Location Tracking Systems
for Community Supervision

This technology brief is the second document in a four-part series (**Figure 1**) on technologies to support the monitoring and supervision of individuals on pretrial release, probation, and parole (i.e., community supervision). The goal of this series is to offer foundational insights from use cases, examine the challenges of community supervision, highlight example products, and discuss the future of select technologies and their implications for community supervision. This brief focuses on technologies associated with location tracking systems (LTS) for individuals on community supervision.[1]

Key Takeaways

- LTS are traditionally one-piece or two-piece ankle-worn devices; however, smartphone-based and wrist-worn devices are emerging as alternatives—each with benefits and limitations.

- Social and technology factors are fueling the increased use of location tracking; however, many challenges remain for the implementation of LTS, including agency resource constraints and high officer workload.

- The consumer electronics market will likely continue to enable smaller, lighter, and less expensive LTS devices with more features and capabilities. As the range of LTS expands, agencies have greater flexibility to match the technology with the risk level and needs of the individual on supervision and the ability to incorporate positive reinforcements, including rewards for compliance.

- LTS are not a complete solution, but rather a tool to support effective supervision. Therefore, LTS must be incorporated into and work within a larger case management strategy based on agency and case realities.

Community supervision, or community corrections, is a broad term used to identify strategies to execute noncustodial sanctions imposed by either a court or a paroling authority. These sanctions are most commonly applied (1) as a form of pretrial release or diversion, (2) postconviction as a term of probation or another alternative to incarceration, or (3) post-incarceration in the form of parole.[2] For several decades, LTS have been used to monitor the location of individuals under some forms of community supervision.[3] Multiple factors have driven increased interest in LTS as part of community supervision, including the impact of COVID-19 on face-to-face supervision, concerns related to prison and jail overcrowding, court case backlogs, and bail reform initiatives. In parallel, advances in enabling technologies associated with consumer electronics and wearables (e.g., sensors, power management, 5G communication) are expanding LTS functionality in ways that can support effective supervision and increase opportunities to leverage technology to improve outcomes.[4] However, LTS are not a panacea, a quick fix, or a one-size-fits-all solution. Operational limitations related to officer workload, costs, noncompliance, and ethical concerns remain. This brief begins with relevant context and use cases for LTS, followed by an in-depth look at technology and product insights and implementation considerations intended to support decisions by courts and supervision agencies. Inclusion of a product in this report does not represent a recommendation, endorsement, or validation of product claims by the Department of Justice, National Institute of Justice, RTI International, or CJTEC.

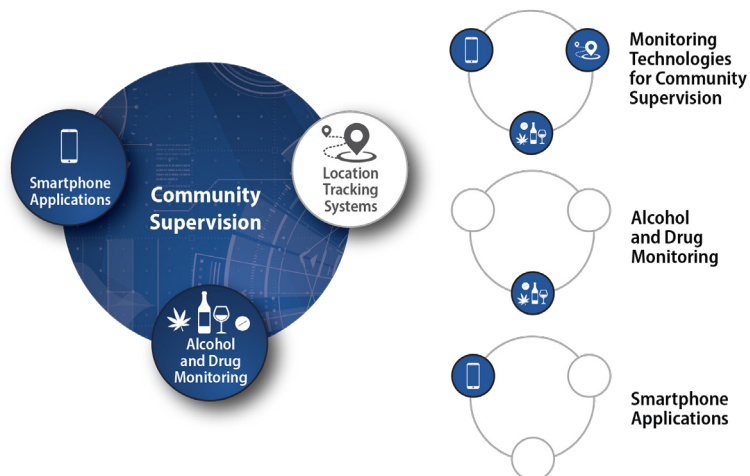## Technologies to Enhance Community Supervision

Figure 1: This brief offers insights on trends and realities specific to location tracking; additional documents in this series address other aspects of community supervision.

Context

LTS may be used at the pretrial stage for high-risk individuals, at postconviction as a condition of probation, or as part of postprison probation or parole supervision. As a condition of their release, individuals may be restricted to home confinement, required to stay away from certain locations (e.g., victim's house), or required to be at certain locations during parts of the day (e.g., school, work). The level of tracking and monitoring required as part of community supervision varies by a person's risk level.

Successful LTS implementation involves a variety of actors within the community corrections ecosystem (**Figure 2**). Individuals are assigned to location tracking as part of community supervision by judges or correctional agencies. In some cases, supervision with LTS is mandated by statute (e.g., those convicted of sexual offenses). Agencies may also use LTS as part of a graduated sanctions process to ensure all available options are exhausted before pursuing incarceration for violations of the conditions of supervision. LTS are used with a variety of target populations, including juveniles, gang members,[5] and those accused or convicted of sexual[6] or domestic violence offenses.[7] In addition to ensuring compliance, LTS data can be incorporated into systems of positive reinforcement. Across all use cases, LTS should not be viewed as a stand-alone solution, but as a tool used as part of a case management strategy.[8]

"Those working in this field are being challenged to shift from being 'referees' to 'coaches,' to provide a system of success rather than a system of punishment, and to leverage what they do with individuals on community supervision in a prosocial way."[9]

LTS Ecosystem Actors within Community Supervision

The Individual on Community Supervision
Responsible for maintaining compliance with the conditions of supervision, often including paying for LTS.

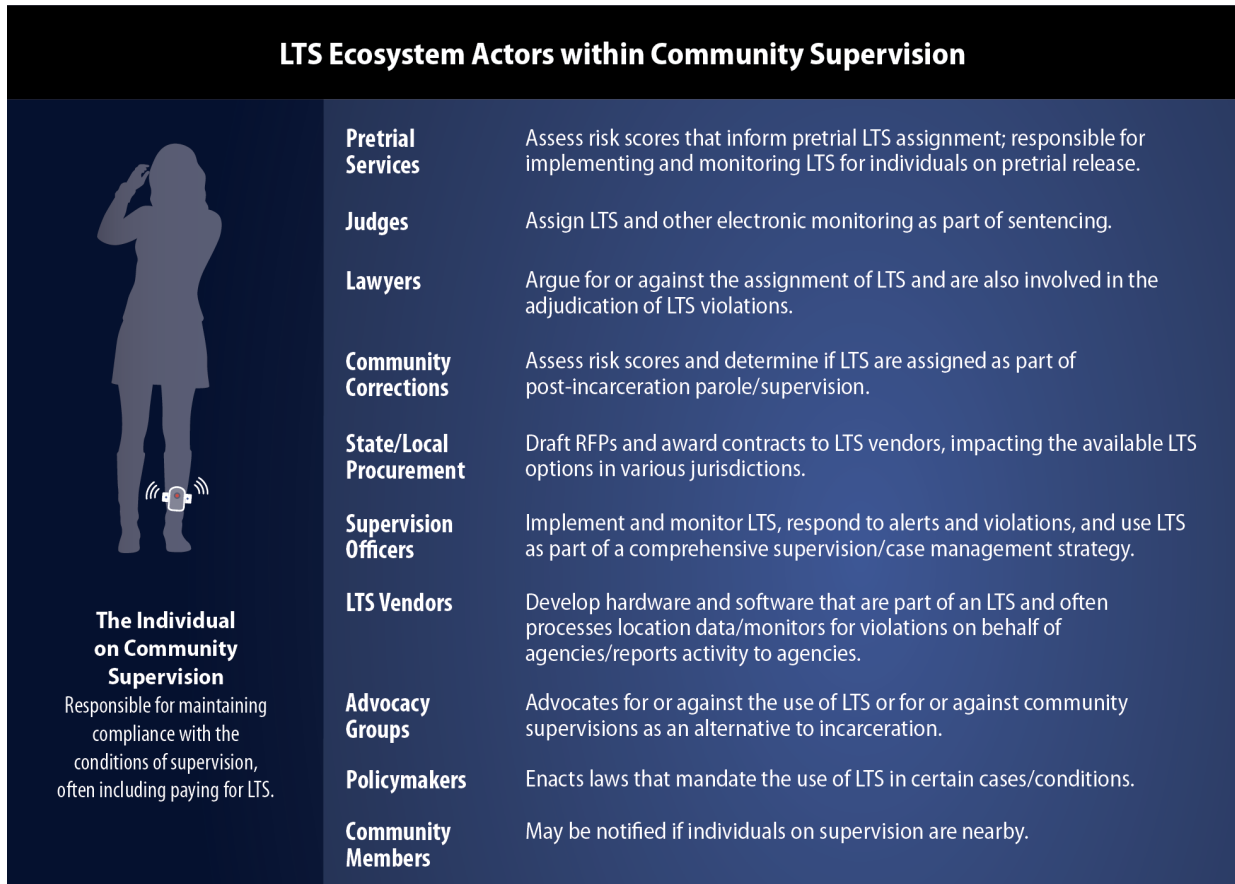|	
Pretrial Services	Assess risk scores that inform pretrial LTS assignment; responsible for implementing and monitoring LTS for individuals on pretrial release.
Judges	Assign LTS and other electronic monitoring as part of sentencing.
Lawyers	Argue for or against the assignment of LTS and are also involved in the adjudication of LTS violations.
Community Corrections	Assess risk scores and determine if LTS are assigned as part of post-incarceration parole/supervision.
State/Local Procurement	Draft RFPs and award contracts to LTS vendors, impacting the available LTS options in various jurisdictions.
Supervision Officers	Implement and monitor LTS, respond to alerts and violations, and use LTS as part of a comprehensive supervision/case management strategy.
LTS Vendors	Develop hardware and software that are part of an LTS and often processes location data/monitors for violations on behalf of agencies/reports activity to agencies.
Advocacy Groups	Advocates for or against the use of LTS or for or against community supervisions as an alternative to incarceration.
Policymakers	Enacts laws that mandate the use of LTS in certain cases/conditions.
Community Members	May be notified if individuals on supervision are nearby.

Figure 2: Resource-constrained jurisdictional justice systems are exploring new ways to supervise individuals using proven and emerging technologies. Success requires collaboration between a variety of ecosystem actors, including the individual on community supervision.

The use of LTS is growing.

Several societal and policy shifts have converged to contribute to the increased interest in LTS, including the COVID-19 pandemic, court case backlogs, bail reform, and cost reduction initiatives (see Brief 1 of this series for more detail). Although there is no official source of national data on the use of location tracking devices, there are indications of significant growth. For example, in 2015, the Pew Charitable Trusts estimated that more than 88,000 individuals were supervised with this technology, a 30-fold increase from the roughly 2,900 reported a decade earlier.[10] Most recent estimates indicate that this number has increased to approximately 180,000 individuals.[11] For context, more than 3.8 million individuals were on probation or parole supervision in December 2020.[12]

"The most important long-term business driver [for correctional agencies] is the search for alternatives to incarceration to control jail and prison populations through early release and diversion strategies."[13]

LTS are used in a variety of criminal justice settings, but the empirical research about their effectiveness shows mixed results.

Questions as to whether LTS "work" are overly simplistic and fail to capture the complexities of effective case management in community supervision. Proponents for the use of LTS have argued that electronic technologies can be integrated as an alternative to detention and represent an effective strategy for managing individuals on community supervision. Two "indirect" ways LTS work are the heightened accountability and deterrence effects it has for an individual on LTS, which could affect behavior change and modifications. Detractors cite the lack of robust evidence for LTS effectiveness at reducing recidivism or improving outcomes, concerns about net-widening, stigma, and potential threats to public safety. Over the last couple of decades, several research studies have looked at the effect of LTS on recidivism.[14] Conclusions from these studies vary, and researchers noted many contextual factors that likely influence the effectiveness of LTS, including the nature of the offense, point of implementation in the criminal justice process (pretrial vs. posttrial), and coincident release conditions (e.g., behavioral counseling). In addition, many research studies cite the importance of various implementation factors, such as aligning the goals of supervision with the use of technology and ensuring adequate staffing and resources.

"Despite the growing popularity of electronic supervision tools, especially GPS tracking of sex offenders, the bulk of research fails to find a significant crime reduction benefit from using electronic supervision. This is not to say that electronic supervision is not a worthwhile component for community supervision."[15]

Technology and Product Insights

LTS come in multiple form factors and comprise hardware and software technologies that enable simultaneous location, time, and identity verification.

Traditional LTS comprise a variety of technologies, including both hardware and software, configured to continuously locate and track individuals under supervision in near-real time. Tracking receivers determine an individual's location using radio frequency (RF), Global Positioning System (GPS), Wi-Fi, and cell tower triangulation, and associated software systems map and monitor individuals' movements into or out of specific areas (often termed inclusion or exclusion zones). LTS are configured to trigger an alert in response to a variety of conditions, including when the individual leaves an inclusion zone (e.g., home confinement or curfew), the individual is in an unauthorized location, the device has a low or dead battery, or the individual attempts to remove or circumvent the device. Based on the risk level of the person on community supervision and the agency's needs, location tracking can be active (**continuous** reporting of location and alerts to authorities), passive (**periodic**, typically daily reporting), or a hybrid of the two (i.e., passive tracking until a violation occurs, automatically switching to active tracking when a violation is detected).

LTS hardware systems typically come in one of three form factors, as illustrated in **Figure 3**:

1. **One-piece systems** are securely attached to the ankle or wrist of the individual on community supervision.
2. **Two-piece systems** comprise a body-worn receiver/transmitter and a body-attached device that is "tethered" (e.g., Bluetooth, RF) to the receiver/transmitter.
3. **Smartphones** can serve as a location tracking system that is not attached to the individual but can incorporate various methods of biometric identification or be tethered to a secure body-worn device.
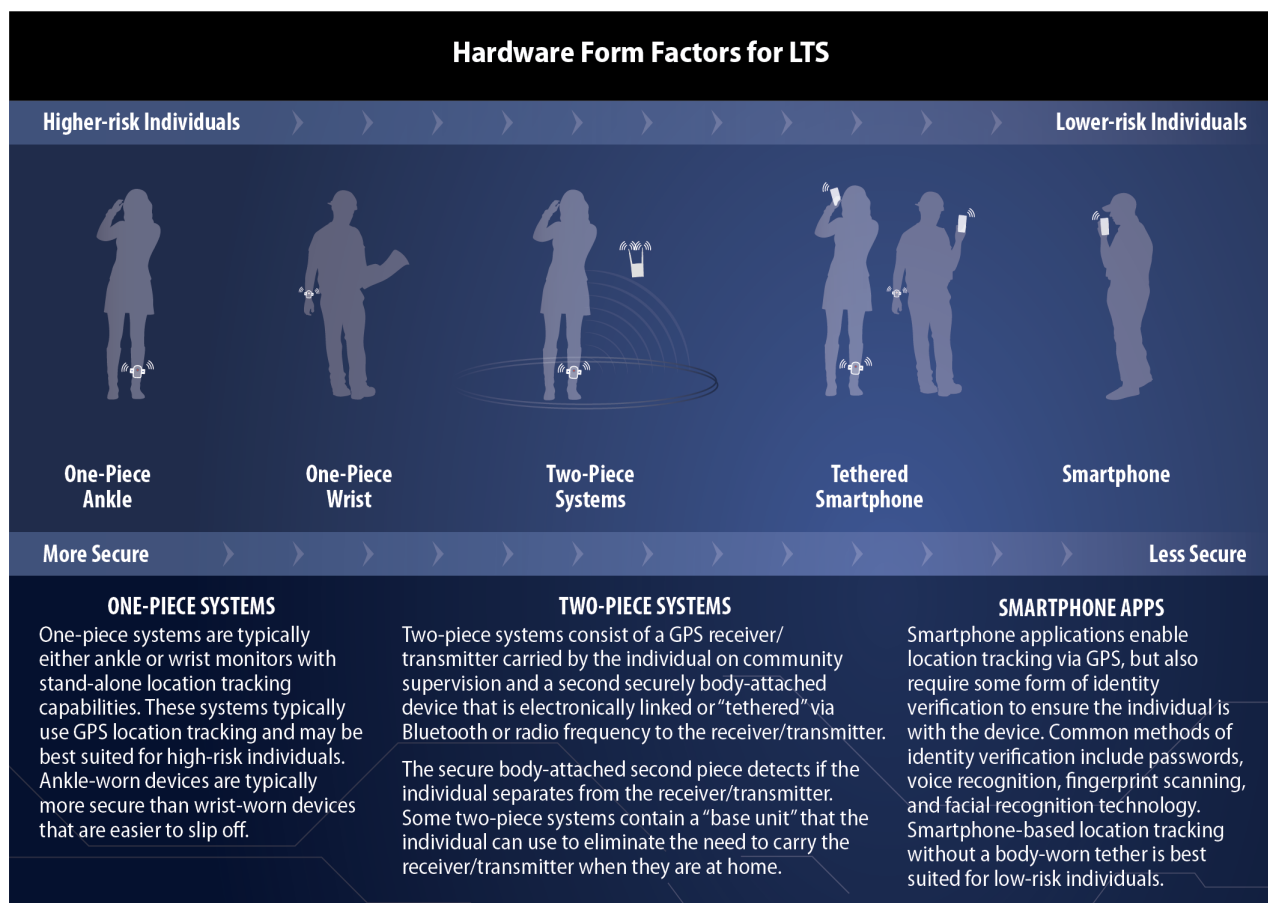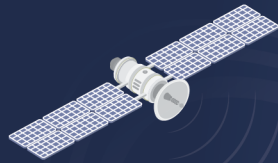

Hardware Form Factors for LTS

Higher-risk Individuals — Lower-risk Individuals

One-Piece Ankle | One-Piece Wrist | Two-Piece Systems | Tethered Smartphone | Smartphone

More Secure — Less Secure

ONE-PIECE SYSTEMS
One-piece systems are typically either ankle or wrist monitors with stand-alone location tracking capabilities. These systems typically use GPS location tracking and may be best suited for high-risk individuals. Ankle-worn devices are typically more secure than wrist-worn devices that are easier to slip off.

TWO-PIECE SYSTEMS
Two-piece systems consist of a GPS receiver/transmitter carried by the individual on community supervision and a second securely body-attached device that is electronically linked or "tethered" via Bluetooth or radio frequency to the receiver/transmitter.

The secure body-attached second piece detects if the individual separates from the receiver/transmitter. Some two-piece systems contain a "base unit" that the individual can use to eliminate the need to carry the receiver/transmitter when they are at home.

SMARTPHONE APPS
Smartphone applications enable location tracking via GPS, but also require some form of identity verification to ensure the individual is with the device. Common methods of identity verification include passwords, voice recognition, fingerprint scanning, and facial recognition technology. Smartphone-based location tracking without a body-worn tether is best suited for low-risk individuals.

Figure 3: Location tracking products offer a range of capabilities in terms of security and communication.

Methods for Location Tracking in Community Supervision

Location tracking is enabled by a variety of technologies that are often used in combination to create a full location tracking system

Wi-Fi
Wi-Fi access points can be used to verify that a device is within geographic range of the Wi-Fi network and establish device location. This method can be useful in locations with limited GPS or cellular coverage (e.g., urban canyons, subway systems, rural areas).

Cell Tower
Cell tower triangulation can be used to locate a device. Cell towers are also critical for transmitting GPS data.

Global Positioning System (GPS)
GPS uses a system of navigation satellites. Receivers in body-worn devices or in a smartphone convey location via signals sent to and from the satellites calculating the position of the receiver. GPS can be used to track an individual on community supervision over a large area and can be integrated into body-worn devices or used as part of a cell phone system.

Radio Frequency (RF)
Some LTS use short-range (50 ft–150 ft) radio frequencies to communicate between body-attached devices and receiver/transmitters (RF beacons). These RF beacons can be placed in a limited number of fixed locations (e.g., home, work) primarily to conserve battery life of GPS tracking devices.

Data Monitoring Centers
Data from LTS are sent via the internet or cellular communications to data centers, usually maintained by LTS vendors.

Software and Analytics
Vendor-provided software platforms enable analytics and data visualizations to support monitoring and supervision activities.

Supervising Agency
The supervision agency receives alerts and notifications from data monitoring centers when violations occur.

Figure 4: Location tracking is enabled by a variety of technologies that are often used in combination to create a full location tracking system.

Advances in enabling technologies are increasing capabilities and options for LTS.

As technologies are developed or improved for other consumer applications, they create technological tailwinds for LTS capabilities. Many of the enabling LTS technologies are consumer electronics, including smartphones and other smart devices, as represented by the following examples. The product examples highlighted in this report are illustrative, not comprehensive, and inclusion of a product in this report does not represent DOJ's, NIJ's, RTI's or CJTEC's recommendation, endorsement, or validation of product claims.[16]

Location accuracy and reliability continue to improve as a result of using multiple satellite systems (e.g., GPS, GLONASS, Galileo) and cellular tower triangulation technology. A common problem with LTS is false alarms caused by weak GPS signals, especially in underground/indoor locations and urban areas where buildings may interfere with coverage. Vendors are developing parallel solutions that use cellular networks as backup systems to GPS satellite signals. Cellular network data can be triangulated between cell towers to pinpoint movements of the individual on community supervision. Companies are developing more versatile SIM cards that allow for instant, dynamic transition to the strongest cellular signal available at any location. A more recent innovation is location detection via Wi-Fi access points, which can be beneficial in maintaining the location of the person on community supervision when they are indoors and in other GPS-challenged environments (e.g., urban canyons). Although location detection systems continue to improve, their performance is not perfect—particularly in rural areas with poor internet connectivity and cellular service.

Example: Attenti's Tracker 1 uses both cellular LTE signals and Wi-Fi communication over AT&T and Verizon networks to enhance location accuracy and reliability.

Hardware miniaturization has facilitated smaller, lighter, and less obtrusive forms aligning with an increase in demand for less stigmatizing, more comfortable devices. In addition, hardware miniaturization has enabled one-piece, wrist-worn devices. Wrist-worn LTS represent a nascent trend aimed at reducing stigma and improving communication, although they pose challenges related to security and battery life.

Example: Buddi's SmartTag at 4 oz is an example of a smaller and lighter device design.

Charging technology and design are advancing to improve the experience of the person on community supervision. One-piece, ankle-worn devices were originally designed to charge via AC power. This "plug-in" charging method is most prevalent today. In effect, this charging method requires the individual on community supervision to be "tethered" to a wall outlet for a period each day to recharge the device's battery. To make the charging process easier, manufacturers have developed portable charging systems so that individuals on community supervision can move around freely while charging their device. This industry trend is sometimes referred to as "on-body charging."

Example: Several products like GEOSATIS' Electronic Ankle Bracelet, Securus Technologies' BLUtag, and Buddi's Smart Tag (above) come with charging "collars" that attach to the device and wirelessly transfer power.

Battery capacity and power management strategies continue to improve battery life. In certain conditions, certain devices now have the capability to operate for over 100 hours on a single charge. The transition toward 4G/5G communications protocols has contributed to improved power management because these protocols are generally more efficient when transmitting data, which can save power. Motion detectors embedded in devices and RF beacons in the home or workplace of an individual on community supervision are now commonplace and help preserve power by reducing location point frequency when the individual is in a known location or is not moving. Although these advances have made daily charging unnecessary from a technical perspective, agencies still generally require that the individual on community supervision charge their device daily to help maintain a regular charging schedule, which can help prevent low or dead battery alerts that generate significant work for officers.

Example: SCRAM Systems' Ankle Monitor Bracelet advertises up to 40 hours of battery life. The bracelet converts to RF monitoring when in range, which can reduce location and communication alerts, therefore extending bracelet battery life.

Tamper resistance and detection are critical for security, especially with high-risk individuals. One common way to defeat an LTS is to remove the body-attached device by simply cutting the strap, a problem that many agencies have experienced, particularly with juveniles. Strategies to mitigate tampering or removal of the device include (1) strengthening the strap with Kevlar or steel to deter cutting, which results in less equipment loss, and (2) adding detection features so that the strap can alert authorities before removal occurs and officers have time to respond.

Example: Track Group's SecureCuff is an example of a security cuff that is made to be difficult to cut. Track Group's SecureCuff is lined with a 1.58-mm thick stainless-steel strap and includes a fiber-optic technology strap for tampering notification.

Signal interference is another common form of tampering. A common form of attempted GPS circumvention is wrapping the transmitter in aluminum foil or some other type of physical signal barrier, known as **signal shielding**. Some products have sensors that send an alarm if a signal is impeded, but responding to these alerts creates additional work for officers. **GPS jammers** broadcast noise on the same frequency used by GPS satellites, disrupting location detection. Although illegal in the United States, they are often available for purchase online. **GPS spoofers** create counterfeit GPS signals, making it appear a device is somewhere it is not. The most common types of GPS spoofers are smartphone apps that override a phone's legitimate location to create a false location. Advances in artificial intelligence (AI) are enabling new forms of GPS spoofing. Data analytics or AI may be able to detect spoofing attempts. Using multiple antennas and advanced algorithms can reduce spoofing by identifying fake signals.

Caution: High-security strap designs

Some segments of the market are demanding more robust security. Agencies appear to be increasingly specifying requirements for high-security straps and devices in procurement documents. Agencies should understand that these products would not conform to NIJ's Standard 1004.00 for Offender Tracking Systems.[17] This voluntary standard specifies that conformant devices must be able to be removed with medical disposal scissors (commonly known as emergency medical service/emergency medical technician shears) within 1 minute. This requirement is in place to protect the health and safety of the individual on community supervision and to limit an agency's exposure to liability. To mitigate against potential liability, at least one manufacturer has chosen to not ship their devices with a hardened strap attached. If ordered, the supply of "cut-resistant" straps is provided separately, and the agency is made to acknowledge that if the hardened straps are used, the product will not comply with the NIJ standard (i.e., specifically, the safety specification).

Advanced analytics enable data interpretation that can help with individual supervision and provide additional insights to agencies. LTS generate a vast amount of data, including location, device status, alerts, and violations. Location points alone may total 1,440 per day per individual on supervision. These data are often underused. Location data could be used for a crime scene correlation system to evaluate whether a monitored individual was or was not in the vicinity of a crime when it was committed.[18] However, few jurisdictions have incorporated LTS data as part of their larger Real Time Crime Centers to enhance public safety. These centers analyze various data feeds in near-real time, including video surveillance and ShotSpotter technology,[19] and the location of tracked individuals.[20] The California Department of Corrections and Rehabilitation, the Charlotte-Mecklenburg Police Department, and the Court Services and Offender Supervision Agency (Washington, DC) are examples of agencies with robust crime scene correlation initiatives.[21,22,23]

The use of advanced analytics and AI to create new indicators of recidivism risk and prompt timely interventions by parole officers is theoretically possible, particularly given that multiple data streams (e.g., drug/alcohol test results, risk assessment, social media activity, physiological measures) are integrated with location. That said, more research is needed to understand the predictive ability, operational implications, and ethical considerations of increasing the use of data analytics and AI.

User experience for the officer and agency, such as a friendly interface, useful visualization, and powerful analytics, is becoming a distinguishing factor for LTS. Many agencies struggle with the amount of data generated by these devices and find themselves primarily responding to alerts and violations based on tampering, battery levels, and zone breaches. Advances in user interfaces can help officers be more efficient in reviewing information, which can free them up to be more proactive. For example, manufacturers are increasingly offering visualization tools that automatically organize location data points by category over set time intervals. In this case, rather than individual points on a map, an individual's location might look like an Outlook calendar. Time blocks for approved locations, such as home, work, or school may be distinguished from unapproved or new locations by color. In this way, the officer can quickly focus on what is new or different about the individual's pattern of behavior and flag a new location as a point of interest for follow-up.
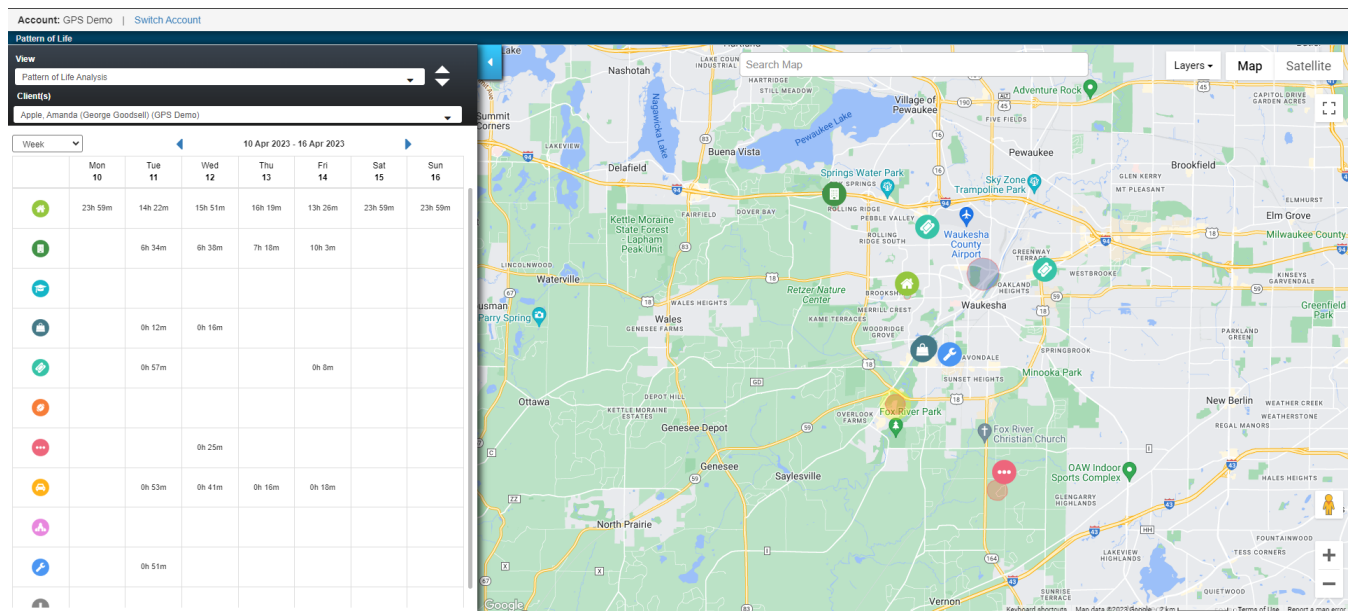
Example: SCRAM GPS Analytics generates visuals based on the 1,440 location points recorded each day. The visuals allow officers to understand the movements and patterns of the individual on community supervision.

One-Piece, Wrist-Worn LTS

One-piece, wrist-worn devices represent a nascent trend in LTS technology to reduce stigma and improve communication; challenges related to security and battery life exists.

A 2016 survey identified one LTS one-piece, wrist-worn device, whereas in late 2022 at least four one-piece wrist-worn devices were on the market.[24] In contrast to traditional LTS devices, which are usually attached to the ankle of the individual on community supervision, these one-piece products mirror consumer applications and look like smartwatches, albeit quite a bit bulkier. This new breed of wearable technology also offers location tracking, violation and low-battery alerts, tamper/removal alerts, curfew monitoring, exclusion/inclusion zones, web-based monitoring platform, and pairing with an RF beacon. The major advantages of these devices include reduced stigma for the individual on community supervision, greater comfort, and additional communication channels between the supervision officer and the individual. All devices contain a speaker and microphone for two-way cellular communication with the supervision officer or monitoring center.

Current market offerings all have an LCD screen to display information such as date/time, battery status, and text messages from the supervision officer or monitoring center. The current generation of technology does not have keyboard functionality allowing individuals to respond to text messages, but they can acknowledge receipt. Some products are distinguished by larger screens and color displays that provide transmittal of more information. For example, in some cases, the individual on community supervision may receive personalized information such as a curfew schedule and reminders, upcoming appointments/drug tests, and positive reinforcements for compliance.

The battery life of current one-piece, wrist-worn devices is somewhat limited (e.g., 24–48 hours) compared with traditional LTS devices; however, the use of beacons and other power management strategies, such as reduced location reporting intervals, may be deployed to extend capacity. Depending on the product, charging may be accomplished via USB, AC, or untethered through a mobile charging pack. Full charge can be achieved in 2–3 hours.

Because of the geometry of the human body, it is generally less challenging for an individual to slip a device from the wrist as opposed to the ankle. Therefore, some products offer "slip detection" in addition to other standard circumvention attempts such as cut straps.

Example: ShadoWatch from Shadowtrack incorporates Wi-Fi, GPS, and network location technology.

Example: S911 Enforcer from Laipac provides alerts to the monitoring center when an individual enters or exits a predefined area.

Example: VeriWatch from BI incorporates GPS, Wi-Fi, biometric facial comparison, and notification and acknowledgement capabilities.

Domestic Violence Victim Protection

Some LTS include technology to track the relative distance between the individual on community supervision and victims of domestic violence.

Over the years, legislation (e.g., Jessica Lunsford Law, 2005) has driven the use of LTS for those accused or convicted of criminal behavior, particularly sexual offenses. This legislation is designed to protect victims of domestic violence. To date, 23 states have passed laws allowing courts to place perpetrators of domestic violence on LTS to help augment and enforce orders of protection.[25]

From a technology perspective, traditional LTS products have long been able to determine if the perpetrator enters an established and fixed exclusion zone (e.g., near the victim's residence or place of employment). However, because the victim does not remain stationary, additional protections are required. Specifically, there is a need to also track the victim to determine if the perpetrator and victim come into proximity with one another. The buffer area around a moving victim is often referred to as a "mobile exclusion zone." Over the years, manufacturers have developed small tracking devices (pendants) for victims that communicate with the perpetrator's LTS and alert the victim (as well as the monitoring center/law enforcement agency). A warning can be sent to the victim or supervision agency if the perpetrator comes within proximity and may also be sent to the perpetrator to vacate the area.

A more recent innovation uses an application installed on the victim's smartphone that is advantageous because the victim does not have to carry an additional device. Common features include multimodal alerts to the victim about proximity breaches and communication with the monitoring center and law enforcement. Most products have panic buttons that automatically connect the victim with the monitoring center and law enforcement. Some products provide other alerts to the victim, such as low battery on the perpetrator's LTS device and tampering indications.
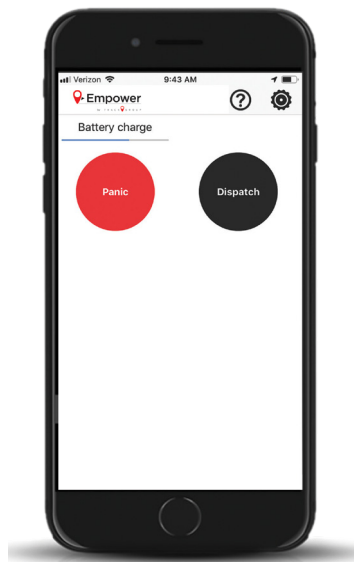
Example: Empower from Track Group is a smartphone app designed specifically for victims of domestic violence. The app is equipped with a panic button and dispatch button to support the user in emergency situations.
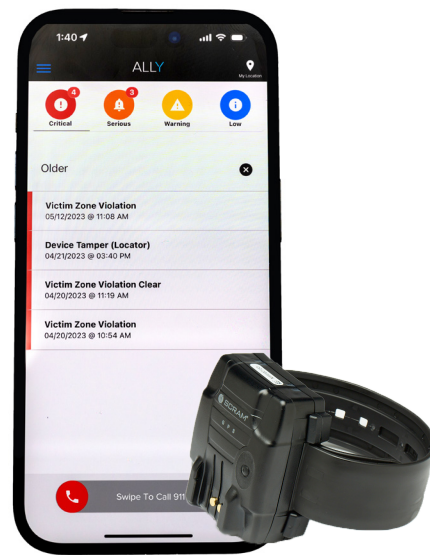
Example: Ally from SCRAM Systems is a victim notification app that works in conjunction with SCRAM GPS to notify when an individual on supervision's GPS is in proximity to the victim's phone.

Smartphone applications for location tracking appear to have a place in community supervision for individuals who are considered lower risk.

Smartphone applications can support a variety of community supervision activities, including facilitating remote check-ins, providing appointment reminders and other positive "nudges," and facilitating location tracking (see Brief 4 in this series). Agencies are exploring ways to use the capabilities of smartphone applications to supervise lower-risk individuals without the stigmatizing effects of traditional LTS. The number of smartphone applications that serve as a location tracking tool for community supervision has grown significantly in the last 5 years; the first products emerged approximately 7 years ago, and today, more than 15 of them are on the market. Several factors have made these applications so attractive:

- **Smartphones' near ubiquity and ease of use:** According to Pew Research Center, 95% of U.S. adults ages 30 to 49 and 96% of those 18 to 29 reported owning a smartphone;[26] thus, most people are comfortable with the technology.

- **Computational power and native location tracking:** Modern smartphones are essentially powerful handheld internet-enabled computers with a multitude of capabilities, including location-based services (e.g., GPS, Wi-Fi, cellular tower triangulation).

- **Built-in communication services:** Tools to enable simple ways to check in, as well as document and send calendar reminders, are standard.

- **Less or no stigma:** Unlike ankle monitors, smartphone applications may reduce the stigma associated with supervision.

- **Comfort and convenience:** Smartphone applications increase the comfort and convenience for individuals on community supervision.

LTS can be installed on a vendor-provided phone, also known as "corporate owned," or on the phone of the individual on community supervision, which may be referred to as "bring your own device."

- **Vendor-provided/corporate-owned devices** are purchased or leased by the individual on community supervision and offer greater security advantages; however, they can be more expensive for the individual than using a personal device. Vendor-provided/corporate-owned devices offer agencies the ability to control user activity by limiting the download of additional apps or restricting texting or internet access. Restrictions can be tightened or loosened based on risk level and compliance.

- **Bring your own device** approaches can be less expensive for the individual on community supervision; however, they have equity and security limitations. The near ubiquity of smartphones has created a market for LTS that are compatible with a personal cell phone of the individual on community supervision. Although most adults in the United States own a cellphone, there are disparities in their operational capacity. In the case of juvenile justice, many juveniles on community supervision may not have a cell phone and the means to keep it charged, or they cannot afford or do not have a data plan that would enable the LTS app to work.[27] With a personal device, the supervision agency is not able to control native features of the device (e.g., downloads, SIM card, settings). As a result, other device functionalities can be altered to disable the location tracking technology intentionally, such as turning off Wi-Fi, using airplane mode, or removing a SIM card. Sometimes these behaviors can be detected, but not always.

LTS phone applications can link location data to the individual on community supervision's identity using continuous or periodic identity confirmation.

- **Continuous confirmation** provides a much greater level of confidence that the person is with the smartphone and may be more suitable for moderate-risk individuals. Continuous confirmation is akin to a two-piece LTS. The smartphone takes the place of the tracking device and is linked via RF to a secure body-worn tether. Alerts are generated if the two devices are separated or if the tether is tampered with or removed. The frequency of checkpoints is adjustable based on case needs and allows for maximization of inclusion and exclusion zones and curfews. Products come with ankle tethers; however, wrist-worn tethers are becoming available.

- **Periodic confirmation** is more suitable for lower-risk individuals who may not require "on-demand" location monitoring. Stand-alone applications without a physical tether periodically prompt the individual to check in. As they perform the check-in process, the application captures their location data. These check-ins may be scheduled, random, or on demand. To confirm that the smartphone is with the individual on community supervision at the time of check-in, the system may use various methods of biometric identification such as fingerprint, voice, or facial recognition to confirm the identity and location of a user.[28]
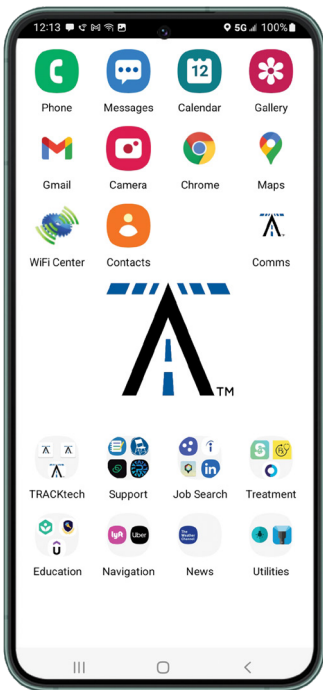
Example: TRACKtech's TRACKphone is a vendor-provided device that supports location tracking with biometric verification.

Example: Corrisoft AIR includes both a vendor-provided device and an ankle-worn tether.

Smartphone applications are unique in the realm of supervisory technology because the apps and the devices they reside on are driven by the consumer market. In addition to location tracking, supervision applications provide a variety of capabilities to support other aspects of community supervision. Smartphone applications for community supervision are covered in more detail in another brief in this series. As with any technology, agencies need to consider the risk level of the individual and the case objectives as they incorporate these applications into the spectrum of graduated sanctions.

Implementation Considerations for LTS

As LTS capabilities increase and new technologies become less expensive, agencies can expand their programs. However, operational and implementation challenges must also be considered for long-term effectiveness of LTS programs. Strategic planning for LTS program implementation should include a robust evaluation of practical, technical, and ethical/equity considerations. This brief covers select considerations and provides a list of questions that can inform LTS implementation decisions.

Practical Considerations

Purpose

Before implementing LTS, agencies should be clear about the specific purpose they are trying to achieve. The use of these tools should be specific to the purpose, goals, and ethics of supervision and punishment. LTS are not a complete solution, but rather a tool to support effective supervision. Therefore, the technologies must be incorporated into and work within a larger case management strategy based on agency and case realities.

Funding

Placing an individual on community supervision with LTS is typically less expensive than sending them to jail or prison; however, supervising them using LTS generally costs more than supervising individuals without location monitoring. Therefore, the cost of operating a location tracking program (e.g., purchase or lease of equipment, replacement of lost equipment, staffing, administrative oversight) is an important agency consideration.

"While electronic monitoring (EM) may be cost saving compared to imprisonment, authorities may need to consider the financial implications of putting offenders on EM rather than traditional supervision or parole. The decision to adopt EM should depend on whether such supervision is essential as it is not only more expensive (than traditional supervision) but may have a net-widening effect by increasing the number of individuals being controlled by the criminal justice system."[14]

Agencies typically absorb the bulk of the LTS program costs; however, some jurisdictions rely heavily on fees paid by the individual on supervision (also referred to as client-funded programs). Overall, sentiment appears to be increasing that functions supporting the administration of justice should be publicly funded. Some jurisdictions have shifted away from client-funded programs, opting to absorb the costs directly. For example, Baltimore[29] and Denver[30] are among the jurisdictions that have eliminated LTS fees for individuals on pretrial status. This trend is not limited to pretrial; other jurisdictions are reconsidering fees for those on postconviction supervision. For example, a newly enacted law in California repealed the ability of counties to charge individuals on community supervision for a variety of supervision fees, including continuous electronic monitoring (i.e., GPS tracking).[31] If this trend continues and models requiring the individual on community supervision to pay become less prevalent, agency leaders, particularly in jurisdictions that rely on this funding stream, will need to somehow offset the loss of cost-sharing. Leaders will need to secure additional funding or reallocate existing funding, which may cause them to rethink the value proposition of LTS and reexamine how they are using LTS technology (e.g., for which individuals, for what purpose, for how long).

Workforce and Training

Although LTS can be a powerful supervision tool, significant workload implications are associated with monitoring and responding to alerts and violations.[32,5] As the justice system attempts to decrease reliance on incarceration, associated workloads shift from jails and prisons to pretrial services and probation and parole agencies—agencies that are often overburdened and underresourced. The increase in LTS usage has exacerbated this situation. Various forms of noncompliance (e.g., failure to charge the LTS, intentional removal, location violations) create additional work for staff. Overworked staff may be unable to respond to alerts and violations in a timely manner, creating a lack of accountability for the behavior of the individual on community supervision. Not responding to alerts/violations in a timely manner could lead to individuals on community supervision continuing to test boundaries or increase noncompliance.

As LTS programs grow or implement new technologies, agencies must consider a wholistic approach to training. Training on LTS hardware/software is typically provided by the LTS vendor, and policy/procedure training is typically provided by the agency. Failure to allocate sufficient time and resources for training on new systems or for new staff can lead to staff not implementing the technology effectively.

Workforce constraints have the potential to make caseloads and the levels of supervision required unsustainable, creating conditions where supervision programs are unable to meet community safety expectations set by the public. Therefore, it is critical that community supervision agencies and LTS programs be adequately funded and staffed if they are to achieve desired outcomes.

Adequate resources must be available to prevent workloads from becoming unsustainable. The American Probation and Parole Association recommends a ratio of 20:1 for intensive supervision and 50:1 for moderate to high-risk cases as a general rule. In worst case situations, agencies that fail to investigate alerts and violations in a timely manner may leave themselves vulnerable to lawsuits if a tracked client causes harm to others.[9]

Technical Considerations

Data Ownership

Agencies should consider issues related to data ownership for data generated using LTS and be clear about who owns the data and who has the right to access it. In some cases, the data may be owned by the agency, while in others, it may be owned by the vendor that provides the tracking or monitoring service. Issues of data ownership could create challenges if agencies want to change vendors or move data from one system to another.

Data Privacy and Data Security

As the legal and regulatory landscapes surrounding data privacy and data security evolve, agencies must update policies and procedures consistently to ensure that the data generated by LTS programs are both protected and used appropriately.

Ethical and Equity Considerations

Net Widening

Net widening refers to the growing number of people controlled or surveilled by the criminal justice system as a result of administrative changes. The expanded use of LTS may lead to net-widening and overenforcement, criminalizing behaviors that otherwise would be unproblematic. For example, juvenile public defenders in California estimated that between 25% and 60% of youth placed on LTS would have been released if LTS were not available.[33] A large body of corrections research indicates that lower-risk individuals who are supervised at enhanced levels reoffend more frequently and have overall higher recidivism rates than similar individuals supervised at lower risk levels.[34] As location monitoring technologies advance, ongoing discussion about potential net-widening effects and anchoring of LTS strategies in supervision needs can help prevent deployment of technology "simply because we can."

Cost Burden and Funding Models

Agencies should consider equity when thinking about funding models; to offset operational costs and funding constraints, some agencies require individuals on community supervision to pay LTS fees while on supervision. With this approach, the fee amount is based on the ability to pay to avoid overly burdening individuals who are financially challenged. Individuals on community supervision often cannot afford to pay these fees, resulting in debt that, in turn, creates barriers to successful reentry. This issue is particularly poignant for individuals on pretrial status because they have not been convicted of a crime. Further, there is also debate about whether the resources allocated toward collecting fees would be better spent elsewhere (e.g., focusing on behavioral change).

Legal

It is critical for agencies to consider the legal and regulatory landscape before implementation. Requirements can vary by jurisdiction. Agencies should be aware of federal, state, and local laws regarding use and storage of personally identifiable information, personal health information, and other personal information.

Considerations	Questions to Ask
Practical	☐ What is the purpose for using location tracking technology for the individual on supervision?
	☐ Have you matched the appropriate technology (e.g., active vs. passive, traditional GPS bracelet vs. smartphone application) to the risk level of the individual on community supervision and case management objectives?
	☐ Have you identified criteria (e.g., period of compliance, positive behavioral change) for moving an individual off location tracking?
	☐ Have you identified the appropriate performance measures to track to determine program effectiveness?
	☐ Have you considered if vendors or agency staff will run the network operations center that supplies remote monitoring and management services?
	☐ Have you included line staff and supervisors in the pilot?
	☐ Will the agency be expected to respond to violations on a 24/7 basis? If so, who will respond (e.g., on-call staff)?
	☐ Has sufficient budget been dedicated to meet the additional workload demands associated with location tracking?
	☐ Are staff prepared to testify in court, if needed?
	☐ Are policies in place regarding if/when the individual on community supervision's location data will be shared with external entities (e.g., law enforcement, courts)?
	☐ Is there a plan in place for emergencies such as natural disasters?
	☐ Is there a plan in place to communicate with the media before, during, or after an incident?
	☐ Have staff and external stakeholders been educated on the capabilities and limitations of LTS?
	☐ Does the vendor provide staff with initial and refresher training as needed?
	☐ Is training ongoing to account for staff turnover and technology enhancements?
	☐ Are policies in place regarding roles, responsibilities, and response protocols?
	☐ Are staff trained on response protocols?
	☐ Are individuals on community supervision provided with adequate orientation about their responsibilities?
Technical	☐ Have you considered how the technology will perform in your operational environment (e.g., urban canyons, cellular coverage) before entering a contract with a provider?
	☐ Have you piloted the technology before signing a contract and tested factors such as location accuracy and reliability, battery life, alert notifications, enrollment process, and the software interface?
	☐ Is the interface intuitive and easy to navigate (e.g., creation of schedules and zones, breadcrumb trail review)?
	☐ Do the analytic capabilities (e.g., identification of associations, points of interest, approved patterns, anomalies) meet your needs?
	☐ Are the data easily integrated with an existing case management system?
	☐ Who will own the data generated by the LTS—the agency or vendor?
	☐ What level of support do you require from the vendor vs. internal staff (e.g., installing equipment, triaging alerts)?
	☐ Are policies in place regarding the management of physical and electronic evidence (e.g., data retention, preservation of intentionally damaged equipment)?
Ethical and Equity	☐ Who will bear the burden of paying for the tracking system (i.e., the individual on community supervision or the agency)?
	☐ Are tamper-resistance security straps compliant with NIJ's Standard 1004.00 for Offender Tracking Systems?
	☐ Has an adequate risk assessment been conducted to determine the individual's risk and criminogenic need factors relative to the utility of LTS as a community supervision tool?
	☐ Have LTS implementation strategies considered potential net-widening effects?
	☐ Are LTS strategies offering cost structures that do not overly burden individuals who are financially challenged?
	☐ Has the agency addressed all the necessary legal and regulatory considerations before implementation?

Policy Spotlight

Considerations from U.S. Federal Courts[35] for Selecting LTS Technology

When determining the type of technology, probation officers should always consider the purpose for its use and how the technology will mitigate risks and fulfill sentencing objectives.

The least invasive and most cost-effective type of technology should be recommended based on the nature of the offense, the individual's criminal history, and the individual's risk level. LTS can create supervision efficiencies by providing a better allocation of time and, therefore, avoiding undersupervising high-risk individuals and oversupervising low-risk individuals.

The type of restriction imposed should be considered when selecting the type of technology solution. For example, if an individual is placed on a curfew coupled with an employment and travel restriction and it has been determined that they pose a risk to community safety, agencies should consider GPS technology to monitor both the curfew and the employment and travel conditions. If the individual is placed on home incarceration, agencies should consider RF technology because it provides a more cost-effective solution than GPS to verifying an individual's location in the home.

Location monitoring technologies have advantages and limitations. Although LTS technologies may be used to verify an individual's location during a prescribed time, this information, while helpful, is not definitive in terms of determining overall compliance. Combining location data with supervision strategies such as periodic home visits can provide important insights into the behavior of the individual on community supervision.

Location monitoring technology should be dynamic in that probation officers should consistently evaluate the need for the technology, the level of monitoring, and the type of technology used or recommended.

Location monitoring should consider both risks and needs. The use of location monitoring technology can be an effective sanction or action when addressing violations of conditions of supervision. However, it should only be recommended to address specific risks associated with a violation.

Principles of Good Supervision

The U.S. Federal Courts have established six principles of good supervision.[36] These principles can be applied to the consideration of LTS programs and their role in a comprehensive approach to supervision.

Good supervision (and good LTS implementation) is:

- Purposeful
- Individualized
- Proportional
- Multidimensional
- Proactive
- Responsive to changes

"For defendants who qualify for low-risk supervision standards under Judicial Conference policy,[36] contacts with the defendant and his or her social network in the community are not required, and GPS technology should not be used. For these defendants, probation officers should request that the court amend conditions requiring monitoring by GPS to allow for more appropriate monitoring technology (e.g., radio frequency or voice verification)."

—U.S. Federal Courts[35]

Future of LTS

Looking ahead, correctional agencies will have access to a broad range of LTS solutions. Rather than one approach supplanting another, products will likely coexist for a time and fill a niche depending on agency objectives and the risk level of the individual on community supervision. High-security, ankle-worn LTS devices will continue to play an important role in community supervision for high-risk individuals, while emerging smartphone applications may play an increasingly important role in supervision of low-risk individuals.

LTS products will continue to advance as developers leverage advances in enabling technologies developed for smartphones, fitness monitors, GPS-enabled smartwatches, and other consumer products. Future systems are likely to be less stigmatizing and multifunctional. As technology advances, so too will circumvention techniques like GPS spoofing. Product developers should continue to invest in developing countermeasures to potential AI-enhanced circumvention techniques. As evidenced by some of the current smartphone applications, future products will not only capture the location of the individual on community supervision, but also support reporting, case management, and treatment functions. Other sensors may be incorporated such as integrated alcohol monitoring. As with any technology, agencies must balance between what is technically possible, operationally practical, equitable, and ethical to produce the desired supervision outcomes.

Endnotes

1. Different entities use different words to describe and define individuals on community supervision (e.g., offenders, clients). For consistency, this document uses the terms *person(s) on community supervision* or *individuals on community supervision* to align with the Centers for Disease Control and Prevention's guidance on Preferred Terms for Select Population Groups & Communities.

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