

testing clothing Let Manny Do It

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A new employee has arrived at Dugway Proving Ground. Never has a new member of the work force stirred such interest as "Manny" the brainchild of Dr. Lothar L. Salomon, Dugway's scientific director. Manny is an anthropomorphic

robot designed especially to aid in the testing of protective clothing to be used by the US Army in chemical environments.

The design of the robot began in December 1985 when the Test Data Division of the Materiel Test Directorate contracted to Battelle, Pacific Northwest Laboratories, Richland, Washington, to develop the mannequin. Karim Quassin served as the initial project manager and Curtis Jones as Dugway's Battelle representative. The project was transferred to the Instrumentation Branch of Test Data Division when Quassin accepted employment elsewhere. Charles DeWitt is currently serving as Instrumentation Branch project manager for the project,

with James Dyer as the Dugway Battelle representative.

Manny is called "he" because he is sized to match the dimensions of a 75th percentile male; that is, five feet, 11 inches in height and weighing 165 pounds.

This quiet, gentle giant simulates breathing; his chest moves in and out, moist air emits from his nose and mouth, and when he has been under exertion he "breathes" faster. He also sweats when he gets too warm and he is warm to the touch.

Even though he has no sense of balance, he can walk, run, crawl, stand, sit, and kick a ball. He will stress the clothing he is wearing in a test the same as a human would. His greatest ability will be that he will be able to detect chemicals that pass through the protective clothing being tested and where it is leaking through because of the many small sensors built into his skin and attached to the data acquisition computer. This sensing ability will be installed in Manny during Phase III of his life.

His complicated mechanical body will be converted with a thick skin of butyl rubber that has been molded in the human shape.

This is not a simple system. He is composed of several distinct systems. One system is the mannequin himself, a mechanical system consisting of the skeleton and actuators. In the beginning stages an arm used in the automated Michael Jackson show was purchased from Disney World.

The supporting link system is the stainless steel glove box and an articulated arm that holds Manny up in his various poses during testing. Another system is the mannequin's skin temperature, perspiration, breathing, skin structure, and sampling system. Still another sys-



Manny is an anthropomorphic robot which will be used to test protective clothing.

tem is the control system.

The robot is now pre-programmed with a limited selection of test sequences. He can be run by a technician without a computer science background. The English language commands are presented in menu formats. To add to this list of testing maneuvers will require a computer software expert.

Manny has a control system composed of three primary modules: the host computer, his graphics processor, and a distribution control system. Like humans, Manny has a movement library. This library stores the scenarios necessary for basic movement, such as raising the left foot, bending the right elbow, running, bending, crawling, and so forth.

To actually replicate human motion, more is involved than just bending or straightening joints. Timing and speed, plus their order,

make the human movement what it is. To achieve this, joint location data was obtained by several video cameras recording a person performing the exercise, such as walking on a treadmill, with reflective targets on their joints. Later, a computer identified the targets on each frame of the recording using a specially developed automated frame grabbing technique. Then the data was transmitted to the computer file for use in generation of the movement library file.

The computer graphics system displays the basic moves in the library and then assembles them into a complex scenario. These movements can be saved in the host computer's memory for later recall.

Once he has been through the three phases of his life he will be used in experimental studies involving protective clothing. With the ability to duplicate human

movement, breathing, body temperature and moisture, plus being able to detect chemicals that pass through the protective clothing being tested, he can be used in the realistic tests necessary for this country to maintain an effective defensive posture for protection from chemical and biological threats.

Phase I and II of his development effort produced the conceptual design, a prototype robotic mannequin, graphic display system, and distributed control processor. This was done in Richland, Washington. The robot has been shipped to Dugway for evaluation prior to beginning Phase III of his life. Here he will be subjected to evaluations by Jimmy Barnes, Dave Newbold, and other members of the Dugway technical staff. Enhancements will be incorporated by Battelle as a result of the evaluation. 