Naval Surface Warfare Center Panama City Division (NSWC PCD) scientists and engineers are working to optimize military underwater human intervention when the situational awareness, adaptability, agility, or task execution speed of a diver are required. A prototype MK29 (UBA) was displayed at the Office of Naval Research Naval Future Forces Exposition on July 20, 2017.

Today, U.S. Navy divers stationed at Mobile Diving and Salvage Units meet their requirement for manned deep diving operations with the Fly-Away Mixed Gas System (FMGS). The FMGS supports rapid response when the advantages of a diver are needed. The FMGS currently provides breathing gas through an umbilical to a demand regulated, open circuit, diver worn helmet. In each breathing cycle, all inhalation is from surface supplied gas and all exhalant vents to the sea. A large portion of helium and oxygen are wasted.

“When diving deeper than 190 feet, the nitrogen in air becomes narcotic and helium-oxygen breathing gas is necessary. But helium availability has been decreased by use in research and manufacturing. Congress passed the Responsible Helium Administration and Stewardship Act in 2013. Cost already impacts Navy dive training and operations; conservation of helium is urgent,” said NSWC PCD Principal Investigator Dr. John Camperman. “FMGS operational cost is driven by transportation, support vessel size, and consumables. Deck space requirements (largely consumable helium-oxygen gas mixtures) restrict the size of the support vessel.”

The MK29 UBA repurposes a commercially available open circuit helmet and a Navy semi-closed circuit rebreather by modifying them and optimizing integration. The MK 29 vents less of the exhaled breath than the current open circuit helmet and "scrubs" the carbon dioxide from the retained exhaled helium-oxygen gas mixture for subsequent use.
retained exhaled helium-oxygen gas mixture for subsequent use. Prototype analysis and testing have shown that up to 80% reduction in helium consumption is possible. Laboratory testing of the prototype indicates that the full range of FMGS diving is supportable within Navy requirements, and that several life support characteristics are improved relative to the current system, including extended emergency come-home gas duration.

Additive manufacturing was used to print unique titanium components where low profile, low weight, and durability were needed, and traditional fabrication techniques were not practical.

The MK29 can be used to extend FMGS diving operation durations by a factor of five while maintaining the present mixed-gas storage footprint on the support ship. Because less gas replenishment is needed, fewer trips to the dive site reduces vulnerability to weather, hazards of compressed gas cylinder transfer, fuel costs, and total mission time. Alternatively, the MK29 can be used to decrease the footprint of the FMGS system on the deck of the ship without decreasing the number of traditional FMGS dives.

The MK29 is being developed with support from the Office of Naval Research, Supervisor of Salvage and Diving (NAVSEA 00C), and PMS 408. Demonstration dives are planned for the near future.