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# DFI

## Enabling Maritime Autonomy: DFI's ECX700-AL Ruggedized Embedded System in Action

### Background

The maritime sector is rapidly advancing towards autonomous operations, driven by innovations in geospatial technologies and artificial intelligence. This progression encompasses a range of autonomous and unmanned maritime technologies designed for diverse purposes and applications, including Unmanned Surface Vehicle (USV) and Maritime Autonomous Surface Ships (MASS).

Industry: **Marine**

Application: **Unmanned Surface Vehicle (USV), Maritime Autonomous Surface Ship (MASS)**

Solution: **DFI ECX700-AL Ruggedized IP67&IP69K Grade Embedded System- For Offshore Application**



# Background

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Maritime applications are increasingly adopting unmanned and automated systems, shifting away from traditional methods. This transformation underscores the significance of task efficiency and personnel safety by reducing human error and personnel sacrifices.

Both traditional maritime operations and modern autonomous systems, such as USV and MASS, require swift, reliable, and adaptable solutions to navigate this evolving landscape. These robust systems must withstand harsh maritime conditions, optimize routing, enhance monitoring, and ensure rapid emergency responses.

In line with this transformation, our customer has introduced their new USV. Designed to navigate vast oceans and shallow waters, the USV is an essential asset for first responders, emergency services, and government agencies, enabling rapid rescue operations and expedited beach evacuations. Our customer compared various samples from different IPC manufacturers, and DFI's ECX700-AL passed customer-specific tests, showcasing its durability, waterproofing, and resilience to harsh environments. This guarantees its performance in tough conditions, thereby enhancing the safety and efficiency of USV management.

DFI's ECX700-AL is in high demand for maritime applications in the US and Europe, showcasing DFI's commitment to providing robust embedded ruggedized solutions tailored to the needs of today's USV jobs. Our customers appreciate the ECX700-AL for its reliability, strength, and ability to withstand tough offshore conditions.



# Challenges Faced by our customers & DFI's offering

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## 1. Meeting Demands for Ocean Monitoring and Crisis Management

DFI's ECX700-AL embedded system is tailor-made for outdoor harsh environments, meeting the specific needs of our customers' USVs. By providing this robust and reliable embedded solution, it ensures seamless operations in ocean monitoring and crisis management scenarios. ECX700-AL's rugged design and advanced features enable USVs to effectively navigate and respond to emergencies, such as firefighting and rescue missions, enhancing overall mission success and safety. Notably, DFI's adherence to high production standards ensures compliance with international certifications such as ISO 9001, ISO 14001, ISO 13485, IPC J-STD-001, and IPC-A-610. Ensuring customers' success in critical missions throughout the product lifecycle, our full quality management system and comprehensive electrical validation highlight our commitment to quality.

## 2. Critical Communication Hub for Maritime Networks

As a pivotal communication hub, the ECX700-AL plays a vital role in USV operations, serving as a gateway for receiving and transmitting critical information. Tailored to withstand challenging weather conditions and vibrations, this fanless ruggedized embedded system comes with intricately designed I/O setups and an airtight mechanism. It features waterproof connectors, each equipped with a locking mechanism to ensure secure connections. DFI has chosen connectors equipped with waterproof M12 connectors & cables, enhancing signal transmission stability and featuring waterproofing; this also prevents cable disconnection caused by vibrations and maintains stable connection quality.

It supports 4G with an external Nano SIM slot for easy maintenance, protected by a sealed cover. Moreover, ECX700-AL includes a protective pressure relief vent to balance internal and external pressure, effectively preventing heat dissipation that could reduce device lifespan and affect component performance. In maritime networks, the DFI ECX700-AL embedded system facilitates seamless communication between USVs, onshore command centers, and other assets, enhancing situational awareness and enabling timely decision-making.

## 3. Outstanding Ruggedized Embedded Solution for Extreme Conditions

ECX700-AL stands out as a certified embedded system for extreme conditions. Its IP67&IP69K-rated sealed casing ensures dependable performance in harsh climates, enabling USVs to fulfill their missions in maritime environments reliably. Providing dependable performance in maritime navigation, monitoring, and automation systems, enhances reliability and longevity.

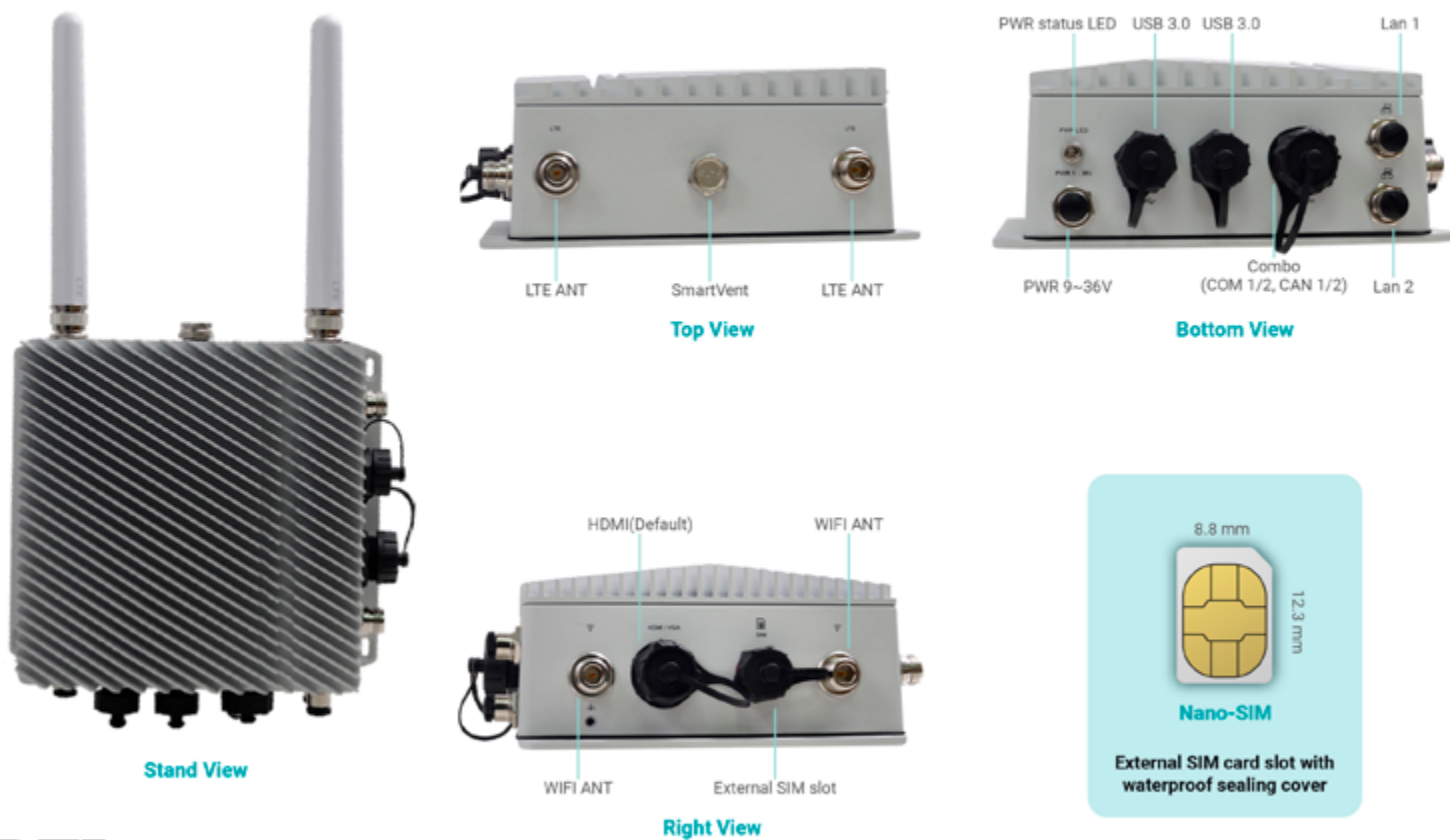
This robust embedded solution's durability against strong vibrations is confirmed through the operation vibration test IEC 60068-2-64 and the operation shock test with half-sine wave 15G, 11ms, 3 shocks per axis. Its resilience to wide temperature ranges of -40 to 70 degrees Celsius guarantees uninterrupted operation in challenging conditions. It has attained certifications such as CE, FCC Class A, and ROHS. Moreover, it has even successfully met our customer's certification requirements. In the next section, we will provide details on the rigorous tests conducted by our customer that the ECX700-AL has undergone.

# ECX700-AL passed tough tests and entered the market successfully

DFI ECX700-AL is designed to withstand extreme environmental conditions, including temperature fluctuation, humidity, and vibration, which are inherent to marine operations. In the realm of USV, reliability and durability are paramount, as these vessels operate autonomously for prolonged periods, navigating intricate routes and maintaining seamless communication with onshore command centers and other USVs.

ECX700-AL underwent rigorous testing by one of our customers. The testing included specific evaluations such as the Operational Endurance Test, Environmental Stress Test, High-Speed Operation Test, and High G-Force Stress Test. The flawless performance of the ECX700-AL during this rigorous testing regime unequivocally underscores the superior quality of DFI's craftsmanship. Moreover, these results, alongside other successful offshore deployments, underscore the ECX700-AL's reliability and efficacy in meeting the exacting demands of USV maritime operations.

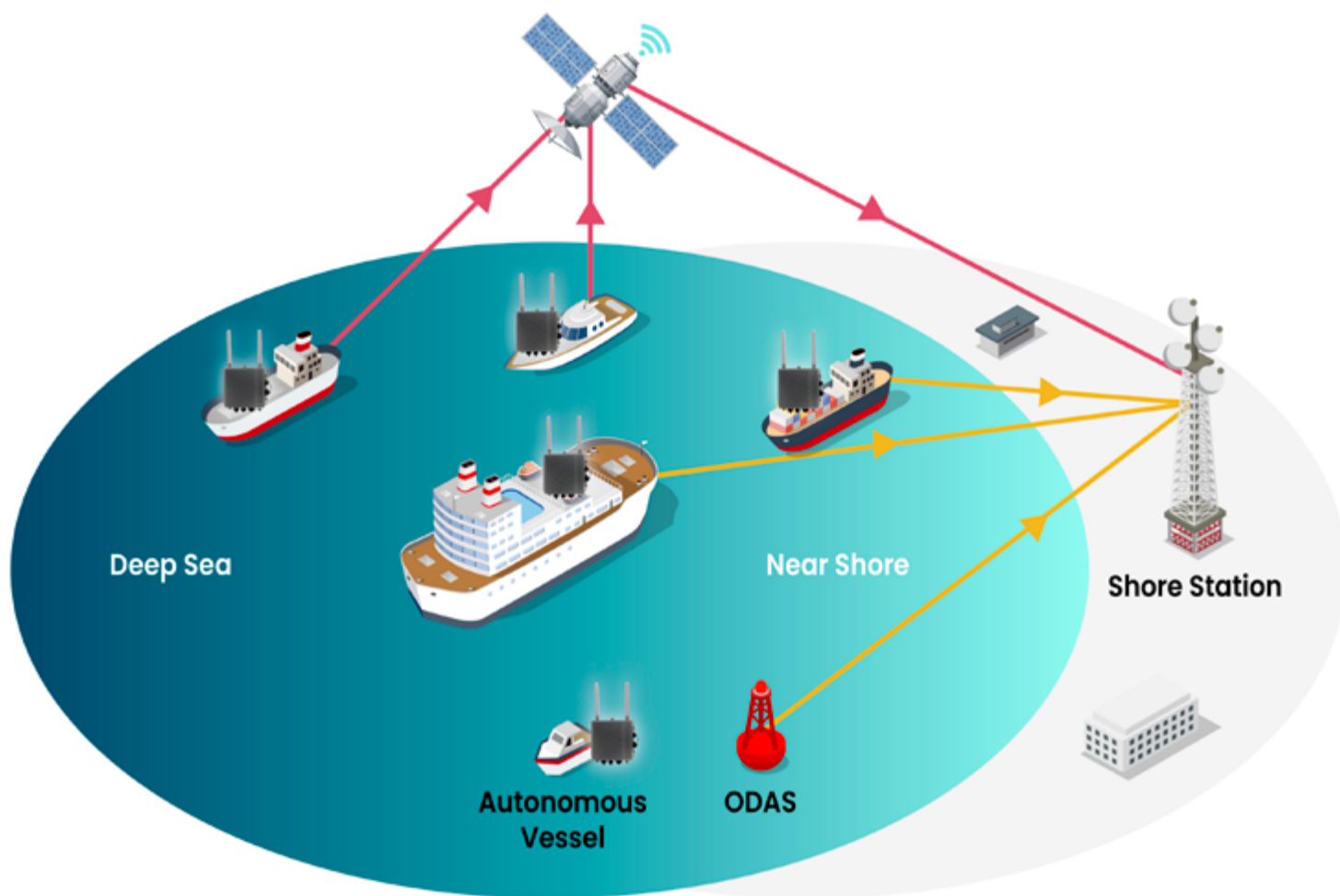
## ECX700-AL KEY FEATURES



# DFI's Response & Results

DFI's ruggedized embedded system ECX700-AL stands as a comprehensive solution tailored to meet the exacting demands of the USV industry. With industrial-grade design and rigorous testing, it ensures both safety and performance, even in the most challenging marine environments. Its versatile capabilities, including peripheral connectivity and the ability to control multiple electronic devices, make it an ideal choice for a wide array of marine applications.

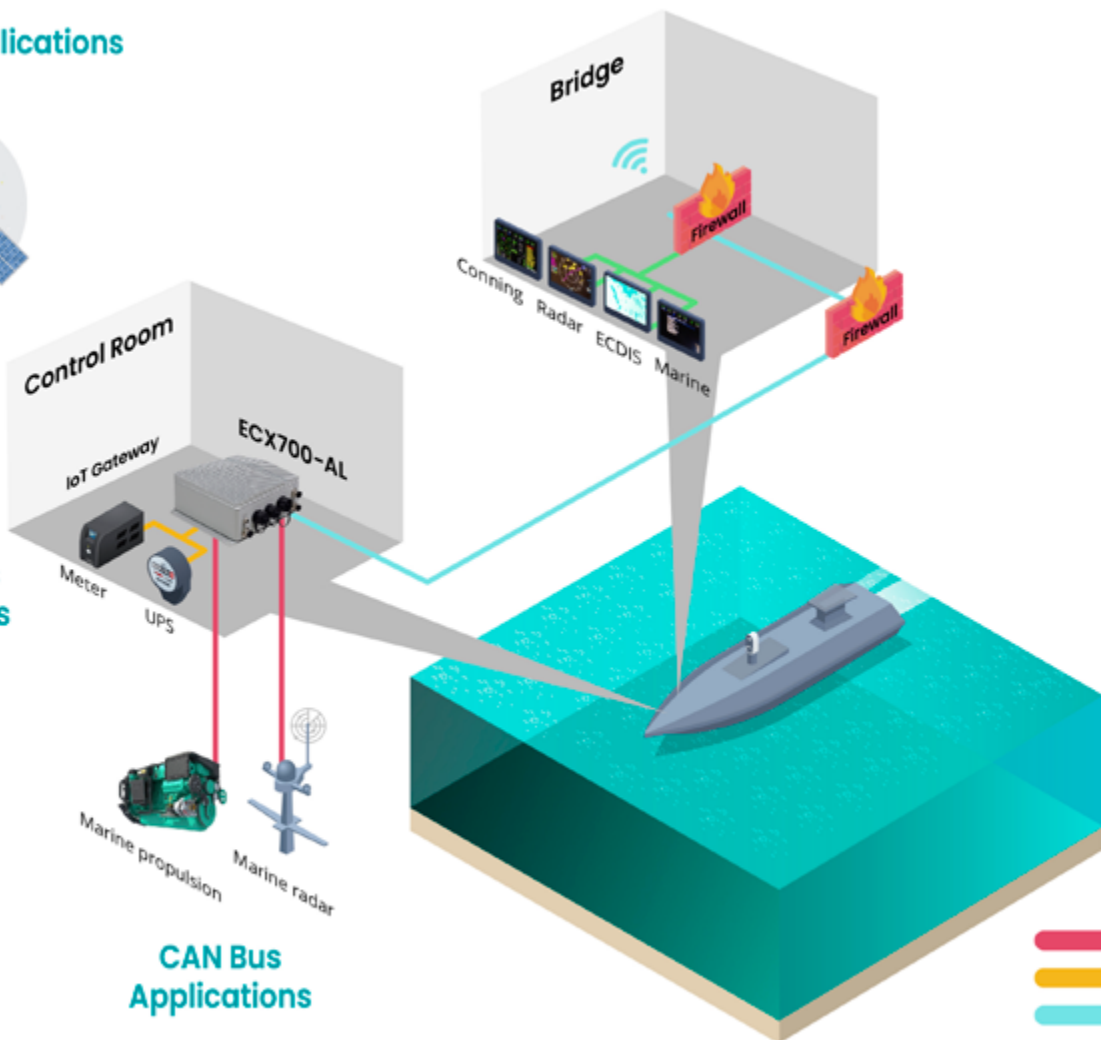
From supporting USV operations at sea to enhancing real-time monitoring and communication capabilities, the ECX700-AL drives innovation and efficiency, facilitating the transition towards autonomous maritime operations including first responders, emergency services, search and rescue, and expedited beach evacuations. Moreover, its data collection capabilities extend beyond land-based applications, with successful maritime deployments in the United States and Europe.



Its precision design ensures outstanding durability, even in harsh maritime, while features like IP67&IP69K waterproof and dustproof ratings guarantee ruggedness and longevity. Moreover, its high-gain antennas and 4G LTE modules with an external SIM slot ensure optimal wireless connectivity and simplify maintenance. This stabilizes wireless signals, further enhancing operational reliability. Capable of operating in extreme temperatures from -40 to 70 degrees Celsius and featuring numerous I/O interfaces, the ECX700-AL ensures seamless integration and exceptional performance across various USV applications.

In addition to offshore applications mentioned above, ECX700-AL's compact design, measuring only 217 x 188 x 87 mm, is highly suitable for installation in tight spaces. With its IP67&IP69K rating, is particularly suitable for outdoor applications such as traffic management, green energy facilities, weather stations, shoreline equipment, high-altitude or high-latitude regions, as well as high-humidity and extreme temperature environments like refrigerated food factories. Besides ensuring stable data transmission, it also effectively reduces maintenance costs.

### Marine Applications



### Serial Ports Applications

### CAN Bus Applications

- CAN Bus
- Serial Port
- Wi-Fi
- Signal

# ECX700AL-Waterproof Test Video

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# DFI

Founded in 1981, DFI is a global leading provider of high-performance computing technology across multiple embedded industries. With its innovative design and premium quality management system, DFI's industrial-grade solutions enable customers to optimize their equipment and ensure high reliability, long-term life cycle, and 24/7 durability in a breadth of markets including factory automation, medical, gaming, transportation, smart energy, defense, and intelligent retail.

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