



FUTURE DEFINING



Unmanned Ground Vehicles

Handling dangerous tasks from a safe distance

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Unmanned ground vehicles (UGVs) have been used in military settings for over a century. In 1915, French engineers developed the “Torpille Terrestre” (Land Torpedo) — a UGV loaded with explosives meant to breach enemy lines. In the 1930s, the Soviets began using UGVs based on the T-18 and T-26 tanks and were dubbed “Teletanks.” The Teletanks were controlled remotely from another tank about a mile away and were deployed in the Winter War against Finland in 1940. The UGV had a humble beginning as little more than a single-use detonation device, but today these vehicles feature state-of-the-art capabilities that work to protect and preserve lives.

UGVs operate without an onboard human presence, which means they can be used in a variety of scenarios where it may be inconvenient, dangerous, or impossible to have a human operator present. AeroVironment’s recently-acquired company, Telerob GmbH, a global leader in advanced UGV solutions, engineers and builds these remote-controlled robots to support such missions.

Telerob’s UGVs safely and effectively perform a variety of dangerous missions, including explosive ordnance disposal (EOD), hazardous materials handling (HAZMAT) and chemical, biological, radiological and nuclear (CBRN) threat assessment. These ruggedized UGVs feature all-

terrain capabilities and offer specialized, precision manipulators, autonomous functionality and intuitive operation to deliver a high degree of mission flexibility. They can be transported via truck or even by helicopter if necessary.

The UGVs are controlled by a human via the Robo Command intuitive touch-screen ground control station. The operator is able to view the current situation in razor-sharp resolution through high-definition pan, tilt, and zoom cameras. The vehicles house two modular tool bays that allow for storage of inspection cameras, window breakers, disruptors, chemical and biological sensors, and powered cutters. The sophisticated software and onboard tool center point control allow for automatic tool exchange during missions.

For extensive mobility, they utilize a versatile 4-track drive system with articulating tracks to conquer challenging terrains from thick mud and snow, to climbing stairs and slopes up to a 45° incline, and traversing gaps up to 16 inches. The tracks can be controlled together, in pairs, or individually, giving the operator maximum navigation control. The UGVs have an auto-leveling feature that allows them to sense the environment underneath and stabilize themselves on uneven terrain.

Part of their multi-mission capabilities includes handling suspicious packages and vehicles,

Outstanding technology and maximum reliability for handling dangerous tasks from a safe distance.

Telerob’s motto, mission and motivation



telemax EVO Recce UGV

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unknown items including hoax devices, illegally constructed explosive devices, as well as other missions that support SWAT teams. In these real-life scenarios, the 6-axis precision manipulator with an eight-inch gripper and 60-inch reach can use the onboard tool bay to mimic a human's fine motor skills, such as unzipping a backpack to remove a suspected explosive or biohazard device, or inserting and turning a key to unlock a secured area.

The UGVs can also employ the onboard 2D and 3D LIDAR scanners to live map the current environment. The operator will receive a scan of the building with an RGB (red, green, blue) overlay giving them a photorealistic environment. The



tEODor EVO secures a chemical pipe access port in this training scenario.

UGV can also map in a pitch-black environment that allows the operator to see depth and understand where obstacles are and navigate around them. In addition, they can provide an accurate physical layout of a dangerous situation such as a live shooter held out in a building with many blind corners and dead ends.

International Use

Currently, UGVs are used in all 27 states of the European Union, and they are also used in numerous European countries. The German Bundeswehr (Army) has the largest number of Telerob systems in that country while the German police have almost as many systems at their disposal.

While UGV usage is mostly concentrated in military and police applications, a few sectors of industry utilize the robots as well. Organizations such as professional fire brigades for chemical plants and the German Nuclear Emergency Response Group also incorporate UGVs in their life-protecting arsenal. The nuclear group consistently trains with the UGVs in the case of a real-life scenario but has yet to call on that training for an actual event.

Other areas that utilize UGVs are the Large Hadron Collider at Genève and the German Competence Center for Rescue Robotics.

Domestic Use

There are at least 10-12 UGV units serving the greater Atlanta area at any given time. The vehicles are often in use at the Hartsfield-Jackson Atlanta International Airport, one of the busiest passenger traffic airports in the world, and they're also used by the Atlanta Police Department.

Exact UGV training scenarios for the Atlanta groups are proprietary, but David Tritinger, a Telerob customer service technician, shared some insight about what UGV training might entail.

"We can deduce that they likely include handling of suspicious items at security checkpoints, locating and rendering safe suspected devices on planes and within the airport, countering vehicle-borne improvised explosive devices (VBIED), and preventing mass casualties," he noted.

In a different part of the country, the Los Angeles County Bomb Squad, the busiest bomb squad in the U.S., responds to 30-40 situations every month, and for these purposes, they utilize the telemax family of UGVs. The response area is massive, ranging from the high desert of Southern California to the beaches and 87 cities in-between. When necessary, the bomb unit will transport the telemax UGV via helicopter to respond to calls on an outlying island. The UGV's portability allows the squad to support their entire jurisdiction rapidly.

Detective Jay Yelick, a bomb technician working the greater Los Angeles area, described a potential scenario:

"A typical [and unsafe] response to a suspicious package would be to outfit someone in the bomb suit, equip them with an x-ray, and send them downrange to make physical contact with the package. They would have to take an x-ray and develop it to even find out what the team needs to do with the package after that. But with a UGV, we can send a robot down there in a safe manner and the robot can exploit the package."

He went on to say, "The humanlike movement of the UGV allows me to retrieve



a cutting tool from the tool bay, open up the package, seamlessly stow the tool and then use the gripper to exploit the items that were in the box and render the area safe. I could restore normalcy to the impacted area long before we needed to have someone in a suit.”

The Los Angeles Bomb Squad is able to



The telemex EVO Hybrid opens an overhead bin during an airplane training scenario.

support civil services such as the fire and police departments in cases where they are responding to homemade laboratories. These situations

are extremely dangerous, and first responders use every tool available to minimize risk and deescalate the scenario quickly and safely. In these situations, the suspected perpetrators are often unwell individuals equipped with firearms. There is also a high potential for fire and explosions due to the illegal equipment contained in the structure that’s used for manufacturing illicit substances.

For these missions, the bomb squad will deploy a UGV to assess the situation and create a 3D map of the area before humans physically enter the space. If possible, the UGV will also dismantle or detonate any potential devices before a human ever has to put on a bomb suit.

The UGV has come a long way in the decades since its inception. With their sophisticated technology and life-saving capabilities, these robots have proven their value in multi-mission scenarios.

The Future of UGVs

Imagine a scenario where an elite team enters a hostile situation involving IEDs, treacherous terrain, and a myriad of unknown threats. To neutralize the danger, the team must survey the environment, establish patrols, neutralize threats, and communicate with lightning speed. And they must execute all of these tasks with extreme precision and timing. Now imagine that no member of that elite team is human.

Instead, visualize that team as a combination of unmanned aerial vehicles (UAVs) and ground robots. UAVs and UGVs are a natural

pairing that can execute the potential scenario all while keeping human beings in control at a safe distance.

A vertical takeoff and landing (VTOL) aircraft like Quantix Recon would map the area and search for IEDs while a telemex EVO Plus ground robot manages EOD threats that Quantix identified. Meanwhile, a Switchblade 300 engages in a sensor to shooter mission that further protects the other vehicles. All of this activity is made possible by a Puma LE serving as a communication relay and extra eyes on the situation. This robotic dream team is an example of multi-domain solutions.

“Multi-domain solutions are the future of autonomous systems and are a significant focus for AeroVironment. Although it is challenging, we continue to develop products that blend science and engineering and provide our customers with reliable, next-generation capabilities from the ground and air,” said Brian Young, vice president, product line general manager.

Young also noted, “Understanding the mission is an important step in the development process, and we look forward to partnering with our customers to solve increasingly complex problems with multi-domain solutions. With the acquisition of Telerob, AeroVironment holds a unique position in the market that allows us to organically develop these solutions for years to come.”

“The combination of UGVs, UAVs, and autonomy will allow operators to perform their missions quicker, safer, and more effectively. I look forward to seeing it happen.”