Accident Reconstruction Technology A Primer

By Jeffrey A. Curran

Gone are the days when all you had was the Coefficient of Friction, some skid marks, maybe some semi-reliable testimony and the estimated amount/seriousness of vehicle damage in order to estimate speed and reconstruct an accident.

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To quote Ferris Bueller, "life moves pretty fast - if you don't stop and look around once in a while, you could miss it." Nowhere is this more true than in the area of accident reconstruction technology. In fact, I'm sure that before this new edition is finished, there will be something else cool introduced that will need to be added to this chapter. (Of course, if I stopped to add everything that came along as it's introduced, I would never get this article finished).

Gone are the days when all you had was the Coefficient of Friction, some skid marks, maybe some semi-reliable testimony and the estimated amount/seriousness of vehicle damage in order to estimate speed and reconstruct an accident. Of course, those things are still quite valuable (well, except maybe the testimony – sadly, that's still only semi-reliable), but today you have so much more information and can do so much more. Such as:

- Show a scene and the vehicles in 3D;
- Show damage to a vehicle, then superimpose the original dimensions;
- Zoom in on a specific area of a vehicle or scene;
- Totally re-create a scene;
- Expand dimensions of a scene or vehicle;
- Rotate around a scene or a vehicle;
- Place vehicles in various places to show multiple simulations.

…and so much more. Technology in this area is truly amazing. So, what I will try to do here is talk about the latest technology and try to give you an idea of what it does and how it can help you. Or at least make you sound smarter at accident reconstruction parties.

3D Laser Scanning

This is exactly what it sounds like – it's a 3D scan of whatever object, human or scene you want scanned. To be honest, an actual technical breakdown of how this stuff works is a little beyond the scope of the book (plus I would risk you skipping the technical parts – or maybe the entire chapter – even assuming I could even understand them well enough to accurately describe them. But in short, 3D laser scanning allows an expert to integrate scans of any of the aforementioned persons, objects or scenes. The scanning of buildings, roads, fences, trees, people (usually surrogates, but hey—knock yourself out) vehicles, failed parts, etc., can be critical in not only figured out what happened, but showing what could have happened if things were done differently and showing what existed at the time to be observed but perhaps was not. It will help evaluate testimony (well-intentioned or purposely not well-intentioned).

3D Printing

A close relative of 3D scanning, 3D printing is also a lot of fun. It can come in handy when you are trying to show a judge or jury what you are talking about but in a form that allows them to hold and see things you want to emphasize. Maybe you've got a car part (or even a whole car) that is integral to your case. You can reduce the size to make it more accessible. You can also conversely make tiny things larger—like a failed screw or bolt, for example. You can 3D print almost anything on whatever scale you want – or even make a whole interactive physical scene of things. (Kind

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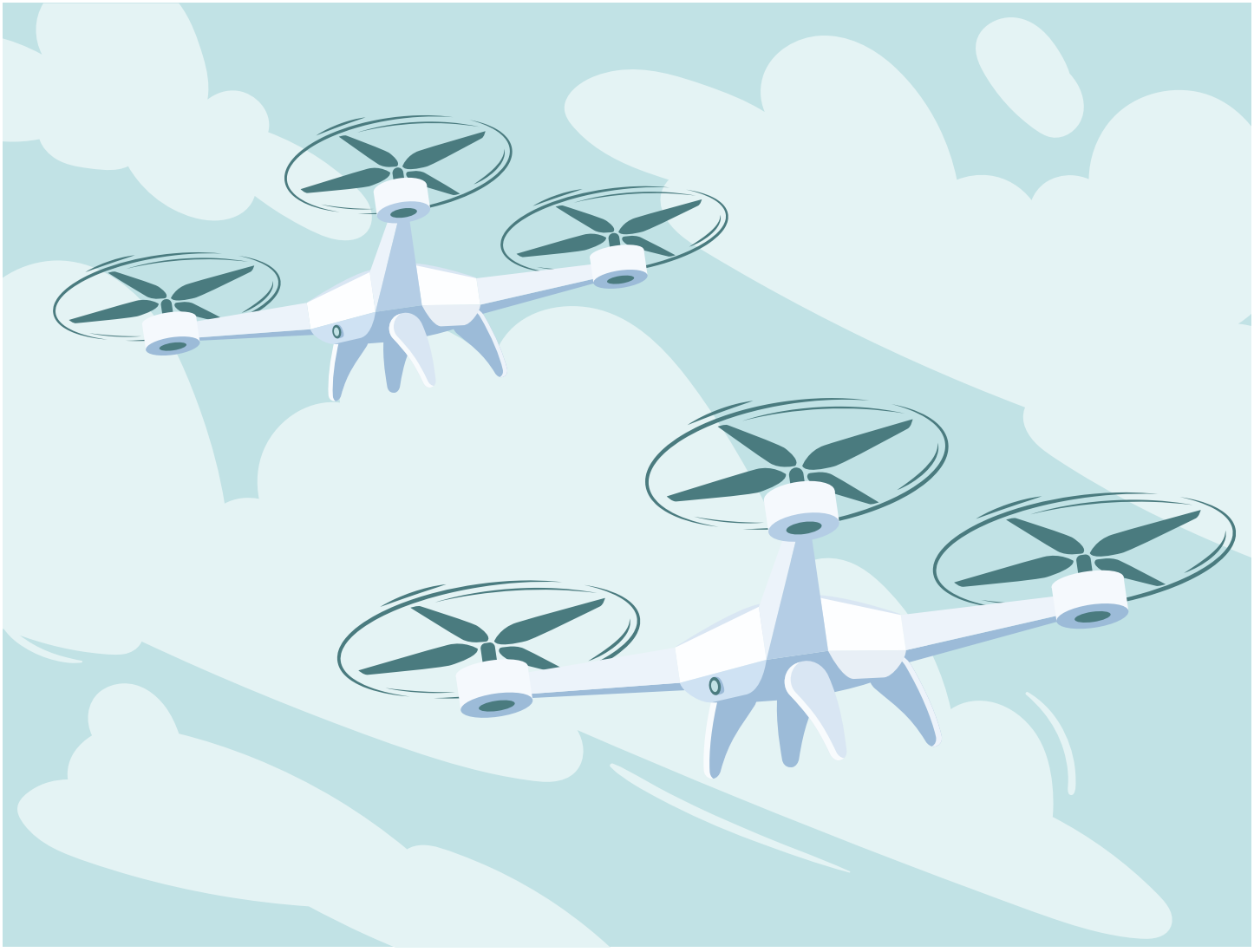

of like playing with Hot Wheels© or model trains, but everything is to the same scale.)

Drones

Here is something with which pretty much everybody nowadays has some familiarity. Drones are generally available to anybody who wants one, at many different price points. However, the use and operation of drones is heavily regulated by the FAA, even if you are just using them recreationally. A thorough review of drone use and regulation is beyond what I'm doing here (or again- beyond what you're likely interested in) but if you just HAVE to know more, go check out the FAA's website on Unmanned Aircraft Systems (the fancy name for drones): ***https://www.faa.gov/uas/***. Or if you REALLY want to get into it, check out 14 CFR part 107, which addresses UAS (drone) regulation.

Of course, what I'm talking about here is using experts and their drones, not using your own. These folks are certified, licensed, etc. Expensive too, but well worth it.

Sometimes you need a drone to get to a certain scene and/or illustrate it from above. Using a drone can also give you/a judge/the jury a better perspective of who and what was where. And of course you don't want to skimp when it comes to what kind of drone to use. There are several on the market, at wildly varying price points. A lot of experts use the reasonably-priced Phantom 4 Pro 2.0 which does everything well—great camera, very steady, maneuverable, *etc.* The Fixar 007 is also a good option, and cost-effective as well. Sony makes a good one, as do many others. Really, you just need a solid, steady, maneuverable drone option that uses a good laser camera mapping system. Some will have a LiDAR (Light Detection and Ranging) mapping system that uses pulses of light to map out whatever is being examined and instantly gives massive amounts of highly accurate measurements. LiDAR is a type of 3D scanning and can detect even small objects. But it is also more expensive than regular 3D scanning systems and requires someone knowledgeable to operate the system.

Photogrammetry (Camera-matching)

Photogrammetry is the science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring and interpreting photographic images and patterns of electromagnetic radiant imagery and other phenomena.

And because I know you are curious, the term "photogrammetry" was first used by

Albrecht Meydenbauer in his 1867 article "Die Photometrographie." Albrecht was a Prussian Architect and fashioned some of the earliest topographic maps and elevation drawings. One assumes he did so without the benefit of 3D scanning or pulsing lasers, but what do I know.

The fundamental principle of photogrammetry is triangulation. More specifically, aerial triangulation. It works basically by taking photos from two or more different locations, and establishing lines of sight from each camera to points on the object. These lines of sight are then mathematically put together to produce 3D renderings of whatever the user desires to produce the 3-dimensional coordinates of the points of interest.

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There are two basic branches of photogrammetry. ***Metric photogrammetry*** involves the precise measurements and computations on photos regarding the size, shape, and position of whatever is featured (or obtaining other information such as relative locations of other things). ***Interpretive photogrammetry*** deals with recognition and identification of the photographic features on a photograph (shape, size, pattern) in order to gather more information from what is depicted in the photograph. There is some obvious inter-relation for reconstruction, but there are distinct uses for both.

Collision Avoidance or Collision Mitigation Systems

Collision Avoidance Systems (CAS) are really just that—systems designed to help a vehicle avoid a collision. Also known as a pre-crash system, forward collision warning system, or collision mitigation system, the technical definition is these things is that they are advanced driver-assistance systems designed to prevent or reduce the happening or severity of a collision. As they have progressed, such systems are referred to mostly as Advanced Driver Assisted Systems (ADAS). These usually monitor a vehicle's speed, the speed of the vehicle in front of it, and the distance between the vehicles, so that a warning can be provided to the driver if the vehicles get too close. Sometimes radar, LiDAR and/or cameras are used to detect an imminent crash. GPS sensors can also detect fixed dangers such as approaching stop signs or other such things. Pedestrian detection and lane departure can also be a feature of these types of systems.

Collision avoidance systems are fascinating. Of course, there's the stuff your car/truck may already have (or that you see on TV commercials), like automatic braking, steering control, etc. But then there's an endless stream of possible stuff to come. That stuff is fun to talk about, and I could go for quite a while on the philosophy, infrastructure needed, policy, etc. But for your sake, I'll just restrict the discussion right now to stuff you can use to reconstruct an accident.

Some current systems in use to look for commercial vehicles include Detroit Assurance (Daimler/Freightliner), and OnGuard (made by ZF). Passenger systems vary by manufacturer, but most systems include at least forward sensors, cameras (rear and forward), lane departure warnings, etc. Whether they come standard or as an option is also dependent on the make and model. Mobileye is one company (and a branch of Intel) that also provides technology to manufacturers, and also makes its own standalone aftermarket system. (I'm sure there are others that I am overlooking, and I'm sure they are also cool and advanced to a point that escapes our capacity to accurately convey what they do. If you are one of those companies, please don't sue me for leaving you out).

Other Technologies/Sources of Helpful Information

- Electronic Data Recorders (EDR's) – hardly new, but these are evolving in terms of what information they can preserve and store. Unless your car is ancient (1990's or before) there will be a lot of useful stuff for the reconstructionist to use here.
- Infotainment Systems – not the first stop on the collection tour, but these can also have some good info, including but limited to speed and location.
- FARS/Total station scanning- These are different uses of laser scanning/LiDAR technology. This kind of technology is used to scan an area of interest, a vehicle involved, or basically whatever you want to scan, and then put that scan together with other information and produce a simulation (see below). Case in point: I'm working on a death case right now involving some construction equipment, and the expert has been able to scan the specific equipment involved and create a 3D image which can be rotated, looked at, placed in a scale drawing of the scene, etc. Its unbelievably helpful.

Simulations

I've saved the most fun for last here. (I also put it last because I know you likely skipped to the end of this just to see how long it was when deciding whether you wanted to read it or not.) Actually, I saved it for the end because simulations are what you can do if/when you've done a lot of the above stuff. Once you get all the background information you can, you may be in a position to use simulation software to perform underlying calculations (based on physics) and evaluate vehicle movement, timing, and crash severity. You can place vehicles in various places in the scene, show different possible scenarios, illustrate some hypotheticals, etc.

Just be careful, because there are a lot of jurisdictions that either don't allow or are strict when it comes to the trial use of reconstructive simulations. I'm probably preaching to the choir here, but just check before you spend a few hundred grand on an elaborate reconstruction only to find out you can't use it. This may seem like it can go without saying, but I'm going to say it anyway.