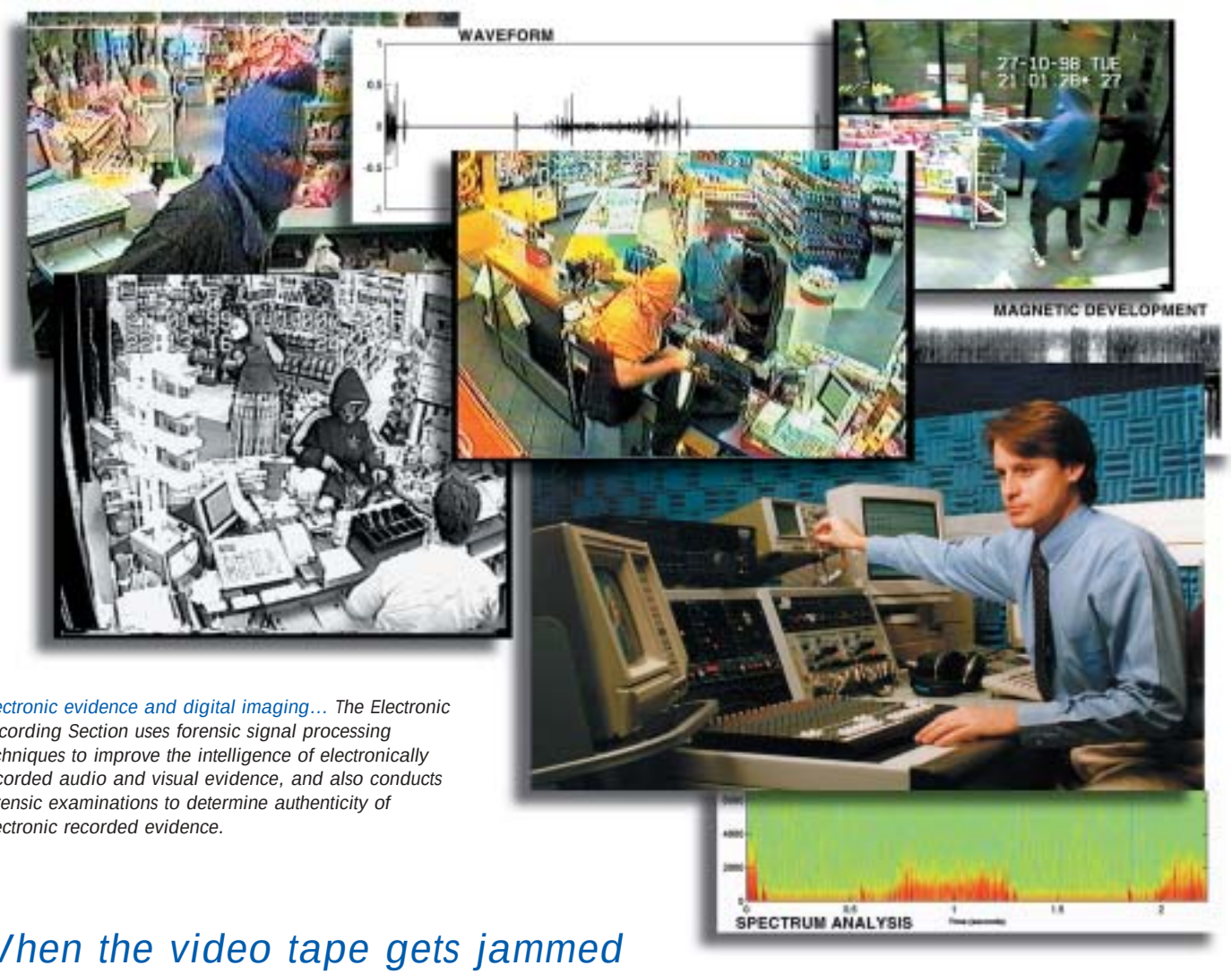

Electronic evidence and digital imaging… The Electronic Recording Section uses forensic signal processing techniques to improve the intelligence of electronically recorded audio and visual evidence, and also conducts forensic examinations to determine authenticity of electronic recorded evidence.

When the video tape gets jammed

by Richard Wilding, Technical Officer, Electronic Recording Section

It's early in the morning and most of the city is only just starting to prepare for another day when a cleaner discovers the body of a young man in the carpark of a suburban shopping centre.

Officers called to investigate have no witnesses but the centre management does have a multi-camera security system that runs 24 hours a day. Centre security are contacted and the previous night's video tape recording is cued up for review using a special decoder that allows the isolation of individual camera views – one of those cameras is trained on the position of the body.

This seems straightforward enough: a scan through the tape will reveal the fatal events of the night before. However, at the critical moment the tape, which has probably been re-used on many occasions, has suffered some form of damage and the video becomes a chaotic mess of fragmented camera frames before jamming in the recorder.

Electronic evidence

This type of scenario is now commonplace in a world of increasing electronic surveillance. The past two decades have seen a proliferation of recording systems that are designed to increase public safety and help reduce crime.

Along with the public use of electronic surveillance systems has been a shift to the use of electronic evidence in both investigations and court proceedings.

Electronic evidence in the form of audio and video recordings, as well as various forms of digital imaging, has therefore gained worldwide recognition for forensic purposes. In Australia there has been official recognition of electronic evidence by the Senior Managers of Australian and New Zealand Forensic Laboratories (SMANZFL). Courts also have recognised the importance of electronic evidence. In fact video surveillance recordings are often deemed more reliable than witnesses to a crime.

Leaders in the field

The Queensland Police Service Electronic Recording Section (ERS) leads Australia in the areas of tape enhancement and analysis, and all technical staff are tertiary qualified in audio and video signal processing.

Requests for forensic video processing at ERS have tripled in the past five years,

rising from 699 for the year in 1996 to over 2,100 in 2000. Currently the laboratories process an average of 535 audio and videotapes per month. This upsurge reflects the rapidly expanding use of electronic recordings in forensic applications.

New technology and software development

Recent work with video recordings has seen a marked shift within the laboratories to computer based non-linear editors in order to fulfil the demand for high quality still image extraction and enhancement. New acquisitions at ERS include three Apple Macintosh G4 workstations and Panasonic DV recorders dedicated to the task of video signal processing.

The shift to digital video processing allows a wider variety of sophisticated enhancement methods than was available with older analogue technology. This has resulted in technical officers at ERS working with scientific analysts in the area of object identification and comparison of items such as clothing and tattoos using digital image extraction of footage from security surveillance systems and hand-held camcorders.

However, forensic video processing represents only a fraction of the overall market for commercial software developers and dedicated tools are extremely scarce.

Custom software has consequently been developed by ERS to address this issue. This software provides video frame overlays for the purpose of image noise reduction and multiplex decoding of various video security systems which has proved problematic in the past.

National recognition of the section's expertise has led to it becoming a member of the Electronic Evidence Specialist Advisory Group - a specialist working group instigated by SMANZFL to advise on matters of policy and procedure. This expertise has resulted in the referral of many difficult cases to the Queensland laboratories from interstate and other government agencies. Electronic evidence produced by ERS has been used nationally and technical officers are often required to give expert testimony in Australian courts.

Authentication

The widespread acceptance of electronic evidence in court also has raised questions about the possibility of tampering or manipulation of its contents. These concerns have been heightened in recent years by the proliferation of consumer-level digital media systems. Consequently, one of the most demanding areas of forensic work carried out by ERS is that of authenticity analysis.

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Authentication of material for court requires an in-depth knowledge of a host of media formats and signal processing methods and each case often presents new challenges to the analyst. Tapes are examined closely for physical signs of tampering and the recorded signal is subjected to an exhaustive array of electrical tests, including waveform and spectral analysis, to determine any inconsistencies.

The results are compiled and findings presented to the court as a written technical report. The Electronic Recording Section's experience in this area spans many years and the laboratories regularly receive requests for authenticity analysis from interstate police services.

Damaged tape scenario

Returning to our scenario of the damaged security recording, in this instance the investigating officer submitted the videotape to the ERS for possible repair and enhancement. Technicians inspect the tape for the extent of the damage and are able to repair it so that it is once again in a state suitable for replay.

The video signal is then optimised electronically using a time-base corrector and recorded in a digital form to a computer hard disk allowing for non-destructive processing and enhancement. Though the signal from the recording is highly unstable, a single half-frame of video is extracted and shows the victim with another male person.

After further enhancement with image processing software to reveal identifying features from a shadow, a photo-quality print is produced and shown to the case officer who immediately recognises the second male as a known suspect in a series of local assaults.

From this point the still image becomes a critical piece of evidence in the murder investigation and subsequent prosecution of the suspect in court.