectile.**
  2. The outer cover is torn or damaged.
  3. The ESAPI is cracked and you hear loose pieces.
  4. ESAPI flexes when bent.
  5. The front and back faces of the plate begin to separate/delaminate.



# Defend-X<sup>®</sup> Polymer Process Trauma Plate as Compared to Ceramic Trauma Plate Technology

- Interceptor Body Armor is designed around Ceramic Plate technology.
- Ceramic Plate technology met the past needs but insurgents have developed battle plans to defeat the current body armor.
- Ceramic Plate technology requires a capital intensive reacquisition and logistical support strategy to meet the demands of combat driven field action.
- DefensTech Defend-X<sup>®</sup> trauma plates are based upon a patented process incorporating unique materials and polymers unlike any ceramic technology.
- Defend-X<sup>®</sup> Plates are Complete Off The Shelf Solutions ready for drop in use in the Interceptor Ballistics Carrier. Long term the DefensTech plates can be incorporated into a carrier that does not have to be certified to National Institute of Justice.
- Defend-X<sup>®</sup> plates require no special handling. They can be dropped, sat on, thrown from a helicopter and shot multiple times in a small area before failing if failing at all.
- Defend-X<sup>®</sup> Plates come with a 5 year warranty. This substantially reduces the capital intensity in the long term acquisition strategy.



# Defend-X © Polymer Process Trauma Plate as Compared to Ceramic Trauma Plate Technology

## CERAMIC

- COMPLIES WITH NIJ STANDARDS
- SINGLE SHOT SURVIVABILITY WITHIN A 2 INCH SHOT GROUP
- ANY IMPACT CREATES FRACTURING AND DETERIORATION OF INNER STRUCTURE
- SPAULING A PROBLEM
- MUST USE BULLET PROOF VEST IN CONJUNCTION WITH CERAMIC

## DEFENSTECH

- CERTIFIED TO NIJ LEVELS' IIIA, III AND IV.
- STAND ALONE PLATE AGAINST .50 CAL PROJECTILES FOR STRUCTURAL AND VEHICLE STRENGTHENING
- MULTIPLE SHOT SURVIVABILITY WITHIN 2 INCH SHOT GROUP AREA
- PROVEN TO WITHSTAND IMPACTS FROM BLUNT FORCE TRAUMA, DAY TO DAY USE AND REPEATED BALLISTICS IMPACT
- PATENTED PROCESS ELIMINATES SPAULING
- DEFENSTECH PLATES ARE STAND ALONE





# Defend-X<sup>®</sup> Polymer Process Trauma Plate as Compared to Ceramic Trauma Plate Technology

## CERAMIC

- INCENDIARY ROUNDS PENETRATE CERAMIC PLATES
- MUST BE X-RAYED IN THE FIELD FOR SERVICEABILITY
- USER CAN DAMAGE PLATE DURING COMBAT OPS WITHOUT KNOWLEDGE
- NO WARRANTY
- OUTER SKIN PENETRATION RESULTS IN CERAMIC MATERIAL LEACHING OUT INDUCING FAILURE
- PLATE DETERIORATES-IT IS OUT OF SERVICE

## DEFENSTECH

- INCENDIARY ROUNDS WILL NOT PENETRATE DEFENSTECH (NIJ CERTIFIED)
- PLATES AREN'T DAMAGED UNLESS DELAMINATION OCCURS FROM MULTIPLE HITS
- 5 YEAR WARRANTY
- NO CERAMIC MATERIAL TO LEACH; DEFENSTECH POLYMER PREVENTS CORROSION



# Defend-X<sup>®</sup> Polymer Process Trauma Plate as Compared to Ceramic Trauma Plate Technology

## CERAMIC

- SUSCEPTABLE TO DAMAGE FROM PETROCHEMICAL EXPOSURE
- MAINTENANCE INTENSIVE
- RIGID DESIGN
- USER MUST BE EXTREMELY COGNIZENT OF HANDLING PRACTICES AS DIRECTED BY USER MANUAL

## DEFENSTECH

- CHEMICAL RESISTANT
- WATER PROOF
- MINIMAL MAINTENANCE REQUIRED FOR MAXIMUM SURVIVABILITY
- CAN BE MADE TO VARIOUS SIZES OR SHAPES
- CAN BE MANUFACTURED TO BODY CONTOUR
- DEFENSTECH PLATES ARE USER FRIENDLY
- NO SPECIFIC HANDLING INSTRUCTIONS REQUIRED





# Defend-X™

## Life Saver Trauma Plates

### THE FIRST LINE OF DEFENSE

The **Defend-X™ Life Saver Trauma Plate** is the ultimate form of personal ballistic protection available. The **Defend-X™ Life Saver Trauma Plate** is the first proven non-ceramic NIJ Certified M855 multiple round stand-alone trauma plate on the market today.

The **Defend-X™ Life Saver Trauma Plate** is Certified to NIJ standard Level III and IV, and can defeat multiple rounds of 5.56 x 45 mm 62 GR, M855 (SS109 Green tip) 3200 ft./sec. + 100-0. Our AP-I stops 30 CAL M2 AP and 7.62 x 39 Armor Piercing Incendiary Projectiles, and all lesser threats. Defenstech pioneered a rifle plate for police officer vests utilizing the existing trauma pouch for protection against rifle fire. **Defend-X™ Life Saver Trauma Plates** are designed to fit most standard carrier harnesses (or vests). Our patented process can be designed to the users requirements or specifications.



Municipalities can obtain assistance with your purchase through the Bulletproof Vest Partnership Grant Act. The BVP assists states, counties and cities in obtaining funds to purchase ballistic vests for law enforcement officers. Contact our sales team for Grant Information.

**Defend-X™** Trauma Plate Package w/*BDS Tactical* Stacker Plate Carrier Vest with Cumberbun System



**DefensTech™**  
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*Protecting those who  
Protect and Serve*

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