NTLC NATIONAL TRAFFIC LAW CENTER NDAA

BETWEEN THE LINES

Volume 31, Issue 10 | October 2023

UPCOMING TRAININGS & CONFERENCES

A full list of NDAA's virtual learning sessions is available at
➤ ndaa.org/training-courses/.

NDAA's Mastering Masking Digital Course/ On Demand Training (CLE Available)
➤ ndaa.org/training/mastering-masking-2/

NDAA's Human Trafficking and the Impact on Commercial Driver's Licenses/On Demand Training
➤ ndaa.org/training/human-trafficking-and-the-impact-on-commercial-drivers-licenses/

NDAA's Prosecuting DUI Cases Online Course/ On Demand Training (CLE Available)
➤ ndaa.org/training/prosecuting-dui-cases/

NDAA's Investigation and Prosecution of Drug-Impaired Driving Cases Online Course/On Demand Training (CLE Available)
➤ ndaa.org/training/on-demand-learning-investigation-and-prosecution-of-drug-impaired-driving-cases/

Demystifying Cellular Records Analysis & Technology (Live Webinar)
November 1, 2023 @ 2:00 p.m.–3:15 p.m. ET

NDAA's Leadership Academy—Defining Leadership in Prosecution
November 14–16, 2023, Dallas, TX

RESOURCES

Impaired Driving Resources
➤ ndaa.org/programs/ntlc/

CDL-Related Resources
➤ ndaa.org/programs/ntlc/commercial-drivers-license/

NDAA STAFF

Executive Director
Nelson O. Bunn, Jr.

Chief Operating Officer
Christine Mica

Vice President, Education & Engagement
Lorena Vollrath-Bueno

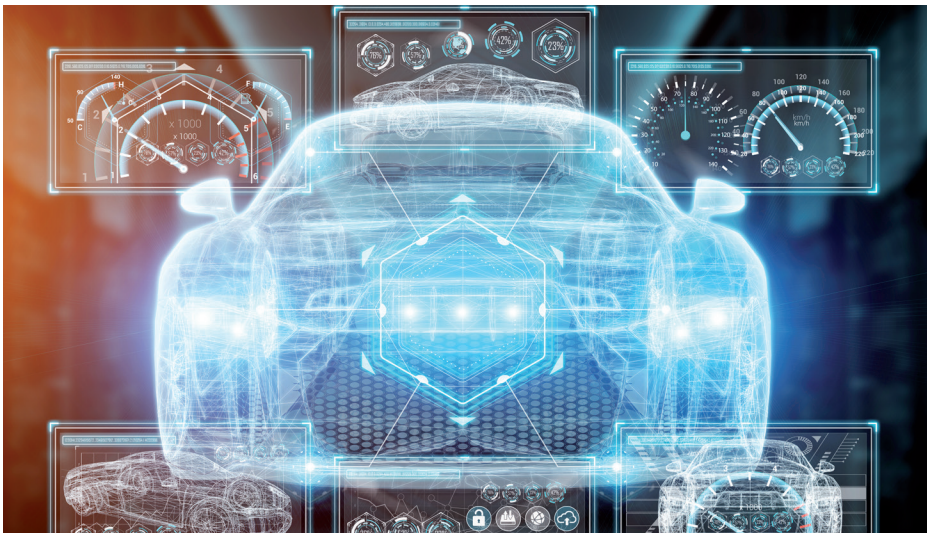
THE NATIONAL TRAFFIC LAW CENTER

Director
Joanne E. Thomka jthomka@ndaajustice.org

Senior Attorneys
M. Kimberly Brown mkbrown@ndaajustice.org
Jim Camp jcamp@ndaajustice.org

Staff Attorneys
Erin Inman einman@ndaajustice.org
Bella Truong btruong@ndaajustice.org

The National Traffic Law Center is a division of the National District Attorneys Association. This document was prepared under Cooperative Agreement Number 693JJ91950010 from the U.S. Department of Transportation National Highway Traffic Safety Administration. Points of view or opinions in this document are those of the authors and do not necessarily represent the official positions or policies of the Department of Transportation or the National District Attorneys Association.



Vehicle Data Forensics and Legal Considerations

By Metro Nashville (TN) Police Lieutenant James T. Williams, Special Operations—Traffic Section

When a person steps into a modern vehicle today and powers it up, a sophisticated network of computer systems springs into action, gathering and generating millions of data points and information. Increasingly, vehicles come equipped with an array of equipment and features that rely on the collection and use of the data. This data contains details about both the driver and the vehicle and serves many purposes, from supporting safety features, conducting performance analyses, and enhancing convenience features, to elevating entertainment options. While many of these Electronic Control Units (ECUs) collect and process this data within the vehicle itself, the increasing prevalence of Wi-Fi-enabled vehicles, Bluetooth technology, and cellular connections means that today's cars are becoming increasingly connected to other devices, including smartphones and other vehicles.

In this age of advanced technology, vehicles have become more than just a mode of transportation, they have transformed into rolling data repositories. Modern vehicles are equipped with sophisticated computer systems that record a wealth of information. This trove of data presents law enforcement and prosecutors with insights into a wide range of criminal offenses. Harnessing this data, however, raises significant legal and privacy concerns. This article provides an overview of some of the systems investigators can delve into, along with potential legal considerations.

Vehicle data forensics is the intricate process of extracting, preserving, and analyzing electronic data stored within a vehicle. In the realm of vehicle-related crimes, such as vehicular homicides, fatal hit-and-runs, and even street racing offenses, investigators can find valuable information through a forensic examination of these systems. The systems most likely to be accessible, beneficial, and contain relevant data include the vehicle's Event Data Recorders and the infotainment and telematics systems.

Event Data Recorders

Often colloquially referred to as "black boxes" in informal conversation, an Event Data Recorder (EDR) is a module bearing little resemblance to the flight data recorders used in aircraft. An EDR functions as an ECU and the Airbag Control Module is the most common type. Its main function is to control the vehicle's restraint and airbag systems, with data recording for events being a secondary function. When an "event" occurs, this module records a time series of data. Originally, manufacturers installed EDRs to collect data to ensure the proper functioning of airbag and engine systems.

In this age of advanced technology, vehicles have become more than just a mode of transportation, they have transformed into rolling data repositories.

EDRs are subject to federal regulation under the Federal Motor Vehicle Safety Standards, specifically within 49 CFR Part 563. These federal regulations provide precise definitions for events and trigger thresholds, which dictate what data is recorded. In this context, an event is defined as "a crash or other physical occurrence that causes the trigger threshold to be met or exceeded, or any non-reversible deployable restraint to be deployed, whichever comes first."[1] The trigger threshold, on the other hand, is characterized as "... a change in vehicle velocity, in the longitudinal direction, that equals or exceeds 8 km/h within a 150 ms interval. For vehicles that record 'delta-V, lateral,' trigger threshold means a change in vehicle velocity in either the longitudinal or lateral direction that equals or exceeds 8 km/h within a 150 ms interval."[2]

Since EDRs became federally regulated, the availability of EDR data has proliferated. Approximately 276 million vehicles are registered in the United States.[3] According the manufacturer of the Bosch Crash Data Retrieval (CDR) system, "[i]n the United States and Canada alone, more than 200 million registered vehicles are equipped [with EDRs] and approximately 98% of new vehicles sold in the US and Canada today have an EDR."[4] President Obama signed the Driver Privacy of Act of 2015, providing that vehicle electronically recorded data is the property of the vehicle owner and cannot be accessed by third parties (*e.g.*, law enforcement) without the owner's consent or a court order (*e.g.*, search warrant).[5]

---

[1] 49 CFR Part 563.5(b).

[2] *Id.*; *see also* www.nhtsa.gov/research-data/event-data-recorder, accessed on October 10, 2023.

[3] This number is from the 2020 Highway Statistics, State Motor-Vehicle Registrations 2020, from the U.S. Department of Transportation, Federal Highway Administration, Policy and Government Affairs, Office of Highway Policy Information and last updated February 16, 2023, available at www.fhwa.dot.gov/policyinformation/statistics/2020/mv1.cfm, accessed on October 11, 2023.

[4] Bosch Event Data Retrieval Tool Solutions, available at boschcdrtool.com/#:~:text=In%20the%20United%20States%20and,Canada%20today%20have%20an%20EDR., accessed on October 11, 2023.

[5] www.govinfo.gov/app/details/COMPS-13423 Driver Privacy Act of 2015, Pub.L. 114-94, Div. B, Title XXIV, Subtitle C, Part I (§§24302 to 24303), Dec. 4, 2015, 129 Stat. 1712.

A report generated from the data extracted from an EDR usually consists of pre-crash data related to vehicle performance and safety systems. It is important to emphasize that each report varies, since the data presented is dependent on the manufacturer's specifications. Generally, an EDR records five seconds of pre-crash data, which may include the following information:

- Vehicle speed (as reported by the vehicle)
- Brake usage
- Acceleration data
- Engine RPM
- Input from the steering wheel
- Delta-V (change in velocity)
- Potentially additional data elements as per manufacturer specifications and capabilities.

Generally, the recorded speed is the data point of most interest to an investigator. Everyone involved, including investigators, prosecutors, and jurors, usually want to know, "How fast was the defendant driving at the moment of impact?" Thus, some data points, like steering wheel input, are frequently overlooked. These overlooked details can offer a seasoned analyst a much broader understanding of the events preceding the collision. With a little mathematical analysis, the five seconds of pre-crash data can be used to determine the vehicle's locations during that timeframe, thereby offering a clearer picture of the moments leading up to the crash. A trained and experienced CDR technician and analyst can provide significant insight from this data, providing valuable information about the sequence of events.

Infotainment Systems and Telematics Data

In an age where connectivity reigns supreme, many vehicles come equipped with telematics systems. Vehicle telematics, in essence, combines GPS systems, onboard vehicle diagnostics, wireless telematics devices, and black box technologies to record and transmit a wide spectrum of vehicle data. This data includes information like speed, location, maintenance requirements, servicing needs, and is cross-referenced with the vehicle's internal behavior.[6] A vehicle telematics system includes these vehicle-installed tracking devices to "… facilitate the transmission and storage of telemetry data via wireless networks and the vehicle's own onboard modem and diagnostics. …"[7] These systems continually collect data on various aspects, including vehicle location, speed, fuel consumption, and even driver behavior. Telematics data essentially serves as a digital breadcrumb trail, aiding investigators in reconstructing events.

Telematics data essentially serves as a digital breadcrumb trail, aiding investigators in reconstructing events.

A vehicle's infotainment system represents more than just a source of entertainment. It functions as an integrated media system that delivers information and entertainment features to both drivers and passengers. The infotainment screen, positioned at the top of the center stack, serves as the digital control panel for adjusting cabin temperature, audio volume, and other preferences. Moreover, drivers can use this screen for navigation and to operate their phone.[8] What's noteworthy is that modern infotainment systems not only provide these functions but also store data related to phone calls, text messages, navigation history, and other user interactions. This stored data can offer significant insights into a driver's activities leading up to a particular incident.

[6] www.heavy.ai/technical-glossary/vehicle-telematics, accessed October 4, 2023.

[7] *Id.*

[8] Kelley Blue Book website, www.kbb.com/car-advice/best-infotainment-systems/, accessed October 4, 2023.

Ultimately, infotainment and telematics systems are a collection of ECUs that combine information and entertainment, effectively connecting vehicle occupants to their digital world. While some of these ECUs and systems operate discreetly in the background, the infotainment system interacts directly with the occupant(s) (including the driver) and is a primary focal point within the vehicle. It directly engages with the occupants and plays a pivotal role in enhancing their driving experience. Moreover, many infotainment systems are intertwined with telematics systems, such as OnStar, enabling the transmission of data through telecommunications. Many modern vehicles are equipped with cellular connectivity, which can extend to wireless connectivity like Vehicle-to-Infrastructure (V2I) or Vehicle-to-Vehicle (V2V) systems. These systems facilitate communication and requests to and from the infotainment system, and this connectivity can be either integrated within the vehicle itself or tethered, usually through an occupant's cellphone.

Accessing data beyond the EDR within the various vehicle ECUs is becoming more prevalent. Law enforcement agencies now have access to an array of tools that support investigators throughout the entire vehicle forensic process. This includes the identification of vehicle systems, the utilization of specialized hardware for data acquisition from these systems, and the application of forensic software for in-depth data analysis.

An invaluable aspect of infotainment and telematics systems is their ability to furnish geolocation data. A forensic analysis of the data stored within these systems can reveal loads of information, including vehicle tracklogs, precise locations, travel routes, and velocity records. Within these systems, navigation features often record trackpoints, which are compiled into tracklogs, essentially serving as historical records of the vehicle's locations and movements. In addition to tracklogs, there are also location and route data, which differ in that they represent places manually entered or selected on the map by the user. These locations and routes may not necessarily signify that the vehicle physically journeyed to those spots, but they do provide insights into the user's intent or planned destinations.

Infotainment and telematics systems are a collection of ECUs that combine information and entertainment, effectively connecting vehicle occupants to their digital world.

Another significant data category to explore within infotainment systems revolves around media data. Many modern infotainment systems either possess their own connectivity capabilities or establish connections to apps and media through the user's mobile phone. There are multiple ways in which these systems can link with media devices, with the most common methods being Bluetooth, Wi-Fi, or USB cables. Regardless of the chosen method, the infotainment system and the mobile phone engage in communication and data sharing. Often, when a person enters a vehicle, he might be prompted to "pair" his device with the vehicle's system. This pairing process results in the exchange of a substantial amount of information and data. Even in cases without pairing a phone to the vehicle's system, the system may still record the detection of a nearby Bluetooth device and store its identifier. USB connections also serve as a common means of connectivity. While not all USB ports offer the same functionality, a USB connection can essentially function similarly to a Bluetooth pairing, facilitating the transfer of data from one device to another.

The data accessible through these connections has the potential to be vast. It can encompass a wide range of information, including unique identifiers of devices. For instance, a vehicle may retain records of dozens of cell phone identifiers for phones that were present in the vehicle and communicated via Bluetooth or other connection methods. Contacts represent another potential data category that may be discovered within infotainment system data though access to contact data is typically subject to user permissions within many systems.

Call logs, much like what one might find on a cell phone, could also be present in the infotainment system data. Text messaging (SMS) data may also potentially be stored in infotainment systems, but most SMS data found during vehicle forensic analysis primarily include only incoming messages. In a broader context, any media files, such as an index of audio files accessible to the vehicle, could also be accessed through vehicle forensics.

Vehicular Homicide Case Study

The combination of infotainment system and EDR data are often complementary in crash investigations. One such investigation serves as a compelling example of how leveraging both systems' data can transform a weak case into a strong and successful one.

In this case, a woman driving a Ford Explorer on the interstate struck a Jeep Wrangler from behind. The force of the impact caused the Jeep to roll over, ejecting the driver and killing him. The driver of the Ford sustained minor injuries and was subsequently transported to a nearby hospital by ambulance. There were clear indications suggesting that the Ford driver was impaired at the time of the incident. Shortly after her arrival at the hospital and prior to the arrival of an officer to secure her, the Ford driver left the emergency room. Her father picked her up after she used her phone to call while at the hospital. Her departure occurred prior to the collection of an evidentiary blood sample, posing a significant obstacle to the case.

The lead investigator learned the hospital nurses documented the driver's intoxication and added notes about the phone call the suspect made during the brief time she spent in the emergency room. The investigator successfully subpoenaed the medical records to secure the nurses' notes. With this information in hand, the investigator turned his attention to the vehicle forensics aspect of the case.

The combination of infotainment system and EDR data are often complementary in crash investigations.

A search warrant was obtained to download and analyze the data from the Ford Explorer's EDR. A trained EDR technician and analyst conducted the imaging of the EDR and performed the analysis of the obtained data. The collected data was verified from the crash and the analysis revealed critical information: 1.5 seconds prior to the crash, the recorded speed was 101.2 MPH and, at the time of the crash, the vehicle recorded speed was 91.3 MPH.

Subsequently, the investigator secured search warrants for the removal, imaging, and analysis of the Ford's infotainment center. The download from this particular infotainment system recovered 2,433 pages of data. This included two days' worth of GPS "breadcrumbs," effectively providing a data point for every second the vehicle was powered on during that period. Derived speeds from the GPS data, although not as precise as the vehicle-recorded speed, indicated the vehicle had been traveling at speeds of 103.8 MPH and 94.9 MPH in the vicinity of the crash area at the time of the collision.

This data alone could be used to determine the Ford driver's recklessness. However, additional data was retrieved and incorporated into the case, further enhancing its strength. The GPS data also showed the vehicle had been parked in an area with several bars earlier in the evening. The data disclosed the mobile devices that had connected to the vehicle via Bluetooth. One device, named "J's Telephono," connected to the vehicle approximately 20 minutes before the crash and disconnected a few minutes before the collision, at a different location. This information prompted investigators to visit the area where the phone disconnected, where they conducted a door-to-door inquiry.

During their canvassing efforts, investigators encountered two individuals, including the owner of "J's Telephono." These two individuals told investigators they met the suspect at one of the two bars located near where the GPS data indicated the vehicle had been parked. Subsequently, a state Alcoholic Beverage Commission agent interviewed the bar's employees and learned the suspect was a regular patron who paid with cash for alcoholic beverages on the night of the crash.

The combination of vehicle forensics data analysis and traditional detective work proved pivotal in reconstructing a sequence of events and gathering evidence that might not have been accessible through other means. As a direct outcome of these extensive efforts, the driver of the Ford ultimately pled guilty to Vehicular Homicide by Reckless Conduct.

To successfully use the available data, it is important for law enforcement personnel to receive comprehensive training and gain significant experience with these systems. Forensic hardware and software for EDRs and infotainment systems are readily available commercially and can be procured for use. Many times, law enforcement agencies invest in purchasing these tools but neglect to allocate the necessary resources for training officers in their proper use and data analysis. A Crash Data Retrieval (CDR) report can be easily challenged if a thorough analysis of the recovered data has not been conducted to establish its authenticity and relevance to the case. Therefore, it is crucial for prosecutors to ensure that any collected data includes an analysis report from a properly trained investigator.

Preserving the integrity and authenticity of vehicle data is of utmost importance to ensure its admissibility in court. This necessitates adhering to proper forensic techniques and maintaining a robust chain of custody for the data. Any mishandling or improper treatment of data could result in its exclusion from evidence, potentially jeopardizing the entire case.

The complexities of vehicle data often require the expertise of forensic specialists who can interpret and explain the findings for judges and juries. Expert witnesses play an indispensable role in establishing the credibility of the evidence. Their testimony serves as a bridge between the technical intricacies of the data and the understanding of non-technical individuals in the courtroom, facilitating a more thorough understanding of the evidence's significance.

Legal Considerations

While vehicle data forensics provides access to a wealth of information, it also raises significant legal and privacy concerns that require careful consideration by both the law enforcement officer and the prosecutor.

When accessing vehicle data, a vehicle owner may consent for law enforcement to access it. Typically, though, the primary question is whether a warrant is necessary. Generally speaking, in the absence of an owner's consent, accessing the data will require a judicially approved search warrant. The protections of the Fourth Amendment against unreasonable searches and seizures extend to digital data stored within vehicles (see the above reference to the Driver Privacy Act of 2015). Courts often assess the reasonableness of the search based on whether the data is easily accessible or if invasive methods are required for extraction.

The complexities of vehicle data often require the expertise of forensic specialists who can interpret and explain the findings for judges and juries.

In order to secure a search warrant for the contents of the EDR, an officer or prosecutor must establish probable cause to believe a crime was committed by the defendant, and evidence of the crime is present within the EDR. The affidavit submitted to the judge must provide a comprehensive description of the EDR, what it does, and the data it contains and how it relates to the probable cause. It is imperative for law enforcement officers and prosecutors to possess a thorough understanding of the laws, policies, procedures, and practices applicable in their specific jurisdiction.

A prosecutor must also be well-prepared to address any motions to suppress or motions in limine brought by a defendant. Achieving this requires a thorough conversation with the crash investigator responsible for the data recovery and analysis. The prosecutor will need to substantiate the reliability of the technology, including both the hardware and the software, as well as confirming the soundness of the methodology used by the technician and analyst. This entails a comprehensive assessment of the expert's qualifications, the adherence to proper data retrieval procedures, and the expert's ability to interpret the data accurately. It is essential for both the law enforcement officer and prosecutor to remember that a data report cannot replace traditional crash reconstruction and investigation. When executed correctly, a data report should enhance and reinforce the credibility of the reconstructionist.

After successfully acquiring data from a vehicle, law enforcement must exercise caution when contemplating the release of the vehicle. It is important that an officer or prosecutor avoids the inadvertent destruction of possibly exculpatory information prior to affording the defendant the chance to access it. In this regard, a prosecutor must remain vigilant, understanding the obligations established by *Brady*,[9] and acknowledge that bad faith is not a prerequisite for potentially adverse consequences to be imposed. Potential remedies for such mishandling of evidence encompass the exclusion of evidence from trial, the issuance of a jury instruction regarding the mishandling of evidence, or in more severe cases, the dismissal of the entire case. It is critical for all parties involved to maintain due diligence in preserving and disclosing evidence to uphold the principles of justice.

A state's privacy laws can also impose limitations on the collection and utilization of certain vehicle data. These legal provisions are designed to protect individuals' privacy rights while also granting law enforcement the necessary means for conducting their investigations. Striking a balance between these two objectives requires careful consideration of principles, including proportionality and necessity. Law enforcement agencies must weigh the need for gathering evidence against the imperative of safeguarding individuals' privacy rights, ensuring they do not overstep their lawful authority.

Conclusion

Vehicle data forensics undeniably serve as a powerful tool for law enforcement and prosecutors in modern investigations and legal proceedings. Nevertheless, it exists within a complex landscape fraught with legal intricacies and privacy considerations. Achieving equilibrium between the demand for evidence and the protection of privacy rights, adhering to proper forensic protocols, and staying informed about evolving legal precedents are key challenges in this field. As technology continues to advance, the legal framework surrounding vehicle data forensics will inevitably evolve, demanding law enforcement and prosecutors tread responsibly and ethically in the pursuit of justice.

About the Author

Lieutenant Williams has worked for the Metro Nashville Police Department for seventeen years and currently oversees the Traffic Investigations and School Crossing Guard Sections of the Department's Traffic Division. Prior assignments within the Department include serving as an officer in patrol as a Crash Investigator on the Fatal Crash Team and as a sergeant where he was the supervisor of the DUI Unit, Crash Investigation Unit, Hit & Run Unit, and Aggressive Driving Unit.

In 2016, he was selected as a National Institute of Justice Law Enforcement Advancing Data and Science (LEADS) Scholar. Since 2020, he has served as the Co-Chair of the International Association of Chiefs of Police (IACP) Police Research Advancement Section and is a member of the IACP Research Advisory Committee.

Lt. Williams is a Drug Recognition Expert (DRE) and is accredited in crash reconstruction by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR).

[9] The suppression by the prosecution of evidence favorable to and requested by an accused violates due process where the evidence is material either to guilt or to punishment, irrespective of the good faith or bad faith of the prosecution. *Brady v. Maryland*, 373 U.S. 83 (1963).