Three-Dimensional Laser Scans of Humans

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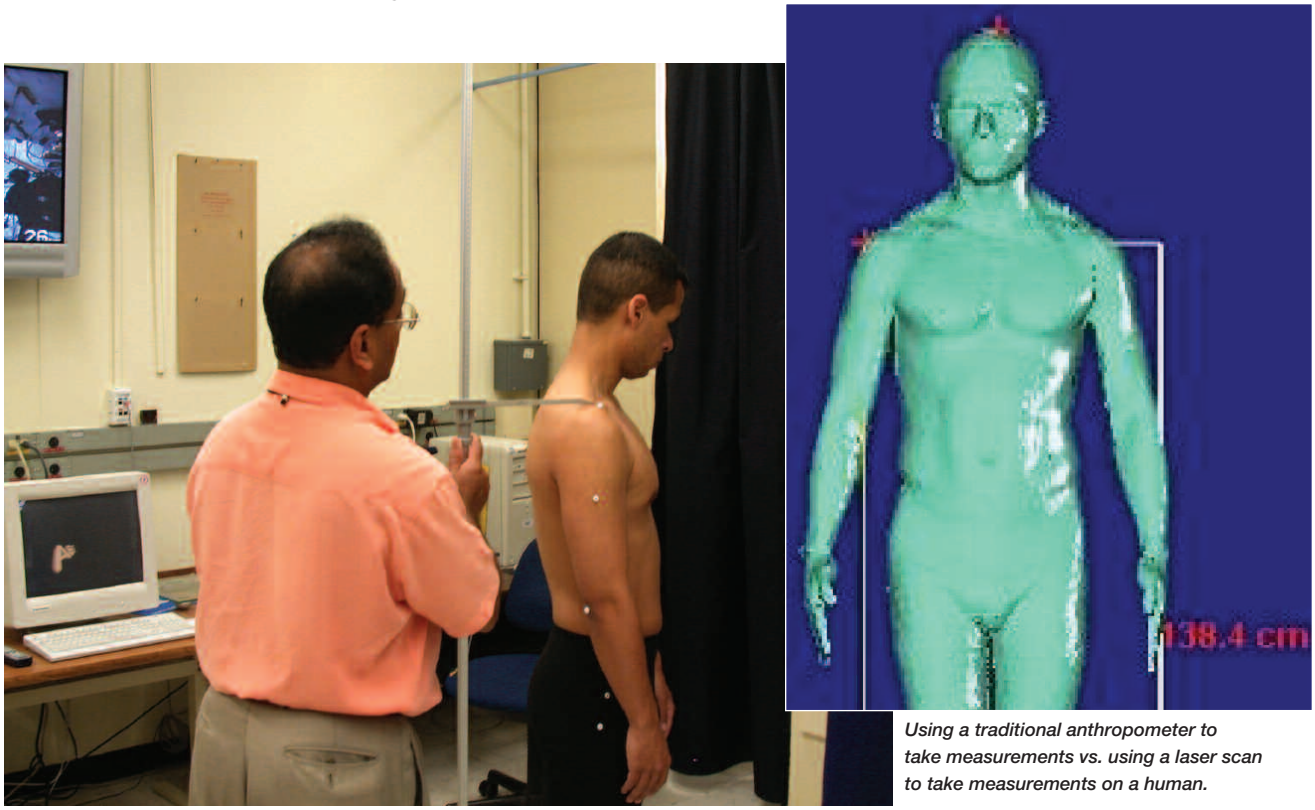

Using a traditional anthropometer to take measurements vs. using a laser scan to take measurements on a human.

A three-dimensional scanner broadens the spectrum of capabilities that anthropometry currently offers. Scan data can be used to take the more traditional measurements, but also has the ability to capture and quantify the volumetric aspects of data in ways no traditional technique can. With this new technology, posture- and segment-based center of mass, volume, moments of inertia, and even surface area can be quantified and applied to the astronaut suit-sizing process. The use of this scanner technology necessitates the validation of its accuracy in comparison to manual measures, as well as the development of tools that mitigate some of the limitations of the scanner data capture. The scanner is comparatively accurate to traditional measurement techniques, with the added benefit of saving the scan for future reference. In addition, tools to merge several scans into one and to fill voids in the scan data were developed and verified for accuracy. Further tools will be developed to acquire nontraditional measurements (e.g., volume and surface area) from whole-body scans.

Accuracy of Linear Measurements from Whole-body Laser Scans

The accuracy of measuring human subjects with the whole-body scanner was compared against the traditional method of using an anthropometer. The scan method is just as accurate as the traditional method but has the added advantage of being able to recall the stored scan and take additional measurements without requiring the subject to be brought back to the lab. Additionally, the scanned image can be used for additional measurements such as calculating body segment mass and moments of inertia.

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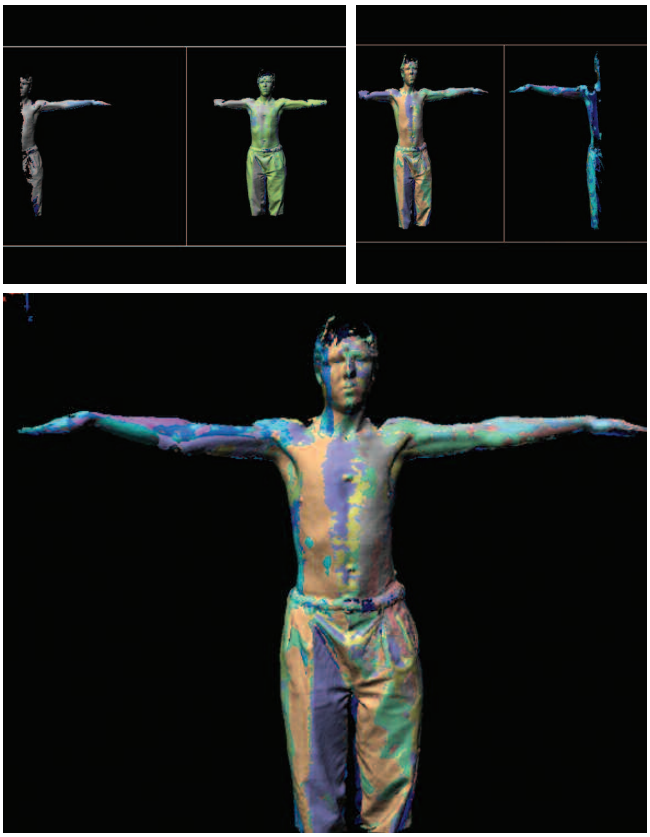
continued

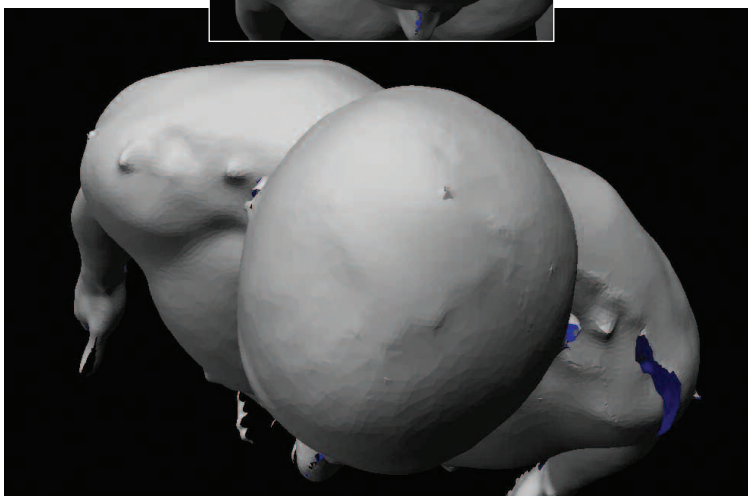
Tools

Merging of Scanned Data: The VITUS Smart Scanner, by VITRONIC, scans 1 m x 1 m and 2.1 m in height within 10 seconds. In some cases, some measurements cannot be captured in one scan (e.g., fingertip to fingertip). A method to merge partial scans of objects that cannot be totally captured in one scan was developed, thus allowing the desired anthropometric measurements to be taken from the merged scans.

Filling of Voids: In some instances, the scanner encounters problems scanning surfaces that are either horizontal to the camera view, or obstructed from camera view by arms or hands. If circumferential measurements need to be taken of the obstructed part, the voids must be filled. A method to fill in the voids of scan data was developed; as with the merging of scan data, desired anthropometric measurements can then be taken from the filled scan.



Partial scans, merged scan.



Successful void fill.

Conclusions

Scan data has enormous capabilities in the field of anthropometry. Not only can it be used to take traditional measurements, but it also offers a vast amount of other information that traditional measurement techniques do not. Use of scan data will make the design of equipment for astronauts a more successful process.