

# Project 12: Final Salable TSBT Product

Chris Dedo (IE), Joseph LeBlanc (ME), Trevor Stewart (IE), Eric Wilson (IE)



## PATENT

### Patent (US8215165 B2)

A device for simulating projectile performance

Includes:

- Support frame
- Removable inserts:
  - Hide
  - Muscle
  - Bone
  - Organs



Specifically simulates projectile performance on:

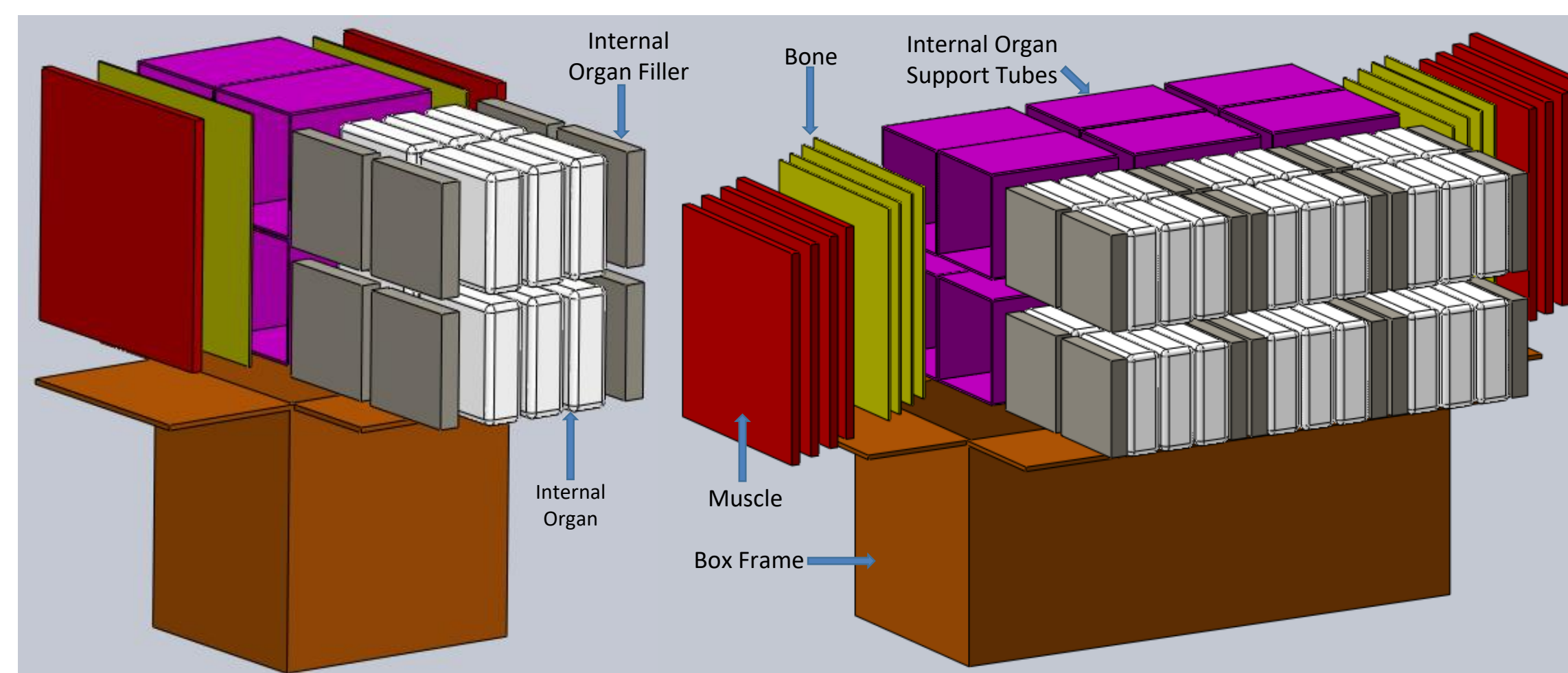
- Big game hunting animals (Whitetail deer, Elk, Grizzly bear and Cape buffalo)
- Human Torso (for bulletproof vest affectability)

Constraints:

- 1:1 Simulant to average biological material thickness ratio
- Width must be the same as average of animal it is simulating (i.e. 30" for Cape buffalo)

## PRODUCT

### Deer and Cape buffalo Simulator



#### Key Features

- Simple design: Low-cost manufacturing and ease of use for the consumer.
- Recyclable: System can be tossed in recycling when testing is complete.
- Interchangeable Parts: Same parts manufactured between deer and Cape buffalo

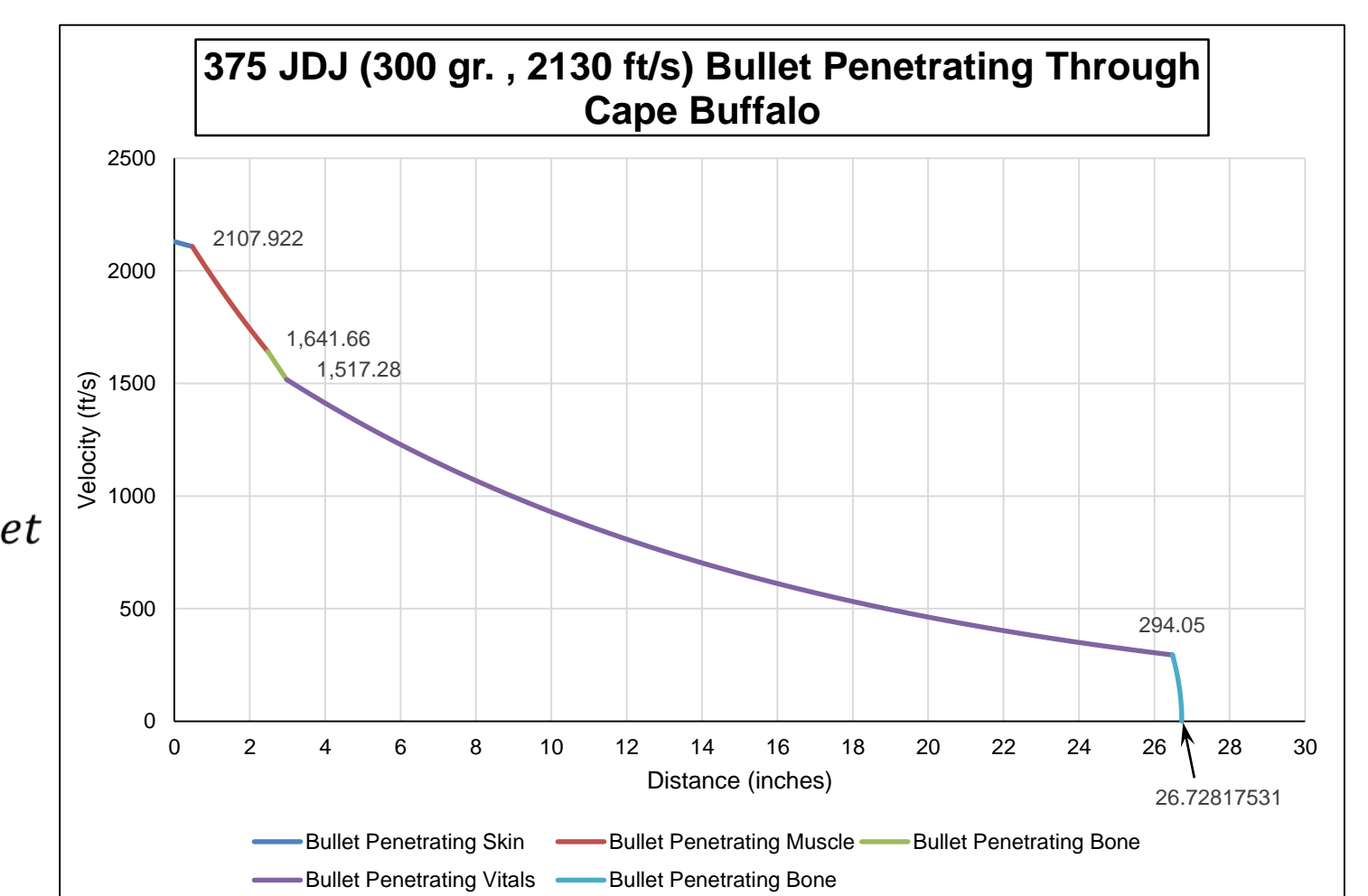
## MATHEMATICAL MODEL

Penetration estimate by Poncelet's Ballistics Model

$$\Delta V = \sqrt{\frac{1}{\rho} \left[ (\tau + \rho V_0^2) e^{-(2\rho \frac{A}{m} x)} - \tau \right]}$$

$$P = \frac{m}{2\rho A} \ln \left( \frac{\rho V^2 + \tau}{\tau} \right)$$

- $\Delta V$  = Velocity increment
- $\rho$  = Target density
- $\tau$  = Target shear strength
- $V_0$  = Bullet velocity
- $A$  = Cross sectional area of bullet
- $m$  = Mass of bullet
- $x$  = Material thickness



\*NOTE: Graph above shows skin, even though removed from test model, in order to incorporate all parts.

## VALIDATION

### .22LR Muscle Test

- Alternate to Corbin SIM-Test required due to cost
- Neoprene Duro 60 selected for accuracy and reduced cost



Federal, 38 gr. HP copper plated, high velocity					
Test Results					
Neoprene			Corbin SIM-Test		
V <sub>i</sub> (fps)	Bullet Dia. (in)	Depth (in)	V <sub>i</sub> (fps)	Bullet Dia. (in)	Depth (in)
1202	0.349	1.76	1205	0.349	1.843
Neoprene			Corbin SIM-Test		
V <sub>i</sub> (fps)	Bullet Dia. (in)	Depth (in)	V <sub>i</sub> (fps)	Bullet Dia. (in)	Depth (in)
1215	0.349	1.662	1221	0.36	1.767
Avg Depth	1.711		Avg Depth	1.805	
Avg V <sub>i</sub>	1208.5		Avg V <sub>i</sub>	1213	
Avg Neoprene/Avg CST		94.79%			

Cape Buffalo	Shot	Caliber	Bullet Weight (gr)	Shot Location	Impact Velocity (ft/s)	Calculated Depth (in.)	Actual Depth (in.)	% Error	Within Tolerance (+/- 10%)?
CB1	Shot 1	.375 JDJ	300	BL	2130	26.728	25.885	-3.257	✓
	Shot 2	.375 JDJ	300	BR	2108	26.722	25.125	-6.356	✓
	Shot 5	.44 Mag	340	TR	1404	26.728	25	-6.912	✓
	Shot 6	.44 Mag	340	TL	1412	26.547	25	-6.188	✓
CB2	Shot 7	.44 Mag	340	BR	error		25		
	Shot 8	.44 Mag	340	BL	1395	26.546	25	-6.184	✓
	Shot 3	.375 JDJ	300	TL	1853	26.664	25.125	-6.125	✓
	Shot 4	.375 JDJ	300	TR	error		25.125		

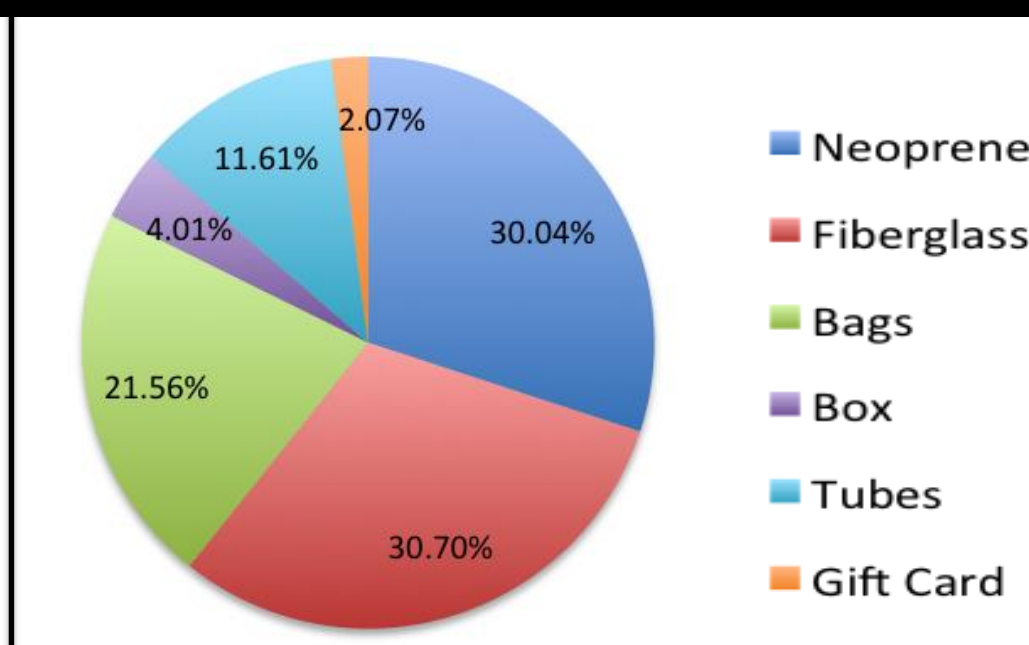
- Full scale test completed with .375 JDJ and .44 Magnum in Cape buffalo.
- All results within our required +/- 10% range of accuracy
- Shorter than predicted penetration attributed to increased cross sectional area of deformed bullet
- Deer simulator used for the testing of various types of hunting ammunition

## MANUFACTURING/DISTRIBUTION



Product/Service	Company	Single Unit: Deer	Single Unit: Buff.	Initial Order Size	Total 1st Order	Single Deer \$	Single Deer Qty	Initial Deer	Single Buff. \$	Single Buff. Qty	Initial Buffalo
1 Muscle Simulant	Shanghai Shouhuo Rubber and Plastic Co. Ltd.	\$3.15	\$3.15	5,000	\$15,750.00	\$6.30	2	\$3,150.00	\$25.20	8	\$12,600.00
2 Bone Simulant	Zhejiang Haodesheng Insulation Material Co., Ltd.	\$1.75	\$6.24	2,000	\$7,985.00	\$3.49	2	\$1,745.00	\$12.48	2	\$6,240.00
3 Organ Bags	Shandong Xianshi Packaging Products Co., Ltd.	\$0.09	\$0.09	24,000	\$2,154.00	\$1.07	12	\$534.00	\$3.24	36	\$1,620.00
4 Outer Box	Shandong Xianshi Packaging Products Co., Ltd.	\$0.58	\$1.06	1,000	\$820.00	\$0.58	1	\$290.00	\$1.06	1	\$530.00
5 Internal Organ Filler	Anqushi Xingwang Packaging Products Co., Ltd.	\$0.07	\$0.07	16,000	\$1,184.00	\$0.59	8	\$296.00	\$1.78	24	\$888.00
6 Tube	Shenzhen Jinfuli Paper Packing Co., Ltd.	\$0.43	\$0.43	8,000	\$3,440.00	\$1.72	4	\$860.00	\$5.16	12	\$2,580.00
7 Fulfillment	eFulfillment	-	-	1,000	\$5,050.00	\$3.45	-	\$1,725.00	\$6.65	-	\$3,325.00
8 Distribution	Amazon	-	-	-	-	-	-	-	-	-	-
<b>Total</b>		-	-	<b>57,000</b>	<b>\$36,383.00</b>	<b>\$17.20</b>	<b>29</b>	<b>\$8,600.00</b>	<b>\$55.57</b>	<b>83</b>	<b>\$27,783.00</b>

## BUDGET



Item	Cost
Neoprene	\$362.25
Fiberglass	\$370.23
Bags	\$260.00
Box	\$48.33
Filler	\$10
Tubes	\$120.00
Gift Card	\$25.00
<b>Total</b>	<b>\$1,195.81</b>

## SAFETY



- All personnel on range required to wear ear and eye protection.
- Safe range location.
- Capt. Dave is designated range officer.
- All personnel have a right to call a cease fire for any reason.

