



# “expertly,” SPEAKING

Winter/Spring 2020

FORENSIC CONSULTING, TECHNOLOGY & ANIMATIONS

## Featured Articles

### TREE STAND FALLS LOOMING ANALYSIS

Falls from elevated positions are the leading cause of accidental injury and death of hunters.

Could a reasonably prudent and attentive vehicle operator have seen this coming?

View from DJS "Eye in the Sky"  
DJI Phantom 2

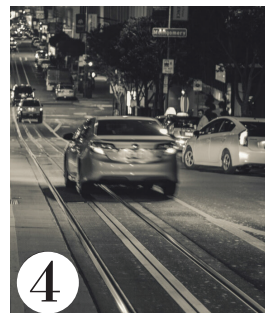
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# DJS Associates, Inc.

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# TREE STAND FALLS

03

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Sr. Mechanical Engineer

Deer hunting season in Pennsylvania usually lasts from September through January. Many hunters will use elevated vantage positions, such as tree stands. Typically small platforms, some with seats, tree stands attach to trees and are intended to provide the user a stable perch from which to hunt. Statistics show falls from elevated positions have exceeded firearms accidents as the leading cause of accidental injury and death of hunters.

While some of the falls can be attributed to carelessness, others are related to the failure of the tree stand or related equipment. Improper use of a tree stand does not always indicate carelessness by the hunter, as confusing instructions and instructions inconsistent with the product have been identified as factors leading to dangerous assembly and use.

The mechanical failure of tree stands can vary. In some matters, the stand is loaded beyond the allowable weight limit due to improper purchase or the hunter neglecting to account for the weight of their gear. In either case, the total weight on the stand exceeded what was allowed by the manufacturer; however, there should also be a factor of safety designed into tree stands, which allows for loading above the allowable limit without a structural failure occurring. A second factor that can contribute to failure of a tree stand is compromise of the structure, from damage, degradation, or manufacturing defects. Incidents involving a manufacturing defect, such as poor welds or improper sewing of attachment straps, have caused tree stands to move, resulting in the hunter falling from the stand.

Not all tree stand falls result in injuries. In some cases, hunters are protected by properly using a well-designed fall arrestment system. However, only a small percentage of hunters are wearing any type of fall arrest system, and of those being worn, some are using poorly designed systems, or using it improperly. Even when the fall arrest system functions properly and prevents the hunter from falling to the ground, they are not out of danger. Hanging from the tree in a harness, possibly by themselves, and perhaps without cellular connection, the hunter could be at risk of potentially fatal conditions such as suspension trauma or positional asphyxia. It is important to be able to self-rescue; the ease with which this can be accomplished is a function of the type of fall arrestment protection they are wearing and their familiarity with the system.

Assessment of the cause of a tree stand fall and the reasons a hunter was injured or killed depends on a complete analysis of all factors to determine the role each played in the incident. This includes the need to consider not just the design, condition and performance of the various components, but how they were being used by the hunter at the time of incident. Only when the full incident is analyzed can conclusions about the cause of the fall and injuries be reached.



John specializes in the investigation and analysis of alleged mechanical failures of products including industrial equipment, consumer products, occupant restraints, and more.

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# Looming Analysis: Approaching a Stopped Vehicle on a Highway at Night

Robert T. Lynch, P.E.

Principal Collision Reconstruction Engineer

**Case Synopsis:** A tow truck, traveling at night, was stopped within the right lane of a limited-access highway to see if assistance was needed for police activity on the opposite side of the highway. Approximately 20 seconds after the tow truck stopped, it was impacted in the rear by a pickup truck. The operator of the pickup truck sustained injuries and brought a suit against the tow truck operator.

**Analysis:** The client, who represented the tow truck operator, requested an engineering analysis to determine if a reasonably prudent and attentive vehicle operator could recognize that the tow truck was stopped from a sufficient distance to be able to avoid the collision. The analysis involved determining the Point of Looming Detection (PLD), which is the distance at which an operator can be expected to perceive that the vehicle is stopped or moving so slowly that an emergency response is necessary to avoid the impending collision. Note that the PLD is not the distance at which one can see the taillights of a vehicle up ahead, as simple observation of the taillights alone does not offer any information on determining if a vehicle is stopped. The PLD is largely dependent upon a driver's perceived separation of the taillights as one draws near to the stopped or slow-moving vehicle. The faster one is closing on a lead vehicle, the quicker the taillights will appear to separate from each other, providing the necessary visual queue to realize that a response is needed to avoid a collision.

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The point of looming detection for this case was determined to be approximately 300 feet. This distance was sufficient for an attentive vehicle operator traveling at 55 mph to perceive, react, and avoid the stopped tow truck by either braking or swerving. That is, the analysis of the available data indicated the pickup truck operator was inattentive as he approached the stopped tow truck as the attentive driver would have been able to avoid. The pickup truck operator testified that he was looking to his left toward the police activity on the other side of the roadway leading up to the collision, which contributed to his inattention.

**Result:** The case went to trial and expert testimony was provided. Although the tow truck operator created a hazard by stopping in an active travel lane, the jury found the pickup truck operator more than 50% at fault for being inattentive and not avoiding the collision.

## A Fall at the Construction Site

Stanley Pulz, P.E., CSP,  
Codes & Industry Practices Expert

**Case Description:** An employee fell approximately 11 feet from a mezzanine that was under construction where he and a co-worker were in the process of placing decking. The employee eventually passed away from his injuries.

**Analysis:** A construction safety analysis included a review of all relevant deposition transcripts and other discovery documents, reports, training records, and photographs, among other file materials. In addition to reviewing the case materials, a site visit was performed, and research was conducted regarding materials, codes, and standards related to acceptable workplace safety practices and standards. It was determined that the employee and his employer failed to comply with OSHA and national consensus standards regarding fall protection, including failure to modify the means and methods of the construction by utilizing a scissor lift to which they had access. The scissor lift would have prevented exposure to the 11-foot fall hazard.

**Result:** Case resolved in a favorable manner.

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# FISHY FISHEYE: Image Refraction Challenges with Surveillance & Dashcam Evidence Analysis

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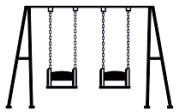
When video footage or photographs exhibit extreme distortion and rounding of straight edges, the term “fisheye” is commonly used. Fisheye is caused by the convex structural nature of wide-angle camera lenses that, as you might guess, resemble the bulbous eyes of our common aquatic denizens. These lenses refract or bend light entering the camera so that a wider view can be captured on the image. This is an important feature for businesses and consumers when choosing a surveillance or dashboard camera system.

When it comes to analysis of video with this type of extreme distortion, however, it can introduce visual and mathematical challenges when correlating two-dimensional features of the image frame to their three-dimensional positions in the physical environment. As part of the software-assisted videogrammetry process to re-create the camera’s position and orientation in 3D, any distortion present in the footage needs to be removed, returning straight edges curved by the structure of the lens to their natural linear perspective. This is typically called lens calibration or lens distortion correction. Once performed, traditional analysis of visually plotting reference points on the video frame in relation to physical measurements can be more efficiently achieved.

The same goes for software-assisted videogrammetry analysis. Unexpected error results from camera-matching algorithms may sometimes say otherwise; that’s when the fisheye... gets fishy. Not all lenses refract or distort the same way unless they are manufactured to a high level of quality and precision. Using various techniques with different software and lens models may be necessary to get the error within an acceptable level, sometimes processing the footage through multiple passes of lens distortion correction. Even then, error levels may indicate an issue rendering the footage unsuitable for software-assisted videogrammetry. Typically there is a good reason why such footage may be hard to calibrate. Where was the camera mounted? Was it inside a building or vehicle? Is there another refracting layer between the camera lens and the environment such as a window, windshield, or even a clear acrylic housing around the camera itself? Having this additional layer of transparent material may very well add unpredictable and uneven refraction for which current lens correction methods are unable to resolve. It can be frustrating working with what may appear to be a typical, fisheye distorted footage only to struggle in reducing the videogrammetry error, but more often than not, it’s the glass bowl which the fish is in that’s making it fishy.

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# HISTORY REPEATS ITSELF IN ACCESSING EVENT DATA

R. Scott King, BSME, Principal Automotive / Mechanical Engineer

As automotive and heavy truck technology continues its apparent evolution to increased vehicle autonomy, the systems providing that autonomy are increasingly capable of recording potentially important data; however, accessing that data may prove difficult. For example, many newer commercial trucks are equipped with forward-looking cameras and/or radar units to detect and respond to potential roadway hazards. The automatic responses these systems provide range from activating audible alerts and haptic steering wheel feed-back to autonomously applying the brakes. Moreover, these systems often store camera images and radar targets describing the event that initiated that system's activation and/or intervention. Similarly, an increasing number of passenger vehicles are equipped with cameras that operate in the same way. Toyota, Nissan, and Subaru are a few of the vehicles currently known to possess forward-looking cameras that record event images during system activation.

Event Data Recording (EDR) technology is not new. Airbag Control Modules (ACM) have been recording crash-relevant data for over two decades and accessing the data they record has become commonplace. Indeed, whether voluntarily or by federal mandate, the data they record is readily accessible through commercially available means; however, this was not always true. When first introduced, the manufacturers held exclusive access to data these devices contained by requiring proprietary software. Engineers and investigators within the collision reconstruction community knew this data existed but could not readily access it. Now, it seems, history is repeating.

In a recent investigation, an operator of a vehicle equipped with passive brake assist alleged his vehicle stopped suddenly and abruptly even though he did not apply the brakes. The vehicle's marketing literature and owner's manual described how the vehicle was designed to sense impending collisions and in the extreme case, activate the brakes autonomously. The vehicle was equipped with a forward-looking camera which research revealed was designed to capture a single image of whatever caused the brake system to intervene. However, reminiscent of years before, the image from this vehicle's camera currently requires the manufacturer's proprietary equipment and software. Like years past, the manufacturer of this vehicle declined to voluntarily participate in the effort to obtain the data.

Despite the resistance of some manufacturers, others have made access to photographic and radar data available using commercially available equipment: Toyota, Lexus, Freightliner, and Kenworth are among those that do.

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## WHAT CELL PHONE DATA IS STORED IN YOUR CAR'S INFOTAINMENT SYSTEM?



Infotainment systems store data from any cell phone connected via Bluetooth, Wi-Fi, or USB.

### Call Logs:

Infotainment systems are able to store contacts, keep track of call history, and store a stockpile of text messages

### Navigation Data:

Infotainment systems have the ability to log GPS breadcrumb trails of routes traveled

### Internet History

Infotainment systems can maintain data pertaining to your browser history

### Photographs

Infotainment systems may amass any photos taken while connected to the vehicle

## DID YOU KNOW?

Infotainment systems as we know them were first implemented by Ford as a response to the introduction of the iPhone in...

In 2020, how many new vehicles are expected to have infotainment systems?

2007

80%

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# 20/20 VISION: COLLISION RECONSTRUCTION 07

Justin P. Schorr, Ph.D., Principal Collision Reconstruction Engineer

President of DJS Associates, Inc.

The world around us is changing rapidly. Technology continues to develop at an exponential pace, and new frontiers are being breached just as quickly as they come into focus. While fears of **automation** continue to swirl over industries with mainstream news coverage assuring us that large-scale job loss is just around the corner – it is important to stop for a moment and take stock of the world as it actually exists. While it may not seem like being in the business of **collision reconstruction** would provide unique insight into how things may play out – consider that experts in this field were told “learn to code” and to start making other career plans when **Event Data Recorders (EDRs)** first came into prominence a few short decades ago. Instead of killing the industry, collision reconstruction experts became more in demand, as the addition of data did not eliminate the need for an engineer’s review, it made it all the more necessary and important. At the same time, the 2020 prediction that I feel most comfortable with is that vehicles with this technology are still far, far away from being as safe, let alone safer, than their human occupants. Still, while this next decade will see the development and deployment of human-enhancing, lifesaving, **advanced driver assistance systems** – those with higher ambitions (say, to corner the market on a 3 trillion dollar transportation industry) will continue to push for more and more automation. Only time will tell how these “driverless dreams” will play out.

In looking towards the “next big thing” in the world of collision reconstruction – the first foundational shift has already begun with more and more crashes being captured by **video cameras** (which seem to be almost everywhere: ATMs, doorbells, dashcams, private and public surveillance, and more). While video is objective evidence, which can be analyzed, quantified, and explained in plain language with compelling visuals – this process is tedious, complicated, and requires knowledge of everything from **physics** to **lens distortion** in order to produce an accurate, understandable end product. Moreover, **video analysis** is oftentimes reliant on detailed data defining the surrounding environment – the collection of which has been accomplished by notebooks and wheels, transit-prism survey equipment, one-man GPS-based survey equipment, **laser scanners** capable of capturing small windows over an extended period of time, 360-degree laser scanners which capture millions of points in a matter of minutes, and, most recently, **drones**. Moving forward, the combination of the more recent laser scanning devices with quick-collection, non-intrusive, drone-based devices will allow for site data to be captured in decreasingly burdensome periods of time at accuracies far beyond that which my grandfather, wheel-in-hand, could have ever imagined when he started this company in 1961.

New data sources certainly do not end with video and drones – more and more the devices, which we have become reliant upon, are documenting and memorializing our every move. There is a wealth of information from our vehicles and mobile devices which is time-synced and stored in the **infotainment systems** present on nearly all new vehicles. Our **cell phones** themselves are now accessible to forward-thinking firms on the cutting-edge of new data extraction technologies. Even old technologies, like **digital cameras**, have experienced a resurgence as the photographs they capture contain detailed **metadata** which allows for analysis of potential **spoliation** issues, and the images themselves can be post-processed to produce a 3-dimensional end product that is growing increasingly accurate. Networking and communications have allowed ambitious firms like DJS to place “boots on the ground” at locations throughout the country – providing **24/7 response** services from Philadelphia to Salt Lake to Santa Monica and everywhere in between. **3D Engineering Animations** are becoming more detailed – and, here at DJS, we have even traveled to the **4th dimension** as we have created **virtual reality environments** ready for exploration by anyone who puts on the headset. That’s right – rather than wondering, “what the heck was this driver thinking,” we are now able to place you directly in that driver’s shoes where you can experience everything that driver could see – or should have seen – in the moments prior to a crash.

What has become obvious is that to achieve a complete “picture” of a crash requires well-rounded professionals, knowledgeable in a broad spectrum of disciplines who know what data exists, have the wide-ranging toolbox of skills required to obtain that data, have the physics and engineering-based training to analyze the data, possess the intuitive and industry-specific experience to understand how to present this data, and have the creative vision and technical ability to produce compelling exhibits highlighting the case-specific needs of the client. Not only has technology failed to remove the human from this industry, but “one-man shops” are giving way to teams of humans with diverse backgrounds who are not beholden to technology – but rather find unique and inventive ways to harness its power and apply it to **meet the needs of their clients**.

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# TEENAGE GIRL DROWNS IN LAKE 08

## After Succumbing to Carbon Monoxide Poison While Sitting on Back of Boat

In a highly unusual case, a young teenage girl drowned after blacking out while sitting on the swim platform of a speed boat. At the time of the incident, the victim was attending a popular wake boarding camp conducted by a local church.

This wake boarding and bible camp was very popular and had functioned for years without incident. The camp depended entirely on volunteer wake board instructors, volunteer drivers, and donated boats.

While the camp was very disciplined about offering bible studies to the campers receiving wake board instructions, little if any safety instructions were provided to boat drivers, instructors, and campers. This led to safety infractions such as having boat drivers without safety lookouts on board, lack of safety checklists, and, though required when wake boarding, life jackets were allowed to be removed upon returning to the boat as a passenger.

At the time of the incident, the victim was not only allowed to remove her life jacket, she was allowed to sit on the swim platform by the engine, which is extremely dangerous. Sitting on swim platforms while the engine is running can be deadly due to carbon monoxide poisoning, especially in boats that do not have catalytic converters installed. Within minutes of the victim sitting on the swim platform, she fell unconscious, slipped into the water, and sank directly to the bottom of the thirty-foot-deep lake. Although campers saw her fall into the water, she quickly disappeared from the surface and could not be found by rescuers. She was recovered from the water the following day. In an unusual twist, the camp was not sued in this case, but the marina donating the boat to the camp was.

Plaintiff argued that the marina never provided a safety orientation to the boat driver and the campers. Defense argued that the boat was well signed and marked with warnings detailing that sitting on the swim platform with the engine running could result in death, and the boat driver was responsible for protecting his campers in, on, and around the boat. Defense also argued that if the boat driver had simply required ALL those in the boat to wear a life jacket, the victim could have been rescued and resuscitated.

This case settled and the message was clear: life jackets need to be worn by everyone on a boat at all times. Sitting or standing on a swim platform must never be allowed. Whenever more than one group or agency is involved with a water activity, a group use policy must be in place prior to the event, outlining who is responsible for what when it comes to safety.

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