D43 Vehicle System Forensics and Criminal Investigations Involving Automobiles

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Learning Overview: After attending this presentation, attendees will have been exposed to the rapidly growing science of vehicle system forensics.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by disclosing how the discovery of vehicle system data and the development of tools for data acquisition have opened an entirely new source of key evidence in investigations involving automobiles.

Attendees of this presentation will be exposed to the rapidly growing science of vehicle system forensics. Like other forms of digital forensics, the acquisition of data from automobiles centers on the retrieval of digital data from various forms of storage media, and there is an overlap with some data from familiar digital forensics sources, including phone data (phone call histories, call logs, contacts, and text messages). However, unlike traditional digital forensics, the data acquired from vehicles can include key evidence regarding historical vehicle whereabouts (breadcrumb trails), vehicle velocities, hard acceleration/braking, traction events, doors opening or closing, gear shift selector changes, etc. Examples of the successful use of vehicle system data in criminal cases will be presented, including the case described below in which the data were key evidence in a vehicular murder case prosecuted in the United Kingdom.

The storage of digital data in automobiles is not a new concept, but the usefulness of such data in criminal investigations has developed more recently. Digital data in automobiles began with diagnostic data used for the purpose of maintenance and repair, along with the control and monitoring of emissions. Apart from diagnostic data, many vehicles have recorded crash data since the late 1990s and early 2000s. Event Data Recorders (EDRs) have advanced over time to record tri-axial acceleration traces and pre-crash vehicle data. The latest, and perhaps most powerful, entry into the available data from automobiles is the development of vehicle system forensics.

On August 5, 2017, there was an altercation at Bar Form, a bar in Enfield, United Kingdom. The altercation moved outside to the parking lot, where Bradley Clifford, 24, had parked his Ford® Mustang®. Mr. Clifford was arguing with Jashua Francis, 19, regarding his girlfriend. The two men agreed to go to a car park for a fist fight. Mr. Clifford got in his Mustang® and Mr. Francis got on his moped. Riding pillion on the moped was Sobhan Khan, 18, a friend of Mr. Francis. As the parties drove away, Mr. Khan smashed a bottle on the side of the Mustang®. Mr. Clifford then pursued the moped at high speed through the city streets of Enfield until finally catching it and ramming it from the rear. The impact ejected both Mr. Khan and Mr. Francis. Mr. Khan died from his sustained injuries. A crime scene image, used with the permission of the metropolitan police, is shown as Figure 1.

The Mustang® was manufactured with a Ford® Sync Generation 3 infotainment system, which yielded direct evidence of the crime, including vehicle track logs (breadcrumb trails) and velocity logs derived from Global Positioning System (GPS) data, as well as wheel speed data reported on the vehicle's Controller Area Network (CAN) bus. Equally valuable was the indirect evidence the system provided. The breadcrumb trail in the data gave investigators a highly accurate trace of the pursuit path. With this, police personnel searched the surroundings along this path for sources of video evidence (i.e., security cameras). With the prevalence of security cameras in today's world, investigators were able to identify numerous cameras that captured video footage of the chase. The gathered video clips provided corroborating evidence of vehicle speed, but also the aggressiveness of the pursuit, the vehicle spacing at points along the route, evasive actions by the moped, etc. The volume of evidence that included the direct vehicle system data and the indirect evidence that resulted from it overwhelmingly disputed any claims that the impact and resulting death of Mr. Khan were accidental.

Figure 1. Crime scene image, courtesy of the metropolitan police, United Kingdom

Vehicle System Forensics, Infotainment and Telematics, Vehicle Investigations

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