

Technology vs. Fatigue



High-tech gadgets could save tired drivers from deadly wrecks

By Tim Barton

“Drowsy drivers often drive with their eyes closed for several seconds without realizing their eyes are actually closed. Eye closures of three to four seconds are common for drowsy drivers.”

- Attention Technologies literature

Far too many truck drivers die when fatigue overwhelms them while they are behind the wheel. Now technology may be on the verge of saving some of those lives.

Federal statistics indicate that more than 200 truck drivers a year die from fatigue-related accidents.

Many more are injured or cause injury and death when they are overtaken by fatigue. To stem this tide, a small army of sleep researchers and scientists work constantly to develop technology that warns drivers of their level of fatigue and of the performance degradation it causes.

Researchers are concentrating their testing on three promising technologies which have application for driving. Dr. Dave Dinges, a leading sleep researcher at the University of Pennsylvania,

is strong in his opinion that while these devices may hold the key to future success, help may also come from some as-yet-unheralded device. Right now, the three devices under scrutiny in a joint U.S.-Canadian study involving one American and one Canadian fleet, are the:

- SafeTrac lane tracker,
- Perclos eyelid closure monitor
- Actigraph sleep activity monitor.

SafeTRAC by Assistware

SafeTrac is a vision-based lane tracking system sold by AssistWare Technology. The unit consists of a small windshield mounted camera and driver interface box that can be mounted on the dash, or embedded in the dash or headliner. An audible alert sounds when the vehicle moves from the lane center. Dr. Dean Pomerleau, founder of AssistWare, says there are two distinct functions the system offers.

If the vehicle begins to approach the berm or center line too closely, SafeTRAC will immediately generate a warning to the driver.

The drowsy driver function tracks a driver's lane centering in

rolling eight- to 10-minute periods and reads out a numeric score of performance on a constant basis. If this "alertness score" drops below a certain number, SafeTRAC generates a warning.

Pomerleau says the primary difference between these two functions is time. The drowsy driver alert creates its score by recording a baseline of driver performance over a longer period of time, while the lane departure function guards against immediate lane drifts.

Ed Cleek, a driver for McKenzie Tank Lines, has been using the SafeTrac lane tracker for almost a year. Cleek says he has incorporated the unit into his normal driving routine. "It keeps you on your toes even in situations where your attention wanders and you're not necessarily tired," Cleek says.

The lane departure function works whenever the vehicle begins to exit its lane, regardless of a driver's previous performance. There is a false alarm protection readout as well. It keeps alarms from sounding when a driver uses his turn signals and provides visual confirmation that turn signals are in use.

The system uses a camera to detect a variety of signals from the road that delineate lanes. It primarily uses center lane markings, but it is capable of using oil drops, occasional small retro reflectors or the road edge itself. "SafeTrac operates effectively in over 97 percent of highway conditions and gives false alarms less than once in every eight hours of driving," AssistWare says.

Cleek says the SafeTrac is an excellent safety tool. "I've gotten so used to it that I miss it when it's turned off."

Perclos

While devices like SafeTrac determine a driver's performance by monitoring the vehicle, the Perclos camera, developed by Richard Grace at Carnegie Mellon University in Pittsburgh, monitors the driver directly. Perclos, or 'percentage eye closure camera', is a dash-mounted unit with a small camera the driver adjusts to focus on his eyes.

Grace, now chief executive officer of Attention Technologies, says he looked at many psychomotor behaviors before deciding to focus on eyelid closure. He explored heart rate, brain waves and galvanic skin response as fatigue indicators. "We found that these behaviors were affected by many things besides fatigue and that devices measuring them gave a lot of false alarms," he says. "The eyelid closure camera works for everyone without false alarms from physiological causes other than fatigue."

According to Attention Technologies literature, Perclos senses a fatigued driver's level of alertness very quickly and warns him with an audible signal and a readout of the distance he has traveled with eyes closed. Research has shown that drowsiness increases slowly over an hour or more. Perclos provides

SafeTRAC alerts the driver when his truck moves from the center of the lane or if his driving performance begins to decrease.

early warnings during this progression of drowsiness based on the frequency and length of eye closures. According to the literature, "Drowsy drivers often drive with their eyes closed for several seconds without realizing their eyes are actually closed. Eye closures of three to four seconds are common for drowsy drivers." A vehicle can travel 360 feet in four seconds at 60 miles per hour.

The Perclos camera has four controls adjustable by the driver: volume, brightness, sound selection and sensitivity selection. There are six sounds ranging from a gentle beep to an aggressive klaxon. The visual display shows the driver how far he has traveled with eyes closed. "Seventy to 80 percent eyelid closure is considered closed, meaning that the pupils are covered by the eyelids," Grace says. "A driver whose eyes are closed to that extent cannot see."

Actigraph

The Actigraph sleep activity monitor, or 'sleep watch' provides both a sleep profile and a performance profile. The watch provides a time display and is worn on the wrist. It measures the activity of the wearer, both when

sleeping and awake. When a wearer is asleep, the watch relates the measure of activity to a mathematical algorithm based upon a pre-existing standard of sleep. At the touch of a button the watch will then read back to its wearer the length and quality of his sleep as a percentage of available energy. "There is a direct relationship between the amount of movement and the quality of sleep," says Tom Kazlauskis, vice president of ambulatory monitoring at Precision Control Design, the company that makes the watch. This relationship makes it possible for the watch to determine sleep quality. Much like a fuel gauge, the watch will show sleep as a reservoir, which is drained by activity, making the readout easy to understand.

The watch also measures performance and fitness for duty. A sleep reservoir below 65 percent full is considered to be a sign the driver needs sleep and should not drive. According to Precision Control Design, the device "provides a chronological history of sleep periods back 24 hours and estimates ability to perform selected tasks. Sleep and performance are displayed. An arc shows hours when significant sleep has occurred 24 hours back

from the current clock time. When the performance screen is activated, the arc predicts the wearer's ability to perform a specific task measured from 100 units down to 53."

The watch has a sensor that cancels out the mechanical movement of the truck, for example, and can discern if the watch has been taken off and put in a stable location. According to Kazlauskis, "The watch can only be fooled by taking it off and allowing someone else to use it."

The fuel gauge-style readout of performance level is constantly available by glancing at the watch face, and you can see a percentage display at the touch of a button.

Kazlauskis emphasizes the watch is a personal feedback device. "There are no hard numbers to indicate when a person needs sleep," he says. "As a driver learns how the watch feeds back information, he will be able to recognize what the watch is telling him. Then he can make decisions about his sleep and his driving time."

In large part the success of fatigue management technology will depend upon driver acceptance. If drivers find the machines useful, such devices could help save lives. The driver must also be willing to use the information he receives from them. A strong education in the recognition of fatigue and its causes is an absolute necessity. Even more necessary is the driver's willingness to use what he knows to get the sleep he needs ■

This article originally appeared in the July, 2003 issue of Truckers News. It has been edited for size and minor corrections.

For more information about AssistWare please contact:

Mike Formica
724-449-SAFE (7233)
mformica@assistware.com
www.assistware.com