



**Homeland
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts unbiased operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

Information provided by the SAVER Program will be shared nationally with the responder community providing life- and cost-saving assets to federal, state, and local responders.

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, please see the SAVER Web site or contact the SAVER Program Support Office.

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Opinions or points of view expressed in this document are those of the authors and do not necessarily represent the view or official position of the U.S. Government.

This SAVER TechNote was prepared by the Space and Naval Warfare Systems Center, Charleston, for the SAVER Program.

SPAWAR



Systems Center
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TechNote

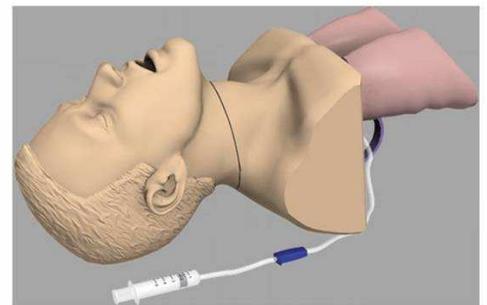
Patient Simulation Technologies

Patient simulation technologies are often used in emergency responder training to teach and allow practice of basic and complex medical skills through hands-on experience. These technologies include partial task simulators and real-life simulators. Partial task simulators are used to teach a specific skill and include partial body simulators, virtual reality trainers, and manikins. Real-life simulators, commonly called human patient simulators (HPSs), are used to teach a wide range of medical procedures by replicating patient physiology in realistic emergency and routine medical situations.

Partial Body Simulators

Partial body simulators are lifelike models of portions of a human body. They generally come with medical instruments to enable emergency

responders to practice specific medical procedures. Examples of partial body simulators used in emergency responder training include: torso models for cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) training; arm models to teach blood pressure monitoring and intravenous (IV) catheterization; foot and hand models to teach suturing; and head and lung models to teach endotracheal tube insertion or clearing an obstructed airway.

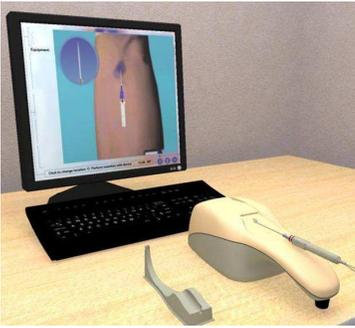


Partial Body Simulator

Ranging in price from \$300-\$2000, partial body simulators are available in pediatric and adult models and some have interchangeable parts to alter the gender or physiology of the model if necessary. Each model is designed to withstand repeated practice of medical procedures and most have replaceable parts, such as artificial skin or airways. Some simulators are used in conjunction with instructor-led training and some interface with computers for training via software.

Virtual Reality Trainers

Virtual reality trainers utilize computer software with 3-D graphics to provide audible and visual instruction on specific medical procedures. The virtual reality trainers most commonly used in paramedic and emergency medical technician (EMT) training are augmented trainers. Priced around \$15,000, augmented trainers feature interactive equipment, such as haptic devices and/or medical instruments, that allow practice of a specific skill. A haptic device is an interface between the user and the computer that provides tactile feedback when manipulated.



Virtual Reality Trainer

For example, some augmented trainers offer a software module that comes with a body-based haptic device and needle to teach IV catheterization. As an emergency responder inserts an IV catheter into the body-based haptic device, a 3-D graphic on the computer monitor displays information, such as the catheter insertion depth, that allows the emergency responder's technique and performance to be evaluated. The software provides immediate feedback and maintains a history of each attempt to master the skill.

Manikins

Manikins are life-sized models of the human body used for a wide range of training, such as CPR, Advanced Cardiac Life Support, specific traumas (e.g., broken bones), and mass casualty. Durable and rugged, manikins are designed for use in the field, allowing emergency responders to train in a realistic setting. They are available in adult, child, and infant models and can range in price from \$250-\$12,000.



Manikin

Some advanced models simulate cardiac rhythms, pulses, pupil dilation, and bleeding to provide more realistic scenarios for training.

Human Patient Simulators

HPSs are lifelike, computer-controlled manikins that are available in adult, child, and infant models. Unlike partial-task simulator manikins, these hi-tech manikins are able to teach a wide range of medical skills by realistically depicting patient physiology. The HPS is capable of simulating normal and abnormal bodily functions and can be programmed to exhibit the symptoms of a variety of diseases and emergency medical conditions. HPSs are often set up in a learning environment, known as a simulation lab. These labs can resemble operating rooms, emergency rooms, or ambulances and may contain equipment, such as a heart monitor, that can be connected to the HPS for training purposes.

An instructor runs the system and monitors the training, which is often captured on video for critiquing the emergency responder's performance. During training, the instructor implements a scenario (e.g., cardiac arrest, allergic reaction, drug overdose, car accident, or pneumonia) causing the HPS to exhibit realistic symptoms. Emergency responders must diagnose the symptoms by examining the HPS and checking for vital signs. Emergency responders can then administer treatment, which could include dispensing drugs, inserting endotracheal and chest tubes, establishing IVs, giving CPR, or tending wounds. The HPS can be pre-programmed to react to the treatment or the instructor can enter a response. The correct diagnosis and treatment will result in patient improvement. Delivering the wrong treatment can cause the HPS to exhibit an adverse reaction and simulate death. Emergency responders can see the results of their actions in real-time, enabling them to learn from any mistakes.



Patient Simulation Lab

Picture courtesy of Florida Atlantic University Disaster and Emergency Training Facility in Boca Raton

HPS models range in price from \$40,000-\$200,000. Setting up a simulation lab could cost an additional \$200,000. Some universities and teaching hospitals allow use of their simulation labs for training and may charge tuition or a daily use fee.

HPSs can be used to train and certify emergency responders in Basic Life Support, Advanced Cardiac Life Support, and Trauma Life Support. HPSs can be taken into the field for more realistic training scenarios. Multiple HPSs are sometimes used to imitate a mass casualty incident to train emergency responders in chemical, biological, radiological, nuclear, and explosive or weapons of mass destruction disasters.

Additional Information

Florida Atlantic University
<http://med.fau.edu>

The Responder Knowledge Base
<https://www.rkb.us>