

# Intelligent Navigation System

## ► Overview

The Intelligent Navigation refers to the application of modern information technology, automatic control, artificial intelligence, and big data analytics to enable ships to perceive their environment, make autonomous decisions, perform coordinated control, and achieve dynamic optimization during navigation. The core objectives are to enhance navigational safety, economic efficiency, environmental sustainability, and automation, while reducing human intervention and promoting a transition toward efficient, low-carbon, and smart maritime operations.

The Intelligent Navigation System integrates key functions such as situational awareness, intelligent route planning, collision avoidance assistance, energy efficiency management, and human-machine collaboration. It supports multi-source data fusion and dynamic environmental modeling, combined with a highly reliable control architecture to intelligently manage complex navigation tasks. The system is designed in strict accordance with the China Classification Society (CCS) Rules for Intelligent Ships, offering comprehensive capabilities in intelligent perception, decision-making, and execution, and is suitable for both newly built intelligent ships and retrofitting existing vessels for intelligent upgrades.

## ► System architecture

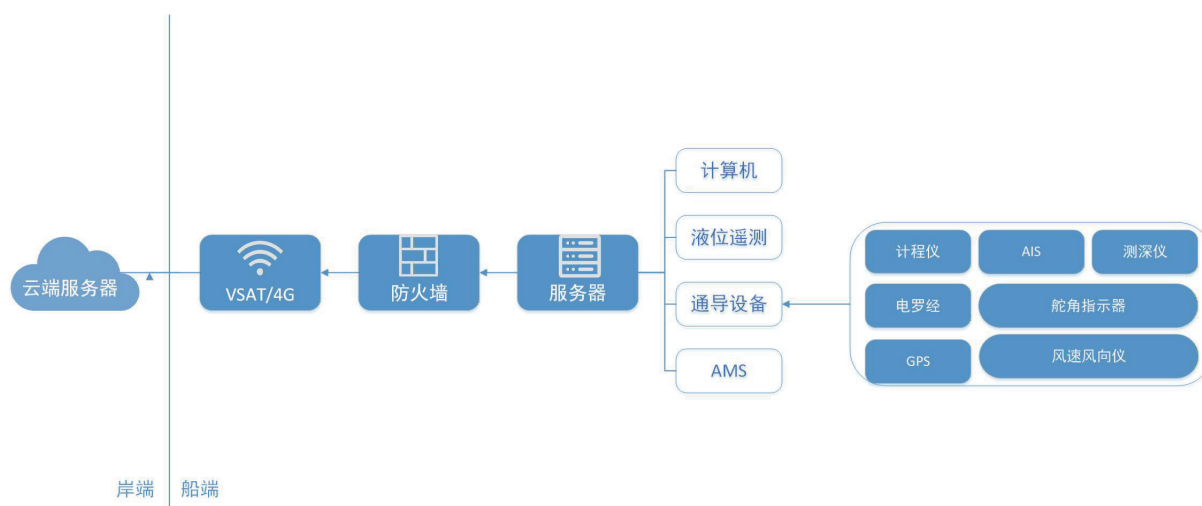


Figure 1 The Intelligent Navigation System

## ► Product features

- Multi-Source Data Fusion for Enhanced Perception Accuracy;
- AI-Powered Decision-Making and Control;
- Modular Design for Easy Integration and Expansion;
- Closed-Loop Voyage Data Management for Retrospective Analysis;

## ► Product function

- Navigational Situation Awareness;
- Energy Efficiency and Speed Control;
- Intelligent Route Planning and Dynamic Optimization;
- Voyage Data Recording and Intelligent Analytics;
- Collision Avoidance Decision Support;
- Human-Machine Collaboration and Interface Optimization;

## ► Product technical parameters

- System Indicators
- Data Update Rate:  $\geq 1$  Hz (for navigational status data)
- Positioning Accuracy:  $\leq 5$  meters (GPS/DGPS)
- Data Storage Capacity:  $\geq 12$  months of voyage logs (local/remote)
- Heading Control Error:  $\leq \pm 1^\circ$  (in auto-heading mode)
- Collision Avoidance Response Time:  $\leq 3$  seconds

## ► Software interface

