Reflections on 35 years in Electronic Monitoring

By Dennis J. Doffing

2024 will mark the 40th anniversary of the commercialization of electronic monitoring for criminal justice clients. In 1984 Judge Jack Love of Arizona challenged an electronics engineer, Michael Goss, to develop a person-worn device based on a Spiderman comic. Mike passed away a few months ago but his success, and those of the early adopters of a technology that promised to transform alternatives to incarceration, endures in the thriving field of electronic monitoring as practiced in the 21st century. To mark this significant anniversary, *The Journal of Offender Monitoring* asked me to look back at some of the key milestones I observed (and was a part of) during my 35-year career—how we developed this industry, transformation points, influences, and where we are today.

Over a forty-year period beginning in the early 1970s, America's incarceration rate grew by 450%, from 161 per 100,000 population in 1972 to 767 per 100,000 in 2010.[1] By 2012, the prison and jail population had grown to 2.23 million people, highest in the world. Mandatory minimum sentences, "three strikes" laws, and the elimination of parole by many states all contributed to the expansion of prison and jail beds. The growth of EM tracked the growth curve of incarceration. It originated not as an alternative to incarceration but as a way to make "house arrest" more secure and reliable.

But as the imprisoned population soared, many grew concerned: the boom in prisons and jails proved to be very expensive for states and counties to sustain, and criminologists increasingly came to believe that prison expansion was delivering diminishing returns in terms of public safety, and might even be harming communities. As jurisdictions began to pull back from their overreliance on prisons, electronic monitoring offered a less costly, less punitive, and more community-centered alternative. The shift did not represent a retreat from holding offenders accountable—the lifetime GPS monitoring for convicted sex offenders adopted in recent years by many states can hardly be considered lenient—but rather a more flexible and proportional approach that cost less to administer and improved the likelihood that an offender could return to society as a productive citizen.

Technology

The earliest technology for the remote monitoring of offenders was primarily radio-frequency (RF) based—and basic. The first designs were not the product of market forces or government procurement requirements, but the ideas and innovations of a remarkable cadre of engineers who devised and built them. In addition to Mike Goss, we need to recognize the efforts of Tom Moody, Dave Bower, Fred Smith, Valene Skerpak, Glenn Rothbart, Fred Rasmussen, Ed Reynolds, Jim Buck, Don Melton (see page 21), and others. The earliest transmitters were bulky. Many did not have tamper straps. The first units I used were equipped with medical straps we riveted onto the ankle; staff signed them in marker—when we took them off, we checked the signature to verify they had not been tampered with. Passive monitoring in the form of voice verification or coded digital transmissions were a part of early EM programs, sometimes in conjunction with RF to add a second layer of security as we were not always sure of the reliability of RF at that time.

One transformation point in the industry was in the 1990s, when customers had gained some experience and started to demand better systems and features. An embarrassing incident exposed a significant security flaw, when the L.A County Sheriff's staff replicated an EM RF signal using a garage door opener. That motivated the industry to adopt encrypted signals very quickly! RF technology became more reliable and smaller, with the advent of fiber-optic straps becoming a standard. The '90s also saw a proliferation of new manufacturers trying to stake a claim in the fast growing market. Some had niche ideas or a small technical advantage, but many could only build the initial design and did not have the capability to adapt, change, or expand. The larger companies who could adapt their technology quickly to provide upgrades and meet growing customer demands were able to ride the wave of growth as virtually all 50 states had some electronic monitoring programs in place by the new Millenium.

Perhaps the most significant single technology transformation point was the introduction of GPS monitoring. The first GPS units bore little resemble to today's compact devices. They employed an RF transmitter attached to the client, who carried a laptop PC-sized bag (a *large* laptop) that contained an RF receiver, GPS circuitry, analog cellular component, and heavy battery/charger. Manufacturers boasted that these new units could go a whole 4 hours before "the bag" needed to be charged! A lot of agencies began to seriously consider the new GPS-based systems for high risk clients (particularly sex offenders), but there was still plenty of resistance to such a cumbersome system.

When a single-piece ankle worn GPS system was patented in the early 2000s and shown to be effective, a new transformation point dawned. New companies moved into the EM market with a viable alternative to RF monitoring that increased public safety and gave program staff much more data and flexibility in their daily case management. Some of the larger RF companies were able to pivot into this GPS sector and from about 2005 onwards GPS become the dominant product in the electronic monitoring field. Since then there have been innovations, upgrades, and improvements in GPS

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equipment, many of them generated by customer demand and marketplace competition. Longer battery life, multiple location technologies, multi-carrier capabilities, GPS shielding/jamming alerts, and some innovative accessories (beacons, steel straps, charger options for example) expanded the product mixes agencies could choose from.

What about software? In the early days DOS based systems or (now ancient) database programs were used to take the calls from receivers to store and interpret data from alerts, and print out reports (on dot-matrix printers). The first monitoring system my agency purchased had a capacity for up to 100 devices active at a time—we never envisioned needing more capacity than that. Many agencies wanted their own host system on site, but few were really prepared to use them properly. My agency's first system was housed in the jail, where it was not air conditioned and smoking was prevalent. The smoke coated the hard drive and attracted dust (also prevalent), so we blew out a drive about every 18 months, which was accepted as an unavoidable part of the program. Large scale host systems could handle up to 400 clients, and some manufacturers began staffing monitoring centers to handle the needs of smaller customers or those who wanted to test the waters before committing large dollars to their own host EM systems. Reports were mainly in the form of "alerts" and daily reports were printed. The process of faxing alerts and daily summaries from EM host centers to supervision offices took hours and deluged line staff with pages and pages of data to sift through.

Not every new innovation succeeded. The mid-90s saw a failed transformation when PMI-Mclaughlin, a large private service provider, developed the FREEDOM host system. This innovative host could work simultaneously with several different manufacturers' RF field equipment and, being a PC networked configuration, was scalable. It was marketed as being adaptable to the demands of a larger agency base. It failed because the equipment manufacturers viewed FREEDOM as a threat to their monitoring revenues, control of their own data, and host sales: they encrypted new generations of RF receivers so they could not be used on FREEDOM. It should be noted that the European version of this system, INDEPENDENCE, was popular and successful as it was capable of working with field equipment from Elmo Tech (now Allied Universal), Strategic Technologies, Digital Technologies 2000, EMSI, Vorec, CSI and Zeta (a South African product not used in the U.S.).

As the 1990s drew to a close, the locus of software development moved away from the agencies to the monitoring companies, hastened by a combination of Y2K concerns, the increasing complexity of computer systems, and the realization by customers that they lacked resources to maintain host systems locally. Manufacturers were better equipped to maintain and upgrade hardware and software, scale systems to handle many thousands of devices simultaneously, and host systems in secure, hardened locations with redundancy and backup systems in place to keep uptime over 99.9%. The cost of monitoring came down as volume of usage increased. Another factor was a move from purchasing equipment and systems to leasing. RF and GPS equipment was changing rapidly, and keeping current by having to re-purchase every few years was costly. Leasing provided regular times to review, bid, and possibly replace EM equipment to stay up to date as the industry evolved.

From Resistance to Acceptance

It took time for the marketplace to embrace electronic monitoring. Safety was a major worry: how could an ankle bracelet provide the same level of security that a jail cell did? For a while it seemed like every time a monitored offender committed a crime, it made the headlines. Gradually, though, as the technology got better and better, and best practices developed and were adopted, hysteria yielded to caution, and then acceptance.

Beginning with Jack Love, pioneering judges, sheriffs, commissioners, and others began to understand that monitoring a curfew at home with real time reporting filled an important role in the spectrum of supervision options available to the courts and corrections. I was the Director of a multi-county community corrections agency in the 1980s. When we started looking at this new thing called "electronic monitoring," we thought it was just a "big city" thing for the Chicago's and New York's of the world. But the closer we looked (I still have the meeting minutes from 1986-87), the better we understood what having this option would mean. For starters, it allowed us to move 20 inmates from jail into a home detention program. We developed a simple risk assessment with 6 questions that helped identify suitable candidates for monitoring, and established an oversight committee of citizen and local corrections staff to review any "iffy" referrals.

The 1990s were a decade of enormous growth for electronic monitoring. The multi-layered nature of the criminal justice system allowed for many potential customer sites. Acceptance began at the local level, for clients who were known to local jail administrators, probation officers, and judges, and for whom the risks were seen to be low. When one jurisdiction started a program, neighbors and similar operations took notice and started to see how it could work for them. Interest was growing, and the potential encouraged manufacturers to expand their sales forces.

As the 1990s progressed, EM reached a tipping point when growth really began to accelerate; it seemed like every agency wanted to have an EM program. The service provider I worked for grew from contracts in two states in 1991 to customers in 37 states and 3 foreign countries by 2000. Virtually every type of criminal justice client seemed like a prime candidate for electronic monitoring, even given the limitations of RF. The same equipment used for juvenile clients was also used on child support violators, misdemeanants, sex offenders, even high-risk parolees. Naturally, the goals were different for different populations. Some agencies

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sought to use EM to encourage social change or were rehabilitative in nature, like reducing truancy or stabilizing adults in their homes. Some agencies were public safety oriented, and used EM to enforce restrictive curfews, using violations to trigger a swift return to custody to avoid new crimes. Some clients were sentenced to EM for weekends as a way to provide a sanction while allowing the offender to stay gainfully employed during the week. Monitoring could be used as a pretrial measure, or as an outright alternative to a sentence of jail or even prison. Our agency, like many, viewed EM as an intermediate sanction in lieu of jail time for probation violators, and as an element of early jail release for good behavior, which allowed us to exercise some prudent control as an offender reentered the community. The growth of EM was helped by the fact that the early programs did a pretty good job at data collection: agencies could show success rates of 80% or more, and could also show that violators were not committing new crimes, but rather were failing for "technical" reasons—missing curfew, failing a drug test, or being unable to maintain adequate housing or employment. While not desirable outcomes, these were acceptable risks for the courts, sheriff, and community given the savings of jail space, cost effectiveness, and positive reentry by the majority of successful cases.

Evolution of EM Applications

Along with the fast-growing acceptance of EM was the evolution of the applications in which it was used. Early programs focused on locally adjudicated adults who might otherwise be sentenced to short jail terms. Those successful programs led some jurisdictions to consider monitoring for juveniles and felony-level adults.

"Continuous" offender monitoring was always a goal of EM, but in actual practice RF systems were only capable of sending intermittent verification of an offender's location—and a lot could happen in the interval between signals. It was not until the introduction of GPS that true continuous tracking became a reality. Although no programs had the capacity for 24/7 tracking prior to GPS, after it arrived everyone suddenly had to have 24/7 coverage. If curfew verification at random intervals was good, *always* knowing where an offender was must be better, right? But the added capability also added to the workload and analytical complexities of those operating programs. If a monitored offender wasn't home at the appointed hour, were they nearby and running late or were they at an unauthorized location? Were they chasing after their dog in the neighbor's yard or making a quick trip to the liquor store? What were the staff's new responsibilities? There were also new technology issues to resolve: were the locations shown caused by GPS drift, or were they accurate? (And how accurate were they?) Was there a cellular void to contend with? A simple change of schedule could create a stream of new alerts to sift through. The alerts generated by monitoring equipment of unprecedented sensitivity might be worthwhile, especially with more serious clients and programs, but many added little or no value. Since virtually all EM programs now are GPS-based, we have created a lot more work for case managers and field staff. We have not sized our technology to the programs we are operating. In truth, RF continues to be a useful and appropriate tool for many commonplace applications, especially with recent improvements. There are now wrist-worn devices that work with smartphones and apps to assist with advanced case management. There are pluses and minuses for all of these options, but GPS has become the default choice when perhaps there are better "fits" in the EM technology spectrum.

Electronic monitoring has proved very popular with two populations. Lifetime GPS tracking for sex offenders is now widely prescribed by state criminal statutes as a way to monitor predatory or pre-predatory behavior. And GPS monitoring is increasingly being used to enforce court orders of protection granted to victims of domestic violence. The "Legislative Developments" section in each issue of *Journal of Offender Monitoring* is crammed with new statutory provisions mandating the use of GPS monitoring in sex offender and domestic violence cases.

One underutilized application is crime scene correlation. All manufacturers offer the capability to review GPS points, compare them with current crime locations and do a fast and accurate analysis to determine if clients were close enough for long enough to merit interest from law enforcement. The few agencies I am aware of that do use this correlation tool find that it is a huge time saver, eliminating from investigations the hundreds of known offenders NOT in the area. (It is also possible to use EM correlations to identify possible suspects or witnesses to crime.) I would estimate that less than 5% of EM programs use this part of their EM system, even though most can do it free of charge. Added workload, lack of coordination with law enforcement, and data privacy issues may all contribute to why this capability remains so sparingly used.

Another application that sees limited use is the tracking of positive activities and pro-social behavior. We do track work and home, exclusion zones, and some other occasional activity. But the current technology is capable of telling us what clients are doing to promote change, growth, and activities to reduce their risk and/or need in the community. We can program every AA and counseling location into EM software, and show time and attendance as part of a daily report. We can show a parent attending a child's soccer game, PTA conference, or scheduled religious service. All of this is beneficial information and could be used to step down clients into lower supervision levels as we document the success of each individual. This may create new work for staff, but if it moves clients to lesser supervision it can save time and resources in the longer term. I once had a social worker tell me her goal was to "catch 'em doing good." There's definitely a place for that in our evolving community supervision milieu.

There may yet develop new and unexpected applications for EM, such as expanded support for substance abuse probationers, but for now we seem to be

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set for target populations. Using layered applications (GPS to RF to passive to smartphone) could be an integrated solution for agencies, and the ability to give the precise "dosage" of supervision is intriguing as well, but the populations will be the same. Growth will come from getting everyone in the already identified target groups who should be on a monitor hooked up to one.

The Industry

EM began with some industrious and visionary engineers who could see new applications and adapt current technologies to work with them. Several companies that were already established in different sectors quickly set up new groups to respond to this "EM" that was getting a lot of media attention. In addition, there were many start-ups that had a new invention they were certain would bring them success. VOREC introduced the first fiber-optic tamper, Digital Products Technology marketed a passive/active RF solution and an alcohol sensor mounted inside a phone handset, Guardian (the radar-detection company, not the interlock one) assembled a small RF receiver with many new features, and Mitsubishi had a videophone capable of real time video calls for passive home monitoring. All are footnotes in the growth of EM. Curiously, the large electronics companies like Philips, Motorola, Siemens and others never entered the market. They could have brought a level of expertise and standards of design and performance that might have accelerated the field. There have been, by my back-of-the-envelope estimate, several hundred thousand EM devices deployed in the field, and it was still not enough volume to attract the major electronics players. Instead, EM manufacturers are more likely to be purchased by security or corrections companies as a way to complement their portfolio of services—not a bad thing by any means, but the trend seems to be holding back R&D, and innovation in technology has slowed. Products now have a much longer operational life before new models with innovative new features get introduced. There seems to be a coalescence of product and software specifications with little to push the industry in new directions. In terms of technology, EM has reached a comfortable middle age.

The Future

What can the field expect as we enter our 40th year as an industry? Customers and companies seem to have settled on the "appropriate" EM populations, although actually implementing EM for all the identified uses is far from completed. Research is telling us that EM is most effective with medium-risk offenders and that using EM with offenders with a low-risk of re-offending is unnecessary, wasteful, and may do more harm than good in term of recidivism. There is little appetite for using EM with offenders convicted of serious, violent crimes, who represent most of the populations in our prisons after the last decade of de-incarceration—electronic monitoring won't make much of a dent in our remaining prison population.

Technologically, we seem to be set in terms of GPS/tracking accuracy, cellular communications (no 6G on the near horizon), and the algorithms will be tweaked but not necessarily reconstructed. Engineers tell me they are waiting for battery technology to improve, as that seems to be the single largest component in a device. Given that it can cost millions to bring to market a new EM product—to develop, test, certify, and ramp up for production—there has to be a real reason to do so. Customers aren't willing to pay more for a new product line if the current one is serving their needs. Downward pricing pressure means manufacturers will be less willing to risk a new product without a proven market.

There has been and will continue to be big changes relating to data and how it can be harnessed into actionable outcomes. If you operate a 100-unit program that uses GPS with once per minute tracking, that is *4.3 million locations* per month. Looking for trends, changes, and trying to anticipate success or failures is an obvious way that EM and AI might work together.

In the future, we also need to provide better data for management and direct supervisors of staff. Some larger agencies already have implemented this, but everyone should be looking at ways to monitor a program's health. How often are officers logging in? How long does it take to resolve/clear alerts? Who are the most frequent violators? What is the year-to-date trend on completion reasons as listed by the supervising officer? Which officers have the highest rate of alerts per client? If we increase the EM program by 10% on a certain type of client, what can we project will be the workload based on similar clients? All of this information is already available in most EM software programs (or at least the raw data), we just need to ask for it and have a dialogue among vendors and customers on what it may mean. I spent the last few months of my career working with agencies on questions like these, and they all agreed that such insights might be of immense value—but they didn't know to ask for it. One customer is anticipating lowering alert workload by over 70% based on the data mining done by me and my colleagues.

I have had an excellent ride on this career of electronic monitoring. Being in the front row of the changes, challenges, crossroads, innovations, and adaptations has been fun. What has kept me working in this field is that each agency or customer is unique, and their needs, abilities, resources and responses will create a unique program that works for them. That is probably why program comparisons have been so difficult to make by researchers—the variables are just too many! I'll see what the next chapters are as they unfold, and hope everyone in the field can contribute to the body of knowledge of community supervision strategies to benefit us all.

Endnote

[1]National Research Council 2014. The Growth of Incarceration in the United States: Exploring Causes and Consequences (page 33). Washington, DC: The National Academies Press. https://doi.org/10.17226/18613. ■

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