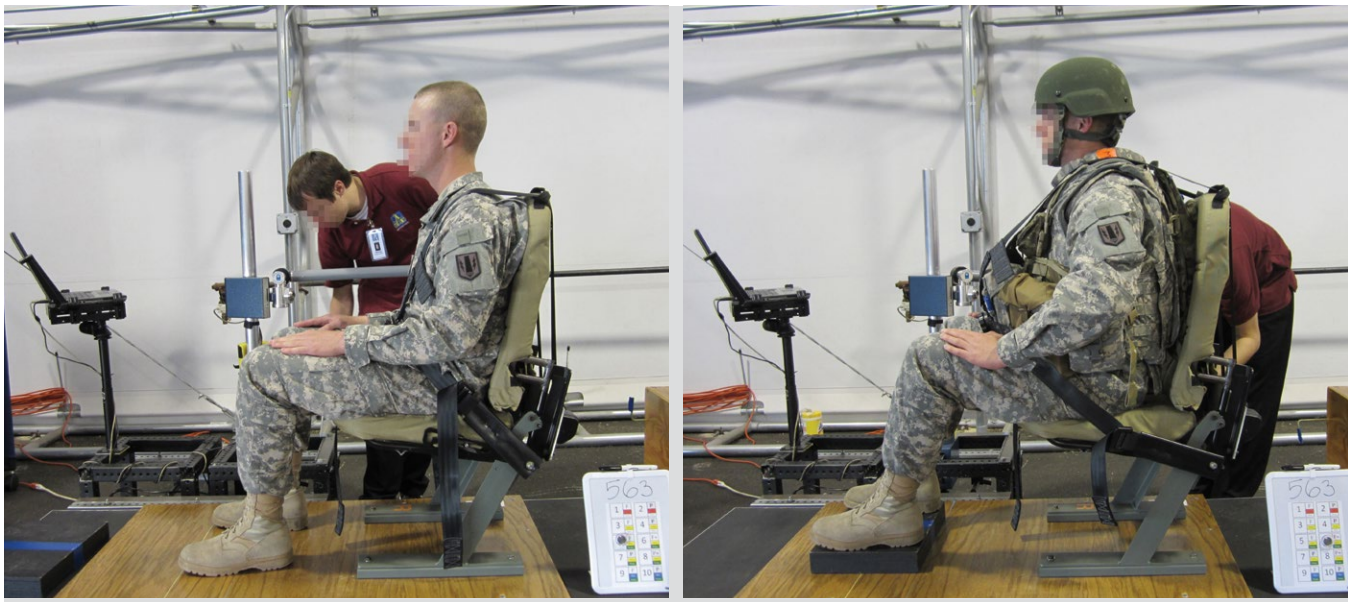
Got Gear: More Realistic Soldier Models

By *accelerate* Staff



A University of Michigan research team went to three Army bases to measure more than 300 Soldiers of assorted sizes and shapes to help develop more accurate virtual portrayals of Soldiers — with and without gear on — for computer software models. Updated virtual Soldier models will help engineers conduct more precise occupant-centric design and safety studies. (Photos courtesy of Dr. Matthew Reed, University of Michigan.)

Army designers who needed a virtual adult male in vehicle modeling and simulation studies have been relying on a software manikin named Jack™ for about 18 years. But a newly developed Soldier model created by measuring real men and women at Army bases will dramatically change vehicle design accuracy.

Jack has never correctly reflected the way a real, fully equipped Soldier sits in a military ground vehicle or the variability caused by different sizes of active-duty men and women. Government, academic and industry partners in the Automotive Research Center (ARC) are developing a new virtual Soldier featuring true-to-life dimensions combined with the effects of being "encumbered" — that is, wearing all the protective equipment and gear Soldiers need on a mission while secured in safety equipment in an Army combat or tactical ground vehicle.

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>
> — Holly Howard
> TARDEC Engineer

The updated virtual Soldier model is based on measurements from more than 300 enlisted men and women to account for the changes in circumference and constraints with full equipment on, while factoring in height, weight, posture, body shape and seating angle.

The updated model allows engineers to improve Soldier safety and survivability, its lead researcher explained.

"The path forward to increased safety is modeling and simulation (M&S)," stated Dr. Matthew Reed, a research professor at the University of Michigan Transportation Research Institute. "It all starts with being able to simulate a human in all variations. We can now study the space claim that results from a Soldier's body with all their equipment over them. Those factors weren't available before. For the first time, we'll be able to quantify accurately the additional effects produced by the width of the protective equipment and all their gear, wearing two different ensembles representing a rifleman and a SAW [squad automatic weapon] gunner. This information is already being used for advanced vehicle layout."

GEARED TOWARD ACCURACY

Reed presented the study's results at the 2012 ARC Conference in Ann Arbor, MI, in May. The ARC is a collaboration among the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), college researchers and private industry partners working together to advance modeling and simulation studies. TARDEC engineers have been using Jack in vehicle designs since the mid-1990s. Their blast effect studies in particular could not reflect that a fully encumbered Soldier tends to sit with a slight hunch in the seat and his movements are restricted by his gear and safety harness. **"**We're changing that with this project," Reed noted.

Reed, working with a private contractor, sent teams to three Army bases to measure 309 Soldiers (including 52 female Soldiers) using a combination of computerized measuring tools and manual input to locate body landmarks on shoulders, spines, knees and other bones. The team is analyzing the data and intends to refresh virtual models used in M&S studies.

"In the long run, we want to use the data to revamp vehicle design specifications in the Army standards. This is 35 years behind what civilians are doing in passenger car, light truck and commercial vehicle studies," Reed explained. "We actually want to jump ahead of what's being done in civilian vehicles and use 3-dimensional models to define new design standards."

The TARDEC team processing data in the studies stressed that survivability in conflict areas is the No. 1 motivation, but comfort and safety will also improve when the software tools accurately represent the variations in a Soldier's posture, shape and seating position.

Accurate measurements of male and female Soldiers with various body types helped a University of Michigan research team develop more precise computer models. Army engineers are already using the updated models to perform safety system simulations. (Photo courtesy of Dr. Matthew Reed, University of Michigan.)

"We've talked about Soldier-centric design — now we can accurately do it," commented TARDEC Engineer Holly Howard. "With the preliminary data, we are already taking these findings into consideration."

This rendering shows how circumference and posture can change when comparing an average-size male computer model to a virtual Soldier wearing a full package of equipment.

"Now our designers will know how much space we'll need to allow for the encumbered Soldier," added Stacy Budzik, TARDEC Engineer. "Nobody had the ability to cover a [computerized] model with gear and now we can do it with a wide range of body types, too."

In a blast situation, particularly an explosion under the vehicle, the force produces a pressure wave, and Soldiers in the path of that energy are put at risk of head, back, lumbar and pelvic injuries. Dr. Reed explained that the new virtual model could help minimize those injuries.

"We think using these data to appropriately design vehicles and position the model will help improve vehicle seat designs and will protect a much larger percentage of Soldiers," Reed summarized.