Forensic Tape Analysis, Inc.

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TAPE ENHANCEMENT EXAMINATIONS

An integral part of any voice identification task is to attempt to ensure that the most intelligible speech samples are available for comparison purposes. All too often, however, the limitations of the surveillance recorder, microphone, and adverse room reverberation effects severely degrades the audio signal. Through the proper selection of a variety of analog and digital filtering devices unwanted sounds can often be attenuated.

ANALOG FILTERS:

In the past tape enhancement techniques traditionally relied upon exclusively analog instruments such as high-pass, low-pass, notch filters, graphic and parametric equalizers, comb filters and compressor-limiters. The band pass filters, for example, were often effective in reducing specific tones or noises within the speech frequency range such as tape hiss which could be eliminated with the appropriate high-pass filter. These instruments were effective primarily when the noise sources are basically stationary but they also reduce a portion of the desired voice signal and thus were inefficient in eliminating wide-band noise such as room reverberation effects.

DIGITAL FILTERS:

The recent introduction of the adaptive digital filter has significantly increased the experts ability at improving speech intelligibility while removing room reverberation effects. These so-called "smart filters" are capable of accomplishing adaptive filtering, analysis-synthesis, spectral subtraction and deconvolution. These filters are effective in reducing pure tones, noise, and convolutional effects caused from room acoustics and reverberation.

One of the more recent filters encompasses not only an adaptive filter, but includes low and high pass filters, band pass/band stop filters, comb filters, AGC, delay line, signal loopers and specific signal generators. In addition, cursor and value switches facilitate selecting and adjusting the processor values thus permitting an extremely wide range of operating settings.

OTHER DEGRADING FACTORS:

Because of inadequate equipment and poor operator technique, a host of additive adverse factors besides noise can further reduce speech intelligibility. Improper recorder speech or transient mechanical problems ("wow and flutter" disturbances) can further degrade the output signal as can poor quality recording tape (producing drop-outs, stretching, etc.) and improper AC or line shielding which can produce power instabilities and AC line leakage effects. The enhancement process often, therefore, first requires an examination frequency response. An FFT (Fast Fourier Transform) analyzer is normally used to check out the play back speed deficiencies and to help correct azimuth malalignments.

Copies of the enhanced tape are then returned to the submitter on standard cassette formats, while work notes detailing the selected filters are retained with the examiner's case file. They should also include observations concerning track configuration, azimuth and speed errors, aural and frequency observations, and any recommendations being passed onto the contributor to enhance the playback process.

Although not deemed absolutely essential, it is highly recommended that the original tape(s) be provided the expert for enhancement purposes. Every reproduction of the original tape produces additional signal degradation and increased noise effects, thus reducing the efficiency of the enhancement effort. If necessary, both analog or digital "patch cord" direct copies can be made in the field which would provide the best alternate "copy" if the original will or cannot be released.