JS HELD

PERSPECTIVES

Advanced Technology in Forensic Engineering: 3D Scanning, HD Drones, Video Analysis, and Berla iVe Vehicle System Forensics

Our perspectives feature the viewpoints of our subject matter experts on current topics and emerging trends.

INTRODUCTION

Forensic technology is moving forward at a rapid pace. Americans are bombarded by high tech forensics in every TV show or movie they watch. From CSI to MacGyver, investigators solve their cases and problems with innovative technology. Jury members are not immune to the influence of these popular media depictions; they expect to see advanced technology utilized in the analysis of a case. These cases can range from, but are not limited to, traffic collisions, fire investigations, or structural failure investigations. As forensic engineers, problem solving is our job, and using advanced technology is expected—not always by attorneys and adjusters, but certainly by jurors.

This article will discuss 3D scanners, high definition (HD) drones, video analysis software, and Berla iVe Vehicle Infotainment data analysis software and examine how they can be used in a case.

3D SCANNING

Recent developments in 3D scanner technology have led to 3D scanning becoming a common tool in a wide range of investigations. The 3D scanner can preserve the scene, and/or the object, in digital format more accurately than the combination of diagrams, maps, and/or photographs, which has up until recently been the standard. 3D scanner technology allows for rapid 360-degree documentation of scenes, vehicles, or machines. Typical scan times (varies depending on the chosen scanner settings) are under 10 minutes per scan and are decreasing as technology advances. When documenting with a 3D scanner, little goes unnoticed. The speed and accuracy of the technology is constantly improving, and the time required on site while capturing more detailed measurements is decreasing. While this is important in static situations (stored evidence, open roadway, etc.), it is even more important in the scene investigation when the situation is still potentially dynamic, and time is of the essence.

The accuracy of a 3D scanner provides the user with comprehensive data that is not isolated to a particular point but is available for any area scanned. This assures that on the day of, the day after, or a year after the incident, the dimensions and visible conditions of the location, structures, and objects are preserved. Examples of which would be a roadway with temporary construction closures, or a building with fire or structural damage. In these two situations, the locations will change, yet with a 3D scan, a visual and measurable copy of the status of the location can be stored indefinitely to provide detail and workable data in the future if required.

Inset

Inset is the representation of a scanned vehicle (Photo 1). Each pixel you see is a three-dimensional point of data. With more than 50 million points of data, documenting damage to a vehicle is straightforward. The amount of data also provides additional options for compelling demonstrative aids.

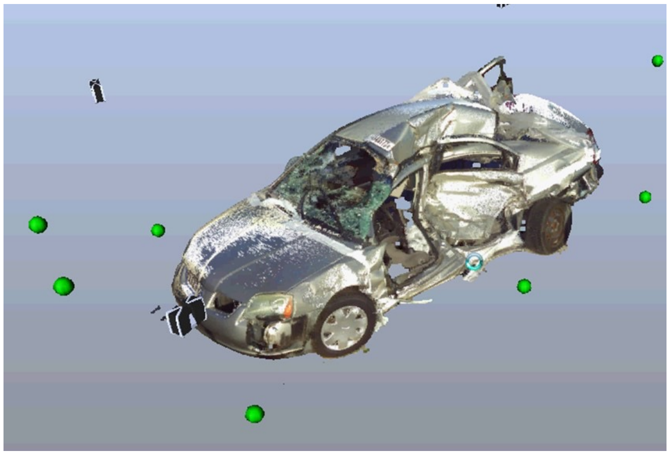

Photo 1 *- 3D Scan of Crushed Vehicle*

HIGH-DEFINITION DRONES

Drones are starting to play a primary role in forensic engineering. Drone platforms equipped with 4K cameras allow for unprecedented video and photographic documentation of active or older crash sites, fire scenes, building inspections, and complete documentation of vehicles (Photo 2). As with the 3D scanner, documentation using a drone platform is quick and thorough, providing a wide range of views from bird's-eye to even a first-person human perspective. For larger areas, the drone will be able to provide a quicker scan of the area in question than that of a typical 3D scanner. The drone also has the ability to provide data from a more elevated position which can be required in some investigations.

Photo 2 *- 4K Drone Photograph*

Video and photographs from a drone platform are captured in high resolution digital formats. These high-resolution images, combined with ground targets, reference measurements, or scanner data, can be used to obtain accurate measurements. The exceptional quality of the photographs allows for the use of Photomodeler or other analysis software.

Another use of drone video is animations. Video shot using the drone can be combined with forensic animations to serve as demonstrative aids for mediation or trial.

DASH CAMS / SURVEILLANCE VIDEO ANALYSIS

Dash cameras and video surveillance are becoming more common as the technologies become less expensive and more accessible. Dash cams are being used in large commercial fleets, RVs, and private vehicles. Many times, the presentation of the dash cam video may be all that is necessary to bring a case or claim to a close. But in most instances, the video captured by the camera is used to acquire more accurate dimensional and speed data for the reconstruction of a vehicle accident. The dash cam or surveillance video can also be used to refute, confirm, or clarify witness accounts.

Surveillance video also offers the opportunity to obtain additional information about an accident or event. Newer security cameras are capturing events in HD format. The high-resolution video offers increased accuracy during the analysis. In a crash scene involving an intersection, it can provide information as to traffic signal light phasing at the time of the collision and exact location of the involved vehicles. In a fire investigation, it can assist in providing area of origin and in some cases, cause.

Analysis of dash camera and security video is advancing, too. Now software, used originally in the movie industry, is being used to analyze video for speed and distance data. This software, combined with documentation of the scene and vehicles, can lead to very accurate analysis and reconstruction of accidents and fire development.

One example of this technology is SynthEyes, which provides engineers with extensive tools to obtain relevant data from dash cams or surveillance video footage. Inset is a sample of the SynthEyes technology being applied to a dash cam video of an incident (Photo 3).

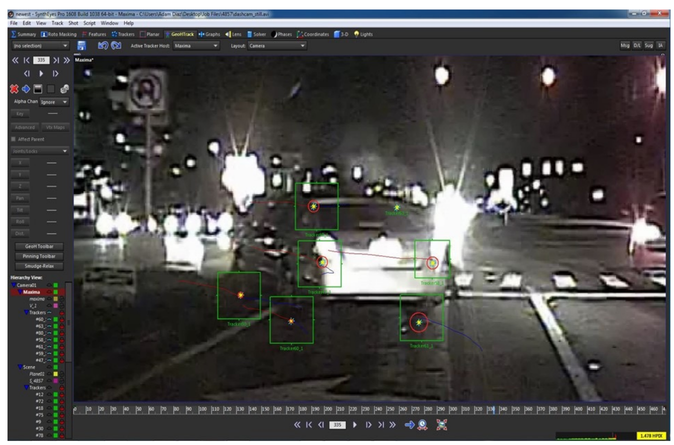

Photo 3 *- Syntheyes User Interface*

BERLA iVe VEHICLE SYSTEM FORENSICS

New technologies developed by BERLA and their iVe Vehicle System Forensics provides us the ability to acquire the information stored in many newer vehicles that can include historical location, system operational data (hard acceleration, hard braking, gear shifts, wheel speed, etc.), connected devices and if they were in use, time stamps, geo-data, and much more data that is captured by the vehicle. Unlike an EDR that requires an event to store pre and post-crash data, this is information that is constantly being stored in the vehicle's infotainment and telematics systems. Obtaining this data can provide insight into the driver's actions leading up to the crash, to include the moment of the crash. In the event of a hit and run, the data can show if that vehicle was in the area of the crash at that specific time and date. Additionally, the data can also show whether any devices linked to the infotainment system were in use at the time of the collision.

Depending on the data available in the vehicle of interest, the information obtained can assist in increasing the accuracy of a reconstruction. It can also assist in potential claims of distracted driving leading to a collision. The information can also provide insight into the driving behavior leading up to and including the collision. In the case of bicycle and pedestrian collisions where there is no event recorded by the EDR due to a delta V that is too small to record an event, vehicle systems and location information, which is constantly being recorded, can provide useful information for the reconstruction.

APPLICATION

Today, it's all about having the latest and greatest technology. As engineers and investigators, we share that sentiment, but we also understand that the end result of our work is to educate and explain. What makes these technologies so important is not only the comprehensive data they offer, but the variety of approaches they offer as well. With 3D scanner or HD drone data comes the ability to choose the level of sophistication the expert elects to present during a case. In other words, it is possible to tailor the approach to the audience and the case. For example, it may be best to use 2D line drawings of the scene and vehicles presented on easels for the jury. Additionally, a 3D image/model could provide different perspectives of the same scene, and the presenter could change the point-of-view on demand. The 3D data of the scene and vehicles could further be used to render an animation and still images that explain an accident reconstruction, how a particular machine operates, or how a fire develops. Another option would be to use the data to 3D print a scaled model of the scene, vehicle, building, or machine (Photo 4). This method allows for hands-on demonstrations and explanation of analysis. When it comes to "show and tell," showing often trumps explaining.

Photo 4 *- Upper Left: Subject Vehicle, Upper Right: Vehicle Scan, Lower: 3D Printed Model*

CONCLUSION

Advanced technology is everywhere, and the court room is no exception. Using advanced technology from the start of an investigation is expected by most jury members. 3D Scanning, 4K drone flights, advanced video analysis software, and vehicle infotainment and telematics data are on the leading edge of advanced technology in evidence preservation and accident analysis.

Using advanced technology offers more information and options for the analysis and for the presentation of case issues. More information and options can also benefit the decision-making process on how to handle a claim or case.

ACKNOWLEDGMENTS

We would like to thank Jonathan Wolgemuth and Chris Stewart, PE for providing insight and expertise that greatly assisted in this research.

MORE ABOUT J.S. HELD'S CONTRIBUTOR

Chris Stewart, PE is a Senior Engineer in J.S. Held's Forensics Practice. He specializes in product failure analysis and the reconstruction of traffic accidents involving trucks, buses, automobiles, motorcycles, bicycles, and pedestrians. Mr. Stewart employs leading-edge technologies in the preservation of evidence and the reconstruction of accidents.

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