

# Department of the Navy SBIR/STTR Transition Program

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Topic # N13A-T010

Prehensor for one atmosphere diving suit

Vishwa Robotics and Automation, LLC

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** ONR

**Transition Target:** Navy Explosive Ordnance Disposal Group 2 (EODGRU2) and Mobile Diving and Salvage Unit 2 (MDSU2); Supervisor of Salvage and Diving (SUPSALV); and the Submarine Escape & Rescue Program Office (PMS 391)

**TPOC:**  
(202)781-4062

**Other transition opportunities:**  
NASA, NOAA

**Notes:** The Vishwa Robotics Extensor can be used on manned and unmanned systems. The left image shows a Navy Remotely Operated Vehicle (ROV) equipped with the Extensor grasping a sphere. The right image shows the Extensor on an Atmospheric Diving Suit (ADS) hand pod showing human-like dexterity with a power drill. This project has received international recognition and large media attention in the U.S., UK, Spain, etc., and in such journals as Popular Science, The Economist, Spanish El Mundo, National Geographic, Scientific American.



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## WHAT

**Operational Need and Improvement:** U.S. Navy diving, EOD and salvage forces cannot perform work deeper than 300 feet without using Submersibles, ADS or ROV. The current systems are very restricted in their manipulation capability to perform complex work due to low dexterity pincer end effectors (lobster claw type). This rudimentary manipulation results in excessive time spent working a problem underwater, the inability to operate task-specific tools, and the inability to complete a specific job.

**Specifications Required:** The manned (e.g., ADS/Submersible) grasper needs human equivalent strength and dexterity while the unmanned (e.g., ROV) grasper needs super human strength along with the ability to work under remote control from the sea surface. Both the ADS and ROV systems must be maintainable on the work site.

**Technology Developed:** Development of human-like robotic fingers with human-like opposable thumb for deep sea operations will enable expanded use of the Navy ADS and unmanned underwater vehicles (UUVs) such as ROVs and Autonomous Underwater Vehicles (AUV). The technology is adaptable to ground and space robotic vehicles also using rudimentary claw type pincers.

**Warfighter Value:** Improved grasping dexterity in deep sea will enable expanded use of the ADS and UUVs (e.g., ROVs and AUVs) to conduct underwater search, inspection, construction, salvage and science missions. The increased use of dexterous ADS and UUV will reduce the reliance on physiologically hazardous ambient (wet) diving techniques.

## WHEN

**Contract Number:** N00014-15-C-0029 **Ending on:** April 19, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Human like robotic fingers	Low	Operation under water on ROV	7	April 2016
Human like robotic thumb	Low	Operation under water on ROV	7	April 2016
Human like robotic hand	Low	Operation under water on ROV	7	April 2016
ADS controller (SBIR Option)	Med	Operation on ADS suit hand pod	7	April 2017

## HOW

**Projected Business Model:** Vishwa Robotics is already demonstrating the Extensor at underwater trade shows to many commercial customers. In parallel we are continuing to improve the Phase II design by joint diving and salvaging exercises with the Navy EODGRU2 and MDSU2. Our lean manufacturing plan includes delivering tens of units in under six months to all our military and commercial customers.

**Company Objectives:** Vishwa Robotics' objective is to become a global leader in high dexterous manipulation and intelligent robotics by providing Extensors for sea, space and other terrestrial extreme environment robots such as bomb disposal robots, nuclear environment robots, humanoid robots, and manned and unmanned extreme environment exploration robots. These types of robotics would operate under extreme environmental conditions, such as high/low temperatures and pressures found undersea or in space, and could also be subject to radiation, chemical, or corrosion exposure.

**Potential Commercial Applications:** The Extensor can also find applications for use by police/SWAT bomb squads in bomb disposal robots and bomb disposal suit graspers (hand protectors and extenders), as well as in nuclear disaster response robots. NASA space suit glove replacements and satellite repair robotic arms could also benefit from this technology because of its ability to operate in extreme environments. This technology can also be extended to commercial ROV, depth-independent submarine actuator and industrial manipulator manufacturers, and can support oil & gas exploration, underwater construction, and personal service robots development.

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