

- 59 pathologies and traumas available between Willy & Debbie
- Unlimited repetition of views without human exposure
- Radiographs that permit evaluation of trainee performance



TEACHING & TRAINING PHANTOMS FOR MILITARY & CIVILIAN FIELD HOSPITALS & EMERGENCY ROOMS

The concept of grouping a large number of casualties in two teaching/training phantoms was originated by the Fleet Hospital & Operations Training Center in Camp Pendleton, California. Wounded Willy & Damaged Debbie were designed and constructed by RSD.

These phantoms yield radiographs resembling those of a human body with human technical factors and limited artifacts, articulated to enable basic views to be presented, and with an appropriate level of human anatomy. They are well-balanced patient substitutes for basic training of radiologic technologists, particularly in military or emergency room environments.

At 5' 1" (156 cm) tall, weighing 105 lb. (48 kg), Willy & Debbie match the size and weight of RSD's Take-Apart Pixy. Technologists must learn to work with patients of all sizes and weights, so a smaller adult-size phantom is as valid for training as a larger phantom, and position is facilitated.

Both Willy & Debbie demonstrate and evaluate positioning and imaging techniques, including kVp, mAs, contrast, optical density, OFD and TFD. Their radiographs are optically equivalent to humans in density and contrast.

Model Numbers

Model No.	Product Description
RS-600TA	Wounded Willy & Damaged Debbie, Opaque, Take-Apart
RS-601TA	Wounded Willy, Opaque, Take-Apart
RS-602TA	Damaged Debbie, Opaque, Take-Apart
RS-600TTA	Wounded Willy & Damaged Debbie, Transparent, Take-Apart
RS-601TTA	Wounded Willy, Transparent, Take-Apart
RS-602TTA	Damaged Debbie, Transparent, Take-Apart

See chart for available pathologies and traumas.

Materials *See page 30 for more information.*

RSD Soft Tissue	RSD Cortical Bone	RSD Trabecular Bone
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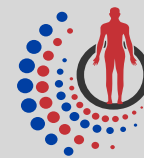
Specifications

Packing Size	Packing Weight
206W x 81D x 64H cm	120 kg
81W x 32D x 25H in	265 lb.

PATHOLOGIES & TRAUMAS

A COMPLETE LISTING OF EXTERNAL MARKINGS, LOCATION AND DESCRIPTION

No	Willy or Debbie	Description	Side	External Markings
-01	Willy	Metallic fragment in orbit	R	None
-02	Willy	Multiple fragments lower face	N/A	None
-03	Willy	Step deformity of intraorbital rim	L	Bruise
-04	Willy	Separated fracture of frontal zygomatic suture	L	Swelling
-05	Willy	Metallic foreign body over skull	N/A	None
-06	Willy	Mandible fracture with missing bone	N/A	Open Wound
-07	Debbie	Depressed comminuted fracture of zygomatic arch	L	Swelling
-08	Debbie	Mandibular fractures	R	Swelling, Bruise
-09	Debbie	Cloudy maxillary sinus	L	None
-10	Debbie	Fracture of nasal bones with mild displacement	N/A	Bullet or Foreign Body Hole
-11	Willy	Displacement fracture of mandibular condyle	L	Swelling
-12			R	
-13	Willy or Debbie	C4, C5 Compression fracture	N/A	None
-14	Willy or Debbie	C7 Fractured by bullet	N/A	Bullet or Foreign Body Hole
-15	Willy or Debbie	C-spine bullet anterior to trachea shadow	N/A	Bullet or Foreign Body Hole
-16	Willy	Fracture of lateral ribs 6 & 7	R	None
-17	Willy	Mediolateral fracture of ribs 8 & 9	L	None
-18	Willy	Multiple rib fractures, four metallic fragments visible	R	None
-19	Willy	12th rib fracture	R	None
-20	Willy	Bullet in hemothorax overlaying 8th rib	L	Bullet or Foreign Body Hole
-21	Willy	Bullet in hemothorax overlaying 8th rib	N/A	Bullet or Foreign Body Hole
-22	Willy	2 cm metallic fragment in mid chest	R	None
-23	Willy	Bullet visible below costal margin under 11th rib	L	Bullet or Foreign Body Hole
-24	Willy	2 bullets in LUQ	L	Bullet or Foreign Body Hole
-25	Willy	Shattered distal scapulae	L	Bullet or Foreign Body Hole
-26			R	
-27	Debbie	Widened mediastinum and pleural effusion	N/A	None
-28	Debbie	Chest tube, lung inflated	L	Tube
-29	Debbie	Infiltrate	N/A	None
-30	Debbie	Bullet in mid-abdomen	N/A	Bullet or Foreign Body Hole
-31	Willy	Unstable fracture of L1	N/A	None
-32	Willy	Compression fracture of L5	N/A	None
-33	Debbie	Metallic foreign body lateral to PSOAS	R	None
-34	Debbie	Compression fracture of L4	N/A	Bullet or Foreign Body Hole
-35	Debbie	Metallic fragments – 2 mid-abdomen, 1 each in RLQ and LLQ	N/A	Bullet or Foreign Body Hole
-36	Debbie	Bullet in mid-abdomen	N/A	Bullet or Foreign Body Hole
-37	Debbie	Metallic fragments – 2 mid-abdomen, 1 each in RLQ and LLQ	N/A	None
-38	Willy	ILIAC crest comminuted fracture with metallic fragments	R	Bruise
-39	Debbie	Displaced fracture of pubic ramus	L	None
-40	Debbie	Sacroiliac disruption, acetabular fracture	L	None
-41	Debbie	Foreign body lateral to PSOAS	R	None
-42	Willy	Non-displaced pubic ramus fracture	N/A	None
-43	Willy	Superior and inferior pubic ramus fracture	R	None
-44	Willy	Pelvis fracture with symphysis diastasis and sacroiliac joint disruption	N/A	None
-45	Willy	Bullet in sacrum	N/A	None
-46	Willy	Shattered acetabulum	L	Latex “shorts”
-47	Willy	Shattered femoral head	L	Latex “shorts”
-48	Willy	Comminuted midshaft fracture	L	Swelling
-49	Willy	Left femur comminuted fracture 12 cm above knee	L	Swelling
-50	Debbie	Proximal tibia fracture	L	Swelling
-51	Willy	Comminuted fracture of tibia and fibula	R	Swelling
-52	Willy	Displaced ankle fracture	R	Swelling
-53	Debbie	Minimally displaced distal tibia fracture	R	Swelling
-54	Debbie	Displaced fracture of calcaneus bone	R	None
-55	Willy	Displaced fracture of radius and ulna	L	
-56	Debbie	Volar angulated distal radius and ulna fracture	R	
-57	Willy	Angulated comminuted fracture of midshaft radius and ulna	R	
-58	Debbie	Minimally displaced distal radius fracture not involving wrist, offset bone ends		
-59	Debbie	3rd and 4th metacarpals shattered	L	Thickened, back of hand



Applications

Field trauma & ER evaluation of technologist performance

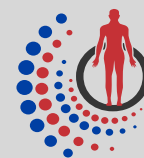
Teaching & training of patient positioning

Image quality

Diagnostic radiology

Dosimetry verification

Protocol verification

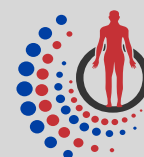


Modalities

CT

X-Ray

Fluoroscopy



Anatomy

Shoulders have ball and socket joints

Elbows and knees flex 90° to 100°

Broad range of positioning capabilities, including the “frog position”

Debbie features fractures of the left shoulder and left hip plus arm and leg traumas on the right side

Willy features traumas of both arms and legs

Soft Tissues: There are unlimited, small variations in density and absorption throughout the human body. Phantom soft tissue is closely controlled to have the average density of these tissues.

Skeletons: RSD skeletons are highly detailed polymer moldings which reproduce the shape, mass density and attenuation coefficients of cortical bone and spongiosa. RSD's proprietary moldings allow for continuous production, eliminate the restrictions of human skeleton bones (including limited availability, unethical collection of human bone specimen, variable size, and uncertain chemical composition), and avoid the loss of marrows in dried natural skeletons thereby making RSD skeletons superior to "real bone."

Molds: Molds for the RSD cortical bone and spongiosa were made from human skeletons consistent with the sizes of the soft tissue molds.

ICRU 44: RSD skeletons conform closely to the standards established by the International Commission on Radiation Units and Measurements ([ICRU Report No. 44](#)); mass density is reduced slightly to take into account a small decrease in calcium content for older patients.

LINEAR ATTENUATION DATA

1. Monte Carlo simulation was used to calculate linear attenuation coefficients as a function of beam.
2. Monte Carlo results were validated with linear attenuation coefficients derived from Hounsfield Unit measurements at discreet energy levels.
3. RSD Phantom material linear attenuation data was compared to NIST data using ICRU Report 44 compositions of human tissues.
4. NIST data was interpolated when necessary.

MATERIALS	DENSITY (g/cc)
RSD Soft Tissue (Opaque)	1.08
RSD Soft Tissue (Transparent)	1.10
RSD Cortical Bone	1.83
RSD Trabecular Bone	1.17

RSD SOFT TISSUE					
Energy (MeV)	Mean (HU)	Calculated (μ)	μ (ICRU 44)	% Difference	Ratio
00.08	60.30	0.1948	0.1932	0.80%	0.9921
00.10	52.88	0.1797	0.1795	0.15%	0.9985
00.12	57.10	0.1717	0.1709	0.44%	0.9956
00.14	52.95	0.1623	0.1624	0.07%	1.0007
00.20	--	0.1477	0.1439	2.61%	0.9746
00.30	--	0.1245	0.1246	0.04%	1.0004
00.60	--	0.0950	0.0941	1.01%	0.9900
00.80	--	0.0825	0.0826	0.13%	1.0013
01.00	--	0.0744	0.0743	0.18%	0.9982
02.00	--	0.0520	0.0519	0.18%	0.9982
03.00	--	0.0351	0.0357	1.71%	1.0174
06.00	--	0.0288	0.0291	0.88%	1.0088
08.00	--	0.0252	0.0255	0.98%	1.0099
10.00	--	0.0229	0.0232	1.49%	1.0151
15.00	--	0.0203	0.0203	0.15%	0.9985
20.00	--	0.0189	0.0189	0.17%	1.0017

RSD CORTICAL BONE					
Energy (MeV)	Mean (HU)	Calculated (μ)	μ (ICRU 44)	% Difference	Ratio
00.08	1365	0.4345	0.4280	1.51%	0.9851
00.10	1048	0.3496	0.3562	1.84%	1.0188
00.12	0977	0.3211	0.3274	1.91%	1.0195
00.14	0902	0.2932	0.2986	1.80%	1.0184
00.20	--	0.2511	0.2513	0.09%	1.0009
00.30	--	0.2155	0.2137	0.84%	0.9916
00.60	--	0.1596	0.1598	0.11%	1.0011
00.80	--	0.1403	0.1402	0.10%	0.9990
01.00	--	0.1274	0.1261	1.06%	0.9895
02.00	--	0.0883	0.0885	0.17%	1.0017
03.00	--	0.0611	0.0625	2.29%	1.0235
06.00	--	0.0512	0.0525	2.46%	1.0253
08.00	--	0.0468	0.0474	1.20%	1.0121
10.00	--	0.0446	0.0444	0.39%	0.9962
15.00	--	0.0410	0.0409	0.16%	0.9984
20.00	--	0.0393	0.0397	1.02%	1.0103

RSD TRABECULAR BONE (SPONGIOSA)					
Energy (MeV)	Mean (HU)	Calculated (μ)	μ (ICRU 44)	% Difference	Ratio
00.08	551	0.2849	--	--	--
00.10	515	0.2586	--	--	--
00.12	439	0.2337	--	--	--
00.14	318	0.1541	--	--	--