

Hello kitty

A NUMBER of nations are flirting with the idea of sending a robot, or unmanned ground vehicle (UGV), to do a man's job – Canada has their MATS programme, Germany is examining it and many other nations are behind these on the same curve. CUGR (chemical, biological, radiological and nuclear unmanned ground reconnaissance) is perhaps the most advanced, though this is still only an advanced concept technology demonstrator (ACTD). CUGR is actually a two-part programme; as well as the CBRN Unmanned Ground Vehicle (CUGV), there is also the Joint Contaminated Surface Detector (JCS), a raman detector that is designed to be fitted to current reconnaissance vehicles. More information can be found at www.cugract.decom.army.mil.

Of the two it is the UGV that gets the most attention; robots have the same place in the users' mindset that tanks did in 1917. Pete Annuziati explained where they were in the process. "One of the major objectives for an ACTD is transitioning the concepts and technology to a Programme of Record for acquisition procurement and fielding," he said. "ECBC transitioned the CUGR's CBRN Unmanned Ground Vehicle (CUGV) to the Joint Project Manager Nuclear Biological Chemical Contamination Avoidance (JPM NBC CA) as a production system in October 2007. JPM NBC CA is planning for fielding of the CUGV as a Component of End Item with its Monitoring and Survey Set Kit and Outfit procurement. Another objective is to foster the user's concepts of operation and his tactics, techniques and procedures (TTPs). ECBC left two residual CUGV systems with the 95th Chemical Company, US Army Alaska; one system with the US Army Pacific and one with the CBRN School for extended user evaluations, doctrine and requirements generation."

Roughing it up
The development of TTPs is often what makes a programme fly or crash; once the soldiers gets their hands on it they start using it in ways that were never conceived of, which can often seal the fate of an ACTD – whether it is taken up with alacrity, or put on a shelf as a curious artefact. Annuziati explained that they had not got up to what could be called full TTP development yet. "We had some feedback from the 95th – they were like our user, but it wasn't taken into the field, or anything like that," he said. "These are people who are responsible for Civil Support Teams (CST) and base protection in places like Fort Richardson Alaska, etc. They do a lot of training missions and take part in an exercise in Alaskan boundaries, so while we didn't get a lot of real-world feedback from them, they did have some issues with the system, related to continual operation of the camera on the robot or some of the detectors. So, while they were not quite as detailed as you are hoping, one of the biggest shifts we have seen is that when we originally launched CUGV it was going to be one component aboard a larger manned recon vehicle and the CUGV could be deployed as needed. When the user saw the capability of CUGV they wanted to use it in an unmanned role, rather than attached to some recon vehicle; it augmented their unmanned recon capability greatly, and on top of that they saw domestic use as well, for federal fire departments, etc."

It is not just the CBRN elements of the US military that have shown an interest and provided input; the EOD community is also interested in Packbot (the platform of CUGV) – specifically the US Navy. Mr Annuziati explained. "Since the US Navy's Explosive Ordnance Division also has a CB mission and uses its PackBots for their EOD mission, ECBC also transitioned its CUGV technical data to them," he said. "ECBC

has also entered into a Co-operative Research and Development Agreement (CRADA) with the PackBot manufacturer, iRobot Corp, and they will be producing a commercial version."

It has been a share-and-share-alike relationship with the Navy, since the two projects have focused on different ends of the scale. "Most of what we have got from them has been in terms of the actual robot platform," said Annuziati. "They continue to make refinements and improvements to the platforms beyond what we were responsible for. They haven't got to the point yet where they evaluated detectors, so they are happy to take what we have done as a jump start to integrate detectors in accordance with their own budget availability. We are still pursuing other avenues of expanding the robotics programme: we have been talking to OSD and they have missions to look at other robotic uses – something to do with semi-autonomous operation of detectors or robots, auto-navigation and mapping as well as explosive detection. They are on the table but have not been executed yet."

As the name would suggest – chemical, biological, radiological, nuclear – CUGR was designed to have the full range of sensors on it, yet bio has not been included. While there have been improvements in bio detection since CUGR started, Annuziati suggested they were still not mature enough for an unmanned platform. "Biological detection and identification in real time from a robotic platform has been a goal for the ACTD, but we have not had any luck finding a commercial system sufficiently mature to evaluate," he said.

Yet there are elements of biological detection that could still fit in CUGR's remit: sampling – either by a roller wheel or the arm – would be of value, especially in areas of potential gross contamination, as would some particle counters, for example. "Anything could

Pete Annuziato, CUGR Team Leader at Edgewood Chemical Biological Center (ECBC), tells Gwyn Winfield about taking CUGR out into the wild

be done; the questions is what needs to be done," said Annuziato. "This has gone to the user for them to define what their requirements are, but to date a specific requirements document for robots to do rece has not materialised. Currently the emphasis is on looking at things on a broader scope, so what reconnaissance systems might mean and the type of capability for the subsets hasn't been fleshed out properly, and this would fall into that subset. A lot of what we have put on the robot has direct application; the warfighter always wants more and we will have to seek guidance from the Joint Requirements Office (JRO) and the services about what is needed."

Once the requirement is defined, it might well be that some form of biological detection could be included. If CUGV had a force-protection role, making routine sweeps around a base, then things like particle counters, which require careful, painstaking background readings, would have a use. If it remains a site exploitation tool – while it would have greater applicability for chem

and rad – until a cheap, robust, effective bio detector came on the market its role would be extremely limited. "This is where we are right now – deciding exactly how to approach this," said Annuziato. "At Fort Leonard Wood, which is responsible for requirements and how it is going to be used, they have not decided on usage; right now they have one robot and their doctrine and requirements people are doing some experiments with it to decide what they need. The short answer is to find out what role it is going to play if fielded with military chemical units."

In terms of the sensor package, CUGV uses a Multirae plus, an LCD 3.2E, a sorbent tube sampler and an AN/UDR14. Detectors often have a complementary technology to balance out the vagaries of their system, such as flame photometry with IMS or FTIR with raman. Was there a chance that the same sort of sensor package would be adopted in CUGV, so that there could be

some sort of sensor fusion to balance out the differences in false alarm rates? "We don't get involved in balancing detectors; we demonstrate that the technology works and that there is military utility of putting sensors on a robot and sending it forward to get a response back," said Annuziato. "At ECBC we are waiting to see whether they want us to go further; the ACTD under DTRA and the Secretary of State for Defense for Systems and Concepts had a time limit to do certain things and that is up in September, when we will close down the shop – unless I get new marching orders! I can't just pick something up and do it – that is something that JPM NBC CA and the CBRN School are looking into, though they can come back and ask us to do the sensor fusion if they feel it has some merit."

Mature attitude

The Iraq experience has been a boon to all UGV manufacturers, and the user has learned to use these devices in new and radical ways. One of the ways that

Packbot has been used in Iraq is for it to be hurled through windows, etc, which would not be



Has survey and UGVs found the right partnership in CUGR? ©iRobot

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one of the most sensible things to do with CUGV as detectors tend to get a bit cranky when used in such a way. So has there been some attempt to ruggedise the package to ensure it can still function in this less than pristine environment? "We have not seen many problems with detector or robot reliability or durability throughout our engineering, technical and operational demonstrations," said Annuziato. "During our residual period, which began in October 2006, most of the problems experienced by the 95th Chemical Company with the robot were minor; we shared this information with iRobot Corp who honoured much of the repairs under warranty.

"When we integrated the sensors into the robot, one thing we looked for was sensors that were mature. One of the benefits of that is that these detectors are fairly well packaged. The JCAD candidate – or rather the commercial version, the 3.2E – is waterproof with the rain cap closed; we modified the UDR14 so that was waterproof when you had a connector plugged into it, so you didn't have to rely on the IR emitter that it usually uses to transmit data. Because the MultiRae is not submersible we had to mount that on the arm of the robot so the chassis could still go through streams without affecting the detector. We looked at the limitations of the detectors and addressed them as best we could without compromising their performance; one example of that is that there is a box on the chassis that can be remotely opened or closed, so if there is a need, for stream crossing, you can close the box which seals the detectors in the box until it is safe to open it again and resume your sampling mission."

September will see the end of the funding for the ACTD, but what of the future for CUGV? Will there be a chance for it to live in some brave new world, or will it be forced to dream of electric sheep? "We at ECBC will move onto other projects, possibly with the robot to see whether we can transfer other capabilities," said Annuziato. "The other thing about the robot being transferred to JPM NBC CA is they will be the ones



Once users get their hands on UGVs they find new roles for them ©iRobot

picking it up and giving it to soldiers in the field. I think the procurement plan is to put 15 of them on an outfit such as the 95th – a specific unit that has some detectors, SCBA gear and the robot, and that would be deployed to handle site-exploitation roles. What originally happened was that the robot, because of its cost, was not viewed as an essential item – more a 'nice to have' – but once Major General Reeves saw it he said, 'I want these integrated into the sets', so they will be phased in."

The CUGV programme is a good example of what is happening in CBRN UGVs: the technology is there to be used, there are commercial variants available now (see the Roundup at the back of this edition), that shows this is way past proof of principal, yet it is the doctrine of usage that holds it back. UGV

use in areas of gross contamination is one easy fit yet, with the exception of TICs attacks, this becomes an expensive tool. Also, much of CBR detection is based on common sense; there are numerous stories of high readings on chemical detectors while birds were still flying around, or bio detectors going nuts when a herd of camels walked passed – common sense is still one of the best detectors and this cannot be planned into a UGV. That said, there is always the golf bag approach, that you are a more versatile responder if you have the assets than if you don't. Clearly, in much the same way that this is happening across CBRN generally, UGVs will become multidisciplinary, either bristling with explosive, narcotics or CBR detectors, or with a sensor suite to suit the package.

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