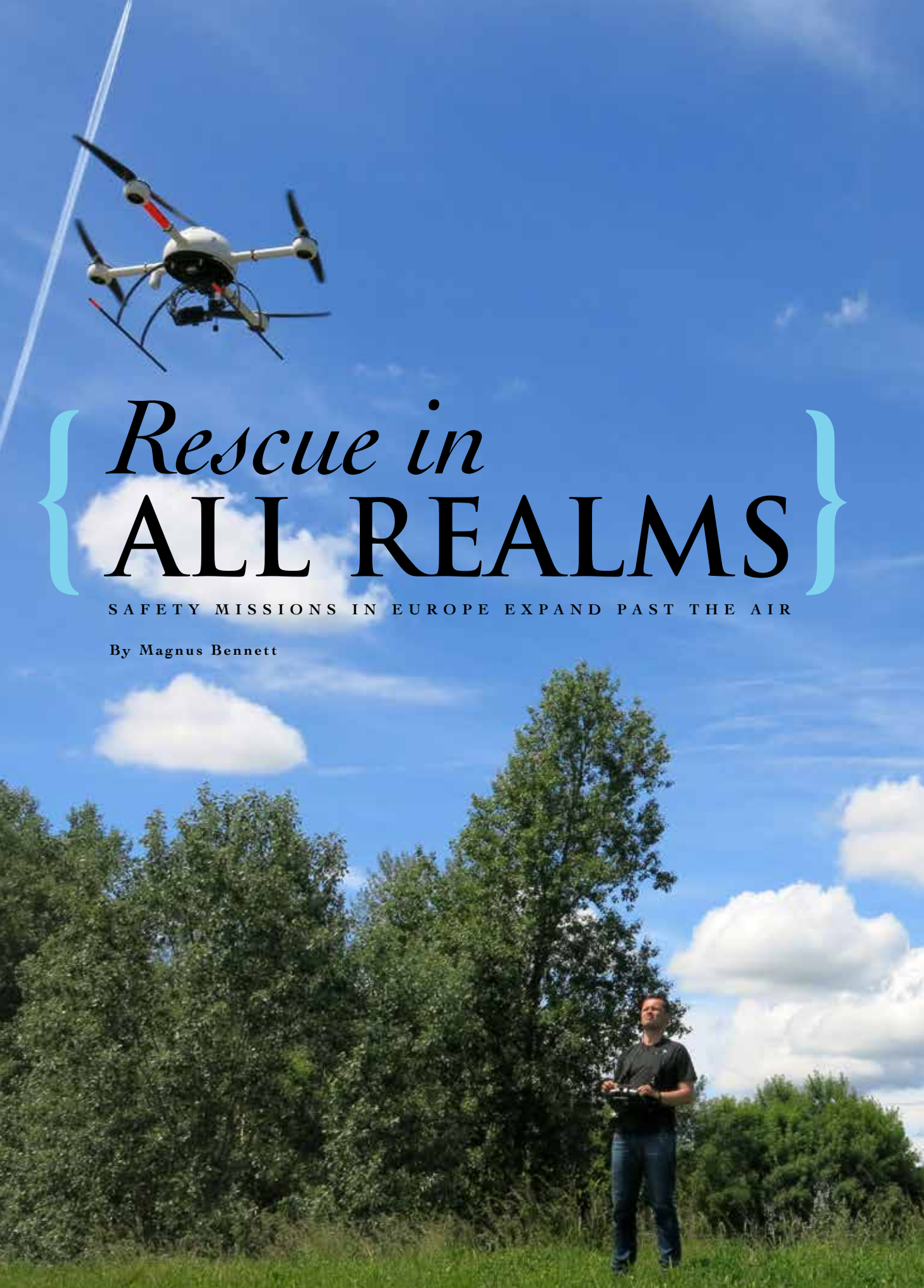


Rescue in ALL REALMS

SAFETY MISSIONS IN EUROPE EXPAND PAST THE AIR

By Magnus Bennett

The ICARUS project used UAS to map flooding in the Balkans in 2014.

Unmanned maritime search-and-rescue projects have been a rarity in Europe in past years, but researchers, companies and governmental organizations in several countries are attempting to change that.

ICARUS, an acronym for Integrated Components for Assisted Rescue and Unmanned Search operations, is perhaps the biggest project currently running on the continent.

Although much of its work has focused on land-based scenarios, several partners have been collaborating on unmanned rescue missions at sea.

In October, Italian aerospace and defense firm Calzoni — part of the U.S.-based L-3 Communications Corp. — Portuguese research and development institute INESC TEC and the Portuguese Navy Research Centre conducted a major trial at the NATO Centre for Maritime Research and Experimentation in La Spezia, Italy.

During the trial, an unmanned aerial vehicle, an unmanned surface vessel and a rescue capsule were deployed to detect a victim on the water's surface and deliver first-aid support. The aerial aspect of the mission was undertaken by a quadrotor UAV called LIFT, developed by the Barcelona-based private foundation Ascamm, while Calzoni's U-Ranger USV was used as an unmanned crisis response boat.

Outfitted with a sensor suite designed and built by CMRE, U-Ranger was deployed to the scene of a staged maritime accident, where it released an unmanned capsule developed by INESC TEC.

The capsule was able to navigate autonomously on the water, carrying a life raft that was automatically inflated close to the victim.

"The U-Ranger is a fast boat capable of performing a set of missions including marine surveillance," Calzoni Research and Development Manager Daniele Bertin says. "In this project the vehicle has been developed further to be optimized for search-and-rescue missions. For this purpose, it has been complemented with parts developed by partners, which include navigation sensors."

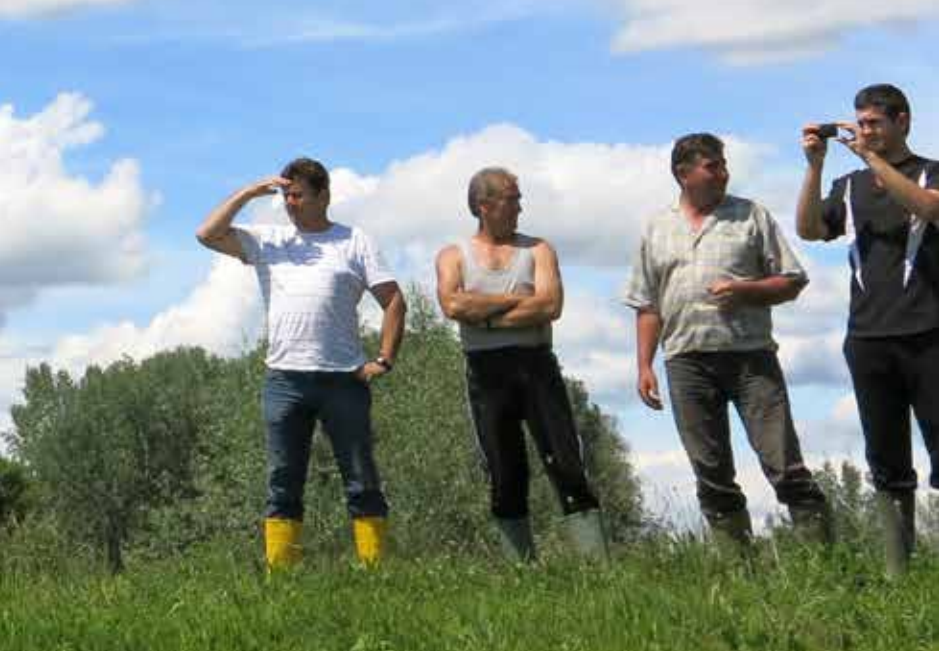


Photo: ICARUS

Stefano Fioravanti, from CMRE's engineering department, said the project aimed to overcome some of the challenges faced in maritime search-and-rescue scenarios, such as harsh weather and sea conditions.

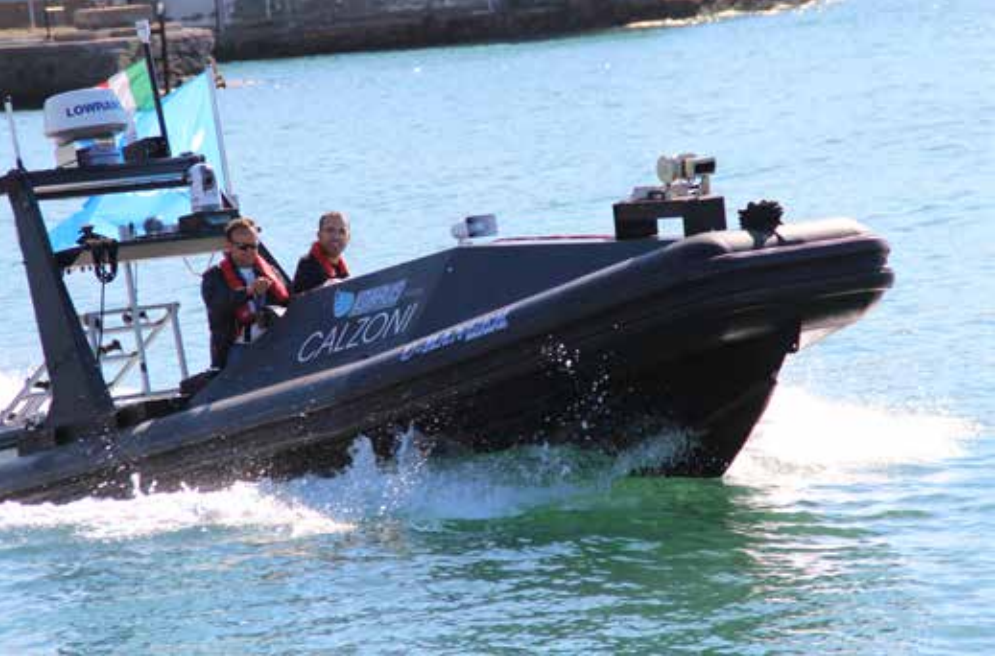
"To make a robot resistant to the marine environment, you need to ensure all parts of it are enclosed in a rain- and splash-proof casing," he tells *Unmanned Systems*. "Not only that, you also need any exposed piece — like connectors, cables, etc. — to be rain- and splash-proof, and if you plan to use or reuse the robot for a long time, you need those parts to be sun and salt resilient. All this comes with a price in weight, which is a serious problem for air drones used in a maritime scenario."

Fioravanti says the trial was able to show "a high degree of integration" of assets used, adding that a single operator of a C2I station developed by Belgian space technology company Space Applications Services was able to control all three robotic vehicles simultaneously.

Other challenges that European projects such as ICARUS have faced include gaining permission to run autonomous surface vessels in open water.

"For instance, in Italy the U-Ranger cannot be used without a professional pilot on board, thus making the whole concept problematic," Fioravanti says. "In the ICARUS project an important part is devoted in getting the approval of end users for the technologies developed.

"End users are frequently governmental organizations, especially in a sea scenario, and it is necessary to convince them of the validity of the robotic tools so we can use their political influence in order to get a response from legislators," he continues. "In addition to that, due to the engi-



Calzoni's U-Ranger USV served as an unmanned crisis response boat in the trials.

neering challenges of developing surface drones, costs are probably higher than in the land domain, where land robots are already employed in many risky situations."

Despite the many obstacles facing the partners, Geert de Cubber from the Royal Military Academy in Belgium, which is coordinating the ICARUS project, describes the trial as a success.

"It is clear that — certainly in a marine context, where the search area is in general very large — one single system is never going to be capable of fulfilling a successful operation, so multi-unit collaboration is a key aspect," he says. "The fact that these tests showed that such collaboration potential is starting to work shows great promise."

The partners will have a final opportunity to refine their contributions to the ICARUS project this summer when a shipwreck accident will be simulated in the coastal waters near Lisbon, Portugal.

In that trial, the Portuguese navy will conduct maritime search-and-rescue operations to locate victims in the water.

They will be assisted by a range of unmanned vehicles developed by ICARUS partners.

Aerial systems will be used to provide crisis managers with an initial assessment of the scenario by performing victim search operations.

After that, unmanned surface vehicles equipped with unmanned capsules will be deployed to rescue victims in the water.

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ICARUS may be one of the biggest SAR projects in Europe, but others have been lining up to make a contribution to the field.

The University of Southampton is one of the few European-based research facilities that has focused much of its attention on maritime-related SAR projects.

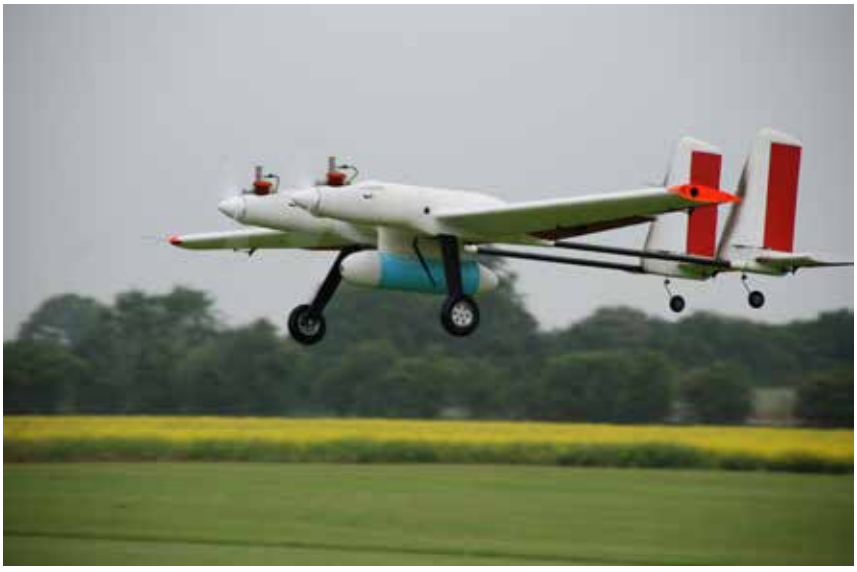
The English university has developed a series of maritime UAVs, which are largely made from 3-D printing techniques.

The university lays claim to being the first to produce a fully printed aircraft in the form of a technology demonstrator called SULSA (Southampton University Laser Sintered Aircraft) in 2011.

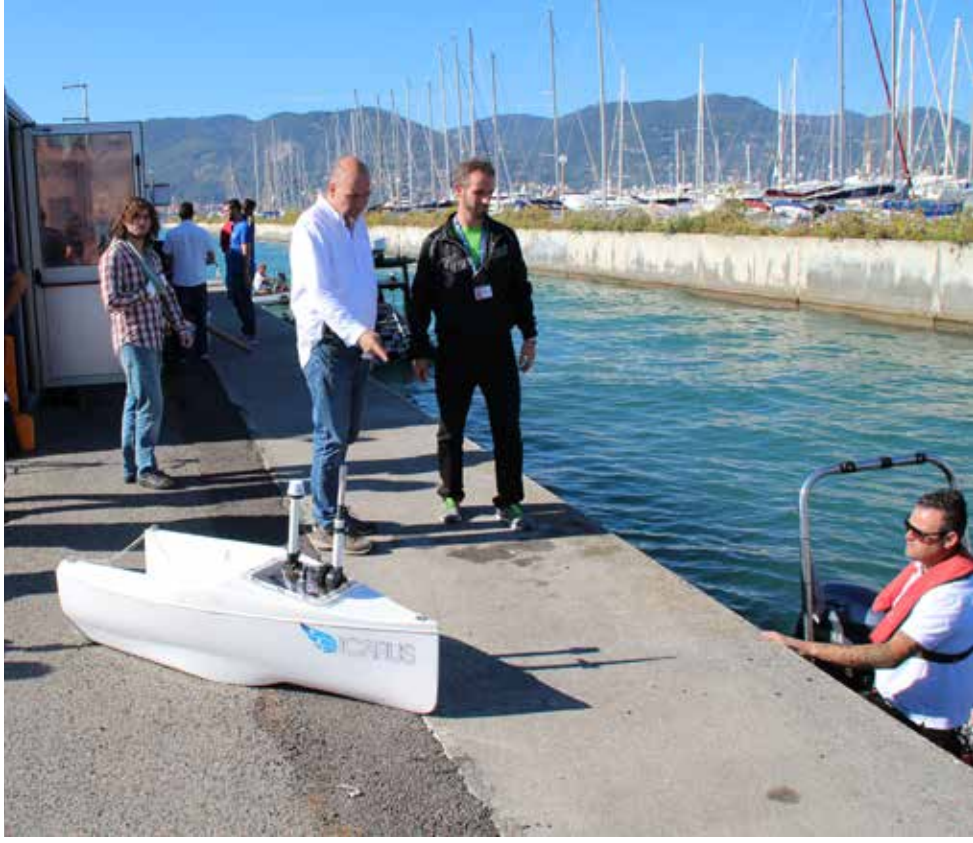
It has since produced several new and more sophisticated versions as part of the European Union-funded 2Seas project, which is aimed at developing low-cost maritime surveillance aircraft.

The 2Seas project involved collaboration between a number of European partners, including Delft University in Holland, the Port of Rotterdam and Kent Police in England.

Its latest UAV, known as SPOTTER (Southampton Platform for Observation, Tracking, Telecommunications and Environmental Recon-



Southampton University's carbon-fiber SPOTTER UAS.



Preparing to launch a smaller USV during the ICARUS trials.

naissance), weighs more than 20 kilograms and has been designed to fly for up to eight hours at a time over the sea. Fueled by a gasoline engine, it has a top speed of 100 mph.

The UAV's central wing box, fuel tank and engine mountings have been printed by 3-D printing firm 3T, while the wings and tail are made from carbon fiber.

Researchers say an emphasis was placed on endurance and reliability.

"What is distinctive about it is the aircraft doesn't have a single point of failure," says James Scanlan, a professor of design for engineering at Southampton. "For example, it is a twin-engine aircraft, with twin generators and two autopilots."

Scanlan says test-flying the UAV has proved challenging, as civil aviation authorities are cautious about risk.

"We have been getting permission to fly extended line-of-sight missions, but we are looking to get approval for beyond-line-of-sight flights," he says. "We want to fly eight-hour missions out over the sea."

Despite the difficulties, Scanlan says a range of businesses and organizations have expressed interest in taking the research project forward, including the Royal National Lifeboat Institution, which is looking to test the aircraft early this year.

"We are in discussions with a number of local companies who are interested in taking it on," he tells *Unmanned Systems*. "If we could produce it commercially ourselves, we could sell 10 tomorrow. Using UAVs in search-and-rescue operations could both save lives and cut the costs of these missions. In time, UAVs will be inexpensive to manufacture, so they could be used in extreme conditions when coast guards would be reluctant to send human beings." ■

Photos: ICARUS, Prof. James Scanlan / Southampton University.