*Journal of Drug Policy Analysis*

*Volume* 1, *Issue* 1 2008 *Article* 1

# The Future of DIRECT Surveillance: Drug and alcohol use Information from REmote and Continuous Testing

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## Abstract

It is now possible for probation officers to detect probationer alcohol use remotely and continuously. This essay describes three devices intended to collect Drug and alcohol use Information from REmote and Continuous Testing, or what I call DIRECT surveillance. It also highlights some of the major questions associated with the implementation, consequences, and future of DIRECT surveillance. While most of the focus is on alcohol use among probationers and parolees, the essay does discuss the use of these technologies in other settings, and for other drugs. It also addresses issues related to other types of electronic monitoring which can be used separately or in conjunction with DIRECT surveillance (e.g., GPS).

**KEYWORDS:** alcohol, drugs, testing, probation, parole

*I would like to thank Erin Kilmer Neel, Adam Thomas, and two anonymous reviewers for improving this article.

## I. Introduction

It is now possible for probation officers to detect probationer alcohol use remotely and continuously, and there is work in progress trying to extend this to some illegal drugs. Researchers affiliated with the Naval Research Laboratory received a patent (#5,891,649) for a device that transdermally detects and instantaneously sends information about illegal drug use to any modem-enabled computer or phone. The commercial success of a related device for detecting alcohol use suggests this type of surveillance is not only feasible, but in demand. These devices enable what I call DIRECT surveillance, where DIRECT stands for drug and alcohol use information from remote and continuous testing.

This essay describes three devices intended to enable DIRECT surveillance. It also highlights some of the major questions associated with the implementation, consequences, and future of DIRECT surveillance. While most of the focus is on alcohol use among probationers and parolees, the essay does discuss the use of these technologies in other settings, and for other drugs. It also addresses issues related to other types of electronic monitoring which can be used separately or in conjunction with DIRECT surveillance (e.g., GPS).

## II. State of the Technology

Alcohol and drug testing technology has advanced considerably from the observational pupil tests of the 1950s (Wish & Gropper, 1990; West & Ackerman, 1993). Urine testing is the most common type of testing, but new technologies are becoming more attractive as agencies look for ways to decrease fraud and increase the detection window. When alcohol and illegal drugs are consumed, a small portion of these substances and their metabolites are excreted from the body via perspiration. Using a variety of technologies, these substances and their metabolites can be detected—even in very small amounts. Table 1 presents three devices that enable DIRECT surveillance: Secure Continuous Remote Alcohol Monitor (SCRAM), Wrist-Transdermal Alcohol Sensor (WrisTAS), and Drug Monitoring System (DMS).

**Table 1.**
**Devices that Enable DIRECT Surveillance**

| Name | Company or Lab (State) | A | D | Publicly Available | Communications Technology | Detection Technology | Geographic Restrictions |
|---|---|---|---|---|---|---|---|
| Secure Continuous Remote Alcohol Monitor (SCRAM) | Alcohol Monitoring Systems (CO) | Y | N | Y | Bracelet stores info, wirelessly transmits to modem, submits info to AMS | "The sensor side of SCRAM includes an air pump that actively draws in ethanol vapor from the skin surface into the fuel cell." * | Must be close to home modem to upload test results |
| Wrist-Trans-dermal Alcohol Sensor (WrisTAS) | Giner (MA) | Y | N | N | Version 5 stores info and a cable is used to upload information to a computer[1] | "[A]n electrode oxidizes the ethanol and forms acetic acid that diffuses into the reservoir. The current is converted to a digital signal…" * | Must be standing next to the computer; unclear whether this information is automatically sent somewhere |
| Drug Monitoring System (DMS) | Naval Research Laboratory (DC) | Y | Y | N | Bracelet to pager to computer via wireless email | The device includes antibodies that interact with the drug when it is perspired. This interaction displaces labeled anti-bodies that "migrate through a spacer layer and are trapped by a layer containing a suitable selective binding material. The label is illuminated or excited by a light source and detected by photo-detector." ** | None, but need an intermediary device (pager) because of power limitations |

**Sources:** A = Detects alcohol; D= Detects illegal drugs. *Marques & McKnight, 2007; **Kidwell et al., 1999. [1]Marques and McKnight reviewed Version 5. Version 6 reportedly has a remote telemetry system.

## Secure Continuous Remote Alcohol Monitor (SCRAM).

SCRAM was developed by Alcohol Monitoring Systems (AMS) and is a commercially available ankle bracelet that measures ethanol consumption via perspiration. AMS encourages judges to sentence offenders with alcohol problems to wear the bracelet for at least 90 days and the bracelet must be worn 24 hours a day (even in the shower). The device tests for ethanol up to twice an hour (regardless of location) and communicates with a special modem that is placed in the subject's home or office. Information about consumption and potential tampering are stored in the bracelet and sent to the modem by radio and from the modem via telephone lines to the AMS headquarters in Colorado. Courts and community corrections departments are then notified when a drinking or tampering event has been detected. It is important to note, however, that the bracelet-to-modem communication can only take place when the subject is 30 feet from the modem and it cannot work if there is no landline available (AMS, 2008a).

The SCRAM system is becoming popular. The device was beta tested in 2002, received pre-market approval from the FDA in 2003, and is now being used

in 46 states. AMS (2008b) reports that more than 65,000 offenders have been monitored with the device, for cases ranging from driving under the influence to domestic violence. In many jurisdictions, the court requires that the offender pay for the testing, which includes $50-$100 for installation and a daily monitoring fee of $10-$12 per day (AMS, 2008a). While the daily cost for house arrest varies across the country (depending on the technology, the vendor, and negotiating power of the jurisdiction), the daily cost for SCRAM is reported to compare well with standard electronic position monitoring (Marques & McKnight, 2007, p. 50).[1]

As for the accuracy of SCRAM, an independent review of an early iteration of the bracelet by the National Highway Traffic Safety Administration found that "When subjects dose themselves to BAC >=0.08 g/dL, SCRAM correctly detected 88 percent of these events" (Marques & McKnight, 2007, i).[2] For BACs >=0.2 g/dL, SCRAM was able to detect alcohol 79% of the time.[3] The study found that there were no problems with false positives, but false negatives did occur and increased over time. Marques and McKnight attributed this problem to water accumulation in the sensor and noted that this problem has reportedly been solved in a more recent version of the device.[4] I am not aware of any independent evaluations of the new SCRAM II bracelet.

**Wrist Transdermal Alcohol Sensor (WrisTAS).**

WrisTAS was developed by Giner, Inc. to transdermally monitor blood alcohol in human subjects. The device, which resembles a wristwatch, oxidizes alcohol in

[1] In 1999, the National Law Enforcement Corrections Technology Center reported that the daily rate for electronic position monitoring ranged from $5-$25 day.

[2] A blood-alcohol concentration (BAC) of 0.08 grams per deciliter is an important threshold for driving under the influence. The National Highway Traffic Safety Association reports that: "A 170-pound male typically would have to consume more than four drinks in one hour on an empty stomach to reach a BAC of .08. A 135-pound female typically would have to consume three drinks in the same time frame."
http://www.nhtsa.dot.gov/people/outreach/safesobr/13qp/facts/perselaws.html

[3] As for admissibility of SCRAM in court, a report from the Traffic Injury Research Foundation (2007) notes: "As of December 2007, there have been 49 evidentiary hearings involving offenders denying confirmed violations of the SCRAM System...Of these, 1 case was dismissed, 4 rulings are still pending, 39 rulings have supported the technology and 5 rulings have been against the technology -- although in 2 of these cases the defendant was ordered to remain on the device" (26).

[4] "The most likely cause of this problem is a consequence of water accumulation inside the sensor housing: as water accumulates the sensor's ability to detect ethanol is reduced. The SCRAM™ device that was tested has now been replaced by a device with less dead airspace for holding water, and this has reportedly solved the problem of water accumulation. We have no evaluation data on this newer version of SCRAM™" (Marques & McKnight, 2007, 2).

perspiration and measures this oxidation to determine whether the subject has consumed alcohol.[5] Studies by Swift and colleagues (1992, 1993, 2000) find that transdermal measures of blood alcohol concentration are delayed compared to standard breath testing. Swift et al. also find that the peak heights of the TAS and breathalyzer curves are correlated at 0.6-0.7 and the areas under the curves are correlated at 0.9 or higher. This suggests WrisTAS is a promising technology for remotely monitoring alcohol consumption.

However, WrisTAS is currently only used for research purposes and has some important drawbacks, especially from the perspective of community corrections agencies. Since the device must be taken off before a shower or bath (Marques & McKnight, 2007), there is a great possibility of tampering. More importantly, there are critical data loss issues that need to be resolved: Marques and McKnight found a very low detection rate for WrisTAS Version 5 that "was largely due to those devices' erratic output or not recording during nearly 67% of all episodes" (i). As with SCRAM II, I am not aware of any independent evaluations of the new WrisTAS Version 6.

**Drug Monitoring System (DMS).**

In the mid- to late-1990s, the Office of National Drug Control Policy funded researchers at the Naval Research Laboratory to develop technologies that allow for DIRECT surveillance of illegal drugs (*Philadelphia Inquirer*, 1998). The DMS device utilizes both electrochemical technology and enzymatic technology with optical detection to detect use of alcohol or illegal drugs. Results are transmitted from the device to a pager that sends the information directly to the agency that assigned the test. The *Philadelphia Inquirer* includes a non-technical summary of how it is supposed to work:

> The patch is built into a band that can be worn on the wrist or the ankle. In concept, the patch will work like this: Say a person takes cocaine. The drug molecules are excreted in sweat. The surface of the patch is coated with a specific antibody that interacts with the cocaine. In the process, the cocaine molecules dislodge colored particles on the patch and the released particles are detected by a built-in sensor. The concept works somewhat like a home pregnancy test, in which a color indicates a positive or negative result. The patch then relays the information to a transmitter similar to a pager - or potentially a small cellular or satellite phone - worn by the person being monitored. In turn, information is forwarded via

[5] Swift (2000) provides a more detailed explanation: "The detector is a potential controlled device that oxidizes alcohol that generates 4 electrons per molecule of alcohol oxidized; the resulting current is measured, digitized, and stored in memory" (422).

> wireless e-mail to a computer, possibly several states away, identifying who the user is and where he or she is.

There were plans to test this technology with the Philadelphia parole department in the late 1990s (*Philadelphia Inquirer*, 1998; Bureau of Justice Assistance, 1999), but this did not materialize. The *Inquirer* article, which was written in April 1998, reports "that it may take another two years before the drug-screening patch is ready for wide-scale use." However, a literature review and Internet search did not reveal any publications, reports, or notes about this technology. Personal communication with the first author on the patent suggested that the illegal-drug technology was improved, but was still in the lab.

While a patent does not guarantee that a device will come to market, it seems more likely than not that we will see a DMS-like device in upcoming years. The existing research in conjunction with 1) advancements in wireless technologies, 2) the growing popularity of SCRAM, and 3) a potential for use beyond criminal justice populations all point in the direction of feasibility and profitability.

## III. Questions about DIRECT Surveillance

This section addresses some important questions associated with the implementation and consequences of DIRECT surveillance. While this list is far from exhaustive, it should serve as a useful starting point for discussions among practitioners, researchers, and funding agencies.

### How is the information from DIRECT surveillance going to be used?

Devices that enable DIRECT surveillance are simply gathering information which has to be processed by humans—humans who usually have very little time. The devices will only deter consumption and possibly promote rehabilitation if the wearer believes that there will be some aversive consequence associated with testing positive: that might be a formal sanction in a criminal-justice setting or a difficult interview with the therapist in a clinical setting. While there is anecdotal evidence that wearing the device makes it easier to resist peer pressure (wearers can point to the bracelet in social settings to reinforce that they cannot drink), this only works if there is a general belief that something unpleasant might actually happen as a result of testing positive.

These devices will increase the amount of data available for probation and parole systems, but most systems do not use all of the information they currently obtain (see e.g., Deschenes et al., 1996; Kleiman et al., 2003). The impact of new data collection efforts (e.g., DIRECT surveillance, GPS) depends on how this

information is used. While there is evidence that quick formulaic sanctioning can make a difference (e.g., Hawaii's HOPE program; Kleiman & Hawken, 2008), it is unclear whether this approach can be incorporated into routine supervision.

The introduction of a new technology to a community corrections office requires time and resources to educate officers on what the device does and how it can be manipulated. It also requires educating judges on the advantages and disadvantages of sentencing offenders to such a device. While it is critical to have discussions about the merits of the device, it is just as critical to have frank discussions about whether the results will ever be used, and if so, how. Will the department have the capacity to utilize this information? Will priority be given to locating absconders who are avoiding punishment for testing positive remotely? Hawaii's HOPE program highlights the importance of having the judge and community corrections officers on the same page with respect to how the testing results will be used and how absconders should be addressed.

**Will DIRECT surveillance of one substance influence the use of other substances?**

If DIRECT surveillance influences the consumption of substances that can be detected by the technology, it may also influence the consumption of untested substances. While this question is not unique to this particular type of testing, it is especially relevant since DIRECT surveillance makes it much easier to continuously test for alcohol. The answer depends on whether the substances of interest are economic complements or substitutes. Two goods are considered substitutes if an increase in the price of good A leads to an increase in the demand for good B. They are considered complements if an increase in the price of good A leads to a decrease in the demand for goods A and B. A price increase can take the form of an increase in the money price or an increase in the expected sanction of using the substance.

Studies which use individual-level data and the money price of illegal drugs and alcohol generally conclude that alcohol and most illegal drugs are economic complements (for reviews, see Chaloupka & Pacula, 2001; Grossman, Chaloupka, & Shim, 2002); however, this is not a settled issue.[6] As for harder drugs, Saffer and Chaloupka's (1999) study of the relationships among alcohol, marijuana, cocaine, and heroin found that they are all complementary except for the relationship between alcohol and marijuana (results were mixed depending on population). A more recent analysis which merged drug prices with arrestee survey data and drug test results (ADAM) found that cocaine and heroin are

[6] Studies from Australia that include detailed information about the price of marijuana and alcohol yield conflicting conclusions about the cross-price effects (Cameron & Williams, 2001; Williams et al., 2004).

economic complements for arrestees (Dave, 2004). This is important to note since those subject to community supervision are much more likely to have preferences like arrestees compared to college students or those in the household populations.

Whether probationers and parolees will stop consuming all intoxicating substances if some become prohibitively expensive to consume via an increase in expected sanction is an empirical question. Clearly, this will depend on 1) what drugs are detectable (especially alcohol), 2) whether prescription drugs and unregulated substances are readily available to those being tested, and as discussed above, 3) the consequences of testing positive.

**Should parents have access to DIRECT surveillance**?

It is legal for parents to purchase drug tests for their children, and parents today locate their kids at any time by adding GPS tracking to their phones (assuming, of course, they are carrying their phones). There is also a market for "hidden" GPS devices that can be attached to a car so parents will know where the car has been at all times (www.gpsteentracking.com). Thus, one can reasonably assume there will also be parental demand for DIRECT surveillance. Since SCRAM received pre-market approval from the FDA in 2003 and is becoming popular, it would be prudent to start thinking about whether parents should be able to purchase devices for their children.[7] Discussions should obviously focus on substitution and complementarily, but they should also delve into the impact of home-based testing on parent-child relationships as well as the development of peer relationships.

## IV. Conclusions

The invention of devices that collect drug and alcohol use information from remote and continuous testing creates a host of interesting opportunities and new policy questions. Considering the large impacts this type of surveillance can have—impacts not likely to be restricted to the criminal justice system—we should proactively consider how to shape the use of these technologies instead of reacting to them after the fact.[8]

At the local and state level, judges as well as parole and probation departments that have recently decided to adopt SCRAM should reflect on current sanctioning practices for positive alcohol and drug tests and decide whether changes should be made. (These discussions should also address those who

[7] The Food and Drug Administration approved the sale of over-the-counter drug tests in 1997.

[8] A reviewer notes that even if the technology is not perfect, a positive test via DIRECT surveillance could lead to a summons for more traditional testing.

abscond in order to avoid being punished for testing positive). For those agencies that were early SCRAM adopters, it may be fruitful to devote time and resources to learn whether the technology is being used most efficiently.

At the national level, the National Institute of Justice and the National Institutes of Health (especially NIDA, NIAAA, and NIMH) should sponsor discussions with practitioners, researchers, and industry leaders to talk about the state of the technology and discuss the consequences, both intended and unintended. These agencies should also decide whether they want to sponsor the development of related technologies, especially for other substances (e.g., prescription drugs).[9] Since SCRAM is commercially available to detect alcohol, federal funds should be devoted to conducting experimental evaluations in criminal justice settings so we can learn how and for whom this technology can help influence behavior. Experiments that 1) randomly assign DIRECT surveillance, 2) randomly assign different levels of sanctions for positive tests, and 3) closely monitor the use of illicit and prescription drugs (via traditional testing) will generate the most useful results.

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[9] Indeed, the patent application for DMS addresses this possibility.

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