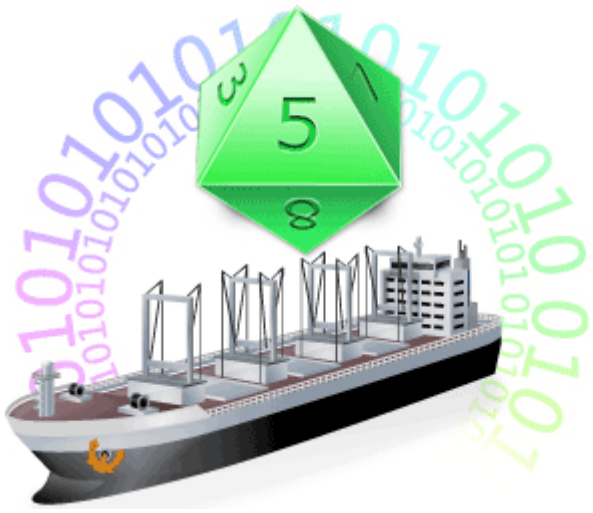
Ship Energy Efficiency Data Collecting and Monitoring System



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Chapter 1 Introduction

Taking Voyage（according to the definition of Company）and Segment（according to the Voyage definition of EU, means the period from the departure from a port of call to arrival of the next port of call） as a basic unit, the ship energy efficiency collecting and monitoring system collects energy efficiency-related data such as arrival and departure port name, arrival and departure time, fuel oil consumption and bunkered quantity, distance travelled and cargo loaded etc. The software is designed to achieve the monitoring and statistical analysis of the energy efficiency-related basic data, and to generate the emissions reports based on different targets. It can be run independently on a single ship as a kind of collecting software, or be used with the current “Ship Energy Efficiency Management System” of CCS to import collected data into the system automatically, thus ensuring the accuracy of energy efficiency data from the source, and the scope of imported data can be authorized by company or ship to take account of different management methods of enterprises, ensuring the security of data. Meanwhile, the software can provide reliable data source for a third party inspection agency to perform data verification, or report the data to corresponding server of shipping enterprises through mail or interface to provide convenient and diversified service for shipping enterprises to perform statistics, monitoring, and reporting management of energy efficiency-related data.

The software development takes the current computer configuration of enterprises into consideration to the maximum extent, in order to decrease the installation, operation and maintenance costs of enterprises. With the bilingual feature in Chinese and English, the software can meet the collecting and reporting requirements of ship energy efficiency data, minimize the costs of shipping enterprises, and help them to collect and report energy efficiency data and calculate and verify the carbon emission.

The ship energy efficiency data collecting and monitoring system uses the C# language and is developed based on .NET Framework 4.0 platform, and uses the open source mysql database.

The software and user manual will be updated irregularly. Please pay attention to the website of China Classification Society and download it.

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Chapter 2 Installation and Configuration

2.1 Minimum configuration requirements

Operating system: Windows XP SP2, SP3 (above SP2 at least), Windows Vista, Windows 7

Memory: above 1G

Hard disk: above 5G

If the system is installed unsuccessfully on a computer with an existing mysql database, please uninstall the mysql database and retry.

2.2 Installation

It shall be installed as follows:

1) Double click the file “SetupEEOI.exe” to enter the installation program.
2) Click “Agree to the License Agreement” (see Appendix II) and start the installation.
3) The system judges automatically whether the essential installation package of the system is installed, enter program installation directly if it is installed.
4) Install the essential installation package of the system.

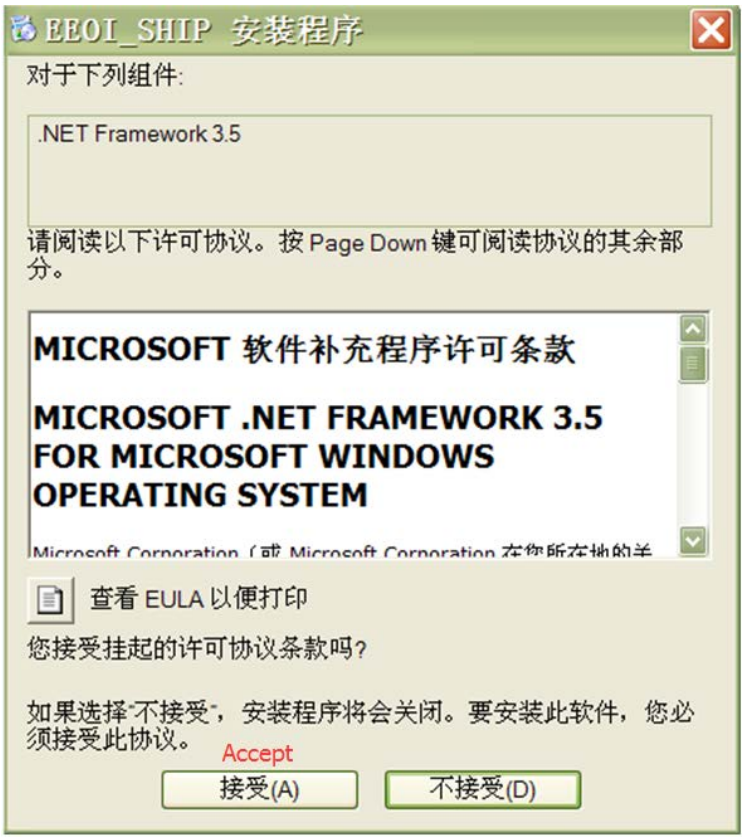


Figure 2.2-2

5) Click “Accept” to enter installation status.

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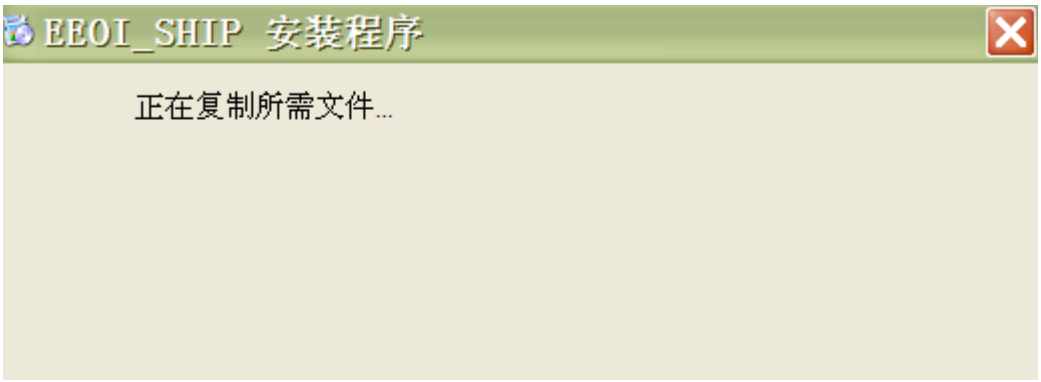


Figure 2.2-3



Figure 2.2-4

6) When the essential installation program of the system is completed or has been installed in the machine already, enter the following interface to install the program according to program installation wizard, and click “Next” until the installation is finished.

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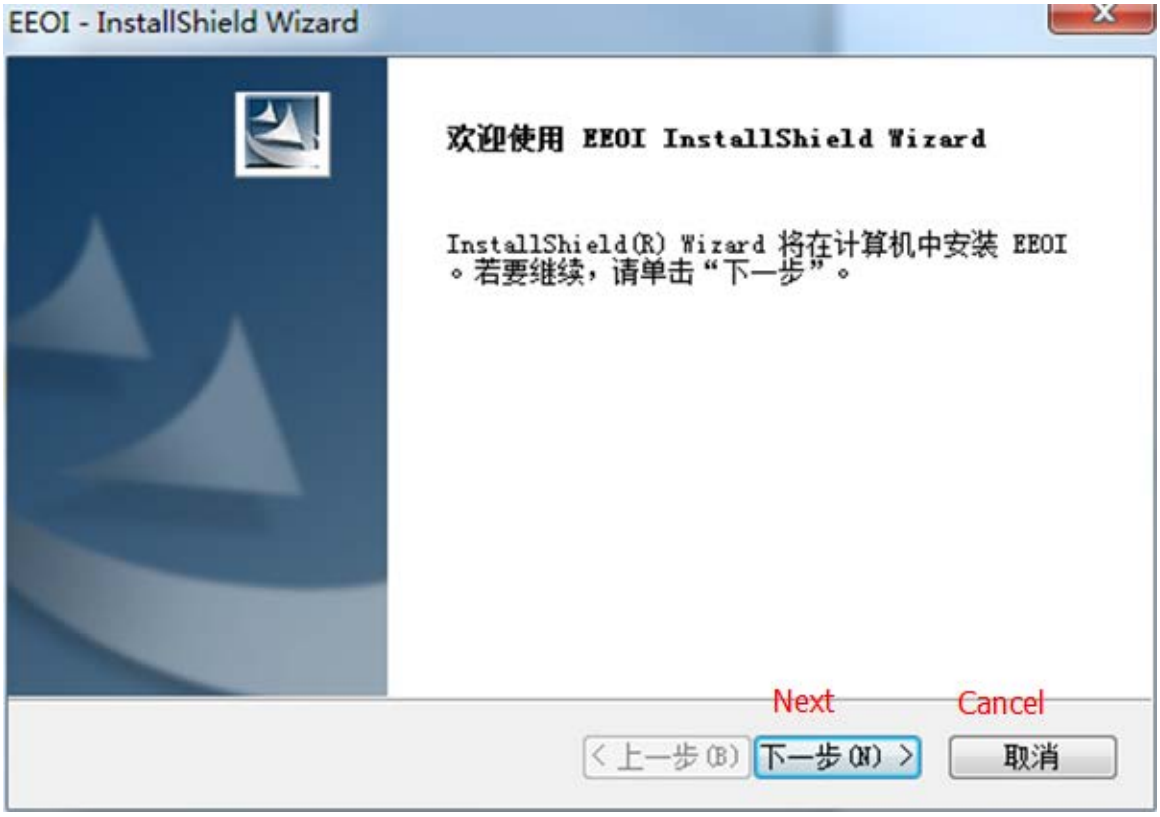


Figure 2.2-5

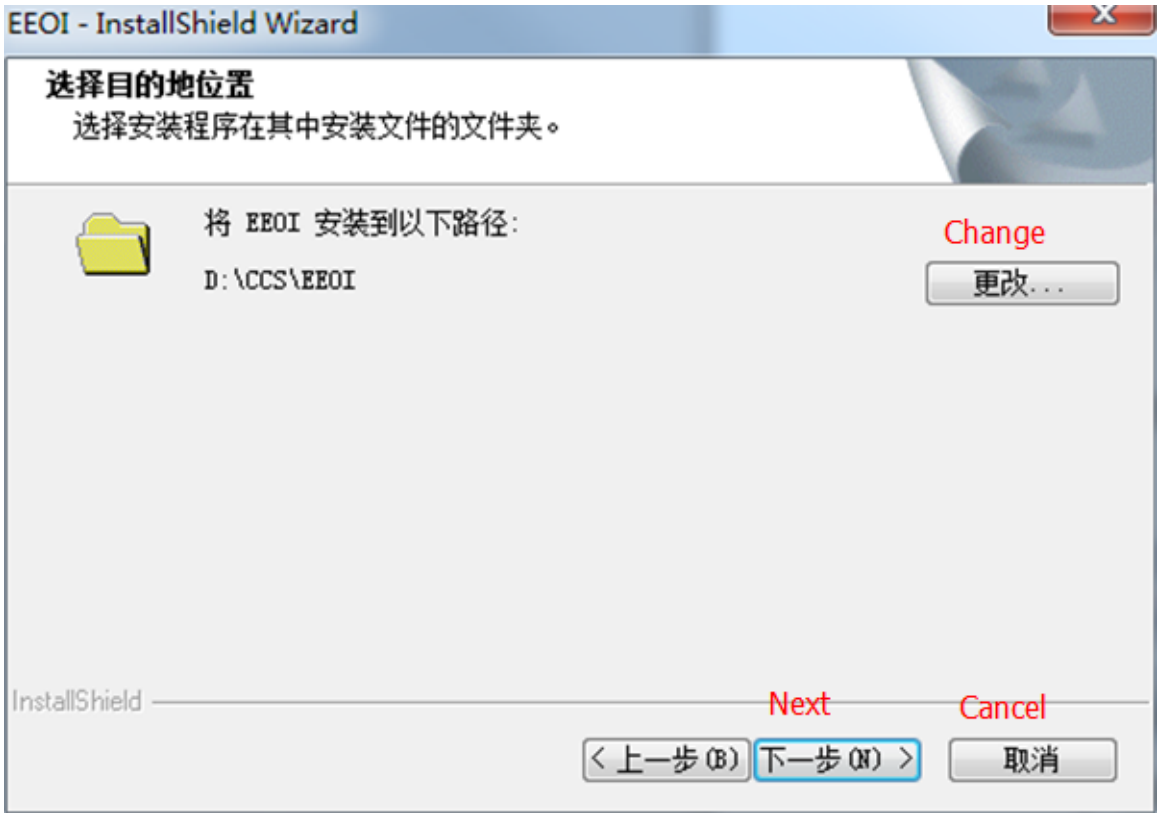


Figure 2.2-6

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Click the “Change” button and select program installation directory. Please make sure that there are no other files in the specified installation directory. For reinstallation after unloading, please reinstall after all files in the original directory are deleted.

Click “Next” to start the installation.

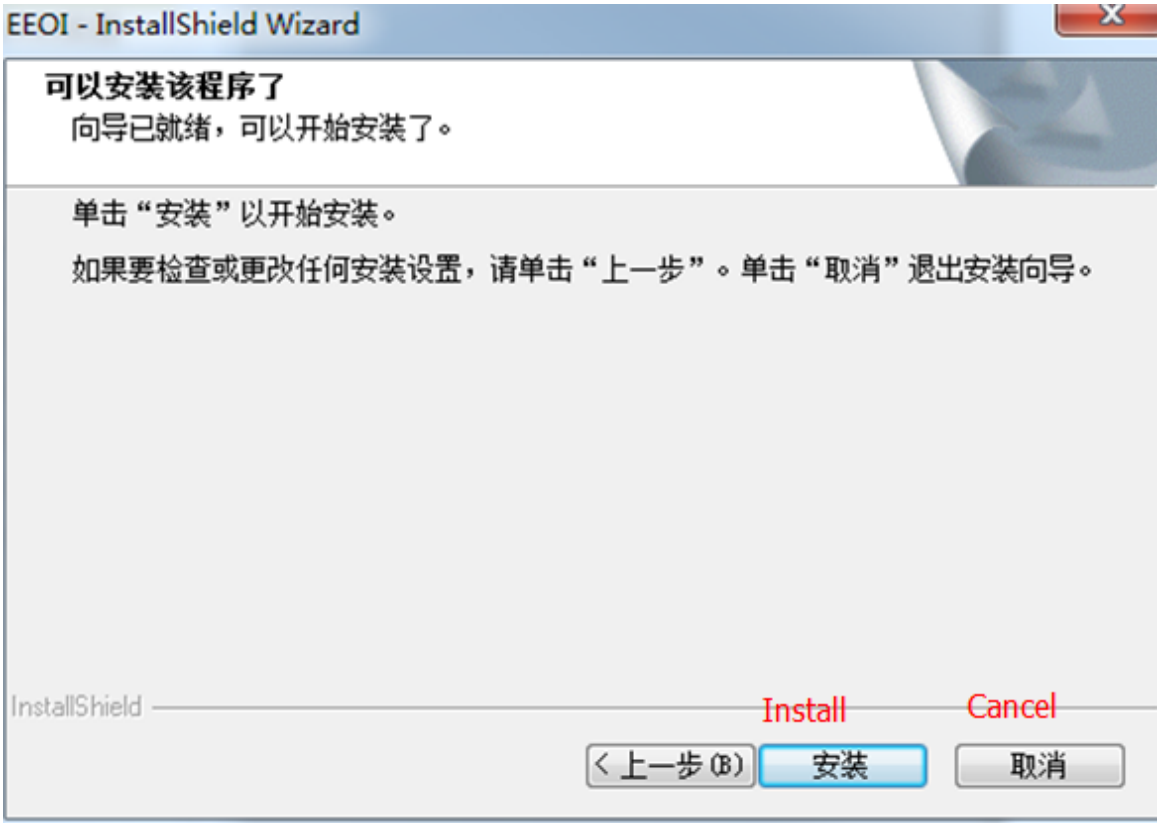


Figure 2.2-7

The system will display the installation process. Click “Cancel” to quit the installation.

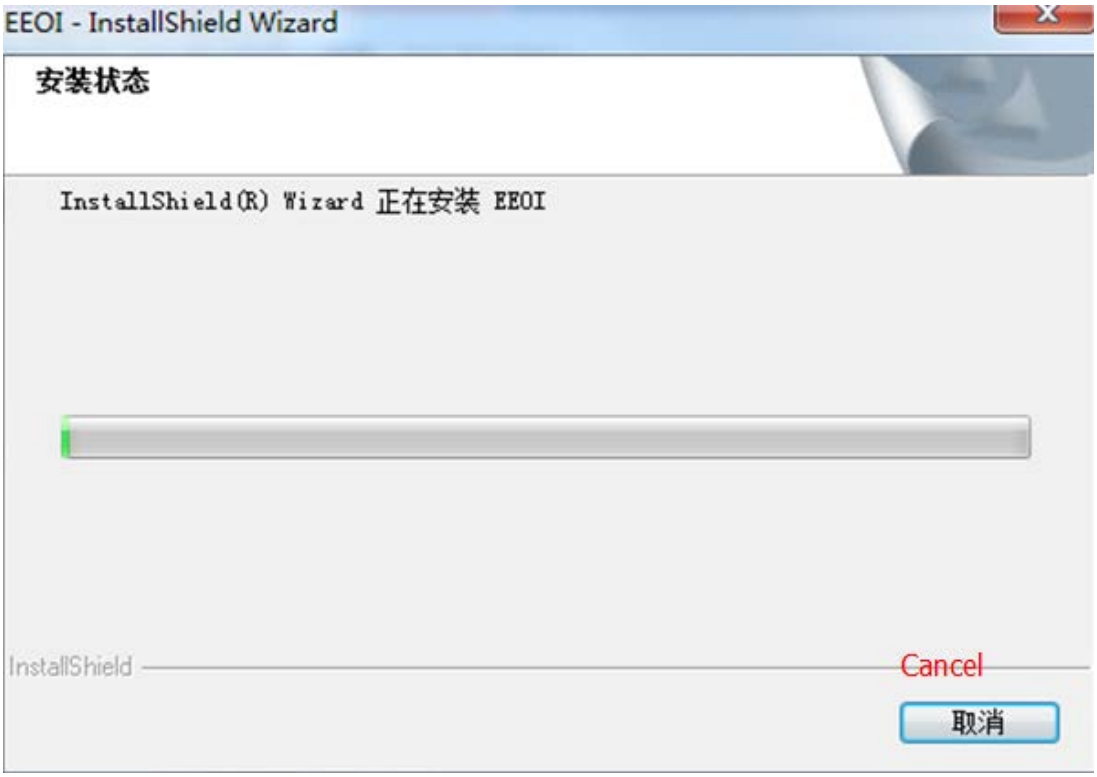


Figure 2.2-8

Click “Finish” to complete the installation.

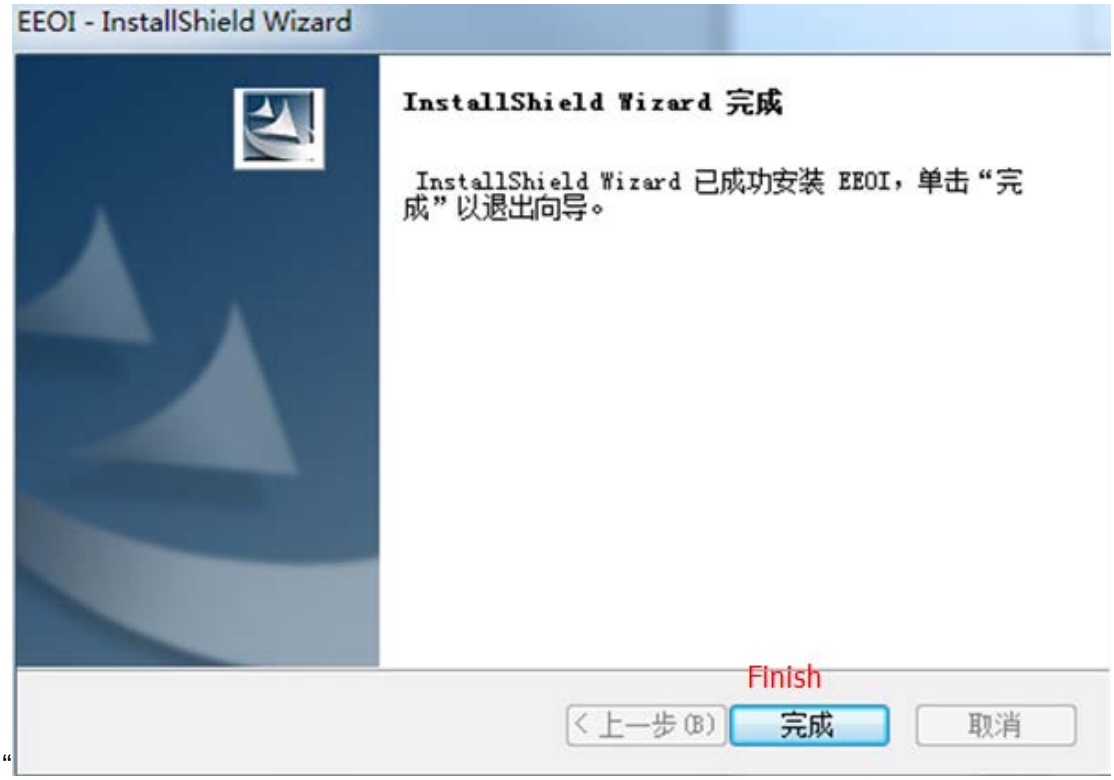


Figure 2.2-9

Chapter 3 Functions

The ship energy efficiency data collecting and monitoring system mainly consists of three function modules, system management module, voyage data and statistical analysis module.

3.1 Login



Figure3.1-1 User login interface

As shown in Figure 3.1-1, enter user name and password in the login interface to verify legitimacy, and then log in the homepage. If necessary, click the button “English” to apply the English version.

The initial user name and password are admin. You can modify and add new user in the user management interface after the login.

3.2 System management

The system management module consists of seven function modules including vessel information, data report setting, role management, user management, port database, change password , vessel theory data,Data Backup/Restore and Auto Backup Directory Setting.

3.2.1 Ship information

At the first login, all ship information is empty and shall be filled in to apply other features.

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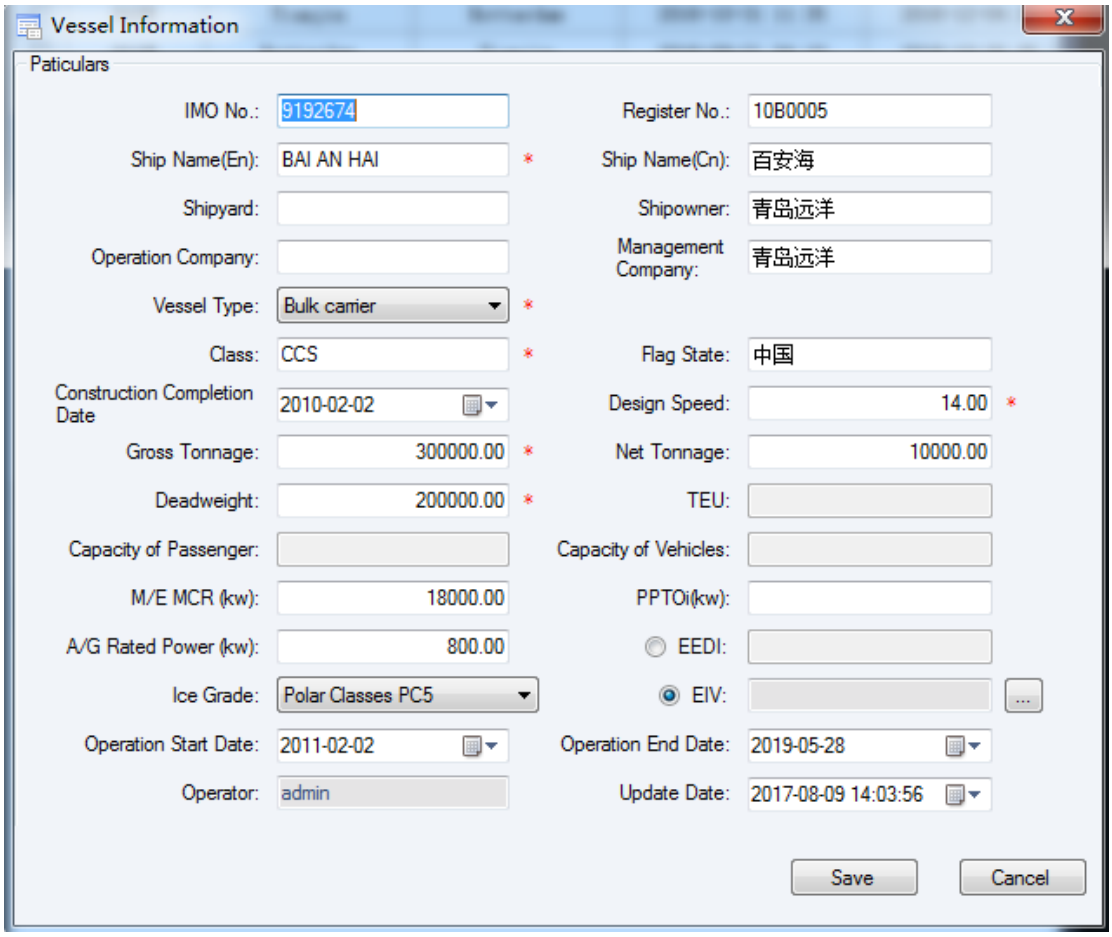


Figure 3.2.1-1 Ship information

Click the submenu “Ship Information” under the “Vessel Management” on the homepage, the ship information management interface is as shown in Figure 2.2.1-1, in which the options with the * mark are required.

If it is necessary to apply EIV, the rated power of the main engine and auxiliary engines and shaft generator power are required.

3.2.2 Data reporting setting

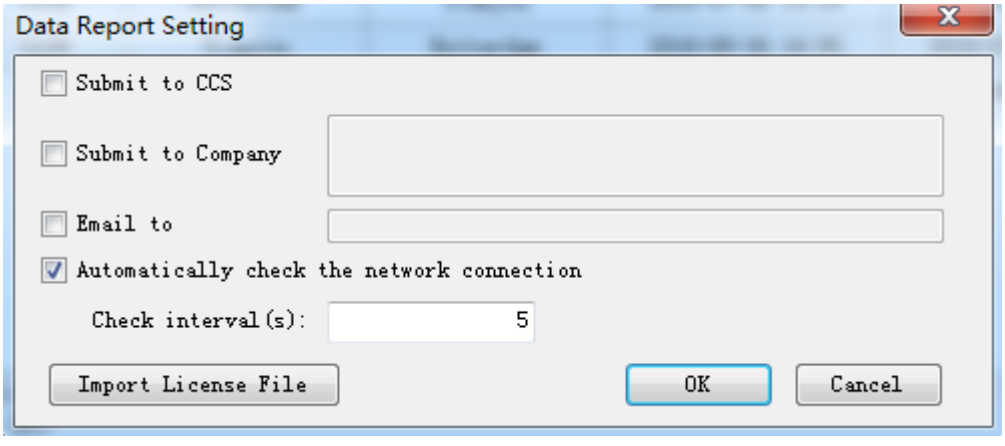


Figure 3.2.2-1 Data reporting settings

Click the submenu “Data Reporting Setting” under “System Management” on the

homepage to display the transmission setting interface as shown in Figure 3.2.2-1.

1) If the data are required to be reported to MRV system of CCS, it is necessary to apply for the company's authorization file or the ship authorization file, click the button "Import License File" to import the file into the system, and then report the ship data indicated in the authorization file.

2) If the company has developed reported data receiving service, select use of the company service and fill in the company service address.

3) When the "Send Mail to Options" is checked, the system will automatically import the selected data as excel file and mail to the mailbox filled in the background.

The system fills in the default send mailbox. To change the send mailbox, please open the file EEOI.EXE.config under the installation directory and fill in the fields according the information provided by the email service provider:

```
<add key="username" value="seedcms" />
<add key="pwd" value="ccs1234" />
<add key="host" value="smtp.126.com" />
<add key="port" value="25" />
<add key="from" value="seedcms@126.com" />
```

4) After the option "Auto Monitor Network Connection" is checked, if there is no network connection at a click of the send button, the software can run a cycle detection of the network connection at the specified time interval, and then automatically start to send mail when the network is connected.

3.2.3 Role management

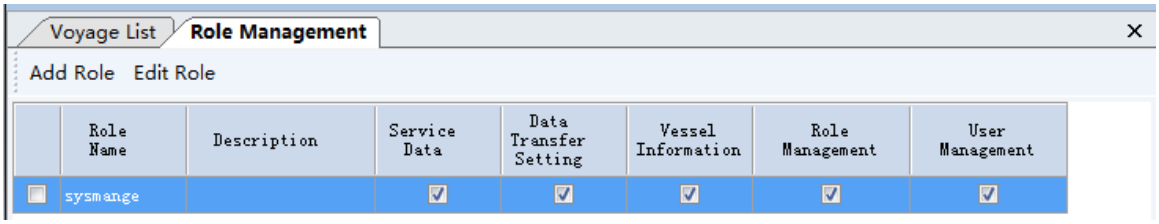


Figure 3.2.3-1 Role management

Click the submenu "Role Management" under "System Management" on the homepage to display the role management interface as shown in Figure 2.2.3-1, having the following functions:

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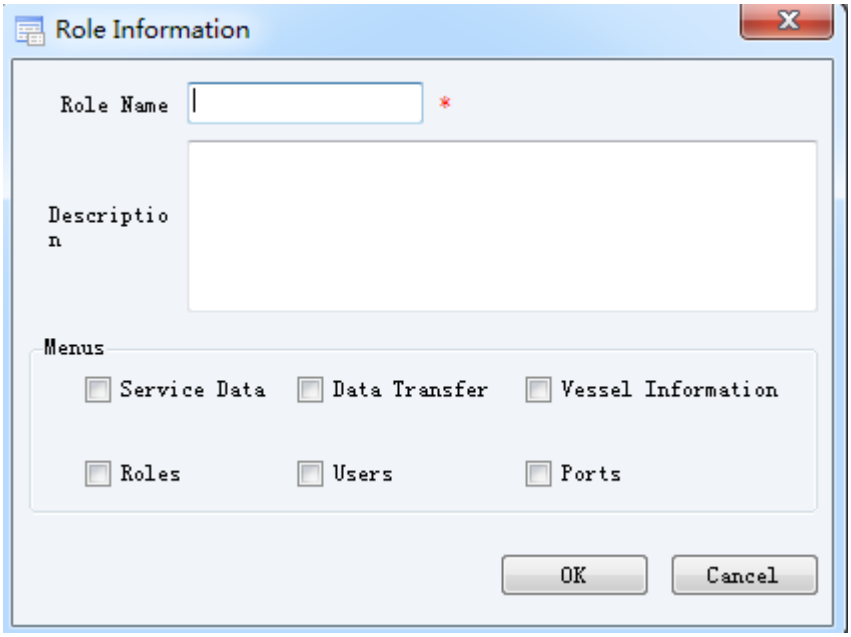


Figure 3.2.3-2 Add role

1) Add role: click [Add Role] to pop up the “Add Role” interface, as shown in Figure 2.2.3-2, in which the options with a * mark are required. If the sub-item under the menu permission is checked, it indicates that the role has the permission of this menu; if not, this role can not operate the functions in this menu.

2) Edit role: select the check box for the role to be modified in the role list, and click [Edit Role] or double click a certain line in the list to pop up the “Edit Role” interface.

3.2.4 User management

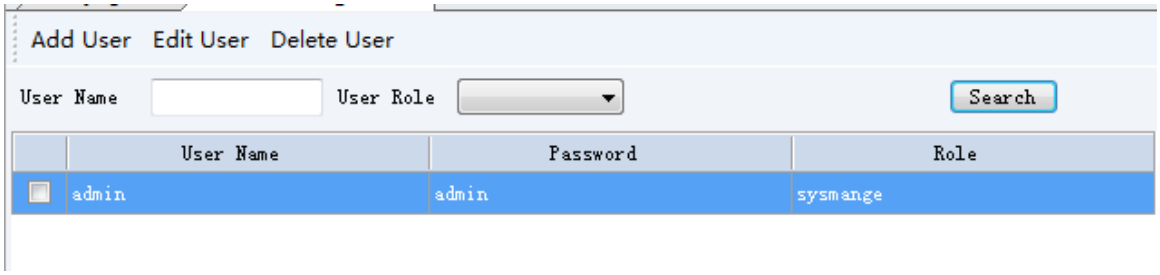


Figure 3.2.4-1 User management

Click the submenu “User Management” under “System Management” on the homepage to display the role management interface as shown in Figure 2.2.4-1, having the following functions:

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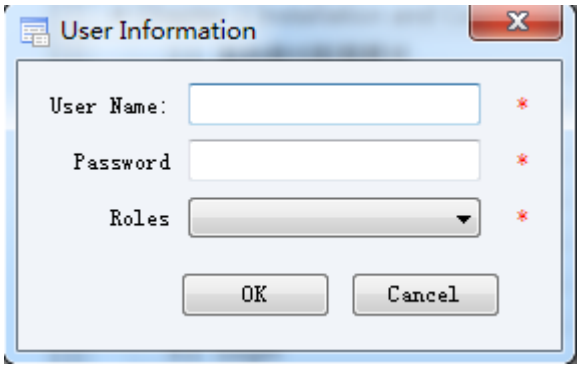


Figure 3.2.4-2 Add user

1) Add user: click [Add User] to pop up the “Add User” interface as shown in Figure 2.2.4-2, in which the options with a * mark is required. The options of the drop list in the user permission are the roles defined in 2.2.3. After selection, a user can have the menu operation permission of this role.
2) Edit user: In the user list, check the check box for the user to be modified, click [Edit user] or double click a certain line in the user list to pop up the “Edit User” interface.
3) Delete user: check the check box for the user line to be deleted in the user list, and click [Delete User] to pop up the deletion prompt or check several lines to delete multiple user data.
4) Search user: filter and query user according to user name and user role.

3.2.5 Port management

Click the submenu “Port Database” under “System Management” on the homepage to display the port management interface as shown in Figure 2.2.5-1, having the following functions:

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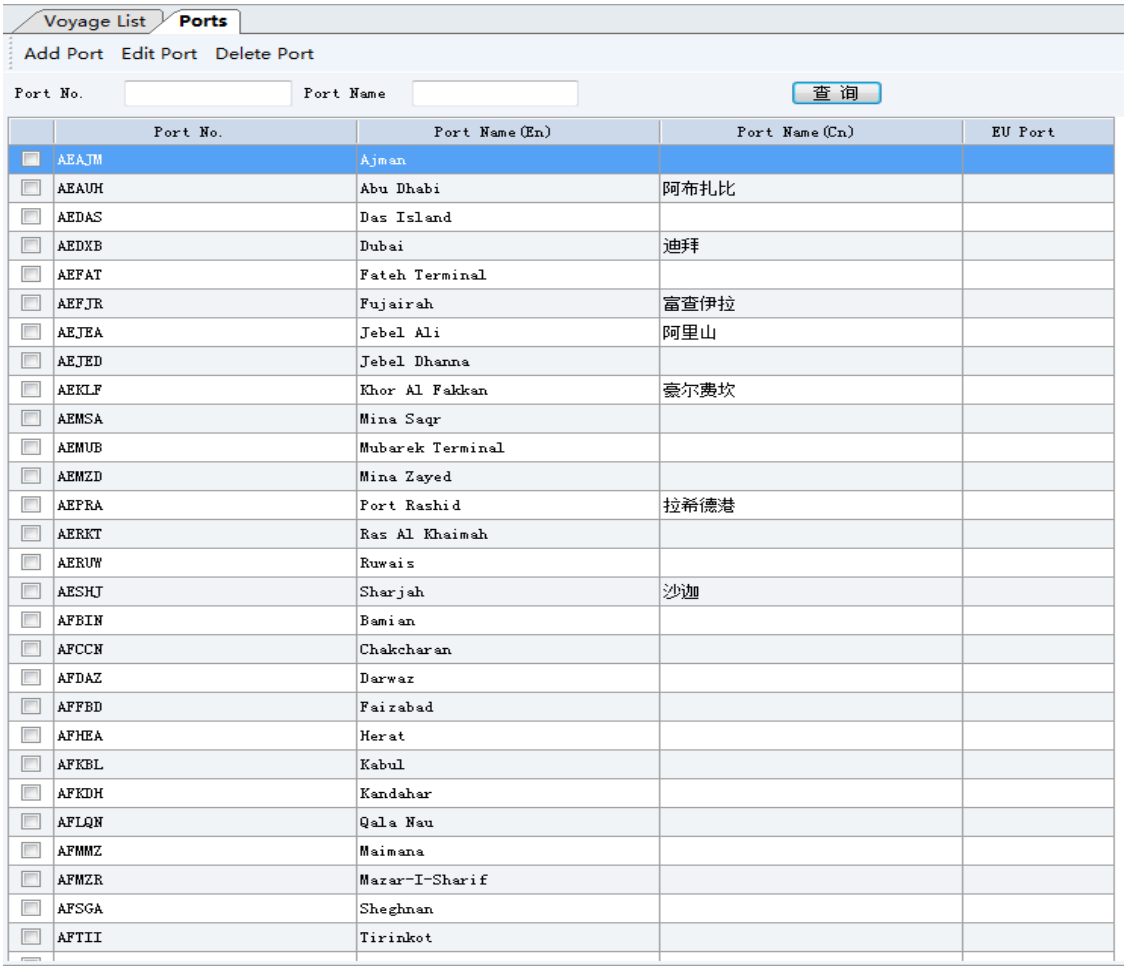


Figure 3.2.5-1 Port management

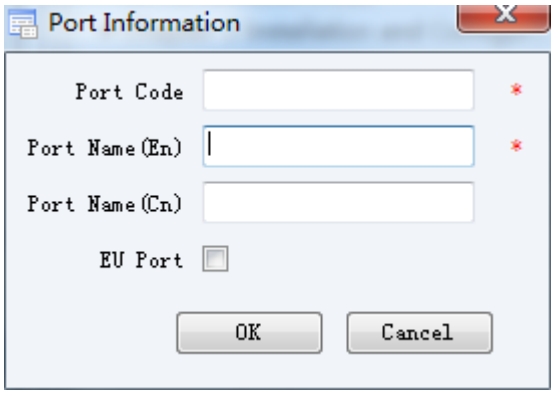


Figure 3.2.5-2 Add port

1) Add port: click [Add Port] to pop up the “Add Port” interface as shown in the following Figure 2.2.5-2, in which the options with a * mark are required. If the port is an EU port, please check the EU port checkbox.

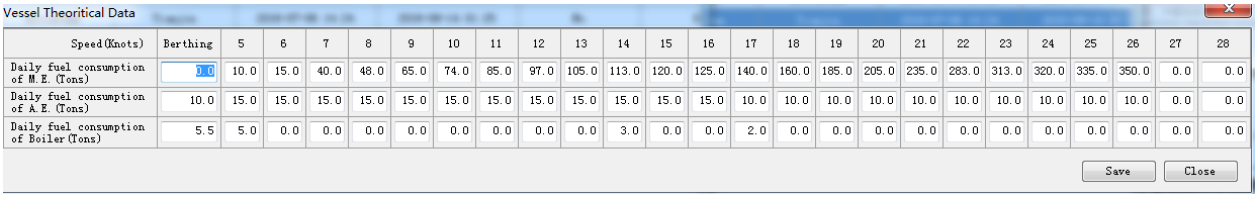
2) Edit port: check the checkbox for the port to be modified in the port list and click [Edit Port] or double click a certain line in the list to pop up the “Edit Port” interface.

3) Delete port: check the checkbox for the port to be deleted in the port list and click [Delete Port] to pop up the deletion prompt message, and check several lines to delete multiple port data.

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4) Search port: filter and query ports based on port name and port number.

3.2.6 vessel theory data



Fill in the theoretical consumptions of the main engine, auxiliary engines and boiler in port and various navigation speeds of the ship in order to check the data in the energy efficiency assessment.

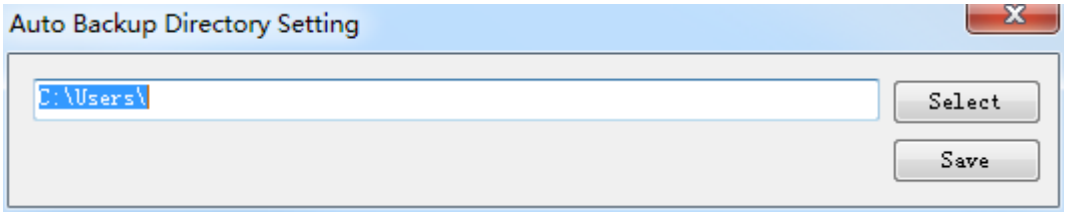
3.2.7 Data Backup/Restore

To avoid unexpected data loss, the system has the data backup function.

1) After clicking the “System management – data backup/restore – data backup” button and choosing the path to store the file, the system will automatically backup the current data as a “.bak” file named according to time.

2) Click the “System management – data backup/restore – restore from backup files” button to restore data from backup files. Note: All current data will be covered during restoration.

3.2.8 Auto Backup Directory Setting



Every time the system saves route segment data, it will also automatically backup current system data to avoid data loss arising from an accident. A backup file is named “data+ time”, for example, “201710160939.bak”. The user is required to specify the automatic backup catalog when it is entered into the system for the first time and can modify the automatic backup catalog in the “System management – automatic data backup catalog setting” menu when necessary. The redundancy mechanism is used for backup in order to restore early data after any entry error. Although a single backup file is small, the backup catalog will be increasing gradually during use. The user may manually delete unnecessary backup files and only save the last backup (i.e. the file name indicating the latest time) after confirming no error in current data.

3.3 Arrival and departure data

The function of the arrival and departure data mainly provides the functions of entering, modifying, deleting, exporting and reporting the data of the port through which the voyage passes. It includes passed by port, floating and anchoring. Click the system menu [arrival and departure information] to enter the arrival and departure list interface, as shown in figure (3.3.3-1). The functions of this interface are as follows:

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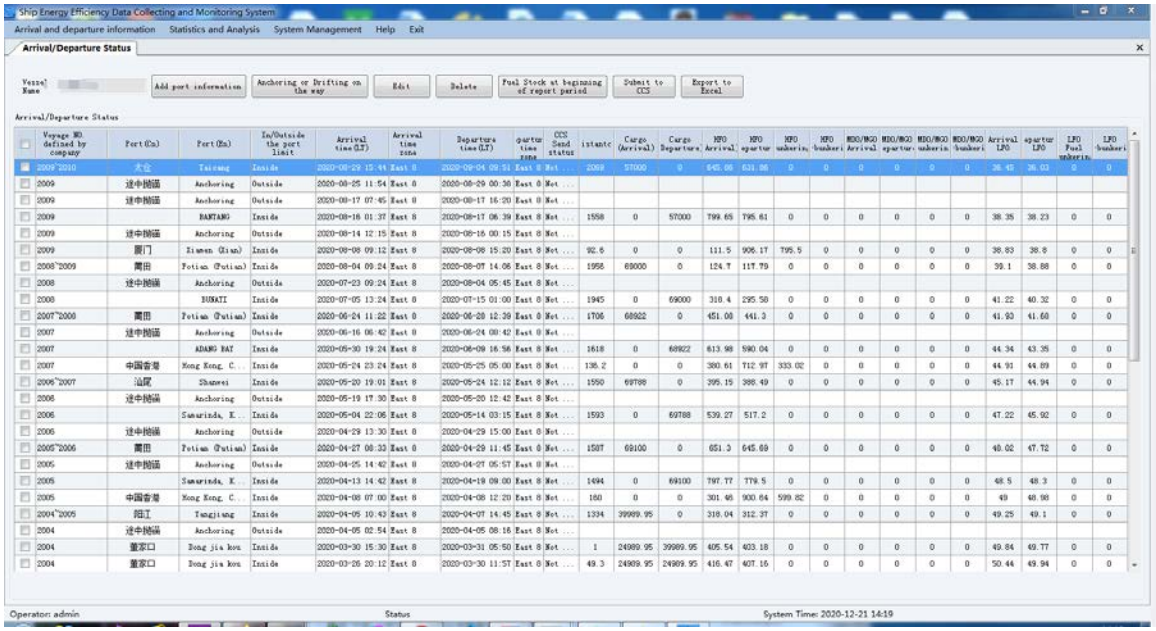


Figure 3.3.1-1 voyage data

1）Add arrival and departure information: click the button 

to add one or more arrival and departure data for this voyage, as shown in figure (3.3.1-2). Items marked with * are required. This interface includes five parts: arrival and departure information, arrival cargo, departure cargo, bunkering volume, output of transferred oil and output of transferred sludge.

2）Voyage number 1 is a required item, which indicates the voyage of the current port. When the port is the handover port of two voyages, it is required to fill in the voyage number 2.

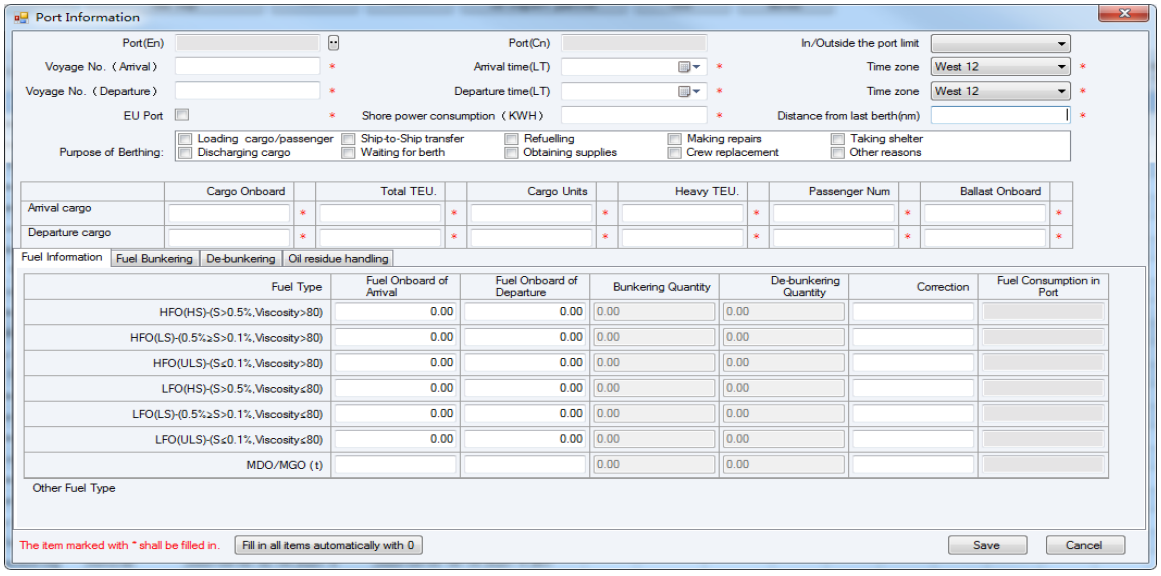


Figure 3.3.1-2 increase arrival and departure

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Among them, the specific bunkering and transferring dates should be filled in for IMO related reports.

When filling in the bunkering quantity, sulfur content of the fuel oil needs to be fill in (according to the percentage, for example, if the sulfur content is 0.005, it should be filled in 0.5) and viscosity. The system can automatically judge whether it is high sulfur oil or low sulfur oil, heavy oil or light oil.

Viscosity criteria:

HFO：viscosity >80

LFO：viscosity≤80

Sulfur content criteria:

H.S.F.O: Sulfur content≥0.5%

L.S.F.O: 0.1%≤Sulfur content <0.5%

U.L.S.F.O: Sulfur content <0.1%

2）Add anchoring / floating information: click the button Anchoring or Drifting on the way to add one or more anchoring or floating data during the voyage

a) Add anchor information: click the button Anchoring or Drifting on the way, as shown in figure (3.3.1-3)

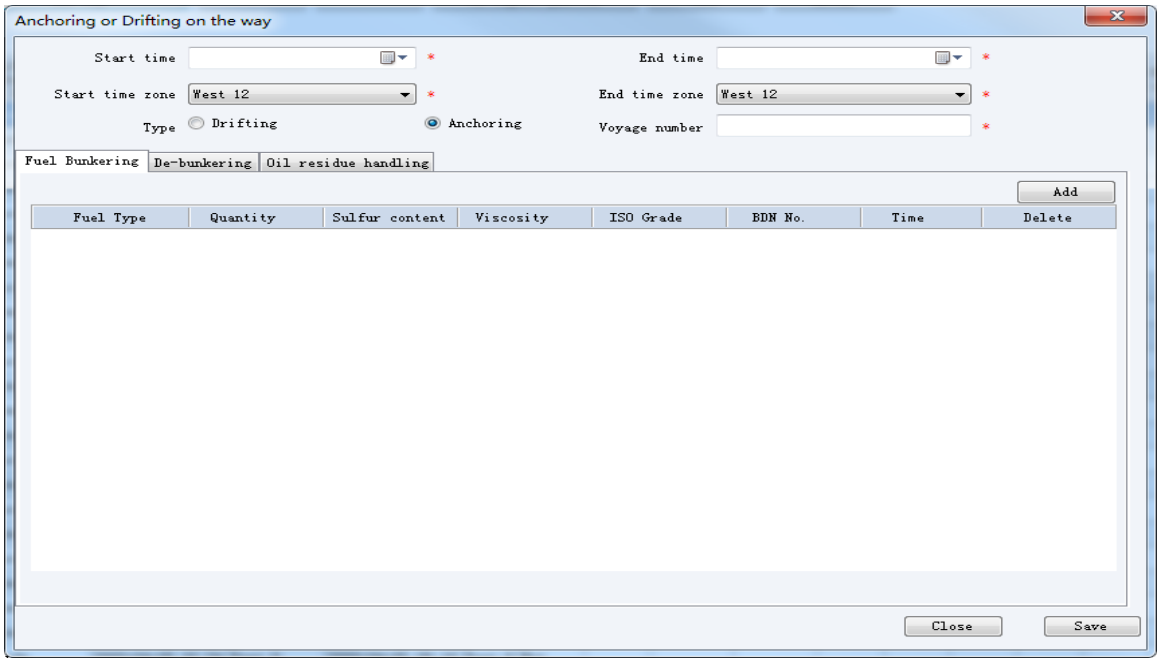


Figure 3.3.1-3 adding anchor

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b）Add drifting information: Click the button Anchoring or Drifting on the way as shown in Fig. (3.3.1-4)

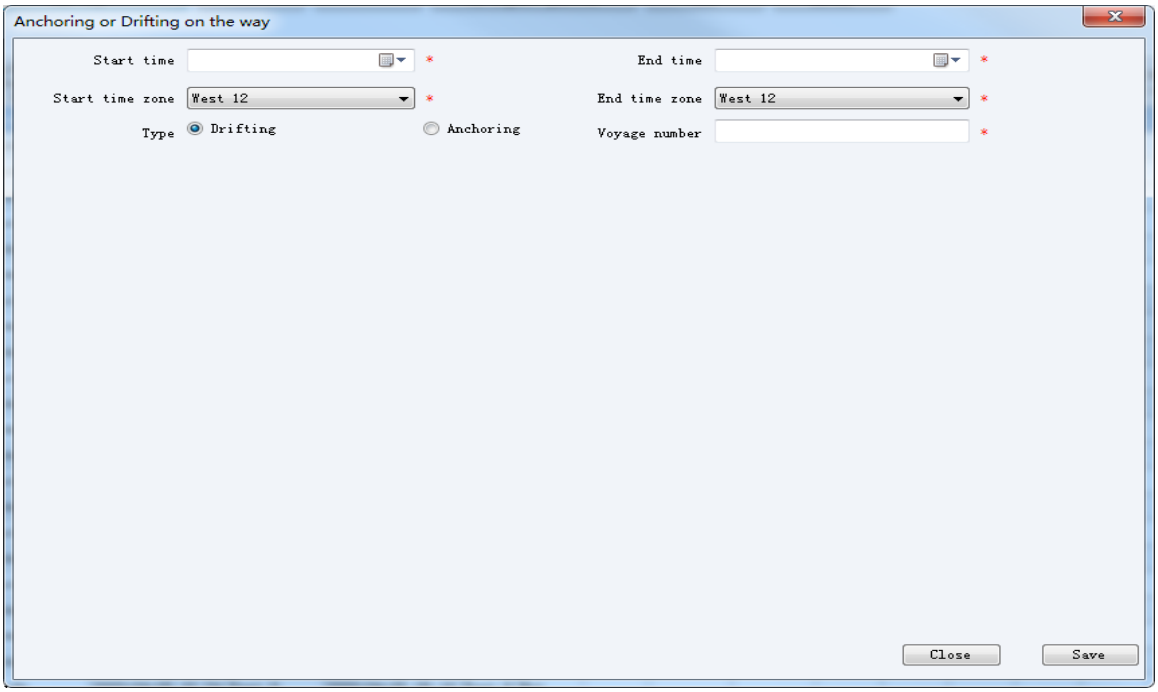


Figure 3.3.1-4 adding drifting

3） Fill in the ship's initial oil storage: Click Fuel Stock at beginning of report period to open the list interface of initial oil storage, as shown in figure (3.3.1-5). The initial oil quantity is needed to generate BDN and IMO DCS.

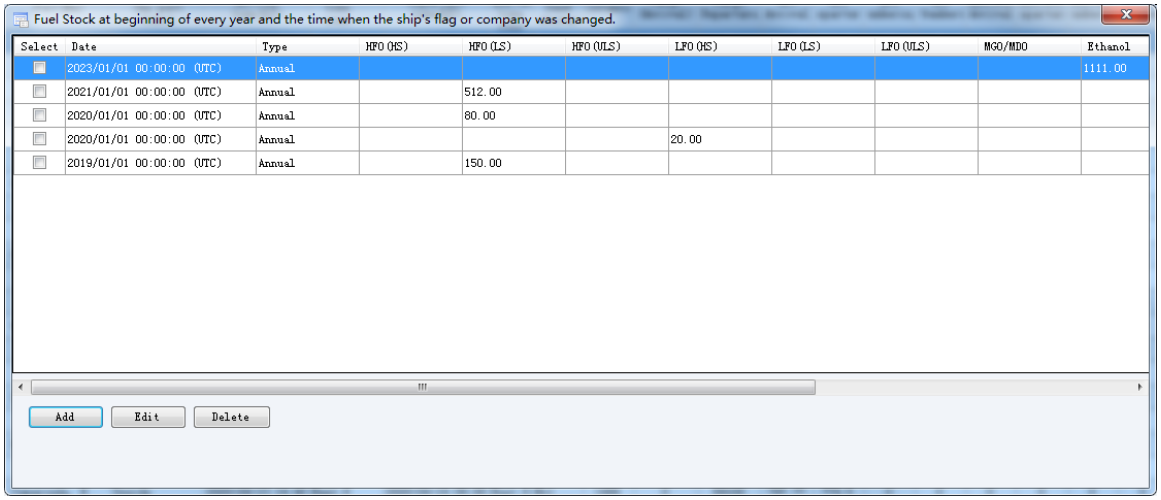


Figure 3.3.1-5 list of opening oil quantity

a) Add opening quantity: click the button Add to open the opening oil

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quantity filling interface. As shown in figure 3.3.1-6

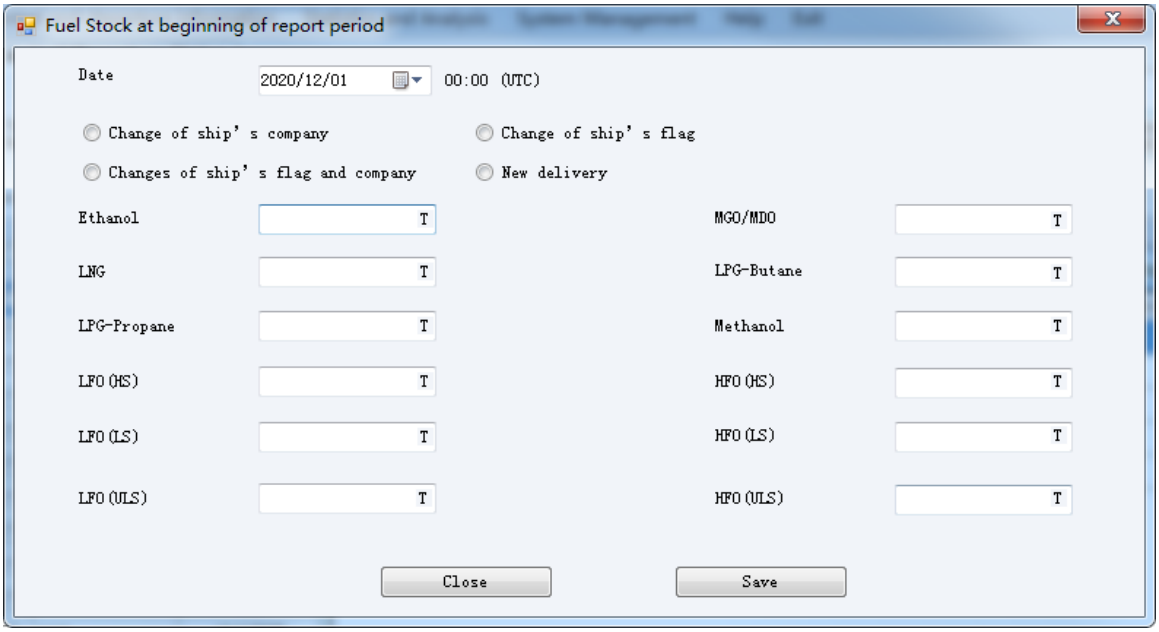


Figure 3.3.1-6 increasing opening oil quantity

b) Edit opening quantity: select a piece of data and click the button Edit to open the editing page. The operation content of the interface is the same as that of the new interface.

c) Delete opening quantity: select a piece of data and click the button Delete.

4) Modify arrival / departure information or anchoring / floating information: select the arrival / departure or anchoring / floating data to be modified in the list, click Edit or double-click a line in the list to open the interface for modifying arrival / departure or anchor / floating data. The operation content of the interface is the same as that of the new interface.

5) Delete: in the arrival and departure information list, check the box in front of the arrival / departure or anchor / floating data line to delete, click Delete to pop up the deletion prompt message, or select multiple lines to delete multiple data.

6) Report data: in the arrival and departure list, select the check box for data transmission and click [Submit to CCS] to report the selected voyage data to the network server.

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7) Export to Excel: Check the checkbox for data to be exported in the voyage list, and click [Export to Excel] to enable the system to export the checked voyage data into specified Excel format and save it under the specified directory by the user.

3.4 Statistical and Analysis

Statistical analysis includes data assessment, list of voyage, EU emissions report and IMO standard data report.

3.4.1 Data assessment

Click [Statistical and Analysis]-[Data Assessment] in the system menu to enter the energy efficiency assessment interface as shown in Figure 3.3.2-1, having the following functions:

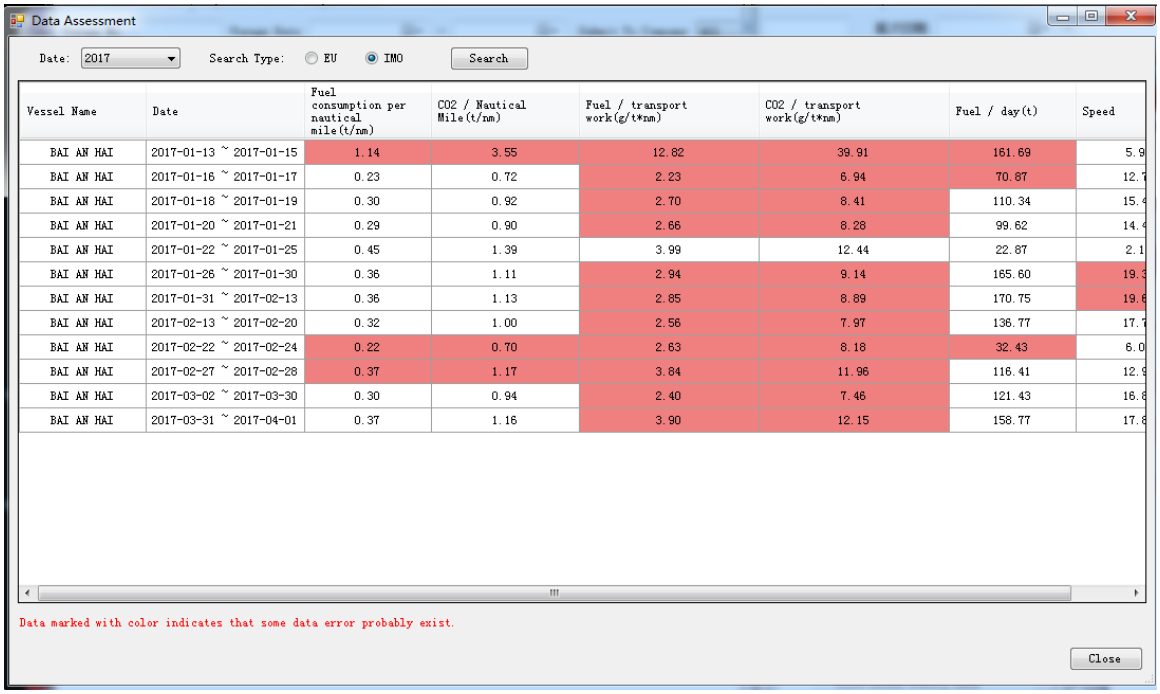


Figure 3.3.2-1 Energy efficiency assessment interface

Select the year and query type, click [Query] to list the results of the energy efficiency assessment within the time range on the interface, in which the red block indicates a problem with the data and displays the exception information when the mouse points to the data.

Abnormal information includes:

1. The average speed is above the design speed.
2. Above the theoretical data of the ship (the data filled in 3.2.6 [Ship Energy Consumption Theoretical Data Management])
3. Above the historical data of the ship

3.3.3 list of voyage

Click [Statistical and Analysis]-[List of voyage] to enter the segment monitoring list interface

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as shown in figure 3.3.3-1, having the following functions:

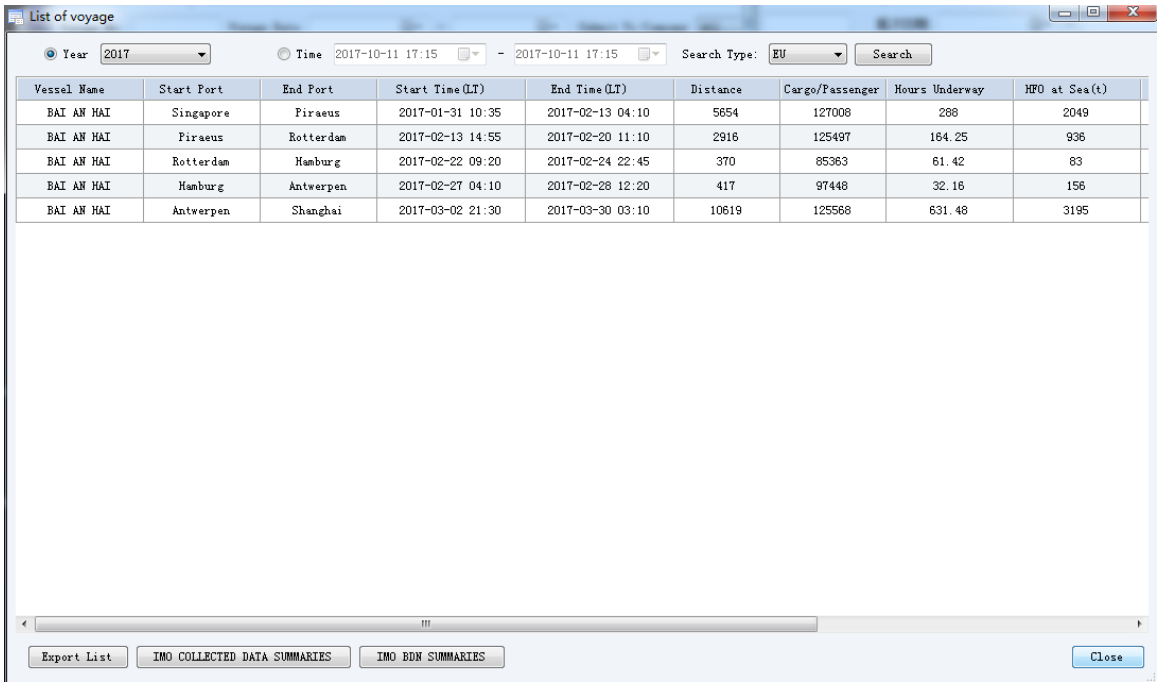


Figure 3.3.3-1 Segment monitoring list interface

Select the year (or period) and query type, and click [Search] to list segment data within the time range on the interface.

1) When the query type is EU, only EU voyages are displayed and the sailing time is calculated based on EU rules; and when the query type is IMO, all voyages are displayed and the sailing time is calculated based on IMO rules.
2) The feature “Export EU List” will export EU segment lists under the EU calculation rules.
3) Export summary tables of IMO collecting data and IMO refueling list, and export relevant reports of IMO based on the selected year (or period).

3.3.4 EU emissions report

Click [Statistical and Analysis]-[EU Emissions report] in the system menu to pop up the dialog box [Query Time Range] as shown in Figure 3.3.4-1.

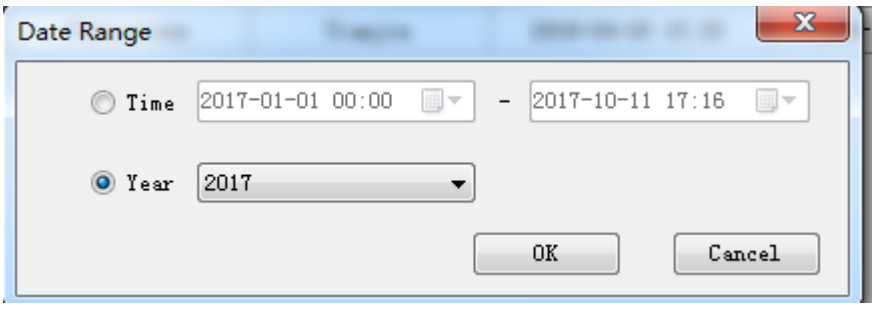


Figure 3.3.4-1 Emissions report

Query according to the selected year or specific period, and click [OK] to display the emissions report interface as shown in Figure 3.3.4-2.

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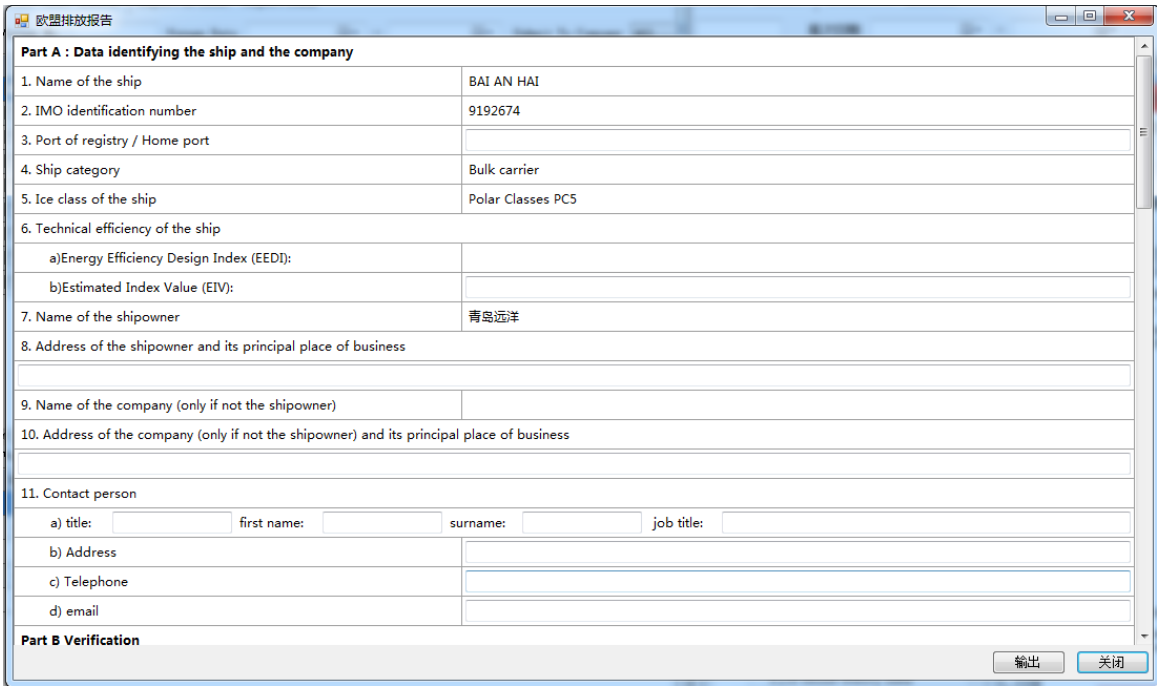
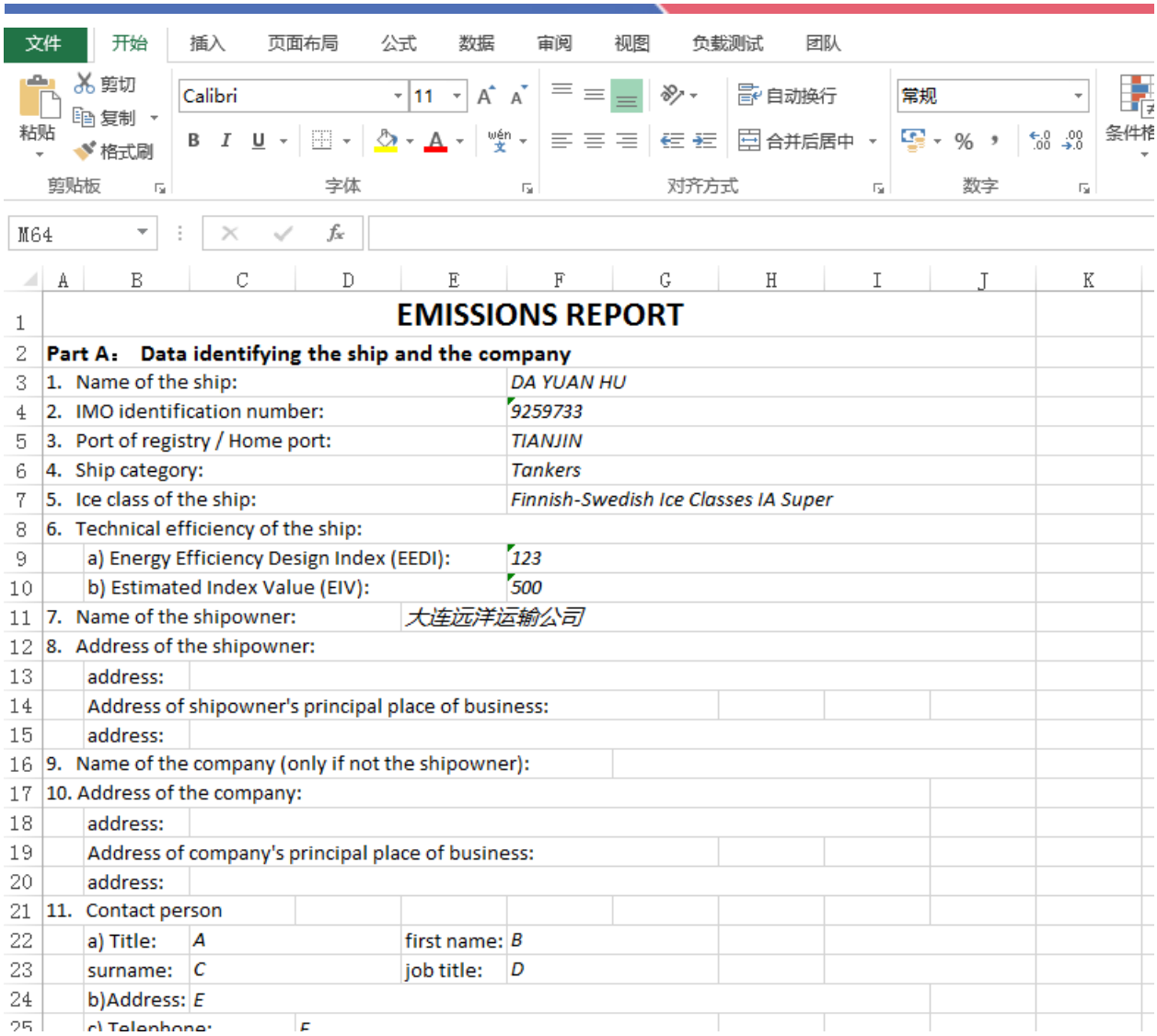


Figure 3.3.4-2 Emissions report

The contents of the emissions report are displayed on the interface, where some items can be entered manually. After that, click [Output] to enable the system to generate the report file in the Excel format and save it under the user specified directory in the following style:

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	A	B	C	D	E	F	G	H	I	J	K
1					EMISSIONS REPORT						
2											
3		Part A: Data identifying the ship and the company									
4		1. Name of the ship:				DA YUAN HU					
5		2. IMO identification number:				9259733					
6		3. Port of registry / Home port:				TIANJIN					
7		4. Ship category:				Tankers					
8		5. Ice class of the ship:				Finnish-Swedish Ice Classes IA Super					
9		6. Technical efficiency of the ship:									
10		a) Energy Efficiency Design Index (EEDI):				123					
11		b) Estimated Index Value (EIV):				500					
12		7. Name of the shipowner:			大连远洋运输公司						
13		8. Address of the shipowner:									
14		address:									
15		Address of shipowner's principal place of business:									
16		address:									
17		9. Name of the company (only if not the shipowner):									
18		10. Address of the company:									
19		address:									
20		Address of company's principal place of business:									
21		address:									
22		11. Contact person									
23		a) Title:	A		first name:	B					
24		surname:	C		job title:	D					
25		b)Address:	E								
		c) Telephone:	F								

Figure 3.3.4-3 Emissions report

3.3.5 IMO standard data report

Click [Statistical Analysis]-[IMO Standard Data Report] in the system menu to pop up the dialog box **[Query Time Range]** as shown in Figure 3.3.5-1.

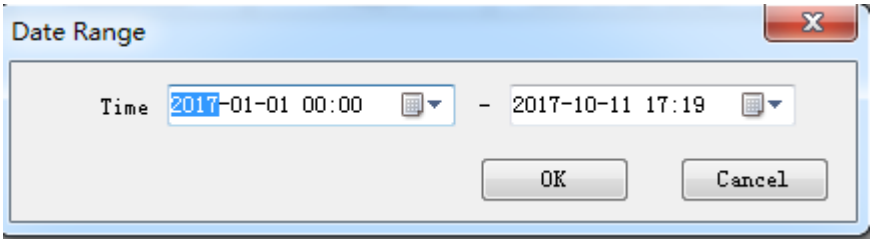
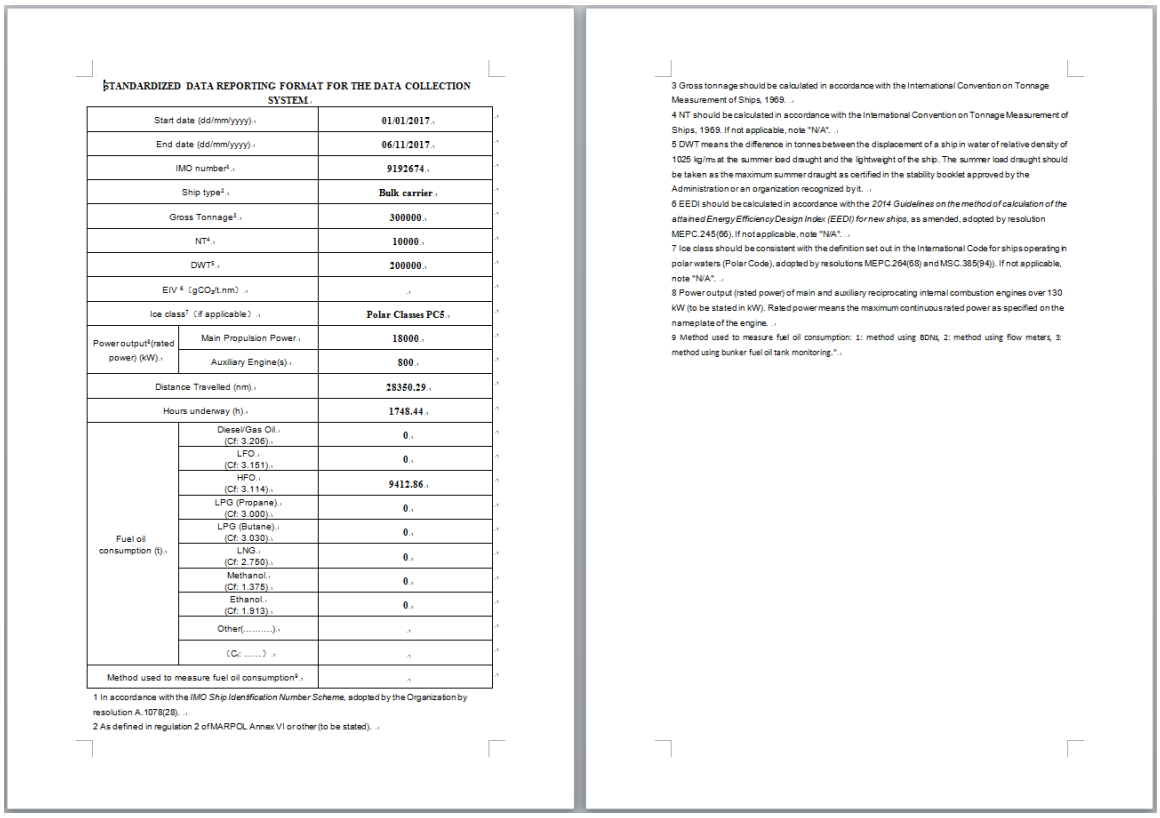


Figure 3.3.5-1 IMO standard data report - time range selection

Query according to a year or a specific period and click [Output] to generate a report file in Word format and save it under the user specified directory in the following style:

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STANDARDIZED DATA REPORTING FORMAT FOR THE DATA COLLECTION SYSTEM

Start date (dd/mm/yyyy)		01/01/2017
End date (dd/mm/yyyy)		06/11/2017
IMO number[1]		9192674
Ship type[2]		Bulk carrier
Gross Tonnage[3]		300000
NT[4]		10000
DWT[5]		200000
EIV[6] (gCO2/t.nm)		-
Ice class[7] (if applicable)		Polar Classes PC5
Power output[8](rated power) (kW)	Main Propulsion Power	18000
	Auxiliary Engine(s)	800
Distance Travelled (nm)		28350.29
Hours underway (h)		1748.44
Fuel oil consumption (t)	Diesel/Gas Oil (Cf: 3.206)	0
	LFO (Cf: 3.151)	0
	HFO (Cf: 3.114)	9412.86
	LPG (Propane) (Cf: 3.000)	0
	LPG (Butane) (Cf: 3.030)	0
	LNG (Cf: 2.750)	0
	Methanol (Cf: 1.375)	0
	Ethanol (Cf: 1.913)	0
	Other(.....)	-
	(Cf: .....)	-
Method used to measure fuel oil consumption[9]		-

1 In accordance with the *IMO Ship Identification Number Scheme*, adopted by the Organization by resolution A.1078(28).
2 As defined in regulation 2 ofMARPOL Annex VI or other (to be stated).
3 Gross tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969.
4 NT should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969. If not applicable, note "N/A".
5 DWT means the difference in tonnes between the displacement of a ship in water of relative density of 1025 kg/m at the summer load draught and the lightweight of the ship. The summer load draught should be taken as the maximum summer draught as certified in the stability booklet approved by the Administration or an organization recognized byit.
6 EEDI should be calculated in accordance with the *2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*, as amended, adopted by resolution MEPC.245(66). If not applicable, note "N/A".
7 Ice class should be consistent with the definition set out in the International Code for ships operating in polar waters (Polar Code), adopted by resolutions MEPC.264(68) and MSC.385(94)). If not applicable, note "N/A".
8 Power output (rated power) of main and auxiliary reciprocating internal combustion engines over 130 kW (to be stated in kW). Rated power means the maximum continuous rated power as specified on the nameplate of the engine.
9 Method used to measure fuel oil consumption: 1: method using BDNs, 2: method using flow meters, 3: method using bunker fuel oil tank monitoring.".

Figure 3.3.5-2 IMO standard data report

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Appendix I Calculation Rules in EU MRV regulation

Data of one voyage are shown as follows:

						Arrival information			Departure information				
Location	Inside or outside port list	Arrival time (GMT)	Activity	Departure Time (GMT)	Distance travelled from the last location	HFO Remain	MDO Remain	On board cargo	HFO Remain	MDO Remain	On board cargo	HFO bunkered	MDO bunkered
Qingdao	Inside	2016/8/29 12:00	Loading	2016/8/30 8:00	600	2033	203	0	2032	202	30000		
Ningbo	Inside	2016/9/1 12:00	Loading	2016/9/2 9:00	400	2000	200	30000	1999	198	60000		
Port anchorage in Ningbo Port	Inside	2016/9/2 11:00	Typhoon avoidance	2016/9/5 10:00	3	1998	197	60000	1996	192	60000		
Drift at sea	At sea	2016/9/8 11:00	Engine fault Drifting	2016/9/8 17:30	1050	1916	188	60000	1916	188	60000		
Singapore	Inside	2016/9/11 19:00	Fueling	2016/9/12 3:00	1150	1830	183	60000	2499	182	60000	670	0
Port Said	Inside	2016/9/28 6:00	Crew replacement	2016/9/28 20:00	5000	2100	158	60000	2099	157	60000		
Outside port list of Rotterdam	Outside	2016/10/9 6:30	Dropping anchor Ship-to-ship transfer	2016/10/9 19:30	3434	1840	141	60000	1839	140	45000		
Port anchorage	Inside	2016/10/9 21:00	Anchor in the berth	2016/10/15 9:00	6	1823	139	45000	1822	131	45000		

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in Port of Rotterdam													
Rotterdam	Inside	2016/10/15 11:00	Unloading	2016/10/17 18:00	3	1820	130	45000	1819	126	20000		
Port of Hamburg	Inside	2016/10/18 15:00	Unloading	2016/10/19 22:30	254	1798	124	20000	1796	123	0		

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1. The ports of Qingdao, Ningbo, Rotterdam and Hamburg shall be considered as the ports of call for the loading and unloading operations. The Singapore port and Port Said shall not be considered as the ports of call due to no loading or unloading operations.
2. The voyage from Qingdao to Ningbo shall not be regarded as EU voyage because the two ports of calls are not EU ports.
3. The voyage from Ningbo to Rotterdam is the first EU voyage, because according to the European MRV legislation, a voyage starts from a port of call or ship-to-ship transfer inside the port to the next berth or ship-to-ship transfer inside the port.

The starting point of the voyage between Ningbo to Rotterdam is the port anchorage in Ningbo which is the last berth in the Ningbo Port.

The termination of the voyage between Ningbo to Rotterdam is the port anchorage in Rotterdam which is the first berth in the Port of Rotterdam. Although 15,000t cargo was unloaded outside the Port of Rotterdam on October 9, 2016, the operation is outside the Port of Rotterdam so that the arrival location of ship-to-ship transfer can not be considered as the termination of this voyage.

The fuel consumption, voyage distance, marine time and cargo capacity are calculated as follows:

a) Fuel consumption of the voyage from Ningbo to Rotterdam

HFO= HFO remain at departing the anchorage in Ningbo Port (1996) - HFO remain at arriving the anchorage in Port of Rotterdam (1823) + refueled HFO in Singapore (670) = 843

MDO= MDO remain at departing the anchorage in Ningbo Port (192) — MDO remain at arriving the anchorage in Port of Rotterdam (139) + refueled MDO in Singapore (0) = 53

b) Fuel consumption inside the Port of Rotterdam

HFO = HFO remain at arriving the anchorage in Port of Rotterdam (1823) — HFO remain at departing the anchorage in Port of Rotterdam (1819) =4

MDO = MDO remain at arriving the anchorage in Port of Rotterdam (139) — MDO remain at departing the anchorage in Port of Rotterdam (126) =13

c) Voyage distance =1050 + 1150 + 5000 + 3434 + 6 = 10640

d) Marine time = the time of arriving at the anchorage in Port of Rotterdam (2016/10/9 21:00) — the time of departing the anchorage in Ningbo Port (2016/9/5 10:00) — the time of berthing at Port of Singapore (2016/9/12 03:00 — 2016/9/11 19:00) — the time of berthing at the Port Said (2016/9/28 20:00—2016/9/28 06:00) — the time of dropping anchor outside the Port of Rotterdam (2016/10/9 19:30 — 2016/10/9 06:30).

Note: the drifting time due to engine fault (2016/9/8 11:00—2016/9/8 17:30) shall be included in the marine time.

e) Berth time in the voyage = the time of berthing in the Port of Singapore (2016/9/12 03:00 — 2016/9/11 19:00) + the time of berthing in the Port Said (2016/9/28 20:00—2016/9/28 06:00) + the time of dropping anchor outside the Port of Rotterdam (2016/10/9 19:30 — 2016/10/9 06:30).

f) Cargo loaded =(60000 x (1050 + 1150 + 5000 + 3434)+ 45000 x 6)/ (1050 + 1150 + 5000 + 3434 + 6)= 59991

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Note: for cargo or passengers of ship-to-ship transfer

- Part of cargo operations of this voyage are outside the ports of call (the cargo capacity shall take the amount of cargo before the transfer and after the transfer and calculate the average capacity of the whole voyage).
- The ship-to-ship transfer inside the port of call shall be regarded as cargo operation at berth: before arriving at the first berth, the ship-to-ship transfer inside the port of call (if any) will be the key point of this voyage to be ended. After leaving the last berth, the ship-to-ship transfer inside the port of call will be the starting point of next voyage.

4. The voyage from Port of Rotterdam to the port of Hamburg is the second EU voyage.

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Appendix II User License Agreement

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