

SUCCESS STORY

TOPIC NUMBER: N06-162

SBIR INVESTMENT: \$1,500,000

PHASE III FUNDING: \$6,400,000



DEXTEROUS MANIPULATION SYSTEM FOR SMALL ROBOTS

RE2 developed a solution for Navy EOD technicians that helped to locate dangerous explosives more effectively; this led to the Maritime Mine Neutralization System and paved the way for a \$100 million acquisition.

RE2, LLC, a subsidiary of Sarcos Technology and Robotics Corporation

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THE CHALLENGE

Navy explosive ordnance disposal (EOD) technicians use a variety of machines and robots to detect, identify, recover, disarm and dispose of unsafe explosives and ordnance. The Navy was interested in improving the feedback, situational awareness, dexterity, and intuitive control schemes of its fielded EOD robots to more effectively perform operations requiring high precision. The need for a better manipulator arm was only part of the objective: A full solution required better feedback and control in addition to physical dexterity. Robotic control for these tasks had to be accomplished by either a human operator viewing the scene remotely and controlling the manipulator, an autonomous controller, or a combination of the two.

THE TECHNOLOGY

Pittsburgh-based RE2 Robotics, a leader in intelligent mobile manipulation systems, leveraged the SBIR program to meet this need and developed its Dexterous Manipulation System (DMS) consisting of a highly dexterous manipulator arm, innovative gripper, and an advanced control system. The highly dexterous arm features redundant degrees of freedom allowing technicians to perform complex maneuvers, including reaching around obstacles or inside containers. The detachable grippers present the gripping feedback operators need to pick up small or fragile objects, and can be replaced by users to attach other tools or upgrade to future better grippers. The DMS also offers better situational awareness and a control unit which uses advanced control techniques to allow the technician to intuitively position, orient, and use the gripper. The DMS was designed to be a replacement payload for the current fleet of EOD robots, beginning with the Foster-Miller TALON.

THE TRANSITION

Through Phase I and Phase II SBIR awards, RE2 evolved its DMS and developed an Imitative controller, as well as a Highly Dexterous Manipulation System (HDMS), which resulted in an advanced, cost-effective, dual-arm system for Tactical Class EOD robots.

This technology was instrumental in RE2 receiving the green light to develop its autonomous robotic Maritime Mine Neutralization System (M2NS). This came by way of a Phase III contract from the Office of Naval Research (ONR), of which \$6.4M has been obligated for the development of the M2NS system. The potential value of the award is \$13,022,459. In April 2022, Sarcos Robotics completed its acquisition of RE2 for \$100M. RE2 is continuing to fulfill the Phase III contract for the M2NS as a wholly owned subsidiary of Sarcos.

THE NAVAL BENEFIT

The detection and neutralization of water-borne improvised explosive devices and other underwater explosives is a critically dangerous task for Navy divers. With the development of the M2NS, technicians can now locate and autonomously neutralize targets in deep ocean waters, while experienced divers supervise from a safe distance. The M2NS consists of a set of RE2 Sapien™ Sea Class robotic arms (which were originally designed and developed for ONR), mounted on a Defender remotely operated vehicle (ROV) manufactured by Pennsylvania-based VideoRay. M2NS also incorporates RE2 Detect™ computer vision software for locating mines, and RE2 Intellect™ autonomy software. An array of sensors boosts the system's situational awareness and its autonomy, helping it to better understand the big picture around it and to react accordingly.

THE FUTURE

In addition to defense tasks, the human-like capability of the M2NS allows it to be used for complex offshore infrastructure and maintenance applications in the oil and gas and renewable wind industries. For example, M2NS can be used for weld inspection of rig piles, ships and floating production storage and offloading (FPSO) systems; mooring inspection and measurement; and valve inspection and manipulation.