

TRIAL RUNS

Joe Greco

Polhemus 3Space FastSCAN

With all the excellent 3D software available in the market today, recreating simple parts has become a no-brainer. However, most modelers still struggle when it comes to building existing objects that have curvy complex shapes. This is where the Polhemus 3Space FastSCAN Handheld Laser Scanner comes into play. Classified as a non-contact digitizer, it allows for fast scanning of 3D objects, even if the object is not stationary.

Once a physical object is scanned, there are many uses for it as a 3D model. It can be employed by an industrial designer as a starting point for a conceptual model. It can also be used to make replacement parts or compared to the original CAD file and checked for deviations. The Polhemus FastSCAN specializes in conceptual modeling as the latter requires more accuracy.

Installing

Even though the manual needs a lot of work, setting up the scanner is fairly easy. The main components of the system are a processing unit, which is about the size of a desktop computer, and a wand. When activated, this wand emits a laser beam that is read by one of two cameras mounted on each end.

The processing unit plugs into the computer's printer port, and the wand connects into this unit. The printer port must be set to ECP mode. If your computer is not capable of supporting this, Polhemus supplies an ECP parallel card. The software is compact enough to fit on two

CADENCE Verdict



The 3Space FastSCAN is a non-contact 3D digitizer for reverse engineering and conceptual studies.

Pros: Fast, handheld scanning; trigger performs many helpful tasks; receiver allows for object to be moved; powerful software controls.

Cons: Certain objects won't scan well; scanned files still need postprocessing; limited accuracy; some problems exporting files.

Price: \$29,995

Polhemus, Inc.

www.ptc.com
Reader Service No. 10

Feature Report Card
Scoring from 1 (lowest) to 10 (highest)

Installation and Setup	9
Interface	8
Features	8
Expandability/Customization	NA
Interoperability	6
Support	6
Value	8

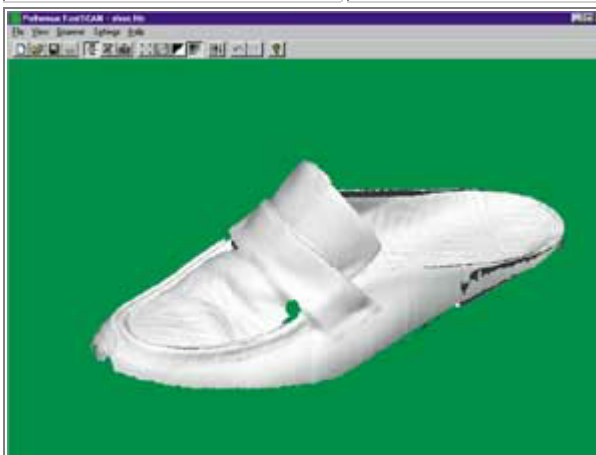


Figure 1. The interface for the FastSCAN software is simple. While some gaps appear on

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compact enough to fit on two floppy disks.

Once I had the software installed, I placed a shoe on a table, pressed the trigger on the wand and passed the red laser over it. Voila! There was the shoe as a flat shaded 3D model on the screen. By selecting the appropriate icon, the FastSCAN software lets you view the model as point clouds, as a wireframe and as a smooth shaded image, as shown in Figure 1. The software is smart enough to record the direction of the surface normals, which can be displayed. Only polygonal and point cloud data is generated; for NURBS surfaces a program such as Raindrop geomagic Studio must be employed, which I will discuss later.

Although my initial scan was far from perfect, I was excited by my early success so I started looking for objects to scan. This is when I discovered the limitations inherent in non-contact laser scanners.

Due to the color of the laser beam, red items do not show up very well as is the case with black objects because both colors absorb light. White paint or powder coatings will have to be used in these instances. The wand has a dial setting that aids in its "seeing" darker objects, which helps, and using a black background with low lighting generally produces the best results. Additionally because the cameras are reading the beam as it hits the surface of the object, transparent parts don't record because the beam just passes through them. Metal and other reflective objects don't record very well either. In fact, large metal objects should not even be near the scanner. Additionally magnetic fields like the one generated by a computer screen, for example, should be at least one meter away. This does not present a problem, however, as the scanner comes with cables almost 20 feet long.

Scanning

With a better understanding of the scanner's limitations, I scanned several objects with a decent amount of success. The scanning process starts when you point the wand at the transmitter and press the trigger for a second. A small gray box about two inches on each side, this transmitter lets the scanner know where it is in 3D space and must be within a meter of the wand.

Depending on the object, the top is usually scanned first and all that is needed is one smooth stroke; I was impressed by how fast the wand could be moved while still recording details, albeit the slower you move the wand the better the detail. No matter how slowly you scan, the best accuracy you can expect from the FastSCAN is about .5 to .75 millimeters.

Once the top is scanned, the sides can be recorded. When you press halfway down on the activation trigger while pointing at the side of an object, the software automatically repositions the model to that view so that the side can be swept. A magnetic tracker in the wand determines its position and orientation in 3D space, and the software automatically fixes overlapping areas. Additionally there are other controls for removing

the model, scanning a complex shape such as this shoe saves a lot of time when reverse engineering is needed.

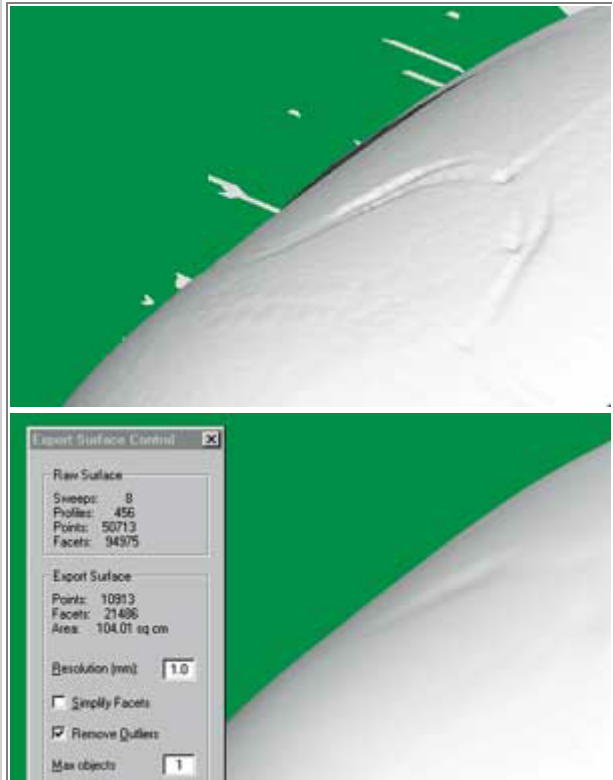


Figure 2. Originally scanned with more than 80,000 facets, this close-up of a computer mouse (on the left) shows the degree of detail that can be captured. However, when the points are reduced via the dialog box, smoother surfaces are created but detail is lost (on the right).

detached background noise. The scanner also allows for a quick undo when the trigger is double pumped, whereas a triple pump will start a new scan.

The model can be rotated on screen by using the arrow keys or by clicking and dragging the mouse, although better visual feedback is needed here. The response time was not instantaneous on my 350MHz PC; however, it was acceptable, especially considering that I was pushing around more than 20,000 facets at certain times. When all sides are scanned, the software has tools to reduce the number of overall points and thus reduce the facets in the model, as shown in Figure 2.

Moving the Object

Sometimes an object has to be moved, for instance, to capture the bottom. Doing so would disorient its absolute position vis-à-vis the transmitter, so in these cases a receiver can be attached to the part. This works well, except that the receiver now is part of the scan. The way to get around this is to first scan a side where the receiver cannot be seen and then use the Freeze Receiver command. With its last position recorded, the receiver can now be removed and the scanning continued.

Exporting

The key to a system such as this is how well it exports data. FastSCAN can generate files in several neutral formats such as IGES, STL, DXF, VRML as well as proprietary formats including OBJ (Wavefront) and 3DS (3D Studio MAX). With most of these formats, files can be saved as either points or surfaces.

Currently a limitation of the software is that it can't export a point cloud file as an ASCII-based file in the standard PT format; instead, it creates a TXT file. thinkdesign, an MCAD program from think3 that has the ability to import point cloud data, couldn't read this file in, but it did handle the IGES file that was saved as point data. I also tried sending point data to Raindrop geomagic's Studio program and found that certain formats, such as DXF and TXT, worked well; others, such as IGES, produced an error.

I tried exporting various formats as surfaces into different programs and had moderate success. geomagic handled most of these surface files, but as was the case with the point data, the software didn't open IGES nor triangulated STL files.

Most MCAD programs did the best with IGES, although Mechanical Desktop took more than 25 minutes to open a file with 20,000 faces. None of the programs I tried, including Mechanical Desktop, could read in a DXF file, and most had problems with STL. Polhemus has acknowledged these export problems and is working on creating cleaner files.

Conclusion

As with other products in its class,

The Polhemus 3Space FastSCAN is a fascinating product, despite the drawbacks-most of which are related to general limitations of laser scanners. If its lack of pinpoint accuracy is not a problem, most users will find that its ability to rapidly input objects will definitely improve their productivity.

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