

X-RAY INTEGRATION FOR ROVs

LT COL LUDWIG PERGOVACZ
EXPLAINS THE METHODS TO INTEGRATE PORTABLE X-RAY SYSTEMS WITH REMOTELY OPERATED VEHICLES (ROVs) AND ASKS: C-ARM, CHASSIS MOUNTING, OR BOTH?



REAMDA's Reacher ROV carrying the X-ray source and the Riddler ROV carrying the VCsecurity DR1417-V panel. The laptop has access to both systems via MESH radio.



DR1417-V panel with Golden XRS3 source mounted on a Telerob Telemax chassis mount.



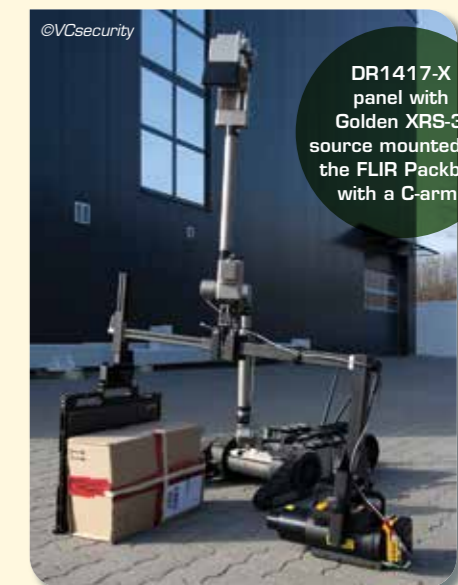
Top-to-bottom inspection using the C-arm.

more than 5 kg, thus limiting the operation.

But it is often required to change heights, angles and distance between the detectors and X-ray source to improve penetration and resolution – or to take several images of a large IED.

Using the C-arm

To mitigate the limitations, operators can use special, lightweight C-arms with a 2.2-kg golden-pulsed X-ray source and a 2-3-kg panel – or even a CR plate that weighs less than 0.5 kg,



DR1417-X panel with Golden XRS-3 source mounted on the FLIR Packbot with a C-arm.

Preparation is everything

In a normal scenario, the ROV will be supplied in advance with the suitable accessories that are integrated without damaging or limiting the ROV's capabilities to perform its normal mission: to conduct an examination remotely from a large distance without putting the operator or others at risk, while driving over or even climbing obstacles.

Integrating the ROV, X-ray systems and other accessories requires a close cooperation between all suppliers. That way all parts can perfectly be integrated physically and technologically without any interference between them.

Swiss Army knife of ROV mounting

The most popular and common integration method between ROV and portable system is the C-arm, specifically designed to firmly mount the panel and source to the ROV manipulator.

To achieve ideal operational performance, the ROV must have the capability to lift more than 15 kg. Versatile scenarios are possible: operators can safely change angles

and heights. Some models even allow the X-ray inspection parts to be dropped and to mount automatically another accessory to complete the mission.

Overcoming weight restrictions

Things get more challenging if the ROV model and portable X-ray system are not designed or planned for integration in advance. The ROV's ability to work in tight spaces and bypass obstacles should not be hampered by the addition of an X-ray system or any other accessory.

When integrating accessories with ROVs, one must make sure that whatever is added to the system does not interfere with other functions of the platform. The automatic movements, along with vital parts like the cameras of the ROV, should also be synchronised with the X-ray system.

During past years, ROV models with lower size and weight became more popular because they are easy to carry and can be deployed more rapidly. This comes at the cost of payload capabilities. At the point where the manipulator is fully stretched, they usually cannot lift

including a holding frame. The usage of heavier components will not only seriously jeopardise or at least limit the operation, but could also cause permanent damage to the ROV.

A practical example is an operator that wants to use an existing, small ROV model with a C-arm that carries a new X-ray system with higher weight than the manipulator lifting capability. VCsecurity consulted with the ROV manufacturer and agreed on a solution: to add new stabilising parts that can strengthen the ROV body to allow it to support the extra weight, combined with an advanced training of the operators for better control of the ROV when mounted with accessories – to avoid losing stability in complex situations. It is therefore possible to retrofit new high-performance X-ray systems to existing ROVs.

Bomb disposal technicians worldwide face complex challenges – most notably, to detect, neutralise and contain improvised explosive devices (IEDs) remotely, rapidly, and with minimum approach time down-range close to the IED. The main method to master these challenges is by employing ROVs. Usually, the robots are equipped with accessories like portable X-ray systems, disruptors, CBRN sensors, and special cameras to reach, inspect, and then defuse or destroy explosive devices



Today, some of the new models are equipped with a weight sensor that will notify the operator if the lifted object is too heavy, and some also include software that monitors the ROV angle. When the robot is not fully parallel to the ground, the software can not only warn the operator, but can also set proper actions needed for stabilisation.

However; in most cases when there is a need to adjust an existing small ROV to a portable X-ray system, or vice versa. There is also a better option to use a chassis mount or a specially designed lightweight C-arm.

Different options for different scenarios

Due to their lower overall weight, some of the smaller ROV models manipulators have the disadvantage of being very easily incapable of manoeuvring, or being almost unusable, in complex missions. These include driving on a bumpy long or narrow road, climbing stairs, or passing other obstacles with the source, the C-arm and the detector.

By using the chassis mount, the distance between robot and X-ray detector can be modified along with the angle. Another advantage is the significantly lower weight on the

manipulator – as it needs to carry only the X-ray detector.

In this way, malfunctions of the ROV due to weight overload can be avoided which – in the worst case – can lead to operator errors. Using a specially designed housing accessory, the X-ray source is held between ROV flippers and transported. The advantages are the even weight distribution and easier use of the entire system in a complex situation.

Nevertheless, the new, lighter design of the C-arm by VCsecurity still allows use of the source and detector in all positions. The aluminium composite design provides a weight saving of 20%. The generator and the panel can also be aligned very easily as compared to the chassis mount option. In connection with the weight savings, the improved calibration gives a perfect integration between the components of the robot and the X-ray system.

For example, a large IED which is larger than a typical 14 x 17” detector imaging area can still be imaged by using the ROV to easily move the C-arm to take several images which can then be automatically stitched together into one image.

To ensure a reliable operation,

the panel is designed for extreme weather and environments with an IP67 rating, drop testing from 1 m, and weight endurance up to 500 kg. In some ROV models it can also be stored in the chassis area during driving, keeping it even safer during missions.

Ultimate flexibility

Another option to expand the mission capability would be to invest in multiple robots. The large ROV model can be integrated with a C-arm while the smaller model can be integrated using the chassis mount. In case it is needed to inspect large objects like cars from side to side (not only top-to-bottom), the two robots can work together as a team. Overall, it can be concluded that VCsecurity has a broad spectrum of options for operators to ensure that missions can be completed safely and rapidly. *

Lt Col Ludwig Pergovacz of the German Air Force Reserves (GAFF) is a ROV integration expert at VCsecurity, a division of the X-ray specialist VisiConsult. As well as 25 years' experience in the military and ten years in the defence industry, he has long been involved in the ROV project.

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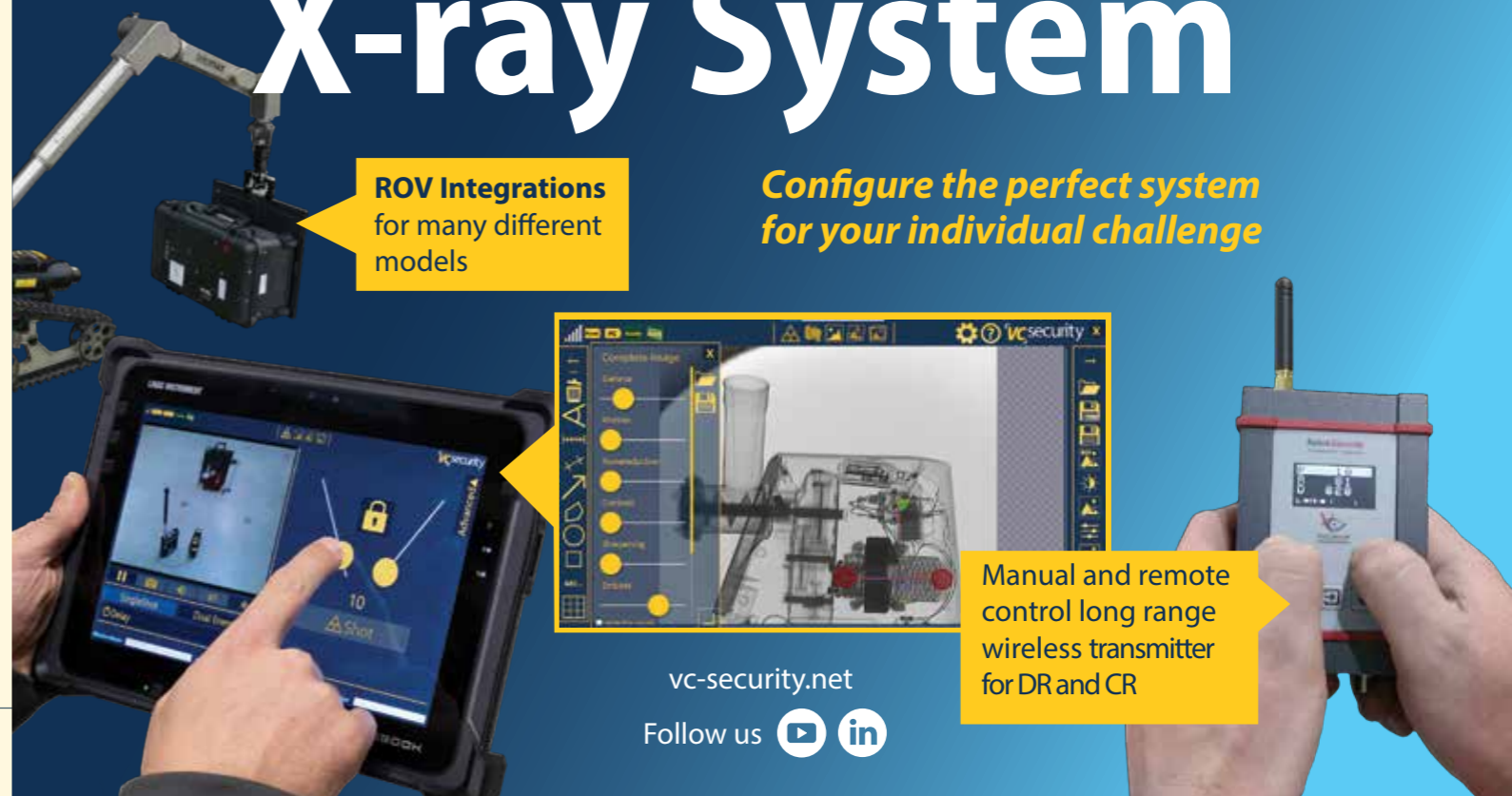
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