Byron Brezina, Advanced EOD Robotic System Technical Project Manager, Naval Surface Warfare Center, Indian Head EOD Technology Division, tells Gwyn Winfield about the next generation of EOD UGV

Rest of the Robots

GW: In terms of the roadmap for the Advanced EOD Robot System [AEODRS – pronounced Ee-dris], what will it replace? Is it a like-for-like replacement of anything or a new capability?

BB: It will be a family of three systems, or increments, a small, medium and large robot. Increment One is the small 35lb backpack for dismounted missions. There has been no small, 35lb or lower, UGV programme of record. There have been several fielded under Juons (Joint Urgent Operational Needs Statement) for when guys in theatre need something, but EOD and other communities don't have a programme of record under 35lb. Increment One fills the gap of that small, man-packable robot. Increment Two is the tactical operations system. This will be operated out of a tactical vehicle, but they stay inside the vehicle and operate it from there. This will replace the Mark 1 and Mark 2 EOD robot; Mark 1 being the Packbot, and Mark 2 being the Talon, which are in the medium, or 164lb size. Some of them have been in service since 2005. Increment Three can be up to 750lb, and that includes the controller. We are expecting a weight of several hundred pounds for the robot itself, and that will replace the fielded Mark 3, Remote Ordnance Neutralization System (RONS), the Andros robot. Increment One fills a capability gap, Two replaces the Packbot and Talon, and Three replaces the Andros. I am speaking for EOD only. There are other communities that use COTs variants of the Packbot and Talon, such as the combat engineers.

GW: AEODRS is a joint capability, for all services, so in terms of the different services do they get a choice of 'flavour?' Can they pick and choose capabilities or Increments, or have they signed up to them all? How does joint piece work?

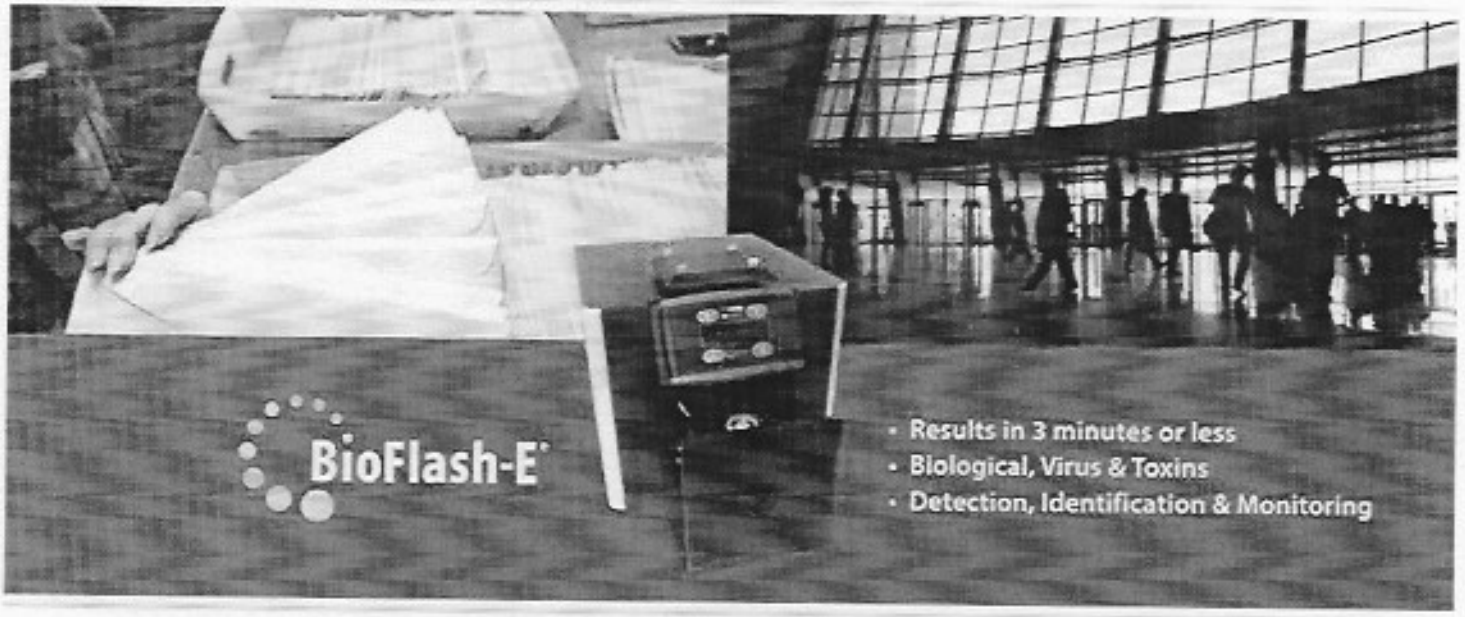
BB: There is a Joint Requirements Document, a CDD (Capability Development Document), which is a formal acquisition document, and for Increment One all the services have said that they will purchase it. They have the right to change their mind, so if they say that they are not going to buy, and later change their mind, they can come in; it is not like a binding agreement. The requirement represents their joint technical, supportability and fielding requirements, which were developed between the four services, and their intentions on how many they wanted to buy.



Increment One and Two EOD UGVs will be man and vehicle portable. ©DoD

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GW: How useful is weight as a category of capability? Now lighter robots can do more, sensors are better and lighter, so it is sometimes inaccurate to say that certain tasks have to be done by a large and heavy robot. What was the rationale behind this?
BB: The weight classes started with an Analysis of Alternatives (AoA) several years ago, and we looked at different ways to meet the need for the next generation EOD robot, and it wasn't determined going into that analysis, which proceeds the requirements; that it was going to be a family. We looked at a whole set of alternatives: including but not limited to single robots, upgrading the existing robots, two robots, two identical robots. That AoA was done with the service representatives and the feedback was the best alternative was a family of systems, that would share a common architecture for the next generation. The sizing of the family did break down according to the users' transportability limitations. They need the dismounted system on foot, and the 35lb number is a sweet spot for a trade between weight and capability. The medium size robot broke down to how much can two people carry for a short distance, as the medium size is out of a tactical vehicle. So they won't carry it for miles and there are military standards and human engineering guidelines which brings it out to 164lb for two men. That does exclude the females, but we are trying to get every pound we can as the medium size robot will be the work horse, the best of both worlds. The large one, like the RONS, is where you will have it on a base, where they will have a larger response vehicle or a trailer, where they are not in a tactical situation, responding to EOD calls and not limited to the amount of equipment you can carry. Once you look at what it can do we look at the combination of robots, one, two three; we came out with this small, medium, large to cover what the robots need to do. Anybody can pick a scenario where the robot won't work, but we feel that we are in the 90% where the robot will be capable of doing what needs to be done.

GW: In terms of Increment One and the ability to investigate enclosed spaces, many existing UGVs can do the 100m depth from the operator that you have stipulated, but often it is the specific culvert, and its twists and turns, that pose the problem. Is the clever part not so much the UGV but the repeater or the systems that can ground penetrate so that there is no loss of control?
BB: On Increment One weight was everything; it was one of the key performance parameters that could not be traded off. Increment One is 100m line of sight, or 50m non line of sight (NLOS) and that is unaided line of sight, no relays or repeaters. It is tested at 50m NLOS, in an established way, but that is not to say that it can go into a culvert of 30ft without limitations. When we talk about Increment Two that has a longer NLOS range, as well as a requirement for an aided line of sight, so we are expecting Two and Three to use repeaters and other devices.

GW: For Increment One what will it do with the device? Will it just confirm suspicions? Will it carry some form of payload, interact with the device? Not only are there weight challenges, but in an enclosed space there will be issues with the movement of the manipulator…
BB: The primary mission of Increment One is recce, but it will also have a manipulator and be required to position 5lb of counter charges or something like that, but it is mainly a recce robot. In terms of using the manipulator in a tight space there wasn't a requirement for that. There is a requirement to carry a certain load, a certain number of degrees of freedom, and a reach of so much. There are ways around the issue of manipulator movement in an enclosed space. You don't have to go into a confined space with your manipulator stowed, and then operate the manipulator in a confined space; you can go into the space with the manipulator extended. We are not expecting any magic!

GW: Will you be looking at three separate contractors for each Increment, one Prime Systems Integrator (PSI) that operates three different systems? Will there be any form of genetic heritage between Increment One and Two, for example, other than the common architecture?
BB: It wouldn't be a scaled-up Increment One, not that it couldn't be, but One has weight as the strictest requirement and we expect components of Increment One, the master module, the cameras, to be used on Increments Two and Three, but basically it is only the architecture that is the same between them. Increment Two might be expanded for dual manipulation and Two and Three will have more capability. As far as the contracting, that is complicated as it is a formal programme of record so there is little I can say. We are about to release our Request for Proposals (RFP) for Increment One, and that will be a PSI contract. Increment Two and Three are being done together, and we expect to have one PSI for both of those. That is not saying that the Increment One could not be the PSI for Two and Three, but they will be separate contractual actions.

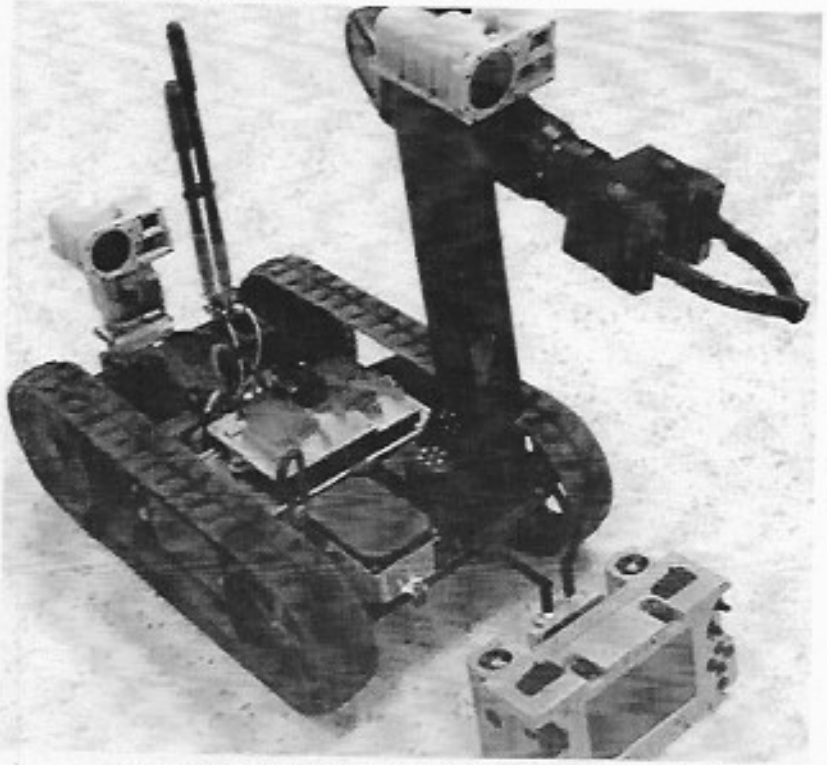
GW: Dual manipulators?
BB: We have the requirement to perform bi-manual tasks, tasks that require two arms, hands, grippers or whatever. That can be met in different ways. We have work going on for dual manipulators, identical manipulators ? the symmetrical approach, like a human, where the right arm is basically the same as the left arm. There is a bi-manual tasking requirement, the prime example given in the requirements document is to unscrew the cap off a 2-inch-diameter pipe. That can be met with an asymmetrical approach, with one arm, high degrees of freedom, one manipulator with fine control, and the second arm as a simpler clamping device to restrain the object that you want to perform the task on.

GW: The word that is frequently used in AEODRS is 'Family of Systems' (FOS). Will this be a number of UGVs working together, with one operator controlling all of them, a certain larger amount of autonomy so that he can set some of them off on tasks?
BB: Right now it is basically one operator with a control station operating one robot. We do have the requirement for

three systems to work in the same vicinity, within range of one another simultaneously, but that would be three different operators. We are laying the ground-work for a future requirement where one operator could operate three robots from one OCU. It can be done. It has been shown in various R&D projects but, as far as a tactical EOD requirement, it wasn't included. We have our robot improvement programme that is working well with the fielded Mark Ones, Twos and RONS as there are always updates and better tech coming out; if the users decide they have requirements in the future for more capability and for electronics obsolescence issues..

GW: CBRN is in Increments Two and Three. There have been other CBRN UGV ATDs (Advanced Technology Demonstrators) such as CUGR and RASR. Did that have any useful lessons or because they are designed for CB rather than EOD meant that they were only of passing interest?
BB: CBRN is not in Increment One because of the weight situation. It is for dismounted missions which means that they would not want to be that close to the agent and they might not have those sensors with it as a standard package. The way that the robots are being designed is that Increments Two and Three have the same requirement to carry typical CBRNE detectors integrated. Increment Two won't be able to carry as much as Three, probably limited to 20lb or so which then takes up the payload capacity for other things, whereas Increment Three could have 30lb of CB sensors and you wouldn't be anywhere close to its payload capacity. I would consider those increments to have the same requirements apart from the weight of the sensor packages. We followed the ATDs, and talked to those people, but those demonstrators didn't turn into programmes of record. EOD will do some of those missions, but it will be one of the many things that they do, so there won't be a 100% transmission of that information into AEODRS. But we don't want to redo things, and we certainly want to find out what sensor worked the best! It would be nice to say that all this stuff just fits together, but the fact is that you get these ATDs and sometimes they just end, and there is no hard transition especially with the current budget.

GW: In terms of AEODRS the industry chatter seems to be around the government-owned architecture. Will this now be the norm for UGV contracts, that this architecture will be updated and added to when new systems, such as mules, enter service? Will this just be the EOD architecture or become the entire DoD UGV architecture?
BB: We first worked to the requirements from the EOD community and developed this architecture to meet their need of a family of systems for the next generation of EOD robot. When we say 'government owned' we mean that it is open. The government doesn't own it. Industry will not need to licence it in order to use it. These interfaces are being made known to industry and they can use them freely. What we don't own is the modules. We are not attempting to own the designs of the modules that make up the systems. The interface that each module presents to the rest of the system needs to meet the government's interface specs - logical, physical and electrical. When people throw out 'government owned' they are worried that we want to own everything but it is only the interfaces that the government is "owning". We are requiring them just for EOD's AEODRS system. Industry can use them in other systems/products as they see fit; we are not trying to create a new standard across industry. We currently have issues with systems that are proprietary. The systems that are currently fielded are modified COTS (Commercial Off the Shelf), where the interfaces between their modules are proprietary, and that is across the military and also the general public ? Apple would be an example. As far as a Joint EOD capability it has limited us to working with the original equipment manufacturer, and there has been a lot of downside to that. This is a way to open it up, to get improvements into the field faster. There is a never-ending list of new things that the user wants, and this is the way to do it.



Increment One will have a number of common systems and architecture ©Indian Head EOD Tech Div