

WHO

SYSCOM: ONR

Sponsoring Program: ONR

Transition Target: PMS 406 – Unmanned Maritime Systems

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Other Transition Opportunities:
PMS 408 – Expeditionary Missions
PMS 420 – LCS Mission Modules
PMS 495 – Mine Warfare

Notes: TDA's e-skin technology provides an impressive improvement to current underwater robotics manipulation devices. We can tailor our e-skin for current and future needs as transition opportunities become available to both DoD and industry.



Prototype e-skin application developed at TDA 2024.

WHAT

Operational Need and Improvement: Haptic capabilities are needed for robots to operate in variable terrain or manipulate variable objects and tools. Many marine environments are dangerous or difficult for human operators to work within, and it would be preferred to augment or replace human operation with robotic operation in these environments. Electronic skins mimic human skin and provide the needed capability.

Specifications Required: E-skins for marine use should be easily manufactured and implemented, and tunable to multiple types of autonomous and robotic systems. They must be fully functional underwater, ideally with equivalent functionality throughout the littoral zone.

Technology Developed: TDA is developing a 3D printed, easily scalable e-skin for underwater use to provide the necessary haptic capability. It is modular and can be easily tuned to the required size and shape for the specific robotic application. The skin offers the same sensory capabilities at any littoral depth and provides a soft interface for robotic interaction.

Warfighter Value: TDA's e-skin can help replace human operators in dangerous or difficult to reach marine locations, reducing casualties as well as physical and psychological strain on the warfighter. It will also enable extended marine operations; e-skin enabled robots can perform tasks at depths with no need to surface, where a dive team would be severely limited by allowable dive time.

WHEN

Contract Number: N68335-24-C-0009

Ending on: Dec 15, 2025

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Multiple e-skin swatches measured simultaneously	Low	Data from multiple e-skins measured simultaneously	4	1st QTR FY24
Optimized sensor and hardware demonstrated on testing gantry	Low	Sensor down-selected for optimization	5	2nd QTR FY25
E-skin applied and tested with a robotic manipulator on test gantry	Medium	Successful force measurement from skin on a manipulator	6	3rd QTR FY25
ML algorithms demonstrated on test gantry	Medium	Correct force map and interaction prediction	6	3rd QTR FY25
Manipulator with e-skin demonstrated in a salt-water test environment	Medium	Useful data produced from test	7	1st QTR FY26

HOW

Projected Business Model: TDA intends to work with prime integrators to install the e-skin technology on their robotic systems before sale to the military. The system will be "bolt-on", meaning it can be easily integrated with existing systems, but strategic planning for integration will benefit the device capability.

Company Objectives:

TDA Research - We Tackle Difficult Problems.

Our team develops cutting edge chemical processes, materials, and hardware for customers in the defense, aerospace, energy, and chemical industries. Our research results in commercialized technologies. Partner with us today to address your most challenging technological issues!

Potential Commercial Applications: Marine robotics is a rapidly growing field as the marine economy expands. TDA believes there is a strong market need for haptic, soft robotic capabilities, both within the DoD and the civilian sector. Additionally, TDA's sensors can be adapted for land-based robotic systems that require soft interactions, such as in-home or medical robots.