PROSECUTOR'S BRIEF

THE CALIFORNIA DISTRICT ATTORNEYS ASSOCIATION'S QUARTERLY JOURNAL

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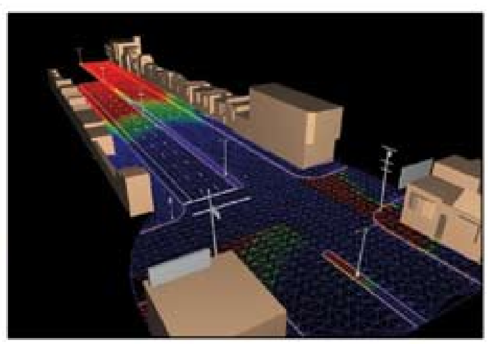
New Tools For Crime Scene Reconstruction

by Craig Fries

Forensic experts can now accurately reconstruct crimes because of the development of high-speed laser scanners. Previously impossible or prohibitively expensive reconstruction can now be done using laser data. The high-speed laser can develop one million measurements of a crime scene in 12 minutes with an accuracy of plus or minus one-quarter of an inch! This information is used to build a computer-generated working model of the crime, which is not only accurate, but also very detailed. If the crime scene and/or physical evidence have changed since the occurrence of the event, they can be re-engineered to the way they appeared during the commission of the crime using laser-assisted photogrammetry. All the physical evidence collected from the scene can be scanned and added to the working model. Even evidence that is no longer available can be reconstructed and added to the working model. The location of eyewitnesses can also be placed in the three-dimensional model to determine what they could see and what they could not. When completed, the working model is an accurate reconstruction of the event as it occurred and can be used to produce an animation of the crime that is admissible in court.



(Above) Laser scanner. (Top right) Laser scan image of a street. (Bottom right) Computer model with laser scan overlay

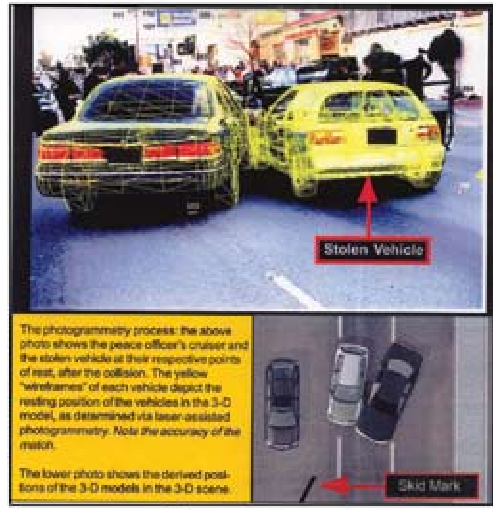
The following is an actual example of an officer involved shooting case that utilized computer-generated reconstruction technology.

At the end of a high-speed chase, in a busy intersection in a large metropolitan area, the driver of a stolen vehicle hit a parked car and quickly backed up into a peace officer's car crushing an officer. The driver was subsequently fatally shot by other peace officers. The family members of the driver filed suit against the municipality and the officers, alleging that the officers used excessive force. There were many witnesses to the incident and their accounts differed in important aspects that made it difficult to determine whether or not excessive force was used. The challenge was to determine whether the physical evidence supported the officers' version of the events.

In order to determine whether the officers' use of deadly force was warranted, the physical scene had to be recreated and the actions of the participants reconstructed in real time. Additionally, the reconstruction had to meet a sufficient level of accuracy in order to be admissible in court and compelling to a jury. However, the incomplete documentation at the scene, combined with the busy traffic and the fact that the incident occurred three years before, made reconstruction very difficult.

First, a three-dimensional working model of the crime scene was developed using a three-dimensional laser scanner. The laser scanner was selected because it could measure the entire intersection without closing it to traffic. The stolen vehicle and the peace officer's vehicle, which had been impounded, were scanned to measure their dimensions and the collision damage—another key set of evidence. The results of these laser scans were used to create highly accurate computer-generated reconstruction of the crime scene, both vehicles, and their damage.

Using laser-assisted photogrammetry, the peace officer's car, nearby cars, and the stolen car were precisely placed in their original resting places in the working model. However, the skid mark made by the stolen car had been erased by traffic. The erased skid mark was needed to determine the acceleration, direction, terminal velocity, elapsed time of motion, and initial location of the stolen car to accurately reconstruct the scene. Using laser-assisted photogrammetry and the available single photo of the skid mark, an expert was able to accurately determine its dimensions and precisely place the skid mark in its correct position in the working model.



An example of laser-assisted photgrammetry.

The computer-generated working model now contained a depiction of the crime scene as it existed at the time of the shooting. Using measurements derived from the working model, the crime scene was reconstructed off-site. The actual stolen vehicle was driven under similar conditions in the reconstructed scene and the tests were videotaped. The video was analyzed frame-by-frame to determine acceleration, velocity, and elapsed time required for the stolen car to create a skid mark identical to the original at the crime scene. Once these variables were determined, the working model was configured to determine the specific path of the stolen vehicle as it backed up and collided with the peace officer's vehicle.

The movements and timings of the peace officers before and during the shooting were needed to complete the computer-generated reconstruction. A second off-site reconstruction was set up. The stolen vehicle and peace officer's vehicle were placed in their proper positions and the officers re-enacted their movements as they were videotaped and timed with a stopwatch.

The scan of the crime scene, the physical evidence, the recreated skid mark, and the results from the off-site reconstructions were combined to create an accurate,



These photos were taken at an off-site reconstruction and used to complete the computer-generated reconstruction.

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time-synchronized re-creation of the crime. The final result was animated and had the potential to be viewed from any perspective, including that of the firing officers. Using the final product, it was determined that the physical evidence conclusively proved that the officers' use of deadly force was reasonable. It was also an admissible visual tool used to present the results to a jury.

Scene from animation.

Craig Fries is the founder of Precision Simulations, Inc. He developed the first computer-generated simulation accepted in Santa Clara Superior Court and the first forensic animation developed using laser-scanning data into a trial court in California. Mr. Fries has maintained a 100% admissibility record for courtroom submissions of his animations and simulators based on his high level of accuracy and forensic analysis.