Criminal Justice Technology Testing and Evaluation Center
A Program of the National Institute of Justice

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Quadruped Robots
for Law Enforcement Applications

This technology brief explores the use of quadruped robots (i.e., robodogs*) by law enforcement. The goal of this brief is to orient and educate law enforcement practitioners and other stakeholders about robodogs and demonstrate how this technology has been employed by law enforcement. This report will provide an overview of quadruped robot technology, use cases by law enforcement agencies (LEAs) and adjacent industries, identify considerations for adopting or implementing this technology, and explore the future role of robodogs in law enforcement.

- Robodogs can be a valuable tool for law enforcement. Key uses include conducting search and rescue operations, assisting with high-risk situations (e.g., hostages and barricaded suspects), accessing hazardous areas, and conducting monitoring activities to increase event security.
- The use of robodogs by law enforcement agencies is not widespread. Most LEAs that have adopted a robodog are deploying the technology in tandem with officer activities (e.g., with Special Weapons and Tactics [SWAT] teams) to reduce the risk of officer injury on missions.
- Widespread adoption of robodogs by LEAs is limited by the technology's high cost.
- Add-on features, such as sensors, communication technologies (e.g., video cameras, walkie-talkies), and manipulator arms, can expand the use of robodogs by law enforcement. However, add-on features may increase the base cost of the robodog by tens of thousands of dollars.
- Community concerns related to the use of robodogs include weaponization, privacy and surveillance, and over-policing of marginalized neighborhoods.
- LEAs considering adopting a robodog should have a clearly defined purpose and scenarios, developed in conjunction with the community, in which the technology would be deployed. Transparently sharing policies on use of the robodog can help achieve community buy-in.

Robodogs are four-legged robots that mimic a quadruped animal's locomotion, stability, and ability to maneuver in challenging and uneven terrains (see **Figure 1**). The diverse capabilities and versatility offered by this technology have contributed to increased interest and adoption of it by LEAs. In recent years, LEAs have used robodogs to conduct search and rescue missions, enhance security in large public areas, and provide heightened situational awareness in high-risk scenarios (e.g., hostage situations). Robodogs have more-advanced movement capabilities than other robots (e.g., tracked robots) used by law enforcement; these capabilities enable them to perform tasks that may help to minimize potential threats faced by agency personnel, victims, bystanders, and suspects and provide more benefits to law enforcement. However, this technology presents a unique set of challenges and concerns from the community that agencies must address, including concerns about weaponization, privacy and surveillance, and over-policing. 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 Criminal Justice Technology Testing and Evaluation Center.

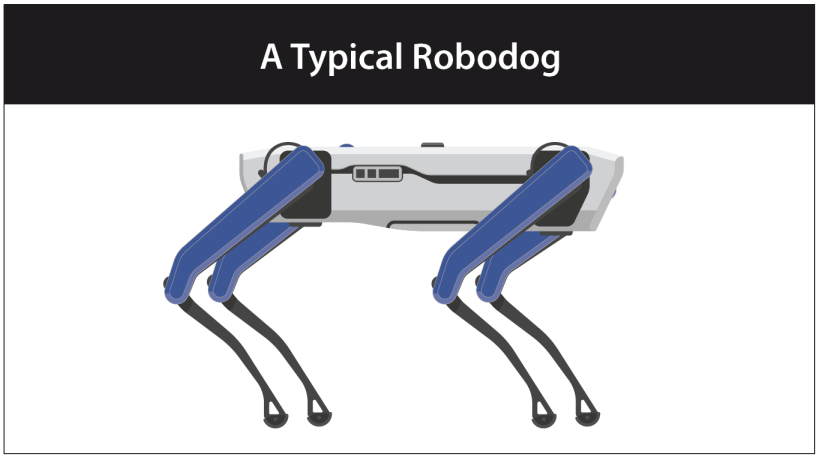


Figure 1: Robodogs are four-legged robots designed to mimic an animal's walking or running gait and stability.

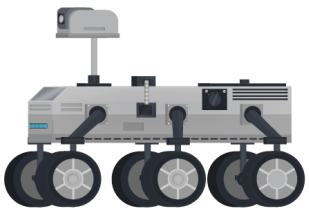
* For consistency throughout the report, this document will use the term "robodog."

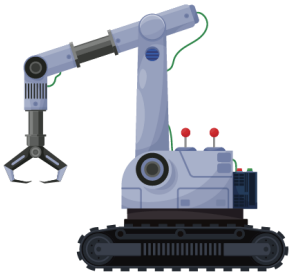
Background

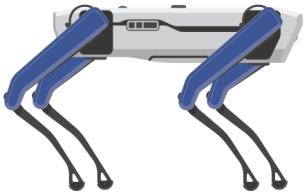
Although the use of robodogs by law enforcement is not currently widespread, agencies have used other types of robots to enhance police operations for several decades. Robot adoption by law enforcement can be traced back to the widespread use of unmanned vehicles by the U.S. military. The 1990 and 1991 National Defense Authorization Act's 1033 Program facilitated the transition of robotic technologies from the military to law enforcement.[1,2] The earliest types of robots adopted and purchased by LEAs were primarily wheeled or tracked designs, mainly deployed for operations that included bomb disposal and reconnaissance.[3] Today, LEAs use a variety of robots to assist officers in other duties (see Figure 2); these robots are not meant to replace officers, but rather to augment officer capabilities and expertise; increase officer safety; and reduce risks to agency personnel, victims, bystanders, and suspects.

In recent years, several robotic products have emerged, including drones (i.e., aerial robots), humanoids, autonomous vehicles (i.e., cars), and robodogs. Law enforcement's interest in adopting robodogs to enhance the on-ground capabilities of officers has grown because robodogs have enhanced mobility compared to wheeled or tracked robots. As of publication, only a handful of U.S. LEAs were identified as having procured a robodog, some of which are profiled in this report in case studies. However, the National Tactical Officers Association's position paper in 2022 against the use of no-knock search warrants in many cases may continue to drive increased use of robots, including robodogs.[4]

Comparison of Robots Used by Law Enforcement







Wheeled Robots	Tracked Robots	Drones	Robodogs
Law Enforcement Use Type Examples			
Wheeled robots are typically deployed for reconnaissance, surveillance or patrol, and bomb detection and disposal; they may be used interchangeably with tracked robots in some instances. Wheeled robots can reach high speeds on flat surfaces.	Tracked robots are typically deployed for reconnaissance, surveillance or patrol, and bomb detection and disposal. The tread's large contact area with the ground allow the robot to navigate rough terrain; however, tracked robots may be used interchangeably with wheeled robots in some instances.	Drones, or unmanned aerial systems (UAS), are used for reconnaissance, traffic monitoring, search and rescue, forensic investigations, and disaster assessment due to their ability to cover large open areas quickly and provide a bird's-eye view of operations.	Robodogs are typically deployed for search and rescue, reconnaissance, and accessing potentially dangerous or unstable environments due to their ability to navigate challenging terrains (e.g., stairs).

Figure 2: LEAs today use a variety of robots with different capabilities.[3,5] Each type of robot can support additional payloads (e.g., cameras, sensors, mechanical arms) that allow for customization to a specific use case.

Benefits and Limitations of Robodogs

In the dynamic landscape of robotics, robodogs have marked a significant advancement in technological capabilities, offering unique advantages over other types of robots. Nevertheless, robodogs also possess certain limitations. **Figure 3** highlights the distinct advantages and limitations of robodogs when compared with other law enforcement robots.

Advantages of Robodogs Over Other Robots Used by Law Enforcement

- **Mobility and Maneuverability:** Robodogs can navigate irregular and rugged terrains and environments more effectively than other robots. The four-legged design enables robodogs to traverse uneven surfaces, including stairs, with greater agility.
- **Self-Correction:** Robodogs can autonomously regain an upright position if knocked over during a mission.
- **Accessing Low-Clearance Areas:** Robodogs can access areas with limited vertical clearance, such as highway overpasses and homes, where drones may encounter difficulties in navigation or maintaining a reliable cellular connection.
- **Providing a Stable Sensing Platform:** Unlike drones, robodogs provide a stable and balanced ground platform to deliver sensing payloads to potentially hazardous environments.
- **Capabilities:** With add-ons, some robodogs can open doors with minimal input from operators, unlike other robots such as drones.

Limitations of Robodogs Over Other Robots Used by Law Enforcement

- **Terrain Challenges:** Despite their ability to navigate rugged terrain, robodogs may still be susceptible to falling over or losing footing on certain terrains, including slick surfaces. Robodogs may have difficulty transitioning from one surface type to another (e.g., dry pavement to sand or shallow water).
- **Connectivity:** Connectivity issues may impede the distance from which robodogs can be remotely controlled, thus limiting their operational range.
- **Speed:** Robodogs may not be as fast as other types of robots over unobstructed distances.
- **Task Specificity:** Robodogs may not be as effective at specific tasks as single-purpose robot designs (e.g., bomb disposal robots).

Figure 3: Although robodogs may offer unique advantages over other robots, this technology also presents limitations.

"Compared to tracked and wheeled robots, quadruped robots are better suited for operating in a wider set of conditions and terrains. They can transit stairs, push doors open, and bring sensor payloads where needed."

—Jon Hackett, Intelligent Robotic Autonomous Systems Program Manager, Department of Defense

The unique capabilities of robodogs present distinct benefits to officers, including enhanced situational awareness and reduced risk of officer, victim, bystander, and suspect injury. Despite these benefits, the use of robodogs by law enforcement has inherent limitations because of robodogs' design and function. **Figure 4** delves into the benefits that robodogs offer officers and their inherent limitations.

Benefits Provided to Community Members and Officers	Limitations to Deploying Robodogs Instead of Officers
▪ **Reducing Safety Risks:** Robodogs can remotely assess potentially dangerous or hazardous situations prior to sending in an officer. Robodogs provide real-time visual feedback, enabling officers to make better informed decisions while avoiding direct exposure to dangers, thus reducing the potential for injury or harm to any individual in the vicinity. Furthermore, robodogs may help to de-escalate a situation and reduce the need for an officer to use force in certain scenarios. ▪ **Providing Real-Time Threat Assessment:** By streaming live video feeds of threats or safety concerns to a remote operator, robodogs provide immediate and actionable information to enhance on-the-ground decision-making and security functions. ▪ **Facilitating Access to Hazardous Areas:** Robodogs can safely access dangerous or unstable areas (e.g., a collapsed building) that may pose risks to human officers, thereby mitigating potential harm to personnel. ▪ **Sustaining Presence in Hazardous or Extreme Environments:** Robodogs can safely access extreme or challenging environments (e.g., hot deserts, snow) and remain deployed (in standby mode) in them for longer periods than officers. ▪ **Identifying Hazardous Items:** Using various sensors, robodogs can detect and identify potentially dangerous, hazardous, or explosive items, enhancing security provided by officers.	▪ **Reliability:** Robodogs may not operate as precisely as needed during a given operation; the robodog may also malfunction during a deployment (e.g., becoming "confused" by an obstacle). ▪ **Communication:** Robodogs may not have two-way communication capabilities, impeding the operator's ability to interact with or respond to a victim, bystander, or suspect. ▪ **Empathy:** Unlike an officer, robodogs lack the empathy and ability to understand and make decisions in a situation. ▪ **Dehumanization:** Robodogs lack the human connection that officers can forge during interactions with community members. ▪ **Deployment Length:** The operational battery life of robodogs may impede the duration of their deployments. ▪ **Capabilities:** Robodogs may be limited by their ability to complete or carry out certain types of tasks (e.g., breaching hard-to-open doors, navigating around large or moving obstacles), impacting its ability to conduct complete searches of areas, whereas officers can carry out these more difficult tasks, conduct searches, and take suspects into custody if necessary. ▪ **Time to Deployment and Response:** Robodogs may take time to set up and prepare for a deployment and to carry out necessary tasks (e.g., opening a door) to reach its desired endpoint; therefore, robodogs may not be appropriate to deploy for situations that require a more-urgent or time sensitive response.

Figure 4: Although robodogs offer many benefits to officers and the public, there are limitations to their use as substitutes for officers.

Community Concerns with Robodogs

Despite the potential benefits that robodogs offer law enforcement officers, some communities have expressed vocal opposition and concerns regarding their adoption and use. Community concerns include the potential weaponization of robodogs, public surveillance and the potential violation of privacy rights, and the over-policing of historically marginalized neighborhoods.

Weaponization

Since 2016, some communities have repeatedly and strongly voiced concerns about the possibility of LEAs deploying "killer" robots equipped with firearms, explosives, and conducted energy devices (i.e., Taser) or other less-lethal weapons. These concerns emerged when the Dallas Police Department, after failed negotiations with a suspect, deployed a wheeled robot equipped with an explosive device to neutralize a sniper who had killed five police officers and wounded seven others, including two civilians.[6,7] The police department detonated the explosive device remotely, killing the suspect without endangering officers or civilians. This incident was one of the first intentional uses of a lethally armed robot by a nonfederal police force, evoking mixed reactions, including concern over the perceived over-militarization of law enforcement and the potential for collateral damage.[8,9] Others argue that the lethal use of robots in specific and rare instances to save or prevent further loss of life, such as this example, may be acceptable.[10]

> Robotics companies are beginning to address community concerns about the potential weaponization of robodogs. In an open letter to the robotics industry and communities, six of the world's leading robotics companies offering advanced-mobility general-use robots, three of which (ANYbotics, Boston Dynamics, and Unitree) offer robodogs, pledged to "not weaponize [their] advanced-mobility general-purpose robots or the software." Furthermore, the letter states that these companies will "review customers' intended applications to avoid potential weaponization . . . [and] explore the development of technological features that could mitigate or reduce these risks."[12]

Although the concern of weaponization is not unique to robodogs, their advanced capabilities and versatility may amplify ethical concerns about weaponization. To help address this concern, some robotics companies and robodog vendors have prohibited weaponization (see **Callout Box**). For example, Boston Dynamics' terms and conditions of sale prohibit the "(a) intentional use of the Product to harm or intimidate any person or animal, as a weapon, or to enable any weapon, (b) use or attempted use of the Product for any illegal or ultrahazardous purpose, (c) unstructured use of the Product in the home or "consumer" environments."[11] This specifically prohibits the weaponization of Boston Dynamic's robot, Spot, and includes both lethal (e.g., guns) and less-lethal (e.g., tasers, pepper spray) weapons that can harm an individual. Boston Dynamics holds, with each agency that uses Spot, a written contract that prohibits weaponization; if an agency weaponizes the robodog, the company holds the right to remotely shut down the technology.

Although some vendors are taking steps to prevent weaponization, community members and local governing bodies may still have concerns about the use of robodogs. To address these concerns, agencies may develop policies and regulations outlining specific situations for deploying the robodog. Local and state-level government bodies may pass legislation limiting or prohibiting the use of weaponized robots. For example, in 2022, San Francisco's Board of Supervisors rejected San Francisco Police Department's proposed policy allowing for unmanned ground vehicles to exhibit lethal force in extreme circumstances, such as when a violent individual poses an imminent risk to life.[13,14]

Privacy & Surveillance

A common concern when new technology is adopted by law enforcement is the impact it will have on community privacy and surveillance. Similarly, most robodogs can support cameras and other sensors and thus have the potential to leverage facial recognition technologies, which raises concerns about privacy and surveillance.[15] Despite some vendors

indicating that robodogs are not capable of facial recognition at this time, policies on other technologies that capture and record images and video, such as body-worn cameras and automatic license plate readers, may offer guidance on ways to mitigate concerns, including policies about the storing, access, and use of any collected data.

Over-Policing Neighborhoods

Police activity and engagement across communities vary based on factors such as crime levels and frequency of requests for service through the 911 system. Due to experiences of more-aggressive and frequent policing,[16] socially and economically disadvantaged communities may be apprehensive about local law enforcement's use of robodogs, especially if the technology is perceived to be disproportionately deployed in their neighborhoods. For example, in December 2023, the City Council of Durham, North Carolina, voted to discontinue the use of SoundThinking (previously ShotSpotter)[17] after a 1-year pilot of its gunshot detection technology, following criticism of over-policing and disproportionate surveillance in some neighborhoods.[18] This decision reflects a broader concern that new law enforcement technologies could exacerbate existing issues of unequal treatment and surveillance, particularly in areas with more social and economic disadvantages. In Los Angeles, the concern that robodogs could exacerbate over-policing in minority neighborhoods was raised by some critics opposing the Los Angeles Police Department's (LAPD's) purchase of Boston Dynamics' Spot.[19] Before procuring a robodog, agencies and jurisdictions should consider the ethical implications of where and how to deploy it. Law enforcement should be cognizant of concerns related to perceptions of over-policing and should look to maximize the balance between public safety and public trust when considering the use of a robodog.

Local and State Legislation Related to Robodogs

Local and state legislation has emerged over the last few years that may have implications for law enforcement's use of robodogs. Although there was no relevant federal legislation at the time of publication, future legislation that impacts the use or procurement of robodogs may emerge. Agencies considering adopting a robodog must be cognizant of legislation that may restrict or prohibit the use of this technology.

Examples of Local Legislation:

- The growing use of technologies with surveillance capabilities by police has spurred civil liberties organizations, such as the American Civil Liberties Union (ACLU) and Electronic Frontiers Foundation, to develop model local ordinances regulating law enforcement use of surveillance technology.[20] These laws, known as Community Control Over Police Surveillance (CCOPS) laws, broadly regulate law enforcement's use of surveillance technologies by making the community aware of the technology and its intended use prior to obtaining it and providing an opportunity for community input. By early 2022, CCOPS laws had been broadly passed in more than 20 jurisdictions across the United States.[21] Although robodogs are currently deployed in tactical scenarios, rather than in general surveillance activities, their features make them capable of being deployed as surveillance tools. LEAs wishing to deploy robodogs should review first whether their jurisdiction has a CCOPS law, or similar ordinance, and should understand and comply with the activities and technologies covered under the law.

Examples of State Legislation:

- The California state legislature implemented Assembly Bill 481 (AB-481) in 2022, requiring LEAs to list all military-grade equipment and to develop policies prior to its use.[22] The law was passed because the use of military-grade equipment could pose disproportionate risk to minority communities; negatively impact psychological well-being, civil rights, and civil liberties; and increase the risk of civilian deaths in the communities where this equipment is deployed. This bill requires California-based LEAs to develop and possibly receive approval on the intended use cases for a robodog before procurement.
- In February 2023, Senators in the Rhode Island General Assembly introduced a bill that prohibits the use of police robots, including robodogs, except when a robot is needed to mitigate an explosives-related incident or to breach a barricade.[23] Although this bill did not pass, it is possible that other legislation limiting or prohibiting the use of police robots may be introduced in other states in the future.

Underlying Technology of Robodogs

A robodog consists of a rigid, typically rectangular, body and four legs. Each leg has several motorized joints (e.g., hip, knee) that define the degree of freedom and possible positions or motions the leg can achieve, and the number of motorized joints depends on both the design of the robot and its manufacturer. Actuation systems, commonly electrically or hydraulically activated, provide power and control to the leg joint structure, enabling the robodog to adopt various types of gaits, including walking and running. High-precision sensors (the type of sensors is unique to each robodog) and cameras provide data and feedback about the robodog's position, orientation, and the surrounding environment.[24,25] These real-time environmental and locational data are then used by control algorithms to optimize stability and adjust leg trajectories and gait, thus allowing the robodog to adapt dynamically and maintain its balance in real time across a variety of terrains.[26]

This dynamic adaptability provides the robodog stability, ease of movement, and ability to navigate difficult and uneven terrain, including stairs, narrow spaces, and obstacle-ridden environments. Furthermore, unlike wheeled or tracked robots, robodogs can adjust their stance, navigate around obstacles, and regain an upright position on their own if they fall over during a mission.[26] These capabilities may allow robodogs to be more reliable and less prone to accidents that require human intervention than other types of robots.

Robodogs marketed to LEAs exhibit a wide range of physical attributes, varying in weight between approximately 38 and 100 pounds, with heights spanning from 27.6 to 30 inches.[27,28] This variability allows robodogs to adapt to different contexts and tasks, enhancing their versatility across various industries and scenarios. Robodogs can adopt different types of gaits, including crawling, pacing, walking, trotting, climbing, and running at speeds up to 3 meters per second (6.7 miles per hour), and they can withstand a variety of weather elements, including extreme temperature climates, water, dirt, and sand.[28,29]

Base Features & Capabilities

Robodogs come pre-equipped with an assortment of sensors and cameras that enable them to appropriately analyze the environment and maneuver their surroundings; the types of sensors and cameras included in the base model are unique to each vendor's robodog product.[30] However, these components are pivotal for tasks such as navigation, environmental analysis, and data gathering.[31]

To achieve a panoramic perspective, some base models of robodogs are outfitted with cameras positioned strategically on the front, back, and sides, delivering a 360-degree view; other base models of robodogs include integrated thermal cameras. These cameras, in conjunction with other perception sensors, such as depth cameras, contribute to the comprehensive spatial awareness required for efficient navigation and obstacle avoidance.

Some robodog models include different colored lights to indicate the battery charge level and the status level of the robot (e.g., if motors are off, engaging, on, or experiencing an error), allowing the operator to understand when the robodog is ready for deployment.[32] In addition, robodogs can connect to networks directly (e.g., via Ethernet) or wirelessly (e.g., via Wi-Fi) for communication (e.g., accepting and executing operator commands), data transfer (e.g., downloading data logs and videos taken by a robodog), and system updates.

A new vendor in the market, designed specifically for law enforcement use cases, integrates interactive touchscreens and video cameras on its robodog, enabling real-time, two-way communication capabilities between operators and suspects, hostages, or community members.[28] For example, this feature could allow officers to communicate with a barricaded suspect without having to approach or enter the premises.

Add-On Capabilities

Robodogs are a platform technology designed to incorporate a variety of add-on options, available from both vendors and third parties, that can enhance capabilities in application-specific ways. These add-ons include increased sensing and awareness, manipulation, communication systems, navigation and mapping, and longer battery life. **Figure 5** details commonly added features, both by LEAs and adjacent industries. LEAs should communicate directly with individual vendors* to understand the robodog's ability to support different add-ons and what add-ons individual vendors have available. By selectively incorporating these components, LEAs can tailor robodogs to their specific needs.

Agencies that are currently using a robodog in the field have noted which add-on features are critical for the effective application of robodogs in law enforcement settings. These add-ons include arm extensions/grippers and claws, enabling the robodog to perform manipulation tasks such as opening doors and retrieving or delivering objects; a 360-degree camera, enhancing operators' and officers' situational awareness by capturing a panoramic view of the robot's surroundings; LiDAR sensors, which provide spatial awareness and depth perception, enhancing navigation and precise obstacle avoidance in complex environments; speakers and microphones, allowing for effective human–robot interaction and communication in dynamic scenarios; and a signal booster, allowing the robodog to operate at extended ranges from the operator.**

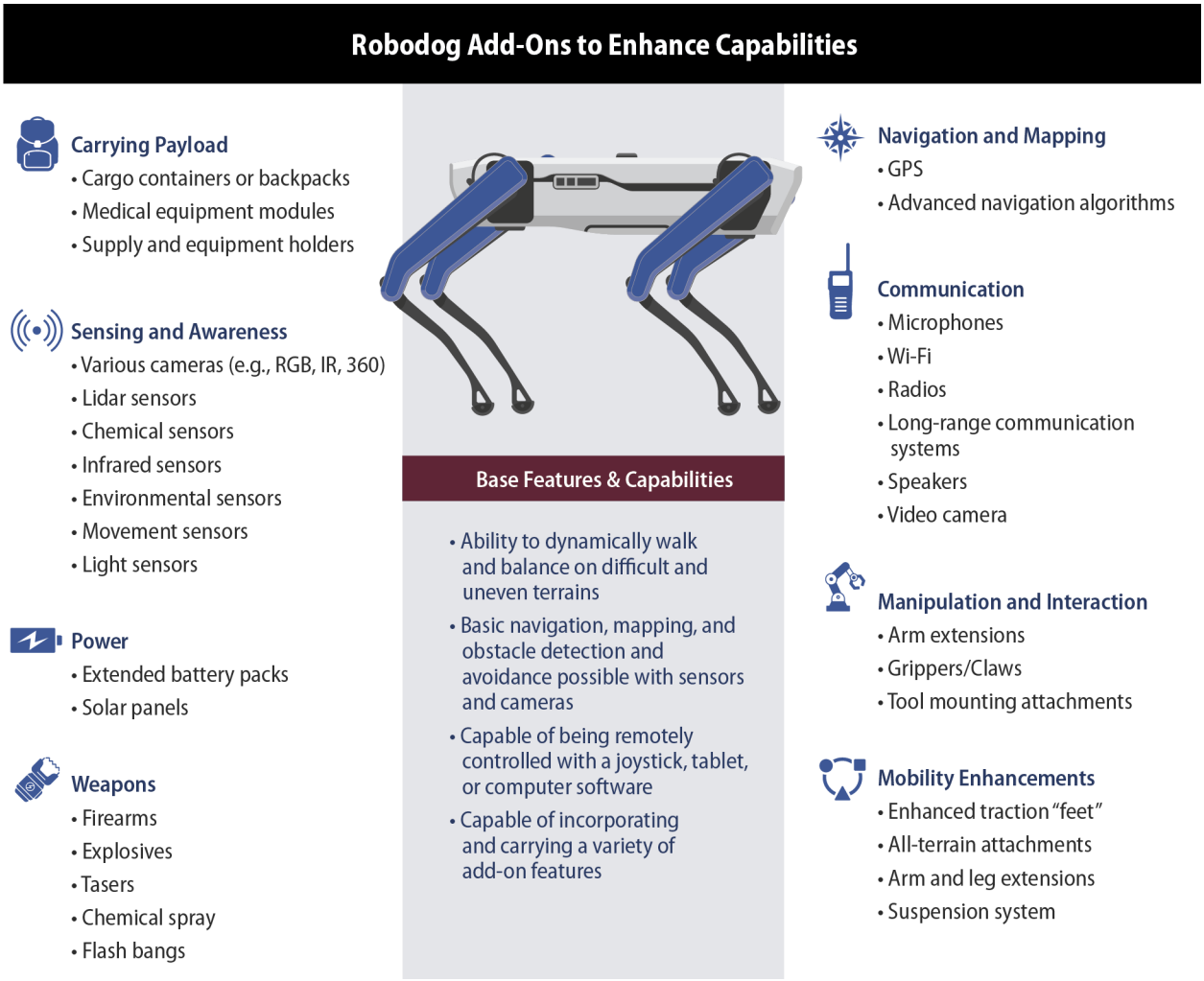


Figure 5: A variety of add-on features can be used to enhance a robodog's base.***

* Not all vendors will offer these capabilities or add-ons. Some add-ons may only be available through third-party vendors, collaborations, or external partnerships.

** The signal booster may not be necessary if the robodog operates on LTE.

*** Although there is no known LEAs using weapons as an add-on at the time of publication, weapons have been used in military applications.

A suite of other add-ons are also available. For example, environmental and chemical sensors can be added to navigate hazardous areas—as seen by the use of Boston Dynamics' Spot to survey the Chernobyl nuclear disaster site to measure radiation levels—or to analyze unknown chemicals.[33] Integrated GPS and advanced navigation systems allow robodogs to traverse challenging terrains with more accuracy, supporting movement and enhancing effectiveness in dynamic environments. Furthermore, additional cameras may offer improved video capabilities that allow for real-time viewing and situational awareness, providing additional support to law enforcement personnel.

Robodog Operation

The onboard control system can be guided remotely by a human operator. Camera systems mounted to the robodog capture and relay real-time images and videos to an operating system, and often run on a computer or a smartphone/tablet application; this information can be relayed over wireless network connection (e.g., LTE), Wi-Fi, or Bluetooth connection. The real-time video feed allows a human operator to monitor and assess the robodog's environment remotely and provide additional controls for movement or redirection. Operators often use remote-controlled interfaces (e.g., joysticks, motion tracking interfaces) to help the robodog complete complex tasks.

Level of Autonomy

Robodogs can operate with varying levels of autonomy, as defined in **Figure 6**. Most LEAs that have adopted robodogs manually navigate the robot through its environment and remain in the loop to guide the robodog to task completion. Even with human operators driving the robodog, it can autonomously navigate and adapt to certain types of unexpected obstacles or challenges in its path; however, larger challenges or obstacles (e.g., cars) in the robodog's path may require operator input for the robodog to maneuver around. Furthermore, some robodogs can open doors with minimal input from the operator; however, picking up objects requires input from the operator. Higher levels of autonomy are used in some military applications (e.g., perimeter patrol[34]) and industrial applications (e.g., industrial equipment monitoring and inspections[35]) but have not been used in the law enforcement context. Even with these higher levels of autonomy, in which the robodog may possess some autonomous or intelligent behaviors, the robodog primarily acts on pre-defined tasks and actions; human operators may still be supervising the systems to monitor real-time updates and notifications. For example, a robodog may be deployed to autonomously conduct perimeter patrol and notify the operator of any anomalies (e.g., damage to the fence). Furthermore, when Ghost Robotics Vision 60 was exhibited at a conference with a weapon for military applications, Ghost Robotics's CEO declared that the weapon itself has no autonomy or artificial intelligence and requires a human operator to trigger its use.[36]

Level of Human Oversight in Law Enforcement Applications

Human in the Loop	Human on the Loop	Human Out of the Loop
Definitions		
Refers to a system or process in which humans are actively involved, providing direct input and navigation control, oversight, and decision-making alongside automated components.	Refers to a system or process where humans have a supervisory role, monitoring and guiding the automated components, but with limited direct involvement in the day-to-day operations.	Refers to a fully autonomous system or process in which humans have pre-programmed a route, process, or activity to complete and have no further involvement or a system in which humans have no direct involvement or control, and operations are entirely managed by machines or algorithms.
Robodog Applications		
Robodogs adopted by law enforcement agencies are primarily operating with a human in the loop.	An on-the-loop robodog capability has not yet been adopted by law enforcement; however, military bases have used it for perimeter patrol.	An out-of-the-loop robodog capability has not yet been adopted by law enforcement, but other industries have used it (e.g., for industrial warehouse inspections).

Figure 6: Although robodogs can operate with different levels of human oversight, LEAs are operating robodogs with a human in the loop.

Vendors

Boston Dynamics, Ghost Robotics, and AITX are the U.S.-based vendors that offer robodogs for law enforcement. Although Boston Dynamics' primary customer base includes industrial and commercial clients, several LEAs both within the United States and internationally have adopted its robodog product, Spot. AITX, a relatively new robodog vendor, is specifically targeting LEAs with its RADDOG 1LE and 2LE products. Ghost Robotics Vision 60 has been primarily adopted by military customers and federal LEAs. There have been no reported adoptions of the Ghost Robotics Vision 60 robodog by state or local LEAs in the United States, as of publication.

Vendor Spotlight

Boston Dynamics Spot

Boston Dynamics, based in Waltham, Massachusetts, is the manufacturer of Spot.[27] Although the primary customer base for Spot is the manufacturing, warehouse, and construction industries, government and public safety customers have started to adopt Spot. Spot has the potential for add-ons such as a manipulator arm,[37] expanding its capabilities for manipulation tasks. Boston Dynamics prohibits the weaponization of Spot.

AITX RADDOG

AITX, based in Ferndale, Michigan, manufactures the RADDOG line, specifically targeted for law enforcement and public safety customers. Two RADDOG robodog models are available: the RADDOG 1LE and the RADDOG 2LE, which differ in size and weight.[28] At the time of publication, the available versions of RADDOG did not offer the capability to mount additional sensors or payloads beyond what is included in the base model; however, the company indicates its ongoing efforts to explore future expansions to its robodog platform. AITX prohibits the weaponization of its RADDOG products.

Ghost Robotics Vision 60

Ghost Robotics, based in Philadelphia, Pennsylvania, manufactures the Vision 60 Q-UGV.[38] The primary customers for this robodog include the defense, homeland security, and military industries, and Ghost Robotics does not have any restrictions related to the weaponization of its robodog. At the time of publication, no federal or military agencies within the United States have reported weaponizing the Vision 60 Q-UGV for use in deployment, although the U.S. Army reportedly experimented with integrating an infantry rifle as a payload.[39]

In addition to these U.S.-based vendors, there are several international robodog vendors, including UniTree Robotics (China), Weilan (China), Xiaomi (China), Deep Robotics (China), and ANYbotics (Switzerland). A comprehensive landscape of companies that offer robodogs was not conducted for this brief.

In addition to selling the robodogs directly, some vendors also offer customers the option to purchase the robodog through third-party resellers and channel partners. LEAs may choose to procure a robodog through a channel partner to obtain additional functionality, as not all desired add-on features may be available for purchase though the primary vendor. Further, some vendors and law enforcement-specific channel partners, such as FlyMotion, may offer training opportunities for robodog operators to become familiar with the robodog operation and capabilities. However, other vendors may not provide training specific to law enforcement's use of robodogs.

Robodog Use in a Law Enforcement Context

Although the use of robodogs by law enforcement is not widespread, more agencies are beginning to experiment with this technology's capabilities. Because of the limited use by LEAs to date, agencies will likely look to adjacent industries for insights on how to use robodogs in the broader criminal justice sector. This section highlights examples of law enforcement's and adjacent industries' use of robodogs to educate law enforcement leaders about potential applications of this technology.

Applications and Examples of Robodogs

Applications of Robodogs by Law Enforcement	Recent Real-World Examples
Enhance Situational Awareness during High-Risk Operations Robodogs equipped with an array of sensors and cameras can provide real-time data to law enforcement personnel. These capabilities allow officers to remotely assess situations and make informed decisions while avoiding direct exposure to violent situations. Robodogs can stream live video feeds and gather data, which significantly improves the understanding of the operational environment. Furthermore, deploying robodogs for a first line of response (dependent on the situation) may help to avoid use of force incidents by providing officers additional space and time to strategically consider how to approach a scenario.	**Hostage Situations:** In February 2021, the New York Police Department (NYPD) deployed a robodog to assist in an armed hostage situation in a Bronx apartment. NYPD first deployed the robodog to enhance the officers' situational awareness before entering the potentially dangerous situation. Ultimately, the robodog helped the team determine that no one was inside the apartment.[40] **Barricaded Suspects:** In August 2023, the Houston Police Department (Texas) SWAT team deployed two robodogs to communicate with an armed suspect who had barricaded himself in a motel after making threats. Despite the suspect's attempts to vandalize one of the robots, the standoff ended peacefully.[41]
Provide Tactical Support Robodogs can provide tactical support by carrying or delivering payloads in place of an officer.	**Delivering a Payload:** In 2022, the Sahuarita Police Department (Arizona) deployed a robodog to deliver a cell phone to a domestic violence suspect who had barricaded himself in his home during negotiations. In this instance, the robodog approached the suspect, allowing the officers to initially maintain a safe distance and avoid a potentially dangerous confrontation. However, because the suspect threw the robot out the door upon approach, SWAT team members ultimately assisted with the situation.[42]
Search & Rescue and Hazardous Environments Robodogs may support law enforcement by accessing unstable environments that could be dangerous to humans. These robots can explore disaster-stricken buildings, inspect hazardous terrains, and survey toxic areas. By doing so, they provide critical data and insights while reducing potential harm to human rescuers or workers. Their agility and adaptability enable them to navigate obstacles and access otherwise inaccessible places, making them a safer and more effective solution for addressing challenges in such environments.	**Search & Rescue:** Following the collapse of a parking garage in New York City in April 2023, the New York City Fire Department (FDNY) deployed a robodog to inspect the interior of the building and search for survivors. The robot was equipped with cameras and sensors to access areas that were potentially unsafe for humans. It was deployed in tandem with a drone, which was used to conduct an aerial survey of the scene.[43] **Inspect Potentially Hazardous Materials:** In 2021, the Dutch National Police Force procured a robodog to conduct initial observations of potentially dangerous drug labs, prior to sending in law enforcement.[44]
Surveillance and Perimeter Patrol Robodogs can enhance both the function and efficiency of human security and patrol operations. In these situations, robodogs are used both with on-the-ground officers for increased security measures and in place of officers in locations where no human presence is needed. Robodogs are also used for perimeter patrol because of their ability to maintain continuous presence and conduct surveillance tasks with various sensors. Robodogs are equipped with advanced sensors that monitor their surroundings and have the potential to react accordingly. They operate in inclement weather, making them suitable for patrols during challenging environmental conditions.	**Event Surveillance:** The Massachusetts State Police deployed a robodog to the Boston Esplanade to enhance security at the 2022 Fourth of July celebration. The robot was used to remotely monitor and identify potentially hazardous items, including bombs, and provided live video feeds of possible threats, suspicious situations, or safety concerns.[45] A robodog was again deployed for security patrol at the 2023 Boston Marathon, enhancing safety measures during the event. The robodog provided real-time video feeds and conducted patrols to monitor the surroundings.[46] **Perimeter Patrol:** In 2022, the United States Space Force demonstrated the capabilities of two robodogs while conducting a semi-autonomous security patrol at the Cape Canaveral (Florida) Space Force Station. Equipped with various optical and acoustic sensors, the robodogs conducted damage assessment and can serve as a surveillance tool around sensitive areas of the base to save significant person-hours.[47]

Figure 7: Robodogs have many applications, demonstrated with recent real world examples in public safety.

Case Study

St. Petersburg Police Department

Before acquiring Boston Dynamic's Spot, the St. Petersburg Police Department (Florida) conducted research on the potential use cases and necessary add-ons for the technology to function as needed.

Since 2014, the St. Petersburg Police Department (SPPD) has embraced the implementation of robots to address various agency needs. In 2022, the Speer Foundation, a privately owned family foundation, approached Police Chief Anthony Holloway about providing funding for the agency to purchase Boston Dynamics' robodog, Spot. Before acquiring Spot, Chief Holloway conducted research on the optimal applications and best practices for deployment, learning from other agencies who had used a robodog. In addition, SPPD spoke with other LEAs to understand what add-ons were necessary to cater to the specific law enforcement uses of the robodog. Ultimately, the department learned that a manipulator arm, enabling the robot to open doors; a 360-degree camera coupled with an infrared camera to ensure comprehensive vision capabilities; and an MPU-5 persistent radio system that extended the remote-operational range of the robodog were necessary for their intended uses. SPPD worked closely with community leaders to secure the necessary approvals to proceed with the acquisition of Spot and successfully procured Spot and its add-ons through a third-party vendor, FlyMotion, for $226,000. SPPD purchased Spot through FlyMotion, rather than Boston Dynamics, because FlyMotion offered add-ons (e.g., the MPU5 radio system) for the robodog that Boston Dynamics did not provide at the time of procurement; in addition, they offered hands-on training and implementation support.

The research conducted during the acquisition phase guided the agency's decision-making process. It enabled SPPD to identify and determine specific use cases for the robodog, which included supporting the SWAT team in challenging and high-risk scenarios such as hostage situations, search warrants, and drug/narcotics raids. The SWAT team assumed ownership of Spot, and three of its members underwent a comprehensive 1-week training offered by FlyMotion. Throughout the training, the SWAT team members learned and practiced how to turn the robodog on and off; maneuver the robodog using the controller and operating system; maneuver the robodog up and down stairs and across different terrains; pick up or drag objects; and open doors.

SPPD fostered public awareness and understanding of how the robodog would be used.

Chief Holloway recognized the importance of engaging with the community on the use of this technology before deploying it. The department orchestrated a well-coordinated introduction of Spot to the community in February 2022. Leveraging a Super Bowl commercial, which showcased robodogs dancing, SPPD took the opportunity to educate the community about the robodog's functionality and intended use, with an emphasis on reducing the risk of harm and injury to police officers in specific scenarios. It was crucial to reassure the community that Spot would be deployed sparingly and only in conjunction with the SWAT team. Having successfully engaged with the community and introduced Spot's intended use, SPPD demonstrated the robodog's capabilities in a high-stakes operation in October 2022.

A successful deployment of Spot showcased its potential in enhancing situational awareness and officer safety.

In October 2022, Spot demonstrated its value during a critical operation involving a kidnapping suspect. The suspect had taken refuge under a highway overpass, barricading himself and the kidnapped child inside a vehicle. Because of satellite connectivity issues faced by a drone and the inability of snipers to gain visual access to the vehicle, the SWAT team deployed Spot to assess the situation. The robodog provided crucial live-stream video feed, offering real-time insights into the suspect's actions and the child's condition. This intelligence proved instrumental in facilitating a successful rescue operation, ensuring the safety of the child.

SPPD's strategic deployment of Spot showcases how robodogs can be effectively integrated into law enforcement operations. Through careful research, community engagement, comprehensive training, and adherence to responsible deployment practices, SPPD demonstrated the potential benefits of using cutting-edge technology to enhance officer safety and ensure successful mission outcomes.

"By deploying Spot, we were able to confirm the suspect did not have a firearm. We were then able to relay that information, with the suspect's and child's position, to the rescue teams for a more informed approach and successful recovery. I can't guarantee that this would have been as successful without the information we gained from Spot."

—Daniel Hager,
Detective,
SPPD

Implementation Considerations for Robodogs

As LEAs explore the potential implementation of robodogs, careful consideration is needed to ensure a successful and responsible deployment. Agencies should consider purpose and goals, societal factors, operational factors, and technical factors through the adoption and implementation process.

Purpose and Goals

Before adopting and implementing a robodog, agencies and the communities that they serve should have a clear understanding of the robodog's intended purpose and goals. A needs assessment can help agencies better identify and articulate the problem(s) they are trying to solve, the available resources, and how the technology will help achieve the desired outcome. When conducting a needs assessment, agencies should consider various factors, such as the situations in which the robodog will or will not be deployed and its benefits and limitations when compared with other available robots or solutions (e.g., using robodogs versus fixed cameras for viewing). Agencies may also explore how the robodog can complement existing agency technology and on-the-ground officers, taking into consideration reliability. Ultimately, robodogs should be used in a way that is consistent with community values; local laws and regulations; and agency policies, values, vision, and mission.

"It is important to have a predetermined list of not only the situations the robodog can be used for, but also the situations the robodog cannot be used for. It's better to think about these situations up front to not only help with the messaging to the community, but also so agencies are not having to figure it out on the fly when these instances occur."

—Jon Hackett, Intelligent Robotic Autonomous Systems Program Manager, Department of Defense

Societal Factors

Societal considerations include community, equity, and ethics. LEAs must be acutely mindful of community concerns. The introduction of robodogs may raise questions about weaponization, privacy, surveillance, equity, and the potential impact on civil liberties. Community members may express apprehension about potential misuse or biases in robodogs' operations or how resources spent on a robodog might be used for an alternative strategy or priority. Agencies and jurisdictions must ensure that the deployment of robots does not disproportionately impact vulnerable or marginalized communities or reinforce existing societal inequalities. By actively engaging with and addressing these community concerns, LEAs can foster trust, transparency, and inclusivity, forging a path toward responsible and equitable integration of robodogs into their operations. Agencies can be transparent with the community about how the robodog will and will not be used and can get community buy-in that the proposed uses are acceptable. To foster transparency, some agencies have published their policies related to robodogs' use and released an annual assessment on how they were used.*,**

* The LAPD published a press release stating that the "robot will only be deployed in a limited number of scenarios, such as incidents involving active shooters, assessment of explosives, hostage situations, hazardous material assessments, search and rescue missions, and barricaded suspects." LAPD. (2023, May 23). *"QUGV" quadrupled unmanned ground vehicle NR23126lr* [Press release]. https://www.lapdonline.org/newsroom/qugv-quadruped-unmanned-ground-vehicle-nr23126lr/

** The SPPD's policy on the robodog's usage is rolled into the general tactical robotic system's policy and outlines that all tactical robotic systems will "only be operated by authorized SWAT personnel who have completed training in its safe operation." Further, this policy notes what the robots will not be used for, appropriate situations in which robots may be authorized for deployment, and deployment criteria. From St. Petersburg Police Department. (2022, February). *Tactical robotic systems* [General order]. https://police.stpete.org/generalOrders/section-3/iii-43TacticalRoboticSystems.pdf

Furthermore, having stakeholder involvement and buy-in throughout the adoption process is critical, as LEAs wishing to procure a robodog may need approval through a local governing body. Community engagement initiatives can also ease community concerns. By involving the communities in discussions and decision-making processes regarding the acceptable uses of robodogs, LEAs can foster buy-in and understanding before deploying robodogs. This proactive engagement may help prevent potential backlash, reduce fear among community members, and significantly enhance transparency, thereby strengthening the community acceptance of the technology and the department's relationship with the community it serves.

"Involving and being transparent with the community is going to be critical for law enforcement agencies adopting quadruped robots. For example, agencies need to be transparent about the specific use cases the robot will be deployed for, and agency-level policies should match this."

—Jay Stanley, Senior Policy Analyst, ACLU

Furthermore, LEAs should be aware of how communities may perceive the physical appearance of robodogs. Some agencies that have successfully procured a robodog have painted or wrapped the body of the robodog in agency colors, allowing community members to more easily recognize that the robodog is associated with a local agency. For example, the Western Australia Police Force wrapped the body of its robodog in blue and white checkers to match the agency's colors, and FDNY painted each of its two robodogs white with black spots to match the appearance of dalmatians, a dog commonly associated with fire departments.[48] Agencies may also consider holding a naming event for the robodog, in which community members propose names for the robot. Involving community members in the naming may help to promote positive associations of the robodog and reduce fears or concerns.

Operational Considerations

LEAs need to assess a variety of operational considerations before implementing a robodog. First, cost plays a significant role, as agencies must weigh the financial implications of acquiring and maintaining a robodog. Budget constraints and long-term sustainability are crucial factors to consider. Besides the considerable base cost associated with robodogs, the essential attachments required to enhance their usefulness for law enforcement applications can increase expenses by tens of thousands of dollars. As a result, some agencies have sought external funding or private donations to procure robodogs. For example, SPPD received a donation from a privately funded foundation to acquire its robodog, and LAPD secured funding from the Los Angeles Police Foundation. NYPD, on the other hand, used asset forfeiture funds to procure two robodogs from Boston Dynamics in early 2023.[49] Agencies must consider whether training costs are included with the purchase of the robodog or whether additional training will be needed with officer turnover. Given the high costs associated with this technology, agencies should think about the value that the robodog will create compared with other technologies. For example, an agency may conduct a return-on-investment analysis before purchasing a robodog to understand the frequency and severity of the previously defined scenarios for which the robodog could be deployed.

LEAs must comply with existing legal frameworks, particularly regarding the use of autonomous systems in public spaces and potential limitations on their deployment. Strict adherence to ethical guidelines and privacy laws is also vital to protect individual rights. Before purchasing a robodog, agencies should thoroughly investigate and understand the regulatory landscape to avoid any compliance-related challenges. Few examples of laws specific to procuring and deploying robodogs by law enforcement have been identified; however, the landscape of rules and regulations governing the use of robotics is constantly evolving.[50] In 2021, at least 18 states enacted bills related to drones, including those addressing privacy concerns, regulating purchasing requirements for LEAs, and governing the allowable uses of drones in law enforcement applications.[51] Additionally, agencies should be aware of whether their jurisdictions require specific authorizations or approvals to procure and deploy robodogs.

Effective governance is essential to establish clear protocols for the operation and supervision of robodogs, including who will operate them. Trends indicate that tactical response or SWAT teams are often involved in operating robodogs alongside other existing robotic assets. It is best practice for the deploying team to undergo comprehensive training to ensure optimal and safe use of this technology in the field. Proper training equips the team with the skills to operate the robodog, enhancing their overall operational effectiveness while prioritizing safety. Establishing a robust governance framework can ensure accountability and the responsible use of this technology within law enforcement operations.

LEAs must be aware of a robodog's vulnerabilities, especially during deployment. Although the robodog may be able to right itself when it is pushed over or thrown by an individual, some resources on social media platforms detail how to counter a robodog by disabling the battery pack, spray-painting the cameras to render visuals useless, or hacking into the Wi-Fi system to take over the operator's control.

Case Study

Los Angeles Police Department

LAPD's journey toward integrating Spot into its operations was marked by careful planning and adherence to community-oriented principles.

Recognizing the potential benefits and challenges of deploying robodogs, LAPD developed robust policies to regulate their usage. These policies were designed to confine their application to high-risk incidents to increase officer safety and minimize risks while explicitly prohibiting their deployment for routine patrol duties or covert surveillance purposes. Drawing insights from successful robodog deployments by other LEAs, LAPD crafted these policies with community-wide transparency, aiming to build trust and accountability.

As part of its proactive approach, LAPD ensured compliance with California's AB-481, which mandates stringent safeguards and oversight for acquiring and using military-grade equipment, including robotic systems. Furthermore, this bill requires the department to establish a concern or complaint process related to the use of military equipment and an annual report on any received complaints or internal audits related to the use of the robodog. LAPD also ensured alignment to Department Manual Section 1/140.15, Acquisition and Annual Reporting of Certain Information Systems and Technologies, which outlines information gathering and storage practices consistent with the protection of privacy and civil liberties. By aligning with the provisions of these legislations, LAPD addressed concerns about the responsible and ethical use of robodogs in law enforcement. This alignment further reinforced LAPD's commitment to upholding civil liberties and protecting individual rights within the community.

To gain approval for the deployment of Spot, LAPD presented a detailed document to the Los Angeles City Council. The document focused on LAPD's existing robot inventory and examples in which the robodog would have been beneficial. This document also included information on Spot's capabilities, highlighting its adaptability and potential applications, including hostage rescues and SWAT deployment. The total costs and deployment guidelines were also included.[52] By emphasizing the robodog's usefulness in critical law enforcement situations, LAPD aimed to convince the City Council of its value as an asset for public safety.

The Los Angeles City Council ultimately approved LAPD's use of Boston Dynamic's Spot, with the caveat that LAPD provide quarterly reports detailing the where, why, and outcomes of the robodog deployment.[53] Through strategic planning, community-oriented policies, and adherence to relevant legislation, LAPD successfully brought advanced technology ethically and effectively into its law enforcement operations.

Technical Considerations

Technical considerations surrounding the implementation of a robodog in law enforcement are important for successful deployment. One crucial aspect is data management, which entails establishing robust protocols for collecting, storing, and managing the vast amount of data generated during the robot's operations. Ensuring data privacy and security is vital to safeguard sensitive information and maintain public trust. For example, in tandem with the Los Angeles City Council's approval of Spot, LAPD published that the robodog "uses secured radio frequencies, does not transmit to third parties, and is encrypted to prevent interception. All digital evidence (photographs, video, or audio) captured by the [robodog's] camera during deployment shall be recorded and archived in accordance with current Department policy."[54]

Moreover, reliability is a critical concern, as the robodog will be deployed in high-stakes situations. Factors such as battery life, operating range, command and control link stability, payload carrying capacity, mechanical wear and tear, software bugs, and sensor malfunctions can impact their performance in real-world scenarios. Exposure to varying environmental conditions or unexpected obstacles, including vandalism, may challenge the robodog's ability to navigate and execute tasks consistently. Regular maintenance, robust testing, and continuous monitoring of systems are essential to mitigate these reliability concerns and ensure that robodogs remain dependable assets for LEAs. Agencies should assess how the robodog will integrate with existing technological infrastructure. Seamless integration with existing technologies and systems is vital to optimizing the robodog's capabilities and streamlining operational workflows.

Case Study

Western Australian Police Force

The Western Australian Police Force's Bomb Response Unit acquired a robodog to overcome limitations of its existing fleet of robots.

In 2020, the Western Australian Police Force's Bomb Response Unit, known as the Tactical Response Group (TRG), received funding to procure a new robot to augment its bomb response capabilities. Seeking a versatile solution to overcome limitations of its existing fleet of robots, TRG identified the potential of a robodog, given its unique abilities to navigate challenging terrains and perform dexterous tasks such as opening doors. After a Request for Proposals and evaluation process of different responding vendors, TRG decided to acquire Boston Dynamic's Spot through a local third-party vendor in 2021.

Following the purchase of the robodog in 2022, TRG encountered a series of software and technical malfunctions, such as the robodog falling over because of problems with its leg joints, necessitating TRG to send the robot back to Boston Dynamic's headquarters for repairs and improvements. Despite the technical setbacks, TRG explored the robodog's capabilities in conjunction with other robots, including a traditional tracked bomb disposal robot. In these exercises, the robodog was tasked with opening doors with its manipulator arm and creating paths to grant access to more-reliable robots. Although the robodog demonstrated strong mobility capabilities, the team observed that its autonomy sometimes led to moments of confusion, giving it less precision than traditional tracked bomb disposal robots in high-risk situations.

TRG plans to primarily employ the robodog for reconnaissance missions, including observation and scouting tasks, leveraging its ability to access areas that conventional wheeled and tracked robots cannot navigate. The robodog will also serve as a path-opener for other robots, leading them to suspicious packages or potential explosives. With the strategic use of the robodog as a part of initial deployments, the TRG aims to enhance the efficiency and safety of bomb response operations.

Key Questions to Ask Prior to Robodog Implementation

Considerations	Questions to Ask
Purpose and Goals	☐ What problem or challenge are you trying to solve by using a robodog? ☐ What are the intended situations for which the robodog will be deployed? In what situations will the robodog not be deployed? ☐ What are the limitations of robodogs? What are the benefits of the technology over humans or other robots?
Societal Considerations	**Community** ☐ How will your agency introduce the robodog to the community? ☐ How will you involve the community when establishing policies around use? ☐ What are the community's primary concerns with the agency's use of robodogs? **Equity** ☐ How can your agency minimize the disproportionate use of robodogs among different communities or populations? ☐ How can the use of robodogs in law enforcement be regulated to prevent potential abuses of power and violations of civil rights? **Ethics** ☐ How can your agency implement the robodog without infringing upon individuals' privacy and other rights (e.g., surveillance)? ☐ Are there any provisions in place to address concerns about the potential misuse or hacking of robodogs for malicious purposes?
Operational Considerations	**Governance** ☐ Who will maintain oversight, and who will be authorized to use the robodog? ☐ Will there be a regular review process for the robodog's use? ☐ What will the authorization process be to deploy the robodog? **Legal and Regulatory** ☐ What local, state, or federal laws may impact your agency's procurement or use of the robodog? ☐ How will your agency regulate your agency's use of the robodog? Does the robodog vendor prohibit any specific uses? **Policies and Processes** ☐ Do you have clear policies on when to deploy the robodog, and will they be made public? ☐ What considerations (e.g., community-based, technical, weaponization) will be covered in your agency's robodog use policy? **Workforce, Training, and Culture** ☐ How often will personnel be required to undergo training on the use of the robodog? Does the vendor, third-party vendor, or channel partner provide training? **Budget and Funding** ☐ Where will the agency procure the funding to obtain the robodog? ☐ In addition to the base cost of the robodog, will there be additional costs related to add-on features and ongoing maintenance?
Technical Considerations	**Technical Infrastructure** ☐ Does your agency have the technical infrastructure required to operate and maintain a robodog? ☐ Will your agency integrate other technologies or payloads with the robodog? **Data Management** ☐ Will the agency collect any data through the use of the robodog (e.g., audio, video recordings)? ☐ Will the agency maintain data collected using the robodog? For how long will your agency maintain the data, where will it be stored, and who will have access? **Privacy and Security** ☐ How will you ensure the robodog is not used by unauthorized individuals? ☐ How will you ensure any data collected or produced by the robodog are not accessible by unauthorized individuals? **Quality** ☐ How will you ensure the robodog is fully functional before it is deployed each time?

Future of Robodogs

Advancements in enabling technologies will likely drive new capabilities of robodogs. New sensors or add-ons, such as enhanced communication systems and expanded sensor capabilities, could further elevate robodogs' role in enhancing officer safety. Similarly, advances in artificial intelligence and robot autonomy could create both additional opportunities and concerns for the use of robodogs by law enforcement.

If robodogs become more commonplace in society, the deployment of robodogs by law enforcement might become more accepted by the public. However, the journey toward widespread adoption will likely be intertwined with an evolving local, state, and federal legal landscape that aims to strike a balance between harnessing the potential of robots for societal benefit and mitigating potential risks associated with their use.

The future trajectory of robodogs is a convergence of technological innovation, societal acceptance, legal evolution, and ethical consideration. Enhanced capabilities could support officer safety and law enforcement operations. However, the responsible adoption of robodogs by law enforcement demands the balancing of technical advancements, lawful practice, and ethical guidance.

Future Applications of Robodogs in the Criminal Justice Sector

Although the focus of this brief is on robodogs for LEAs, robodogs could have applications within the broader criminal justice system. For example, robodogs could be an added layer of security at correctional facilities by conducting autonomous security surveillance and perimeter patrol, a use that has already been demonstrated at military bases. Moreover, because robodogs can collect a significant amount of data, including camera and video footage, they could prove valuable for evidentiary purposes in court proceedings.

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