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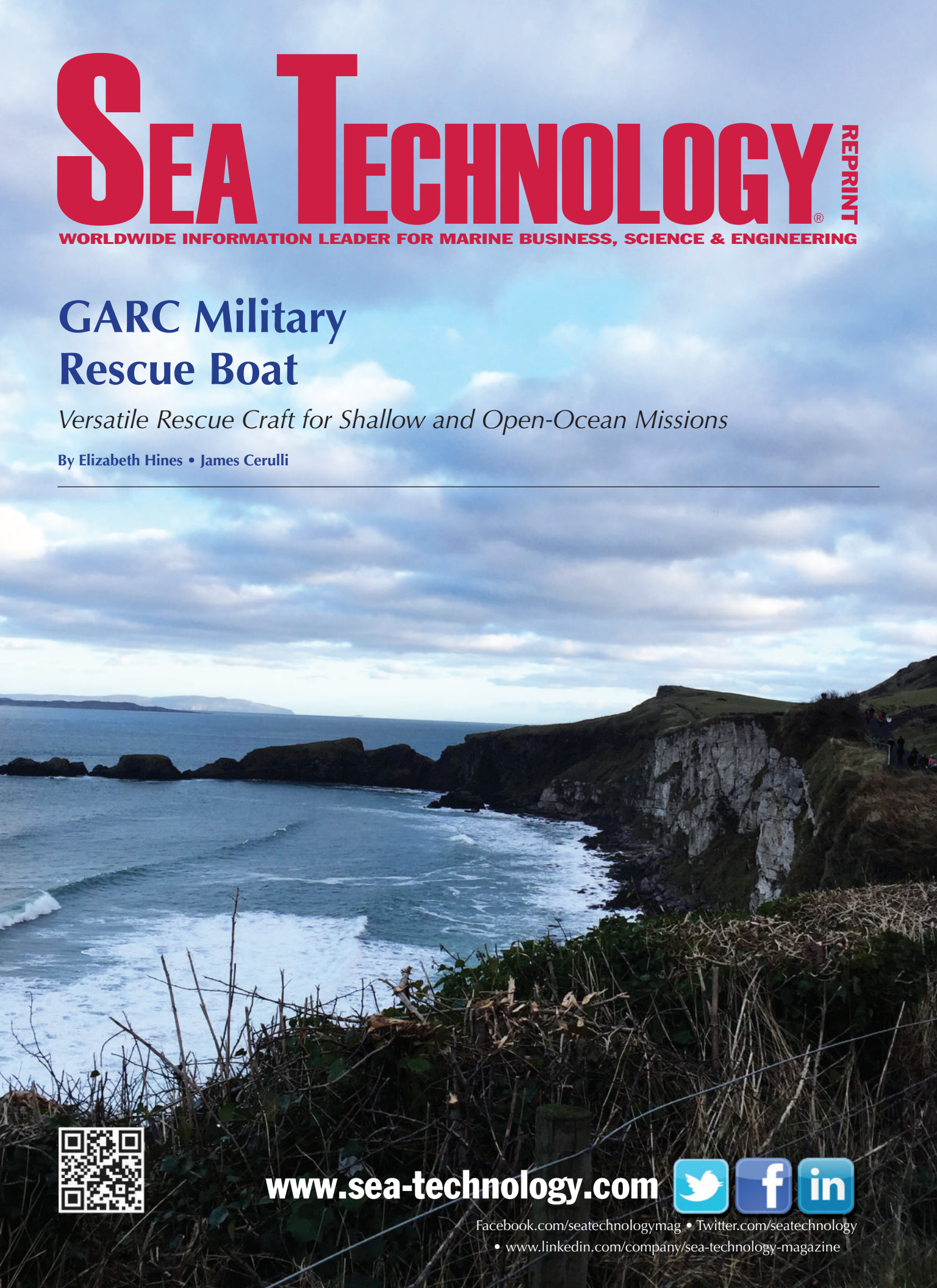

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Versatile Rescue Craft for Shallow and Open-Ocean Missions

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On October 5, 2014 three airmen working at the Kadena Air Force Base were swept into the sea during Typhoon Phanfone, a Category Four storm with winds reaching 150 mph and estimated 15-to-30-ft.-high waves.

A joint rescue mission, launched by the 31st Air Rescue Squadron stationed at Kadena, the 11th Division of the Japanese Coast Guard, and the local fire department, began shortly thereafter, deploying two GARCs and six personal watercraft (PWCs).

"The waves were so high and massive," firefighter Kakuei Oshiro told *Stars and Stripes*.

Within hours, the PWCs either returned to port, unable to handle the waves and the breaking surf, or were disabled, with water jets clogged by floating debris.

The GARC being air-dropped out of a C-130 plane during a training exercise.

The GARC, on the other hand, was in its element. It survived a particularly large wave that disabled one of the PWCs, and went on to rescue the PWC's operator. Two GARCs worked for three days in up to 30-ft. waves, with a payload of two to three U.S. Air Force (USAF) Pararescue specialists (known as PJs) on each GARC. The boats only required refueling once during each 12-hr. day at sea.

Rugged Design

The 3.8-m GARC (Greenough Advanced Rescue Craft) features the maneuverability of a PWC and the stability, payload capacity and range of a rigid hulled inflatable boat (RHIB). The 155-hp. Weber engine has enough power to get the boat on a plane with three passengers. Designers George Greenough and Peter Maguire created the cathedral hull shape especially for stability and for cutting through waves in breaking-surf conditions, so the GARC can be launched through breaking surf. Shallow water is not a problem—it excels in less than a foot of water and the composite hull includes a Kevlar layer, giving it abrasion resistance for rocky river conditions or flooded areas. The jet boat's open transom is ideal for handling both conscious and unconscious survivors; an imperative for all waterborne search and rescue operations. For victims of hypothermia, the GARC includes a warm-water hose attached to the engine.

History

The GARC has had an interesting history. Greenough, well-known for his surfboard designs, has been designing and building surf rescue boats for nearly 30 years. The impetus to update Greenough's famous rescue boat came from Maguire, a former lifeguard who wanted a rescue platform that was more stable and protected the crew from the surf better than a PWC. When the Air Force's Guardian Angel weapons system team of USAF PJs, Combat Rescue officers and professional test engineers tested the GARC for two days in the surf zone at Moss Landing, California, in September 2008, they decided to try dropping the craft from an airplane. GARC proved to be their ideal boat for at-sea rescue operations.

USAF took delivery of the first two test GARCs in January of 2011, finding the GARC to be a fully integrated alter-

The GARC can be launched in breaking surf.

native to the high cost of outfitting disposable PWCs. That same year, NATICK Soldier Systems Center certified the GARC for air drops from C-130s, something enabled in part by the Kevlar layer in the GARC's composite hull.

For the Air National Guard's Pararescue teams, the GARC added a deep-sea rescue capability enabled by substantial payload capacity and quick deployment. The PJ teams are very specialized and their purpose is to save lives: They rescue people beyond enemy lines, they back-fill for combat support, and they carry out large-scale, at-sea rescue missions when called upon by a nation's coast guard or other rescue authorities. The Pararescue men are trained paramedics in addition to being combat trained, and they have to be certified on more than 500 core competencies.

In 2012, Maguire and Greenough sold the GARC to Maritime Applied Physics Corp. (MAPC), an employee-owned engineering firm. MAPC is best known for maritime research and development projects for military applications, such as the first ever HYSWAS (Hydrofoil Small Waterplane Area Ship) and three experimental hydrofoils for the U.S. Navy. Several of their innovative boats have been unmanned. MAPC Founder and President Mark Rice recognized the GARC as a multipurpose platform that fits well with their other maritime systems and hired T.C. Phillips, a former USAF Combat Rescue pilot, Combat Rescue officer and Pararescuer and longtime associate of Maguire's, to help market the boat and liaise with the Pararescue teams currently using the GARC.

When Phillips was introduced to the GARC he was impressed. "The first time I rode a GARC, I understood what a capable vehicle this would be for the PJs to help them with SAR missions," he said. Since that time, he has provided valuable input into making the GARC even more capable.

"In a very short time, GARC has come a long way as a jet boat, and there is no advanced rescue craft on the market today as capable as the GARC," Phillips said.

New Developments

MAPC has now developed a line of manned and unmanned, gas, diesel, 3.8- and 4.3-m GARCs that are stable, dependable, durable, and can turn completely around within one boat length.

"The October rescue and recovery mission in Okinawa proves the GARC's durability and reliability in extreme weather conditions," Rice said. "We know that in future rescue missions, when time is critical and the rescue site could be hundreds of miles offshore, the GARC's ability to be air-dropped from C-130s and C-17s gives it a distinct mission capability for open-ocean rescue operations, such as plane crashes."

MAPC will soon deliver six more GARCs to the U.S. Air Force Reserve. The latest GARC models are all equipped with the Textron/Weber 850 engines, easily capable of 50 kt./hr. With its integrated fuel tanks, at 30 kt., the 4-m GARC has a range of 200 naut. mi., so it is easy to see the advantages over other rescue craft with smaller capacities.

Integrated Technologies

MAPC's customers rely on several enhancements to the GARC demonstrated in the Kadena experience: the trim-jet, the comms system, a sonar attachment, and a soon-to-be-released optionally manned version of the GARC.

The GARC trim-jet changes the thrust vector of the water jet to lift the back-end of the boat so that the vessel planes more quickly under heavy loading. The trim-jet's 400 lb. of lift allows the GARC to carry additional payload, up to a 1,200-lb. capacity.

MAPC has integrated the XPLORE (iX104C5) tablet on the GARC vessel with a docking station. The tablet is mounted as a hands-free display in front of the operator and is removable for off-board situational awareness or mission planning. The XPLORE tablet has a touch screen, is submersible (IP-67 rated), sunlight readable, and regulates temperature with a unique remote heat exchange technology. The XPLORE tablet platform is used in conjunction with these radio platforms: the Harris AN/PRC-117G high-bandwidth radio, the Raytheon MicroLight DM-200 radio, and the Persistent Systems Wave Relay radio. All three of these radios give the user high-bandwidth data communication, and each radio has unique features that make it useful for varying mission sets and interoperability requirements.

The Harris AN/PRC-117G, in addition to the line-of-sight links, also provides an over-the-horizon capability via a satellite link. The radio is secured by the Harris Sierra II software programmable Type-1 encryption module and is certified to carry up to U.S. Top Secret-level voice and data traffic. The radio software has been designed to maximize battery life in battery-powered radios and can support many different encryption requirements. It has a MIL-STD-810G shock absorption certification and can withstand 1-m water depth.

The Raytheon MicroLight DM-200 is a lightweight radio designed for reduced power consumption. It offers Type 1 encryption with secure data and voice communications. Additionally, the MicroLight has an ad hoc self-healing network for greater reliability. The MicroLight is interoperable

with Situational Awareness Data Link (SADL)-equipped aircraft and can automatically provide position, location and tracking to command and control centers.

The Persistent Systems Wave Relay radio can provide a peer-to-peer mobile ad hoc network (MANET) with secure data, video and voice, and real-time position location with more than 30 mbps of multicast throughput.

The FalconView and MAVRCS (Mapping and Visualization Real-time Collaboration Software) are two different software packages for GARC that provide the user with situational awareness capabilities when used in conjunction with the various radios. The FalconView software has been developed for the U.S. Department of Defense over the last 20 years and has been customized for the GARC application. FalconView provides GIS-based situational awareness and allows the GARC operator to communicate seamlessly with the air combat controller. FalconView is often described as somewhere between MapQuest and ArcGIS on the ease-of-use spectrum, and its interoperability with other systems and software make it ideal for military use. The GARC is equipped with a push-to-talk button and up to two headphone jacks mounted on the handlebar.

MAVRCS software, when used in conjunction with the Harris radio, provides situational awareness, including Blue Force Tracking. MAVRCS uses geolocated informational overlays on maps or charts to provide users with an in-depth understanding of complicated situations. MAVRCS has been designed with high-speed operations in hostile environments in mind, and allows the operator to generate waypoints, exclusion zones, set up search areas, designate points of interest, and generate routes. This information can be preprogramed before a mission, updated throughout the mission, and distributed to the other users on the network. Points of interest can be plotted on the tablet and shared within the network, and route changes can be made on the GARC and shared with other users.

As for sonar, GARC can come equipped with a special mount for a side scan or multibeam sonar. MAPC has integrated both L-3 Klein's UUV-3500 side scan and Kongsberg Mesotech's M3 multibeam for mine hunting and undersea detection operations to a depth of 600 m. With the swath bathymetry option, the Klein allows for scanning a wider swath, which is 10 to 12 times the overall altitude of the vessel. The advantages of the Kongsberg multibeam sonar are its high update rates, image quality, real-time output, and ease of use. The M3 can be used in Doppler or chirp modes, providing both imaging and profiling. With the M3's multibeam range of 150 m for small objects, combined with a 120° to 140° field of view, the operator can see the complete underwater picture in real time.

Optionally Unmanned

MAPC expects to release an optionally manned version of the GARC this year that can travel 240 naut. mi. before refueling, has a top speed of 45 kt., and is powered by a 175-hp. diesel Mercury SportJet in-board engine. In its unmanned configuration, it is ideal for proactive and reactive harbor defense, mine hunting (utilizing the sonar mount mentioned above), and over-the-horizon and over-beach missions. MAPC has partnered with FN Herstal and Precision Remotes, which are providing a weapon station that can be pintle mounted. These systems would be remotely operated and are specially designed for maritime applications.

For nonmilitary applications, the unmanned GARC is ideal for undersea cable detection in the oil and gas and wind farm industries. In addition to the radio integration mentioned above, the optionally manned GARC is equipped with sonar EO/IR sensors for real-time subsea intelligence. **ST**

Elizabeth Hines is the manager of business development for Maritime Applied Physics Corp., an advanced marine engineering company in Baltimore, Maryland. Previously, she worked as chief of staff to the Governor's Office of Community Initiatives for Maryland.

James Cerulli has 23 years of technical experience in the areas of electronics, mechanical design, CAD design, solid modeling, electrical system installation, construction, and HVAC with Maritime Applied Physics Corp. He is project lead on the GARC for MAPC and has experience in autonomous and unmanned vehicle design and integration.