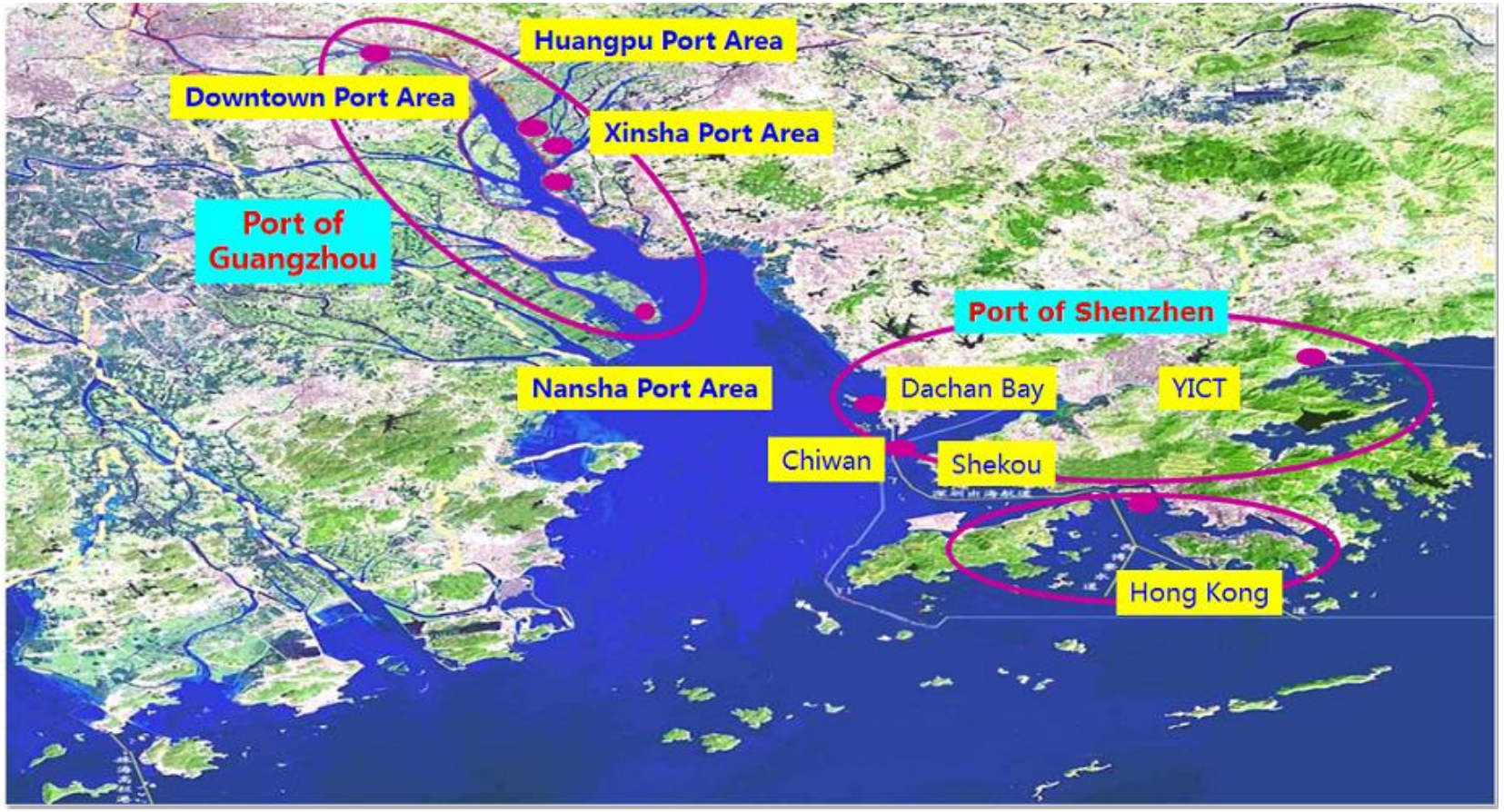
5G Smart Port Project at Guangzhou Port

Guangzhou Port Group Co., Ltd.

Guangzhou Port, the world's leading smart port

- Guangzhou Port is one of the departure ports of the Maritime Silk Road. After more than two thousand years of development, it is one of the most prosperous world ports in history. Guangzhou Port is the largest comprehensive main hub port and an important container trunk port in Southern China.



Guangzhou port

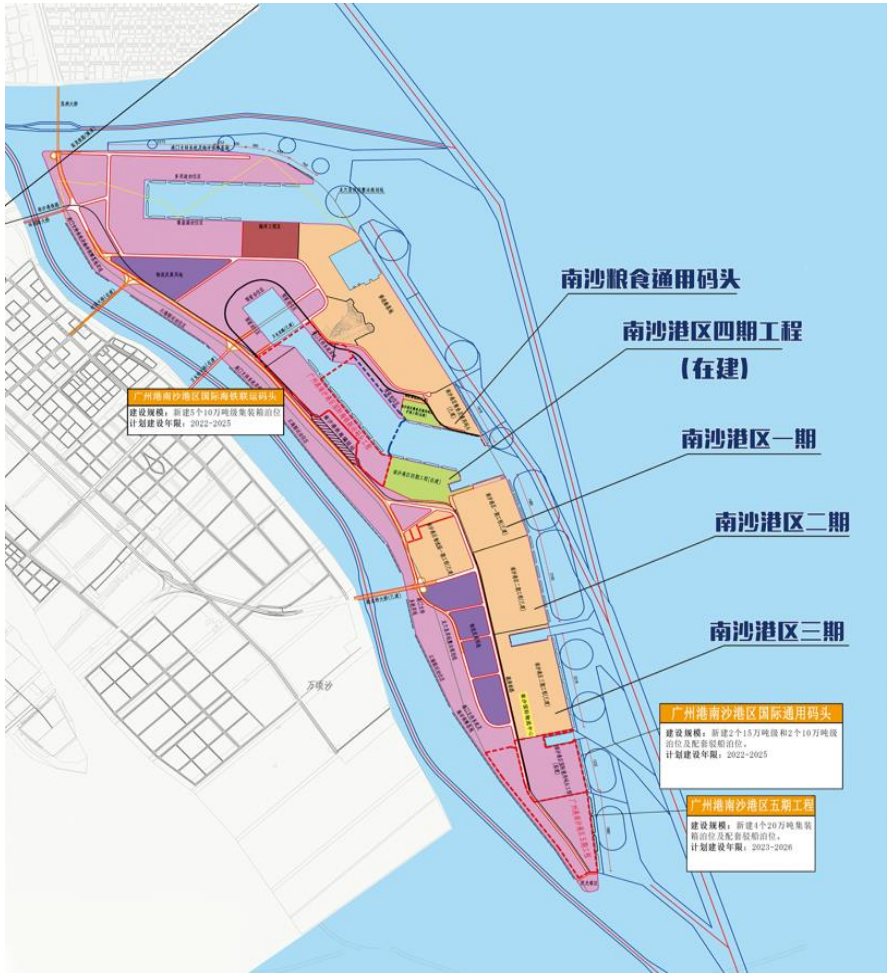
Guangzhou Port, the world's leading smart port

Courses	Shipping houses	Main ports of call
Northwest Europe	2M, OCEAN	Piraeus, Antwerp, Felixstowe, Hamburg, Rotterdam, Southampton, Le Havre, Malta
Mediterranean	2M, OCEAN	Malta, Valencia, Barcelona, Fos, Genoa, Beirut, Marsaxlokk, La Spezia, Gioia Tauro, Said

Guangzhou port

Guangzhou Port Nansha Port Terminal, the world's leading smart port

- Nansha Port is the most important core port area for Guangzhou Port to accelerate the construction of a world-class port, It is also an important part of the construction of Guangzhou's international comprehensive transportation hub and a gateway hub for high-level connection to the world.



Nansha port terminal

Nansha Port Phase IV Terminal - "Guangzhou Solution"

On July 28, 2022, the fourth phase of the fully automated terminal in Nansha Port Area of Guangzhou Port was officially put into operation. The terminal is the world's first fully automated terminal for river-sea-rail multimodal transport and the first newly built automated terminal in the Guangdong-Hong Kong-Macao Greater Bay Area, which helps the construction of international shipping in the Greater Bay Area.

- Four 100,000-dwt seagoing ship berths
- Supporting container barge berths
- >60 patents

Nansha Port Phase IV Terminal - Automated terminal for river-sea-rail multimodal transport

The Phase IV terminal is located at the mouth of the Pearl River, in the Nansha port area connecting the inland water network of the Pearl River system and the deep-water seaport. In order to better adapt to the development trend of large-scale ships and take into account the economic benefits of operating barge operations, we make full use of the natural geographical advantages of Nansha Port Area's water network connecting the river to the sea, and rely on the Nansha Railway to integrate the functions of river-sea combined transportation and sea-rail combined transportation.

- Designed annual throughput capacity: 4.9 million TEUs
- River transportation volume: 1.9 million TEUs.
- Energy saving and economical efficiency

Nansha Port Phase IV Terminal - The world's largest fully automated terminal with horizontal layout

- Container transit port.
- Parallel to the front of the terminal and the yard is laid out horizontally
- Rail cranes can interact with IGVs anywhere in the horizontally arranged yard.

- 4 container ships and 16 barges at the same time,
- Same horizontal layout of the traditional container terminal
- Economy and practical operation
- Automation upgrading and transformation
- Promoting the upgrading of traditional container terminals to semi-automation and full-automation.

Nansha Port Phase IV Terminal - Intelligent Fully Automated Terminal Operating System

Facing the difficulties:

- Multiple types of automation equipment
- Complex working conditions of the equipment.
- IGVs are difficult to drive and locate in irregular areas.
- Devices and workloads increase
- Computing and data behind the terminal are grown exponentially.

- "Super brain"
- Optimal resources for various operation scenarios
- Safety and efficiency

Technology Route: A new generation of automated container terminals

- In view of the high proportion of containers trans from waterway to waterway and the “non-linear” arrangement of the shoreline of the barge terminal and the shoreline of the marine terminal, in the Nansha Phase 4 project, the technical route of "Beidou navigation system and 5G communication + overall horizontal layout of yard + automated single trolley quay cranes" is adopted.

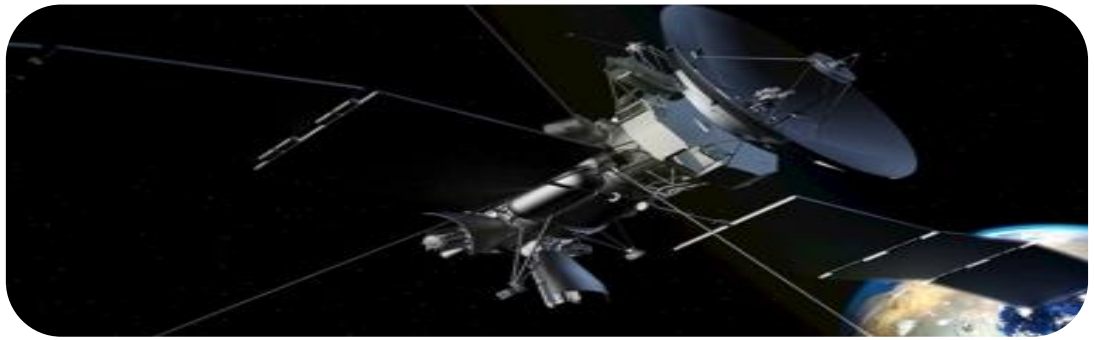
Automated terminal using Beidou navigation system and 5G communication

Overall horizontal layout of the yard

Large-scale deployment of automated single trolley quay cranes

Technical route: Automated terminal using Beidou navigation system and 5G communication

- IGV’ s driving level is equivalent to the L4 level of autonomous driving. The positioning system is mainly based on BDS(BeiDou Navigation Satellite System) and INS Integrated Positioning System, lidar SLAM, visual SLAM and multi-sensor fusion positioning technology. It uses a new generation of artificial intelligence technology to promote the upgrade of in-port container trucks to IGV.
- It is planned to build 10 5G base stations and 8 4G base stations, based on a 5G private network, carrying three types of data: video stream, control stream and IT stream, to achieve 100% double-layer coverage of 4G/5G private network signals in the port area, ensuring real-time, stability, security and reliability of data transmission in the port area.
- Replace the existing technique which uses magnetic nail navigation, combined with Beidou technology to achieve precise positioning of IGV, the IGV operating area is flexible and the IGV energy consumption is low.



Delay<50ms

Bandwith>100Mbps

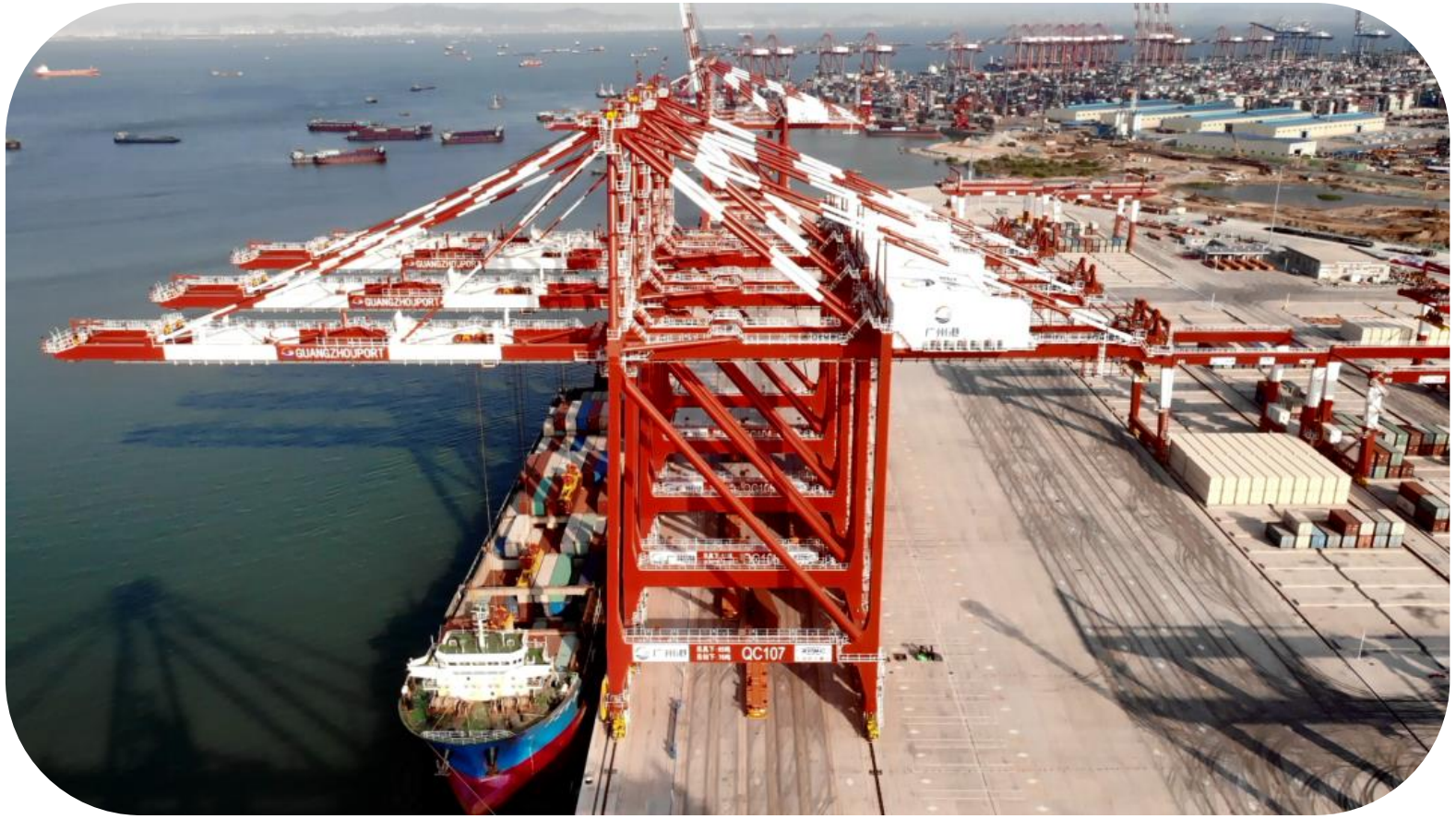
Technical route: large scale deployment of automated single trolley quay cranes

- Large-scale deployment of automated single trolley quay cranes in the field of automated container terminals, based on 5G private network and field tests. The control delay of automated equipment is less than 30ms, which improves the remote control’ s stability of automated rail cranes and quay cranes;
- The on-site video backhaul bandwidth is increased to more than 100M, which solves the shortcoming of unstable wireless networks and inflexible wired connections;
- With 5G remote operation, 1 driver can operate 4-8 rail cranes, which lower the use of drivers and work intensity.

- **12** quay cranes
- **35** rail cranes
- **5G private network+PLC**
- HD video
- Remote driving

Crane/rail crane remote control

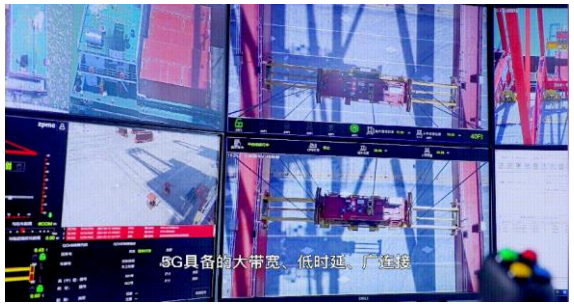
Example: successful loading and unloading of 1,482 TEUs on “Lizhou Jiehai” Ship at Nansha Phase IV Terminal Through Fully Automated Test Process



“Lizhou Jiehai” container ship

- 1,481 TEUs
- 4 quay cranes
- 14 rail cranes
- 42 IGVs

The automated transformation of traditional ports reduces costs and increases efficiency, with remarkable results



In August 2022, Nansha Port Phase 4 was officially put into operation


中华人民共和国中央人民政府

粤港澳大湾区首个全新建造的自动化码头投入运行

Labor cost saving about 100 million RMB /year

- Employment scale of traditional port is 1100
- 70% fewer workers

- QC’s production efficiency increased to 30 units/hour

Safety benefits increase by 95%

- 95% reduction in human accident rates
- IGV with zero emissions and long battery life

Fully automated port, creating a new benchmark in the industry

Renovation of traditional port automation to create a benchmark for the 5G smart port industry

Reproducible standard

- Compatible with traditional port operation mode

Eco-friendly port

- Carbon neutrality: 10,678 tons of standard coal saved, 26,384 tons of carbon dioxide emission reduction
- Reduce pollution: 794 tons of sulfur dioxide emission reduction and 397 tons of nitrogen oxide emission reduction

Humanized management

- 70% fewer port frontline staff
- Accelerate the technological transformation of existing employees

THANK YOU