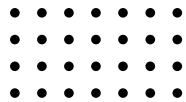




# WinMATE



# 2025

OCTOBER

**WHITEPAPER:**

## CREATING COMPLETE MARINE SOLUTIONS FOR NAVIGATION AND BEYOND

*Building Safer Smarter and More Connected Fleets with Winmate*

**Winmate – Your Best-Mate in Rugged Solutions**

# Why Marine IoT Matters Now

The maritime industry is facing growing complexity. Problems like fragmented systems, rising regulatory pressure, and the challenge of turning vast amounts of shipboard data into actionable insights. Marine IoT provides the answer by creating a connected ecosystem that unifies navigation, cargo, and machinery data while enabling real-time analytics at the edge.

With rugged hardware, reliable networking, and embedded AI, vessels can enhance safety through anomaly detection, boost efficiency with predictive maintenance and fuel optimization, and simplify compliance with IMO and cybersecurity standards. In short, Marine IoT is becoming the foundation for safe, efficient, and sustainable maritime operations worldwide.

## What's Driving The Shift



### DIGITALIZATION

Over 80% of maritime stakeholders view digitalization as critical for future competitiveness, with tools like ECDIS and digital twins becoming standard across commercial and defense fleets.



### AUTONOMY

Maritime Autonomous Surface Ship (MASS) projects are underway worldwide, including trials in Norway, Japan, and South Korea, proving autonomy is moving from concept to deployment.



### ARTIFICIAL INTELLIGENCE

Embedded AI models, such as YOLO variants, have demonstrated over 90% accuracy in detecting vessels, debris, and anomalies in real-world maritime trials.



### SUSTAINABILITY

The IMO 2050 strategy calls for at least a 50% reduction in total greenhouse gas emissions from international shipping compared to 2008 levels.

## Where the Impact Is Seen

#### • Digitalization

### 70% Adoption

Nearly 70% of new vessels are delivered with integrated digital bridge systems and ECDIS, making digital navigation the new global standard.

#### • Expanding Market for Marine IoT Solutions

### \$11B Value

The global Marine IoT market is projected to reach \$11 billion by 2030, driven by demand for real-time monitoring and smarter ship-shore connectivity.

#### • Rapid Growth of Maritime AI Research

### 35% Growth

Maritime AI research output has grown by 35% since 2020, reflecting rising adoption of AI for detection, monitoring, and predictive analytics.

#### • Sustainability and Emissions Monitoring

### 3% Emissions

Shipping accounts for about 3% of global GHG emissions. Meeting the IMO's 2050 goal of a 50% reduction requires IoT-enabled monitoring and efficiency gains.

# Marine Devices & Operational Challenges

Every vessel at sea depends on a set of core technologies to operate safely and efficiently. Navigation systems, monitoring consoles, embedded computers, and networking backbones all play critical roles in day-to-day operations. These devices must withstand the constant pressures of the marine environment. Saltwater corrosion, violent vibration, fluctuating temperatures, and limited connectivity can strain even the most advanced systems. On top of that, crews must contend with overwhelming amounts of data, diverse ECDIS models, and rising expectations for compliance and usability.

This is where the link between challenges and devices becomes clear. For every obstacle, there is an essential piece of equipment designed to meet it.

The following breakdown pairs common operational challenges with the devices that help overcome them.

## Operational Challenges

- **Harsh Environment**

Saltwater, humidity, constant vibration, and extreme temperatures can quickly damage standard electronic equipment on ships.

- **Communication Limits**

At sea, connectivity is limited and often unstable. RF and acoustic links have range and bandwidth restrictions, while satellite connections can be slow or expensive.

- **Data Overload**

Ships collect large amounts of data from radar, sonar, AIS, cameras, and engine sensors. Without filtering, the volume of raw data can overwhelm networks and delay decision-making.

- **Compliance & Usability**

Crews often deal with multiple systems and ECDIS models, each with different interfaces. This increases training requirements and the chance of human error.

- **Energy Constraints**

Remote buoys, AUVs, and offshore platforms must operate with limited power sources. Energy efficiency is critical for long-term deployment.

## Technology Solutions

### Rugged Panel PC and Display



### Marine Ethernet Switches



### Marine Embedded Computers



### Rugged Panel PC and Display

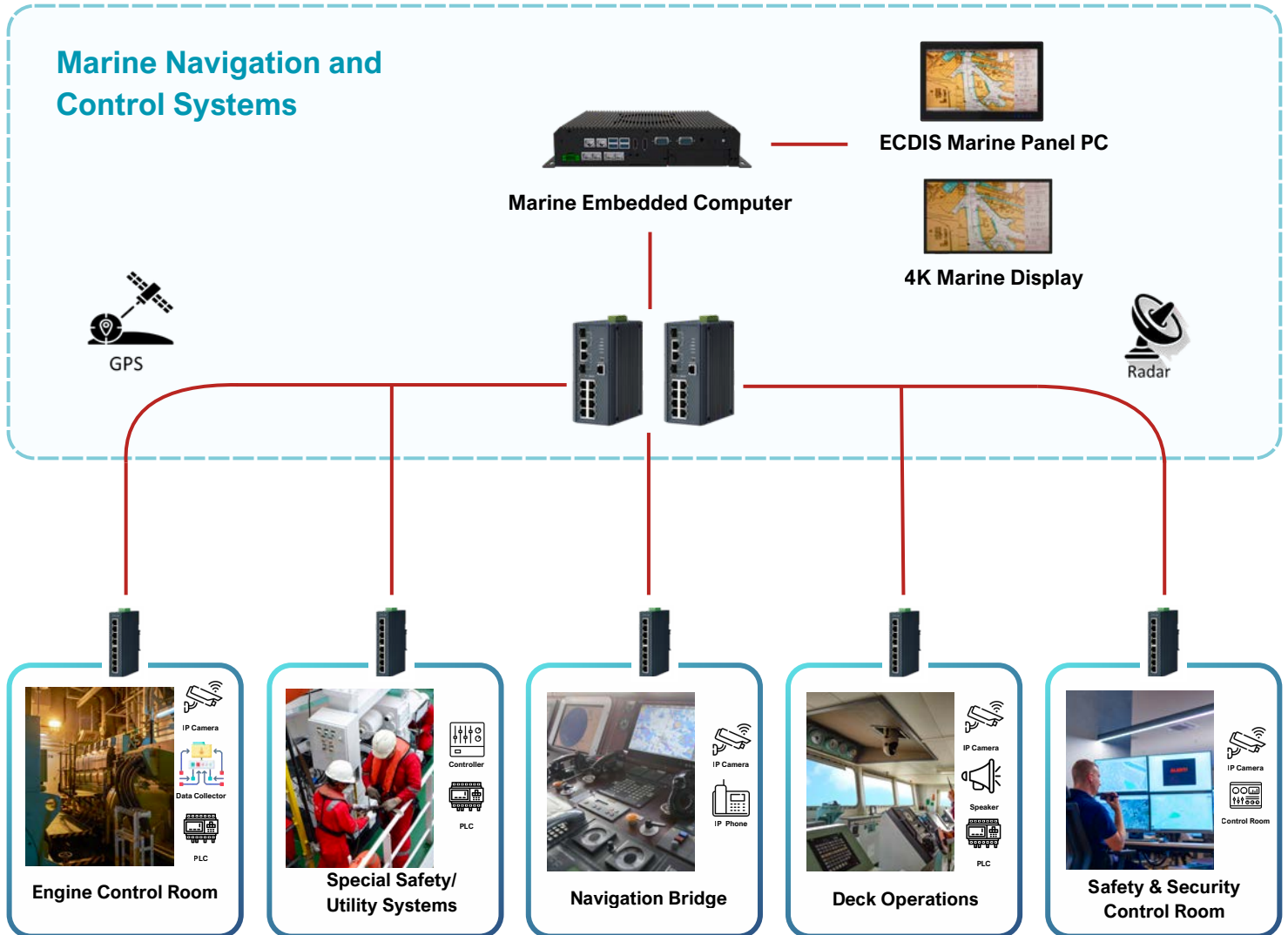


### Marine Embedded Computers



# Winmate's End-to-End Solutions for Connected Vessels

Connecting the Future of Maritime Operations with Winmate Solutions



This diagram illustrates how Winmate enables end-to-end Marine IoT connectivity across a vessel. Data begins at the source, IP cameras, PLCs, controllers, and safety systems located in the engine room, safety control room, special device control, and open deck.

These devices, along with communication systems, feed into Marine Ethernet Switches, which provide the ship's stable, redundant backbone network. GPS and radar inputs are also integrated to support navigation and situational awareness.

All information converges at the Marine Embedded PC on the bridge, where it is processed, filtered, and prepared for real-time use. From there, the data is displayed on marine-certified monitors, including 4K displays for multi-visualization, standard marine displays, and ECDIS-approved screens for navigation.

Together, this ecosystem ensures that ships have a resilient, connected, and compliant platform for safe and efficient operations.

# Winmate Marine Product Family

## Panel PC

10.1" - 27"



*ECDIS Marine Panel PC*

10.1" - 24"



*Marine Panel PC*

10.1" - 14.9"



*Marine Dashboard Panel PC*

## Display

15" - 32"



*ECDIS Marine Display*

10.4" - 24"



*Marine Display*

27" - 55"



*Marine 4K Display*

## Embedded Computer



**I330EAC-IE3**

Intel® Pentium® N6415



**I330EAC-ITW-6L**

Intel® Core™ i5-1135G7



**EACIL20-MR**

Intel® Pentium® N4200



**I330EAC-ITW**

Intel® Core™ i5-1135G7

## Ethernet Switches



**EACSW**



**EACSW-L2**

## Winmate Products Meets Global Marine Standards and Certifications



DNV GL certification is a globally recognized standard that verifies marine equipment meets strict class rules for safety, reliability, and environmental performance. It covers areas such as temperature, vibration, humidity, IP protection, safety, and EMC, ensuring systems can withstand the harshest marine conditions.



IEC 60945 is an international standard that ensures marine electrical and electronic devices used for navigation and telecommunications operate safely and reliably at sea. It defines requirements for electromagnetic compatibility (EMC), durability in harsh maritime environments, usability in varying lighting conditions, power supply tolerance, and safety standards including thermal performance, hazardous emissions, and grounding.



The International Association of Classification Societies (IACS) defines global standards for marine safety and equipment reliability through its IACS E10 Rev. 7 specification, effective January 2022. This standard sets type approval requirements for marine electronics, covering electromagnetic compatibility (EMC), environmental performance across wide temperature ranges with vibration and salt mist resistance, and ingress protection (IP) against water and dust. It also extends EMC testing up to 6 GHz, ensuring devices meet modern communication demands.

# Applications



## Enhancing Bridge Operations and Compliance with ECDIS-Approved Panel PCs

Bridge teams rely on ECDIS for safe navigation, but harsh environments and varying models create reliability and training issues. Winmate's ECDIS Panel PC, DNV-certified and ruggedized, ensures consistent performance and compliance. It unifies navigation data, simplifies operation, and improves situational awareness.

## Enabling Real-Time Data Processing in Engine Control and Offshore Operations

Offshore vessels face bandwidth limits and data overload from cameras and sensors. Winmate's Marine Embedded Computer processes data at the edge, running AI for detection and filtering before transmission. This reduces satellite costs, supports real-time decisions, and strengthens integration with the Engine Control Room.



## Improving Situational Awareness in Bridge Operations with High-Resolution Displays

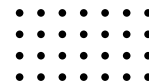
Legacy bridge monitors lacked clarity and multitasking capability, forcing officers to switch between screens. Winmate's 4K Marine Display offers certified durability, high resolution, and split-screen support. Integrated with ECDIS and radar feeds, it boosts situational awareness and streamlines navigation on modern bridges.

### DID YOU KNOW?

ECDIS displays must be precisely color-calibrated to meet IHO and IEC standards, ensuring every chart symbol, contour, and alarm is shown accurately in day, dusk, and night modes. Even slight color shifts can affect safety.

Winate's DNV-certified Marine Panel PCs and Displays are factory-calibrated for compliance and built to perform reliably in harsh marine conditions.





# How Marine IoT Devices Will Define the Next Decade

The maritime sector is entering a transformative decade shaped by digitalization, autonomy, AI, and sustainability. With shipping responsible for nearly **3%** of global emissions, IMO's 2050 strategy requires a **50%** reduction, making IoT-enabled monitoring and edge analytics essential for efficiency and compliance.

Adoption is accelerating, about **70%** of new vessels are delivered with ECDIS and integrated bridge systems, maritime AI research output has grown **35%** since 2020, and the Marine IoT market is forecasted to reach **\$11 billion** by 2030. Rugged, certified devices, Panel PCs, embedded computers, and high-resolution displays will be central to building safe, efficient, and future-ready fleets.

- **Marine IoT as a Backbone:**

Connecting sensors, networks, and edge computing with certified HMIs and displays transforms vessels into fully integrated digital ecosystems.

- **Challenges Meet Solutions:**

Harsh environments, bandwidth limits, and data overload require rugged, intelligent devices, from ECDIS panel PCs to embedded computers and 4K marine displays.

- **End-to-End Readiness:**

Winmate's marine-certified solutions provide reliability across bridge, engine control, and offshore operations, enabling safer navigation, efficient monitoring, and long-term compliance.

## Conclusion

What will define the next generation of maritime operations, more ships, or smarter ships? The evidence points clearly to the latter. As digitalization, AI, and sustainability reshape the industry, vessels will increasingly rely on interconnected systems that unify data, support real-time decision-making, and withstand the challenges of harsh marine environments.

Marine IoT provides this backbone, linking sensors, embedded computers, displays, and certified devices into one reliable ecosystem. With ECDIS adoption growing, AI applications accelerating, and the Marine IoT market projected to reach \$11 billion by 2030, investing in resilient, marine-certified technology is no longer optional. It is the path to safer navigation, efficient operations, and long-term compliance.





## About Us

With over 30 years of industry experience, Winmate is a global leader in rugged computing and intelligent edge solutions. From rugged tablets and rugged laptops to panel PCs, industrial displays, Edge AI systems, and robotic controllers, our products are built to support demanding environments across industries. We specialize in providing tailored solutions and hardware customizations to meet the unique needs of customers in sectors such as industrial automation, defense, logistics, automotive, and more. Backed by in-house testing laboratories and a strong global distribution network, Winmate ensures reliable performance, long-term support, and proven durability.

For more information about Winmate, please visit our website: [www.winmate.com](http://www.winmate.com)

## Contact Us

### Winmate Inc.



No. 18, Zhongxing S. St.,  
Sanchong Dist.,  
New Taipei City 241017, Taiwan  
**Tel** +886-2-8511-0288  
**E-mail** sales@winmate.com.tw  
**Website** www.winmate.com

### Winmate USA Inc.



2640 Mathews Street,  
Smyrna, GA 30080, USA  
**Tel** +1 678-653-8800  
**E-mail** NASales@winmate.com.tw  
**Website** www.winmate-rugged.com

### TTX Canada Inc.



150 Werlich Drive, Units 5&6  
Cambridge, Ontario, N1T 1N6 Canada  
**Tel** +1-519-621-1881  
**E-mail** Sales@ttx.ca  
**Website** www.ttx.ca

### Winmate Switzerland



**Primelco Visual Data AG**  
Neuhofstrasse 25  
6340 Baar  
**Tel** +41 41 767 01 70  
**E-mail** product@primelco.ch  
**Website** visualdata.primelco.ch

### Winmate Germany



**TL Electronic**  
Bgm.-Gradl-Straße 1  
85232 Bergkirchen-Feldgeding  
**Tel** +49 8131 33204-0  
**E-mail** info@tl-electronic.de  
**Website** www.tl-electronic.de

### 北京京融电自动化科技有限公司 苏州办事处



215100 江苏省苏州市工业园区唯新路69号  
一能科技园3号楼206室  
**Tel** +86-512-6826-6696/6829-6696  
**E-mail** sales@winmate.com.cn  
**Website** www.winmate.com.cn

### Winmate Japan



**HPC Systems Inc.**  
LOOP-X 8F,3-9-15 Kaigan,  
Minato-ku, Tokyo 108-0022, Japan  
**Tel** +81-3-5446-5535  
**FAX** +81-3-5446-5550  
**Website** www.hpc.co.jp