Picture credit: ABD Solutions

AUTOMATION AND DEFENCE

Matthew Price *explores the benefits of autonomy when it comes to ground-based vehicles and security*

The defence industry has been moving towards vehicle autonomy for some time. Most existing automation has been adopted in the air and sea domains as navigating in these environments has a lower level of complexity. Autonomous and semi-autonomous drones are now commonplace in any defence fleet and have revolutionised how operations are carried out. However, automating ground vehicles has been technically more challenging; not only is the environment they operate in more varied, but the decisions needed to be made by the vehicle's AI are more complex.

One key driver accelerating the move towards automated vehicles is safety. According to Michael Griffin, the former US Department of Defense Under Secretary of Defense for Research and Engineering, 52 percent of casualties in combat zones can be attributed to personnel delivering food, fuel and other logistics. In 2009, a US Army study found there was one casualty for every 39 fuel convoys in Iraq and one for every 24 fuel convoys in Afghanistan. Automating logistics provides the opportunity to significantly reduce casualties and injuries.

Another key driver is cost. It is estimated that the US defence uses in excess of 320,000 barrels of oil per day. Automated ground fleets operate much more efficiently, supporting better vehicle and personnel utilisation and simplified operations. If a one percent fuel efficiency saving can be made through automation, it would save upwards of $100-million per year for the US Army.

Cost, as well as being a key driver, is also a key barrier to adoption. Fully autonomous vehicles require a significant amount of development, and this takes time and money. Another key financial element is the desire to maximise the ROI on the billions of dollars already invested in existing vehicle fleets.

However, the biggest reason why automated ground vehicles aren't commonplace is the technical challenge of achieving full autonomy. Controlling a vehicle is relatively simple, but perceiving the world ahead and then making decisions based on that information is incredibly complex. In theatre, vehicles will encounter a plethora of terrain, weather, lighting, obstructions and other vehicles. Also, any 'rules of the road' will often need to be ignored in certain scenarios adding a further layer of complexity.

By controlling elements of an operating environment and by focusing on specific operations, semi-autonomous capabilities can be achieved that provide most of the benefits that full autonomy has to offer.

By initially targeting specific user cases such as logistics or last-mile re-supply, increased focus can be placed on the unique operational requirements resulting in a tailored autonomy solution. In addition, to ensure effective adoption the impact on people and processes also needs to be considered. Applying new capability to existing ways of working will not deliver the full benefits that autonomy has to offer.

One solution that accelerates the adoption of autonomy and brings life and cost-saving benefits to the industry today is to retrofit autonomous capabilities to existing vehicle fleets. ABD Solutions recently demonstrated this approach when in partnership with NP Aerospace, developed the world's first fully automated Wolfhound Tactical Support Vehicle (TSV).

Retrofitting existing vehicles with autonomous capabilities requires a flexible solution that can be tailored to a specific vehicle, environment and operational scenario. A core modular, certified and secure software eco-system is used to build the various elements required for automation; including vehicle management, vehicle control actuation, communication, sense and detect, health and diagnostics and third-party integration.

This modular approach enables the autonomy solution to integrate with core and third-party technologies to ensure that specific requirements are met. The result is almost any vehicle can be retrofitted with autonomous capability and then fully integrated into any end user's existing operational/fleet management system.

Retrofittable autonomous driving systems provide remote control of the Wolfhound

For the defence industry, safety is arguably the key benefit of adopting vehicle autonomy. The technology enables personnel to be taken out of harm's way and to operate or manage fleets from a safe area. As well as removing personnel from direct harm, it can also reduce exposure to less obvious dangers.

Cybersecurity is also a key requirement when digitising vehicle operation and fleet management. As a result, it is critical that any system that is adopted is fully certified, conforming to industry-recognised cyber security standards.

There are several areas where vehicle autonomy provides cost savings to the defence industry. Firstly, automated vehicles can operate 24/7 without any downtime or need to switch shifts. This means that not only are fewer personnel required to carry out a particular task, but also fewer supporting resources (food, water, shelter *etc*). This can have a snowball effect on reducing the logistical cost of an operation.

52% OF CASUALTIES IN COMBAT IS ATTRIBUTED TO DELIVERING FOOD, FUEL AND OTHER LOGISTICS

A retrofittable autonomous solution will also significantly extend the lifecycle of the existing fleet. As there are billions of dollars invested in current vehicles, maximising return on investment on these assets is key to operators.

Across the globe, there is a desire to achieve more with fewer resources. As it costs more than £38,000 for a soldier to complete basic training in the UK, they should ideally be carrying out the most valuable tasks. Automating vehicles enables 'soldiers to be soldiers'. For example, this could mean reducing the number of drivers in a multi-vehicle convoy to just one, or in some situations none at all.

In a geo-fenced environment where logistical tasks are often repetitive, such as forward operating base resupply or fuel deliveries, all the vehicles involved can be synchronised. Mission planning software can ensure that all the vehicles take the most efficient route, reducing fuel consumption and the time to complete the operation. Vehicles that have the ability to detect obstructions can communicate them to the fleet management system to prevent others from encountering the same issue. Once the obstruction has been flagged the vehicle management system can generate an alternative route or a human can remote into the vehicle to immediately assess the situation.

One of the welcome side effects of autonomy is the digitisation of information from the vehicle. It creates new data streams that are invaluable to fleet operators. The vehicle's speed, location, fuel level, diagnostic status, distance to target *etc*. can all be relayed via the vehicle management toolset. Data analytics can process this information to assist with operational decisions, fleet maintenance scheduling and logistics planning.

HOW SOLUTIONS CAN BE USED

Convoys and logistics supply are examples of where personnel and equipment can be exposed to danger

on the battlefield. Vehicle autonomy solutions offer two main alternatives to a traditional convoy. A leading vehicle can be driven by a human with other vehicles in the platoon following the exact path of the lead vehicle. In low-danger scenarios, this is a very efficient way to transport multiple resources long distances. An alternative is to have the lead vehicle driven remotely by a human operator with other automated vehicles following the lead vehicle. This would be preferred in more hostile environments where reinforcements can remain relatively close.

AUTOMATING LOGISTICS CAN SIGNIFICANTLY REDUCE THE CHANCES OF CASUALTIES AND INJURIES

The most valuable advantage that vehicle autonomy solutions offer is removing personnel from dangerous situations. One of the biggest threats to soldiers is from Improvised Explosive Devices (IED). According to 'Honor the Fallen', a database created by the Military Times, nearly 50 percent of US soldiers killed in operation between 2010 and 2020 were caused by IEDs and similar statistics apply to British Army troops. Automated ground vehicles enable de-mining and route clearance to be carried out without the need for personnel to be in the blast proximity. The task can also be completed more thoroughly using accurate path following capabilities, improving the chances of success.

Automated vehicles can also be used to develop programmable targets for training exercises. The target vehicle can either be spontaneously remotely controlled by an operator or follow a specific path. Either can be accurately replicated and repeated all over the world, providing troops with more accurate live firing scenarios than the more traditional static targets or targets following 'rails' or winched along linear paths.

REMOTE CONTROL

The ability to control vehicles remotely creates strategic peacekeeping opportunities too. It helps to support an active peacekeeping presence in areas where it would not traditionally be possible to do so, or where resources are not available. It can also be used to generate physical mass in theatre through resilient swarms of low-cost automated systems rather than using large personnel deployments.

Fully autonomous vehicles will undoubtedly provide significant cost and safety benefits to the defence industry and the challenge now is how to integrate this technology in a timely and cost-effective way to maximise these benefits. Retrofittable autonomy driving solutions offer substantial operational safety and cost benefits and by utilising existing vehicle fleets and infrastructure they can be fitted today offering a stepping stone towards a fully autonomous future ●

Matthew Price is Managing Director of ABD Solutions, a specialist provider of retrofittable vehicle autonomy solutions.

Specially designed driving and pedal robots provide complete control of the vehicle

Picture credit: ABD Solutions