Improved Fit and Performance of the IOTV for Female Soldiers

Steven Paquette,
Anthropology Team Leader

11 May 2011

US ARMY RDECOM

US ARMY NATICK SOLDIER RD&E CENTER

Improved Fit and Performance of the IOTV for Female Soldiers

Examples of unacceptable fitting IOTVs on female Soldiers

Schedule & Cost

MILESTONES	FY11	FY12
Develop Female Sizing System		
Create IOTV Patterns/Prototype		
Conduct Fit Evaluation/Refine		
Fabricate IOTV Prototypes		
Conduct IOTV Field Evaluation		
Finalize Patterns/Prototypes		

Purposes:

To create a sizing system offering improved fit, comfort, and performance of the IOTV (Vest, ESAPI and Side- SAPI Plates) for female Soldiers, and that can increase the overall number of females who are adequately fit with this system.

Results/Products:

- A set of prototype IOTV garments and associated patterns with front, back and side plates that have been explicitly designed and sized based on the body size and shape of female Soldiers.

Payoff:

- Improved Fit, Comfort, and Performance of the IOTV Vest and Plates on female Soldiers.
- Increased number of female Soldiers who receive a functional fit in the IOTV body armor system.

Improved Fit and Performance of the IOTV for Female Soldiers

Status: New

1. **What is the problem?** The current IOTV body armor system (Vest, ESAPI & Side-SAPI Plates) does not provide an acceptable, functional fit for a large number of female Soldiers.

2. **What are the barriers to solving this problem?**
Development of a new IOTV sizing system based on female anthropometry, and validation of this sizing system on a representative sample of Female Soldiers.

3. **How will you overcome those barriers?**
   - Develop an improved IOTV sizing system that accommodates at least 90% of female Soldiers.
   - Evaluate and validate the system on a limited number of female Soldiers

4. **What is the capability you are developing?**
   - IOTV body armor that affords female Soldiers improved fit, comfort, and performance over that available in the existing male-based sizing system.

5. **What is result/products of this effort?**
   - A set of IOTV body armor prototypes based on female body size and shape.

6. **Quantitative Metrics:**

Measure	Current	Effort Objective	Army Objective	TRL or SRL
Predicted IOTV size = Best fitting size	12%	85%	85%	Start: 6 End: 7
Increase Stability and fit of IOTV on female Soldiers	50%	90%	90%	Start: 6 End: 7

7. **How we are leveraging other tech programs:** *This program is being leveraged with ongoing work in the "Improvements in ballistic plate size and geometry" program as well as previous human system interface evaluations on Female IOTV fit conducted in support of PM-SPE.*

8. **Other Attributes:**

   - **Modeling and Simulation:** (Are you developing any modeling tools or working with any during this effort? "No"
   - **Technology Protection Plan:** (Do you have Critical Program information that would require a TPP?"No TPP Required".
   - **International Program:** (Does this effort have any international efforts (DEA or TTCP, other) associated with it? No.
   - **Endorsements:** PM-SPE and TRADOC.
   - **Technology Transition Agreement:** PM-SPE
   - **Affordability Metrics:** (Identify unit and cost, and number of units to get the price.)

Improved Fit and Performance of the IOTV for Female Soldiers

Prototype Design

● It was noted in recent studies that most (86%) of female soldiers fit best in the men's current X-Small IOTV.

●The design features from the current New Improved Gen III IOTV are being integrated into this new female fit body armor.

● Issues trying to be addressed in the new design:

1. Length
2. Side plates too large/long/wide/better location
3. Too big in upper chest/ shoulder
4. Adjustability in the shoulder
5. Inability to seat a weapon/ too much bulk in upper body
6. Issues with collar/yoke/too much bulk
7. Donning and doffing difficult

Improved Fit and Performance of the IOTV for Female Soldiers

Anthropometric Analysis for Sizing Development

• Analyzed anthropometric data for Army females (ANSUR II Pilot Study, 2006)

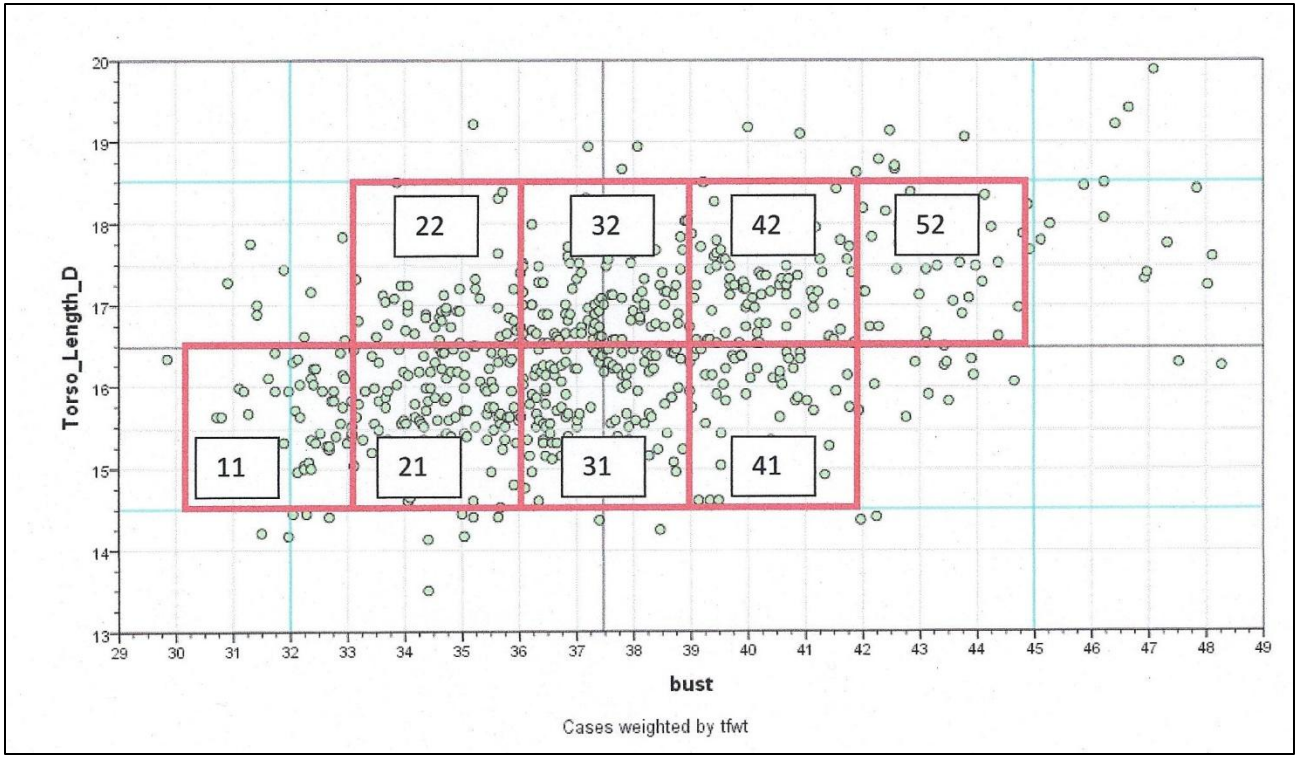
•Developed sizing system using Chest Circumference and Torso Length

•Calculated anthropometric design values for 18 body measurements, for each of 8 sizes

•Provided design values to Prototype Design Team for construction of initial base-size prototype

Improved Fit and Performance of the IOTV for Female Soldiers

Biivariate Distribution of Females for Bust Circumference and Torso Length



SIZE	%	Cumulative %
21	**19.2**	**19.2**
31	16.1	35.4
32	**15.9**	**51.3**
42	13.0	64.3
41	6.8	71.1
11	6.3	77.4
22	6.1	83.5
52	5.7	89.3

Female Specific Sizes

Improved Fit and Performance of the IOTV for Female Soldiers

Female Design Changes

1. Incorporates features of the Gen III Design including an improved quick release

2. An exterior, front, side-opening, 3-D pocket to contain the front plate.

3. Strategically placed darts to curve the front panel, increase coverage at the side bust area, & prevent gapping

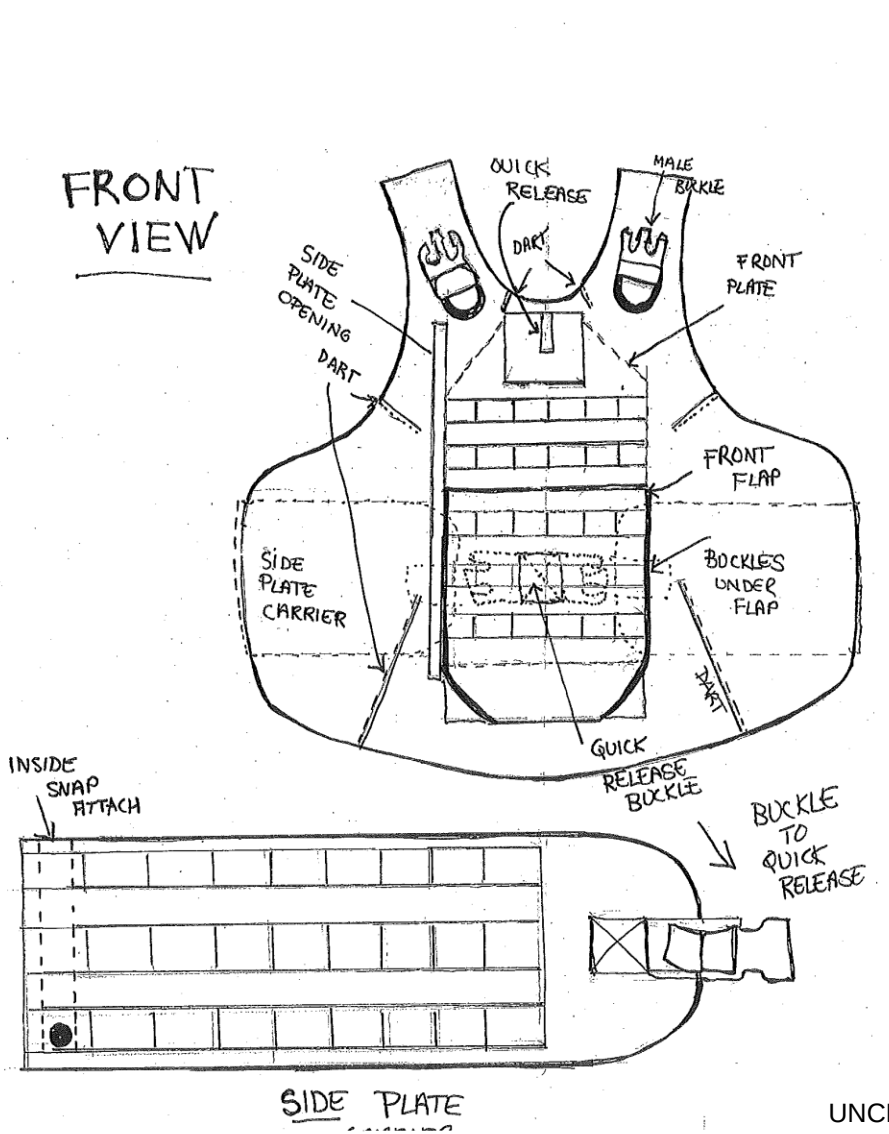
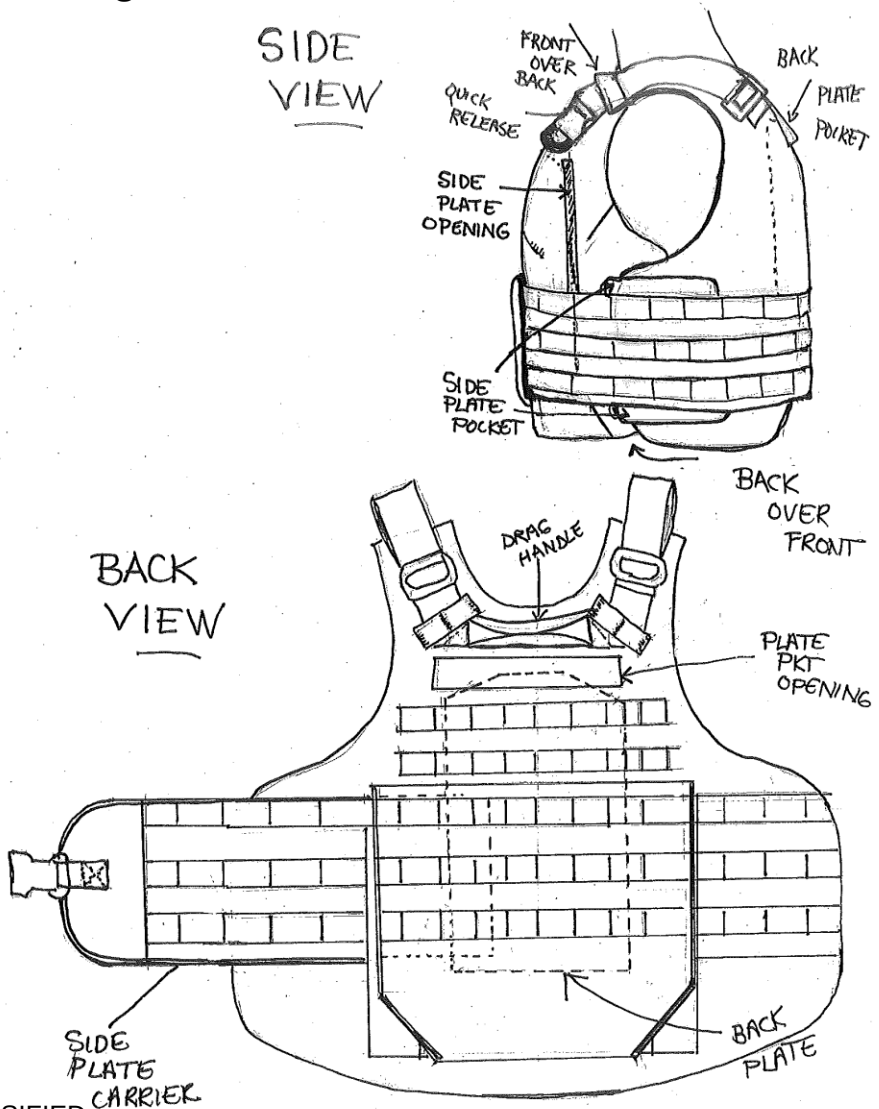
4. Incorporates a power net fabric liner for the front panel to further stabilize the plate to the front of the body

5. The length is shorter with the basic area of coverage shifted, but not reduced

6. The side plate carriers will be narrower and shorter, designed to hold a smaller plate, & placed in a more central position on the side of the body.

7. There will be more adjustability in the shoulder straps & the shoulders will be contoured to improve fit on the narrower female shoulder

8. The yoke/collar will be streamlined for improved fit to integrate into the neck area

Improved Fit and Performance of the IOTV for Female Soldiers

Prototype Design