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**Technology and innovation for port  
equipment and logistics**

Cathay Nebula was established in 2011 with its headquarter in Beijing, We are mainly engaged in the development, production, sales and technical services of intelligent control systems for port equipment and committed to automation, informatization and intelligence of terminal operation process.

Cathay Nebula is customer-oriented focusing on navigation control, laser scanning, artificial intelligence technology and deep integration with business processes. At present, Cathay Nebula has its presence in more than 40 countries and 200 terminals around the world with wide recognition globally. Cathay Nebula has become a well-known high-end intelligent system and service provider in port industry.

As a leader in technological innovation in the industry, we always adhere to the concept of "Technology creates the future, innovation realizes dreams" and empowers the industry with leading technologies. We continue to provide users with "safe, intelligent and efficient" products and services.

01

Company profile

P3

02

Equipment empowerment

P13

03

Operation upgrade

P25

04

Way of future

P37

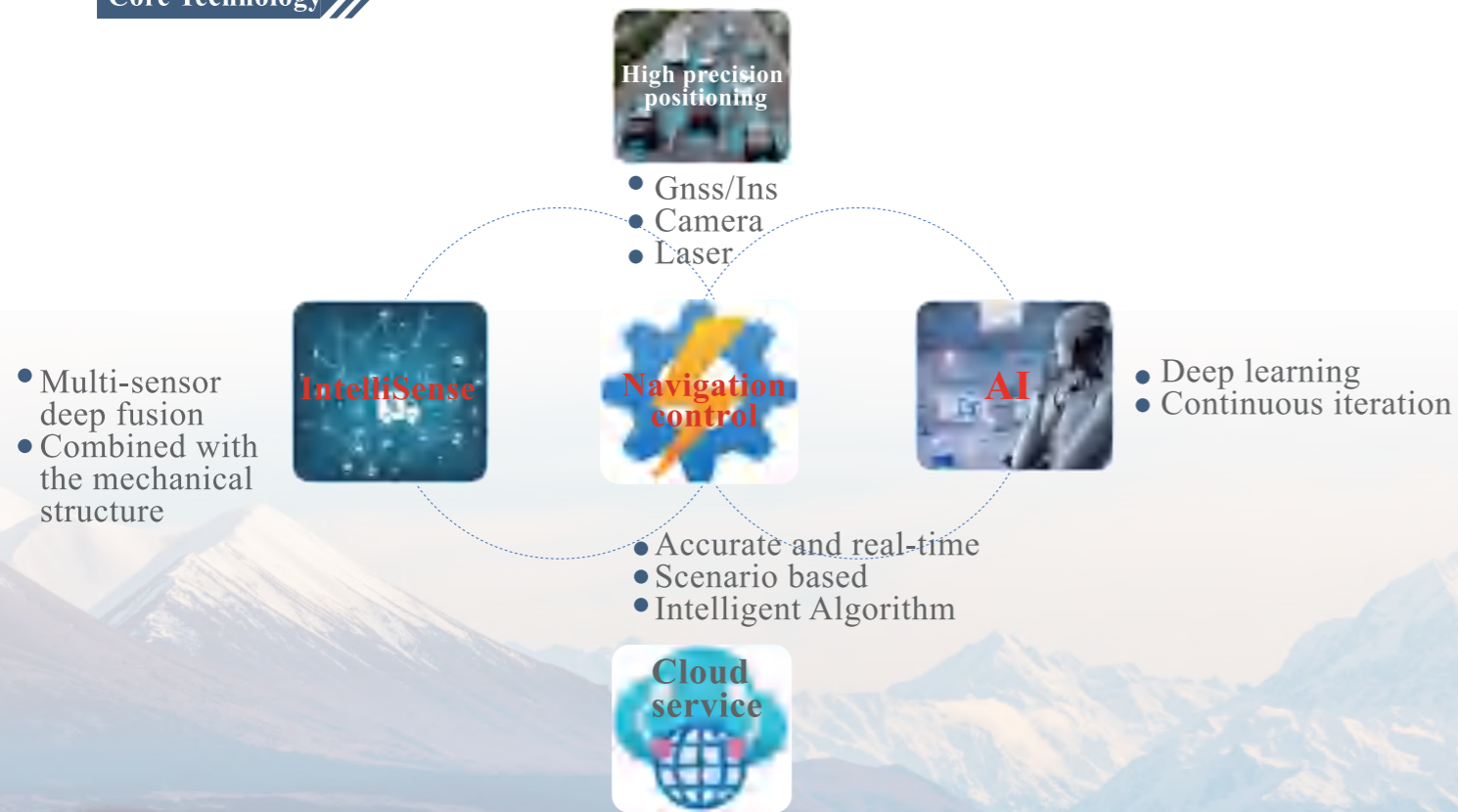
Technological advancement

Innovation | Optimization | Perfection



- R&D center in Beijing & Qingdao
- high-level team of 40 engineers
- Temperature, vibration and other testing laboratories
- Scenario-based simulation R&D platform

Core Technology



Patents & copyrights for in-house developed products



Certification and Awards

## Production Strength

Faster

Better

### » Facility

Cathay Nebula strives to build first-class production and manufacturing capabilities, and has built a 1,200-square-meter assembly line in Qingdao with complete and sophisticated process equipment and testing instruments.

### » Quality control

Cathay Nebula follows ISO9000 quality system and has established a complete test and inspection standard. All products have passed high and low temperature, vibration, aging and other inspection procedures with zero defects.



### » Standardized production

Cathay Nebula has established a standardized production process for 6S management, material selection, wiring, assembly etc. Major systems have passed CE and UL certification.

### » Packing and shipping

Standardized pallet packing box has good protection performance. Each set of products is boxed separately, which is convenient for handling and reduces labor intensity.

Service capability

Global network | Online & onsite | Swift response

Global service network

Service outlets in India, Sri Lanka, Turkey, Thailand, Malaysia, Saudi Arabia, Brazil and other countries, which can provide pre-sales and after-sales consulting and technical services.



13+

Professional team

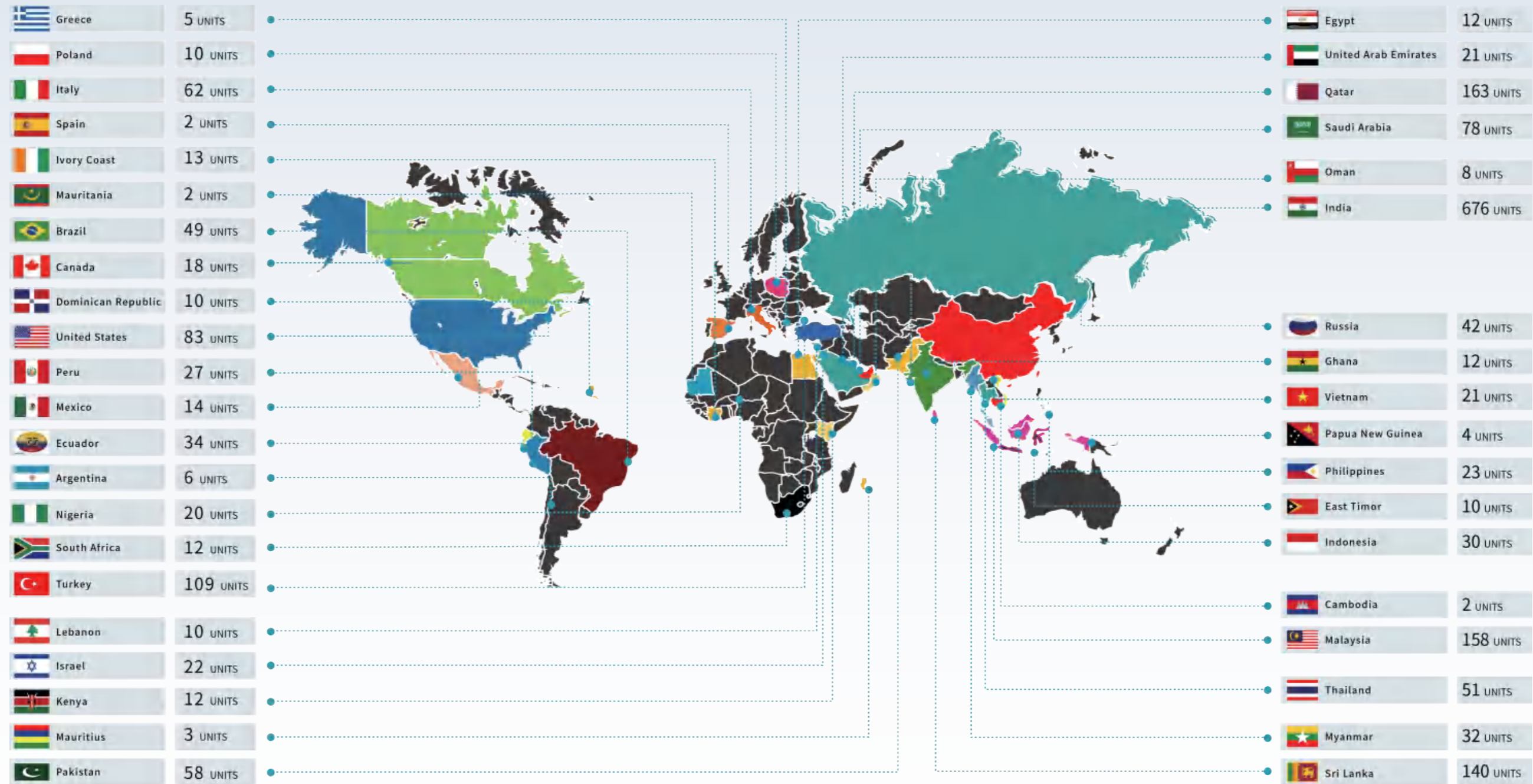
Cathay Nebula has a professional service team of 100+ people to provide professional technical services such as installation, commissioning, training, consulting, etc. We have 22 data-based delivery evaluation indicators, and build a lean management and evaluation system



After-sales service:

- On-site service
- Remote diagnosis & commissioning
- Proactive return visit/inspection for customer feedback

# Global reference



Cathay Nebula has its footprint in more than **200** terminals in **43** countries around the world, with a global sales volume of **4247** units and have been widely recognized by users around the world.

Among those include **511** unit port cranes in **26** automated terminals and counting.

# Smart Port Solutions

Cathay Nebula is committed to:

Equipping automation systems for port equipment, empowering operating equipment, promoting single intelligence and local optimization;

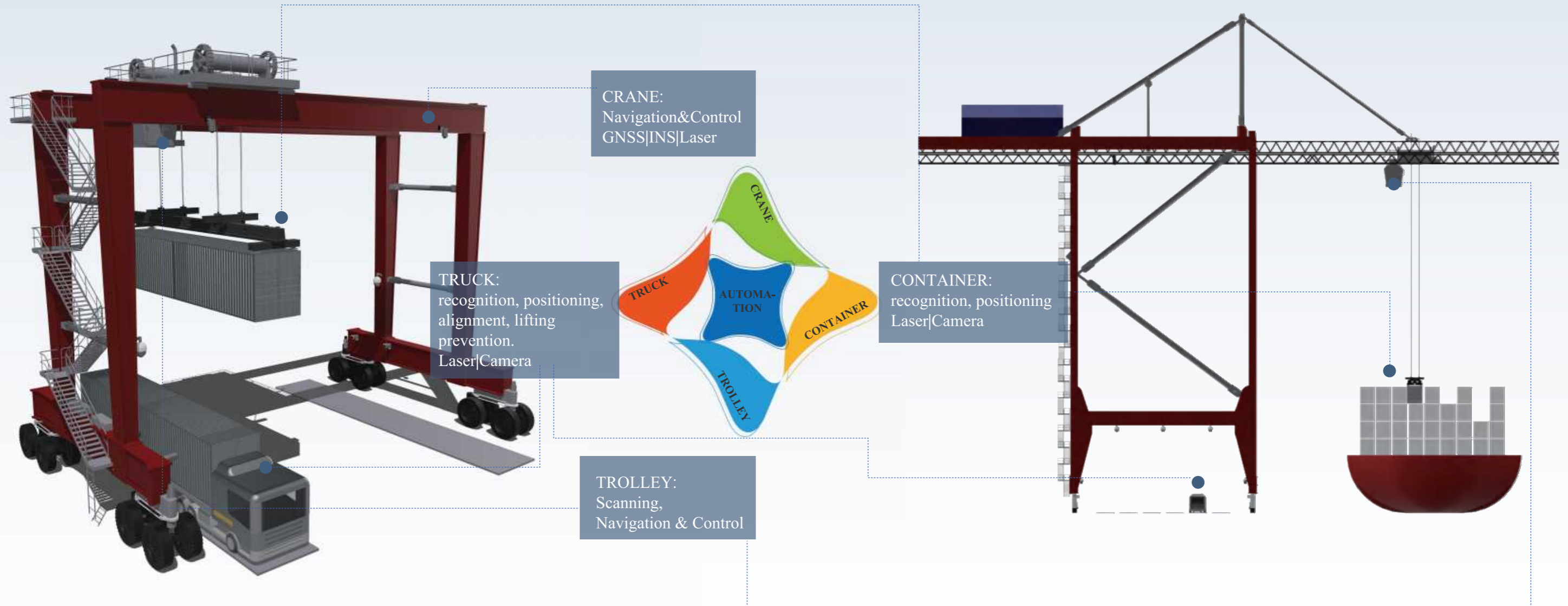
Intelligently upgrading yards, gates, tally, and horizontal transportation, optimizing collaboration processes and assisting build a smarter port hub.

- 01 Empower port equipment  
-Port handling equipment automation
- 02 Upgrade operation intelligence  
-Port operation intelligentization



Port handling equipment automation

Automation upgrades to unleash productivity

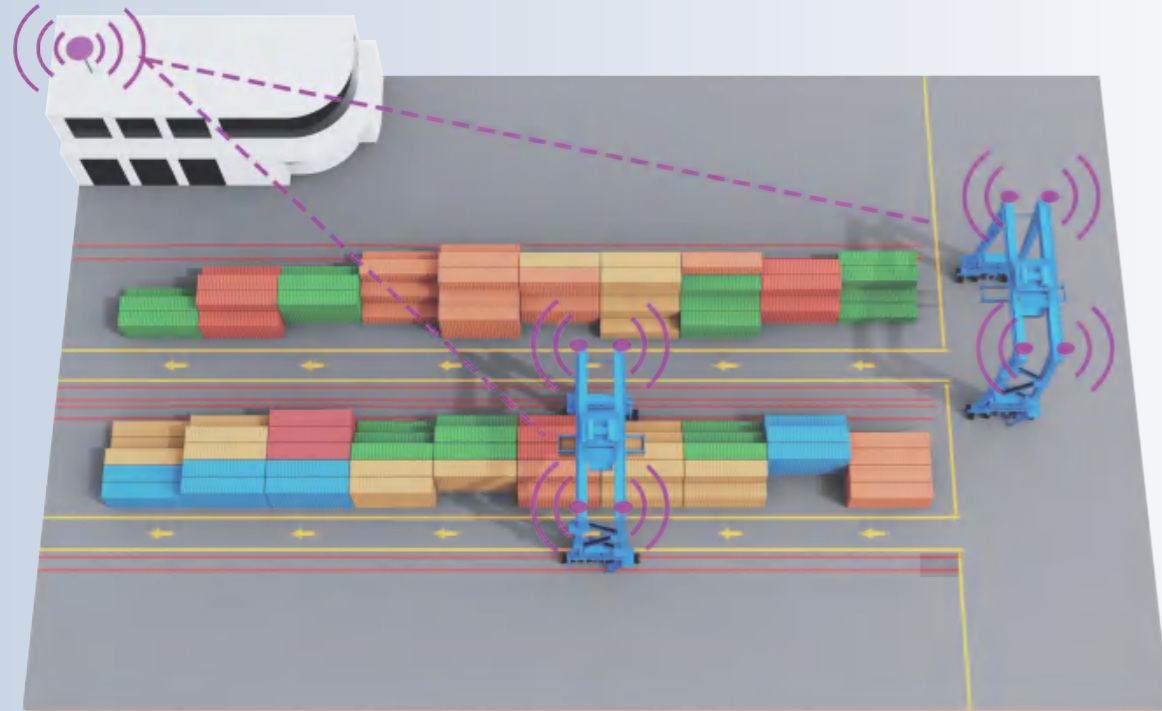


According to industry-related research and public media reports, automated terminals have greatly released productivity, compared with traditional manual terminals:

Productivity **30%↑**    Energy consumption **25%↓**    Labour cost **80%↓**

Auto Gantry Move System (AGM)  
Auto Gantry steering System (AGSS)

Multi-Sensor Fusion | Optimal for RTG automation



The attitude of the RTG is particularly critical for automation. The settlement of yard, deformation of RTG, and the tire pressure will all affect the automated pick-and-place containers. Automating the yard through magnetic marker, gray bus, and vision cannot well adapt to the influence of the bilateral positioning and tilt of the RTG. AGM system adopts GNSS/INS integrated navigation technology, which is designed for navigation and positioning, attitude measurement, travelling deviation correction, automatic arrival and bilateral precise parking of ARTG. It is an ideal choice and can interface with TOS to realize precise scheduling and container management. AGM system can be downgraded to Auto Gantry Steering System.

Scope of application

System	ARTG	RTG	Reach stacker	Portal crane
AGM	●			
AGSS		●		
VTS			●	●



System benefits



Automation without modifying the site



Prevent collision with containers



Reduce labor intensity of manual operation

System features



Precise real-time

Multi-antenna with differential GNSS positioning, real-time synchronous parking on both sides, control error less than 5cm.



Attitude control

Attitude control to compensate for the influence of RTG deformation and yard undulation, making it more suitable for complex old yard



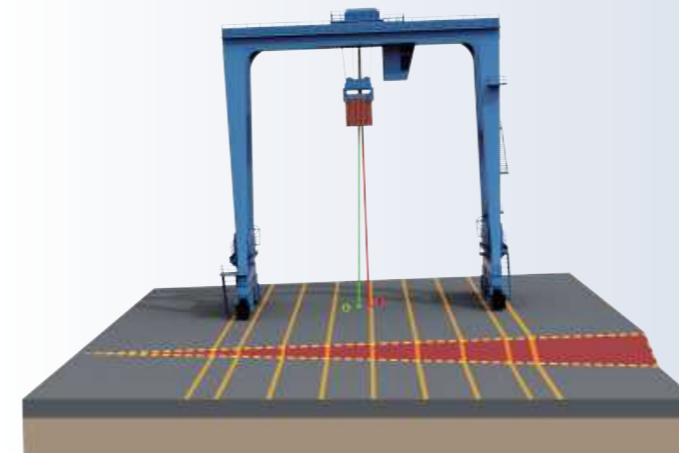
Reliability

Integrated navigation and positioning, can work with high reliability around the clock



High mobility

Compatible for crossing and shifting yards



Chassis Lift Prevention System (CLPS)

1300+ unit installations

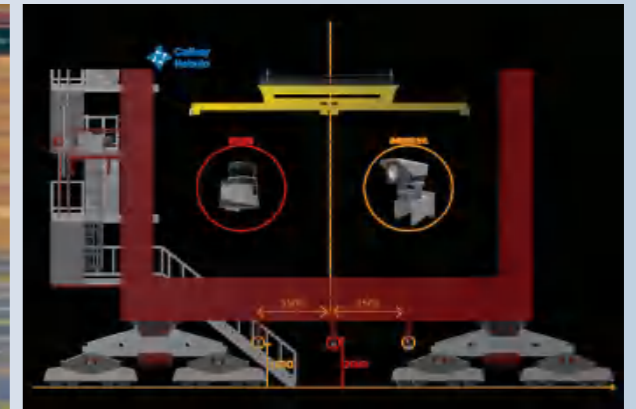


There are many types of trucks, different structures, heights, and complex working conditions. A single protection technology cannot meet the comprehensive protection requirements of automatic cranes. CLPS adopts multi-sensor fusion technology designed to detect the separation of container and the truck chassis for RTG and RMG unloading operations, so as to prevent lifting accidents.

System benefits



Prevent chassis lift and protect truck cabin



System features



Multi-sensor fusion

Laser and camera combination to detect and determine



Accidents playback

Capture images of accident for analysis



AI empowerment

Enhanced performance through continuous deep learning



AI

Twist lock detection



Performance report



Protection analysis

Chassis Positioning System (CPS)



Automated loading and unloading equipment requires the truck to maintain a precise position in both the gantry and trolley direction, so as to ensure the accurate and efficient container handling. CPS adopts laser scanning and vision technology to position trucks, AGV, etc. under RTG, RMG and QC. Truck deviation in gantry and trolley direction is precisely identified for automatic alignment.

System benefits

-  **Safety:** prevent cabin crash, truck abnormal moving and spreader dragging
-  **Efficiency:** shorten alignment time and therefore saving cost

System features

- **AI empowerment:** Built-in truck models for swift truck positioning and alignment
- **Easy calibration:** Calibration button in operator cabin to compensate for projection errors caused by mechanical structure changes and undulation
- **Container gap detection**

Scope of application

System	ARTG	ARMG	RTG	RMG	QC
CPS-3D	●	●			●
CPS-V	●	●	●	●	●
CPS			●	●	●

## Stack/Vessel Profiling System (SPS/VPS)

Automated cranes generally goes for rectangle mode, which cannot take into account both efficiency and safety. SPS/VPS adopts 2D and 3D laser scanning to realize profile-based motion control preventing collisions in working and adjacent bay and also guides parabolic movement of the spreader.

SPS/VPS can be used for RTG, RMG and QC to prevent accidents and optimize spreader motion control.

### System benefits

**Safety:** Collision prevention in stack and vessel

**Efficiency:** Support parabolic movement

### System features

- **Adjacent bay protection:**  
-3D profile to prevent collision in both current and adjacent bay
- **Intelligent control:**  
-Adaptive to MPC algorithm, the movement of the trolley and load is more continuous and smooth
- **Trajectory analysis:**  
-performance assessment
- **Swift bay shiting:**  
-no need to await bay scan-ning before operation

### Scope of application

System	ARTG	ARMG	RTG	RMG	QC
SPS-3D	●	●	●	●	
SPS			●	●	
VPS					●



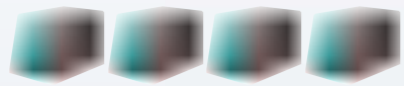
### Solutions for ARTG

 **Advanced technology**

 **No need for site modification**



**Chassis Positioning System (CPS)**  
Laser and camera based



**Stack Profiling System (SPS-3D)**  
3D Laser



**Chassis Lift Prevention System (CLPS)**  
2D Laser and camera based




**Auto Gantry Move System (AGM)**  
GNSS + INS



**OCR Vision Recognition System (VRS)**  
Camera based



**3D Crane Anti-Collision System (ACS)**  
3D Laser + Binocular camera

 **Multi-sensor fusion**

 **Reliability around the clock**

# Port operation intelligentization

1 Gate: Smart Gate

2 Horizontal transportation: Smart scheduling

4 Yard: Visualization

3 Quay: Smart tally

# AI Vision Recognition System (VRS)



Container number, ISO, truck number, IMDG, seal presence, door direction etc. identification for:

- 20/40/45ft standard & non-standard containers
- Single & twin lift
- Span, back-reach and dual trolley operation
- Trucks, straddle carrier, double stack, and bi-direction
- Conventional crane;
- Remote controlled & automated cranes

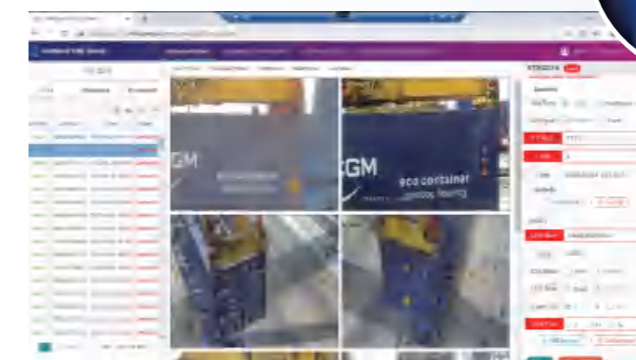
# OCR based tally robot



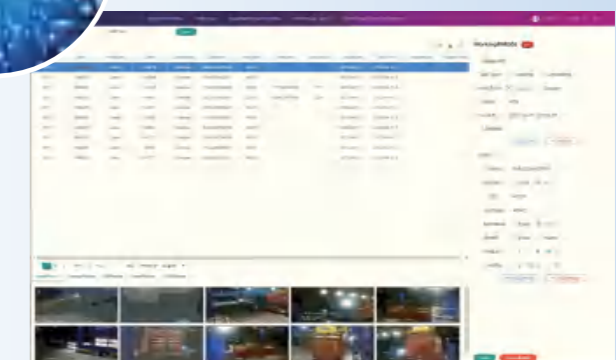
Distributed identification  
Centralized management



Automated damage  
detection



Manual intervention  
with exceptions



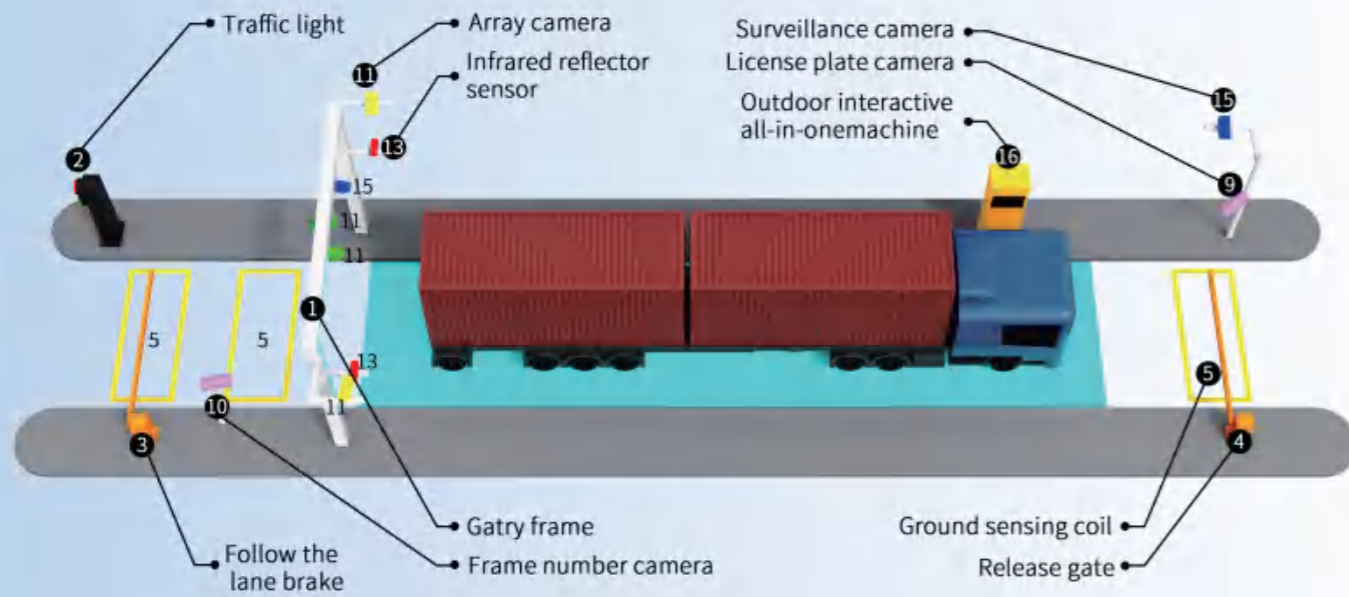
Performance report  
& analysis

## System benefits







- No site tallyman is required
- Cost saving up to 75%
- 1 person for up to 4 cranes
- Hardware share with CPS

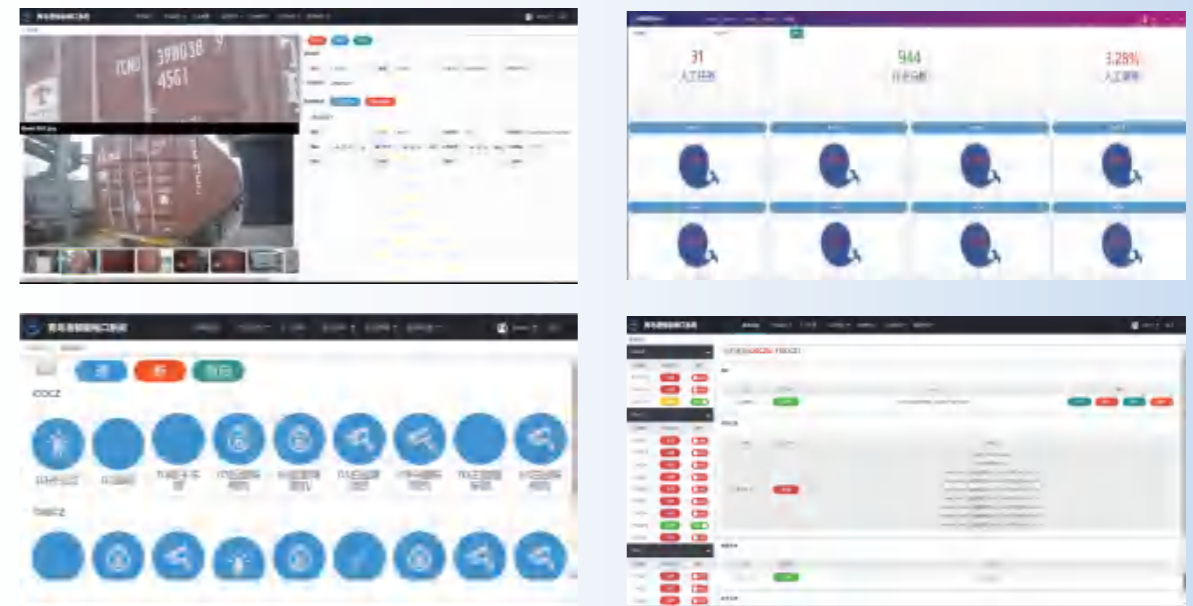
# Smart Gate System

Manual gates are prone to congestion and low efficiency. Based on AI technology, smart gate efficiently complete the information collection and identification of people, vehicles and cargo therefore realizing data pre-processing, automatic identification, electronic documents, and self-service gate passing.







## System features

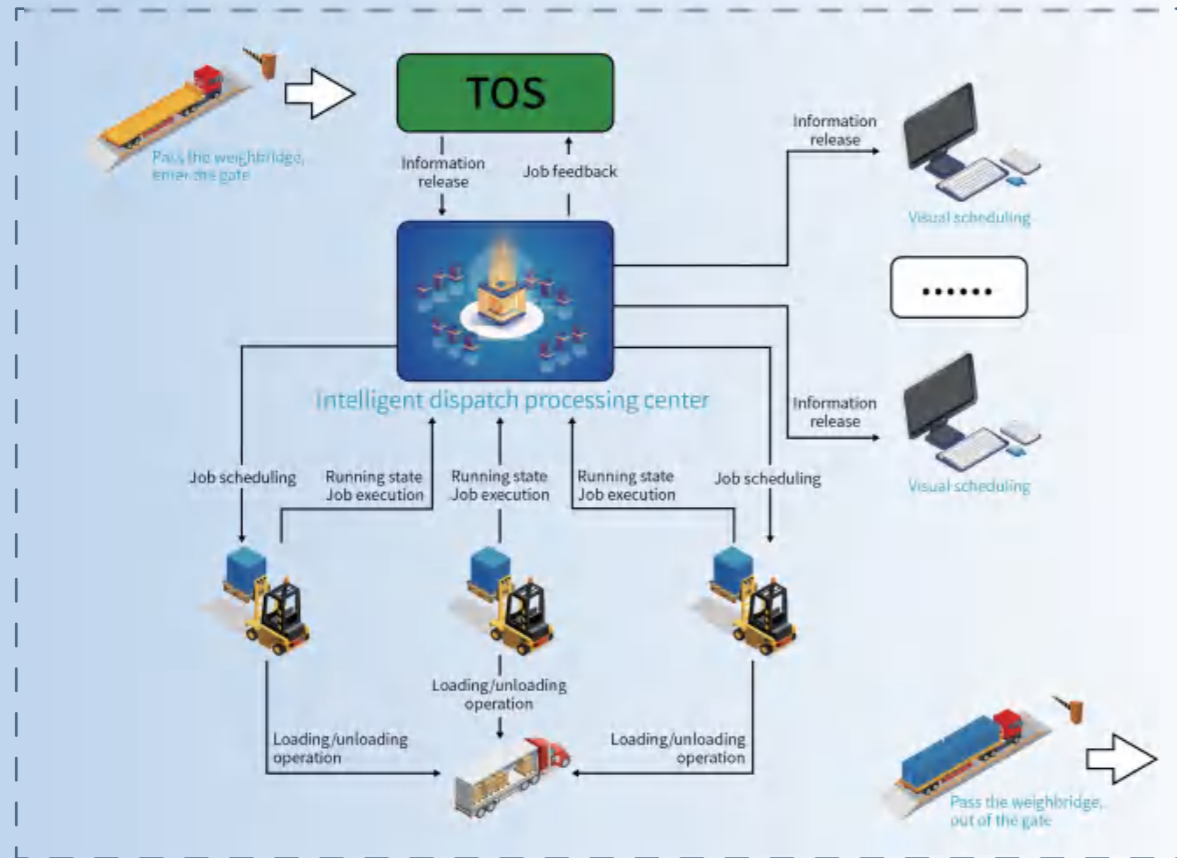
-  Light modification
-  multi-stop gate
-  Remote & centralized management
-  Automatic damage detection
-  Truck speed detection
-  Panoramic container image



## System benefits

-  **Reduce congestion:** Shorten the gate-passing time by 60%
-  **Cost saving:** up to 80%
-  **Service improvement:** Enhance the passing experience and improve terminal services
-  **Environmentally friendly:** Electronic without papers

# Intelligent Scheduling System








The Intelligent Scheduling System comprehensively considers job attributes, job busyness, road network distance, operation capacity to carry out automatic scheduling. It significantly changes the manual scheduling mode of bulk cargo terminals, and realizes scientific and efficient scheduling of machinery.

## Smart Terminal Device



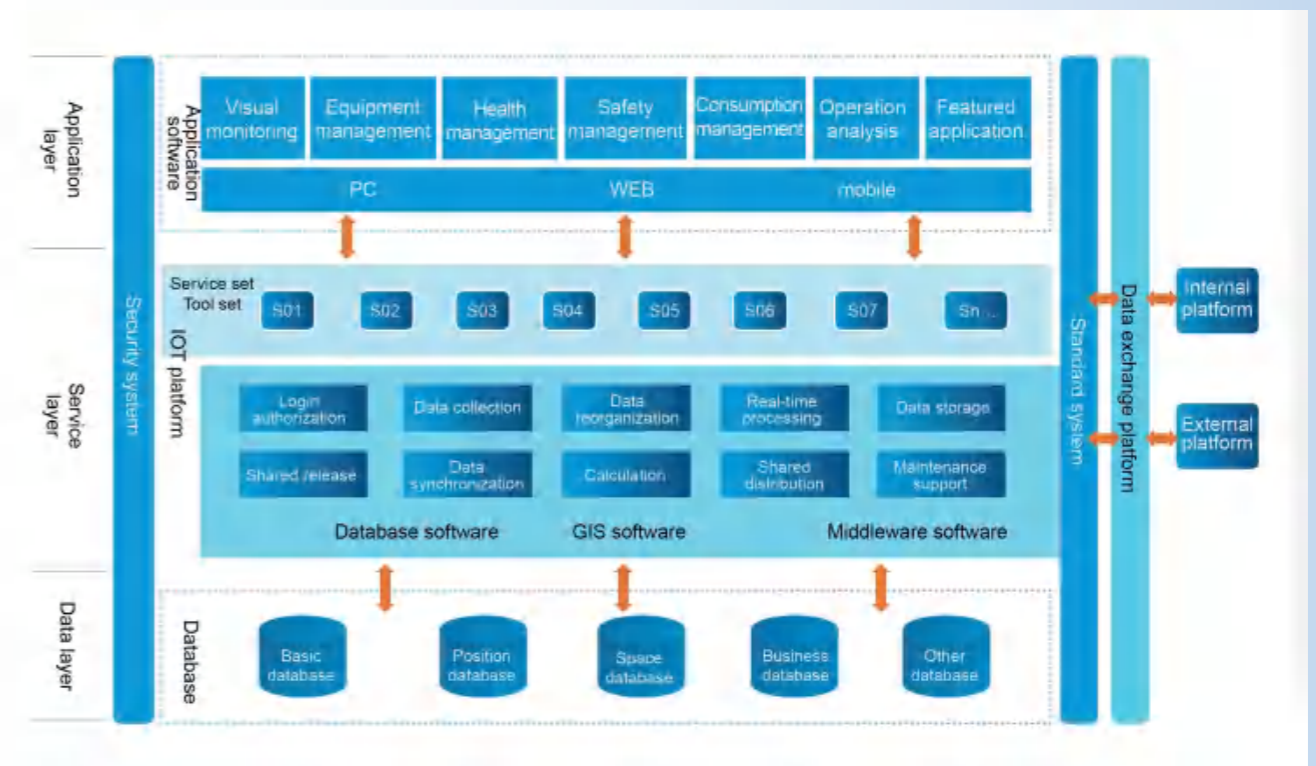
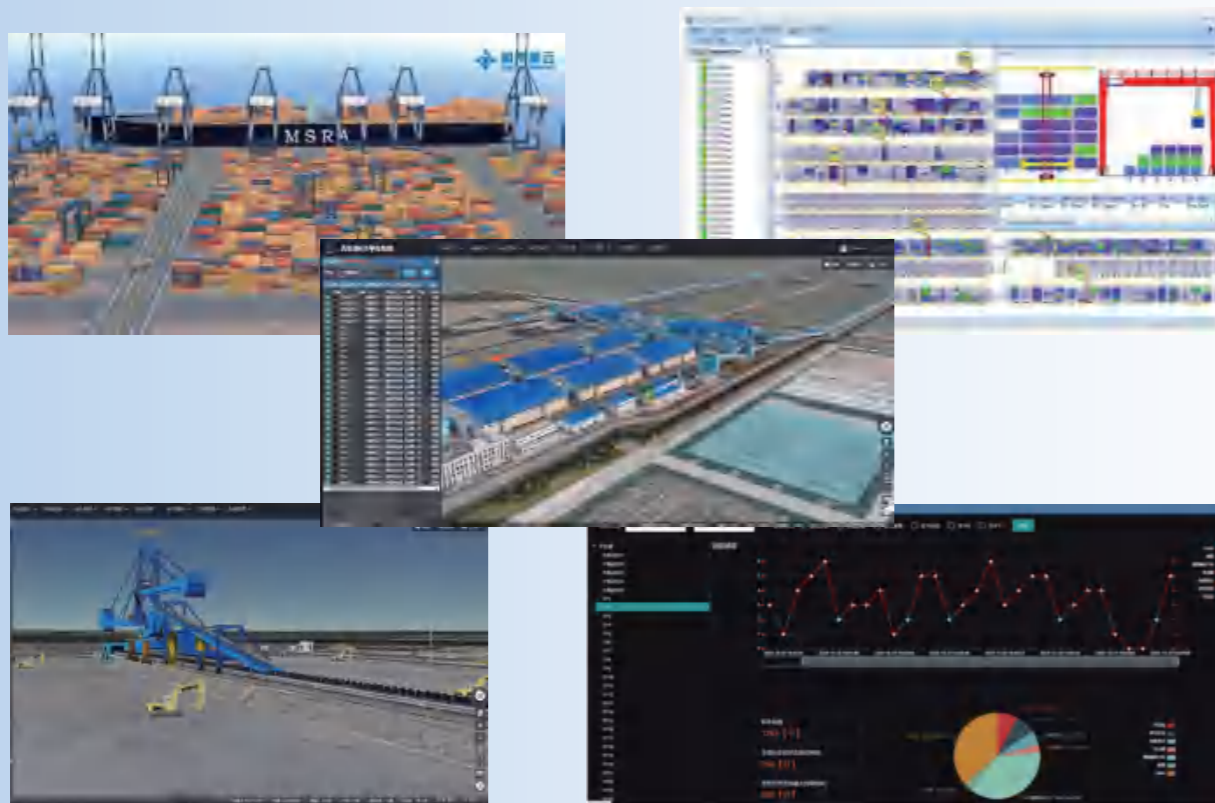
-  Intelligent algorithm, automatic scheduling
-  Driver dispatch
-  GNSS high precision positioning
-  Electronic map, graphical display
-  Disorderly conduct intervention
-  Job statistics in real-time display

## System benefits

-  **Efficiency:** improve up to 20%
-  **Increase utilization rate:** Reduce idling and waiting
-  **Loading accuracy:** GNSS positioning with error within 4%
-  **Automatic job order issuance**
-  **Improve service quality:** speed up vehicle turnover and shorten the stay by 1 hour

# Operating Process Visualization System

The Operating Process Visualization System utilizes GNSS, laser scanning, vision and other IoT sensing technologies, as well as GIS and virtual reality to virtualize the production elements such as yard, mechanical equipment, vehicles, cargo, and integrate business data resources to realize the aggregation, processing, storage, analysis, interaction, sharing and visualization of port data. It builds a digital twin world of the overall picture and provide intuitive scientific decision-making assistance for port operation.



## System benefits

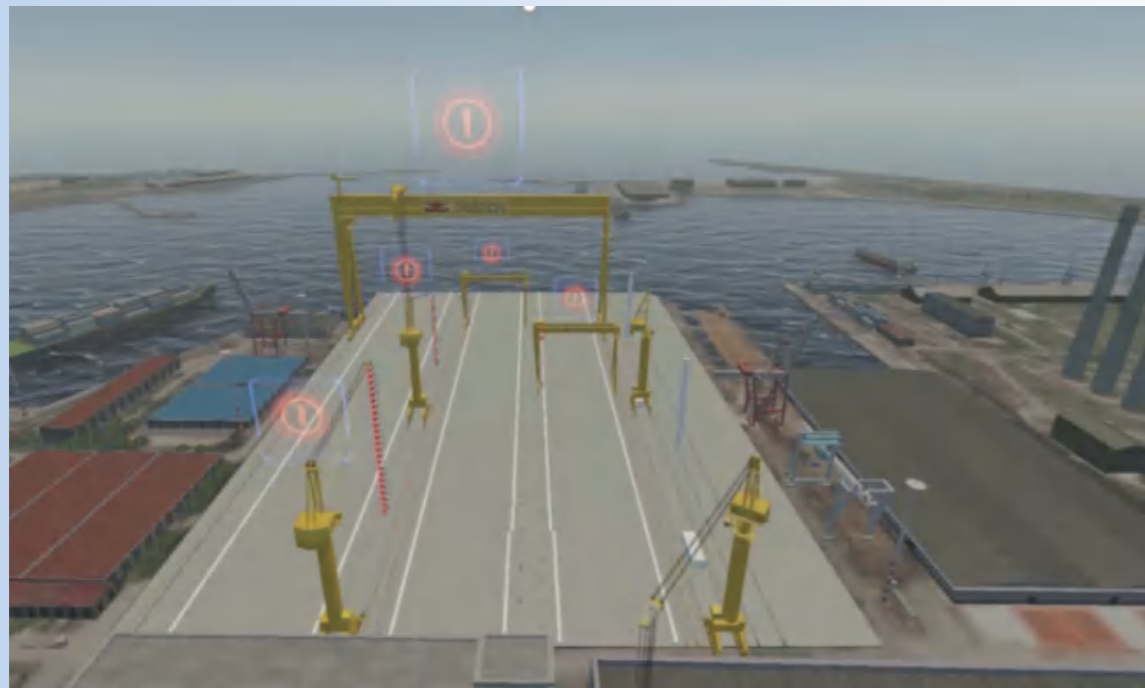
- Operation visualization
- Business synergy
- Scientific decision-making
- Data Graphics
- Management and control integration

## System features

- Mass data access
- Real-time tracking
- Business in one
- Real 3D
- Multi-source heterogeneous data
- Open data sharing
- Statistical analysis report
- Customizable and Extensible

# Machinery Cluster Anti-Collision System-3D

The Machinery Cluster Anti-Collision System adopts high-precision GNSS positioning and orientation technology, and combines the measurement data with the characteristics of the mechanical structure to track the real-time position, direction and speed of each moving component during the operation. It detects obstacles within the three-dimensional space and realize the three-dimensional collision avoidance within equipment clusters. It's suitable for the scenes of cross-mixed equipment with different structural characteristics and motion such as gantry cranes, cantilever cranes, and jib cranes.



## System benefits



Fast perception



Real time monitoring



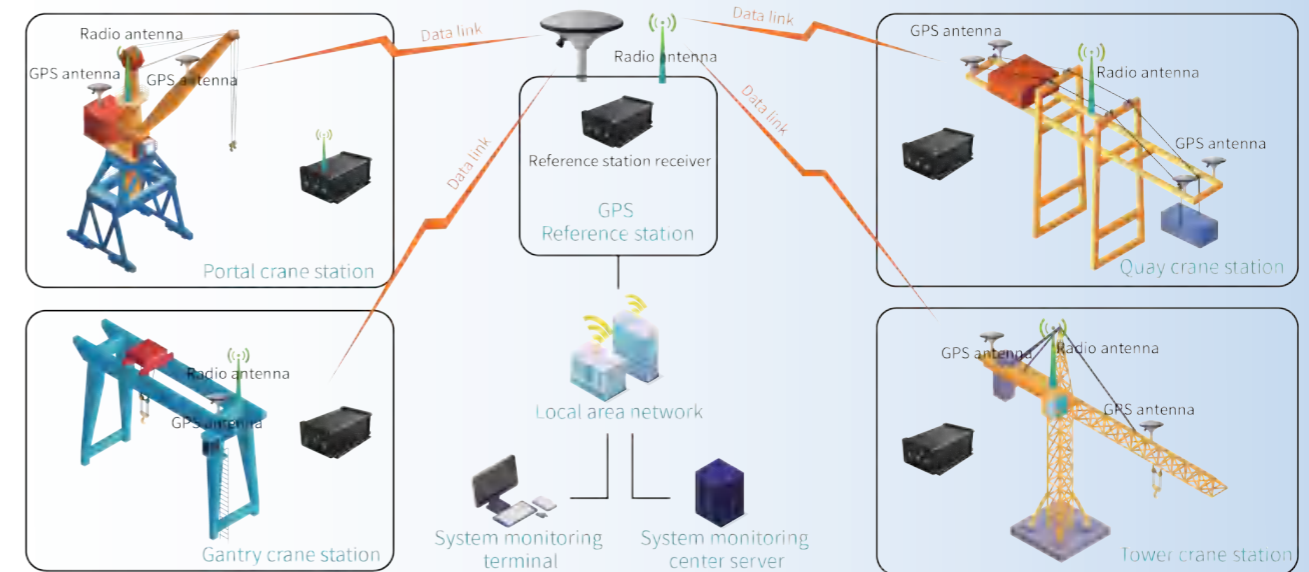
Advance alert









Joint disposal



Systematic assessment



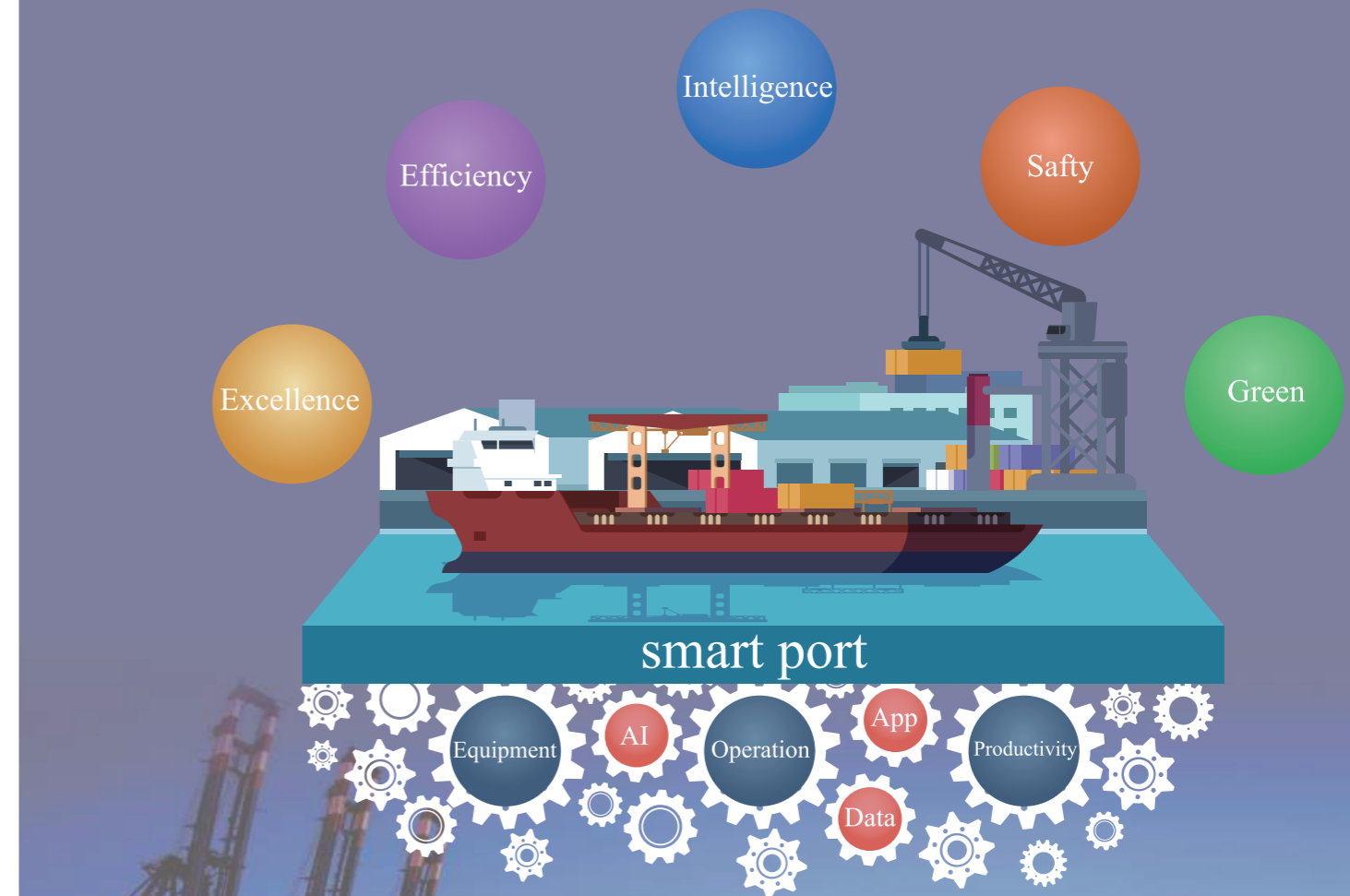
## System features

-  Cross-mixing operations
-  Playback supported
-  3D protection
-  3D visualization
-  Smart & smooth control
-  Electronic fence

Build the future of smart ports with excellent partners



**Comprehensive collaboration for a win-win future**



Cathay Nebula is committed to integrating automation and intelligent technology with business in depth and jointly build a intelligent ecology for port industry.