"eod solutions for life..."™

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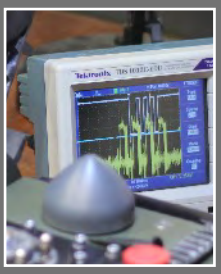
C B R N e



ZEUS MODULAR UNMANNED GROUND VEHICLE

It’s morning rush hour.

A suspect device is reported on a station platform.

The platform is at the top of an escalator.

The station is in the middle of a large city.

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Innocently forgotten bag?…

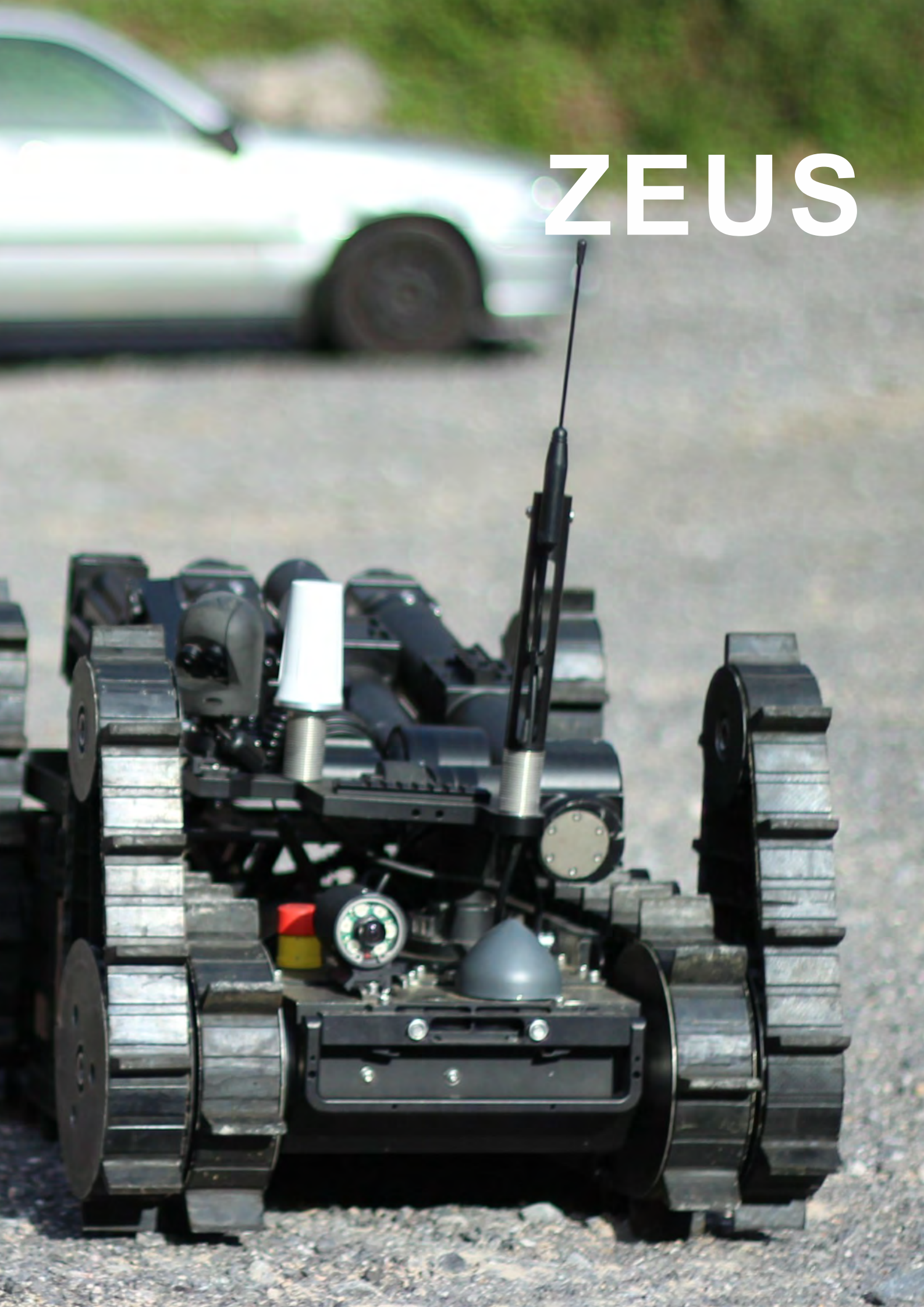
…or IED with the intention to cause death and disruption?

Your task is to get there quickly, with minimum of fuss.

You need a capable Unmanned Ground Vehicle (UGV) to keep your operators at a safe distance, which is quick to deploy, reliable and carry your tools to render that potential IED safe.

Introducing…

ZEUS, the Ultimate Modular Unmanned Ground Vehicle


ZEUS

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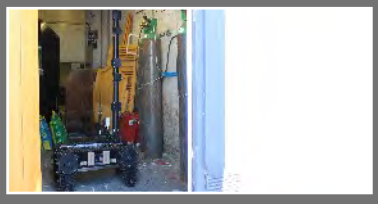

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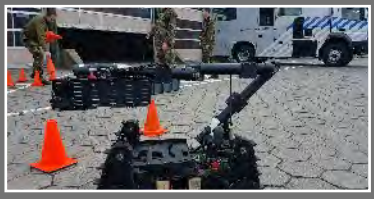
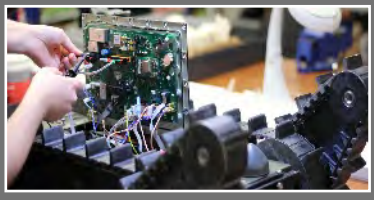

UGV MOD

THE 3 BENEFITS OF MODULARITY

1- CONFIGURE TO MISSION

With today's new threats, you need to transform into a lighter, faster responding unit. The Zeus UGV has been designed for the EOD/IEDD/CBRNe and SWAT community to deal with a range of scenarios from simple reconnaissance, CBRNe investigation or to full scale EOD render safe procedures (RSP).

The highly modular design allows Zeus to be configured from a lightweight simple UGV to a fully capable EOD UGV. This ability to configure 'in field' gives maximum capability with minimum equipment.

Gone are the days when teams would use 2 different UGVs, one for simple reconnaissance and another for specific tasks. Now all those roles can be fulfilled with 1 platform. Until now operators have had lightweight UGVs, that don't have the strength and capability of heavier UGVs and heavier UGVs that don't have the ease of deployment of lightweight UGVs. Now they have all the advantages of both a heavy and light UGV, but in 1 platform.

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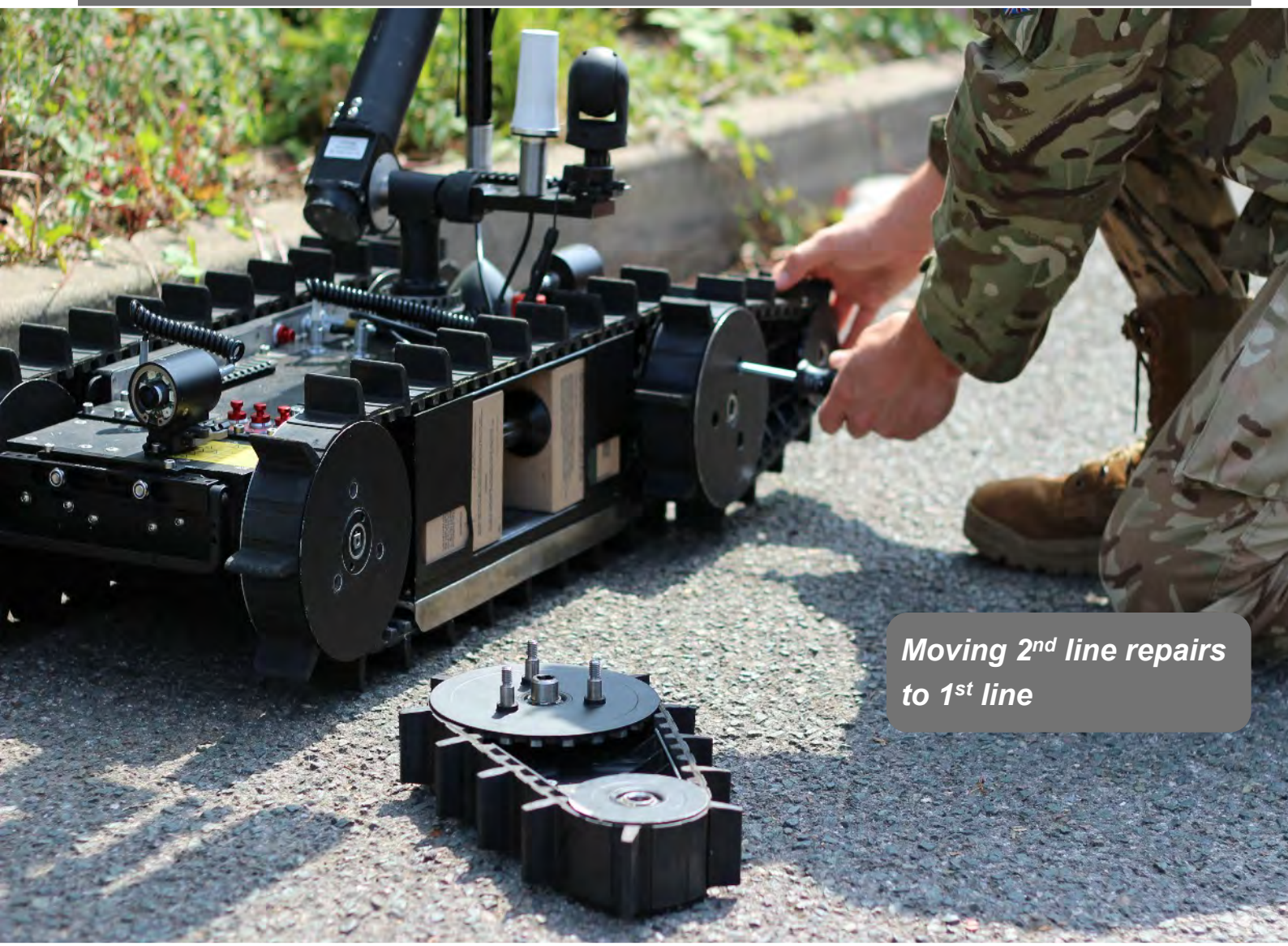
DULARITY

2 - REPAIR IN FIELD

As well as configuring to the mission, the modular design also allows operators to repair 'in field'. Should part of Zeus be damaged in action, there is no longer any need to send the UGV back to a workshop for repair. Within minutes, almost all of the critical sub sections of Zeus can be removed, and by simply replacing the damaged part via the quick release modular construction, Zeus can be back up and running in minutes.



Moving 2nd line repairs to 1st line

THE 3 BENEFITS OF MODULARITY

3 - EASE OF TRANSPORTATION

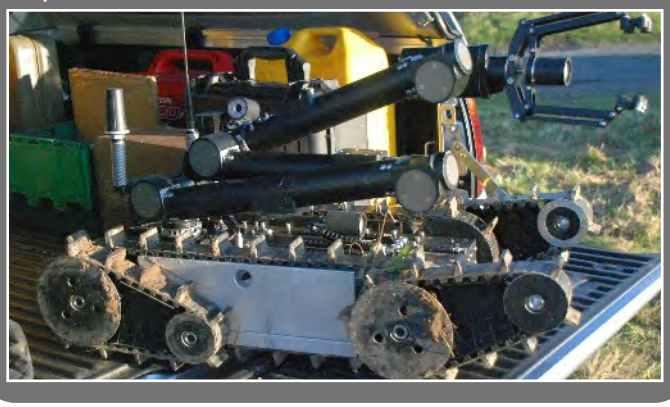
The 3rd benefit is this ability to break down Zeus into its component modules and be carried in a backpack.

This ease of transportation brings a whole new capability to dismounted teams. The unit can be broken down quickly, carried to the desired location, reassembled and made ready for operation in minutes.

This means Zeus truly is a highly capable but man transportable system.

It also allows the unit to be stored more easily within vehicles, utilising multiple small cavities if space is at a premium, instead of one large one. It means that often a dedicated slot for the UGV is not required, and it can be placed under benches or alongside other equipment, meaning you can carry more capability in your vehicles.

Couple this with the lightweight Peli case mounted, or body worn control station, and the ability to configure the UGV to suit certain scenarios, it allows only the essential systems to be carried forward, leaving anything not required behind.



DULARITY

Transportation and Deployment

You need to deploy quickly and in small vehicles. You don't want special dedicated vehicles, and from your Incident Control Point (ICP) you want your UGV moving as quickly as possible to the threat area.

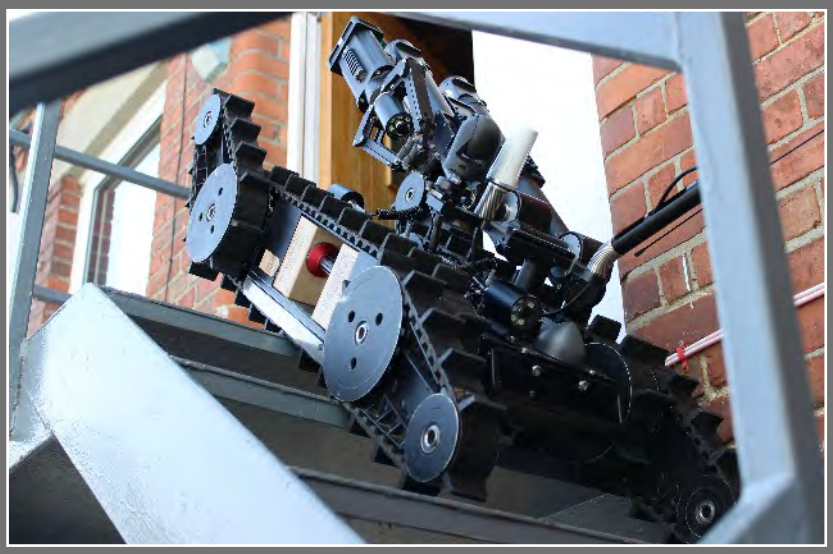
Zeus is light and quick to deploy. Within 3 minutes of arriving Zeus is up and running, including mounting any prepared disruptors, and in less than 2 minutes can be at a suspect area that is 100m away. That means in less than 5 minutes from arriving, Zeus is on the target.

Terrain Capability

No area must be inaccessible to your UGV. Zeus is able to tackle a wide range of terrains, both indoors (such as commercial, domestic and public buildings) and outdoors. Transport links such as buses, trains and aeroplanes present no problems.

TERRAIN C

Stairs and slopes (including lateral) present no problem to Zeus, utilising the front and rear articulating track modules (ATM). Not only do they improve obstacle and stair climbing, but they allow you to descend stairs in a more controlled manner than any other UGV. Many UGVs simply drive over the top of stairs until they 'tip' downwards, but Zeus is able to use its articulating track modules to change its centre of gravity giving a controlled decent. Stability on stairs is also crucial if you are carrying live weapons or expensive CBRNe sensors. The ability to change the length of Zeus by extending the articulating track modules makes it incredibly stable when on stairs.

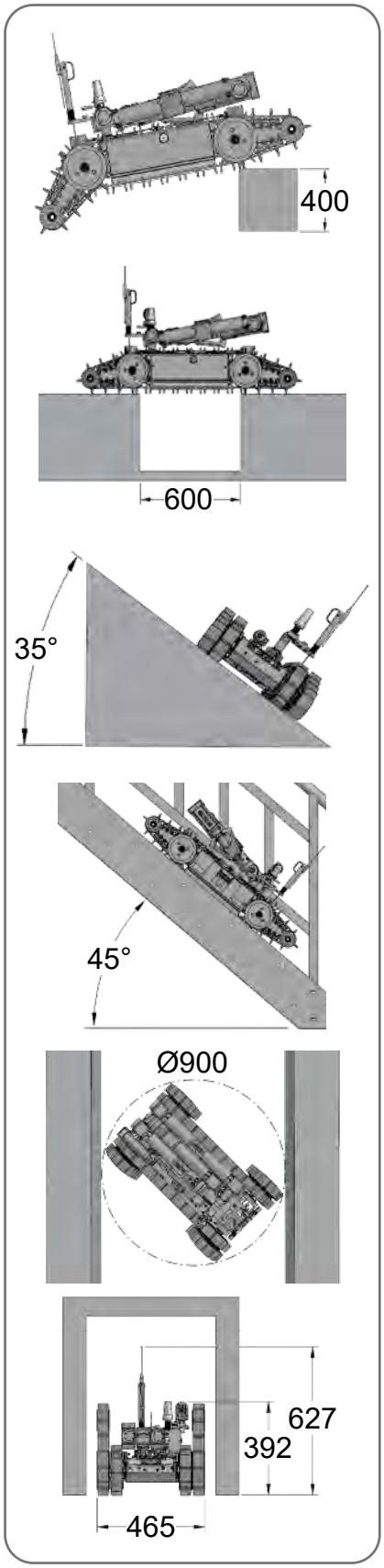


Zeus' unique track design allows it to 'lift' the entire UGV up stairs and obstacles as opposed to traditional UGV tracks method of relying on 'hooking' onto obstacles. This whole new concept in climbing gives unparalleled stability and control whilst climbing. Ditches, trenches and holes also present no problems as the articulating track modules easy broach such features in the terrain.

CAPABILITY

When inside restricted spaces such as aeroplanes & trains, you will need to manoeuvre easily, navigating twisting and narrow passageways. The ability to fold in the articulating track modules allows Zeus to become very short, allowing it to turn in a circle no more than its own length. Additionally more height can be achieved by rotating the articulating track modules vertically downwards.

In all these environments, you may be carrying live weapons or risk triggering trip wires. Therefore the ability to proceed very slowly and carefully, without inducing jerking and shaking and within close range of suspicious items of the UGV is essential. With Zeus' fine and precise control you can easily achieve this.



TERRAIN C

Difficult obstacles such as crossing railway tracks are again easily broached as the articulating track modules can be used to maximum effect adjusting Zeus' the centre of gravity to carefully traverse in full control.

Track throwing, especially in hot weather, when traditional rubber tracks can stretch, is eliminated due to the Aramid reinforced rubber. This makes it almost impossible for the track to expand and jump off the driving sprockets.

Different surfaces whether outdoors such as roads, paving, rutted tracks, grass and foliage or indoors such as tiles and carpets present no problems for Zeus. Even water features such as streams are easily dealt with due to Zeus' water proof design.

The narrow width of Zeus allows it to enter buildings and proceed along corridors, including aircraft and train aisles. Culverts and tunnels don't present problems as Zeus is also low, with flexible antennas which allows it to enter areas with restricted height.

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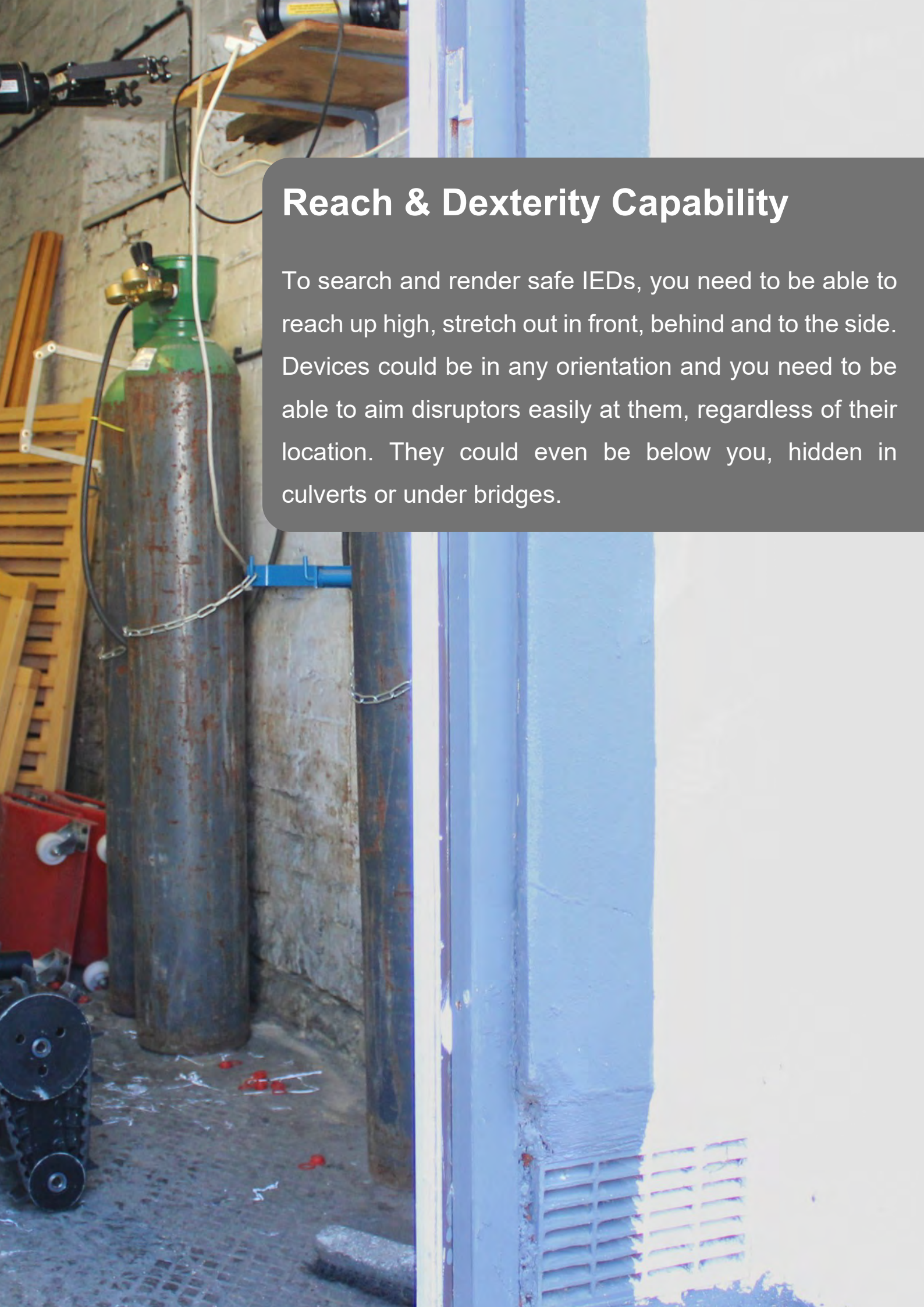
CAPABILITY

Do you need to move your ICP quickly during a deployment and don't want to be restricted by a fixed point to operate your UGV? Zeus has the solution. You as the driver can also move around with the dismounted OCU system. The OCU consists of several modules that can be worn on a Molle/Osprey vest that allows you to cast off the restrictions of a fixed control point and reposition yourself at the optimum location for the task in hand. The modular OCU also allows for easy integration into vehicles or other fixed control points.



Reach & Dexterity Capability

To search and render safe IEDs, you need to be able to reach up high, stretch out in front, behind and to the side. Devices could be in any orientation and you need to be able to aim disruptors easily at them, regardless of their location. They could even be below you, hidden in culverts or under bridges.

REACH & DEXTE

With Zeus' long 3 section arm you have a solution for a long reach, that still maintains dexterity. Extending or telescoping arms on UGVs are good for reach, but they lack the dexterity to gain access to difficult areas such as the foot well or boot of an automobile. The long reach even allows low vehicles to be searched underneath from the opposite side.

Zeus' 3 section arm gives you the reach and dexterity to get into these tough places.

This dexterity allows the arm to reach below Zeus as well, so searching culverts, under bridges, ditches, or even digging into soft ground is easy. Tasks such as opening vehicle or building doors, boots of vehicles and gripping small objects requires precise control, and Zeus delivers this.

In addition, the gripper or claw can hold small tools and allows for the separation of the components of a suspect device after disruption. Examination with the through gripper camera permits confirmation the disruption has been successful.

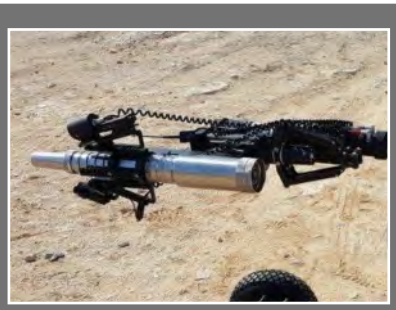
The ability to position a disruptor correctly to enable maximum disruptive effect (for example corner to corner on a bag) and within 2cm of a suspect device, is easily achieved.

Complex arm movements are easily achieved with Zeus' pre-set moves. The operator can select a number of pre-programmed moves such as fully extended & the arm will move automatically.

RITY CAPABILITY

There is even the option for you to save your own pre-set moves, and different operators can have their own saved selection by using the OCU login function. An on-screen graphic simulates the selected move before execution so you can verify the arm and gripper are going to do what you have planned and will not collide with obstacles. Even if you don't use the pre-set functions, a UGV graphic on the OCU screen constantly updates to show you the current configuration of the arm, so you know exactly where it is.

Many UGVs lose the gripper functionality when a disruptor is placed at the end of the arm, but Zeus' unique method of disruptor mounting means you can maintain full use of your gripper during a mission while a disruptor is mounted.

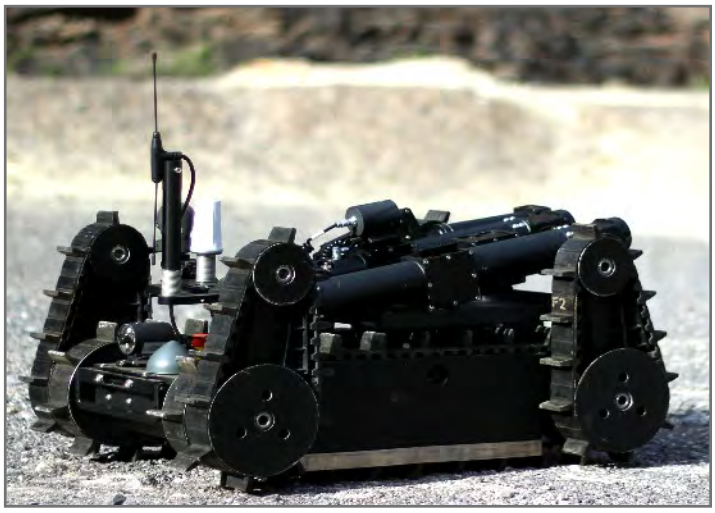


But reach and dexterity don't work on their own, you need the ability to lift charges, deploy EOD tools such as barrelled disruptors, move and drag items such as furniture out of your path for investigation and recover main charges from the ground or vehicles.

Zeus' strong arm gives you the capability to lift up to 15kg.

REACH & DEXTE

Even with all this strength and dexterity, you need to remain small, and not lose your ability to take a UGV into a confined space. Zeus' arm folds down within its own footprint, so you can still maintain high manoeuvrability. To reduce the risk of tipping over, Zeus' strong but light arm design, utilising materials such as aluminium and titanium ensure the UGV's centre of gravity remains low.



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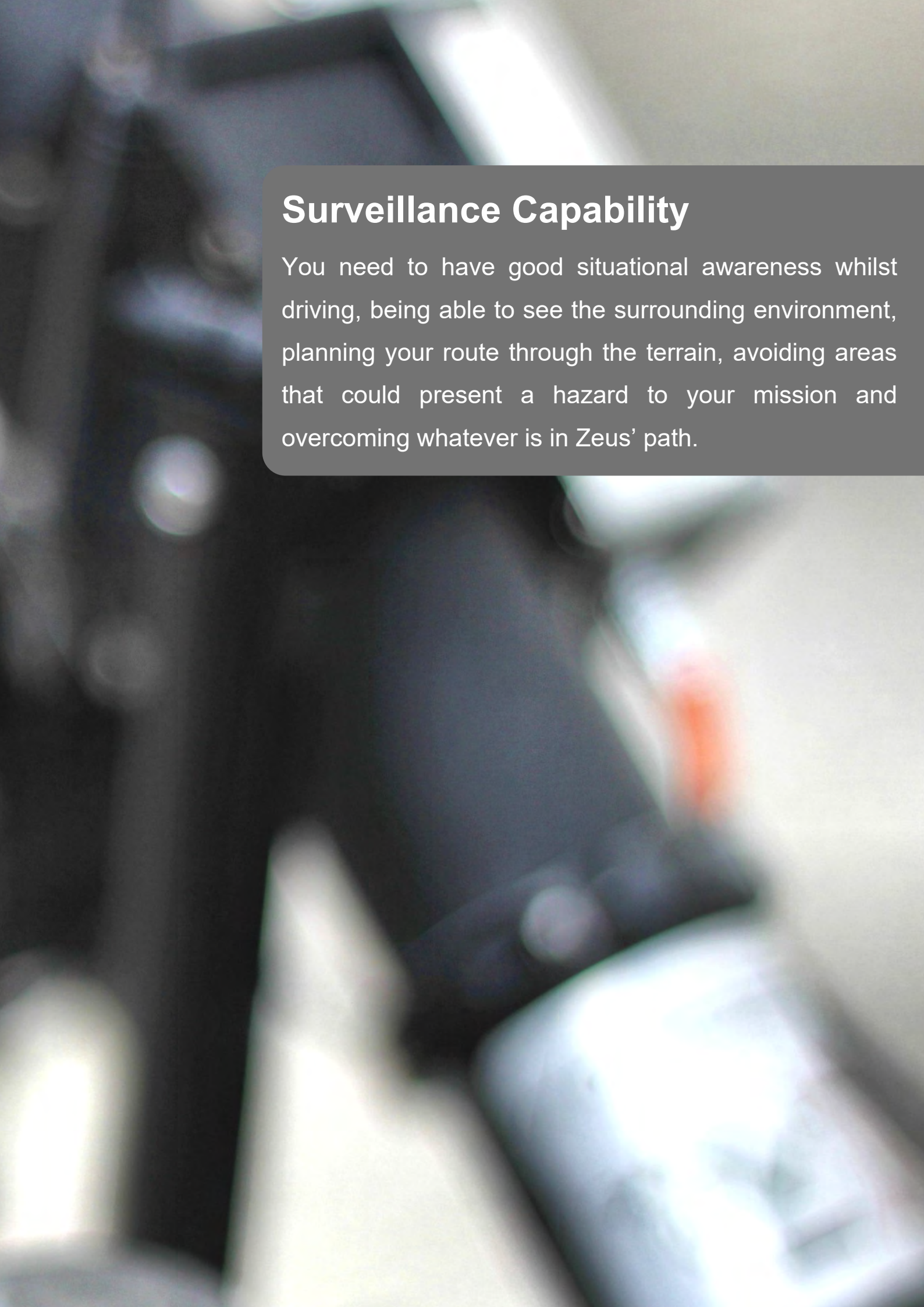
RITY CAPABILITY

Long reach may not be your requirement. You may simply want to place charges at ground level, or have a more basic shorter arm. Long arms add weight and are more complex to operate. Zeus' modular design delivers again. A 2 section arm or 1 section arm is available, giving you the level of capability you require but without the disadvantages and higher cost and weight of a longer arm. Zeus' arms are on a quick release and can be changed in less than 60 seconds.

Zeus does not even need an arm to operate. With the arm removed it becomes a simple reconnaissance platform able to report back images from the target area to deliver 3rd party tools such as CBRNe sensors to the area under investigation.

If you need to carry out in-field repairs to the arm or gripper, the modularity of Zeus allows you to do that with the quick releases. These modular units can be quickly detached from the UGV and replaced by an operator in a number of minutes.

This ensures Zeus can stay on mission, and not need highly trained technicians to maintain your fleet of UGVs.



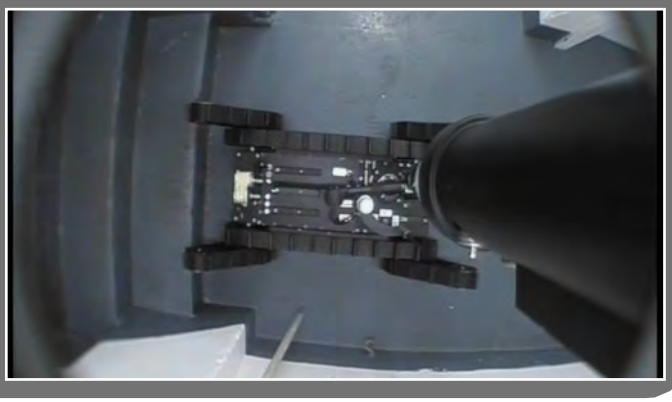
Surveillance Capability

You need to have good situational awareness whilst driving, being able to see the surrounding environment, planning your route through the terrain, avoiding areas that could present a hazard to your mission and overcoming whatever is in Zeus' path.

SURVEILLANC

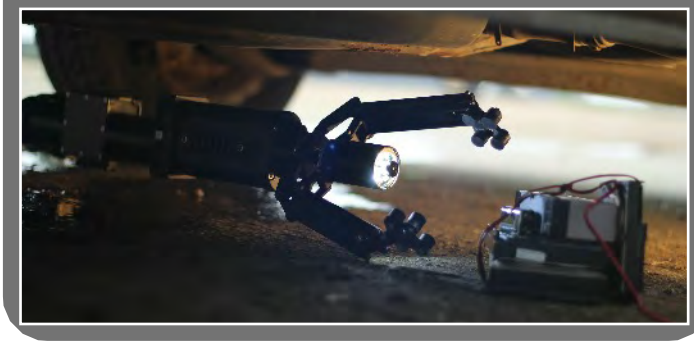
You will also need to be able to search for command wires, trip wires, signs of wire concealment to locate suspect devices before deciding and applying the correct render safe procedure.

You may need to read text on suspect objects, especially in a CBRNe procedure when identifying for example chemicals. Zeus' camera resolution allows recognition of such items at a safe distance, without risking disturbing the area or object under surveillance.



Part of your search procedure may require looking through glass such as on vehicles, and also to see and position correctly your chosen choice of render safe tool both before and after the render safe procedure has been carried out.

You could be working in low light such as under vehicles or furniture, and Zeus' low light capability cameras will aid you here. If the area is very dark, the integrated, variable brightness LED lights will easily flood the required area with sufficient white light, and if you don't want bright lights, you have Infra-Red capability built in as well.



When aiming barrelled disruptors you will need to be able to judge distances accurately for maximum disruptive affect, and Zeus' laser aiming system viewed through the cameras will allow this. Even aiming stand-off disruptors up to 30m away using cameras and no lasers is possible with Zeus' unique and patented capability camera stand-off aiming system

CE CAPABILITY

Afterwards, you will need to be able to see the results and confirm disablement of the device, including identifying components of the device such as wires, detonators and switches.

If you need to record video or take pictures of the camera views, e.g. for evidence collection, Zeus has the ability to do that for all cameras and you can even have various picture in picture set ups so multiple cameras can be viewed at the same time. The control station even has the ability to plug an external monitor in, which allows a bigger viewing area or the ability for other team members to view progress of the task in hand. Video streams can also be passed out via the OCU's Ethernet port to central Command and Control systems.

Zeus has 5 cameras, including forward and rear drive, a pan tilt, a gripper camera and a 5th 'nomad' can be fitted to various locations on the platform, such as on disruptors or to view sensor display. All cameras are wide angle to convey good situational awareness, and have the ability to be zoomed as well.

If you damage a camera and need to replace it, the modular design of Zeus allows you to do that yourself in the field. All cameras are on a quick release system and can be swapped over in less than 30 seconds without the use of a technician. This keep Zeus up and running with the minimum of fuss. Zeus uses a universal camera design, so that front, rear and nomad are the same design and totally interchangeable. This reduces spares inventory and allows for quick field repairs.

Communication Capability

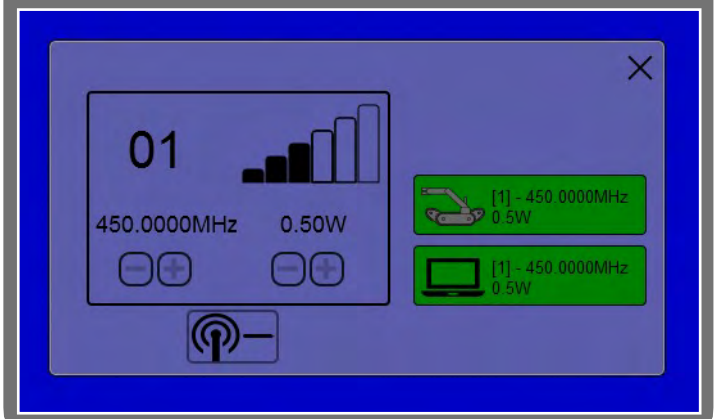
The ability to control UGVs in different terrains including urban is crucial to the success of any mission. Zeus has a number of tools to ensure success. Typically, you will want to work at 100-500m.

COMMUNICATIO

In most situations, you will want to use radio control as this permits the most flexible driving ability and increase manoeuvrability. Zeus has a range of up to 1km and takes advantage of COFDM techniques to ensure excellent video images even in built up areas, inside buildings and tunnels or below ground, such as culverts.

You also need to be confident that the system will not be affected by undesired signals, energy sources, spurious radiation from other transmitters, and natural phenomena. Zeus' design ensures that immunity from interference is maximised.

Local interference can have an effect on radio communication, so Zeus has multiple channels for both data and video radios, which will allow you to move away from any frequencies that may be affected. The ability to change channel and increase the power of the data radio during the mission will also help you extend your range if you are on the limit of distance.



You need your UGV to respond quickly and precisely to driving commands, and Zeus' low radio latency ensures a 'real time' feel to all operator inputs, crucial when carrying out fine controlled movements such as aiming barrelled disruptors.

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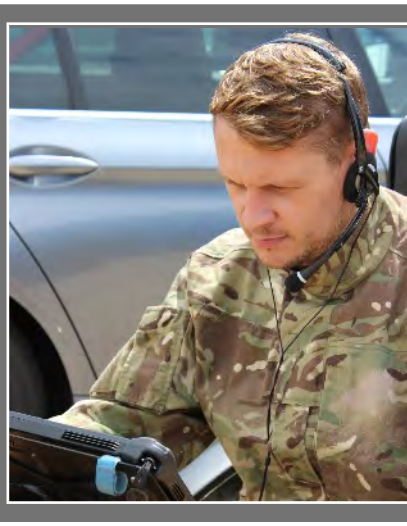
ON CAPABILITY

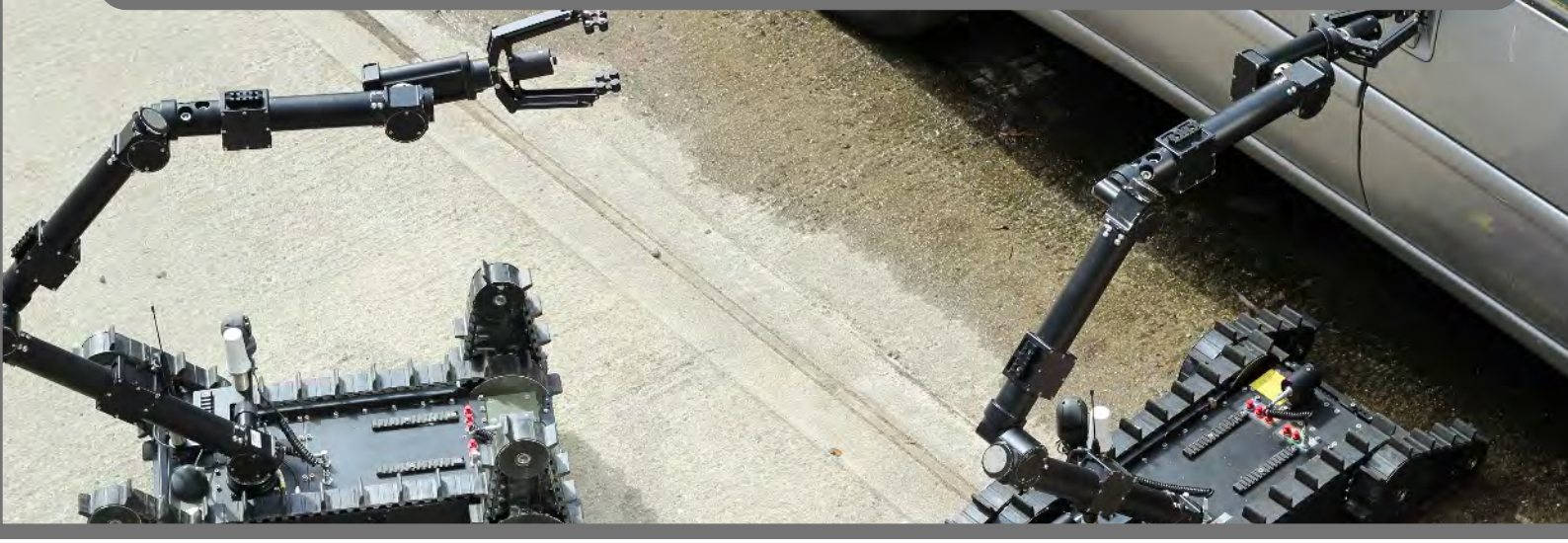
You may be working in parts of the world that need special frequency bands. Zeus can be supplied with various options to suit local radio licence laws or conditions. The modular design of Zeus allows operators to quickly and easily change the communication system to a different frequency band in minutes and in the field with no special tools.

This modular design also allows you to replace your entire communication system if it became damaged. In a matter of minutes this subsystem can be swapped out by the operator and does not require a trained technician. This keeps Zeus up and running and on task.

Sound is an important sense that you don't want to lose working remotely. Being able to hear what is happening remotely at the UGV helps in situational awareness and Zeus's optional 2 way audio system allows not only the operator to hear what is happening but to also to talk to any potential insurgent, including recording it.



You may want to operate multiple UGVs at the same time. Using a second UGV's cameras to look at the UGV on the task can improve situational awareness dramatically. Zeus' multiple channel set up makes this possible, allowing UGVs to work in close proximity of each other without interference.



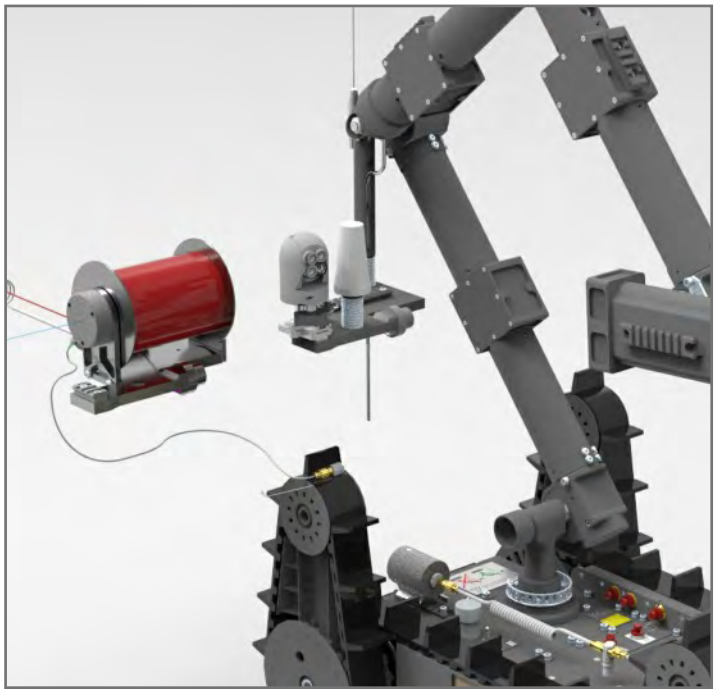
COMMUNICATIO

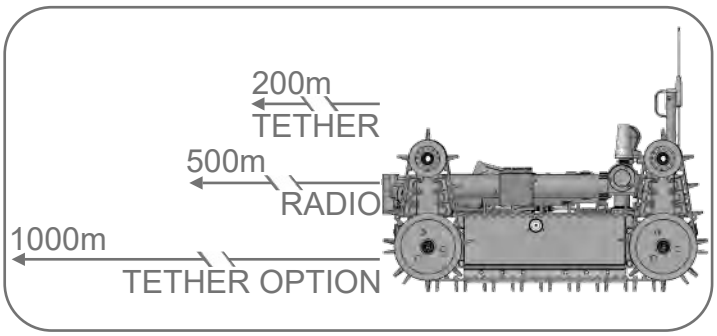
You also need to be confident that an insurgent cannot take control of your UGV. Zeus' data is encrypted to AES128 to eliminate this risk.

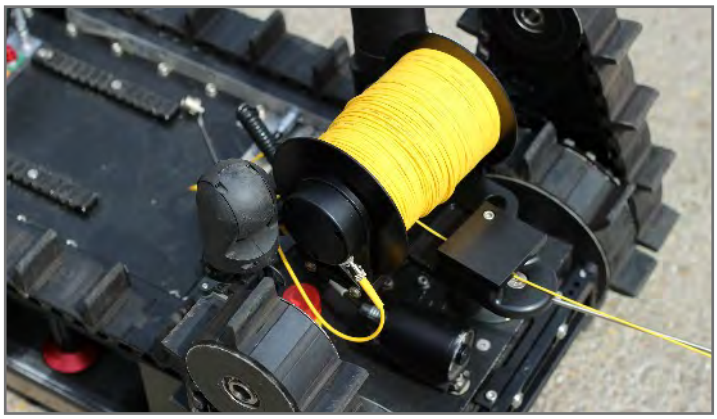
Sometimes, it's just not possible to use a radio link. The terrain may not allow it (such as metal ships which can block radio signals), excessive radio noise or you want to use Electronic Counter Measures (ECM) systems (radio jamming). For these occasions, a fibre optic tether is available.

2 lengths are available. A reusable system of 200m and a single use system which is 1000m long.

The tether system simply mounts on the side of the arm for quick deployment.







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ON CAPABILITY

Operator Control Unit (OCU)

The Operator Control Station needs to be flexible to allow you to work in any location. That could be on a table top, mounted in a vehicle or even moving around to gain the best strategic position. Zeus' ergonomically designed modular OCU allows you to do that. The modular units can be removed from the case and easy positioned in a vehicle. They can even be mounted on a Molle/Osprey vest allowing the operator to move around to find the best location without having to worry about placing the OCU down on a surface.

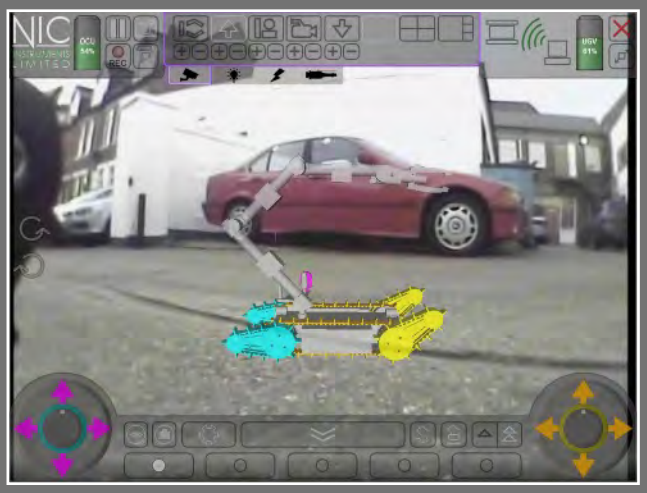
This modular system also allows the operator to replace any modules that maybe damaged quickly and easily. Simply unplug the module in question and swap in a replacement one. The changeover takes minutes, can be done in the field and does not require a trained technician. The main part of the OCU consists of standard ruggedized Windows based tablet, readily available from a number of sources, so it is easy to source in case of damage.

With a quick and simple to learn, highly intuitive touch screen interface, training is minimised and operational success maximised. A simple touch screen control, with a graphic showing the configuration of the UGV at any time, allows you to have an optimum awareness of the current situation. Hardware buttons are eliminated with the touch screen control, allowing software updates to bring in new features without having to replace the OCU. As the software is Windows based, users quickly understand the operating system and can even load additional software onto the OCU for enhanced capability.

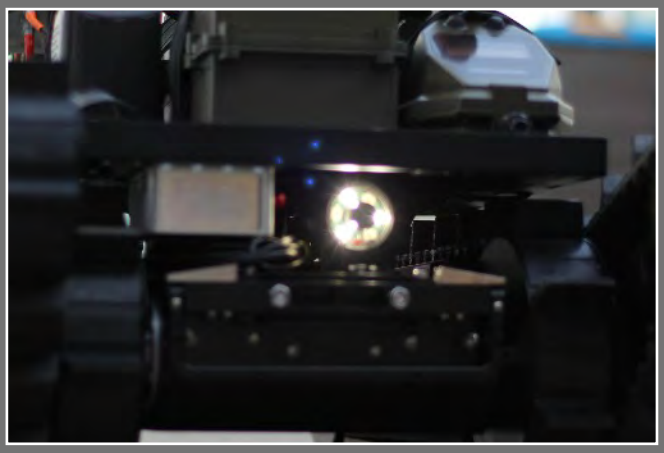
The on-screen graphic does not just show the UGV. Disruptors, CBRNe sensors and a wide range of other additional tools on the UGV can be simulated on screen, again maximising situational awareness.

COMMUNICATIO

Image resolution allows you to search for command wires, trip wires and signs of wire concealment to locate suspect devices and then identify components after a positive action has been taken effectively. You may need to read text on suspect objects, especially in a CBRNe procedure when identifying for example chemicals. Zeus' image resolution allows recognition of such items.



All ambient light conditions can be accommodated by the camera lights, including Infra-Red which are controlled from the OCU.



Picture in picture display allows up to 4 cameras to be viewed at any one time and can be saved to digital media. There is also an auxiliary port to connect additional screen displays, allowing a bigger screen or other members of the team to view progress of the task.

ON CAPABILITY

You need to be able to control and manipulate the arm into complex orientations, maybe during a search procedure or to aim disruptors with sufficient precision to carry out the selected task. Zeus' on screen graphic of the UGV allows you to view in real time its current configuration and adjust it to suit. Complex arm movements are also easily achieved with Zeus' pre-set moves. The operator can select a number of pre-programmed moves such as fully extended and the arm will move automatically. There is even the option for you to save your own pre-set moves, and different operators can have their own saved selection by using the OCU login function. The on screen graphic simulates the selected move before execution so you can verify the arm and gripper are going to do what you expect.

Battery status is a critical factor during a mission, and operators need to know quickly and clearly the current battery levels. Both the UGV and OCU battery levels are displayed on the screen. Additional battery data such as number of recharges, serial number, manufacturer etc. is also available. This additional data is crucial for battery management programs, and allows you to go on task knowing that your batteries will not only recharge and hold their charge correctly but also will do it repeatedly.

OFF
ON
TURN ON
OFF
ON
TURN OFF

Power Capability

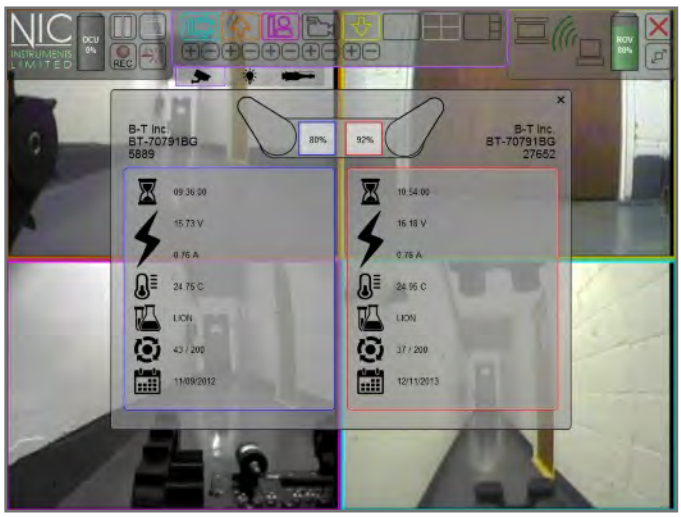
Mission duration is a critical factor and Zeus' 2-4 hour mission duration delivers. You need to be confident that the battery will survive the mission and give you sufficient feedback to replace or recharge batteries before it is too late. A UGV stuck in an uncleared area gives 2 problems. Loss of remote capability and also having to send an operator to retrieve it.

POWER CA

You also need standard batteries that can be sourced locally. Specialist batteries, only available from the UGV manufacturer create a severe logistics problem. High cost, stock holding all add to the problem. Zeus uses the standard 2590 Lithium Ion format battery available form a number of manufacturers. You also don't want multiple chargers due to different batteries for the UGV and the OCU. On Zeus, both the UGV and OCU use the same battery and therefore the same charger.

You need powerful lightweight batteries, and lithium Ion currently offers the best power to weight ratio & availability. The charger supplied with Zeus can charge 2 batteries at once, and can also carry out battery conditioning, crucial to good battery management. Local voltages present no problems as the charger can work at 220V/110V and 24V/12V.

Depending on the battery manufacturer, each battery has a 5 bar LCD display showing current battery capacity. This gives a quick visual reference. Batteries with the SMBUS interface will also send their battery data status to the OCU when installed in the UGV. Battery status of both the UGV and OCU are displayed on the OCU. Additional battery data such as number of recharges, serial number, manufacturer etc. is also available. This additional data is crucial for battery management programs, and allows you to go on task knowing that your batteries will not only recharge and hold their charge correctly but also will do it repeatedly.



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APABILITY

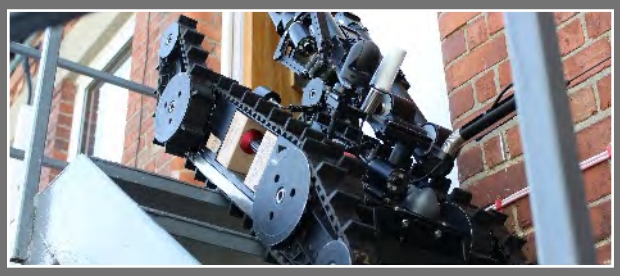
Battery changeover is also very fast, in less than 2 minutes and does not require any tools. Battery changeover can be done quickly in the field, with no need to return to a controlled point. They are held externally, with no covers or access hatches to open. Once inserted, they form a watertight seal. Their low position in the chassis helps with stability as it keeps the centre of gravity low. There is also no cable snagging risk as the 2590 batteries are inserted directly into the UGV or OCU without using cables. Risk of disconnection, for example due to vibration, is eliminated due to their secured insertion method.

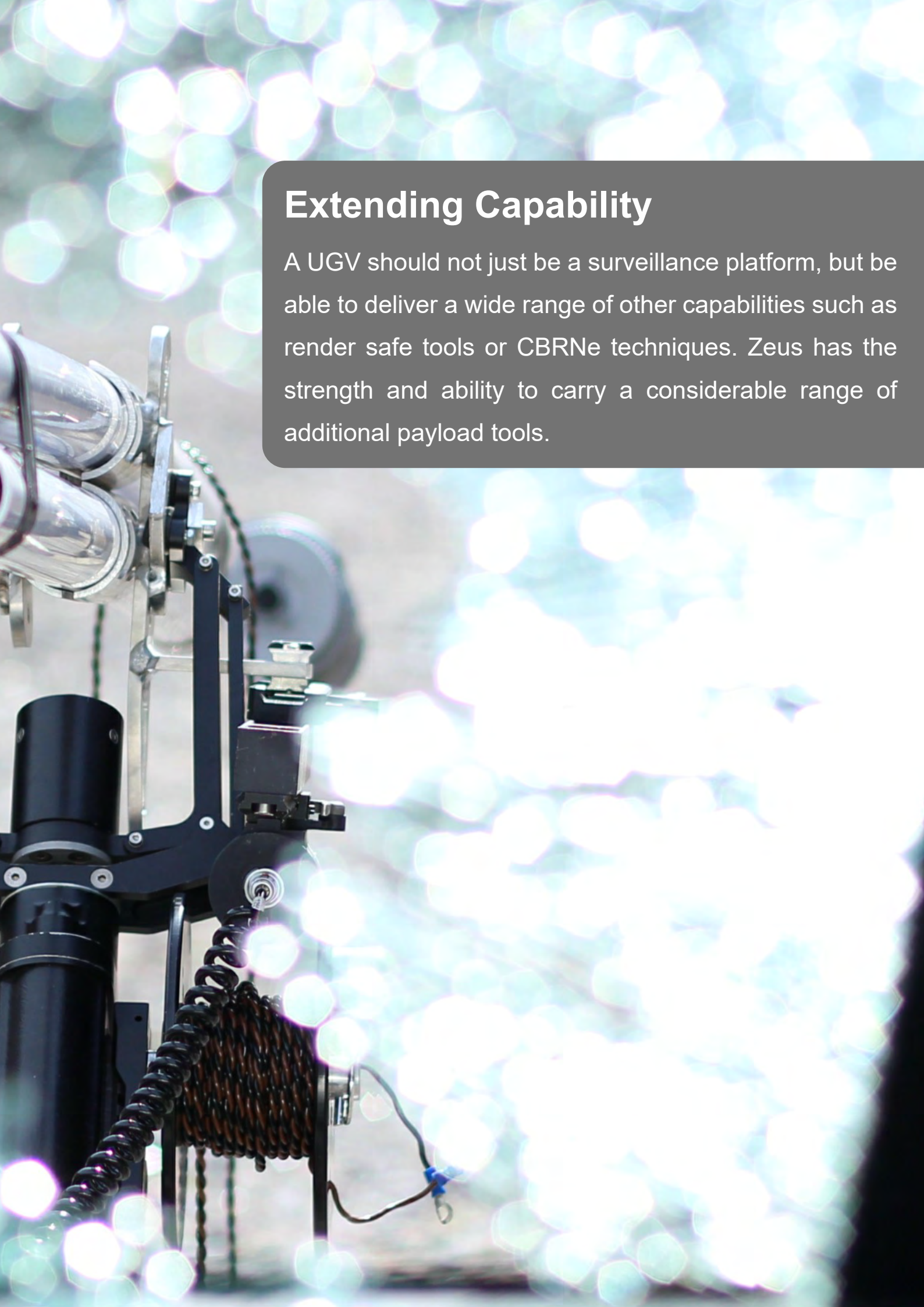
Should batteries become low during a mission, a warning is sent to the operator to bring the UGV back to a safe point. Once the warning is activated, Zeus can still travel at least 500m ensuring it can be brought back to a safe place to change the battery before communication is lost. The OCU has the same low battery warning system enabling the OCU battery to be changed at a convenient point during the mission rather than at a critical point.

Electrical protection is ensured through the batteries own electrical protection system protection and Zeus' protection systems. This ensures that no electrical parts can fail due to electrical problems such as current surge.

If you need to power 3rd party equipment, Zeus has waterproof 12v and 24v on board power supplies ready to deliver the power you need.

Safety is paramount and Zeus' low operating voltage of 24V ensures this. A physical emergency stop is fitted to the UGV and it is also possible to send an emergency stop signal from the OCU to the UGV which will instantly immobilise the UGV by physically disconnecting the batteries. Cleaning and decontamination of batteries is simple due to their sealed design.





Extending Capability

A UGV should not just be a surveillance platform, but be able to deliver a wide range of other capabilities such as render safe tools or CBRNe techniques. Zeus has the strength and ability to carry a considerable range of additional payload tools.

EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

DISRUPTORS
BARRELLED DISRUPTORS

There are many different types of barrelled disruptors on the market which can make having all required mounting accessories impossible, not to mention the knowledge of their use. You might have different systems from different manufacturers and need to hold them all. You need to mount & dismount them quickly and this can take minutes, perhaps unacceptable on a time critical mission. With Zeus it is possible to fully prepare the disruptor prior to mounting, and then fit in seconds, just prior to start of the mission.

Zeus is the first UGV to have a fully universal disruptor mounting system capable of holding the following systems:

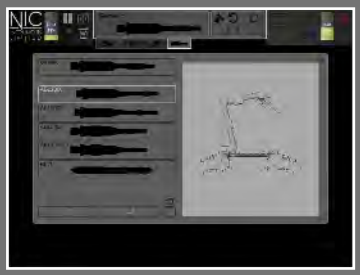
- Chemring
  - RE70
  - RE50
  - RE12
- AB Precision
  - ABL3000
  - ABL3000L
  - ABL2000
  - ABL2000L
  - ABL1000
- Countermeasure Solutions
  - Vulkan
  - Viper
- CTS Canada
  - Lance
- PropArms
  - 12.5mm
  - 20mm
  - 29mm Recoilless
- Generic
  - Pig Stick
  - HotRod

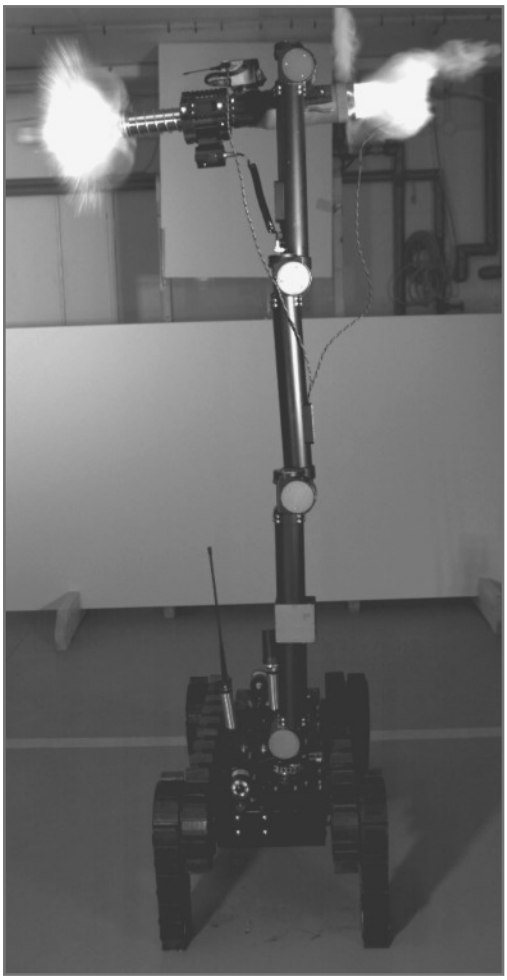
Zeus' unique disruptor mounting system allows you to maintain the claw on the end of the arm. This maintains and maximises your capability.

CAPABILITY

You need to position and aim disruptors quickly and accurately. Zeus' long and dexterous arm can reach up to 2m in height to fire disruptors horizontally for example into airplane overhead lockers. Viewing the potential target and the barrel of the disruptor is possible with the 5th camera that can be mounted onto the universal disruptor holder. The disruptor can also be viewed through Zeus' other cameras, including for example the pan tilt, to maximise your situational awareness.

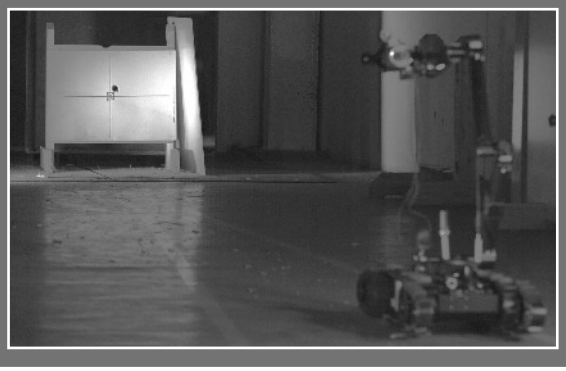
Zeus also has the ability to visually display the mounted disruptor on the OCU screen graphic. This helps the operator gain an understanding of how the mounted disruptor is orientated on the UGV. A unique feature is the 'blast back cylinder' which shows the path of the discharged effluent from the rear of recoilless disruptors. This helps the operator ascertain whether that rearwards discharge presents a threat to either the surrounding environment or the UGV.





Stand-off firing is recognised as one of the hardest tasks to achieve when firing a disruptor from a UGV. Many systems try to use high powered lasers, but not only can these be hard to see on most terrains (especially outdoors) but can present safety risk to the operator.

Zeus has a unique and patented stand-off system that uses twin cameras to aim. Accuracy of up to +/-5mm can be achieved over a 30m range without the use of lasers. No other UGV on the market can achieve the consistency and accuracy of long range stand-off that Zeus can.



EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

DISRUPTORS USER-FILLED EXPLOSIVE CHARGES

User filled charges such as the Alford system are an essential tool in the arsenal of Render Safe Procedures.

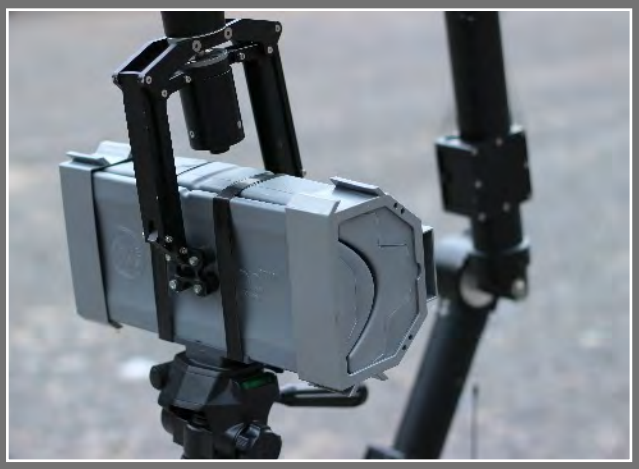
Placing charges is easy with the gripper, long and dextrous arm and multiple camera set up. You need to deploy multiple Alford systems with a single UGV approach and this can be achieved with the range of simple tools.

'The Twin Pole' will allow the deployment of a window breaker and water bottle charge in one approach. The double pole design maximises rigidity during deployment using low cost, easily replaceable house hold plastic pipe. 'The Twin Pole' can even be left on target with the mineral water bottle and the UGV retracted to a safe distance.

The DemiMod and MiniMod are easily deployed with 'The Twin Pole'.

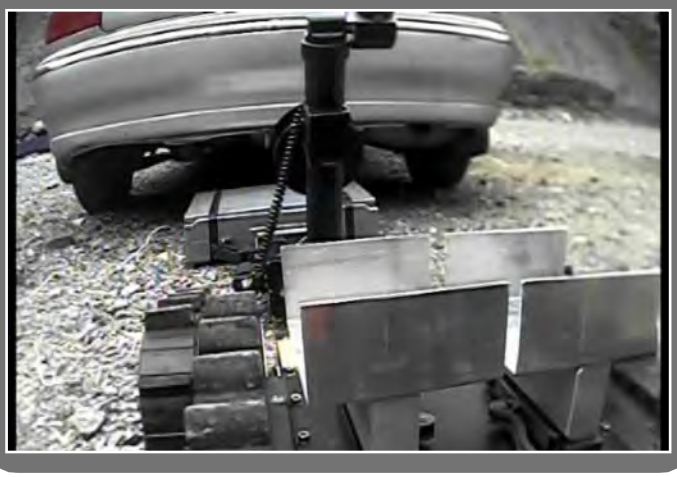
CAPABILITY

MajorMod presents no problems due to Zeus' strong arm, which simply places MajorMod using its own stand. No special tools, apart from a piece of rope are required.



BootBanger, a very heavy tool, also presents no problems for Zeus. Delivered on the UGV chassis, held in a simple bracket, once on target, Zeus' strong arm lifts and positions BootBanger into place.

Initiation can be by single use disposable receiver, or utilising the light weight firing cable reel mounted onto the side of Zeus' arm.



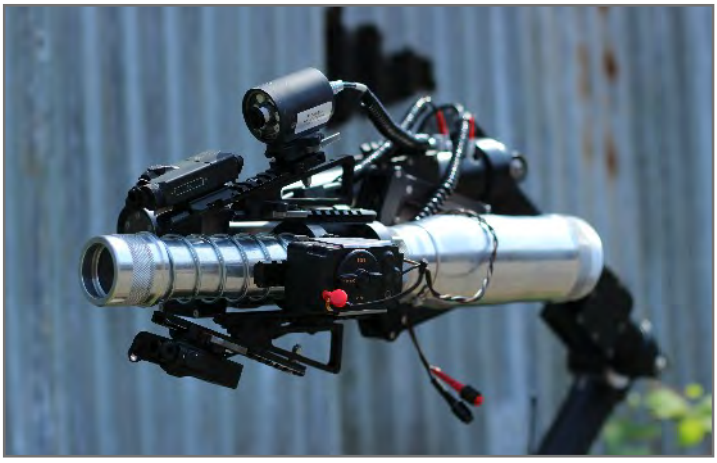
EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

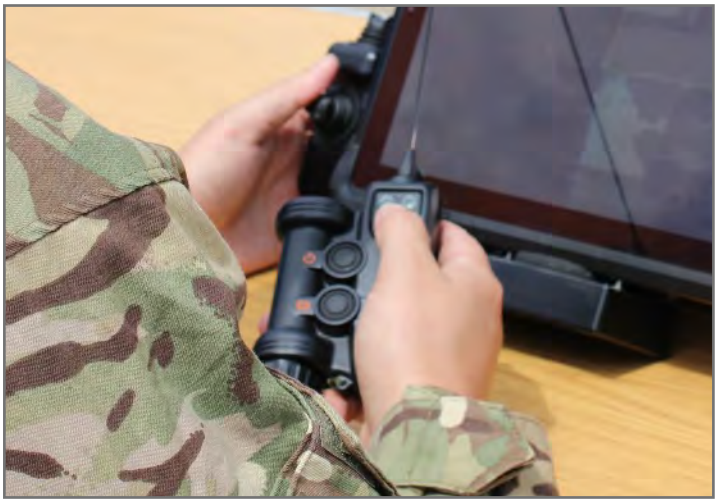
AUXILIARY TOOLS



Firing or initiating EOD tools is a crucial task. 100% reliability and safety are prerequisite. You may already have in-service proved, tested and evaluated firing systems but the introduction of a new UGV could bring yet another 'unknown' firing system into your service. This is not the case with Zeus. Zeus takes your existing firing system and simply clips it onto the UGV.

Firing systems, due to their high levels of safety are extremely expensive, but using your existing system means you are not paying for that capability twice. Reduced training is an immediate benefit as your teams will not have to learn to use another firing system and yet another advantage is that should your firing system fail for any reason, you can simply unclip it and change it within seconds. Your UGV is then back up and running, repaired by an operator in the field and not a technician in a workshop.

CAPABILITY



If you do not have an in service firing system already, of course there is the option to have one supplied with Zeus. Various options are available including 1, 2 & 4 channel systems for firing multiple tools. The firing systems supplied with Zeus are capable of firing tools either individually or simultaneously. Of course, they can also be unclipped in seconds and used as an independent firing system for your other non-UGV operations.

If your country of operation has specific laws governing firing systems, a system that already meets those laws can be supplied. In addition reusable hard wire or single use wire firing cable system are available.

EXTENDING

RENDER SAFE CAPABILITY

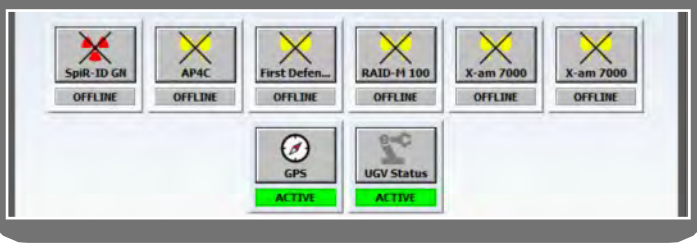
FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

Your area of operation may be CBRNe, which brings its own unique set of requirements. Each CBRNe incident will be unique and a UGV platform that can integrate a wide range of sensing capability is essential.

You will be able to reduce the risk to operators by sending in Zeus, which can carry out visual assessment of the suspect area and then deploy the required sensors to report back in real time information about the incident contamination, and then finally, if required remotely deploy any mitigation or containment systems. Once data about the potential risk is obtained from the sensors mounted on Zeus, a prediction can be made about the potential hazardous area and actions taken to make safe the area or evaluate as required.



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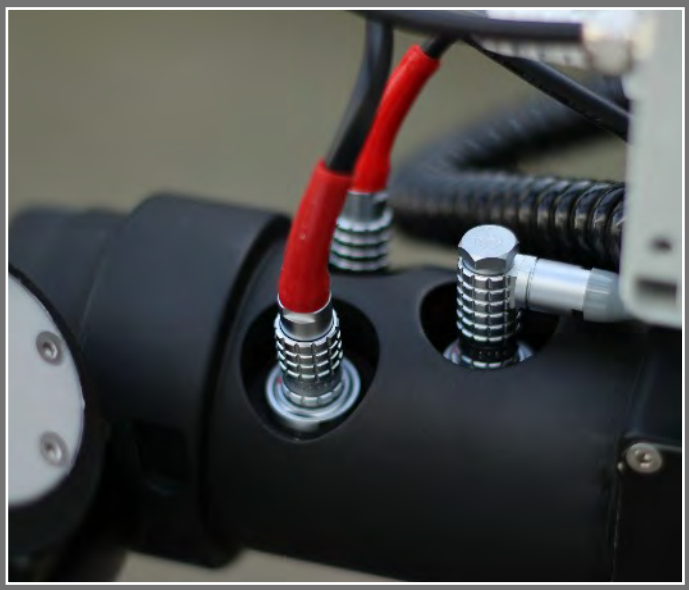
CAPABILITY

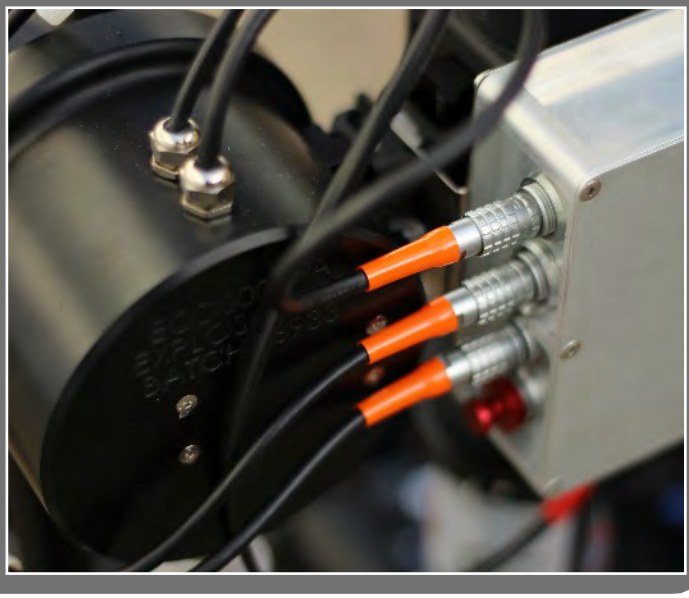
Virtually any sensors may be fitted to Zeus using its universal equipment mount. This mount is not sensor specific, and can accept many different shapes and sizes of sensor.

You may have a sensor that needs to approach a suspect material, and these can be mounted on the manipulator equipment mount at the end of the arm. This allows a sensor to be carefully positioned using cameras and if necessary aiming lasers.



But what about sensor data? Again, no problem for Zeus. As long as the sensor has a data port and can output data, Zeus can accept a wide range of data transfer protocols such as RS232, RS422, RS485 and USB to name but a few and transfer the sensor data back in real time to the OCU.

You may have multiple sensors that need to be mounted, and again this is easily handled by Zeus. There are 2 data ports on the chassis, but if more than 2 sensors are required, the data port hub may be used expanding the number of ports to 4. As there are 2 data ports on the chassis, the application of 2 hubs expands this to 8 available data ports. Hubs can be chassis mounted or arm mounted, dependant on which is the most suitable location for mounted sensors.



EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

If you use sorbent or Tenax tube sampling, then Zeus has an optional tube sampling system that can be mounted either on the arm for point detection or on the chassis for general sampling.

To avoid tube saturation and break through, a twin tube system is available with 1 tube sampling at a very low rate and the other at a very high rate. If there are very low concentrations of contaminant the high rate sampling tube will be able to take an adequate reading, and if there are very high levels of contaminant the low rate sampling tube will take an adequate reading without the risk of breakthrough. All setting including sampling rate and time may be controlled via the OCU.

Critical data from the sensors is then sent back to the OCU, and can either be displayed on the OCU screen or passed out to a central command and control system via the OCU's Ethernet port.

Sensors may also be controlled via the UGV's OCU carrying out commands such as switch on/off or changing settings.

For scenarios where Zeus may encounter an explosive environment, an explosive gas detector is available as an option. This will detect if Zeus has entered an explosive atmosphere and report a warning back to the operator. The operator then has the choice to either fully shutdown Zeus which will completely disconnect the batteries and remove any risk of explosion due to electrical spark, or continue with the mission. If the user choses to continue with the mission, the warning will remain active until the explosive risk has gone away.

CAPABILITY

EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

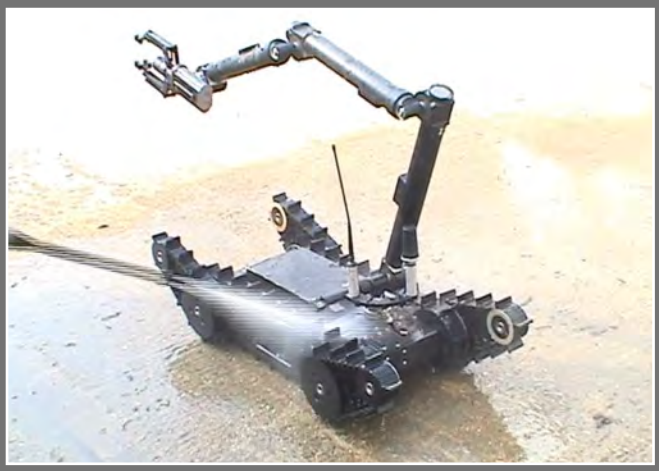
CBRNe

AUXILIARY TOOLS

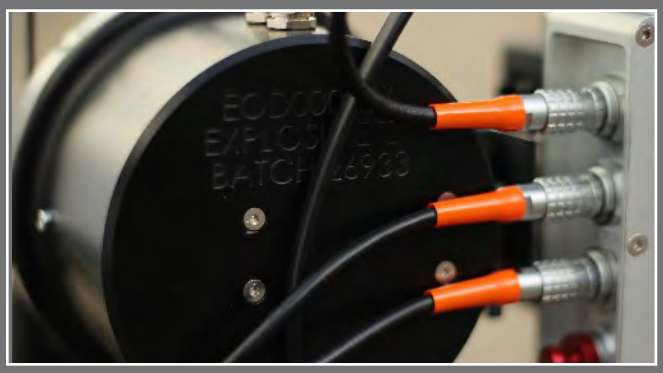
CLEANING AND DECONTAMINATION

Decontamination with common and widespread techniques is a critical capability of your UGV and Zeus was designed from the ground up with decontamination as a core capability.

Zeus is waterproof to IP65. This means it can be washed down without the risk of any liquids causing damage. It can even be cleaned with a pressure washer following strict guidelines.



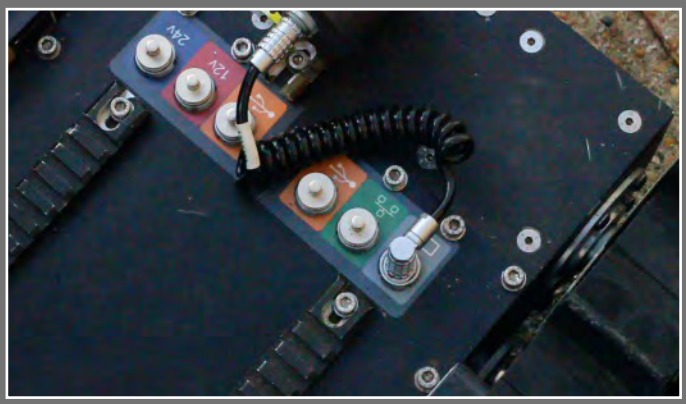
Water entering sockets or connectors is not a problem as they are all waterproof when mated or fitted with a blanking cap.



Chemical resistance is also a key benefit as Zeus is manufactured from chemical resisting materials and finishes. A Chemical Agent Resisting Coating (CARC) paint is applied to all exterior surfaces, and any exposed metal parts are either stainless steel or titanium which are highly resistant to all forms of decontamination and many chemicals.
Plastics and rubber used in the construction have been carefully chosen to ensure resistant to a wide range of decontamination processes and chemicals.

CAPABILITY

The modular construction of Zeus allows it to be dismantled for deeper, more through decontamination. A phased system of decontamination is undertaken, removing modules at each level, and techniques to ensure that each module remains watertight whilst it is decontaminated separately. But being resistant to decontamination is not the only aspect a CBRNe UGV must be capable of. Strict design guidelines (as detailed in NATO Stanag AEP7) have been followed to ensure there are no sharp edges in the design that could cut or tear chemical resistant gloves, the ability to operate Zeus in full CBRNe clothing including switching on and off, changing batteries and plugging sensors in have also all been carefully analysed.



Chemical resistance is a critical factor for a CBRNe UGV. Not only have Zeus' materials and finishes been chosen to resist decontamination but also their chemical resistance has been considered. It would be impossible to design a system that was 100% resistant to all chemicals at all concentrations and evaluated temperatures. However, by using NATO Stanag AEP 7's 9 representative Toxic Industrial Chemicals (TIC), it is possible to determine which TICs and at what concentrations will cause damage and which Zeus is resistant to. Please contact us for more detailed information.

EXTENDING

RENDER SAFE CAPABILITY

FIRING CIRCUITS

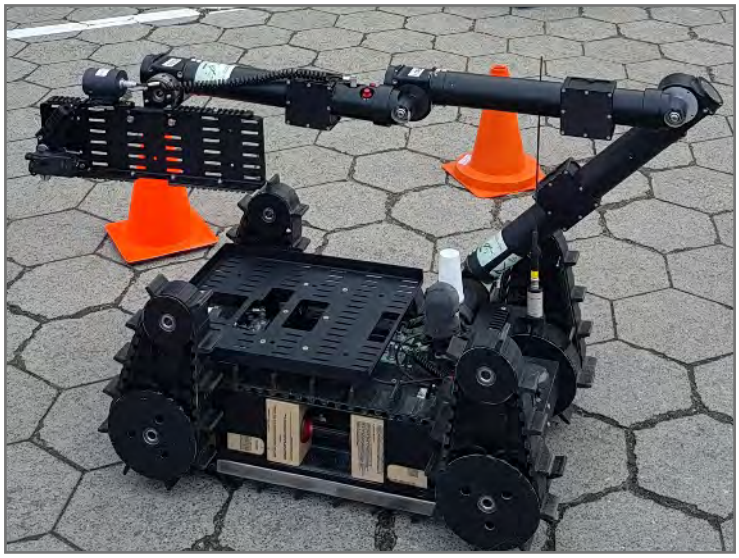
CBRNe

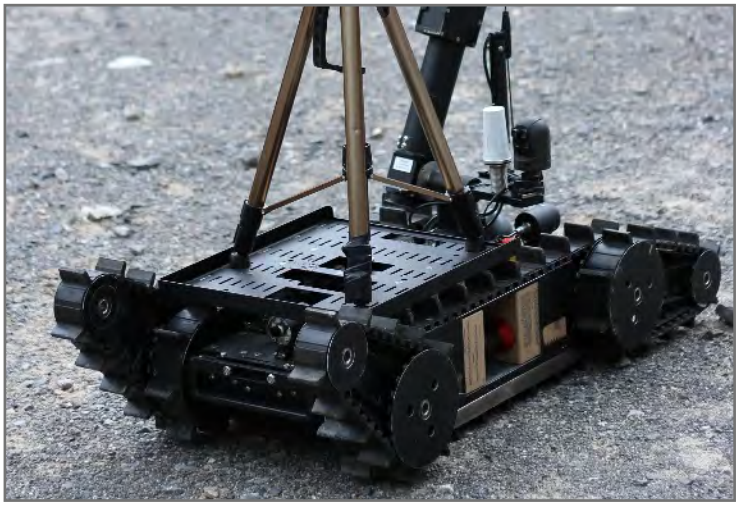
AUXILIARY TOOLS

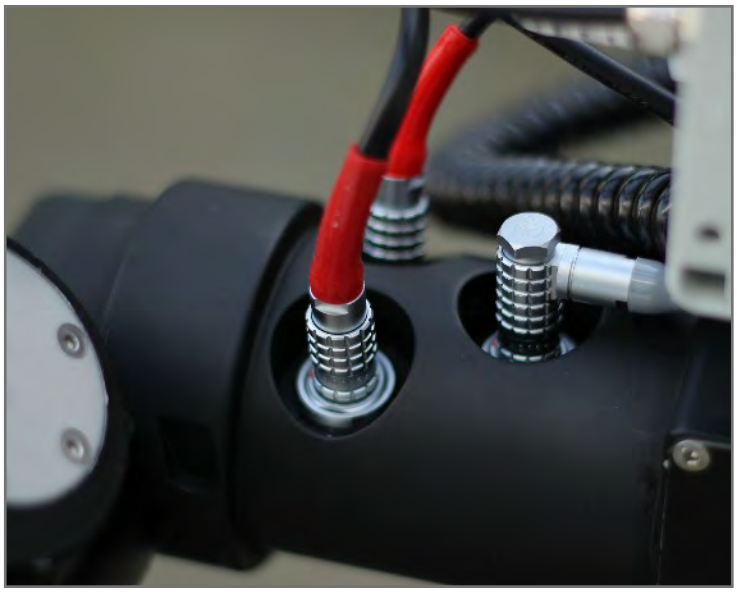
You need a system that is future proof, one that can expand as your requirements change. Tomorrow's requirements will be different to today's requirements and a high value investment must be able to adapt to new threats. Zeus has a number of ways to integrate new capabilities.

The universal equipment mount plates can hold a wide range of differing tools. A chassis mounted plate and an end of arm mounted plate allow a range of tools to be mounted. Point detection equipment is especially suitable for mounting on the end of the arm.

If you need additional power, auxiliary power supplies (12v and 24v) exist at strategic locations around the UGV.







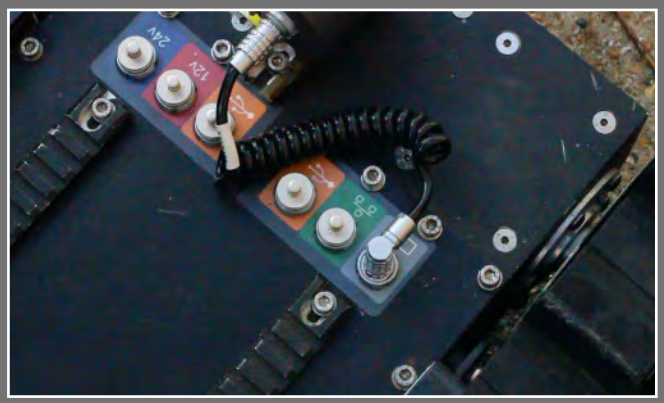
CAPABILITY

EQUIPMENT MOUNT PLATES
SHOTGUN
SENSOR INTEGRATION
X-RAY SYSTEMS
BI DIRECTIONAL AUDIO
GLOBAL POSITIONING SYSTEM (GPS)

If you need to communicate with your additional tools, such as CBRNe sensors, data ports also are located on the chassis that can communicate with a wide range of protocols without the need to fit additional radios or tethers. Not only can you control your equipment, but data may be passed out and back to the OCU using the UGV's communication system. Once the data is back at the OCU it may be logged or transferred out to a central command and control system.

If you need multiple additional tools, a USB 4-port hub is available to increase the number of data ports.

Are you concerned about the wrong plug being fitted to the wrong socket causing damage? That is not an issue with Zeus because all plugs and sockets have a unique key making it impossible to fit the wrong plug into the wrong socket. Coupled with colour coding, you can quickly identify which connectors go where and not worry about the risk of damage should an operator try to put the wrong plug in a socket.



EXTENDING

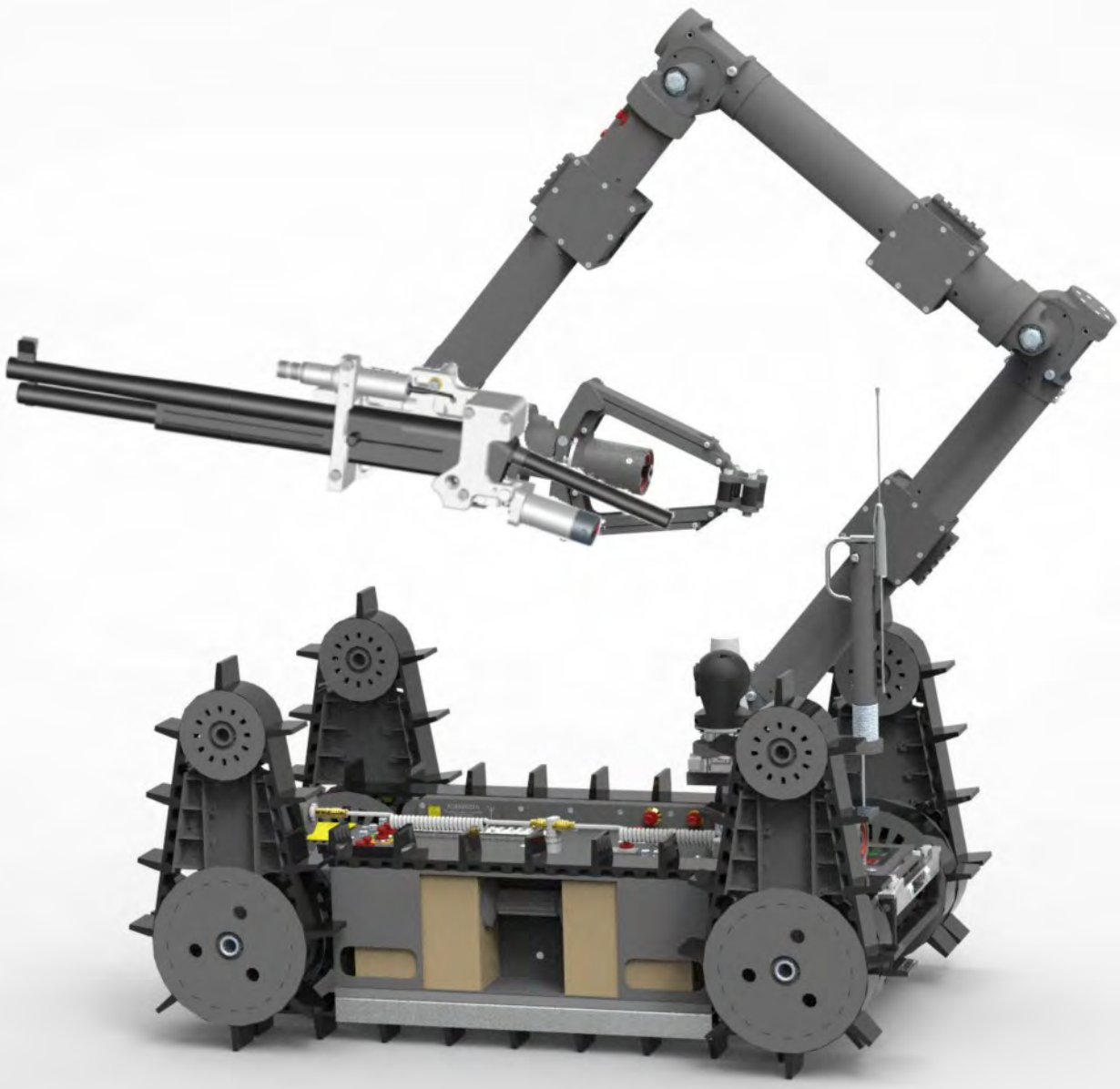
RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

The 12 gauge Benelli M4 Super 90 shotgun may be mounted and fired on Zeus for breaching tasks such as blowing locks off doors and for rendering safe IEDs. The trigger is actuated via the modular firing system which also allows the weapon to reload itself.



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CAPABILITY

EQUIPMENT MOUNT PLATES

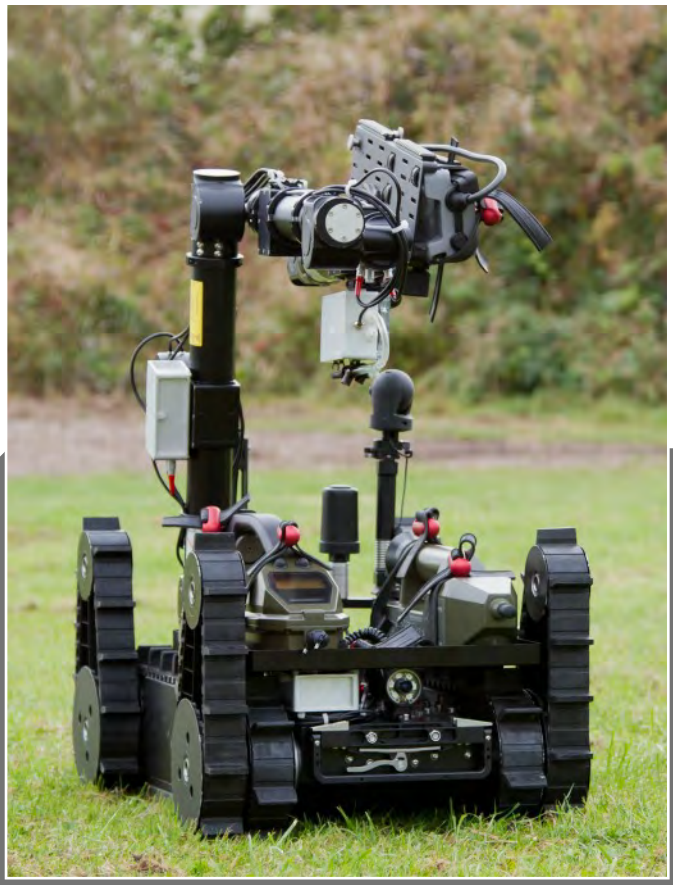
SHOTGUN

SENSOR INTEGRATION

X-RAY SYSTEMS

BI DIRECTIONAL AUDIO

GLOBAL POSITIONING SYSTEM (GPS)



As well as the detailed CBRNe application of sensors, a wide range of other sensors may be mounted on Zeus. In fact, any sensor which has the ability to be remotely controlled via a communications port may be mounted on Zeus and controller by the OCU. Contact us for more information on integrating sensors to suit your specific application.

Zeus has a universal X ray holder system that can hold a wide range of X ray generators and plates from many different manufacturers. X Ray generators may be either held in the universal frame or chassis mounted for optimum performance.

EXTENDING

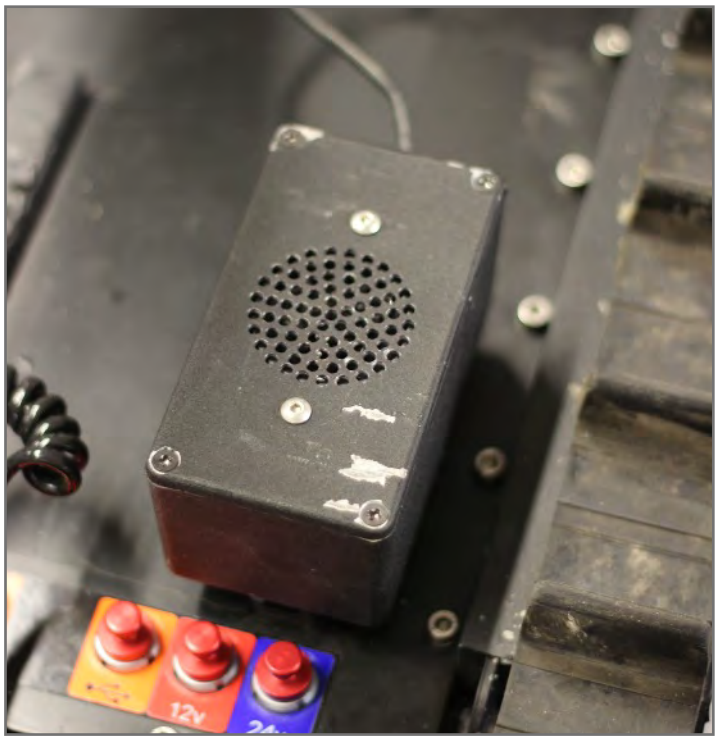
RENDER SAFE CAPABILITY

FIRING CIRCUITS

CBRNe

AUXILIARY TOOLS

Sound is an important sense that you don't want to lose working remotely. Being able to hear what is happening remotely at the UGV helps in situational awareness and Zeus's 2 optional 2 way audio system allows not only the operator to hear what is happening but to also to talk to any potential insurgent, including recording it.



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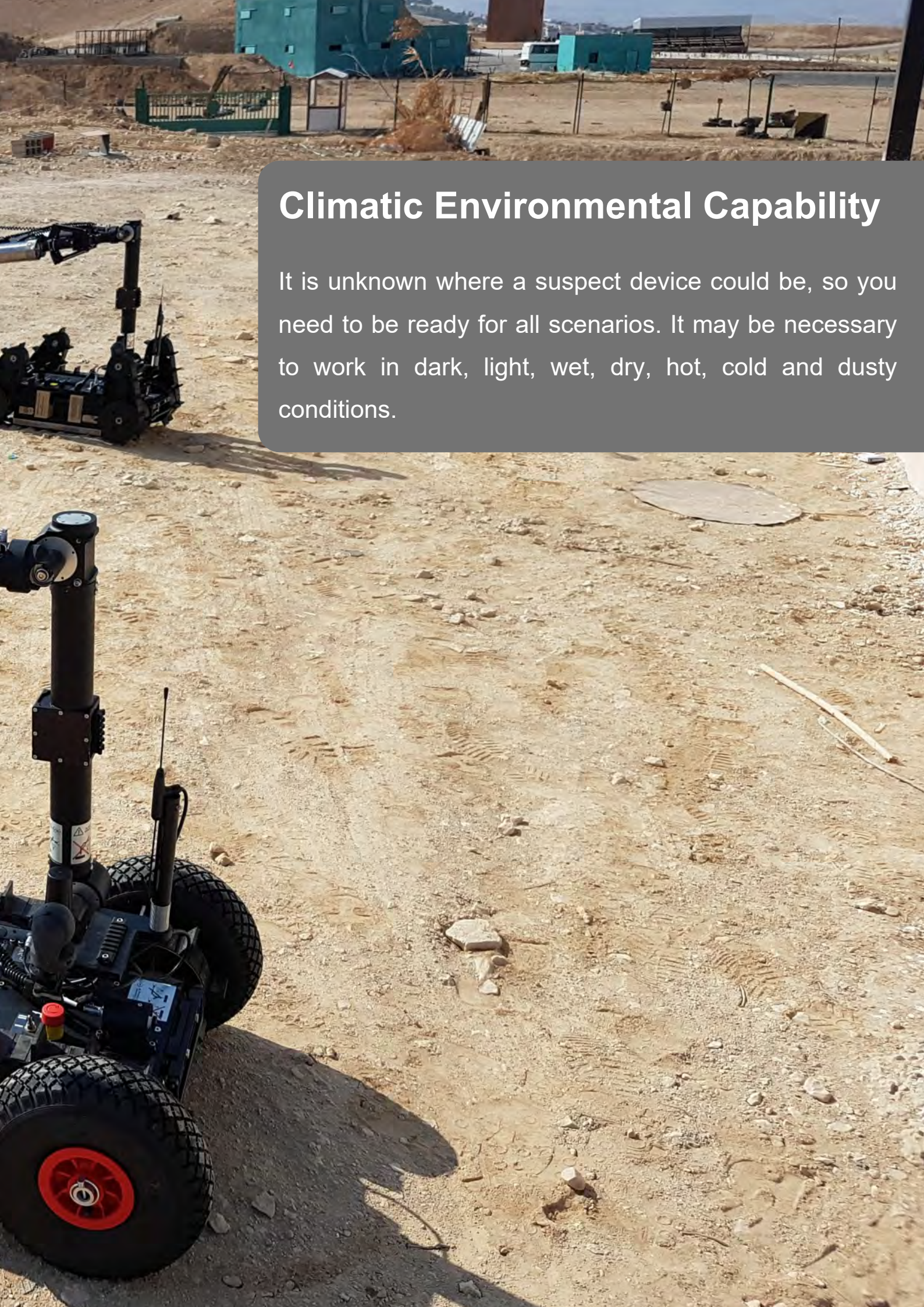
CAPABILITY

Zeus has an optional GPS system, allowing the UGV to report its position back to the OCU. This can then be mapped using various systems. Contact us for more information on integrating GPS to suit your specific application.



Climatic Environmental Capability

It is unknown where a suspect device could be, so you need to be ready for all scenarios. It may be necessary to work in dark, light, wet, dry, hot, cold and dusty conditions.

CLIMATIC ENVIRONM

LIGHTING

TEMPERATURE RESISTANCE

SAND AND DUST RESISTANCE

Normal Light Conditions, Daylight

Zeus has 5 colour cameras that work in all normal light levels.

Low Light Conditions

If you progress into a darker space, Zeus' cameras automatically switch to low light mode without the need to activate the lights.

Very Low Light Conditions

If you proceed into a very dark space, then Zeus's cameras integrated bright white LED lights can be switched on, varying their intensity if required.

If you don't want bright lights, Zeus has Infra-Red lights that can be used instead.

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MENTAL CAPABILITY

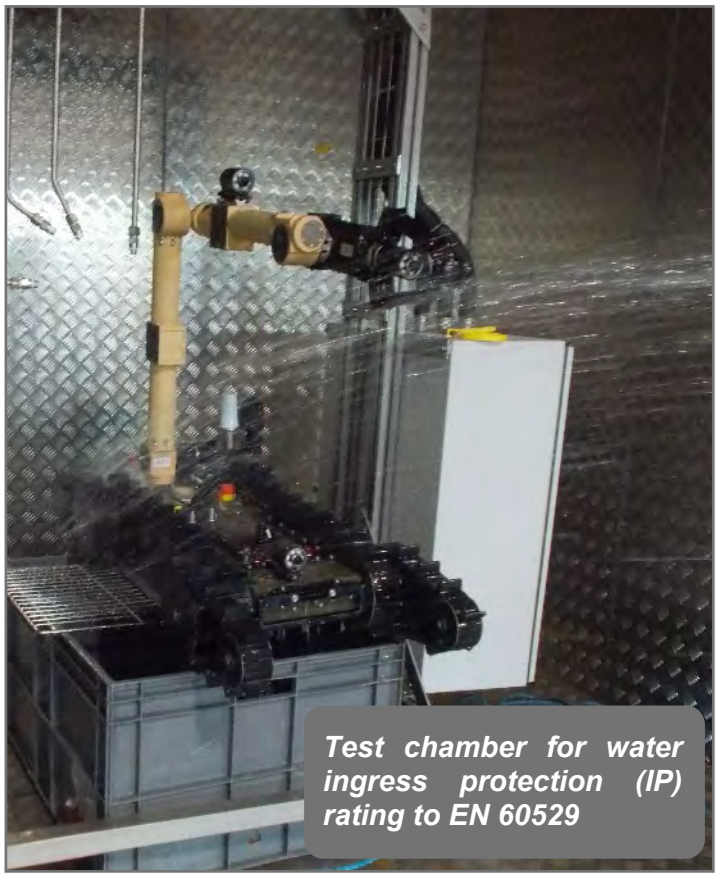
WATER RESISTANCE

CHEMICAL RESISTANCE

EXPLOSIVE ENVIRONMENTS

Heavy rain, damp or very humid conditions should not stop your ability to use your UGV. Zeus is fully water proof to IP65 and can cope with the most arduous and sustained wet conditions, including hosing down and even the use of a pressure washer.

But resistance to rain and humidity are not the only reasons to need a waterproof UGV. You will need to clean your UGV and be confident that the cleaning process will not cause any damage. Zeus' ruggedised design allows cleaning with hot and cold low pressure water, steam, and detergents, without wear, deterioration, or damage.



Test chamber for water ingress protection (IP) rating to EN 60529

CLIMATIC ENVIRONM

LIGHTING

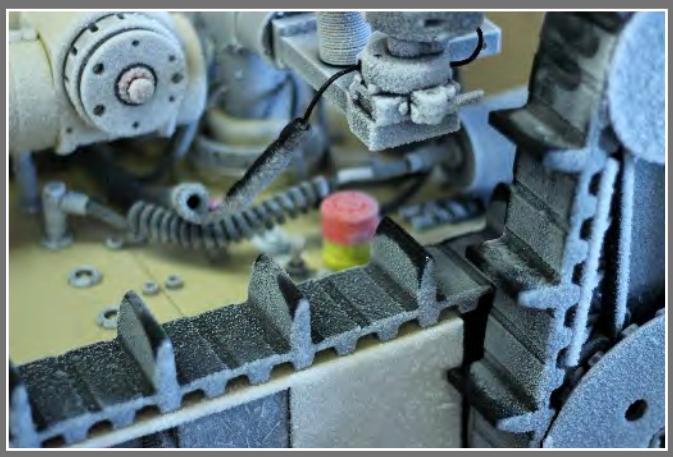
TEMPERATURE RESISTANCE

SAND AND DUST RESISTANCE

Temperatures vary widely around the world, and you need to be sure that your UGV will work when it's very cold or very hot. Some areas of Eastern Europe for example can vary in temperature throughout the year from -32ºC to +49ºC. Zeus' ruggedised design has been carefully considered for these temperature extremes, and independently tested for the extremes of temperature. You can be sure that these environments will not limit your mission.

Test chamber for temperature resistance to EN 60068

But what about hot beating down sun? Heat is not the only problem in hot climates. An often over looked climatic condition is solar radiation which can even occur on cold days. Bright sunlight, even on cold days, can generate temperature extremes and these must also be catered for. Zeus has been designed to cope with this solar radiation as well as simply hot conditions.



MENTAL CAPABILITY

WATER RESISTANCE

CHEMICAL RESISTANCE

EXPLOSIVE ENVIRONMENTS

Corrosion, often enhanced by extreme temperatures and heat must not be a restricting factor. Although a UGV may be able to resist heat and water, over a period of time this can lead to corrosion. Zeus is manufactured from corrosion resistant materials and finishes including a chemical agent resisting paint coating (CARC), stainless steel and titanium, all materials highly resistant to long term corrosion including in salt laden atmospheres such as harbours and quays.

But resistant to climatic corrosion may not be your only concern. You may need resistance to chemicals as well. Yet again, Zeus' choice of paint finishes and materials offers maximum protection against chemical attack.

Please contact us for more detailed information of chemical resistance.

CLIMATIC ENVIRONM

LIGHTING

TEMPERATURE RESISTANCE

SAND AND DUST RESISTANCE

Test chamber for sand & dust resistance to EN 60529

Sand, dust and particles, becoming abrasive due to heavy winds, and over a sustained period, can present a significant risk to the operation of your UGV. Zeus' ruggedised design has been optimised to cope with these harsh environments and independently tested to IP65 proving it can withstand these conditions.

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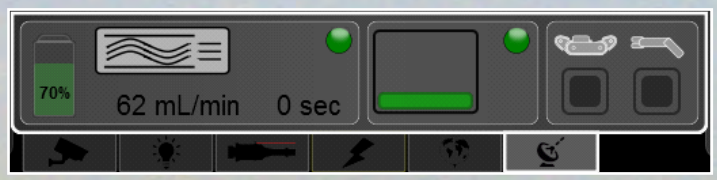
MENTAL CAPABILITY

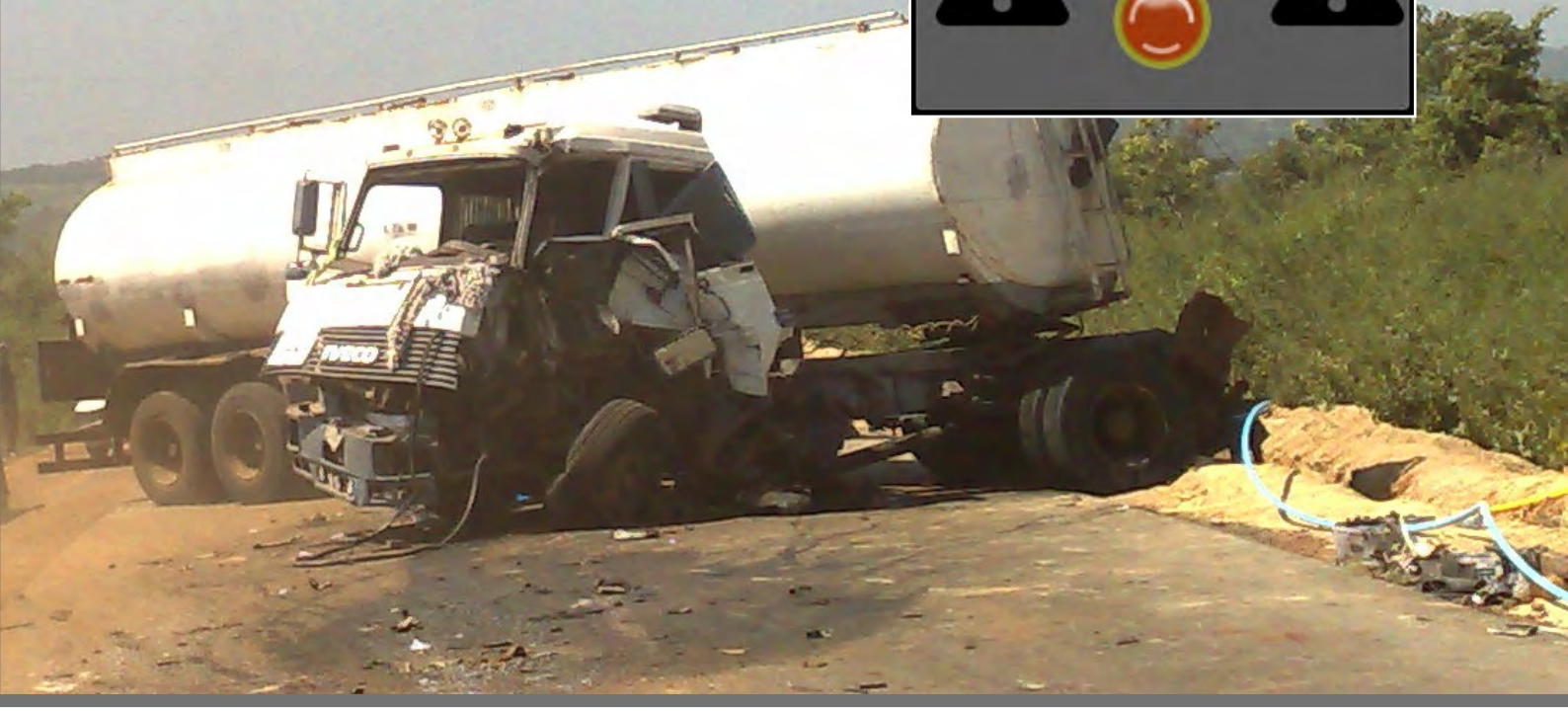
WATER RESISTANCE

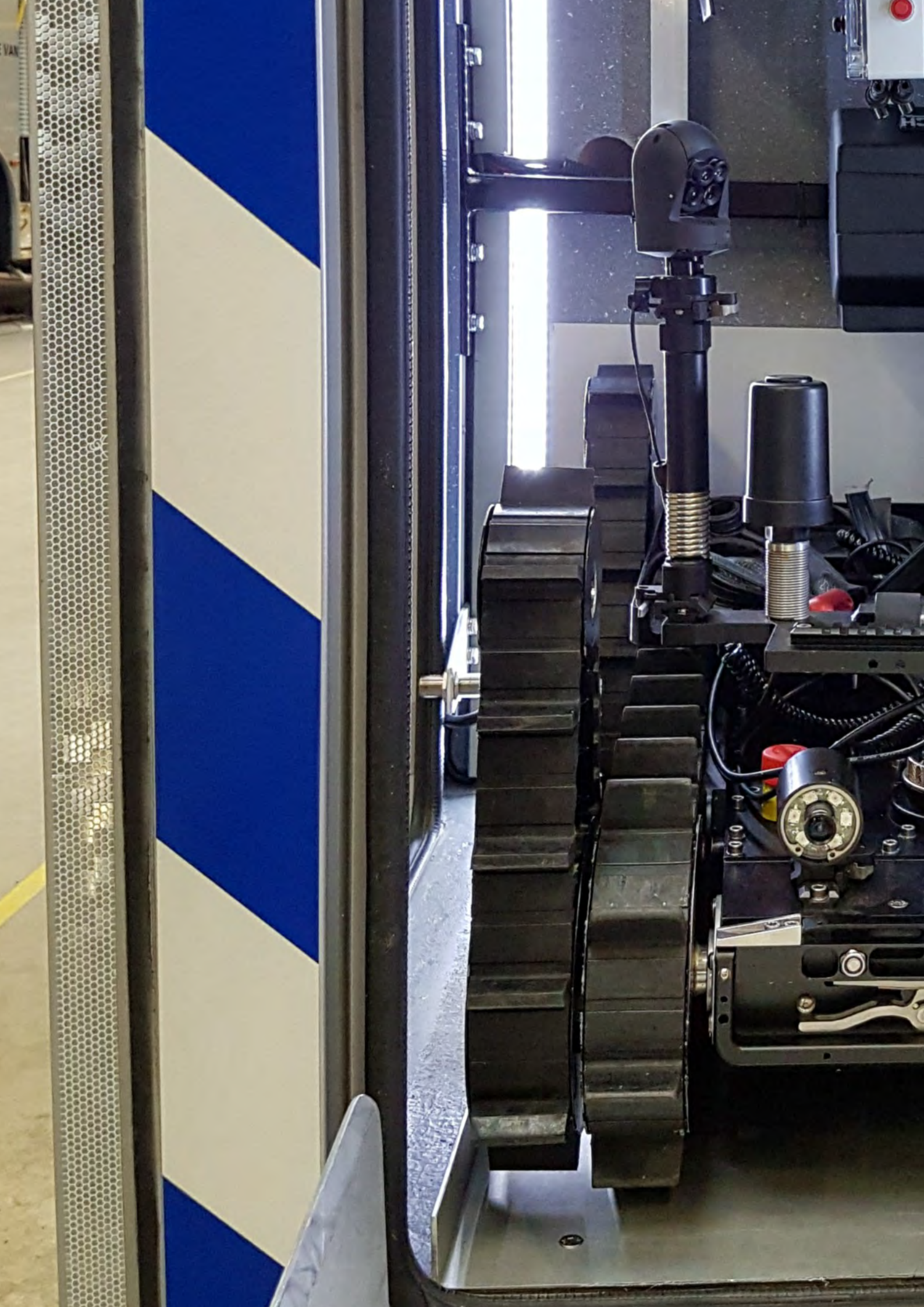
CHEMICAL RESISTANCE

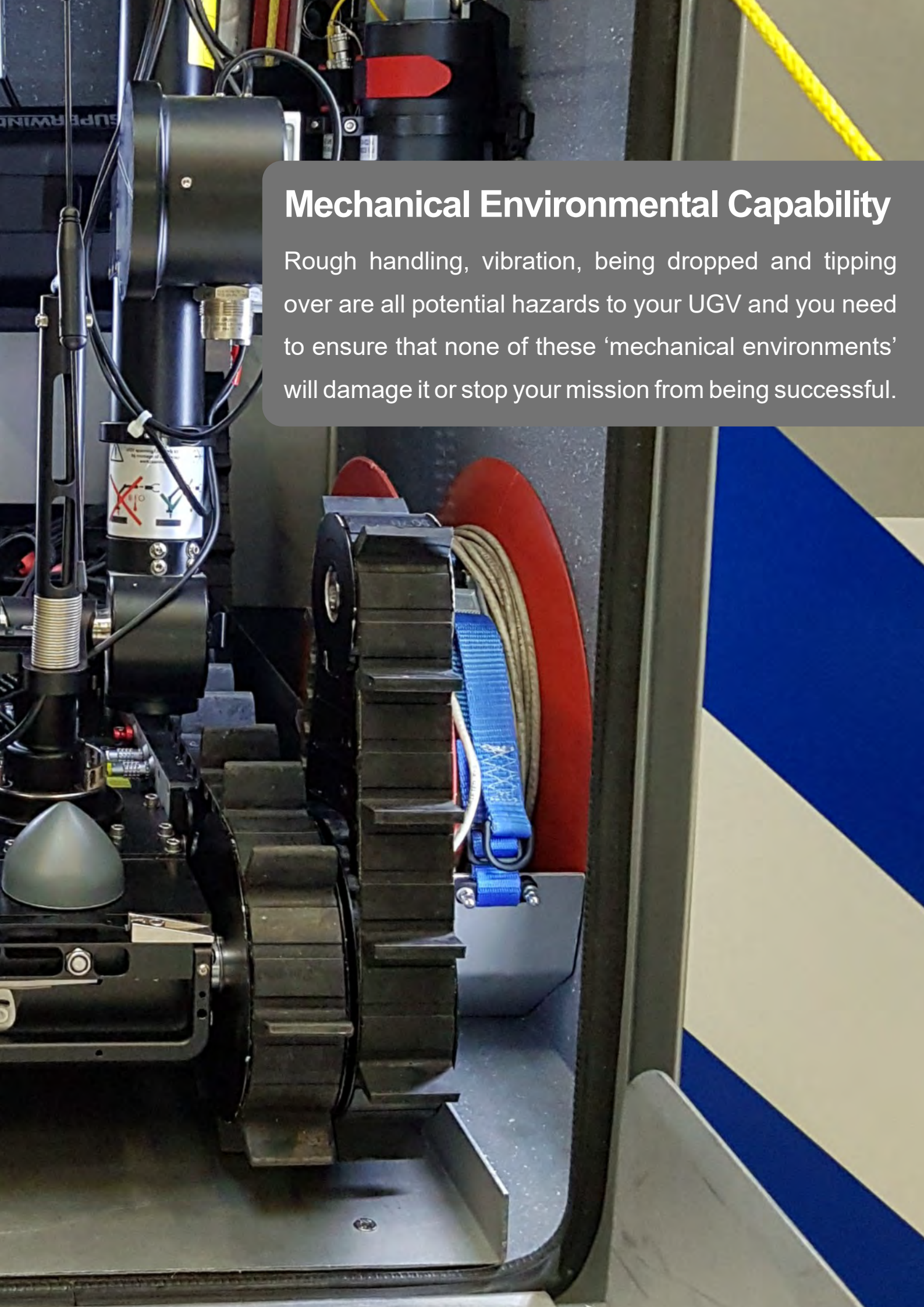
EXPLOSIVE ENVIRONMENTS

If you need to work in a potentially explosive gas environment, Zeus has an optional explosive gas detector. This will detect if Zeus has entered an explosive atmosphere and report a warning back to the operator. The operator then has the choice to either fully shutdown Zeus which will completely disconnect the batteries and remove any risk of explosion due to electrical spark, continue with the mission or return to the control point. If the user chooses to continue with the mission, the warning will remain active until the explosive risk has gone away.









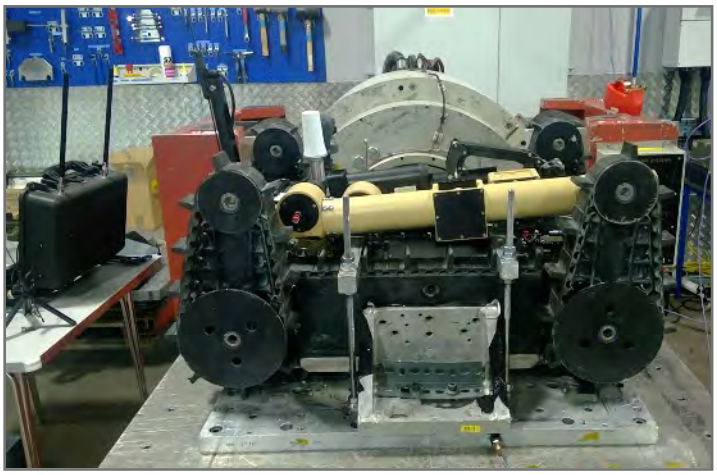
Mechanical Environmental Capability

Rough handling, vibration, being dropped and tipping over are all potential hazards to your UGV and you need to ensure that none of these ‘mechanical environments’ will damage it or stop your mission from being successful.

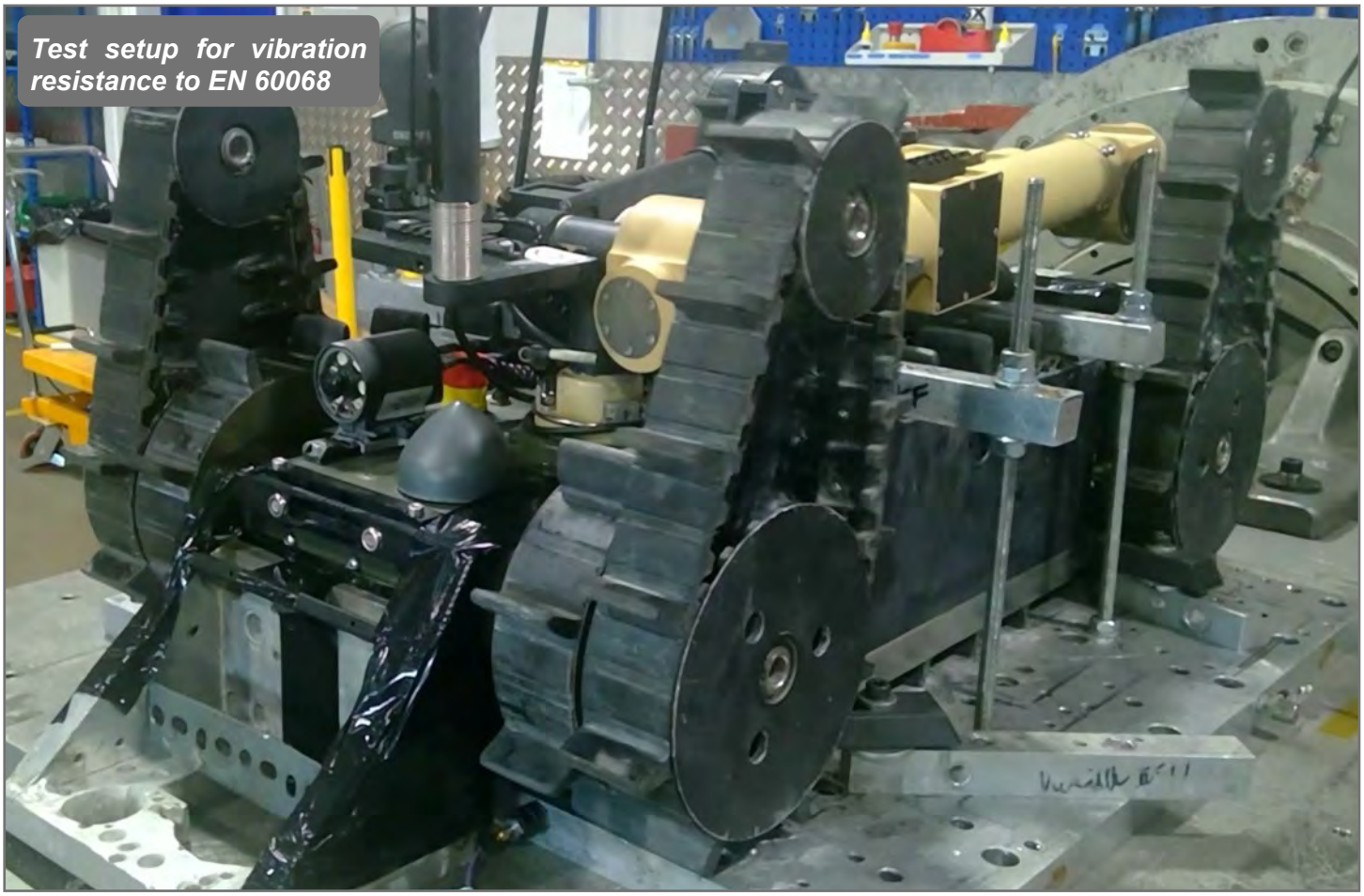
MECHANICAL ENVIRO

VIBRATION

SHOCK



But how can you be reassured that a UGV can withstand these forces? Zeus is designed to be used in these demanding environments, and special consideration has been given to these factors. Simulation of, for example, vibration and being dropped can be carried out in a test facility to international standards and this can go some way to ensuring that in the real world, those kinds of forces won't cause accelerated degradation of your UGV, shortening the operating life.



Test setup for vibration resistance to EN 60068

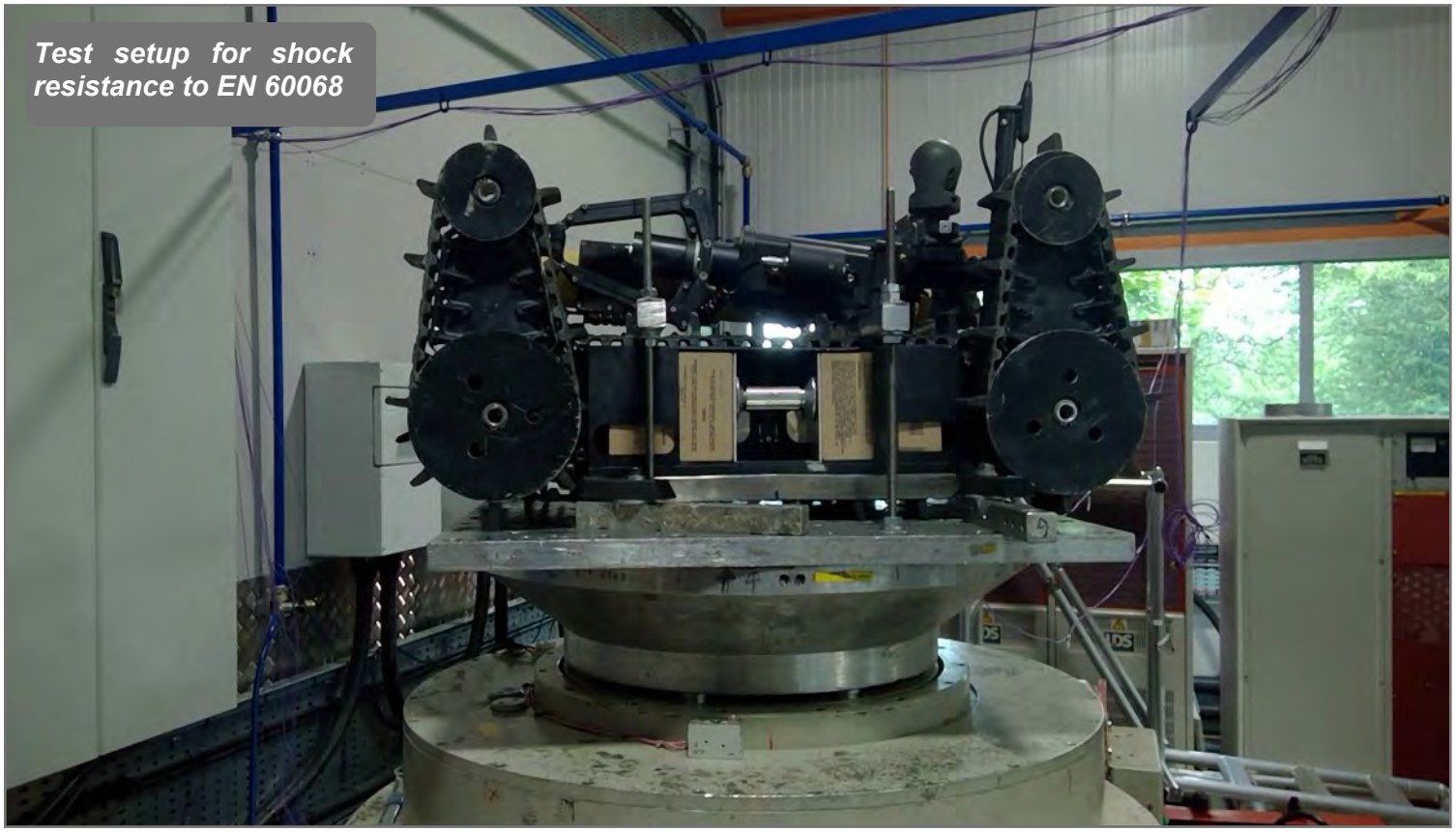
NMENTAL CAPABILITY

It isn't only during use that these factors can have an effect. Transportation, for example in an EOD response vehicle over rough roads and terrain, can also cause vibration and shock loads to the UGV, and these have also been taken into account during the design of Zeus.

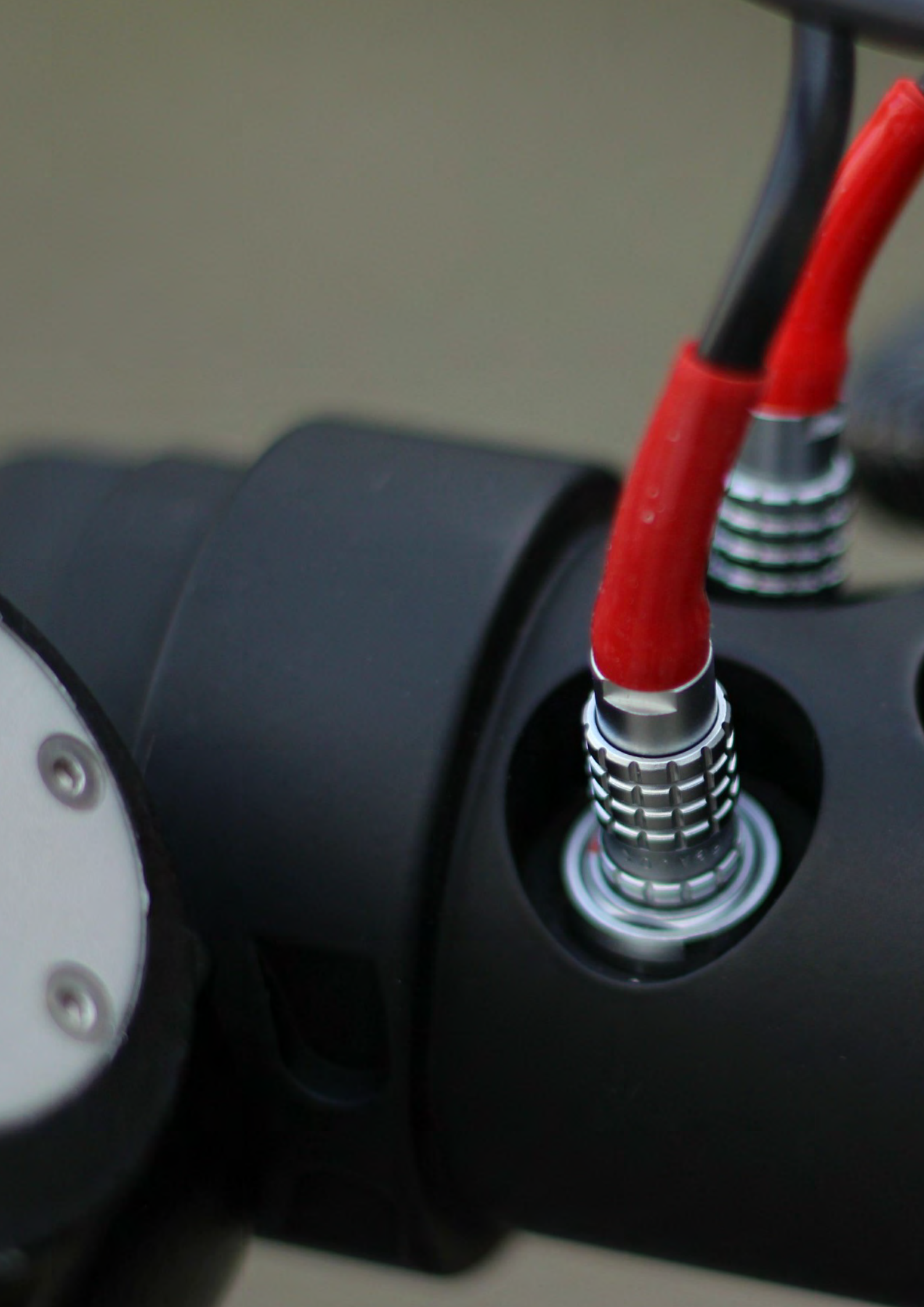
Zeus has been tested to EN 60068 by an independent test house to ensure it meets the requirements of police and military customers, ensuring it will function correctly in the environments that you need to operate.

VIBRATION

SHOCK



Test setup for shock resistance to EN 60068



Electromagnetic Capability

ELECTROMAGNE

EMISSIONS

IMMUNITY

STATIC DISCHARGE

You cannot risk other electrical equipment inferring with your UGV with the result that unplanned movements occur, therefore you need your UGV to have high levels of immunity from other electrical noise.

You also cannot risk your UGV interfering with your other electrical equipment, therefore you need your UGV to have low levels of electrical emissions.

The risk of static discharge must also be accommodated, ensuring your UGV will not fail if exposed to an unforeseen static discharge.

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ETIC CAPABILITY

Zeus has been tested to a number of EMC regulations ensuring emissions are minimised, has high levels of immunity and has resistance to static discharge. Please contact us if you have specific EMC requirements.

Training

The very best equipment, as designed and produced by NIC, will always achieve the desired result as all applications are vigorously tested. To ensure that all equipment is used correctly and works consistently, NIC provides comprehensive training to ensure success when using your equipment on live tasks.

TRAI

Training is designed to supplement existing Standard Operating Procedures in use and provide more capability to the Operator when dealing with devices. All training is conducted by trained & experienced Bomb Disposal Operators with extensive operational experience in Northern Ireland, Bosnia, Iraq and Afghanistan.

These instructors have extensive knowledge of all high threat search and EOD activities and have used it extensively on deployed operations. NIC provides comprehensive training to ensure success when using your equipment on live tasks.

All training combines classroom lessons to impart the design and use of the equipment and practical training to reinforce the theory taught. NIC's system of training utilises the EDIP principle (Explain, Demonstrate, Imitate, Practice) for practical lessons to ensure that all applications are fully understood.

Our customers include:

United Nations

International Military Forces

MOI & MOD

Police Forces

Prisons

Border Forces

Port Security

NIC Instruments have developed a standard series of training course that cover a complete range of topics and areas. Our main courses are based around the following areas:

- C-IED (Counter Improvised Explosive Devices) – "Home made bombs"
- EOD (Explosive Ordnance Disposal) – "Conventional munitions"
- High Risk Search
- CBRNe (Chemical, Biological, Radiological, Nuclear, and Explosives)

Our training is tailored so that we can offer solutions for customers who have little or no previous experience in dealing with the subject matter, right up to subject matter experts, to ensure they remain current and at the forefront of the field.

NING

Our training courses also are designed to “train the trainer”, so that as well as leaving our knowledge with customers to be able to go forward with their new capability themselves, they are also then able to impart their knowledge and skills on, to allow this information to be disseminated amongst the rest of their team, unit or company, ensuring that our training is imparted into as wide a range of people as possible.

Our EOD training packages offer support in the following EOD operation phases:

- Reconnaissance and survey
- Search and location
- Access
- Identification and Diagnosis
- Render Safe Procedures
- Final Disposal

Our C-IED training packages offer support in the following C-IED operation phases:

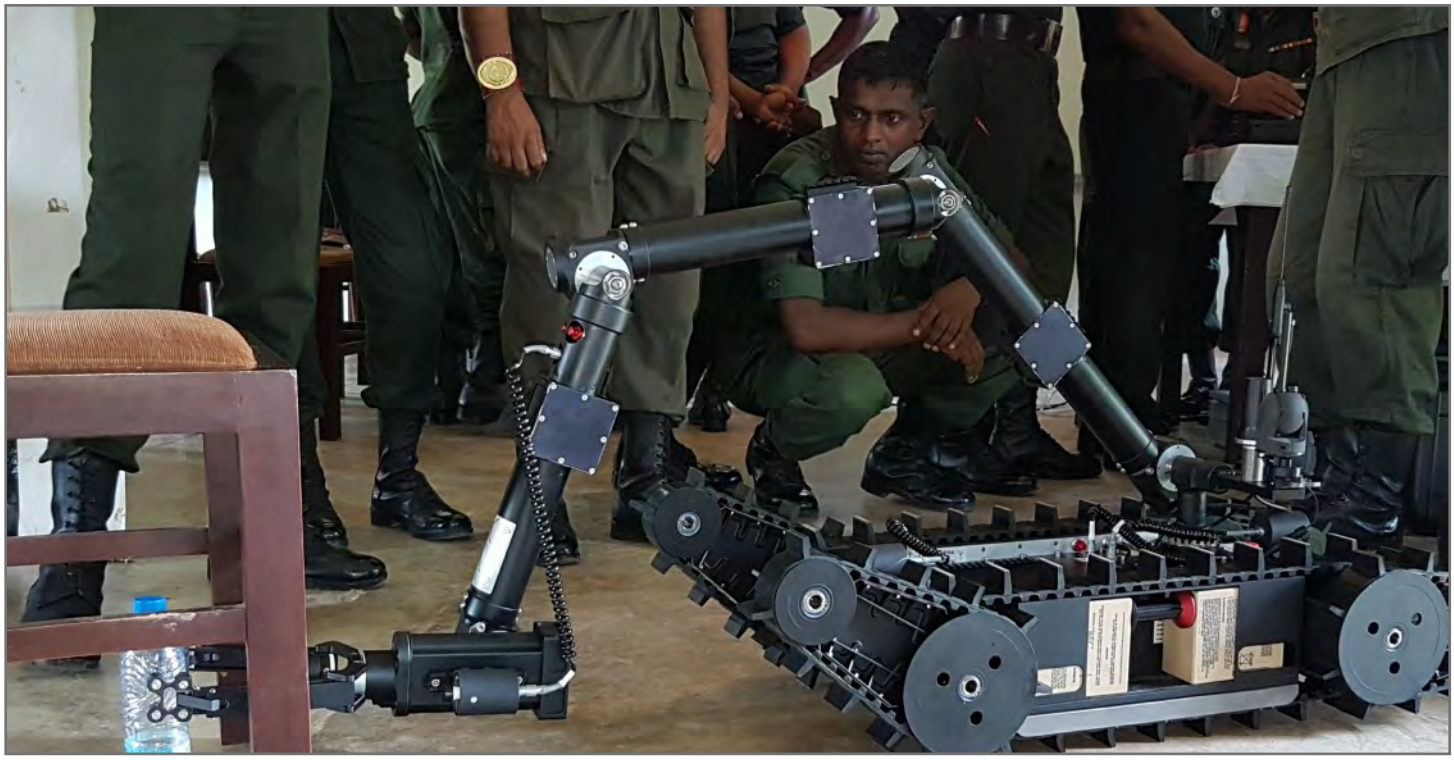
- IED site exploitation & forensics
- Homemade explosives
- IED threat and vulnerability assessment
- IED incident response
- Vehicle borne improvised explosive devices (VBIED)
- Command-wire improvised, explosive devices (CWIED)
- radio-controlled improvised explosive device (RCIED)
- Victim-operated improvised explosive devices (VOIED)
- Explosive Method of Entry (EMOE)

TRAI

The courses offered are a combination of classroom based theory sessions, and more practical hands-on field based exercises that will provide realistic real world scenarios. They offer both a strategic level of training that relates to higher level support looking at capability, policy, suitability of equipment and sustainability of the equipment and training, and also an operational level of training to ensure that the training and equipment you need will deliver the desired outcome. We can provide ongoing consultancy to ensure that you, your trainers and your teams are kept up to date with the latest developments in C-IED, EOD & Search doctrines and advances in equipment.

Bespoke Training

As well as our standard series of course, we acknowledge that not every customer will fit into these, and so our training courses are fully customisable, and we can work with our customers to ensure that we deliver the most appropriate training solutions on a case by case basis. We can offer a range of consultancy services to support and complement our C-IED and EOD training packages, and our ISO 9001 standard that we work to across every aspect of the company will ensure that you will always receive a consistent level of service.



NING

On Site Facilities

NIC Instruments has on its premises a fully equipped training facility of over 250 square metres. This comprises a residential house and garden, a commercial garage / lock up and numerous training vehicles, allowing operators to train using realistic training scenarios in realistic settings providing the maximum training benefit from courses. We also have developed a full UGV test track to simulate all aspects of scenarios related to unmanned vehicle operations.

All training can be conducted at NIC's dedicated training facility, and we can support any requirements related to transportation, accommodation & subsistence, visa and other documentation you might have, from arrival into the UK to departure once training is complete.

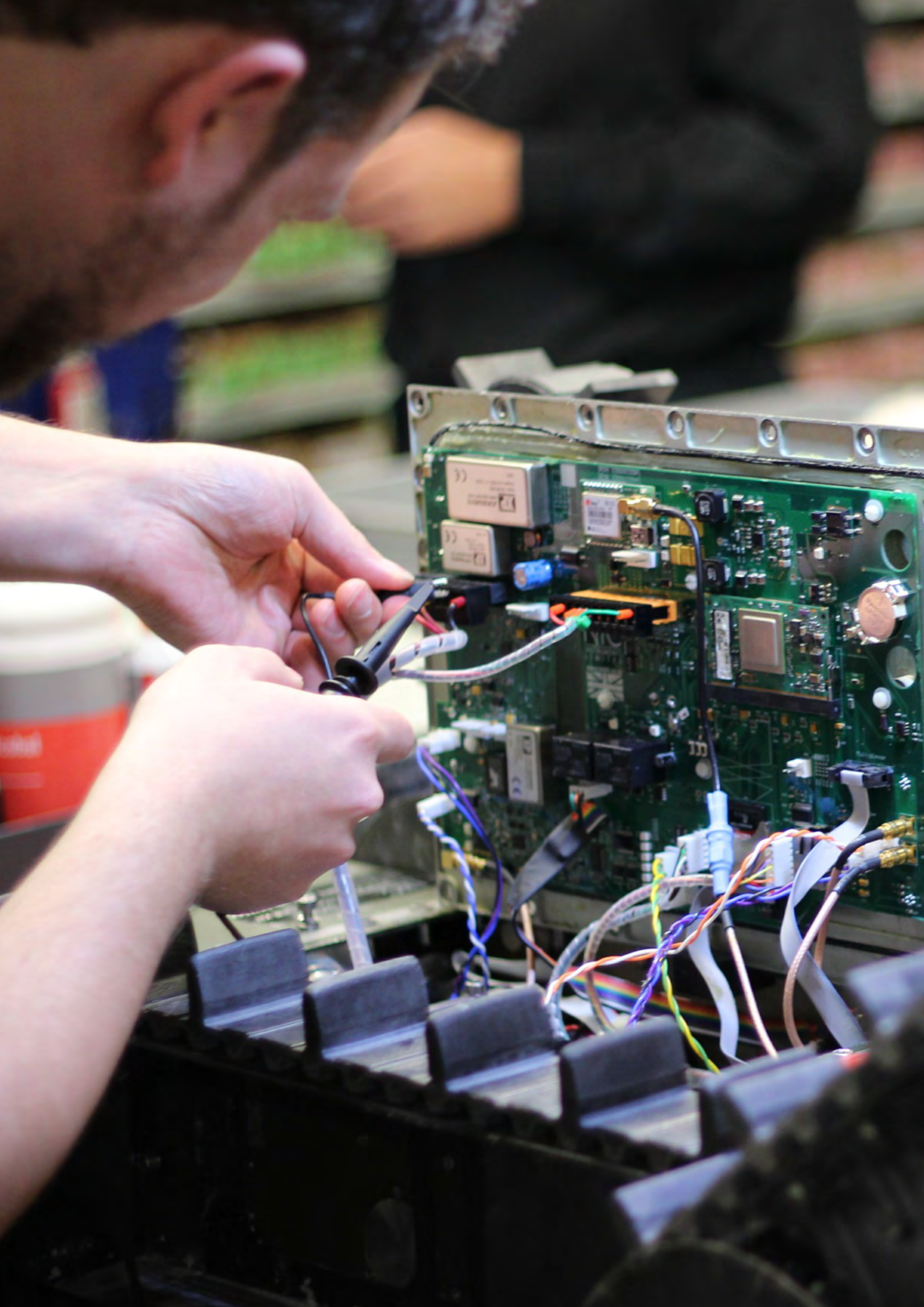
We are conveniently situated less than 1 hour from the major London railway stations and 1.5-2 hours from airports, and less than 20 mins from the main vehicle European entry hubs. (Dover Ferry Port & Channel Tunnel).

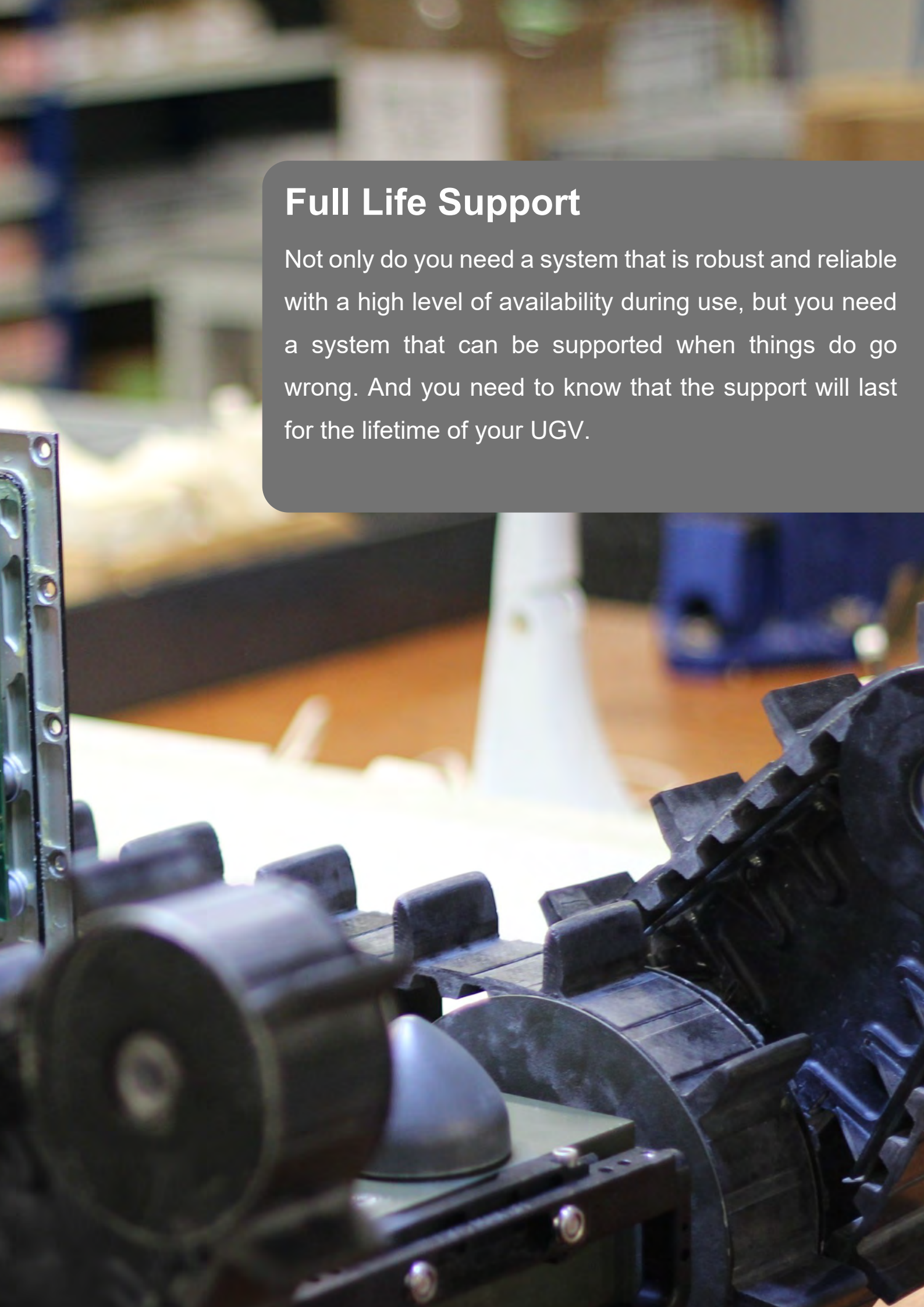
Deployable Training

NIC Instruments can also deliver training in country using our team of trainers. Our teams have a vast range of knowledge and experience, and have delivered training to Governments, Police and Army unit all over the world.

Training Aids

NIC Instruments can supply a wide range of training aids to work alongside our training course, and be used in conjunction with both equipment supplied by us, and equipment supplied by other companies, to ensure that the training given is as current and realistic as it can be, within a training environment. These training aids are designed to be realistic and to assist in developing the skills and techniques required to successfully understand, deconstruct and defeat them.





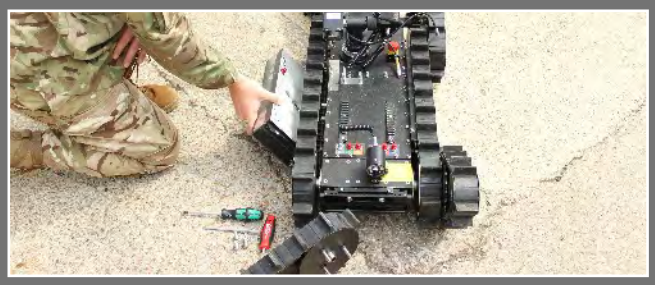
Full Life Support

Not only do you need a system that is robust and reliable with a high level of availability during use, but you need a system that can be supported when things do go wrong. And you need to know that the support will last for the lifetime of your UGV.

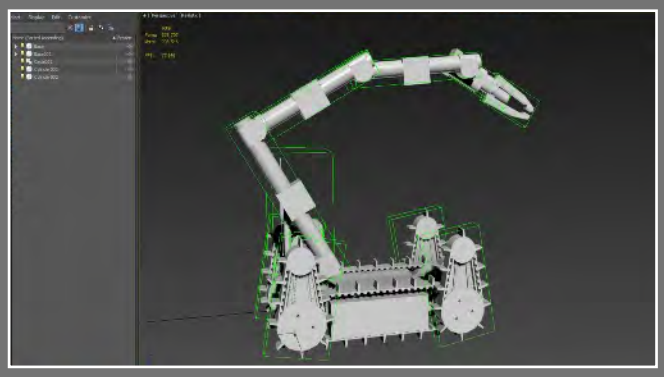
FULL LIFE

You want to shift more of your second line maintenance to first line maintenance, which means allowing your operators to do as much servicing and repairs as possible in field conditions, to avoid having to return the UGV to a workshop and having skilled and trained repair technicians. Zeus's modular design has been developed with exactly this concept in mind. Zeus can be stripped down to its various modules in minutes, and the faulty module quickly replaced, without the need for specialist tools or knowledge.

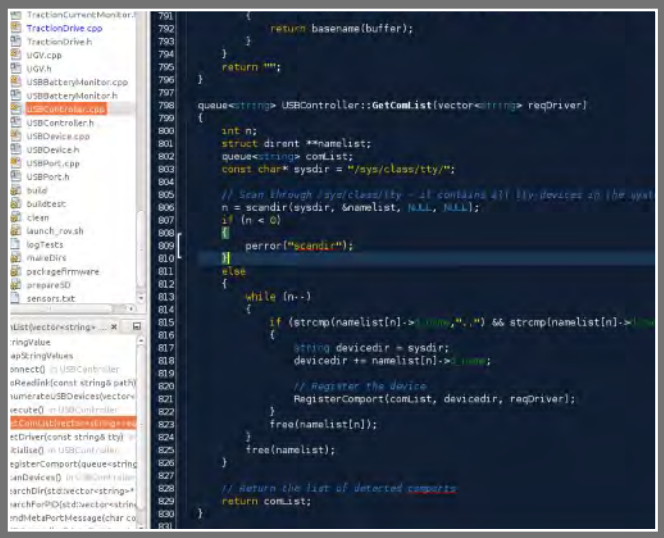
You also do not want to spend excessive time on preventive maintenance, and Zeus supports you here as well. User preventive maintenance is literally reduced to simply keeping the UGV clean, checking tracks, maintaining batteries and checking all functions are operating correctly.



You may bring in a new or upgraded capability and need to be sure that your UGV is future proofed to be able to accept these new systems. Zeus' modular design has growth potential for future improvements, for example integration of new techniques or devices; upgrades or integration of new software without a negative impact on safety, performance, functionality or lifetime.



In addition software and firmware upgrades on both the OCU and UGV platform itself can be installed by UGV operators or by an NIC Instruments technician via the internet.



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SUPPORT

Lifetime Support

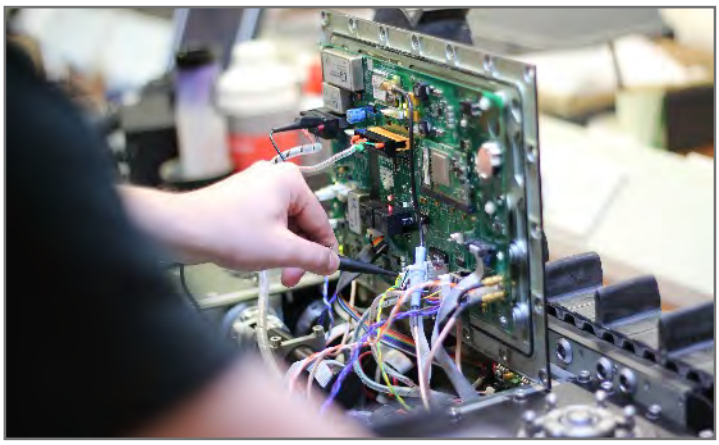
You need to be sure that your UGV will be supported during its entire life. NIC Instruments operates a 10 year support plan and we will guarantee that your UGV will remain operable for that period. A range of annual maintenance packages are available to ensure you maximise the potential of your UGV. Please contact us for more details on maintenance support.

End of Life and Disposal

And finally, after a lifetime of service, when your UGV must be replaced you need to be assured that it can be disposed of safely, legally and with a minimum impact to the environment. Disposal can be carried out in accordance with local guidelines such as the ***Waste Electrical and Electronic Equipment*** recycling (WEEE) or you can take advantage of NIC Instrument's '***Take Back Policy'.*** NIC Instruments will take back any product of its manufacture and dispose of it safely and legally with no costs to the customer.

Warranty

Zeus is delivered with a standard 12 month warranty. Other warranty options exist, please contact us for more details.



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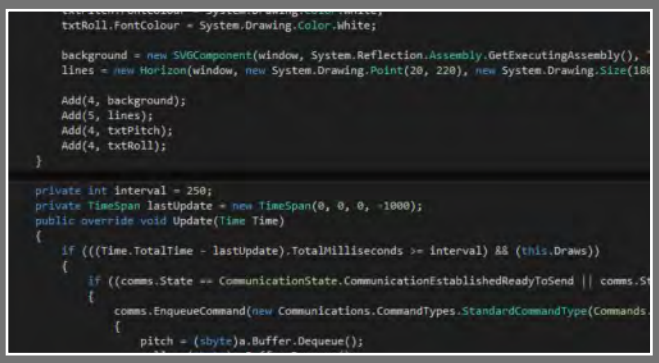
2013
92X385

Engineering Innovation

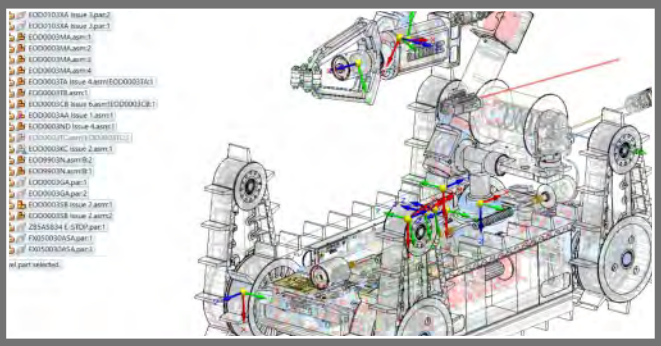
Great ideas will always remain great ideas unless someone can articulate them into reality. And so it is with the EOD/CBRNe community as well as any other. Your ideas, thoughts, plans and processes need translating into the tools to do the job, and this is where NIC Instruments' true strength lies.

ENGINEERING

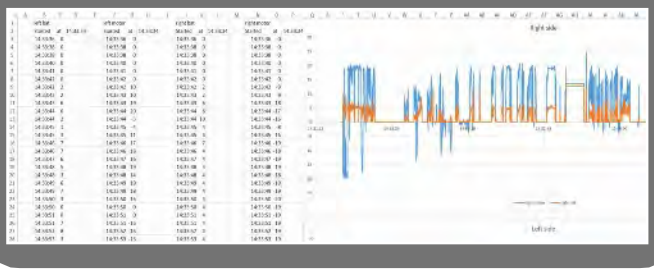
Utilising the very latest, and most advanced manufacturing systems, NIC Instruments is able to design and produce high quality equipment at realistic prices in today's financially constrained markets.



The very advanced, but extremely flexible manufacturing systems not only allow for rapid development but also allow you to request changes and modifications to be implemented with great speed.



Extensive testing of the systems is carried out within our own bespoke EOD testing and evaluations suite, and results of production testing data are stored long term. Only in this way can you be assured of equipment that will stand the test of time.



NIC Instruments is registered ISO 9001, and all equipment is designed, tested and manufactured in our own facilities in the United Kingdom.

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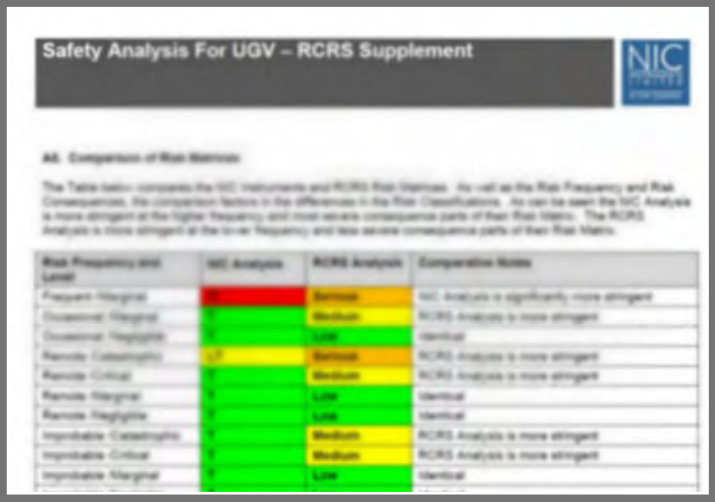
NIC INSTRUMENTS LIMITED

G INNOVATION

Safety Factors

Safety is paramount for your operators and has been considered at all stages of Zeus' design. Careful analysis of potential risks to operators have been analysed and reduced to a minimum. This includes factors such as sharp edges that could cut protective clothing, a critical aspect in a CBRNe role, and a low operating voltage of 24V eliminating the risk of electrical shock.

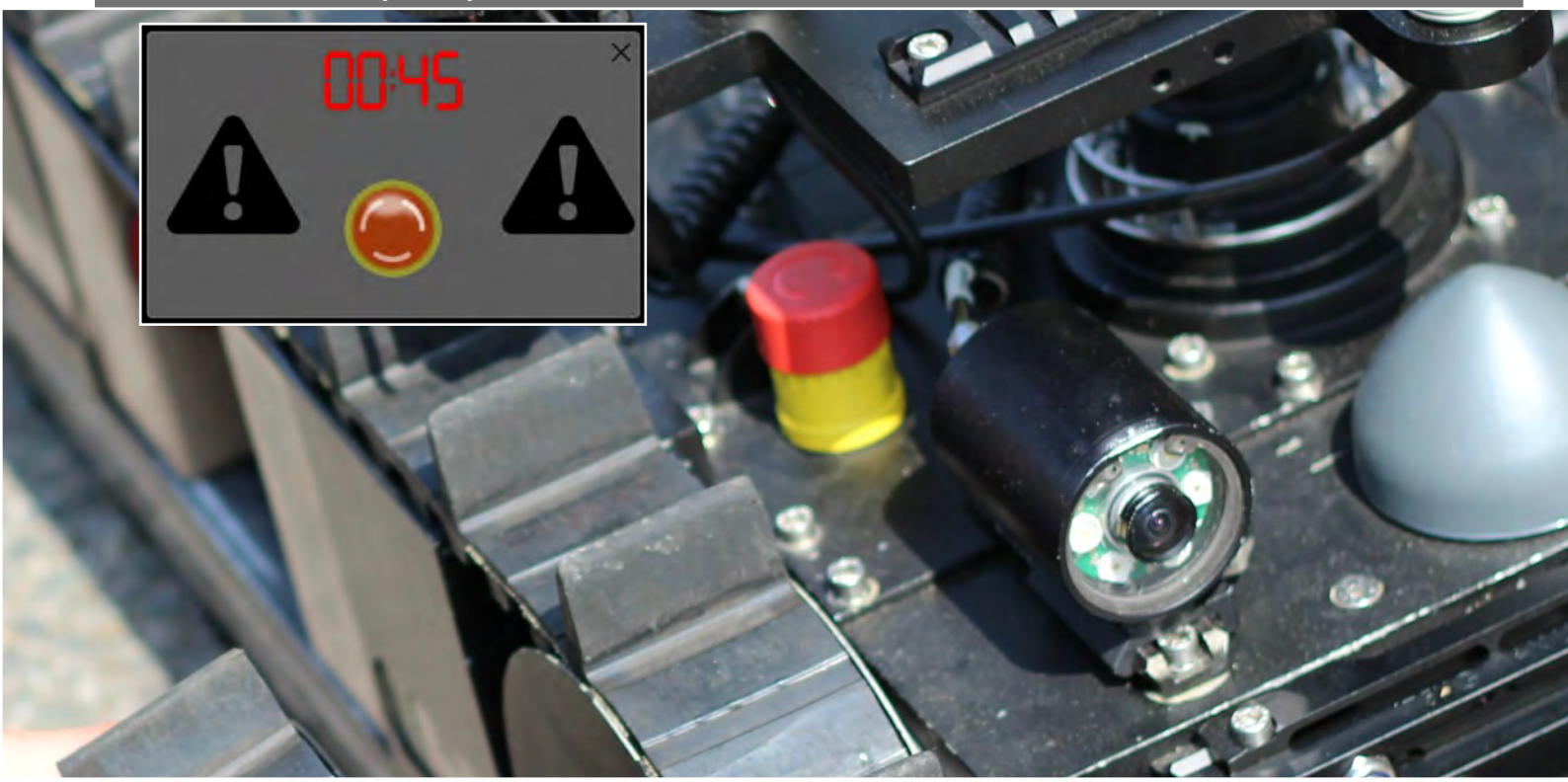

Safety Analysis For UGV – RCRS Supplement

A4. Comparison of Risk Matrices

The Table below compares the NIC Instruments and RCRS Risk Matrices. As well as the Risk Frequency and Risk Consequences, the comparison factors in the differences in the Risk Classifications. As can be seen the NIC Analysis is more stringent at the higher frequency, and most severe consequence parts of their Risk Matrix. The RCRS Analysis is more stringent at the lower frequency, and less severe consequence parts of their Risk Matrix.

Risk Frequency and Level	NIC Analysis	RCRS Analysis	Comparative Notes
Frequent / Marginal	[illegible]	Serious	NIC Analysis is significantly more stringent
Occasional / Marginal	[illegible]	Medium	RCRS Analysis is more stringent
Occasional / Negligible	[illegible]	Low	Identical
Remote / Catastrophic	[illegible]	Serious	RCRS Analysis is more stringent
Remote / Critical	[illegible]	Medium	RCRS Analysis is more stringent
Remote / Marginal	[illegible]	Low	Identical
Remote / Negligible	[illegible]	Low	Identical
Improbable / Catastrophic	[illegible]	Medium	RCRS Analysis is more stringent
Improbable / Critical	[illegible]	Medium	RCRS Analysis is more stringent
Improbable / Marginal	[illegible]	Low	Identical

A physical emergency stop is fitted to the UGV and it is also possible to send an emergency stop signal from the OCU to the UGV which will instantly immobilise the UGV by physically disconnecting the batteries. And should there be a loss of contact between the OCU and the UGV, the UGV is immediately immobilised reassuring you that it will not continue to move in an uncontrolled manner. Immediately communications is re-established, control of the UGV is regained. Contact us for more details on the safety analysis of Zeus.

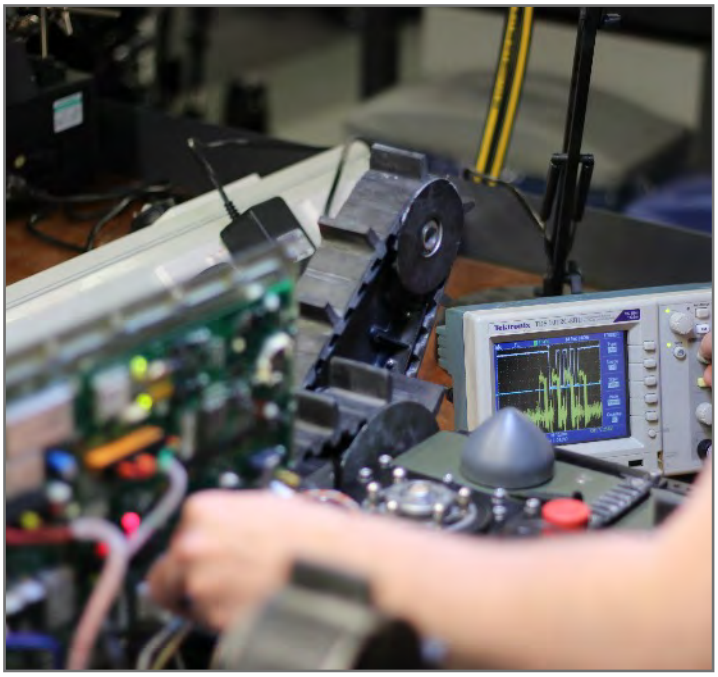


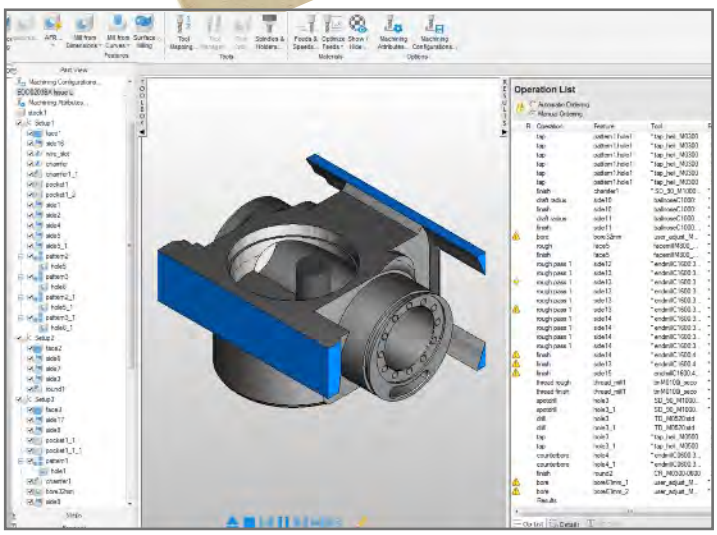
GENERAL IN

History

NIC Instruments has been manufacturing High Threat Search and EOD solutions since the early 1970s. Originally founded as a medical device manufacture in 1946, NIC Instruments brings British world class design and manufacturing to support the work of EOD & CBRNe teams around the world.

NIC Instruments doesn't just make UGVs, but a wide range of high threat search equipment and develop bespoke engineering solutions to today's evolving threats. Please visit our website to learn more about our History and philosophy about reducing the threat to operators put in harm's way in order to make our world a safer place.





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FORMATION

Glossary

AES Advanced Encryption Standard
ATM Articulating Track Modules
CARC Chemical Agent Resisting Coating
CBRNe Chemical, Biologicla, Radiological, Nuclear & Explosive
C-IED Counter Improvised Explosive Device
CWIED Command-Wire Improvised Explosive Devices
ECM Electronic Counter Measures
EDIP Explain, Demonstrate, Imitate, Practice
EMC Electromagnetic Capability
EMOE Explosive Method of Entry
EOD Explosive Ordnance Disposal
GPS Global Positioning System
ICP Incident Control Point
IED Improvised Explosive Device
IEDD Improvised Explosive Device Disposal
IP Ingress Protection
LED Light Emitting Diode
MOD Ministry of Defence
MOI Ministry of Interior
NATO North Atlantic Treaty Organization
OCU Operator Control Unit
RCIED Radio-Controlled Improvised Explosive Devices
ROV Remote Operated Vehicle
RSP Render Safe Procedure
SWAT Special Weapons & Tactics
TIC Toxic Industrial Chemicals
UGV Unmanned Ground Vehicle
USB Universal Serial Bus
VBIED Vehicle Borne Improvised Explosive Devices
OIED Victim-Operated Improvised Explosive Devices
WEEE Waste Electrical and Electronic Equipment

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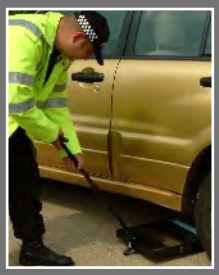

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