A78 Examination of Electronic Control Device Probes to Determine Duration of Application

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After attending this presentation, attendees will learn the usefulness in collecting Electronic Control Device related evidence and how Scanning Electron Microscopy can be used to determine if and how much electrical energy is delivered to a subject during a electronic control device application.

This presentation will impact the forensic community by presenting data that will be useful in the investigation of accusations of excessive force and in-custody deaths involving the use of electronic control devices.

Electronic Control Devices (ECD)have become standard equipment for many law enforcement agencies across the US. Their primary purpose is to deliver an incapacitating shock to a subject through two wire-tethered probes connected to the unit. These devices are used daily with a high degree of success, but when they are not successful, ECDs receive substantial scrutiny. Often when an excessive force complaint is filed, or if an in-custody death occurs, forensic investigators are summoned to reconstruct the event. Historically, the main tool for the investigator has been the data available from the unit itself. Some ECD units have on board memory that records the activation time and duration of the unit. This data, however, does not necessarily equate to the duration of electric energy delivered to the subject.

When an ECD is activated, current across a small primer in the ECD cartridge ignites forcing a nitrogen capsule rearward into a hollow puncture pin. The compressed nitrogen is released into two chambers forcing the blast doors, probes, probe wires, and Anti-Felon Identification (AFID) tags forward out of the cartridge. The two aluminum probes/darts, attached to thin insulated wires, impact into a target. If the probes are typically within 2 inches of a conductive target, electrical energy will be transferred between the two probes completing the electrical circuit. The completed circuit delivers pulses (energy) through the target in an attempt to temporarily incapacitate a human target.

For energy to be transferred from the device, both probes must simultaneously contact the subject to complete the electrical circuit. The probes can miss the target or become dislodged during the incident. If this occurs, the electrical energy will complete its circuit across the wires or by arcing in front of the electrodes of the ECD. Energy will not be delivered into the target.

The wire is connected to the probe by a single knot tied at the base of the probe. At the wire/probe junction, the electric spark jumps between the wire knot and the probe (air-gap) completing the circuit. Due to the impedance of the air-gap, this jump creates heat resulting in melting, scoring, and carbon residue deposits on the knot and the inner surface of the probe from the thermal insult.

Twenty-five ECD cartridges were fired into conductive media at 1-, 5-, 10-, and 20-second durations. The probes from these cartridges were examined stereo microscopically and with the scanning electron microscope (SEM). The physical changes (carbon residue, melting, scoring, and pitting) on the wire knots and the inner probe surface were measured and quantified. It was determined with a high degree of confidence that analysis of the physical changes and residue left on the probes and wire knots can glean information on the duration of electrical energy actually delivered to the subject.

By using stereo and electron microscopy to document, measure, and quantify the physical changes of the ECD probe/wire junction, accurate data on the amount of electrical energy delivered to the subject can be determined within the 1-, 5-, 10-, and 20-second timeframes. If the evidence is properly collected and documented, qualities present on the probes can be compared to the data recorded in the ECD unit itself to determine the duration of electric energy the subject received during the incident.

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