



ADVANCED ROBOTIC MANIPULATION FOR
SPECIAL RECOVERY

CASE STUDIES ON COMPLEX RECOVERY OPERATIONS

REACH
ROBOTICS

RCMP DEPLOY ALPHA 5 MANIPULATOR IN ARCTIC SEARCH & RECOVERY MISSION

The Royal Canadian Mounted Police (RCMP) are a historic institution serving as Canada's National Police for the past 150 years. Among their various services, Underwater Recovery, Emergency Diver Response and Search & Rescue missions are crucial to managing emergencies which occur in Canada's many waterways.

The highly skilled Police Underwater Investigators (PUIs) are trained to deal with extreme, arctic conditions in remote regions. They often employ ROVs and robotic manipulators for operations where human diver intervention is either impossible, or too high-risk.

Recently, a tragedy in a remote region of Nunavut occurred where a road worker operating a large bulldozer plunged through ice to a depth of 160m, where he was inaccessible to emergency response teams. The fatal accident was initially attended by the British Columbia (BC) RCMP who deployed their ROV to locate the bulldozer, assess the scene and conduct a recovery mission. Unfortunately, during these dives the ROV became irretrievably entangled in a Polysteel line and the National Underwater Recovery Training Centre (NURTC) was called to assist.

Skilled PUIs, Sgt. G.E. (Jay) White and Corporals Todd Kaufmann and Steve Wells from NURTC arrived, equipped with a Seamor Chinook ROV integrated with Reach Robotics's Alpha 5 manipulator. They set about planning and rehearsing a recovery mission, suspending the Chinook beside a bulldozer and practiced opening the door using the Alpha 5 with great success.



Cpl. Todd Kaufmann (NURTC), Cpl. Steve Wells (NURTC), Cst. Tim Cucheran (BC Dive Team)

As a Canadian ROV developer, Seamor Marine understands the harsh climates faced by their local emergency services and developed the Chinook ROV to withstand arctic conditions while remaining versatile and configurable. Together with the Reach Alpha 5 – the world's smallest, most dexterous 5-function manipulator, the robotic system drastically reduces risk to human divers in harsh environments while diving deeper and remaining submerged for longer periods.

Having sufficiently prepared for the mission ahead, The NURTC team began by deploying their Chinook vehicle and 5-function manipulator to retrieve the original ROV. Configured with the Rope Cutter end effector, they used the Reach Alpha 5 to sever the Polysteel line, surfaced the tangled ROV and cleared the workspace of obstacles and hazards.

Next, the vehicle was deployed again to locate the site of the accident. Using a Seamor Marine dual function grabber to steady the ROV against the bulldozer, the Reach Alpha 5 manoeuvred the door-handle 90° downwards, opening the door and allowing for the victim's body to be recovered.

The tragic accident and challenging retrieval mission came to a resolve with the victim's body returned to family. The operation was recorded as the deepest successful recovery in RCMP history, and their first above the Arctic Circle. Reach Robotics is proud to partner with pioneering ROV manufacturers like Seamor Marine and assist with significant Search and Recovery operations conducted by RCMP and emergency services worldwide.



Corporal Todd Kaufmann and Corporal Steve Wells

APPLICATION OF ROBOTIC MANIPULATORS IN LAND FORCES & EMERGENCY RESPONSE

Robotics has been widely adopted by defence and security forces across the globe for the clearance and disposal of explosives. Remotely operated vehicles (ROV) or Unmanned Ground Vehicles (UGV) enable the operator to intervene, monitor and dispose of threats from a safe standoff distance, eliminating the need for bomb suits or other technologies that expose humans to potentially life-threatening situations. Similar technology is being trialled and adopted by first responders in dealing with fires, floods or more specific disasters such as malfunctions in nuclear or chemical plants.

Due to the unpredictability of emergency situations, the exact nature of the clearance task to be carried out is only loosely defined. The size, shape or weight of the threat is often unknown until a closer inspection can be obtained. Similarly, access into hazardous locations might be made difficult by fallen obstacles or confined entrance ways. It is therefore essential that the robotic solution can adapt to different conditions and operational challenges in-situ to ensure mission success in the shortest possible time.

The robotic arm, or manipulator with end effector tooling is a critical component of the intervention solution when it comes to conducting these types of operations. The ROV or UGV is a means of transporting the tool or sensor to the required location from which useful data can be obtained or intervention tasks can be carried out.

When a potential threat is detected, the operator determines which vehicle and tools best suit the task requirements with the limited information available. This decision is often made under severe time pressure and with little knowledge of the nature and conditions

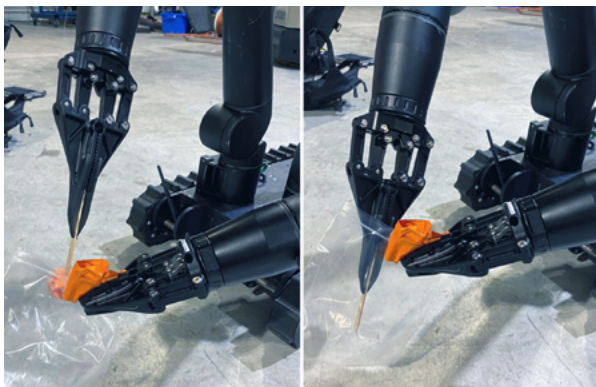
of the threat. The ability to select between multiple tools or end effectors prior to commencing is useful but often versatility around what can be achieved with the selected hardware is preferred. This allows for the manipulator to perform multiple operations such as cutting and grabbing without returning the UGV, saving valuable time.

If a different end-effector tool is required, it is essential the changeover process is fast and efficient and that a broad range is available with varied capabilities. Mission time can also be reduced by storing third-party tools on the vehicle and using a prototypical grabber style end effector to pick-up, hold and swap between them. Although simpler to implement, this method provides less versatility as the ability to actuate is lost when gripping.

As the use case for manipulator arms continues to expand it is important that the design of end effectors and tools is not undervalued. Reach Robotics has a growing library of versatile, mission-oriented end effectors for both Alpha and Bravo manipulator series. From cable cutters to grabber jaws of various shapes and functions, the array of interchangeable end effectors were designed with end-user application front of mind. Reach Robotics continues to work with customers in Land Forces and Critical First Response industries to meet their unpredictable application requirements.



Reach Alpha End Effectors



x2 Reach Bravo 7's remotely conduct hazardous substance sampling



Reach Bravo 5 with Interchangeable End Effector tools

BIA5 & REACH ROBOTICS DEVELOP ROBOTIC SOLUTIONS FOR HIGH-RISK LAND ENVIRONMENTS

BIA5 is an Australian Unmanned Ground Vehicle (UGV) manufacturer specialising in robotic systems for emergency first responders, law enforcement and defence industries. In partnership with Deakin University's, Institute for Intelligent Systems Research and Innovation (IISRI), BIA5 has been instrumental in introducing robotics to Australian policing for tactical operations. Their advanced technology is built to support land-based security in hazardous environments by reducing the risk to first responders and field workers.

Recently, Reach Robotics has been collaborating with BIA5 to develop the first sovereign, UGV-mounted advanced intervention system. Our rugged dexterous manipulators and control technology has been successfully combined with BIA5's All Terrain Robots (ATR). Plans are also underway for integration onto the Vulcan UGV which is currently in development. While Reach Robotics continues to excel in subsea and maritime industries, our collaboration with BIA5 is an exciting expansion towards developing robotic intervention and perception systems for land and air domains, designing technology that is environment agnostic.

Manipulator arms on Explosive Ordnance Disposal (EOD) UGV robots are not new, but the technology currently in service worldwide is significantly dated and has not progressed to adopt the degree of dexterity and intuitive control that is now possible. The integration of Reach Robotics manipulator technology revolutionises the accuracy and intuition of control. This results in reduced training timelines, improved mission success, and unlocks tasks that would be impossible with



Reach Bravo manipulators with BIA5 Vulcan UGV

traditional UGV systems. It's a new era for remote operation in bio-hazardous environments, mines, fire rescue, explosive ordnance disposal scenarios and more.

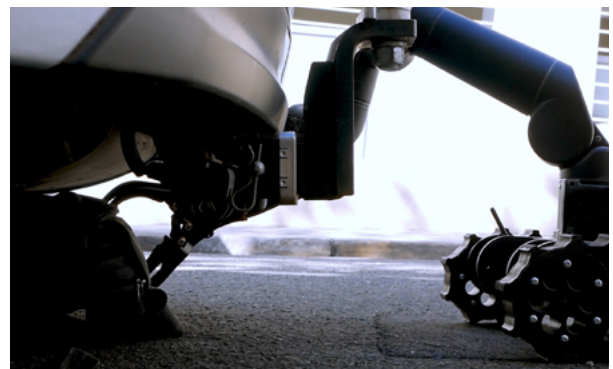
The powerful integration was exhibited at the Land Forces 'International Land Defence Exposition in Brisbane from 1-3 June, together with BIA5.

Intended applications of the ATR and Vulcan integration with Reach Robotics intervention systems are:

- Counter Improvised Explosive Device (C-IED)
- Explosive Ordnance Disposal (EOD)
- Hazardous Environment Inspection
- Special Recovery and Emergency Rescue
- Locating Targets and Tactical Response
- Chemical, Biological, Radiological and Nuclear Defence (CBRN)



Reach Bravo manipulators with BIA5 Vulcan UGV



Reach Bravo manipulators with BIA5 Vulcan UGV