



Research and development for e-Navigation

8th ASEF Conference

26-28 November 2014

兴船报国 创新超越

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Background

- More than **70%** of the world's surface is covered by water
- Almost **80%** of the total cargo tonnage relies on ship transportation
- Around **50%** of accidents have navigational causes



Background

Maritime traffic
accidents:

Collision

Grounding

Oil spill

Piracy



Background

- Larger and faster ships, greater congestion and reduced manning levels have all provided the impetus for maritime field development.



e-Navigation Strategy

■ As defined by the IMO:

“e-Navigation is the harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment”.

e-Navigation Strategy

E=

Electronic 电子	Enhance 加强	Effective 有效
Efficient 高效	Economic 经济	Essential 重要
Easy 容易	Excellent 优秀	Enjoy 喜欢

e-Navigation Strategy

Regulatory activities affecting e-Navigation

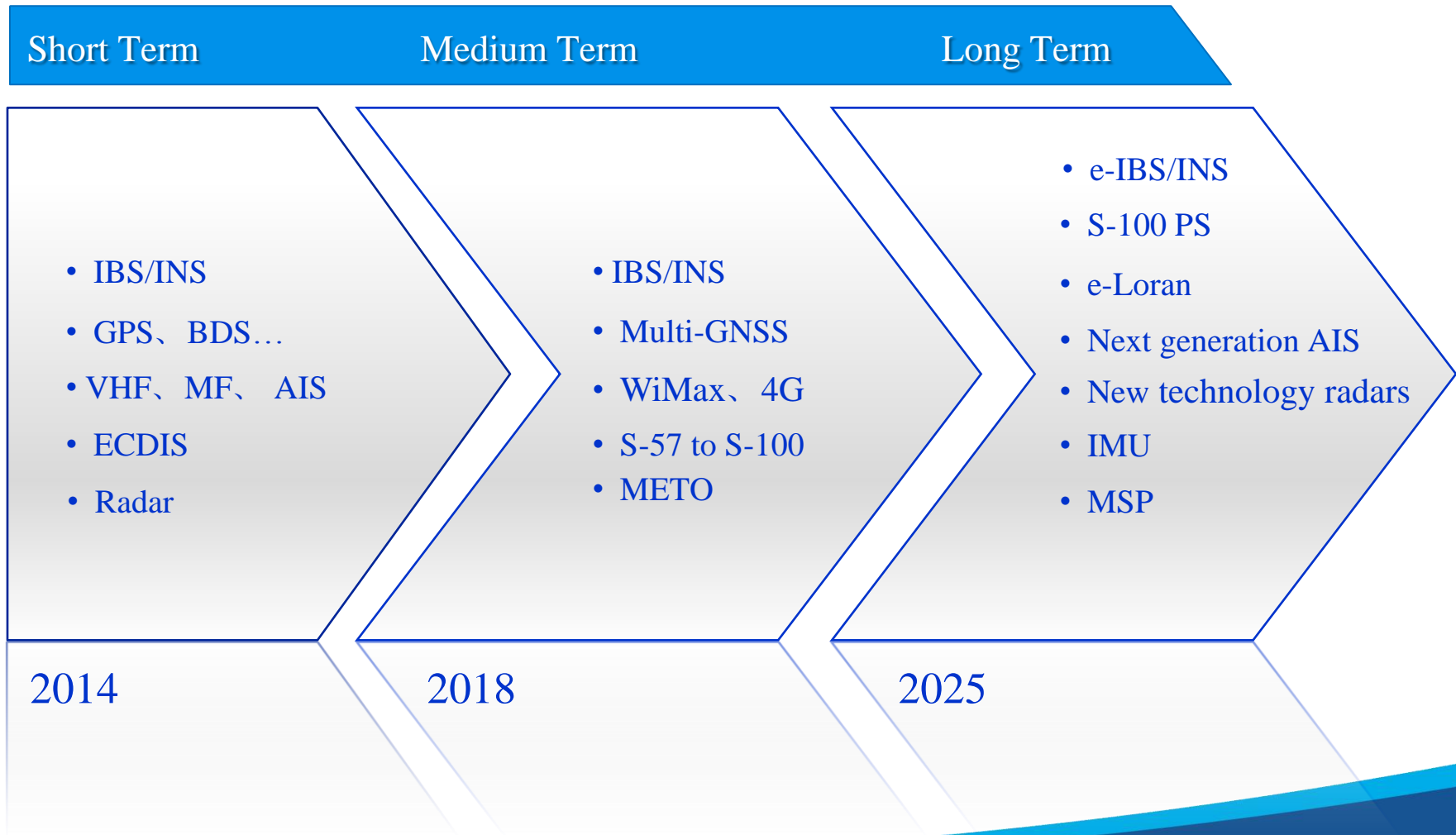
- **There are already several ongoing activities within IMO, IHO, IEC and other organizations which are highly related to the key components of e-Navigation. Some examples:**

- ❖ IMO Resolutions A.817(19), MSC.64(67), MSC.86(70), Performance standards for electronic chart display and information systems;
- ❖ IMO NAV52, Agenda item 4, Revision of the performance standards for INS and IBS;
- ❖ IHO S52, Specifications for chart content and display aspects of ECDIS;
- ❖ IEC 61174, Electronic chart display and information system (ECDIS);
- ❖ IEC 62288 Displays for the Presentation of Navigation Related Information .

e-Navigation Strategy

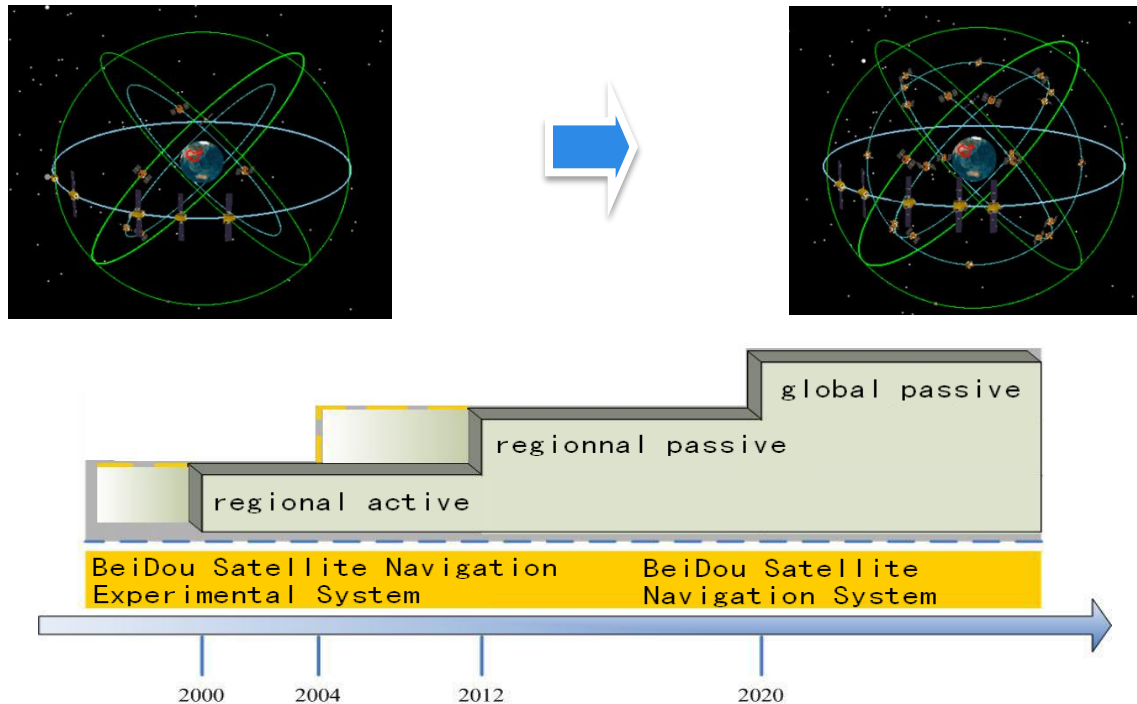
- e-Navigation would utilize existing and new navigational tools and standards within the digital technology environment in a holistic and systematic manner. Use of a structured systems engineering approach:
 - Prototyping including test-beds
 - Requirements capture and management
 - Design
 - Development
 - Verification, Validation and Testing
 - Deployment
 - Operations

e-Navigation Strategy



Work Description

■ BeiDou Satellite Navigation System(BDS, COMPASS) Development



Work Description

- **China's Beidou navigation system makes breakthrough:**
 - **The IMO has ratified the performance standard of a receiver of the shipborne BDS. This is the first BDS to be standard approved by an international organization.**
 - **China's independently-developed Beidou differential navigation satellite system has improved to centimeter level , a major breakthrough in marine application.**

Work Description

■ BeiDou system



Radio Beacon-Differential
Beidou Navigation Satellite
System (RBN-DBDS)



User terminals of BeiDou system

Description of Work

■ BeiDou&GPS Navigation Receiver



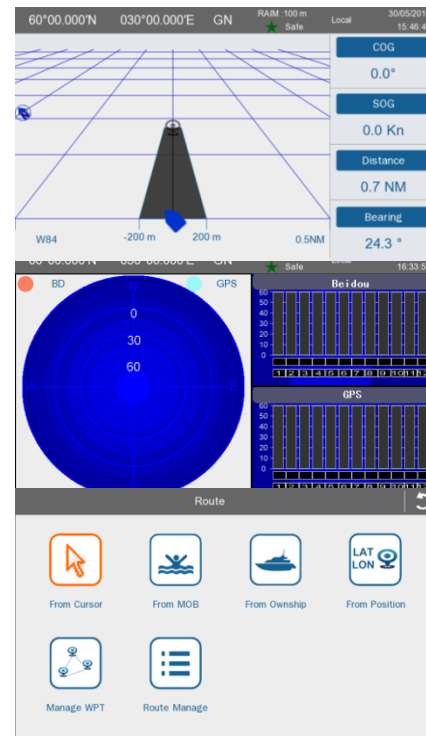
Main receiver unit



Power supply unit



Double mode antenna



Human interface

Work Description

- Since the end of 2010, south China's Hainan province has spent 79 million yuan to install navigation equipment on 6,000 locally-registered fishing boats.



Beidou navigation equipment



Work Description

- We will continue to promote BeiDou Satellite Navigation System's application at maritime field, to establish BeiDou ground-base enhancement system, with IEC, IMO and other international organization to consummate BeiDou Standards, promote BeiDou application and industrialization development.

Work Description

■ Fiber-optic Gyrocompass system



Main compass



Repeater compass



Bearing repeater compass
(Outside unit)



Distribution unit



Control and display unit

Work Description

- **Electronic chart equipment-- The system supports IHO S-57/S-63, VCF and CM93.**



Vertical type



Desktop type



Hand-held type

Work Description

- Autopilot equipment—The autopilot has the automatic control function for heading and track.



Panel module on the wheel house console

Work Description

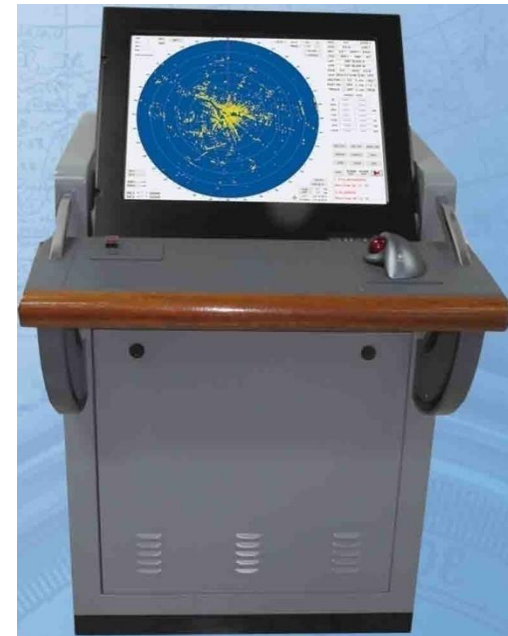
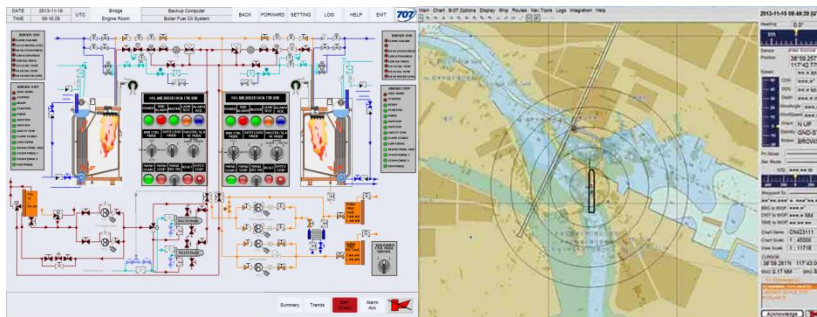
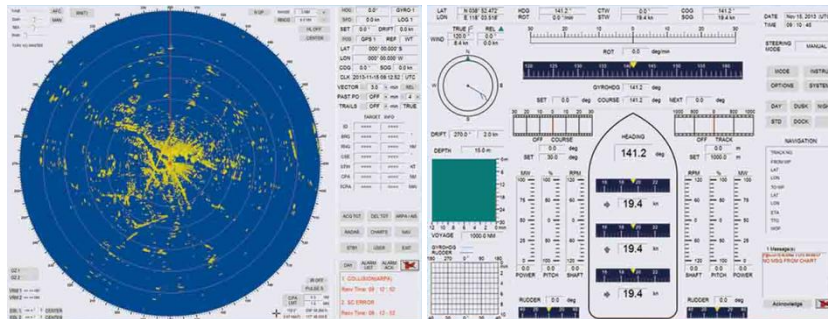
■ Monitoring & Alarm System(MAS)



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Work Description

- Multi-function system--Combining the capabilities of Radar, ECDIS and Conning stations into one unit.



Work Description

■ The modern Bridge--The Integrated Bridge System is based on up-to-date designs which meet existing and proposed international standards for functionality, operation and ergonomics, defined by IMO and IEC.

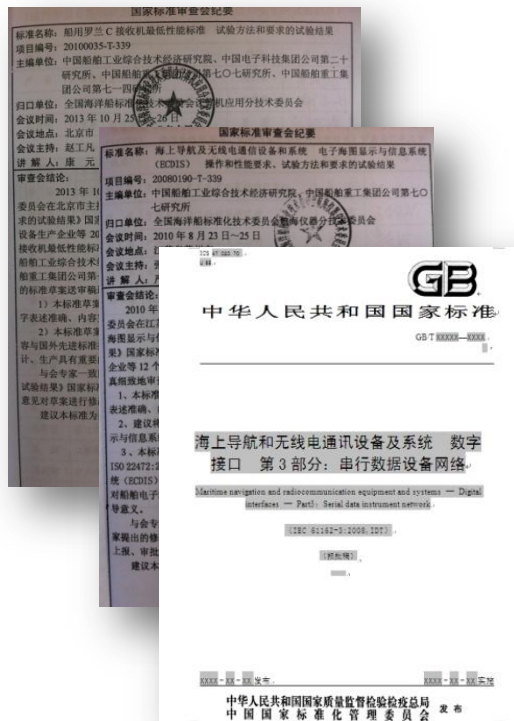


First generation

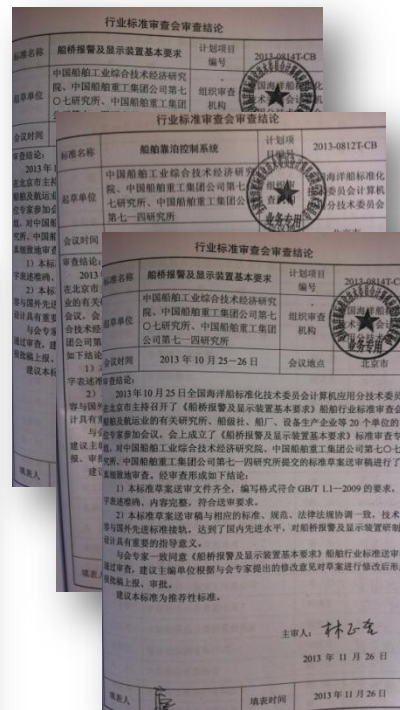


Second generation

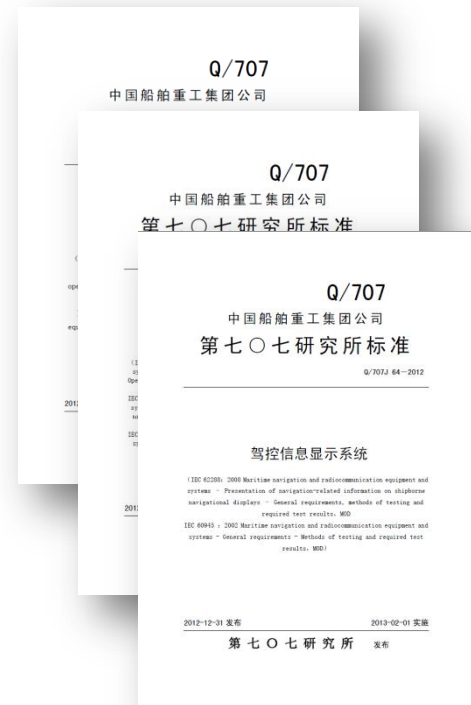
Work Description



National standard



Industry standard



Enterprise standard

Work Description

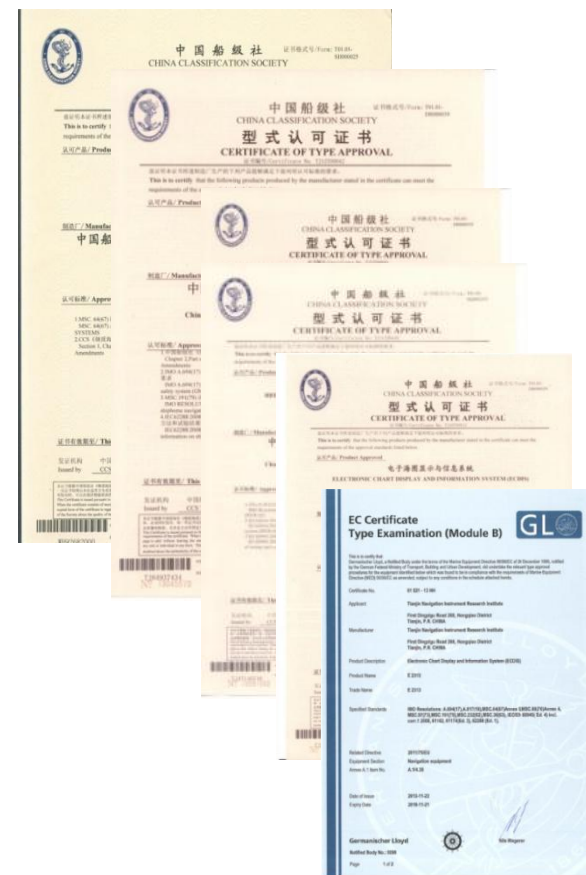
- The products have already got the certificate of conformity of China Classification Society (CCS) and Germanischer Lloyd(GL), and widely in ocean fishing vessel ,oil tanker, bulk carrier, grain ship and coast guard ship, maritime surveillance ship and other types of official ships.



Work Description

■ Product approved

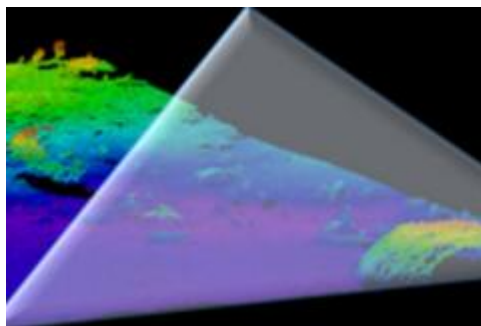
Number	Product name	Certificate
1	ECDIS	GL/CCS
2	BNWAS	CCS
3	ECS	CCS
4	Electromagnetic log	CCS
5	Monitoring & alarm system	CCS
6	Autopilot	CCS
7	Fiber-optic Gyrocompass system	GL/CCS
8	BeiDou&GPS Navigation Receiver	CCS
9	Conning display system	CCS
10	Track control system	CCS



Certificate of type approval

Research and development of e-Navigation

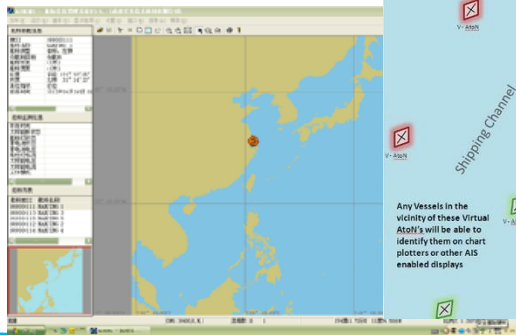
- **Prototype system development**
 - Beacon light integration based on Beidou
 - 3D view and presentation of objects
 - Full coverage depth information
 - Ship-side situation awareness
 - Integrated PNT System



Research and development of e-NAVigation

■ e-NAV demonstrate project

- Yangshan Port e-NAV test bed
- Tianjin Port e-NAV demonstrate project
- Zhujiang Port e-NAV project



Conclusion

- Ships are required to carry a GNSS receiver or a terrestrial radio-navigation receiver.
- Investigating how multiple systems can be integrated on the bridge in respect to system availability and integrity
- New radar technology
- Communications & navigation equipment integration
- Fusion of objects; mainly AIS and radar
- Second generation AIS and AIS basestation system
- S-100 and product specifications

Conclusion

- **Inertial Navigation, lower-cost MEMS technologies**
- **Single window and S-Mode (“Standard” Mode)**
- **Design and build a new series of navigation support systems**
- **Some non-linear integration techniques — such as the EKF, UKF, and particle filter.**
- **Communication between ship-ship, ship-shore and shore-shore**
- **Maritime Cloud, Big Data and Internet of Things**
- **The ship side e-Navigation platform and test bed**

Conclusion

Thank you for your attention!