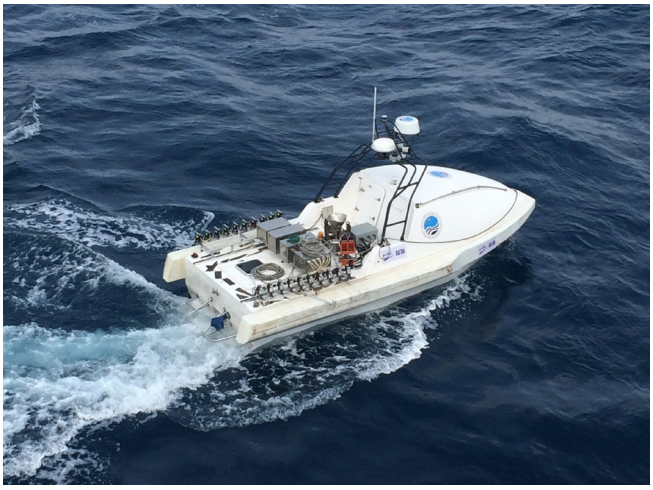
Robotic boats making waves

Shanghai University has developed China's first generation of unmanned surface vehicles.



JingHai USVs developed by Shanghai University are now widely used for marine surveying and charting missions.

China has a coastline of 32,000 kilometres, including islands and reefs, of which much remains uncharted. To better understand the ocean, Shanghai University has developed state-of-the-art unmanned surface vehicles (USVs) that can delve and navigate autonomously to fill in the gaps on China's marine map.

"To develop China's coastal and deep-sea economy, we must have a full understanding of the ocean," says Shaorong Xie, dean of the School of Computer Engineering and Science and former dean of the Research Institute of USV Engineering at Shanghai University (SHU).

The first of its kind established in China, the institute is an interdisciplinary research centre integrating machinery, control, communication, mechanics, materials science, and computer engineering. Based on the university's 30-plus years of robotics research, Xie led a team to develop China's first generation of 'JingHai' USVs.

"The design of JingHai series was beset by challenges," recalled Xie. They need to be able to safely navigate currents, and should be smart enough to avoid obstacles such as reefs, icebergs, and moving ships.

JingHai's research team has made breakthroughs in eight key technologies, including intelligence and autonomous control, marine target detection and recognition, high-performance vibration suppression, and stability control. In the past 13 years, the team has developed multiple series of JingHai USVs, which are widely used as marine robots with autonomous perception and decision-making capabilities for marine surveying and charting missions.

For example, in 2014, JingHai 2 was equipped on the *Snow Dragon 2* polar research vessel for China's 31st scientific expedition to the Antarctica. In the Ross Sea, the USV helped to locate a new anchorage for *Snow Dragon 2* within 0.5 nautical miles of Inexpressible Island. Close to the shore, the anchorage is invaluable for the construction of China's new research station as a service platform.

Since 2015, the JingHai series has completed the first comprehensive geological survey in the South China Sea, and mapped many shallow-water islands and reefs. In 2018, JingHai 3 and 7 carried out the emergency detection and sampling of the contaminated water after the sinking of the oil tanker Sanchi in the East China Sea, providing first-hand data support for the assessment and disposal of the large-scale oil spill.

New technological breakthroughs are expected soon in USV field, Xie says, including swarm intelligence for cluster control and cross-domain synergy between the sky, land, and the sea. The other is strengthened capacity for the USVs to travel into the deep sea with the supply of new energy. ■

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