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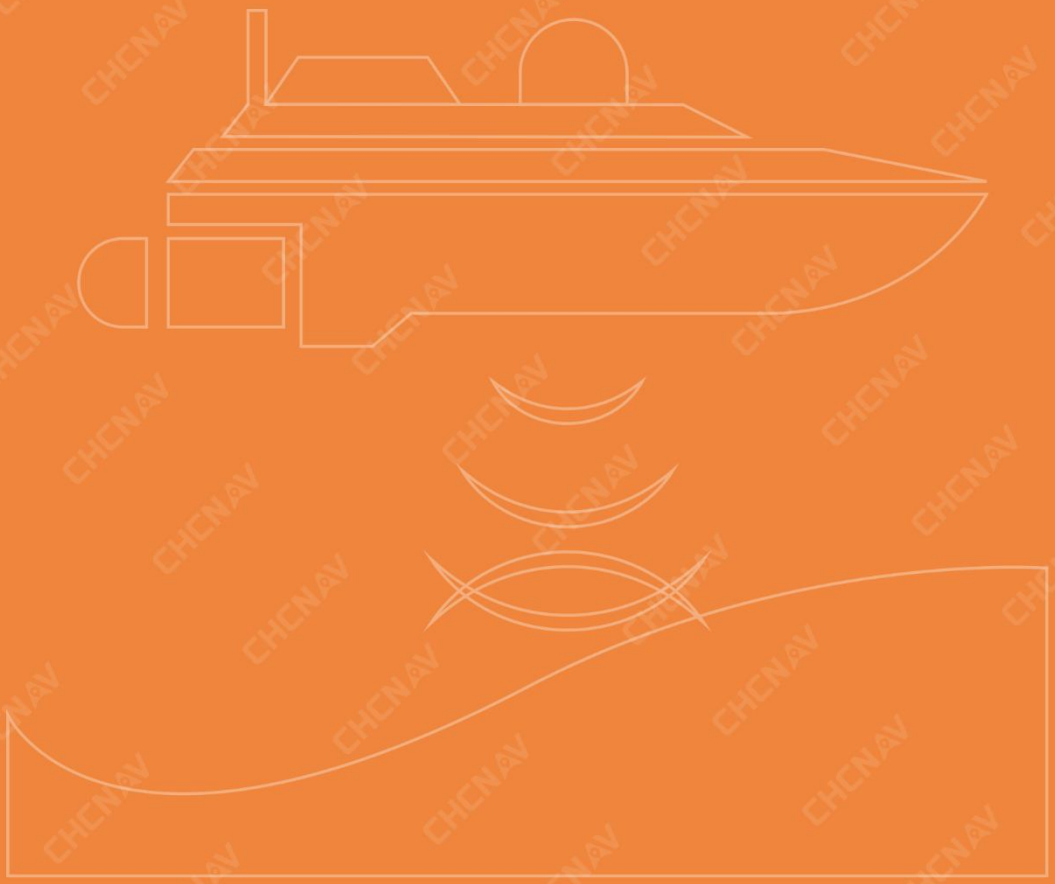

EasySail
Software User Manual

MAKES YOUR WORK MORE EFFICIENT

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REVISIONS TO THE MANUAL

Document Number: CHCNAV-SMSC-EasySail-V1.4.0-20241011

Date Of Revision	Number Of Revisions	Revision Personnel	Illustrate
2023.09.01	1	Richard Lee	The initial version of V1.0 only includes a single-beam topographic survey module
2024.09.29	1	Richard Lee	V1.4.0 software release, including single-beam topographic surveys and ADCP hydrological surveys

PREFACE

INSTRUCTION MANUAL USE

Welcome to use the *EasySail* software instruction manual of Shanghai CHCNAV Navigation Technology Co., Ltd. (hereinafter referred to as CHCNAV or CHCNAV Navigation), which is applicable to the APACHE series USVs produced by Shanghai CHCNAV Navigation Technology Co., Ltd(APACHE No. 3, APACHE No. 3 Pro, APACHE No. 4, APACHE No. 4 Lite, APACHE No. 6) and its D230/D270 single-beam sounder carry out a series of operations such as hull connection, single-beam data acquisition, single-beam data post-processing, and data result export through *EasySail* software. At the same time, it is also connected to the D270 single-beam sounder through *EasySail* software for route planning, data collection, data post-processing, data results export and other operations.

INTRODUCTION TO THE MANUAL

This manual is an introduction to the software operation process of the USV or single-beam sounder produced by Shanghai CHCNAV Navigation Technology Co., Ltd. for single-beam underwater topographic survey through *EasySail* software.

EXPERIENCE REQUIRED

In order for you to better use *EasySail* software, CHCNAV Navigation recommends that you read this manual carefully. If you don't know more about CHCNAV Navigation *EasySail*, please contact CHCNAV Navigation Company for more services according to the above contact information.

HOW TO CONTACT CHCNAV

Service Hotline	400-620-6818
Company name	Shanghai Huace Navigation Technology Co., Ltd
Headquarters address	Huace Spatiotemporal Intelligent Industrial Park, Xianghuaqiao Street, Qingpu District, Shanghai
Base address	Huace Spatio-temporal Intelligent Science and Technology Innovation Park, Guandong Street, Jiangxia District, Wuhan City, Hubei Province
Front desk hotline	021-51508100

Website: https://www.huace.cn/

For all of your customer service needs, including our emergency round-the-clock technical support, please call 400-620-6818 (Line 5)

Use our online customer portal https://www.huace.cn/ and click on the support link to download manuals, firmware updates, software, or other CHCNAV-related documentation.

CONVENTIONS USED IN THIS MANUAL

The conventions used in this document are designed to help you learn how to use the system quickly and easily.

Software menu items are printed in bold: File menu, collect data. Items or keys that require user typing will appear as F1. If a key combination is connected to a plus sign (*ALT+F*), you will hold down the first key while pressing the second key. Italics include program name (*EasySail*) and file name (*default.txt*).

The code or sample files are printed with a fixed font. Here's an example:

```
Equipmentmodel:RiverStar600kHz
Firmwareversion:1.0.6
Serialnumber:
```

SAFETY TECH TIPS

Notes:

The content of the tips is generally a special place for operation, which needs your special attention, please read carefully

Warning:

If you do not follow the warning, it will cause damage to the instrument, loss of data, and system crash, and even endanger personal safety

Tips:

This symbol indicates other information that can help you avoid problems or should be taken into account while using the said feature

IMPRINT NOTICE

This manual is copyrighted by Shanghai CHCNAV Navigation Technology Co., Ltd., and the company has the right to treat it as confidential information. The Company reserves the right to change this manual, and the specifications of the product, equipment, or software described in this manual without notice.

EXCLUSION OF LIABILITY

Please be sure to read the instruction manual carefully before using this software, which will help you better use this software. Shanghai CHCNAV Navigation Technology Co., Ltd. shall not be liable for the losses caused by your failure to operate the software in accordance with the requirements of the instruction manual, or the misoperation of the software product due to your failure to correctly understand the requirements of the instruction manual.

Shanghai CHCNAV Navigation Technology Co., Ltd. is committed to continuously improving the software functions and performance, improving the quality of service, and reserves the right to change the content of the instruction manual without prior notice.

We have checked the consistency of the content described in the printed materials with the hardware and software, but we do not rule out the possibility of deviations, the drawings in the instruction manual are for reference only, if there is any discrepancy with the software, please refer to the latest version of the software.

TECHNOLOGY & SERVICES

If you have any technical questions, you can call Shanghai CHCNAV Navigation Technology Co., Ltd., and we will answer your questions in a timely manner.

RELATED INFORMATION

You can find the manual in the following ways:

1. Obtained by contacting Shanghai CHCNAV Navigation Technology Co., Ltd.
2. Enter the official website of Shanghai CHCNAV Navigation Technology Co., Ltd., and download it by yourself through **Service and Support - Download Center - Marine Surveying and Mapping - Brochure / User Manual**

YOUR SUGGESTION

If you have any suggestions and comments on CHCNAV Navigation *EasySail* software, please contact us. Your feedback will greatly improve the quality of our products.

HISTORICAL SOFTWARE RELEASE DESCRIPTIONS

EasySail V1.4.0 update content:

1) CORS Login - Add SWAS access point
2) Added A4-Lite、A6-V1.1 ship types
3) Coordinate System - Automatically acquires the central meridian
4) Coordinate System - Grid file import is supported
5) Measuring ruler - supports two-point measurement and multi-point measurement
6) Support one-key linking (no need to open the remote control assistant)
7) Single-beam measurement - supports the display of 300,000 trajectory points
8) Added a video view display and blank switch
9) Target points are marked in blue (Auto Sail mode)
10) Hydrographic Surveys - Add Clock Mechanism
11) Polygon point saving is supported
12) Clear waypoints and polygon points
13) Added ship type setting function
14) Voyage control function, add a secondary confirmation box
15) Fix known issues

CONTENS

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1. SOFTWARE OVERVIEW

This section describes the features of *EasySail* software and the minimum installation requirements

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1. BRIEFLY

EasySail is an USV industry application measurement and control software independently developed by CHCNAV, which is designed to be used by all USVs in APACHE series. Support topographic and hydrographic surveys. Topographic surveys support surveying mode, hydrological mode, semi-automatic, and fully automatic survey modes. Hydrographic surveys support mapping and hydrographic models. Enables USVs to automate measurement operations to adapt to the complex needs of various scenarios. At the same time, it supports 4G and data transmission connection, Acoustic Doppler Flow Profiler (ADCP) current measurement, single beam sounder, Hikvision camera video transmission, route planning, virtual hoverstick, CORS login, GNSS registration, SI unit switching and other functions.

Tips:

This guide covers *EasySail* 1.4.0 version

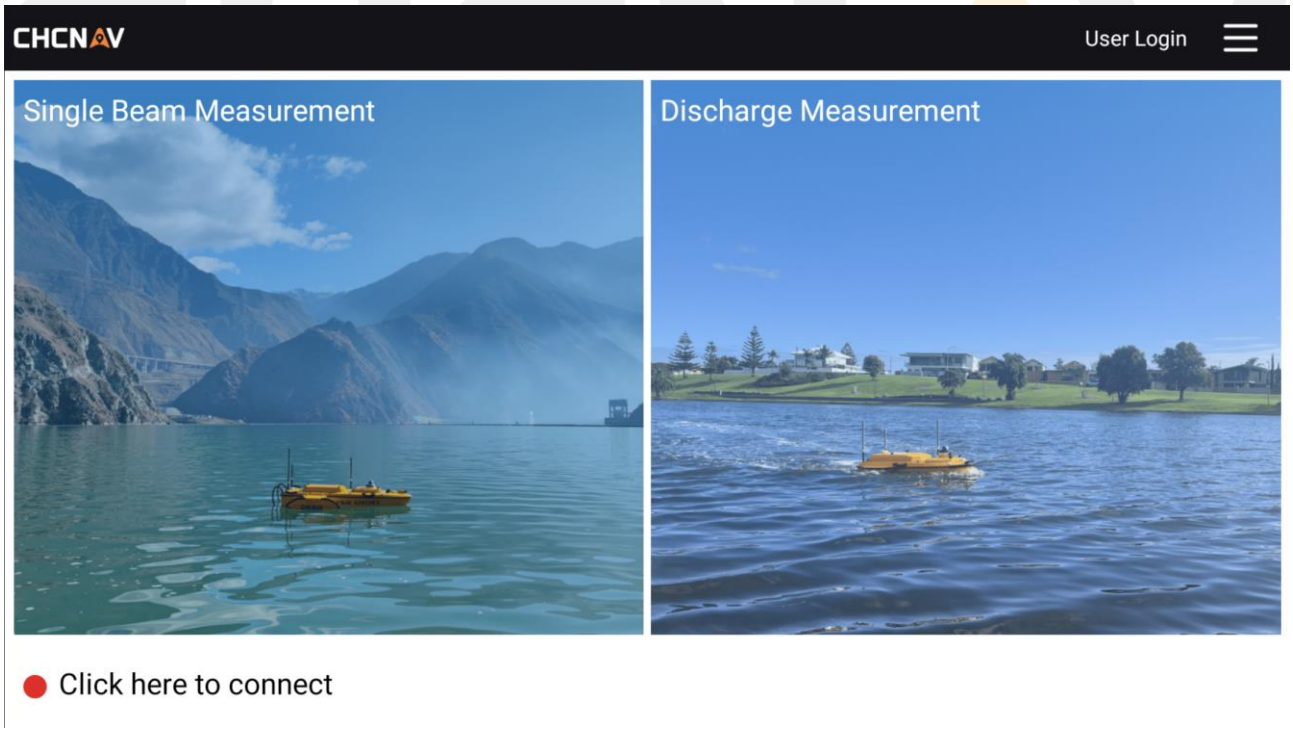

Figure 1.1: The main page of the *EasySail* software

1.1 SOFTWARE OPERATING ENVIRONMENT

The software only supports Android system, supports EC10 remote control and some tablets and mobile phones, Android 9 or above system, resolution 1920x1080.

Support products: APACHE series USV, CHCNAV D270 sounder.

Support locale: Chinese simplified, Chinese traditional, English, Russian, the software will automatically switch languages according to the current system locale, switch the system locale during the software operation, you need to restart the app;

Notes:

At present, many functions of the software require a mobile network, and the use of USVs also requires a network to provide network RTK services, so please ensure that you are in an environment where the network is available when using this product.

1.2 SOFTWARE INSTALLATION / UNINSTALLATION / DATA CLEARING

1. **Download and install**

   To download the software installation package, please visit the official website of CHCNAV: www.huace.cn. After downloading the APK file, you can directly double-click to install it;

2. **Software Permissions**

   In order to ensure normal use, the current software requires customers to open some permissions, including location and storage permissions, and floating window permissions are also required to open the map interface.

3. **Uninstall instructions**

   Uninstalling the software will simultaneously delete all data (engineering data, record control parameters, sounder parameters, etc.) including satellite map tile data, device connection information, custom server, route engineering, etc.

4. **Clear Data Description**

   Using Android to clear the history data will clear all cached application data of the software, including account login information, software engineering, CORS and SWAS information, permission acquisition, logs, etc., the software will be restored to the initial installation state, and you need to log in again, and SWAS and CORS also need to be actively connected.

Notes:

In order to ensure the normal access to the location of the remote control, be sure to turn on the positioning permission and function;

In order to ensure normal data saving and recording and shooting functions, you need to turn on the file storage permission.

1.3 SOFTWARE FILE DESCRIPTION

After the current software installation and use, the storage address for project files is:

1) **EC10 remote control**

   The *EasySail* folder in the root directory, including jobs and logs

2) **Other Android devices**

   Android/data/com.huace.easysail

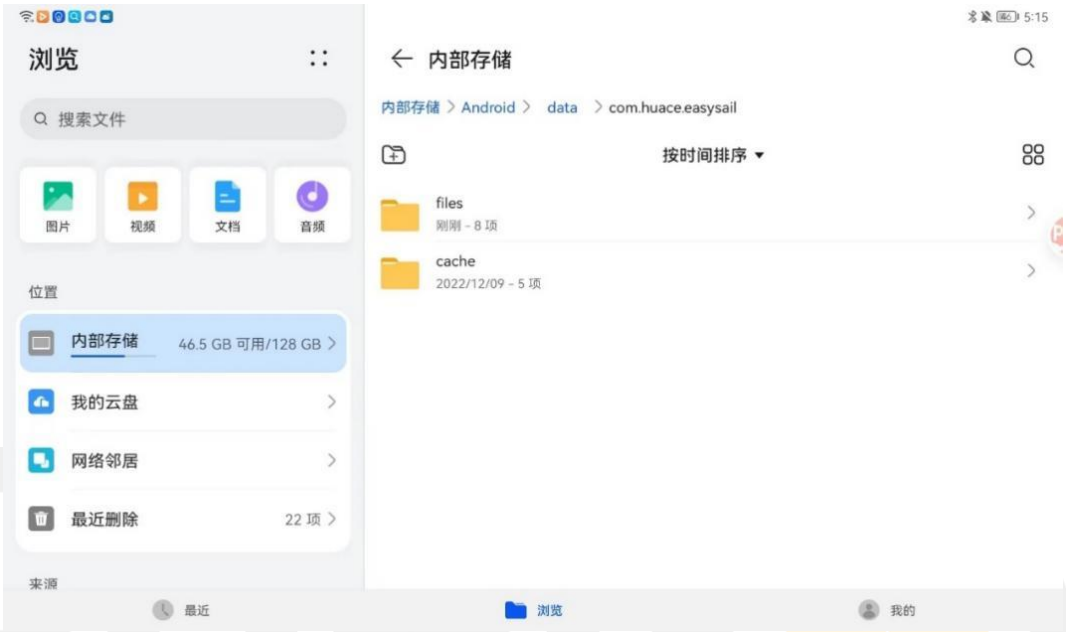

Figure 1.2: Internal storage of the EC10 remote control

1) **Cache**

   It mainly stores cached map tile data, including plane data and map label data;

2) **files**

   Other data generated during the operation of the software.

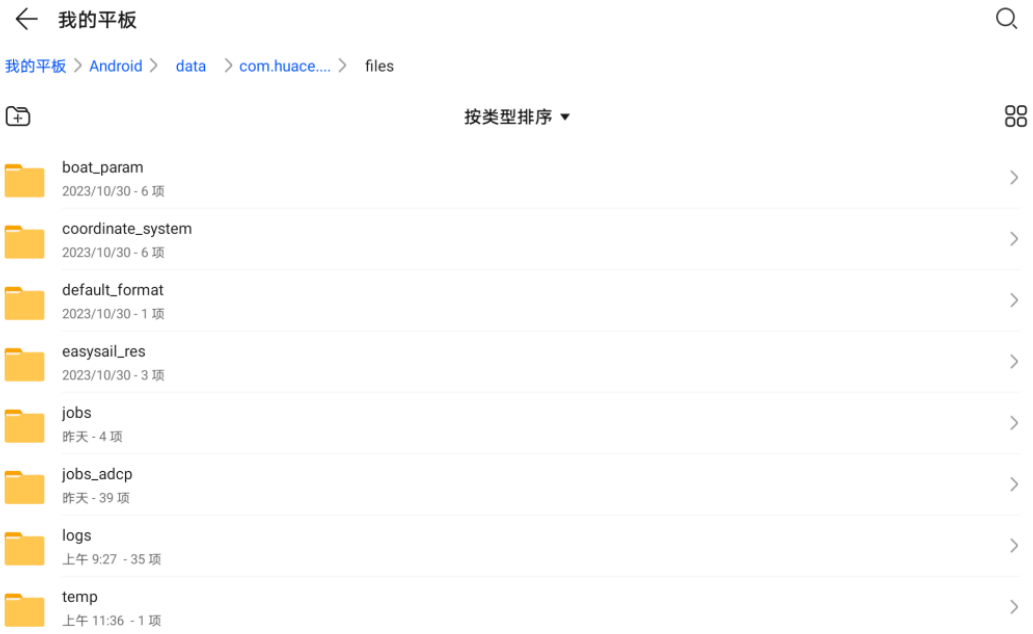

Figure 1.3: *EasySail* software catalog

1) **easysail_res**

   software prototypes and map profiles;

2) **jobs**

   Topographic survey project directory, each route project is a folder, and the folder name is the route name;

3) **jobs_adcp**

   Catalogue of hydrographic survey projects, each test project is a folder;

4) **logs**

   The software operation log, which records the abnormalities during the voyage will be recorded in the log;

5) **fpv**

   Folder for photo, video and video storage. in the corresponding project directory under jobs;

6) **boat_param**

   Store ship control parameter files (*.param*);

7) **coordinate_system**

   Storing coordinate system files;

8) **default_format**

   Deposit user-defined files;

9) **temp**

Temporarily stored file data, which can be ignored;

Notes:

After the project is saved, the result file of shooting and video recording is stored in the following path:

1. **EC10 remote control**

   EasySail/jobs/The name of the project file/fpv

2. **Other Android devices**

   Android/data/com.huace.easysail/jobs/The name of the project file/fpv

Notes:

The default path of the data post-processing file export and the file downloaded by the share code is as follows:

1. File export path: **[1A CHCNAV Export Folder]** in the root directory;
2. Sharing code download path: **[1A CHCNAV sharing code folder]** in the root directory.

1.4 ACCOUNT LOGIN

At present, the software can be used for CHCNAV cloud account registration and login, and under the premise that the network is available, you can directly use the mobile phone number verification code to register and log in. Click the **[Settings]** button on the upper right of the main interface to enter the login interface.

Tips:

You will need to log in again after 30 days of login.

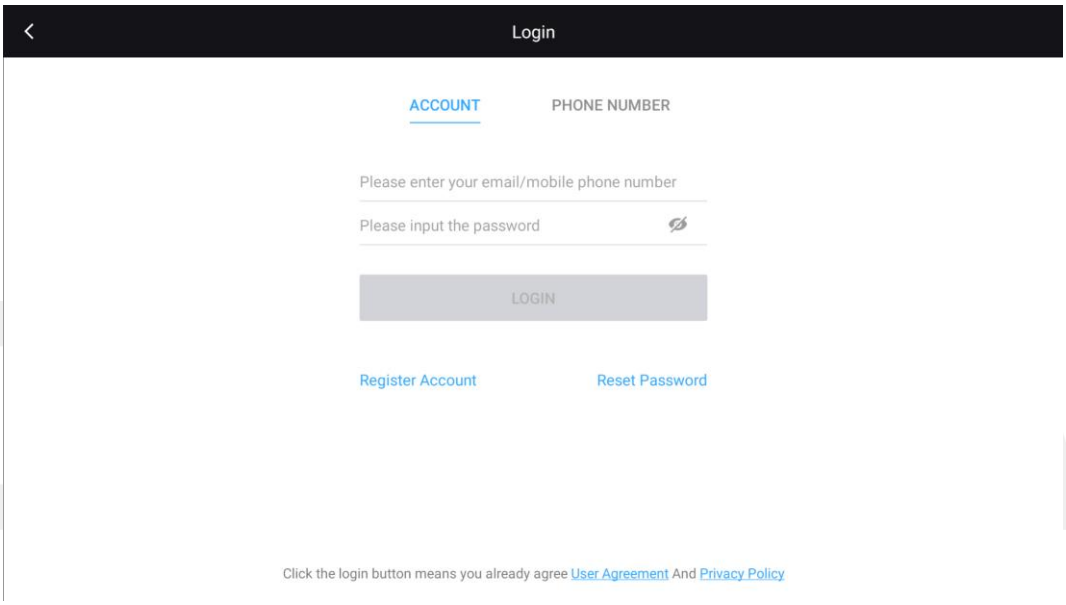

Figure 1.4: CHCNAV account mobile phone verification code login

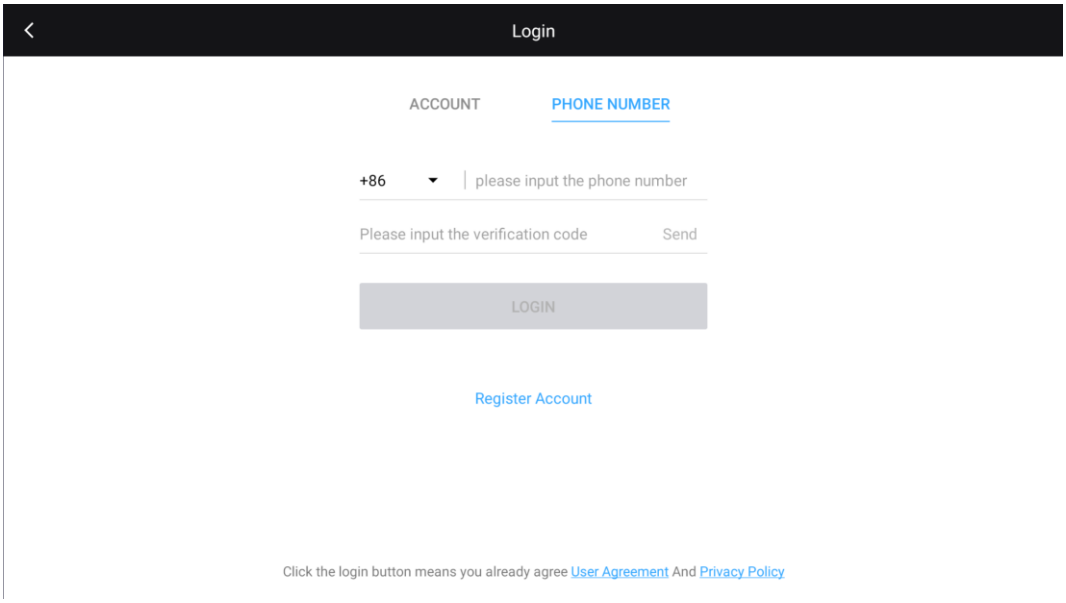

Figure 1.5: CHCNAV account account password login

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2. DEVICE CONNECTION

This chapter introduces the *EasySail* software for the connection of APACHE series USVs, single-beam sounders, RiverStar series ADCP and other equipment

CHCNAV
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2.1 4G MODE TO CONNECT USV

1. The remote control is connected to a 4G network, such as a mobile phone hotspot or inserted a SIM card, to ensure that the Internet can be accessed normally;
2. Select the corresponding server, enter the SN number (that is, the serial number on the GD100), password (**Admin1234**) and other information, and click Connect.
3. To view the camera image, you need to check the video access to CHC cloud and enter the camera serial number (that is, the serial number on the Hikvision label in the cabin)

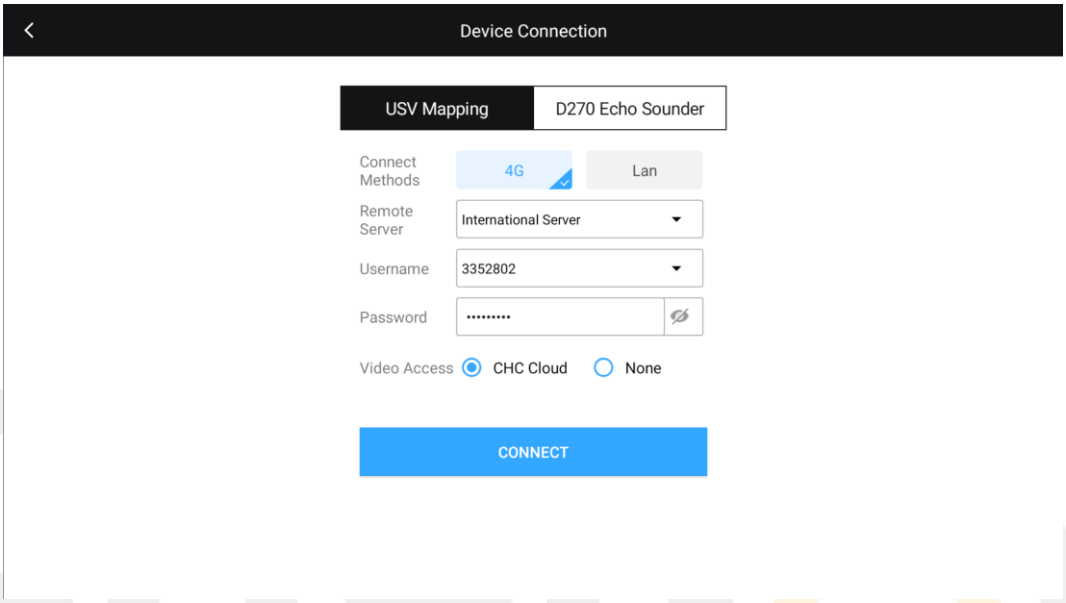

Figure 2.1: Unmanned ship 4G mode connection page

After entering the basic information, click to connect, if the connection fails, the software will pop up a dialog box "**Connection failed, please check the 4G antenna, ESIM card dial-up and data plan, etc.**", you can follow the dialog box prompt text, check in turn.

Tips:

http://service.huace.cn/rechange?sn=

Enter the SN number of GD100 after [=], and you can query the remaining traffic of the current ESIM card, the expiration of the package, and support direct online recharge through this link.

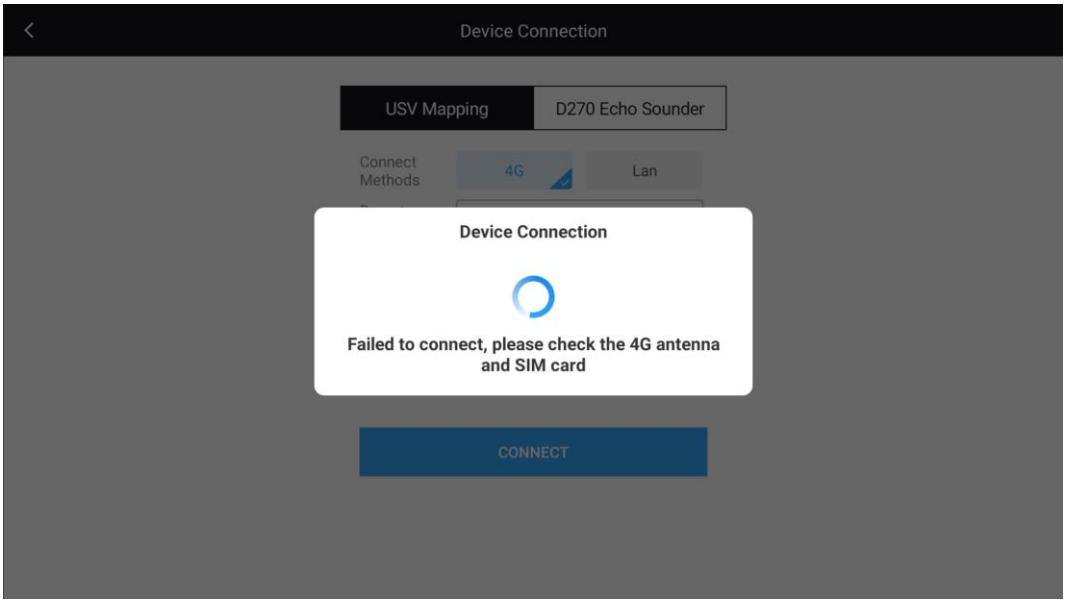

Figure 2.2: The USV 4G mode connection failure pop-up window

2.2 LAN MODE TO CONNECT USV

1. If the current device is an EC10 remote controller for Android, select the EC10 remote control type, otherwise select M12 (need to connect to the WiFi of the USV, WiFi name: APACHE 2.4G-XXXXXXX);
2. The remote control turns on the Ethernet switch, and the network segment must be 144;
3. Unmanned ships must be equipped with 2 RC antennas;
4. The 2 antennas on the remote control are recommended to be placed vertically upwards to help the signal reception;
5. In the straight direction of the USV and the remote control, there can be no obstruction;
6. If you want to view the camera image, select Video Access, and the image is transmitted to the EC10 remote control through the 144 network segment, which has a lower latency and is smoother.

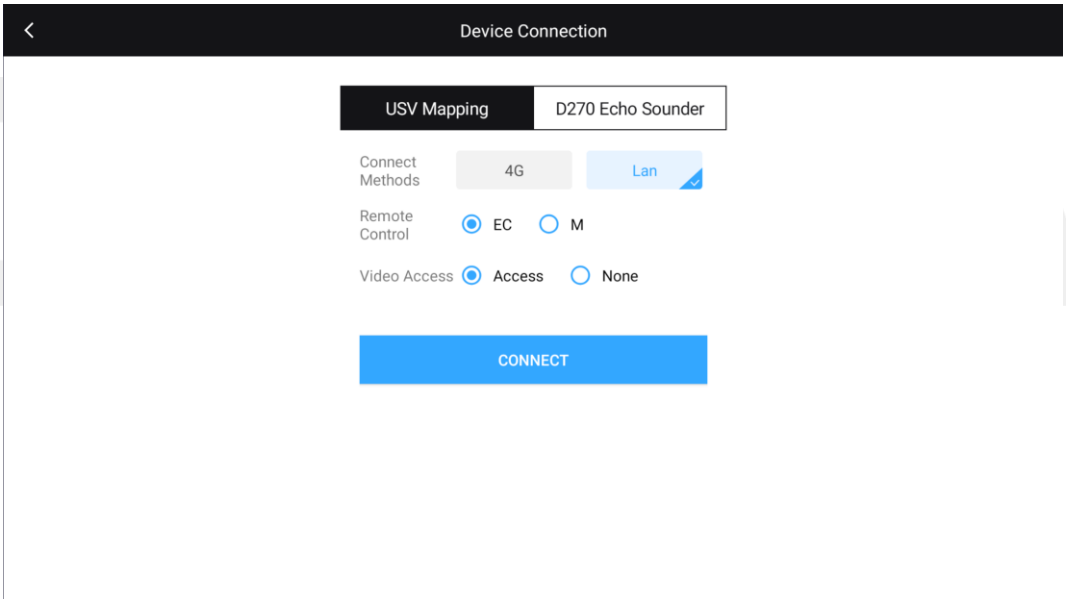

Figure 2.3: USV LAN mode connection page

2.3 D270 SINGLE BEAM SOUNDER CONNECTION

1. Android devices are connected to D270 WiFi
2. Just click the Connect button

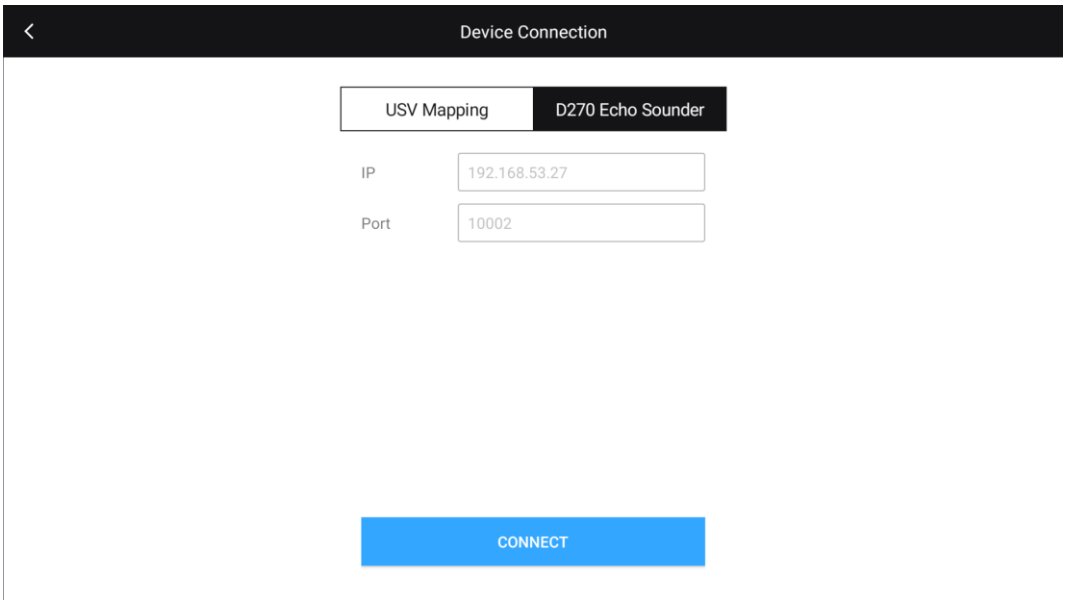

Figure 2.4: D270 Single Beam Sounder connection page

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3. TOPOGRAPHIC SURVEY MODULE

This section describes the specific features in the topographic survey module of the *EasySail* software

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03.

3.1 TOPOGRAPHIC SURVEY QUICK JOB GUIDE

The topographic survey quick operation steps are as follows:

1. The USV is turned on, the remote control is turned on, and after waiting for 1-2 minutes, operate the remote control handle to check whether the motor is rotating;
2. Open the *EasySail* software, connect the USV, after the connection is successful, the USV is launched, and the USV is manually controlled at full speed for 5 seconds to complete the initialization of the USV;
3. Then click **[Topographic Survey]** to enter the project list interface;
4. Create a new project or open an old project to enter the main interface of the satellite map;
5. View self-test information, connection status, etc.;
6. Plan the route and upload it;
7. Start Operation: Switch to automatic sailing mode and click **[Start Recording Button]** to officially start the measurement operation.

3.2 PROJECT MANAGEMENT

The project management interface can display all the saved projects, click **[Project Route]** to enter the project management interface, the interface displays the list of all tasks that have been created, each route task label contains the name, route type, creation time, update time and operation location, click the label to open the route task, open the project to enter the map interface, and enter the management mode through the **[Manage]** button to multi-select, delete, copy, or share the project file. When you need to search for a specific task, you can enter the **name of the search task in the [Search Box]** to support fuzzy queries.

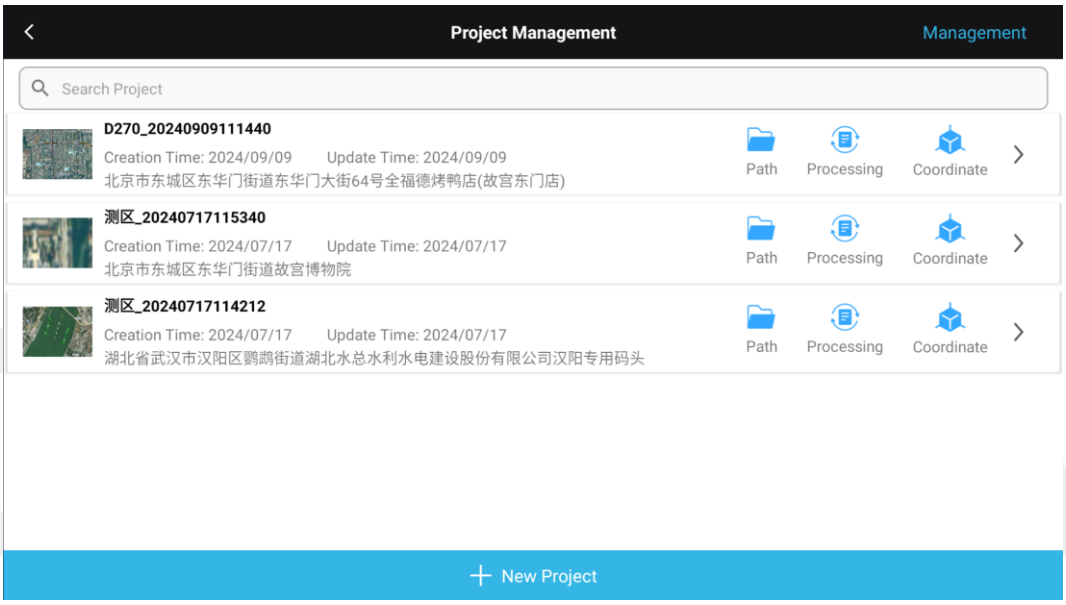


Figure 3.1: Topographic Survey Project Management List

3.3 CREATE A NEW PROJECT

The steps of a new topographic survey project are as follows:

Click New Project, set the coordinate system, you can select the commonly used coordinate system, and the common coordinate system interface can select the saved common coordinate file, or you can delete the file;

1. **Scan the QR code**

   Scan the generated QR code to read the coordinate system parameters of other devices;

2. **Customize**

   Enter the coordinate system parameter interface; Set the coordinate system parameters according to the requirements;

3. **Predefine**

   Enter the predefined coordinate system interface, and you can select the required coordinate system according to the continent and region;

4. **Import from a file**

   Import *.crd or .dc* file to import the coordinate system.

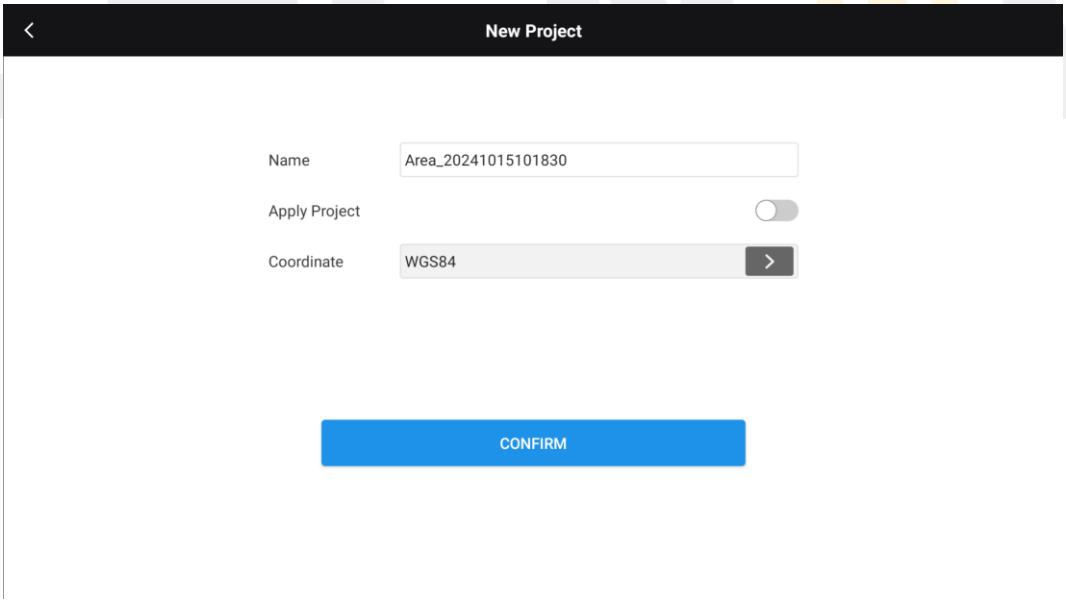


Figure 3.2: The start page of a new project

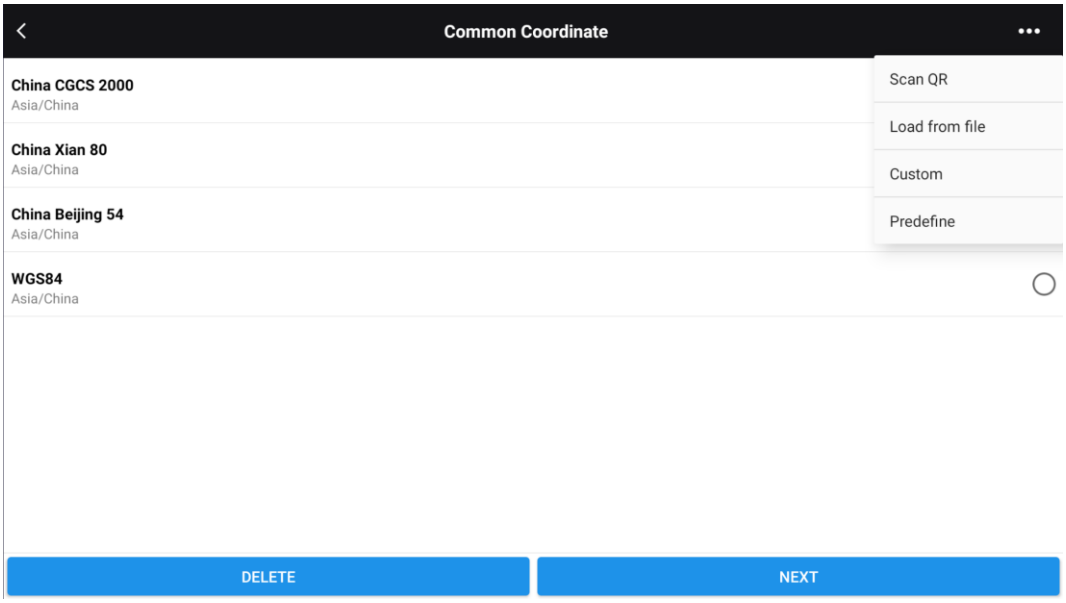


Figure 3.3: Select a coordinate system for a new project

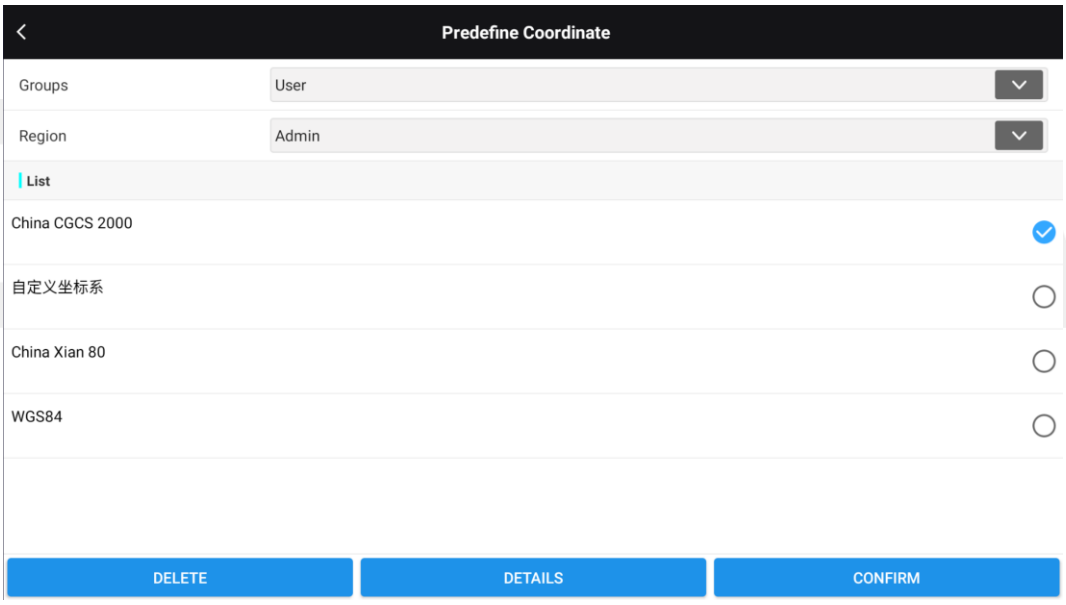


Figure 3.4: Predefined coordinate systems

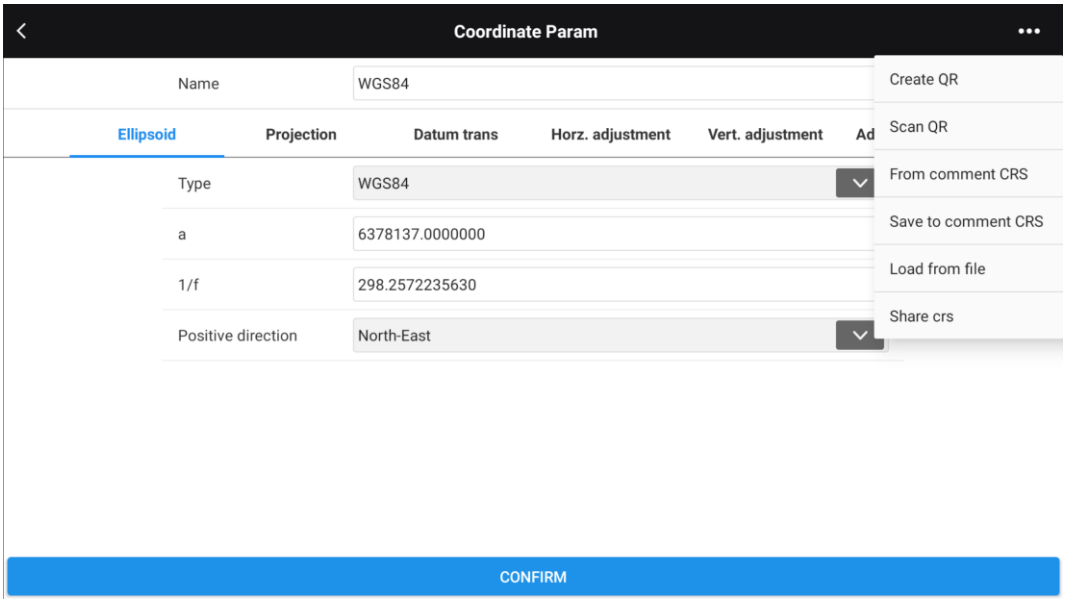


Figure 3.5: More operations on coordinate system parameters

The coordinate system parameter interface can be customized for the coordinate system, and the setting items are: ellipsoid, projection, datum conversion, plane correction, elevation fitting, and correction parameter setting, which can customize the coordinate system according to user needs;

1) **Create QR**

   Generate a QR code for the currently set coordinate system;

2) **Scan QR**

   Scan the generated QR code to read the coordinate system parameters;

3) **From comment CRS**

   Enter the common coordinate system module, and you can directly select the commonly used coordinate system;

4) **Save to comment CRS**

   Save the current coordinate system parameters to a common coordinate system;

5) **Load from file**

   Import coordinate files from local directories to read directly; Support file search;

6) **Share CRS**

   You need to log in to your CHCNAV cloud account before you can share the coordinate system; Generate a 4-digit sharing code, which can be read by using the CHCNAV sharing code tool on the PC side to read the shared coordinate system parameter file, and the sharing code is valid for 30 minutes;

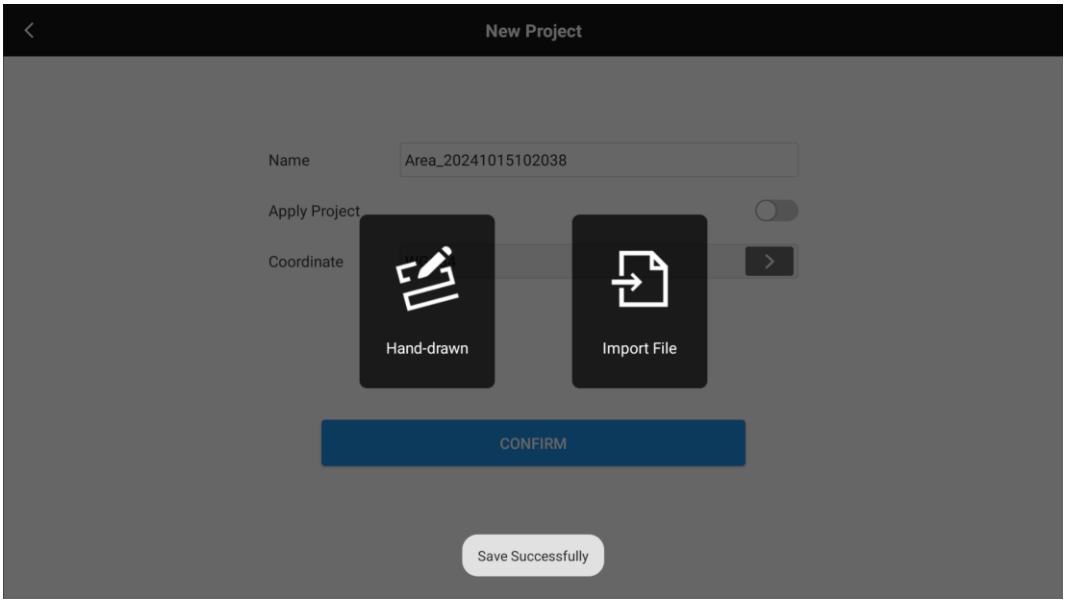


Figure 3.6: Generate route mode

1. **Create a new project**

   The new project supports two scenarios for route planning, i.e., hand-drawn routes and imported files.

2. **Import the file**

   Currently, the software import file supports waypoint files (*.waypoints*), polygon files (*.poly*, *.kml*, *.kmz*, *.dwg*, *.dxf).*) to create a route mission or polygon shape.

Notes:

The import file does not support too many waypoints (up to 500 points), the area is too large, and any 2 points are larger than 10km, which cannot be generated.

3.3.1 INTRODUCTION TO TOPOGRAPHIC SURVEY ENGINEERING PARAMETERS

1) Source ellipsoid

Default WGS84. The ellipsoid here is the target ellipsoid, and you can select the appropriate ellipsoid name from the drop-down list according to your project requirements.

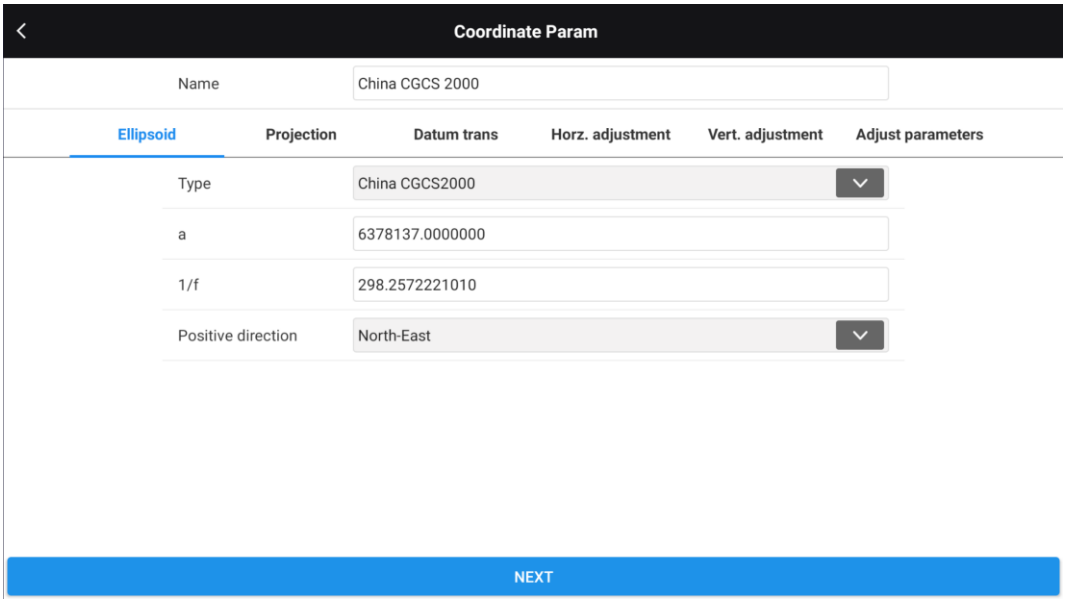


Figure 3.7: Coordinate System Parameter - Ellipsoid

2) Projection

Select the projection method from the drop-down list as needed, and change the central meridian, dimension origin, average latitude, length ratio, east plus constant, north plus constant, and projection surface height.

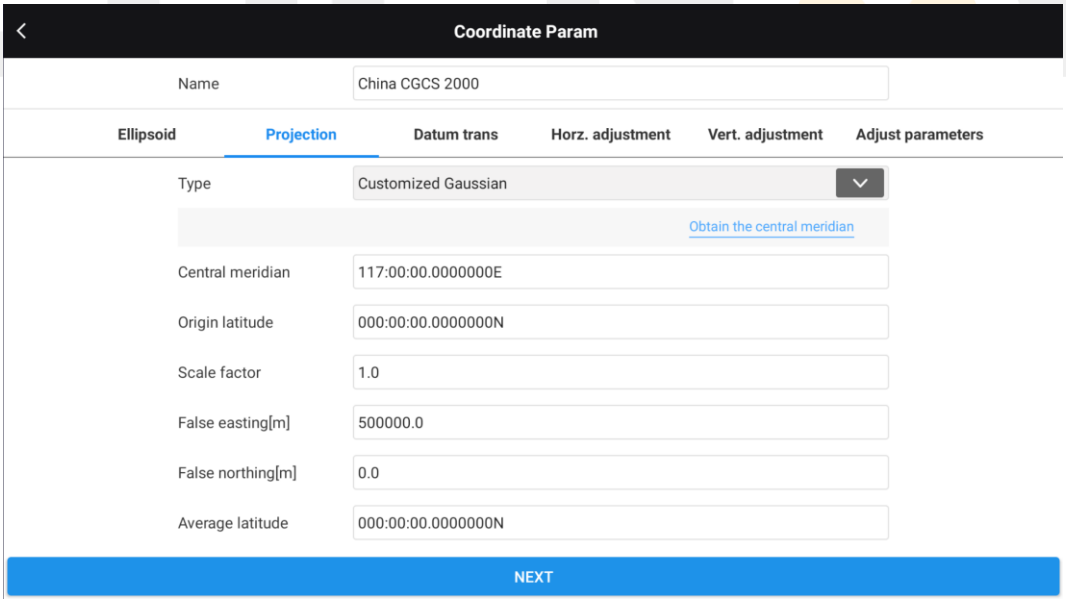


Figure 3.8: Coordinate System Parameters - Projection

Tips:

After EasySail is updated to version 1.4.0, the **function of [Get Central Meridian] is added to the**

position of the input central meridian, which can obtain the local central meridian of the device in the case of star search.

3) Datum trans

In the conversion model, you can select Bursa seven-parameter/three-parameter/strict seven-parameter/grid, and you can also set the coordinate transition mode to XYZ constant/BLH constant

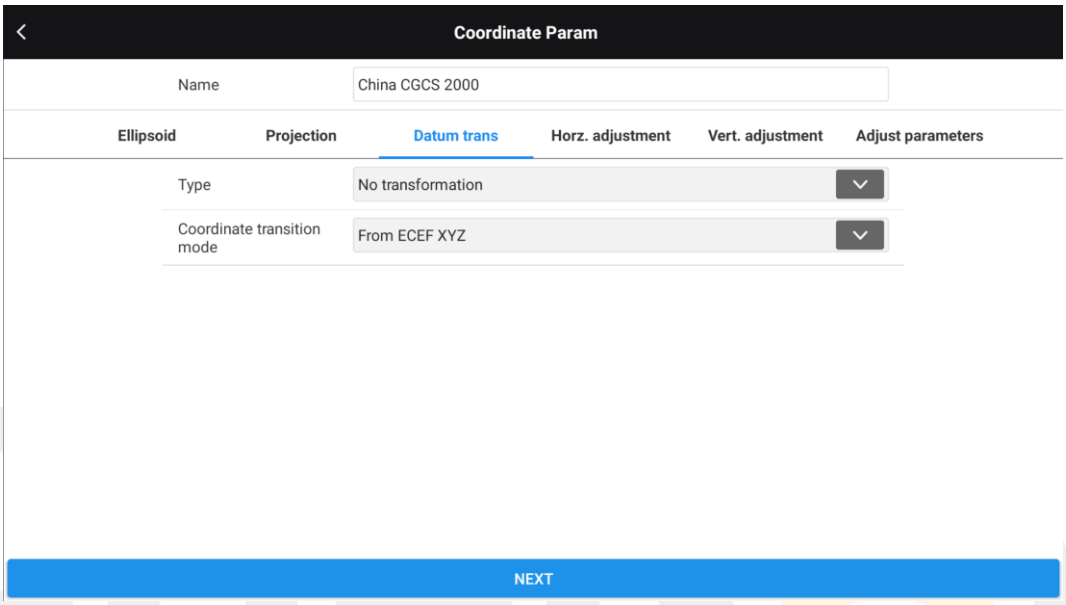


Figure 3.9: Coordinate System Parameter-Datum Conversion

4) Horizon adjustment

The conversion model of the horizontal adjustment can be selected from the ordinary four-parameter and TGO horizontal adjustment. It also supports selecting or externally importing horizontal grids north/east

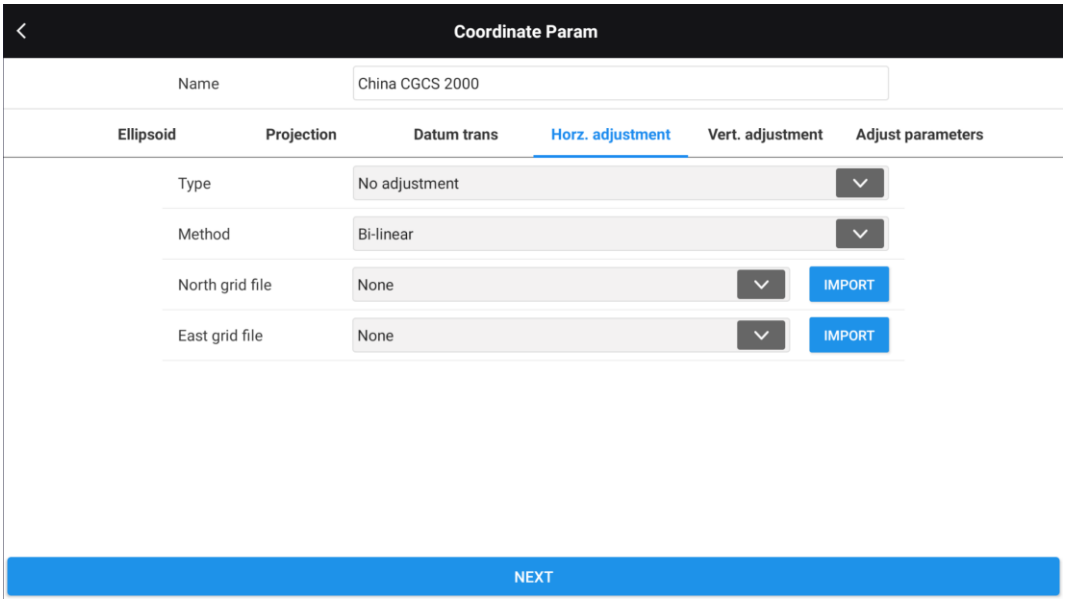


Figure 3.10: Coordinate System Parameters – Horizon adjustment

5) Vertical adjustment

The fitting model can choose from fixed deviation, plane fitting, surface fitting, and TGO vertical adjustment. The geoid model can be selected as none EGM96.ggf、ARM_GEOID_GEO.ggf、sa2010.grd. The interpolation methods can be bilinear interpolation, spline interpolation, or quadratic interpolation.

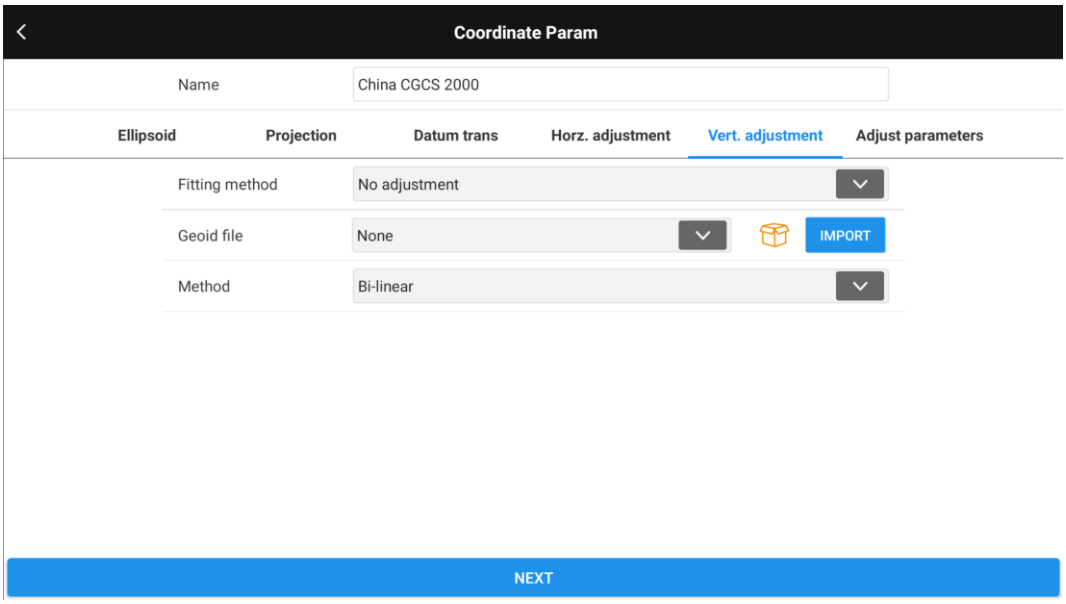


Figure 3.11: Coordinate System Parameter-Vertical adjustment

6) Adjust parameters

You can set offsets such as north/east/elevation.

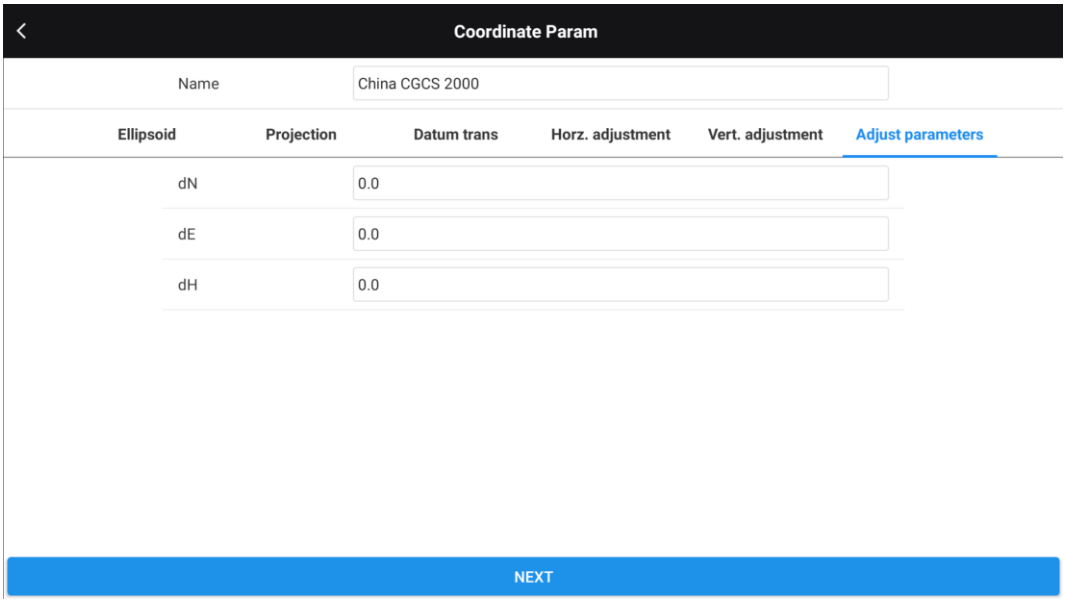


Figure 3.12: Coordinate System Parameters – Adjust parameters

3.4 DEVICE SELF-TEST

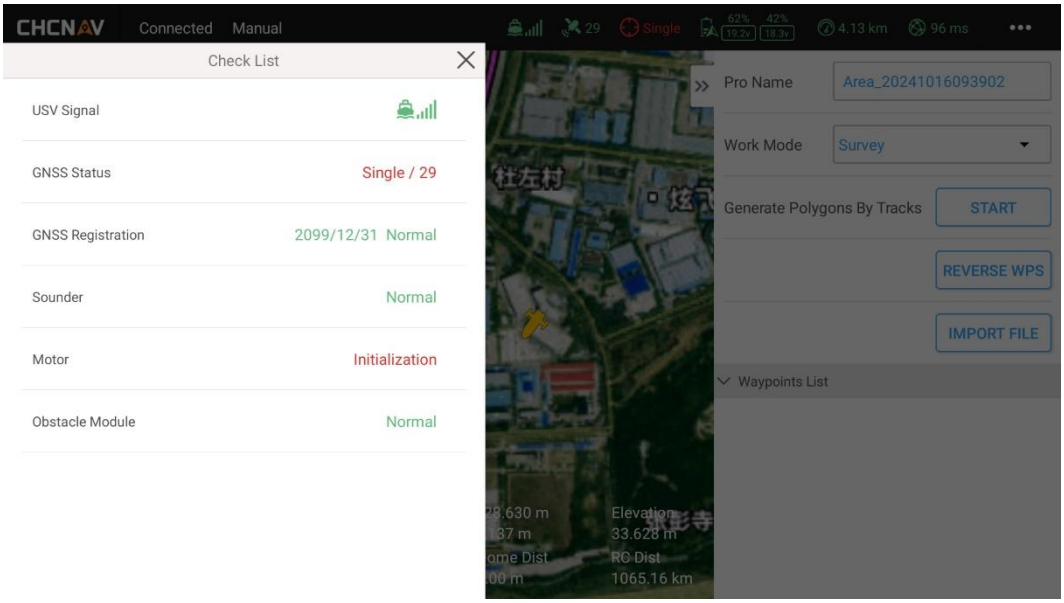


Figure 3.13: Topographic Survey Equipment Self-Test Page

1) **Ship control 4G network signal**

   Real-time display of USV ship control network quality, ⩾ 95%, full grid (5 grids) display; ⩾ 95%, full grid (5 grids) display; ⩾85%, 4 grids; ⩾70%, 3 grids; ⩾60%, 2 grids; ⩾ 50%, 1 grid display; Other, 0 grids are displayed.

2) **GNSS solution mode**

   Locate the solution state, including single point (red), floating (floating) and fixed (green) modes.

3) **GNSS registration**

   If the expiration time is greater than 48 hours, [Expiration Date + Normal] is displayed, which is indicated in green. If the expiration time is less than or equal to 48 hours, [Expiration in 2 days + expiration date] is displayed, which is indicated in yellow. If the expiration time is less than or equal to 24, [Expiration in 1 day + expiration date] is displayed, which is indicated in yellow. If it expires, it displays Expired, indicated in red.

4) **Sounder**

   The connection is successful, and it is shown in green.

5) **Motor**

   The connection is successful, and it is displayed in green; The first connection will show an abnormality, push the longitudinal rod to check the wind direction and power of the motor, and

it will turn green.

6) **Obstacle avoidance module**

The connection is successful, and it is shown in green.

3.5 TOPOGRAPHIC SURVEY, ROUTE PLANNING

3.5.1 HAND DRAWN ROUTES

At present, the operation steps of the new route are as follows: click the map once to generate a task point, click the map multiple times to generate the task point one after another, and confirm the navigation position and direction according to the order of clicking to generate; You can increase the quest points by dragging the **[+]** point on the route. You can also switch the task point properties [mission point (green), sampling point (purple), home point (red), hover point-unlimited (yellow), hover point-time (yellow), hover time can be set according to your needs] in the drop-down box of the route list point properties.

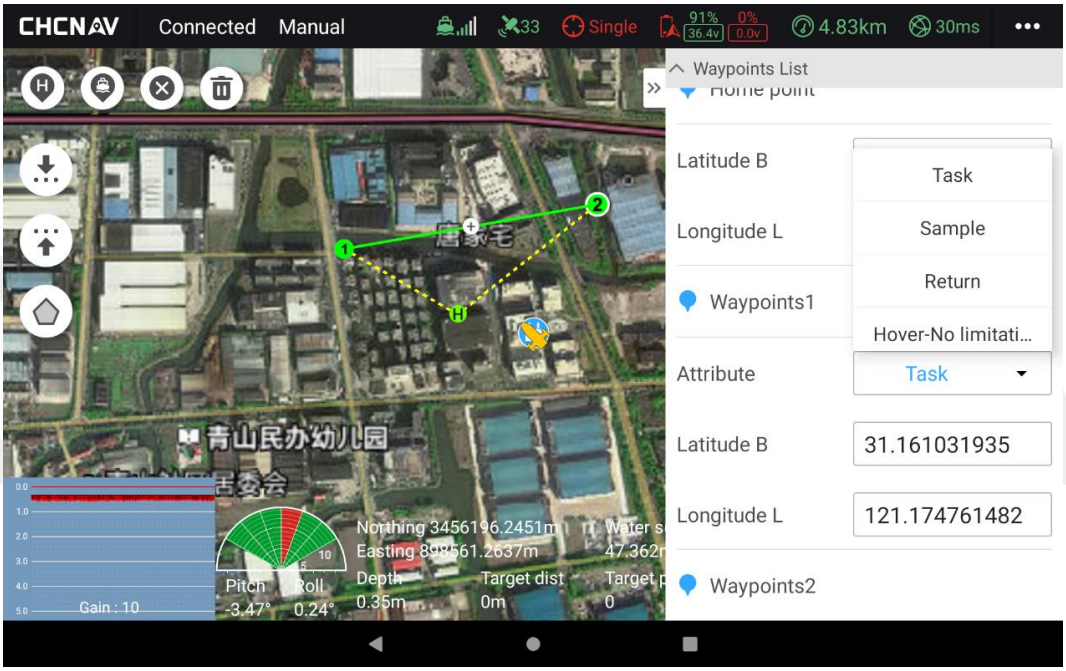


Figure 3.14: Point properties

Notes:

Click the **[《]** button on the right side of the software page to expand the waypoint list for editing.

3.5.2 POLYGON ROUTE DRAWING

The current logic of generating a route after creating a polygon is to click on the map once to generate a polygon boundary point, click three times in a row to generate a triangle, and click the map again to continue to add polygon boundary points. When the edit polygon button on the left is selected, you

can move it by dragging and dropping, or you can delete the selected point (click to select the polygon point to delete the point, and click the single-point delete button);

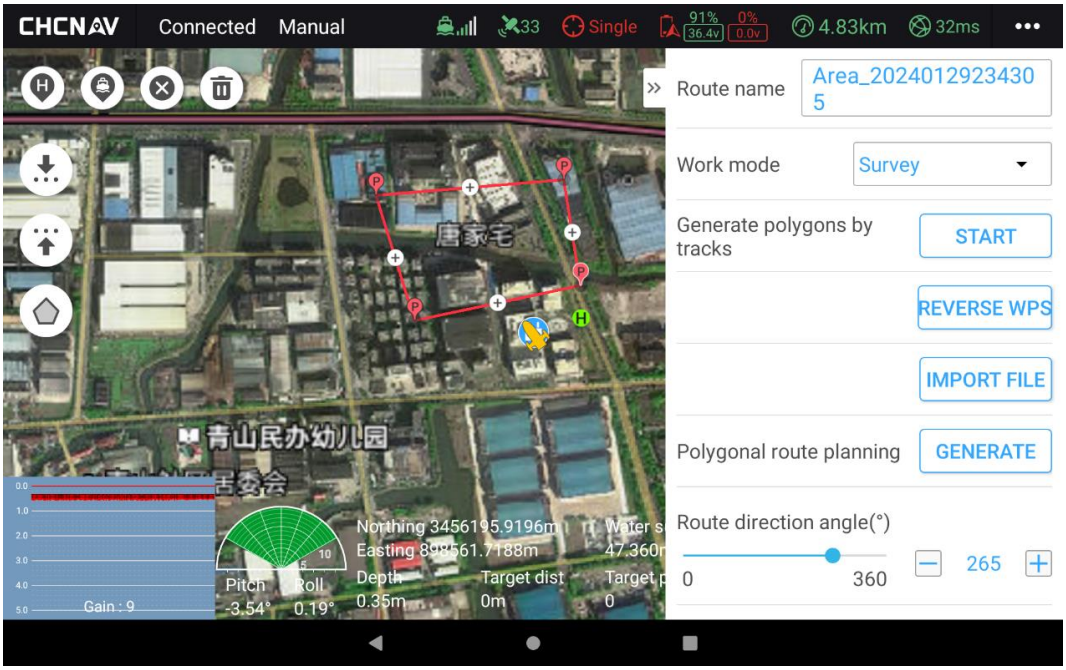


Figure 3.15: Polygon programming

After confirming the polygon range, you can click the generate button on the right side to generate the default route. You can also modify the route by setting the route direction angle, route spacing, start point, and polygon expansion.

3.5.3 TRACKS GENERATE POLYGONS

In the route editing mode, click the [Start] button on the right side of the trajectory generation polygon, and then manually control the USV to run a lap along the boundary of the survey area to automatically generate a closed polygon area.

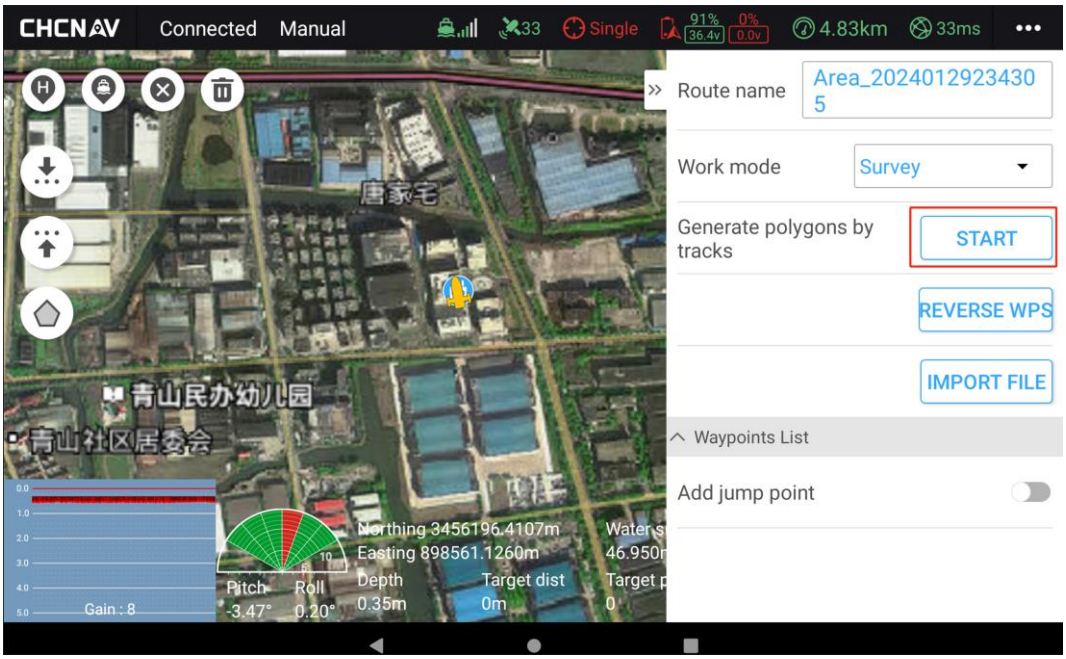


Figure 3.16: Trajectory Generation Polygon - Start

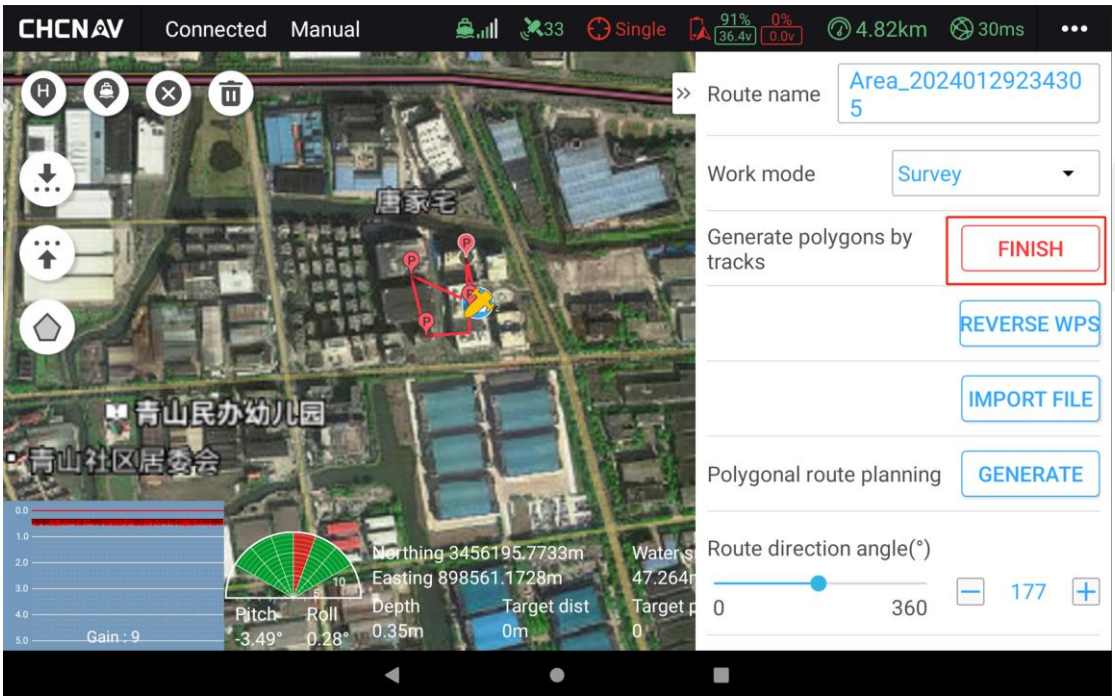


Figure 3.17: Trajectory Generation Polygon-End

Click the **[End]** button, and then click the **[Generate]** button by setting the route direction angle and route spacing to generate a preset route within the polygon area.

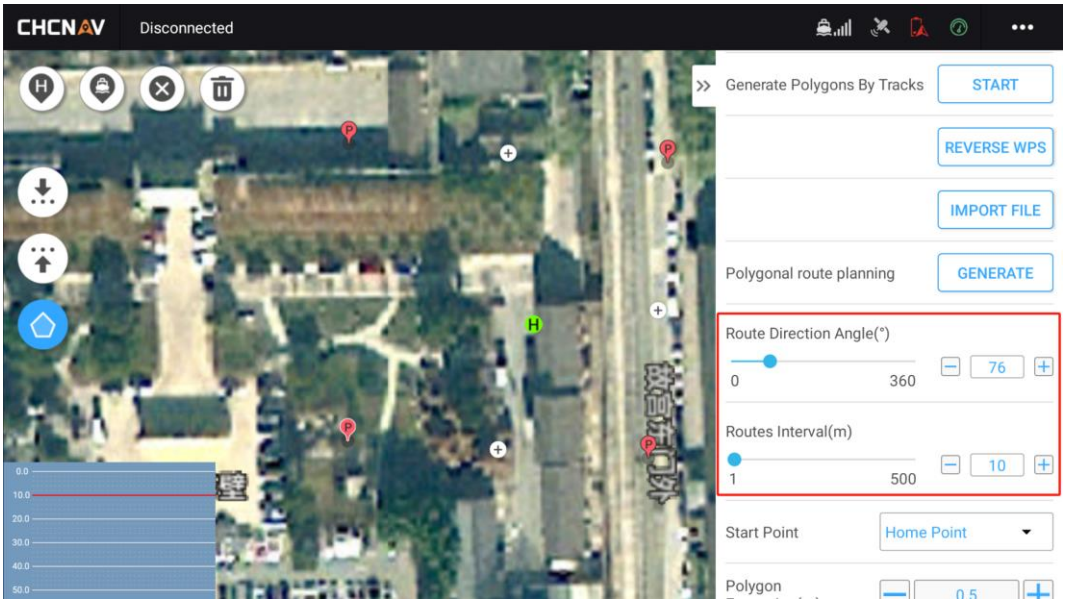


Figure 3.18: Adjusting the Direction Angle/Distance Between Routes

3.5.4 IMPORT THE FILE

When creating a new project for the first time, select Import File, which supports waypoint files (*.waypoints*) and polygon files (*.poly*, *.kml*, *.kmz*, *.dwg*, and *.dxf).*) and so on to create route tasks or polygon graphics;

Notes:

The import file does not support too many waypoints, and the maximum number of waypoints is 500.

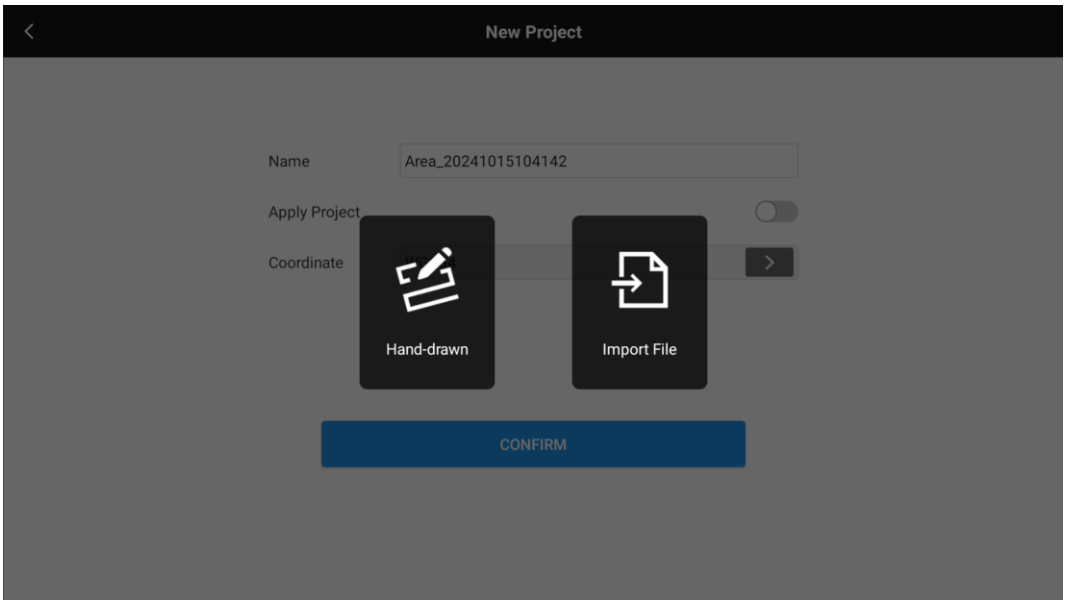


Figure 3.19: Freehand Route/Import File

In addition, in edit mode, in the waypoint list on the right, click the **[Import File]** button to import the file.

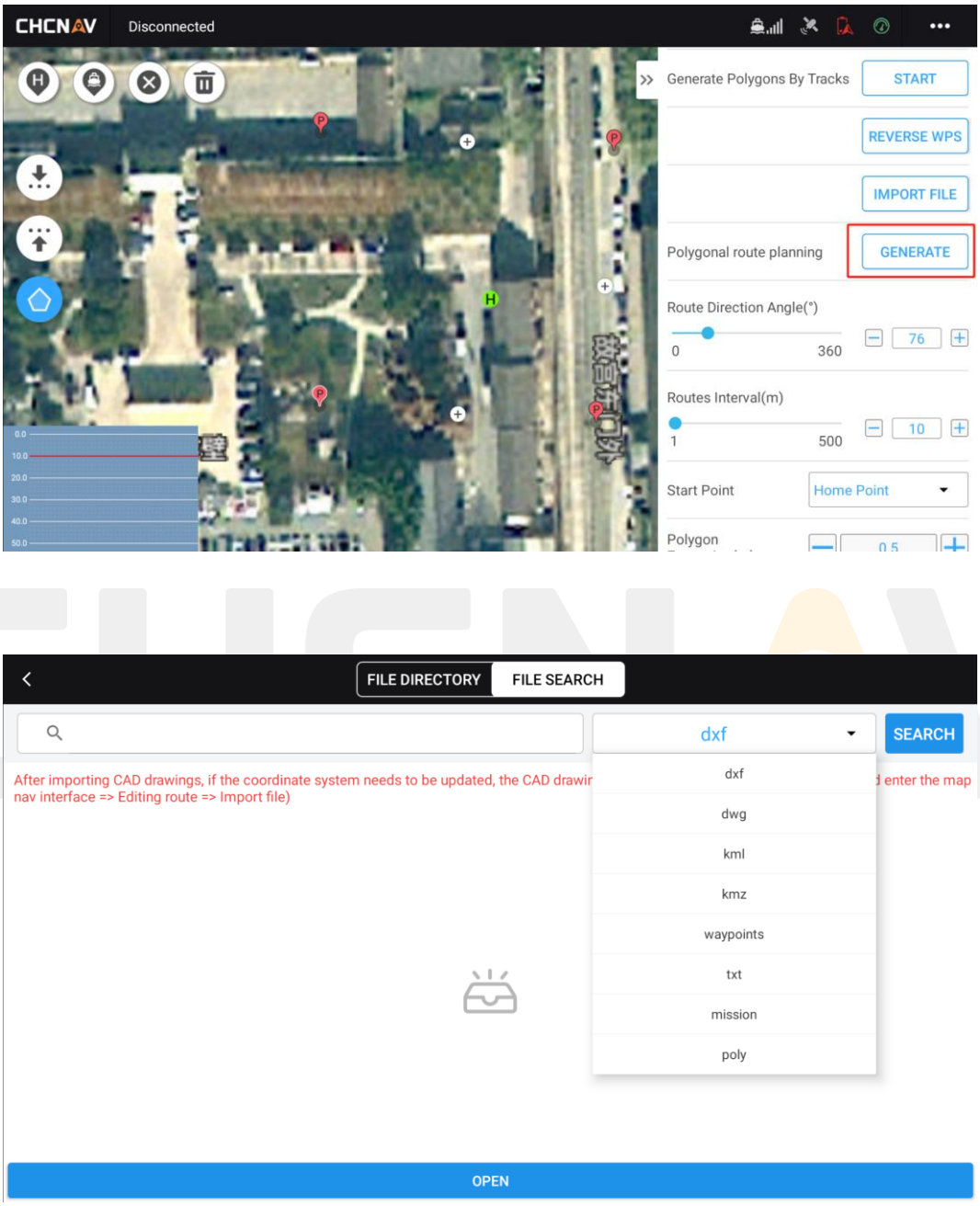


Figure 3.20: Importing files in edit mode

3.6 ROUTE EDITING

Figure 3.21: Topographic Route Edit Page Function Buttons

1) **Mark the Home point**

   After entering the editing mode, click the button to switch to the selected state, and click the map again to generate the Home point.

2) **Mark the point at the current position of the ship**

   If the USV is connected and the software is in edit mode, click the button to generate a task point at the current USV location.

3) **Delete a point**

   After selecting a waypoint on the map or selecting a polygon boundary point in polygon drawing mode, the selected point is surrounded by a circle of white, and click the button to delete the point.

4) **Clear all points**

   Click this button and a pop-up window will appear, select the type of point (task point/polygon point) that needs to be cleared.

5) **Save the route**

   Click this button to save the route. After the route is saved, the measurement operation can be started normally.

6) **Upload routes**

   Click this button to upload the drawn mission route to GD100.

7) **Download routes**

Click this button to re-download the mission route in GD100 to the EasySail software.

8) **Draw polygons**

Click this button to draw polygon range lines in the software.

9) **Add hop points**

The hop point setting is located in the route list, and you can set its on/off state, and modify the starting point number and the number of cycles.

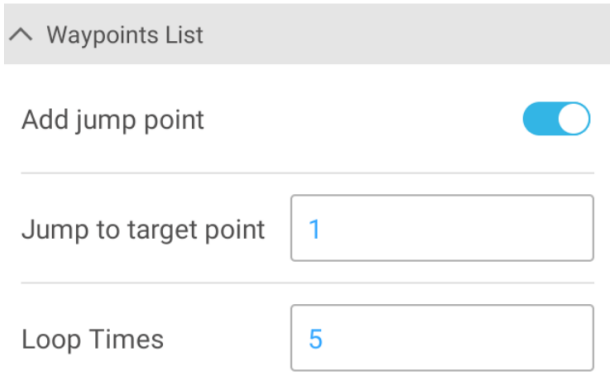


Figure 3.22: Hop point information

3.7 TOPOGRAPHIC SURVEY MAIN INTERFACE

Press and hold the icon to display the function information of the current icon.

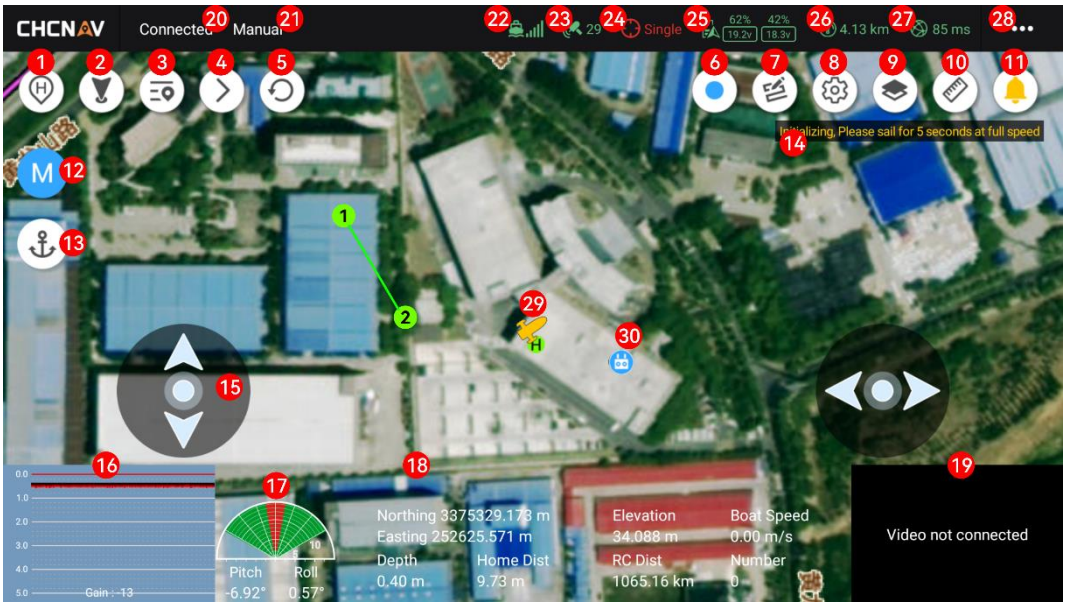


Figure 3.23: Topographic Survey Start Survey Page Function Button

1) **Sail to the Home point**

After clicking, the USV switches to the return state, and automatically sails to the set home point;

2) **Sail here**

After clicking the button, switch to the selected state, click the map, and the G point will be generated, and the USV will switch to the guidance mode and drive towards the G point, and click the map again to change the location of the target point. Click **the [Sail Here]** button again and switch to unselected to turn off the navigation guidance setting, but the USV will complete the last guidance task.

3) **Set the target point**

Clicking this button will display the current task point list in a drop-down manner, select the corresponding mission point number, and the USV will sail to the number position (note: you need to switch to automatic mode).

4) **Next target point**

Click this button to sail the USV to the next target point.

5) **Re-task**

By clicking this button, the USV returns to point 1 and starts the mission again, sailing from point 1 to the last mission point.

6) **Start/end recording**

Click this button to start/end the recording data, and the record number information below will display the number of the recording point in real time.

7) **Edit the route**

When creating a new project, you will enter the map interface, and at this time, it will be in the edit route mode, and the user can operate the route (draw waypoints, delete waypoints, upload, download, etc.).

8) **Map settings**

Click the Change button to set map tracking and map rotation

9) **Layer**

Click this button to display the layer options, including route routes and record points, which can be manually checked and unchecked. If you cancel, you can hide the corresponding layer information on the map.

10) **Ruler**

Click the button to select it. At this time, you can click any 2 points on the map to see the record and direction angle between the 2 points in real time. Click the button again to cancel the display.

11) **Bell**

The real-time message will automatically pop up and be displayed. There are 2 types of real-time messages: one is long-standing, such as [system initialization, full speed navigation 5s], this message must be processed to automatically disappear within 5s, if you ignore it all the time, the message will always exist. The other is a temporary prompt, which will automatically disappear within 5s after popping up, such as [Shoal alarm, please drive away from the area]. Disappearing messages will appear in the bell message list. The list of messages can pop up by clicking the bell button, and if you want to close the list, you can click the bell button again.

12) **Automatic/manual switching**

Toggle between automatic and manual sailing modes.

13) **Hover/unhover toggle**

Toggle hover and unhover mode.

14) **Real-time messaging**

Real-time messages pop up automatically. See No. 11.

15) **Hoverrocker**

Control the throttle and direction of the USV. In the general settings bar, you can set the display and shade. This stick can only be displayed after the route has been saved.

16) **Sounder waveform view**

Real-time display of the sounder waveform.

17) **Millimeter-wave radar view**

Real-time display of the angle and distance of obstacles ahead. Below is the sailing attitude of the USV: pitch and roll.

18) **Common sensor information bar**

Longitude and latitude, earth height, speed, water depth, target point distance, target point, record number.

19) **Camera**

Real-time preview of camera image transmission.

20) **Connection status**

Real-time display of the connection status of the current device.

21) **Sail mode**

Real-time display of the current USV's navigation mode information.

22) **Unmanned ship 4G signal**

Real-time display of the 4G network signal quality of the current USV.

23) **Search for stars**

Real-time display of GPS star search number.

24) **GPS solution status**

Single-point, inertial navigation, floating, fixed.

25) **Battery level**

Remaining power and battery voltage.

26) **Cruising range**

The remaining battery power and the number of miles it can support.

27) **Delay**

The quality of the network traffic that the current device is connected to. Unit-millisecond. If the network is within 300 ms, the network is good. 300-600ms, indicating network fluctuations, communication quality is average. If the network quality is higher than 600 ms, the network quality is poor.

28) Device setup module

Click this button to pop up the device settings interface, including record control, sounder settings, boat control settings, system settings, CORS login, GNSS registration, and general settings.

3.8 PARAMETER SETTINGS

3.8.1 RECORD CONTROL

Set the recording control parameters, and record the data in real time, which is recorded according to the current settings.

For example, if you record 1m according to the distance, you will record. The data in the *.dep* file is recorded at 1m intervals.

Solution Status:

1. Select Fixed - only record the fixed solution and inertial navigation solution data;
2. Select Float - only record fixed, floating and inertial navigation solution data;
3. Select Single Point - Record all data (fixed, floating, differential, inertial navigation, single point)

RMS Limitations:

HRMS stands for *Horizontal Root Mean Square and* is a measure of positional accuracy in the horizontal direction. It represents the average deviation between the measurement and the true position under ideal conditions;

VRMS stands for *Vertical Root Mean Square and* is used to measure the accuracy of position in the vertical direction. It represents the average deviation between the measurement and the true height under ideal conditions.

Tips:

In the actual topographic survey, it is recommended that the solution status be set to a single point solution in the process of data collection, and the RMS is not limited, and the accuracy is limited according to the requirements during the data post-processing.

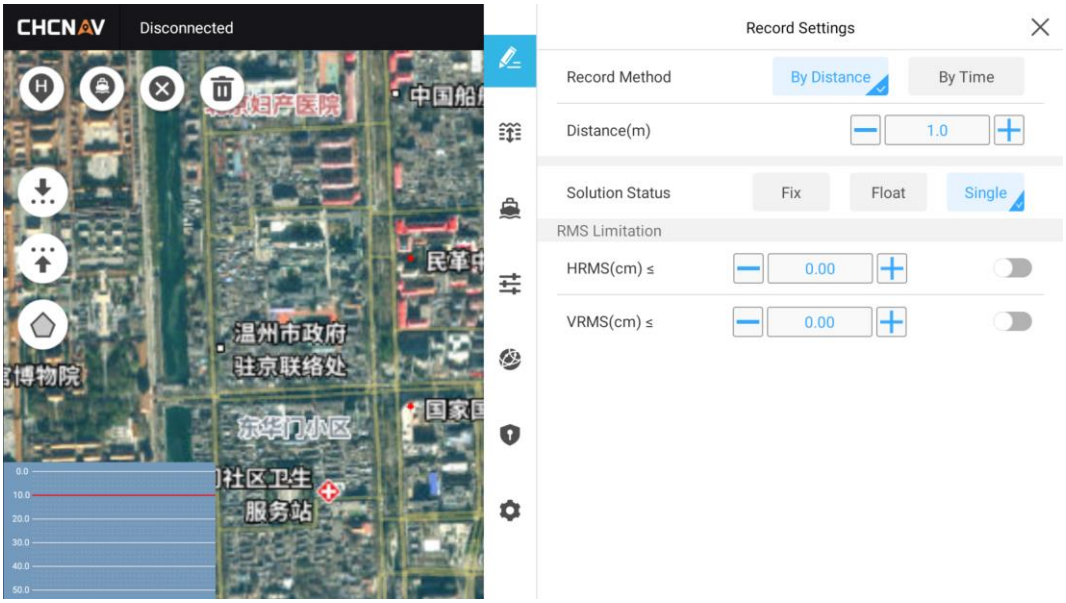


Figure 3.24: Parameter Setup - Record Control

3.8.2 SOUNDER SETTINGS

Set the sounder parameters, and manually set the range, gain, sound velocity, and depth filtering. The setting takes effect in real time, and after setting, you can view the corresponding waveform changes in the lower left corner of the map.

1. **Draft**

   If it is connected to an USV, the draft is bound to the ship type and cannot be manually modified. If the D270 is connected, the draft can be manually modified.

2. **Velocity**

   It can be manually entered, and the temperature and salinity are supported to calculate the sound velocity value at the same time (only the D270 single beam sounder or the APACHE series USV equipped with the D270 single beam sounder is supported).

3. **Salinity**

   Manual entry is possible. Units - thousandths

4. **Temperature**

   It can be entered manually or in real time with the D270 sounder temperature sensor data.

5. **Range**

   It supports manual and automatic, and the current water depth range can be set.

6. **Gain**

   Manual and automatic, the sonic intensity of the current sounder transducer can be set.

7. **Water depth filtration**

Clutter and noise point data outside of the filtering range.

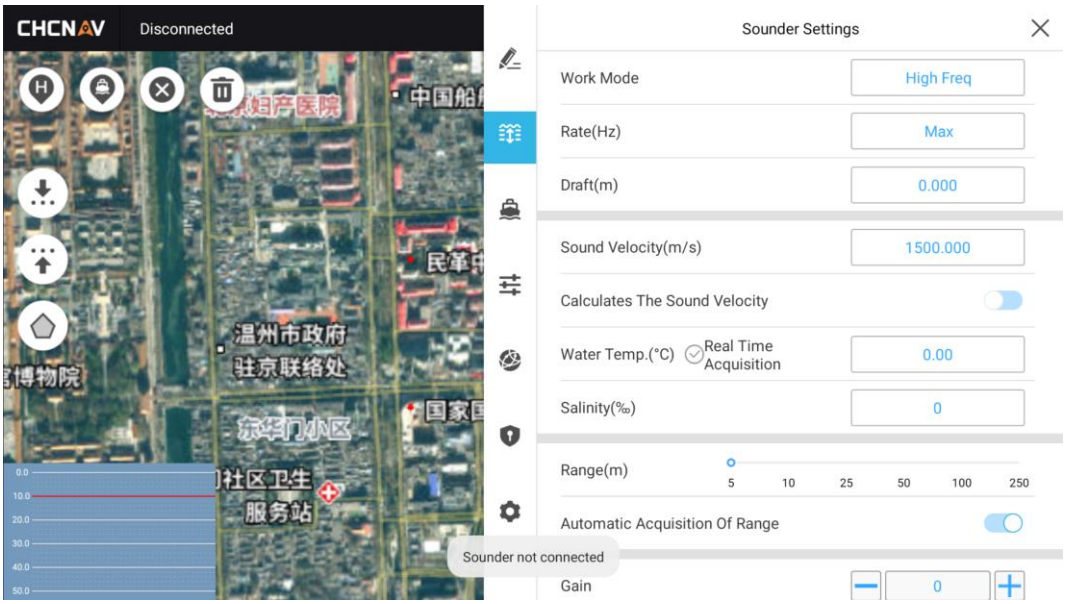


Figure 3.25: Parameter Settings - Sounder Settings

3.8.3 GENERIC - SHIP CONTROL SETUP

1. **Write parameters**

The drop-down list displays the name of the ship type parameter file (*.param*), select the corresponding ship type name, and click **[Write].**

2. **Save the parameters**

Click the Save button to save the current ship control parameters in a custom file (*.param*).

3. **Ship control parameter settings**

Click **[+]** or **[-]** to set the ship control parameters in real time, and support manual input. Takes effect immediately.

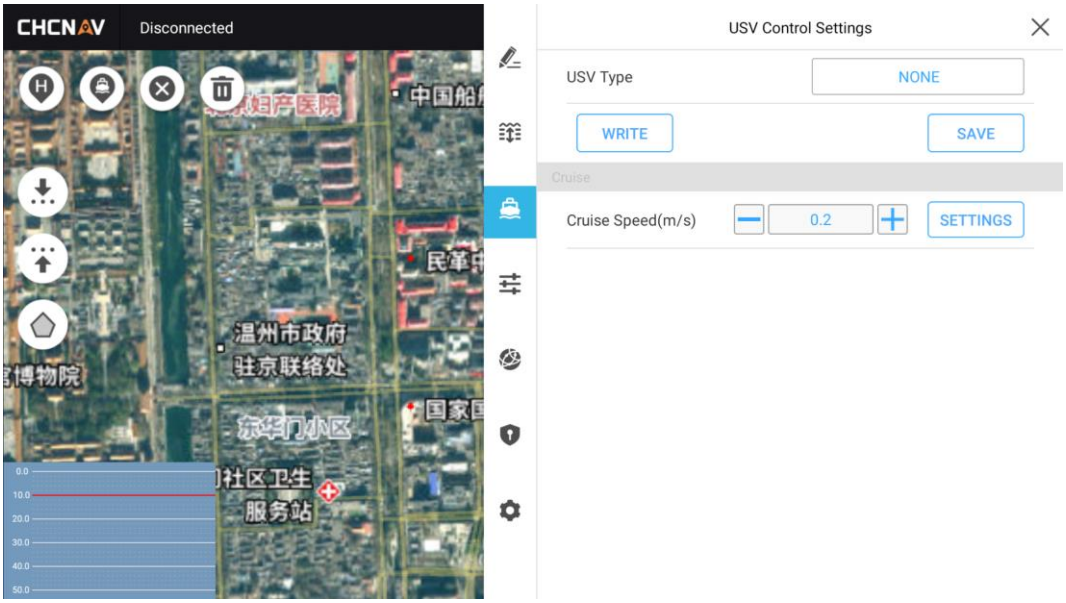


Figure 3.26: Parameter Settings - Boat Control Settings

3.8.4 GENERAL - SYSTEM SETTINGS

1. **The shoals retreated**

   Function switch, turn on this function, and the USV will automatically go backwards and sail away after entering the shallows.

2. **Automatic obstacle avoidance**

   Function switch, turn on this function, the USV will automatically detour or stop when it finds an obstacle ahead.

3. **Lost contact and returned home**

   Function switch, turn on this function, once the remote control is disconnected (the distance between the remote control and the USV is far), after a period of time (lost contact time), it can automatically return home.

4. **Return home with low battery**

   Function switch, turn on this function, if the battery is low, the USV will automatically return to home.

5. **Remote control pairing**

   After the remote control is turned on, if it is not paired with the boat. This button can be used to match the remote control.

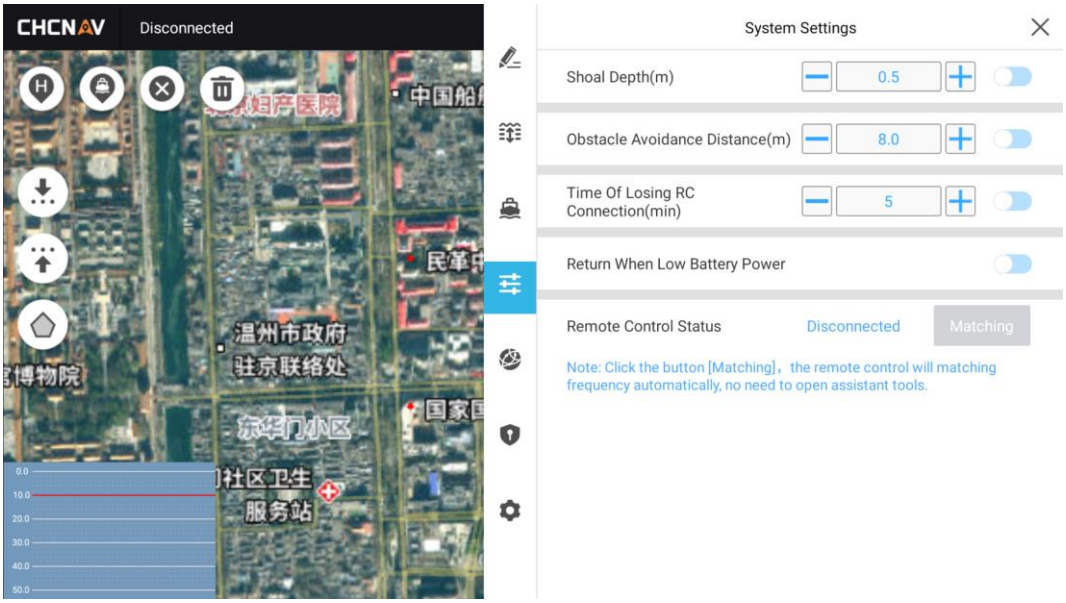


Figure 3.27: Parameter Settings - System Settings

3.8.5 GENERIC -CORS LOGIN

On this page, you can view the current CORS login status. You can also manually enter parameter information to log in to CORS.

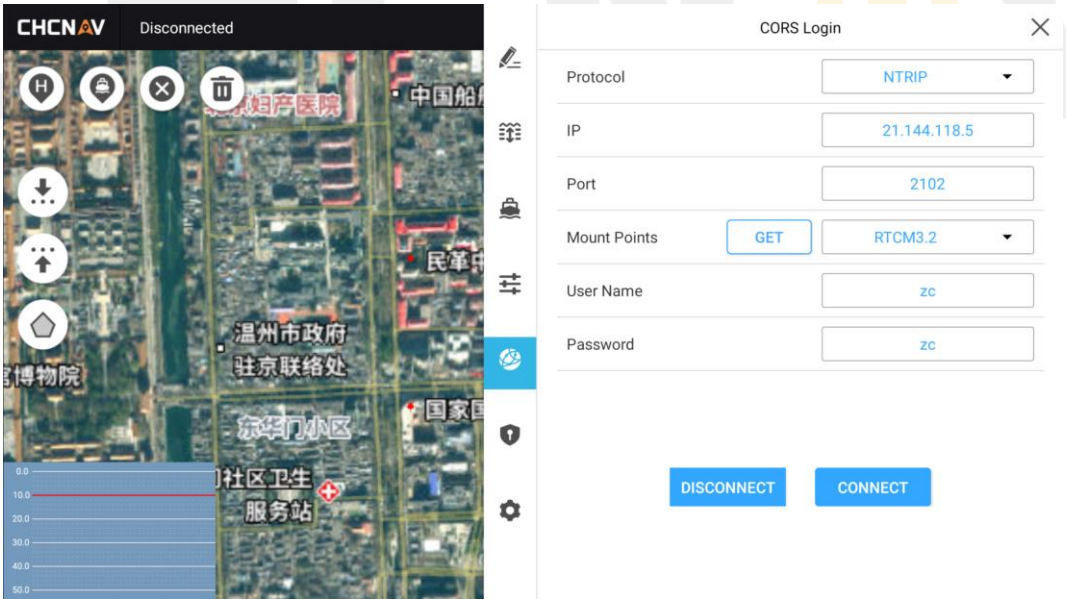


Figure 3.28: Parameter Settings - CORS Login

In the connection protocol section, you can drop down to select the SWAS built-in account, and click Connect directly.

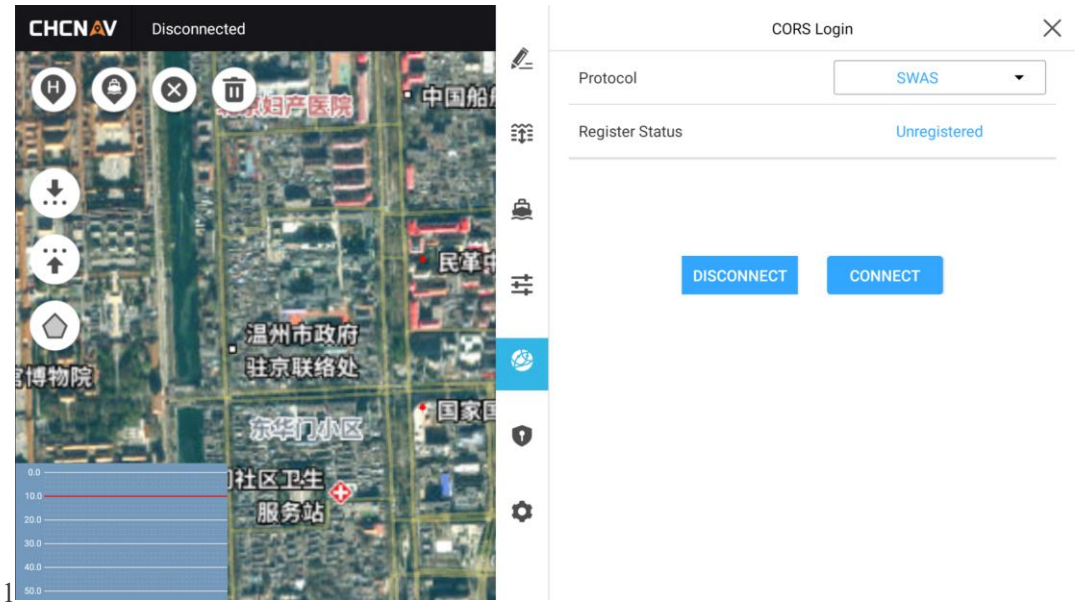


Figure 3.29: Parameter Settings - SWAS Login

3.8.6 GENERIC - GNSS REGISTRATION

It can display the SN number, GNSS registration period, registration code and other information of the current USV.

If GNSS expires, you can contact the technical application for a registration code, and then enter a new registration code at the registration code position in the figure below, and click the registration button to complete the registration.

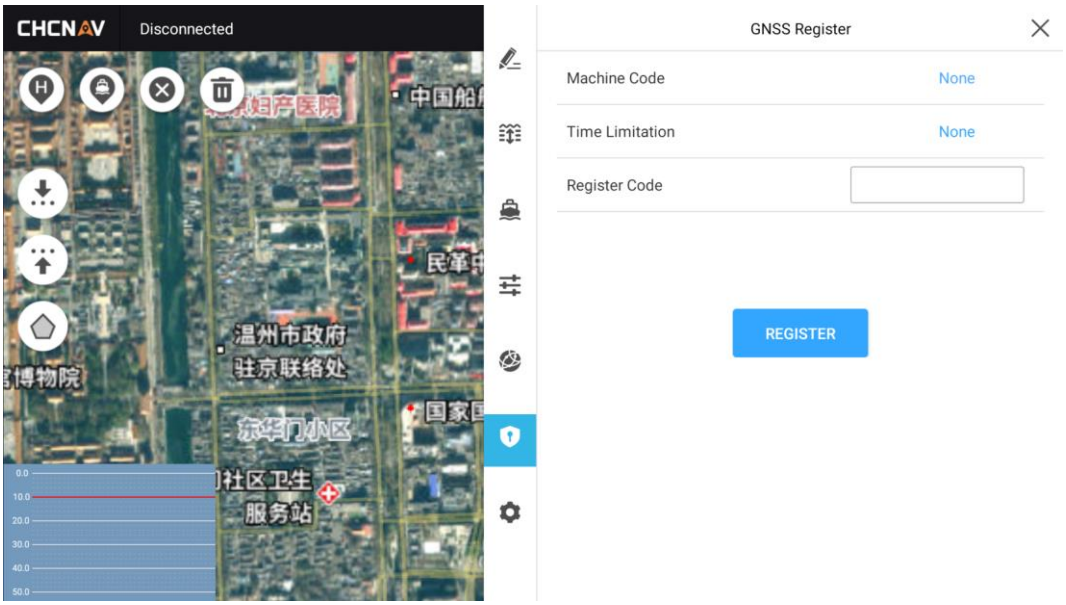


Figure 3.30: Parameter Settings - GNSS Registration

3.8.7 GENERAL - MAP/BOOM SETTINGS

1) Map source

Support day map and ARCGIS and customization.

2) Virtual joysticks

Set the display and hiding of the virtual joystick. It will only appear after the project is saved.

3) Display

View switching for map and video perspectives. Whether each switch is full-screen or half-screen.

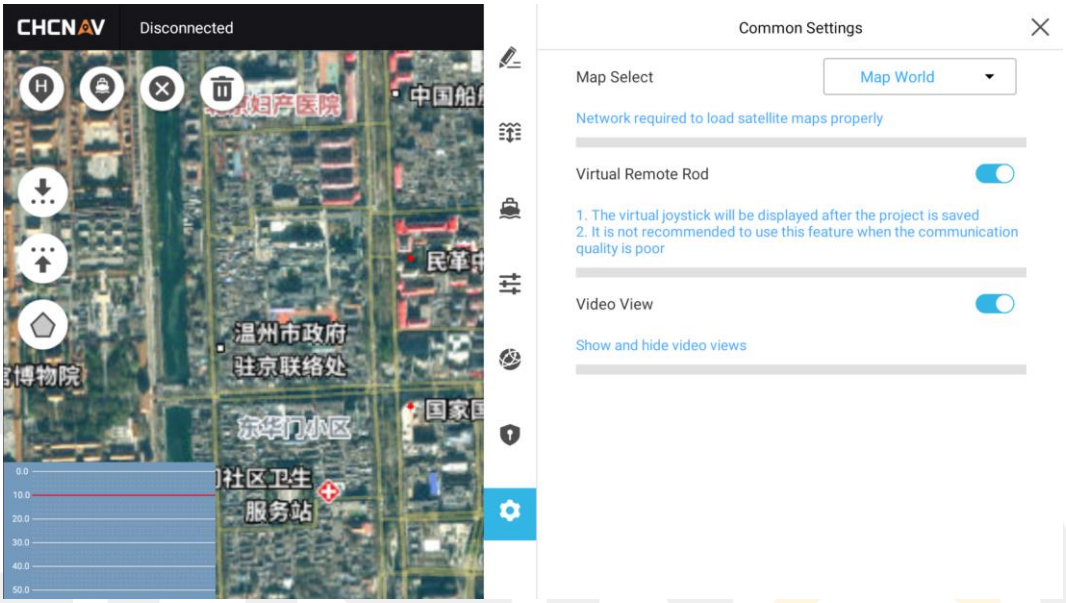


Figure 3.31: Parameter Settings - General Settings

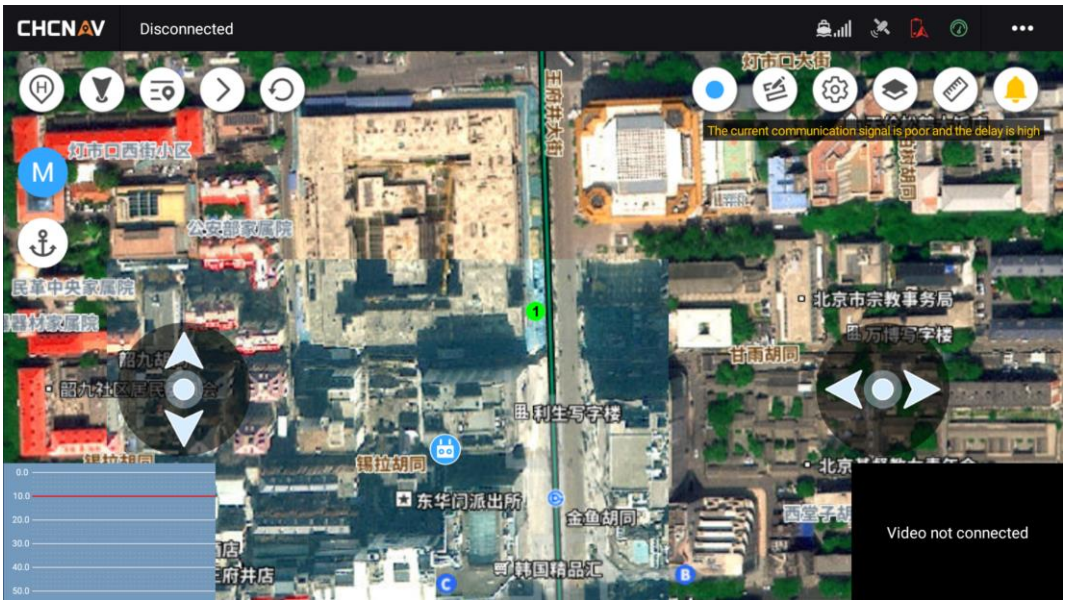


Figure 3.32: Virtual joystick

3.8.8 MAP/VIDEO SWITCHING

1. Click the view box in the lower right corner to switch between the map and video interfaces. Half-screen switching and full-screen switching are supported. Half-screen and full-screen settings can be set on the **[General Settings]** interface.
2. Video full-screen interface, with platform rotation, photo and video recording functions on the right side. The photo and video files are stored in the FPV folder of the current project.
3. In the video view interface, there are play and close buttons in the center of the gimbal in the upper right corner, which can turn the video stream on and off freely.

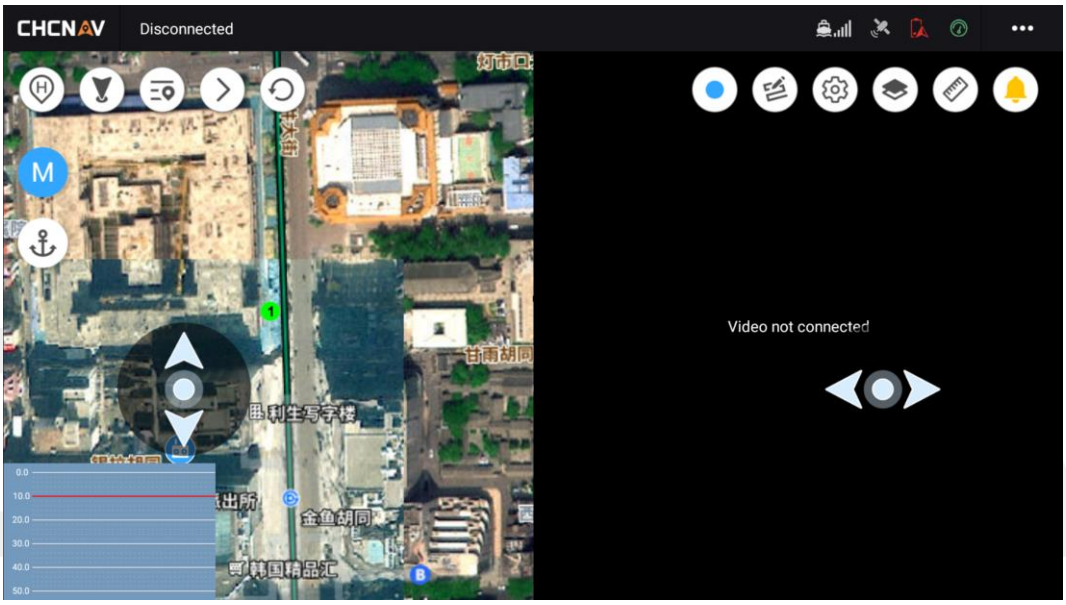


Figure 3.33: Camera/work page half-screen

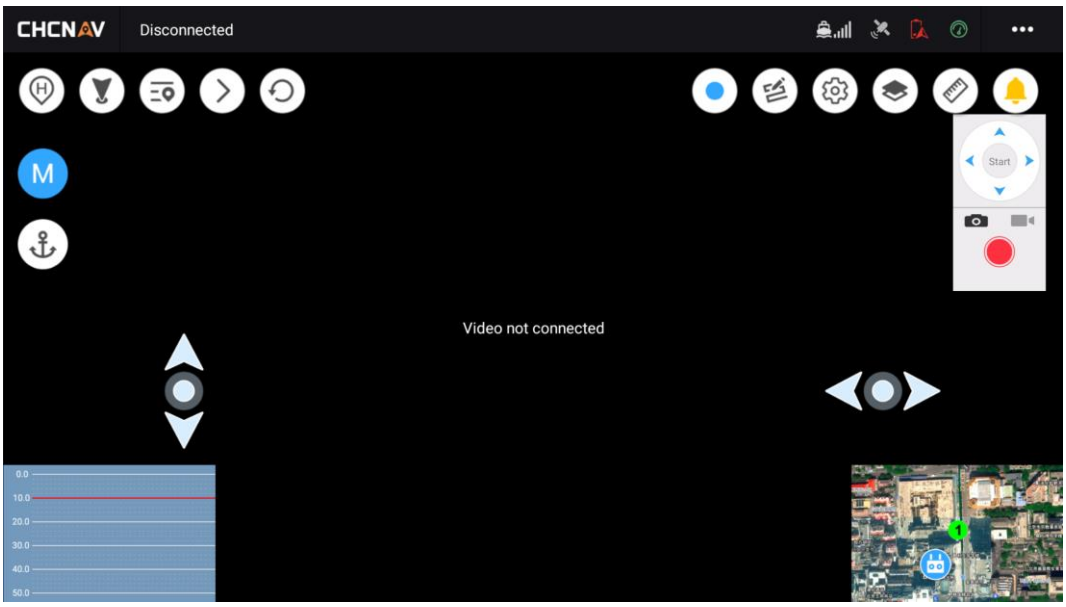


Figure 3.34: Camera full-screen page

3.9 EXTENDED FUNCTIONALITY

The software provides additional extended features, allowing users to learn how to use the software through video tutorials, share software logs, share code downloads, and customize services. The collection of these modules provides users with more options and flexibility to meet individual needs and enhance the experience of using the software. Click on the upper right corner of the main interface, and you can enter the above interface in the pop-up menu.

3.9.1 CUSTOM SERVERS

1. Click **[Custom]** in the upper right corner to add a server, including the server name, IP address, domain name, and port number;
2. The newly added server will be synchronously displayed in the server options of the [Device Connection] interface;
3. After customizing the server, the USV webpage should also be synchronized to add the same server (system settings-N2N settings).

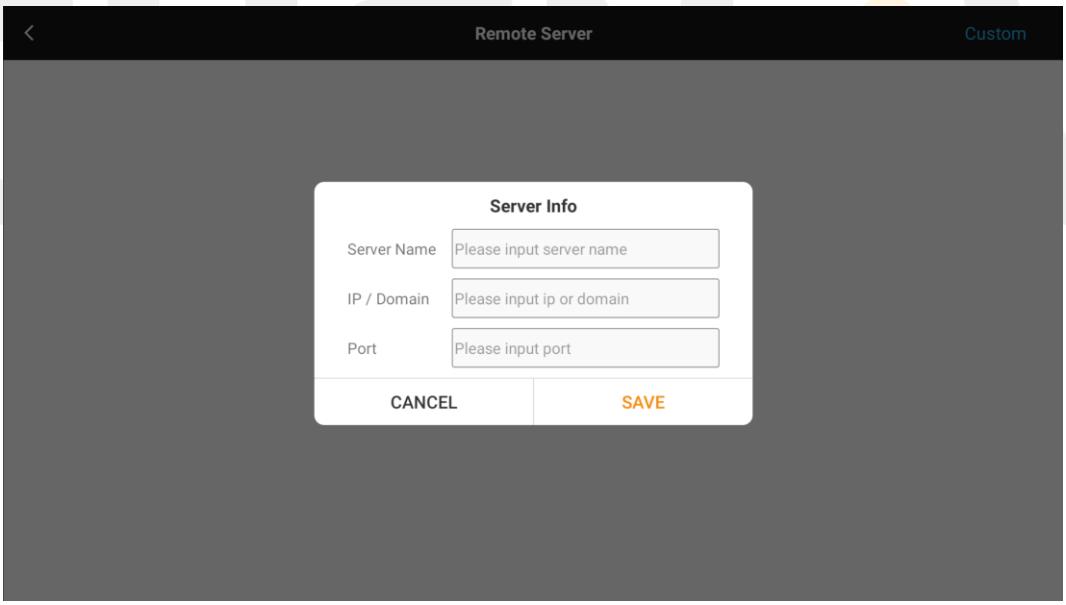


Figure 3.35: Custom server

3.9.2 VIDEO TUTORIALS

After entering the USV video tutorial interface, users can learn how to connect equipment, set the coordinate system, plan the route, set the equipment, and post-process the data. Video resources provide detailed demonstrations and instructions to help users quickly learn how to use the software. You can view the tutorials of different functions by clicking on different titles, you can like and

favorite the video below, and click the button at the top right to refresh, clear the cache and generate a QR code to share with others.

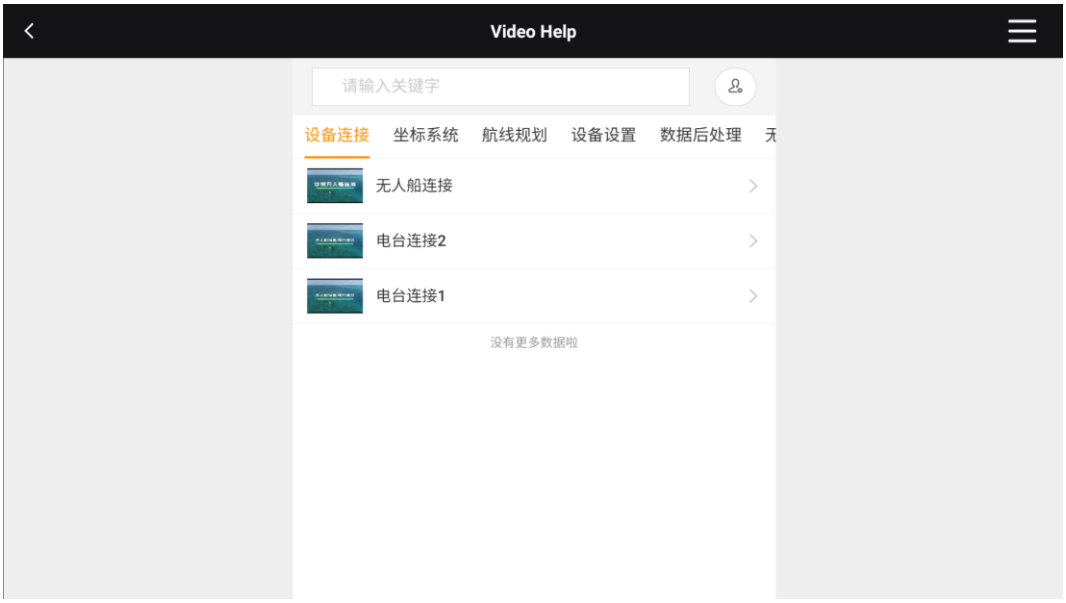


Figure 3.36: Video tutorial

3.9.3 SHARE PROJECTS/LOGS

On the project management interface, click the word **[Manage]** in the upper right corner to copy, share, and delete the project.

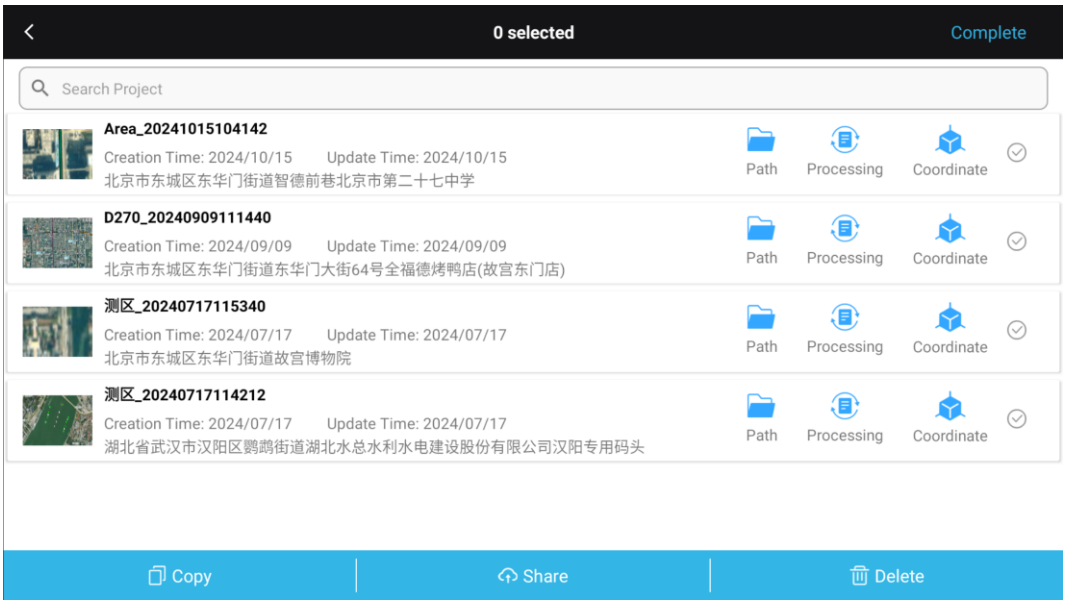


Figure 3.37: Project list management model

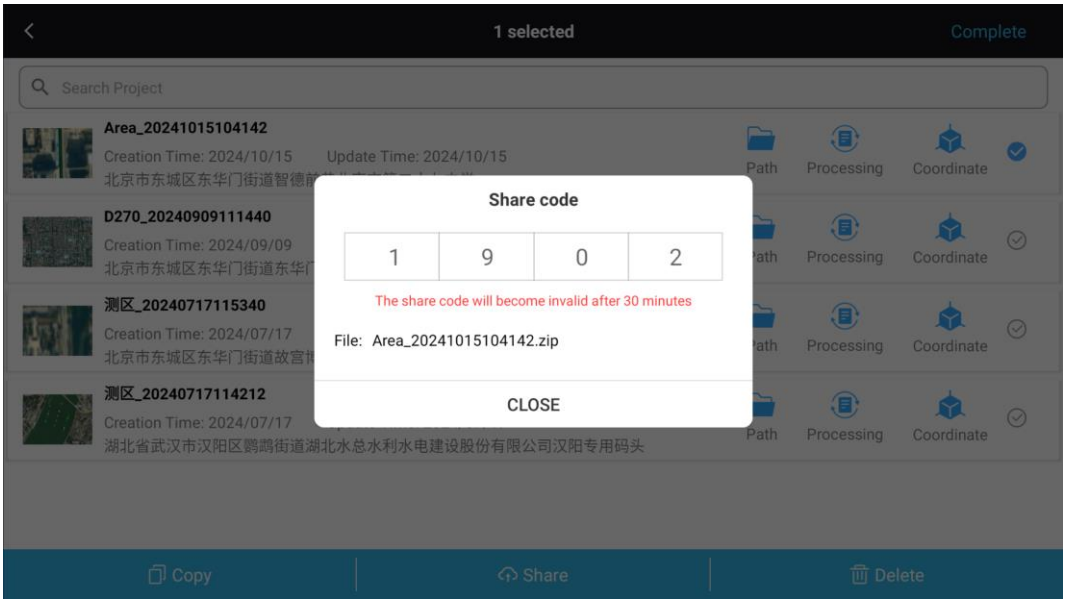


Figure 3.38: The share code generation pop-up window

Click the three bars in the upper right corner of the initial interface, click Share Log, or click Share Code to download. Get engineering data.

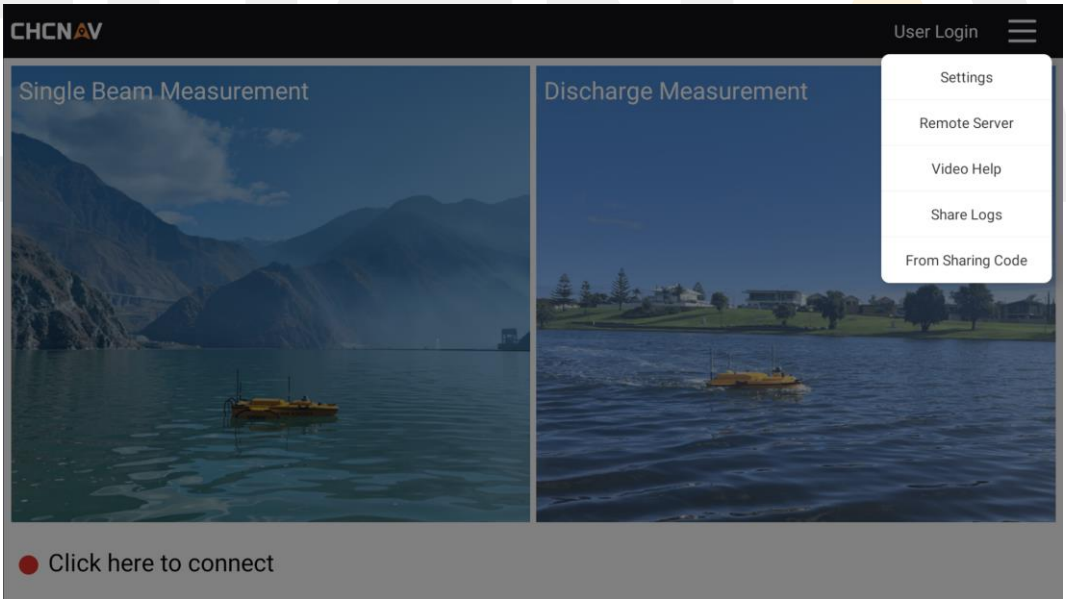


Figure 3.39: More settings for the main page

Select the software log of the corresponding date and share it with the technician for analysis.

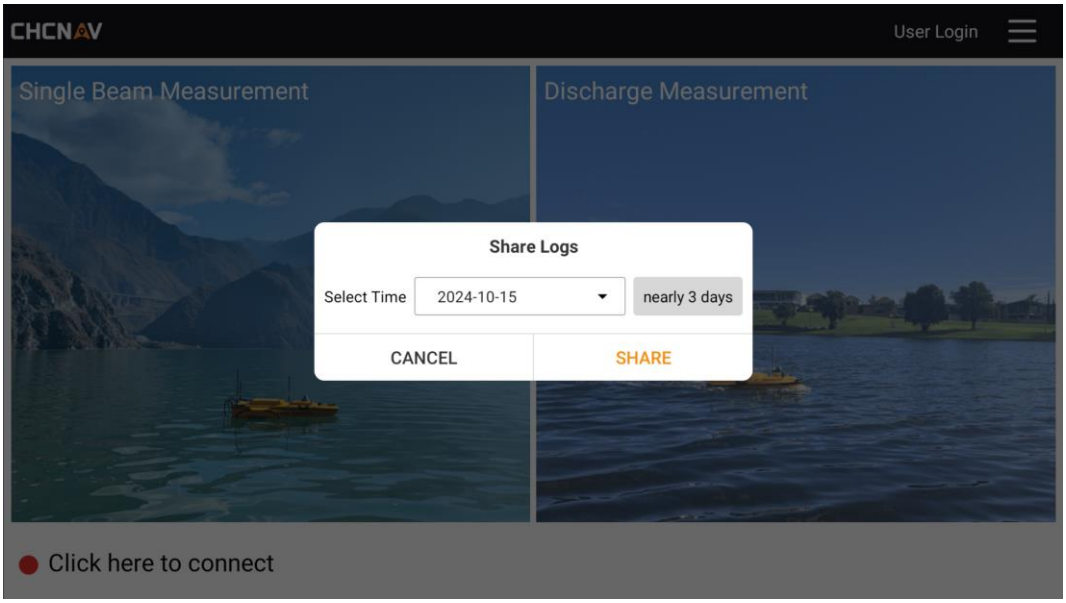


Figure 3.40: The log sharing window

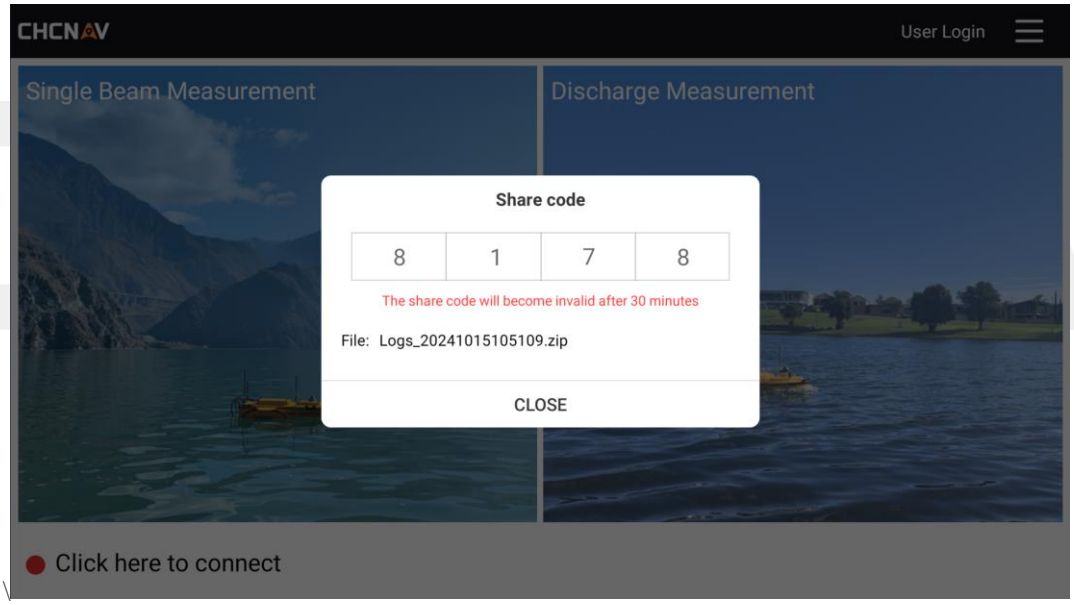


Figure 3.41: Share code pop-up

Notes:

When using the sharing function, you must first log in to your CHCNAV account, download the CHCNAV cloud sharing code tool on the official website, and use it together.

3.9.4 SHARE CODE TO OBTAIN/DOWNLOAD DATA

Open the official website of CHCNAV, download the code sharing tool, and install it on your

computer.

Figure 3.42: The location of the download code sharing tool on the official website

When EasySail software shares the corresponding project/achievement/log, a pop-up window will generate a 4-digit sharing code. Turn on the computer, right-click on the desktop, select **[CHCNAV Sharing Code - File Download],** enter the corresponding sharing code, and enter the corresponding sharing code, and the file will be downloaded to the desktop in the form of a compressed package by default.

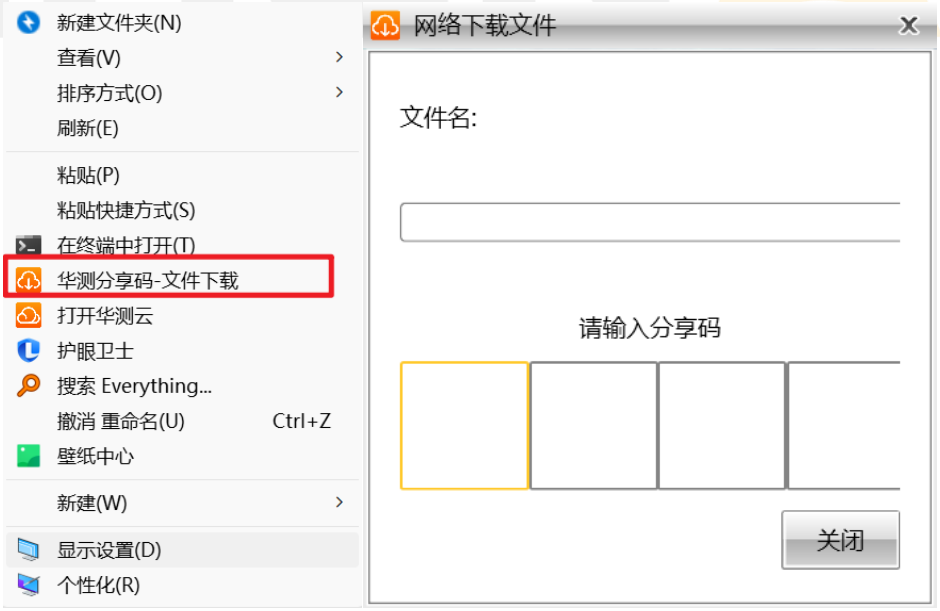


Figure 3.43: Obtaining the share code file on the PC side

After other users share files through the sharing function to generate a sharing code, they can enter the corresponding four-digit sharing code number on the sharing code download interface to complete

the fast download of the file.

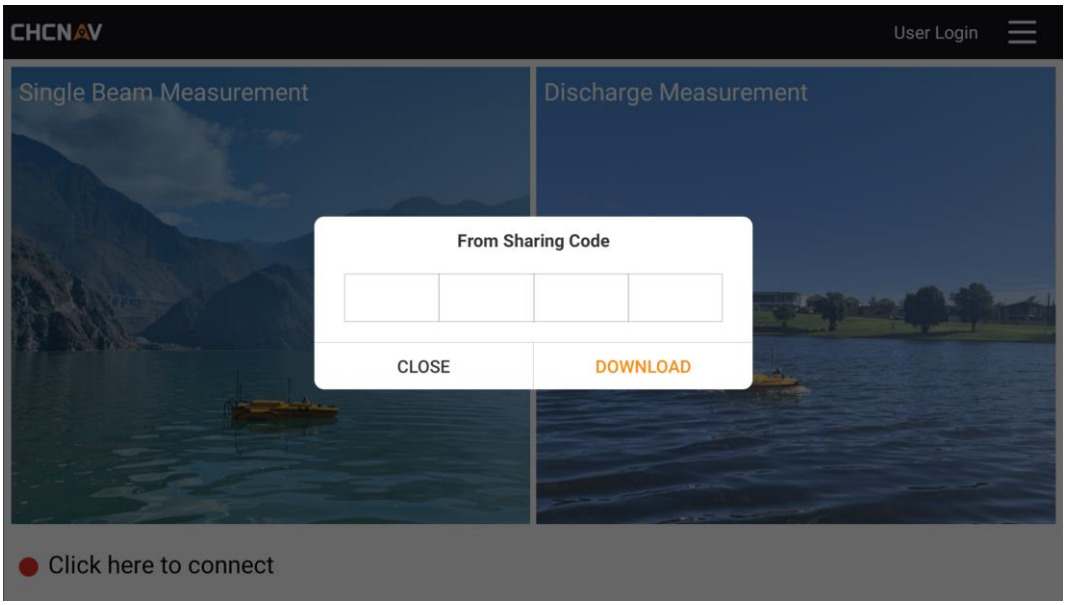


Figure 3.44: The remote control is downloaded via the sharing code

3.10 TERRAIN DATA OUTPUT AND PROCESSING

On the project management interface, click the post-processing button of the corresponding project.

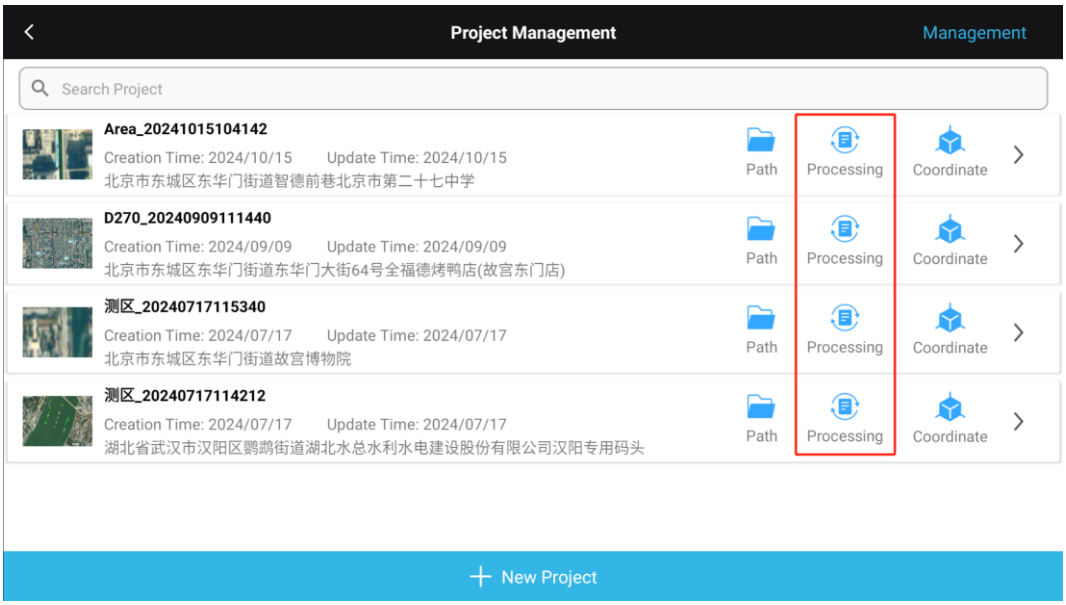


Figure 3.45: Topographic Survey Project Management List

Click the list on the left, the line measurement button, select the line to be processed, and click **[Next]/[Previous]** to switch the line processing.

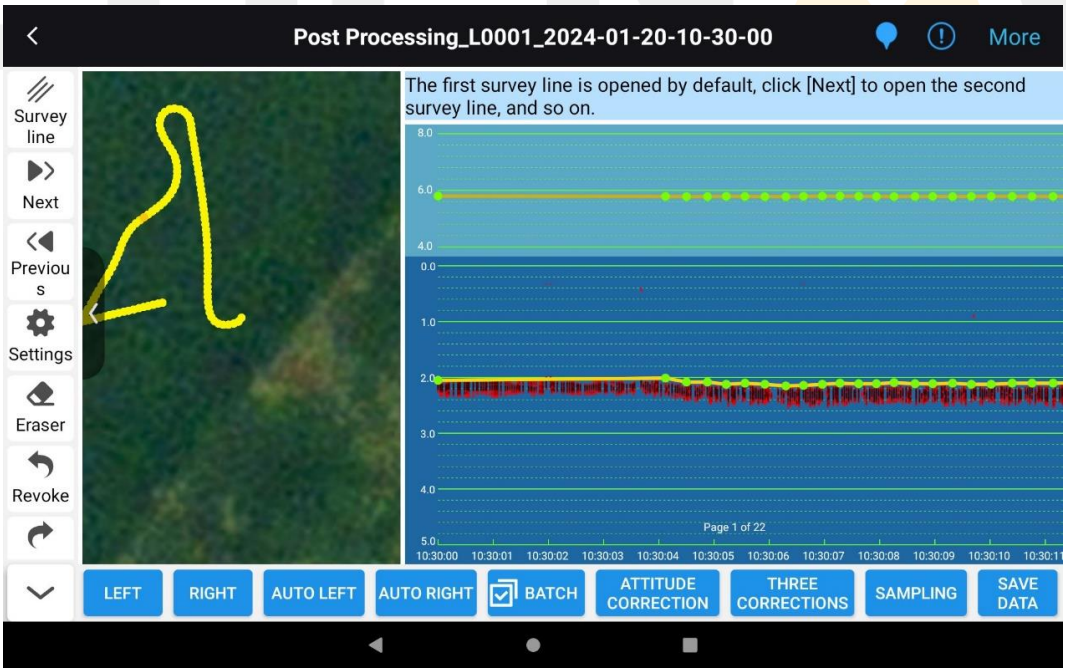


Figure 3.46: Bathymetric Sampling Main Page

Click More in the upper right corner to check whether the Coordinate System and USV Information are normal.

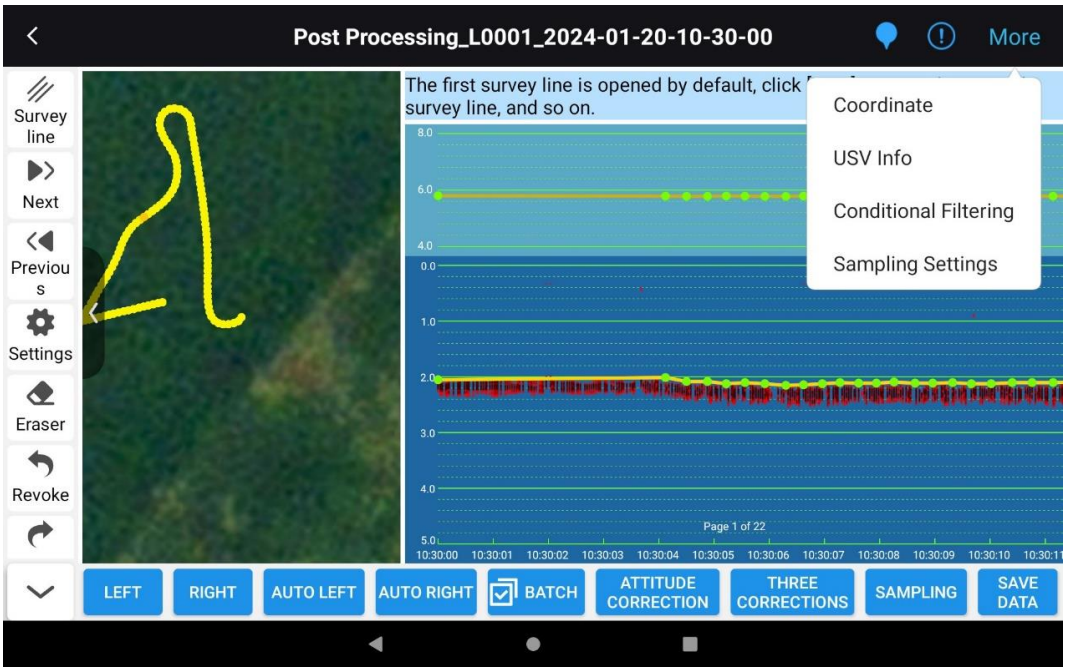


Figure 3.47: More settings for bathymetric sampling

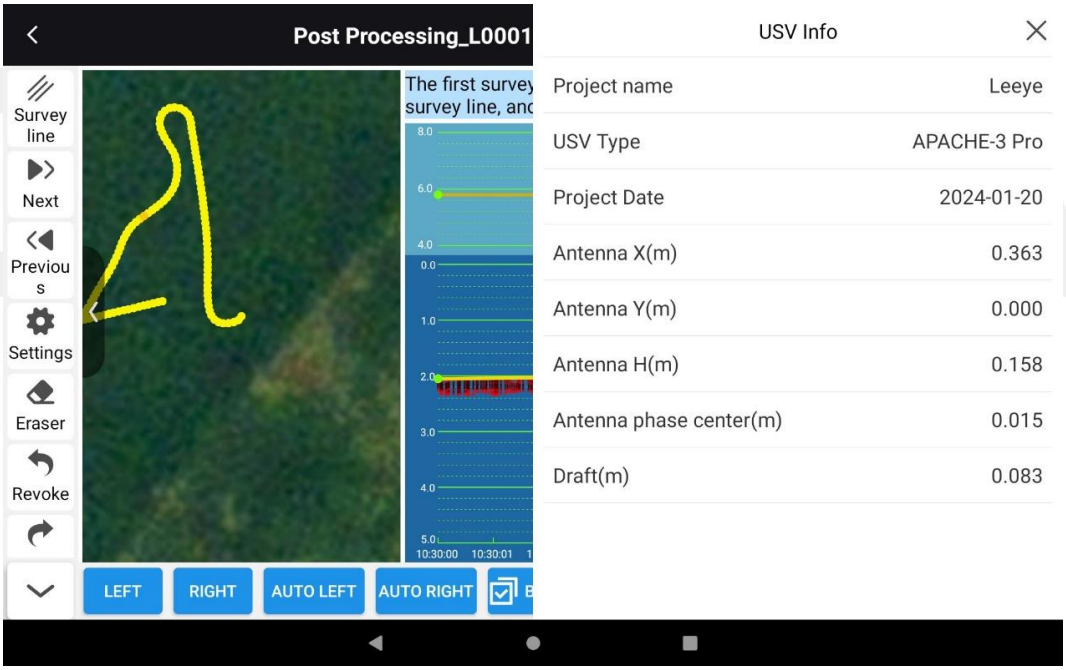


Figure 3.48: Ship type information

In the water depth interface, you can remove the noise by dragging the water depth point to the correct position or clicking **[Eraser].**

Click directly below to move the bathymetric data laterally, such as Move Left/Move Right/Auto Move Left/Auto Move Right.

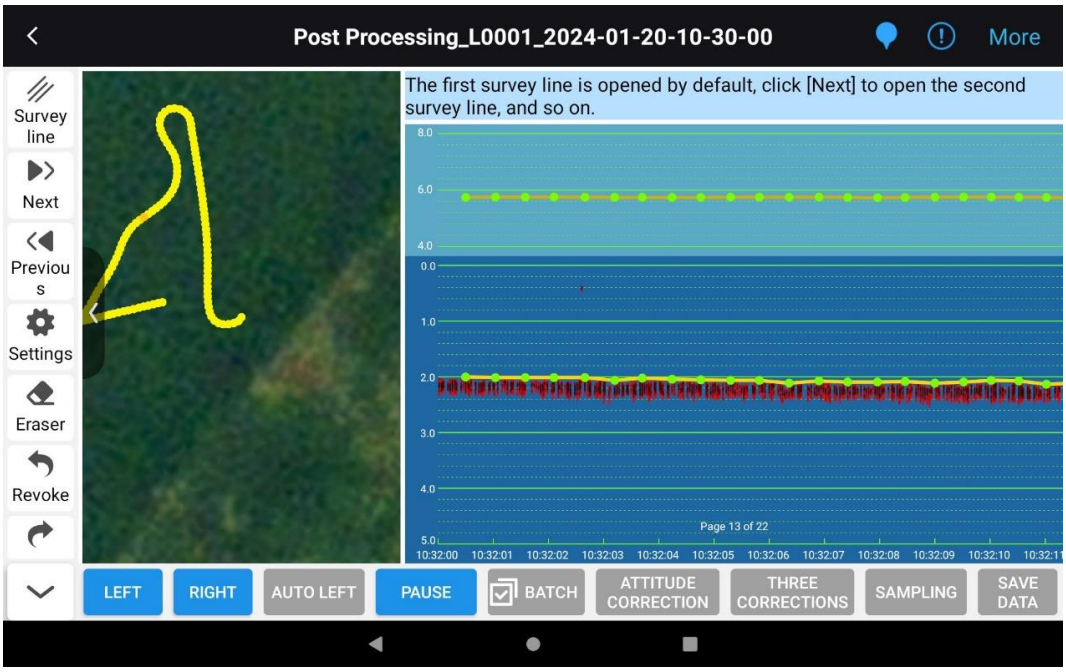


Figure 3.49: Bathymetry editing

After deleting all the noise of the survey line in turn, click Batch, check the test line to be processed, and then click Attitude Correction or Three Corrections (Three Corrections include Attitude Correction, Sound Velocity Correction, and Delay Correction).

Click More in the upper right corner again, Sampling Settings, manually set the sampling interval, and click Isometric sampling in the lower right corner.

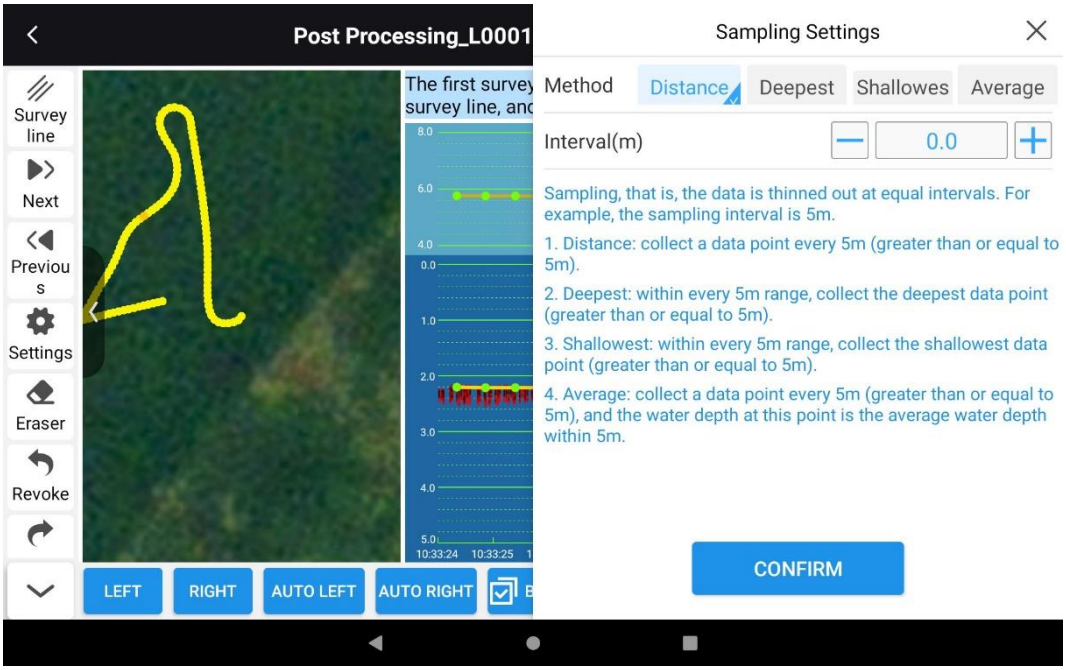


Figure 3.50: Sampling settings

3.10.1.1 Introduction to more settings for water depth sampling:

1) Coordinate system

The coordinate system of project parameters can be checked, and any issues can be corrected in this window.

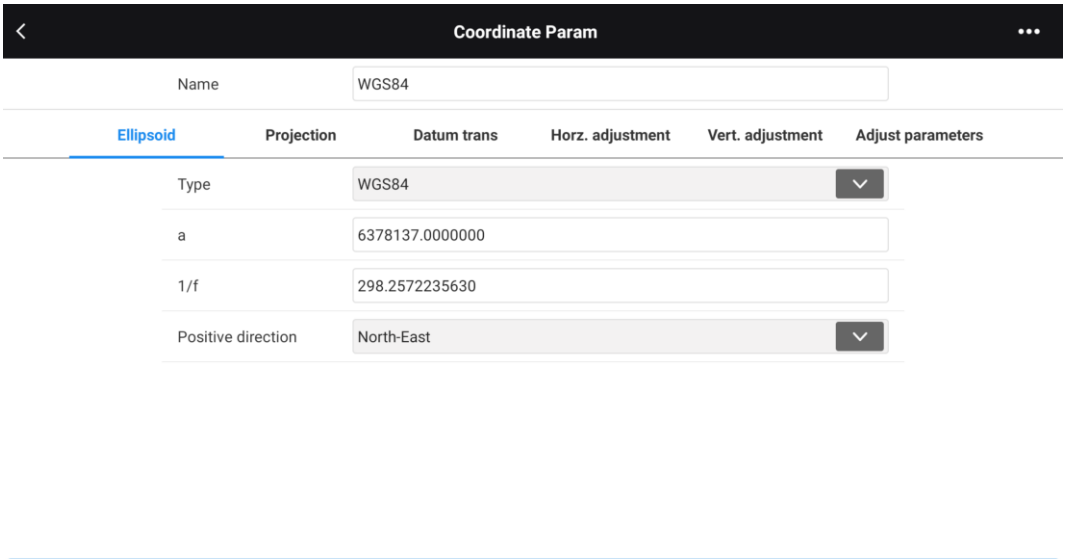


Figure 3.51: Water depth sampling - coordinate system

2) Ship type parameters

This window mainly checks whether the software correctly recognizes the ship type used in the current operation. The window contains parameters such as project name, ship type, project date, antenna X deviation, antenna Y deviation, antenna Z deviation, antenna phase center height, and ship draft.

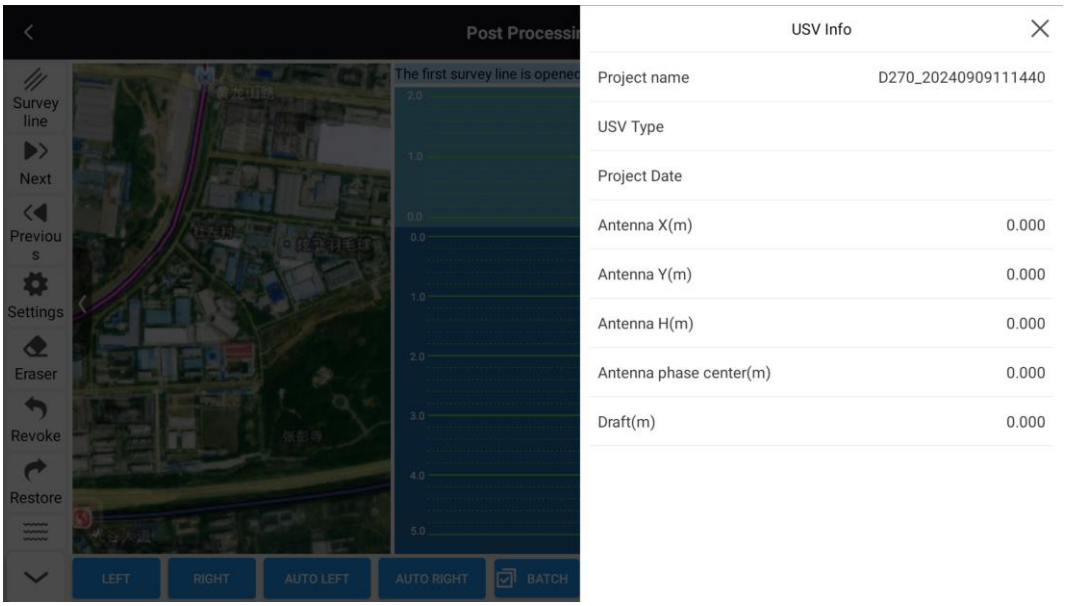


Figure 3.52: Depth Sampling - Ship Parameters

3) Conditional filtering

This includes state resolution, RMS limitation, and depth range filtering, which have the same meaning as the record settings during the collection process.

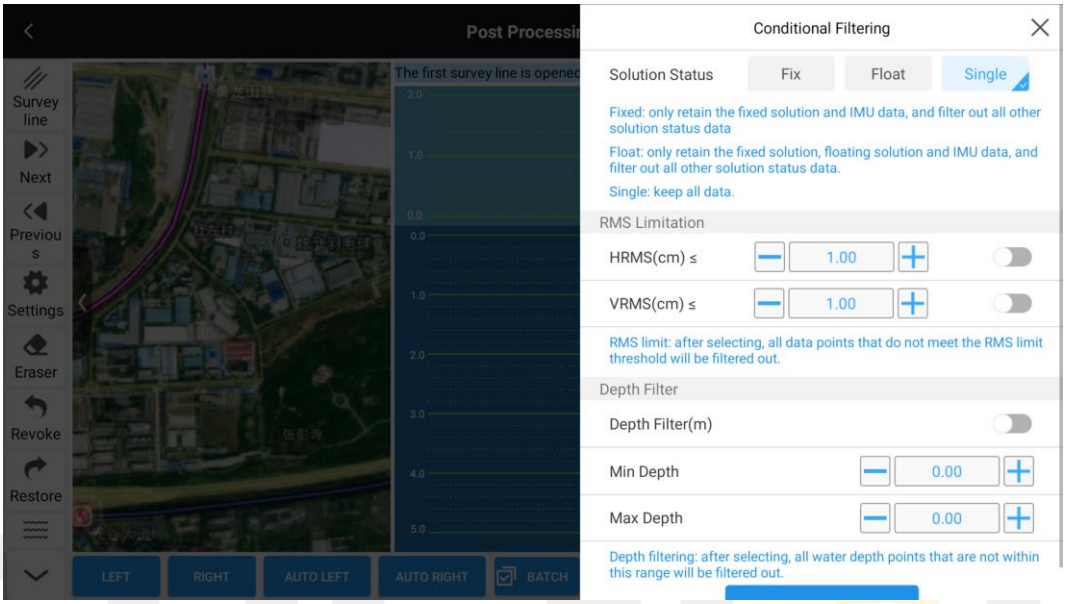


Figure 3.53: Water depth sampling - conditional filtration

4) Sampling settings

This function is used to thinned out the data at equal intervals. For example, the sampling interval is 5m.

1) Distance: collect a data point every 5m (greater than or equal to 5m).
2) Deepest: within every 5m range, collect the deepest data point (greater than or equal to 5m).
3) Shallowest: within every 5m range, collect the shallowest data point(greater than or equal to 5m).
4) Average: collect a data point every 5m (greater than or equal to 5m), and the water depth at this point is the average water depth within 5m.

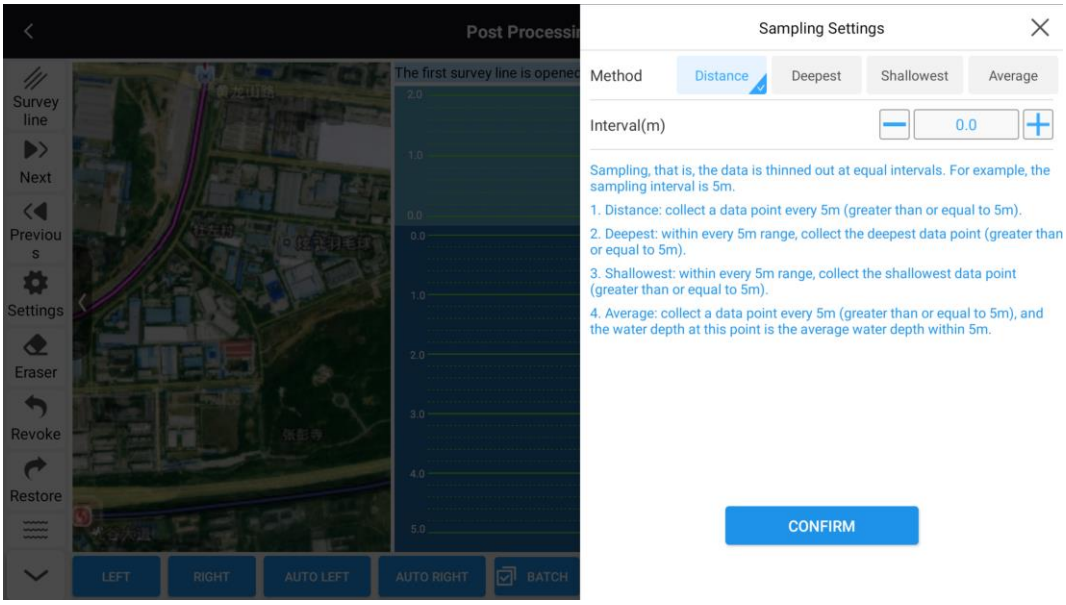


Figure 3.54: Depth Sampling - Sampling Settings

After the sampling is successful, a purple sampling line is generated on the water depth interface, and click to save the data again.

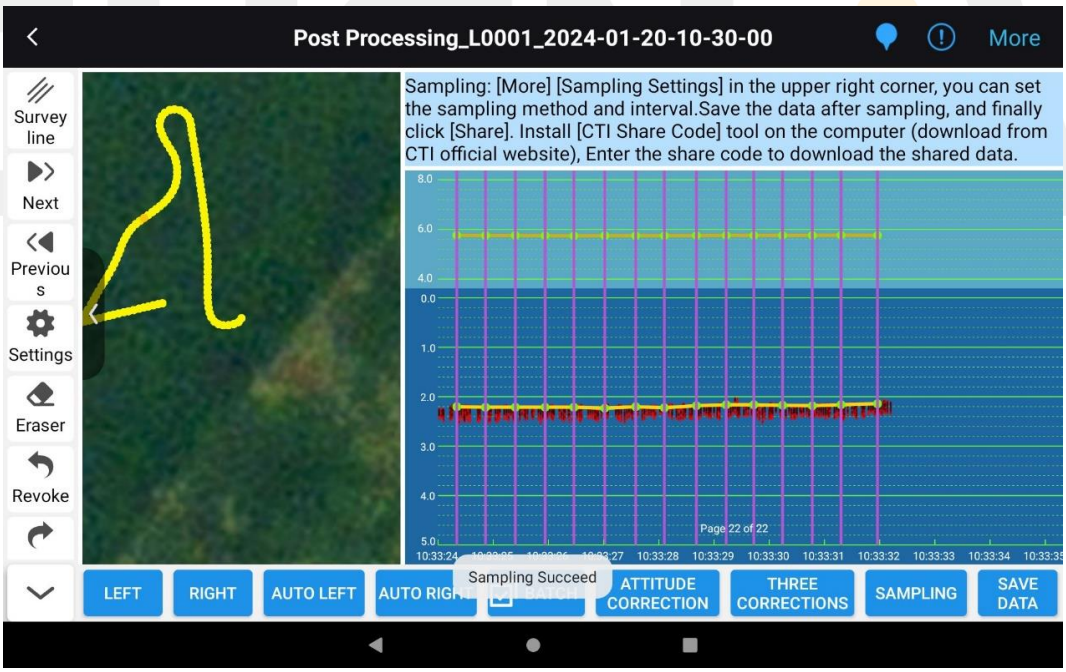


Figure 3.55: Isometric sampling

Select the data format and type to be exported, click Save, and the result file will be saved in the single-beam folder under the current project by default. Click Share to share the data.

Figure 3.56: Saving data

3.10.2 DETAILED EXPLANATION OF POST-PROCESSING FUNCTIONS

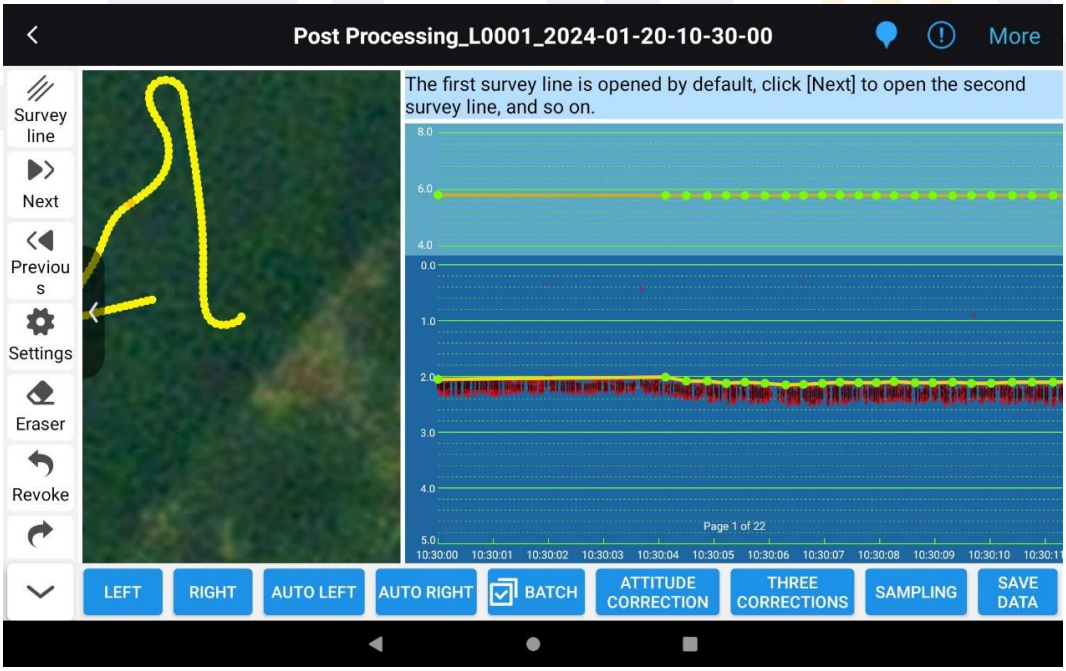


Figure 3.57: Bathymetric sampling page

3.10.2.1 Introduction to Views:

1) Record the color of the points

The points of the fixed solution are shown in green, the points of the floating solution and the

inertial navigation solution are shown in yellow, and the other points are shown in red. Depth point green display: a point is selected, the color of the point changes, and the color of the selected point is orange. At the same time, the corresponding points on the map track view will also be marked synchronously (white circles are highlighted). Manual interpolation renders purple dots; Points erased by the eraser are grayed out and cannot be clicked again.

2) **Map interface**

You can drag and drop to move, zoom in and out.

3) **Map record points are displayed**

The color rendering is carried out according to the water depth, and the grade level is from light to dark: red, orange, yellow, green, blue, purple.

3.10.2.2 Brief introduction of the function buttons on the left:

1. **Turn on the tide test**

Import a moisture test file (*.tid).* Requirements. The TID datetime contains the DEP datetime, and after importing, the water surface elevation is used the elevation data in the TID file is processed.

Notes:

The *.tid* file should be edited as follows:

2024-10-11 14:10 15.00

2024-10-11 17:10 16:00

1) **Fixed interpolation**

Select this button to correct the elevation data for the non-fixed solution.

2) **Eraser**

Select this button, and then select or box select multiple bathymetry points to delete them.

3) **Manual interpolation**

Select this button and click anywhere within the bathymetric view to insert a new record point at the corresponding time and depth location.

4) **Manual sampling**

Manual sampling of feature point data - performed after equidistant sampling. For non-equidistant sampling points only. Select this button, select a non-equidistant sampling point with the mouse, and a red sampling line will be automatically generated.

5) **Quash**

Go back to the previous step (drag a point/delete a point/add or delete feature point sample line).

6) **Recover**

Resume the previous operation (drag point/delete point/add and delete feature point sample line).

7) **The pinch button on the left side of the map**

You can turn on/off the map interface display;

8) **Survey line**

Displays all line files recorded in the current project;

9) **Set up**

1. The water depth, time interval, and time width multiples can be set, and the view interface can be modified;
2. Selectable bathymetry editing mode: locked/single-point up and down/multi-point continuous;
3. Fixed interpolation;
4. Display data point information: After enabled, click to select the measurement point/elevation point to display the point information;

3.10.2.3 A brief introduction to the following function buttons:

1) **Shift Left/Right**

Flip left and right on the water depth interface;

2) **Auto Shift Left/Right**

One-click left and right page turning, manual pause;

3) **Batch**

Lines can be selected. Select a few and process a few. Click **the [Batch]** button to pop up a list of test lines, and there is a checkbox on the right side of each test line. By default, all survey lines are selected. Click the **[OK]** button, and all the selected line data will be read;

3.10.2.4 Introduction to gesture operation:

1. Drag up and down on a single-point longitudinal axis to adjust the water depth.
2. For example, if you select a single point, you can move up and down to modify the depth value, but you can't move the current point left or right. However, when a point is selected, moving it left and right will modify all the points that its finger has passed.
3. Slide the upper left side of the point to the lower right side: perform a multi-point selection

operation, similar to the box selection action on the PC side.

3.10.2.5 Data processing operations:

1) **The depth of the water is high**

   bathymetric view of longitudinal bathymetric intervals;

2) **Time interval**

   the time interval between the view horizontally;

3) **Time width**

   The time width of the horizontal axis of the view is enlarged so that the points are not too dense to be selected;

4) **map**

   Double-click to open the position display of the DEP survey line;

5) **Conditional filtering**

   Select a selection in the box, and then select a DEP line in the line list to filter the view. Or select the DEP test line first, then select the filter conditions, and click the [OK] button to display it in real time;

6) **Sampling Method &; Sampling Interval X**

   1. Distance sampling: Take a point every distance X (>=X);
   2. Deepest (within equal intervals): Within the equal interval X distance, the deepest water depth point data is taken as the sampling point;
   3. Shallowest (equally spaced): Within the equally spaced X distance, the shallowest water depth point data is taken as the sampling point;
   4. Average value (within equal spacing): Within the equal interval X distance, the average value of all water depth data is taken as the water depth point, and the sampling point is determined according to the distance sampling;

7) **Three corrections**

   Sound velocity correction/delay correction/attitude correction;

8) **Posture correction**

   Attitude correction is carried out only based on the inertial navigation data recorded in the USV GD100;

9) **Isometric sampling**

   After the data are corrected and corrected, thinning sampling is carried out according to the sampling interval;

10) **Save the data**

1. You can choose the saving format, that is, save the header items;
2. Parameter settings: Save header: display header information characters;
3. Merge and save: Merge and save multiple lines to a summary file;
4. Suffix: Select the file suffix (*.txt*/*.csv*/*.dat*).
5. Latitude and longitude format: Set the display of latitude and longitude of the saved file;

11) Sound velocity correction/delay correction/attitude correction

1. There are three correction modes: [Monosonic Velocity], [Depth + Sound Velocity] and [Depth + Correction Value]. After the parameter input is completed, click **[Sound Velocity Correction]** to complete the correction, or click **[Skip]** to enter [Delay Correction].
2. Delay correction of the delay time of entering the water depth and position, the position lag is positive, the water depth lag is negative, click **[Delay Correction]** to complete the correction or click **[Skip]** to enter **[Attitude Correction]** 。
3. Attitude correction: input transducer opening angle, transducer installation error, select automatic filtering method (median filtering, weighted filtering, sliding filtering), click **[Delay Correction]** to complete the data correction, or click **[Skip]** not to correct.

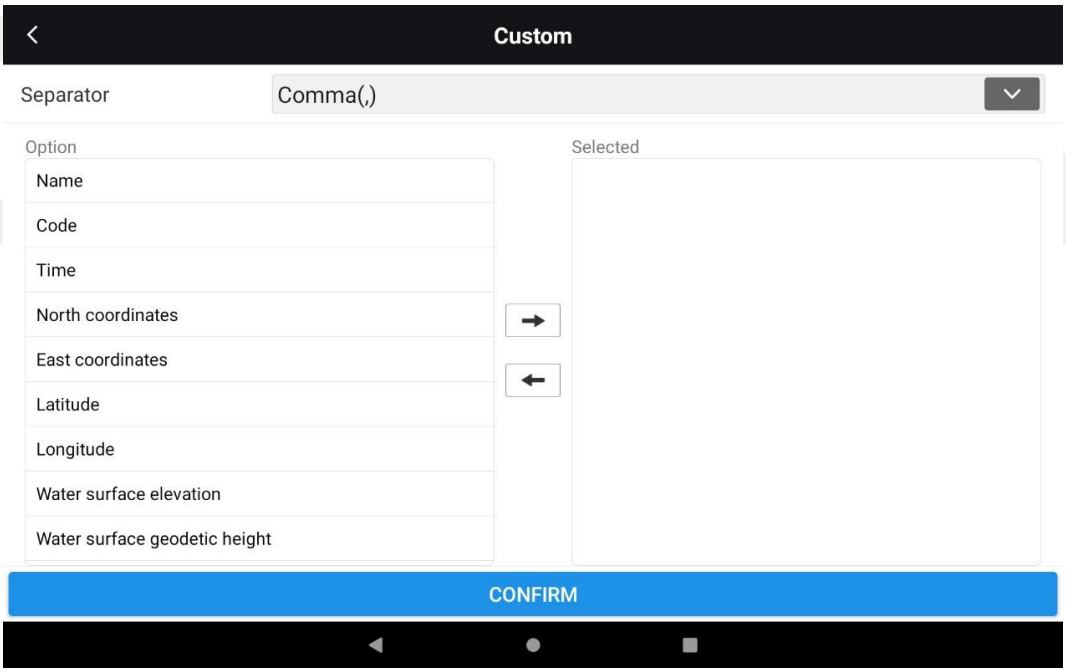


Figure 3.58: Data saved in a custom format

CHCNAV
EASYSAIL

4. HYDROGRAPHIC SURVEY MODULE

This section describes the specific features in the hydrographic survey module of the *EasySail* software

CHCNAV
04.

4.1 A QUICK WORK GUIDE FOR HYDROGRAPHIC SURVEYS

The steps for a rapid hydrological survey operation are as follows:

1. The USV is turned on, the remote control is turned on, and after waiting for 1-2 minutes, operate the remote control handle to check whether the motor is rotating;
2. Turn on *EasySail*, connect to the USV, after the connection is successful, the USV is launched, and manually control the USV at full speed in a straight line for 5 seconds to complete the initialization of the USV;
3. Then click **[Hydrological Survey]** to enter the project list interface;
4. Create a new project or open an old project to enter the main interface of the satellite map;
5. View self-test information, ADCP connection status, etc., and switch the flow velocity profile to full screen;
6. Click **[Start Transmission]** to check the flow velocity isogram to show whether there is data output;
7. Plan the route and upload it;
8. When the USV travels to the target point, click the **[Data Record]** button to start recording the measurement data, and set the starting shore type and shore margin. When driving to the next task point, click the **[End Record]** button, and set the end type and shore margin to end the information collection of the current measurement;
9. After recording the corresponding number of measurements according to the requirements, click the **[Traffic Summary]** icon to view the summary table and export the Excel file;

4.2 PROJECT MANAGEMENT

The project management interface can display all the saved projects, click **[Project Route]** to enter the project management interface, the interface displays the list of all tasks that have been created, each route task label contains the name, route type, creation time, update time and operation location, click the label to open the route task, open the project to enter the map interface, through **[Manage].**button to enter the management mode, and perform multi-select/delete/copy/share operations on the project file. When you need to search for a specific task, you can enter the name of the search task in the [Search Box] to support fuzzy queries.

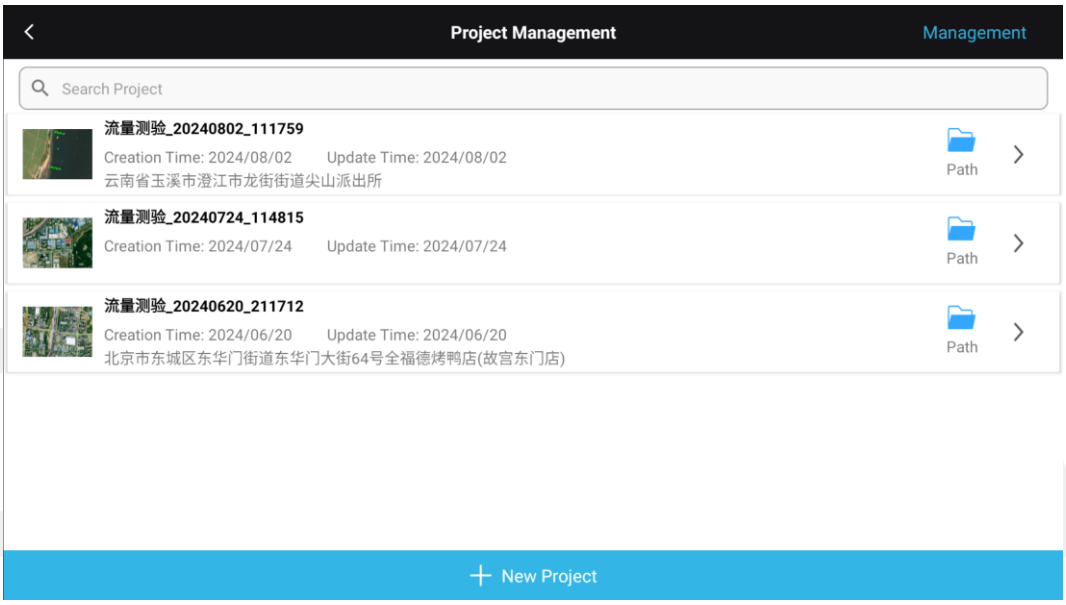


Figure 4.1: Flow Test Engineering Management

4.3 CREATE A NEW PROJECT

1. In the background of the USV web page, the external device type is set to ADCP-RiverStar/RCP, with a baud rate of 115200;
2. After connecting to the USV, it will enter the hydrographic survey project management interface, and it will be automatically connected to ADCP.
3. Click the **[New Project]** button at the bottom. If the ADCP is not successfully connected, the ADCP device parameter configuration page will be entered. If you are connected, you will be directed to the site information screen.
4. Connect to ADCP by setting the ADCP type, ADCP baud rate, GPS baud rate, and GPS network port parameters on the device parameter page. If you select RiverStar as the ADCP model, click "Next" to enter the site information interface, and if you select other models, you will directly enter the topographic survey project.

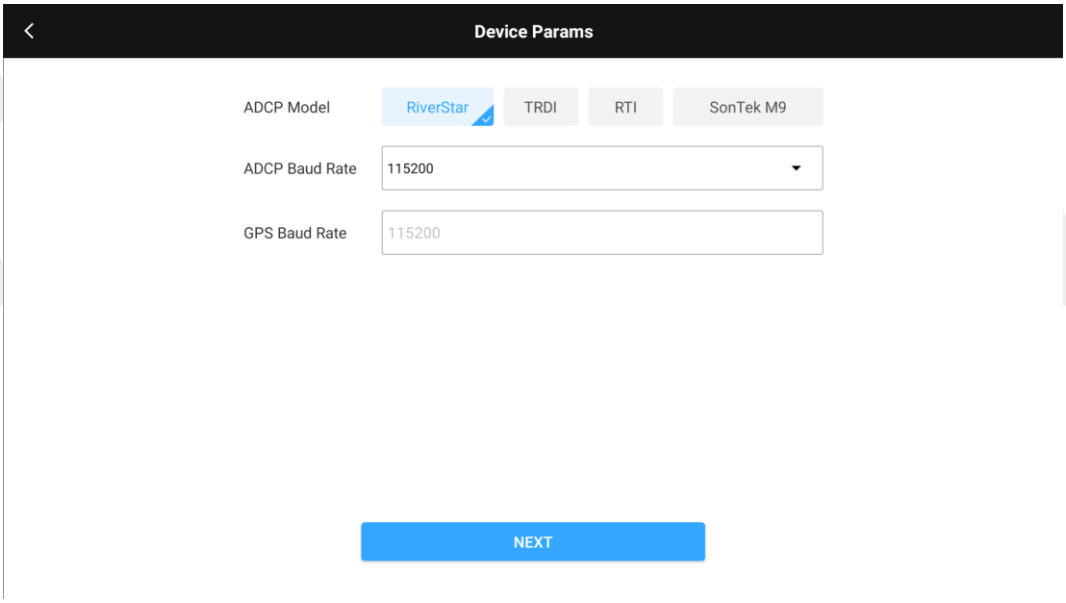


Figure 4.2: Device parameters

5. To enter the site information interface, you need to fill in the site name, station number, river name, water system, measurement unit, measurement location, operator, survey ship number and remarks information, and after filling in the information, click **[Next]** to enter the working parameters interface.

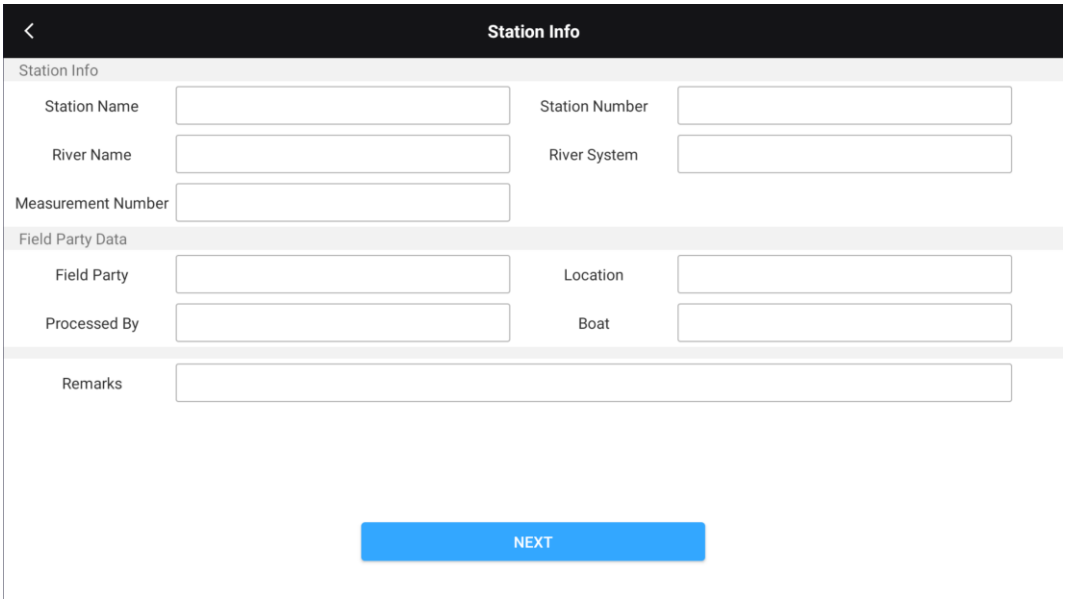


Figure 4.3: Site Information

6. Enter the working parameters interface to set the working parameters of the ADCP, including flow rate reference, transducer draft, external compass offset, and whether to use an external sounder. After the work parameter setting is completed, click **[OK]** to enter the map interface. In addition, it should be noted that if the USV is not connected, only the flow velocity reference can be modified, and other parameters cannot be modified. When the sounder is abnormal or not connected, the external sounder option cannot be modified.

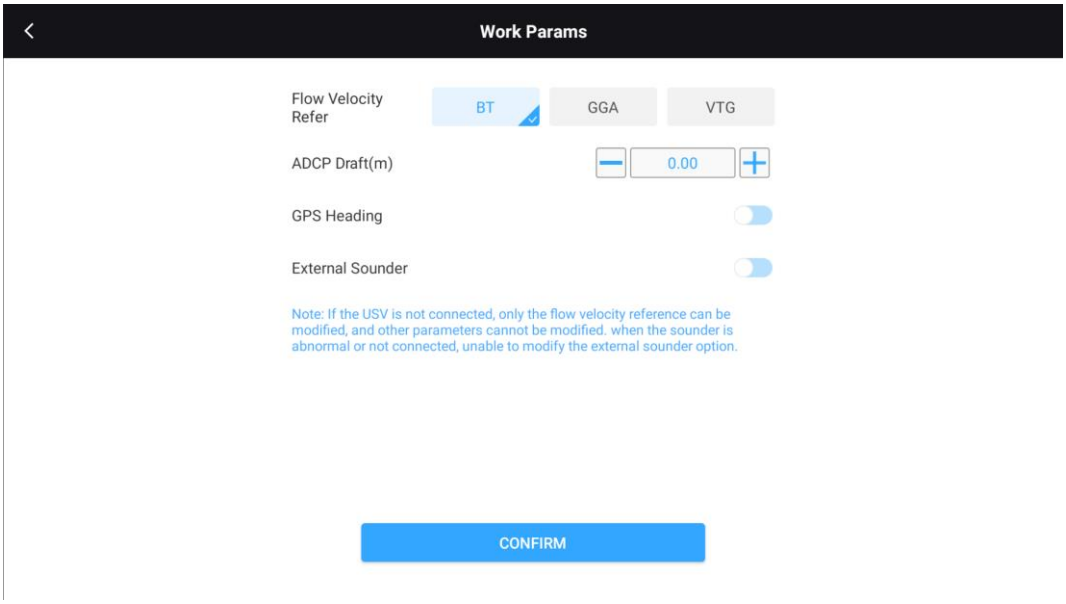


Figure 4.4: Operating parameters

4.4 DEVICE SELF-TEST

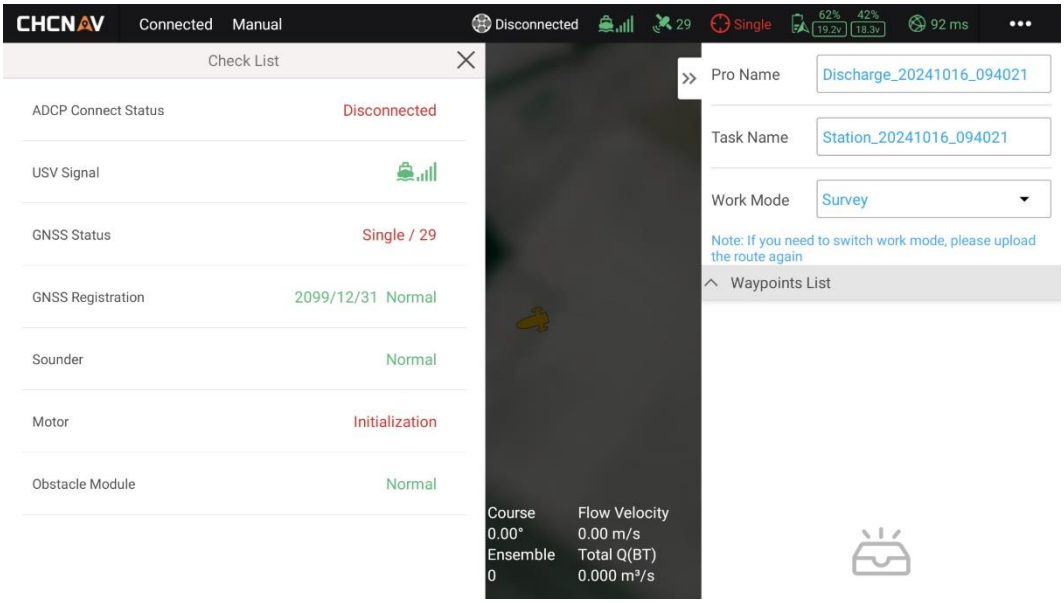


Figure 4.5: Self-test of hydrological test equipment

1) Ship control 4G network signal

Real-time display of USV ship control network quality, ⩾ 95%, full grid (5 grids) display; ⩾ 95%, full grid (5 grids) display; ⩾85%, 4 grids; ⩾70%, 3 grids; ⩾60%, 2 grids; ⩾ 50%, 1 grid display; Other, 0 grids are displayed.

2) GNSS solution mode

Locate the solution state, including single point (red), floating (floating) and fixed (green) modes.

3) GNSS registration

If the expiration time is greater than 48 hours, [Expiration Date + Normal] is displayed, which is indicated in green. If the expiration time is less than or equal to 48 hours, [Expiration in 2 days + expiration date] is displayed, which is indicated in yellow. If the expiration time is less than or equal to 24, [Expiration in 1 day + expiration date] is displayed, which is indicated in yellow. If it expires, it displays Expired, indicated in red.

4) Sounder

The connection is successful, and it is shown in green.

5) Motor

The connection is successful, and it is displayed in green; The first connection will show an abnormality, push the longitudinal rod to check the wind direction and power of the motor, and

it will turn green.

6) Obstacle Avoidance Module

The connection is successful, and it is shown in green.

7) ADCP connection status

If the connection is successful, it will show green [Connected], and if the connection fails, it will display red [Not connected].

4.5 ROUTE PLANNING

The operation steps of the new hydrographic survey route are as follows: in the hydrographic survey mode, click the map once to generate a hovering point, click twice to generate two hovering points, that is, a measurement time, and confirm the navigation position and direction according to the order of clicking to generate; The position can be changed by dragging the hover point. The current operations on hover points include deleting one point and deleting all points, and you can also view the details of the points in the route list, and the waypoint properties can be configured according to your needs.

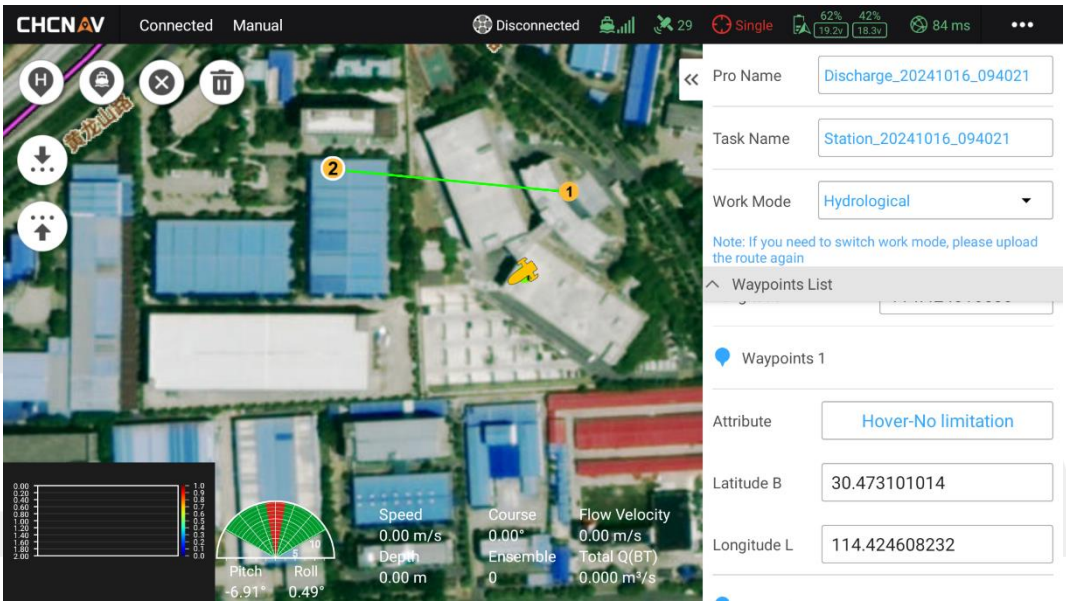


Figure 4.6: Hydrological Survey h route planning

4.6 ROUTE EDITING

Figure 4.7: Main page of hydrological survey work

1) **Mark the home point**

After entering the editing mode, click the button to switch to the selected state, and click the map again to generate the Home point.

2) **Mark the point at the current position of the ship**

If the USV is connected and the software is in edit mode, click the button to generate a task point at the current USV location.

3) **Delete a point**

After selecting a waypoint on the map or selecting a polygon boundary point in polygon drawing mode, the selected point is surrounded by a circle of white, and click the button to delete the point.

4) **Clear all points**

Click this button and a pop-up window will appear, select the type of point (task point/polygon point) that needs to be cleared.

5) **Save the route**

Click this button to save the route. After the route is saved, the measurement operation can be started normally.

6) **Upload routes**

Click this button to upload the drawn mission route to GD100.

7) **Download routes**

Click this button to re-download the mission route in GD100 to the EasySail software.

8) **Draw polygons**

Click this button to draw polygon range lines in the software.

9) **Add hop points**

The hop point setting is located in the route list, and you can set its on/off state, and modify the starting point number and the number of cycles.

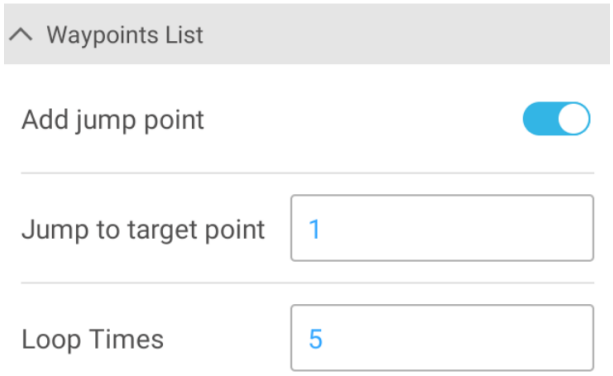


Figure 4.8: Hop point information

4.7 HYDROGRAPHIC SURVEY MAIN INTERFACE

As you can see, some of the interface tools are the same as topographic surveys, and the different interface tool parts are marked out in the image below.

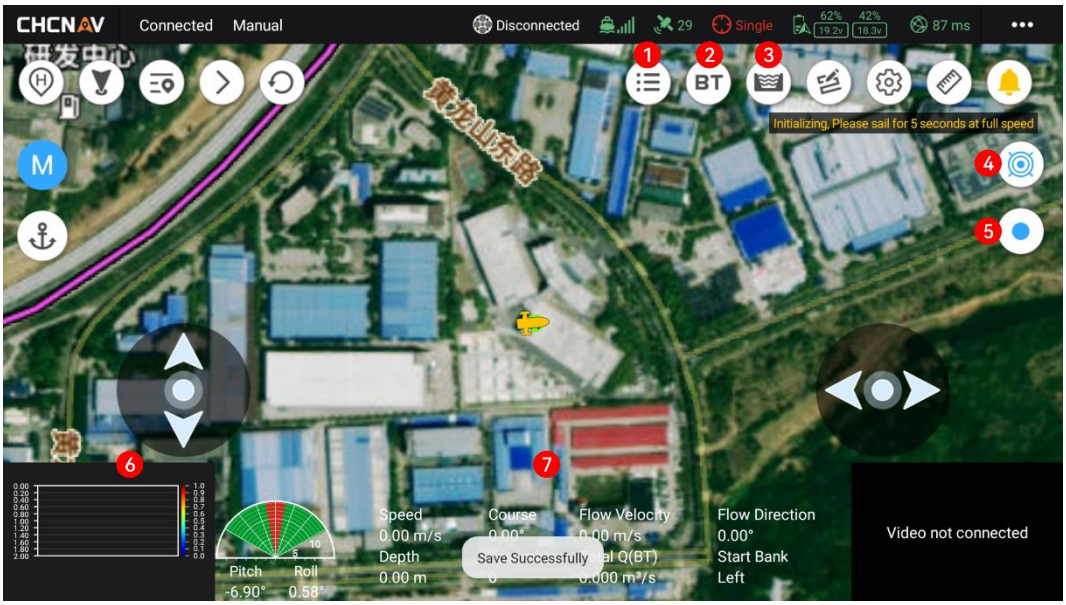


Figure 4.9: Hydrological test function buttons

1) Site traffic measurement information

Click this button to pop up the test task panel, you can view the test task and the test information under the currently selected task, and you can create a new test task.

Notes:

1. Don't reuse the same quiz task;
2. After you create a new task, you can open this panel to view the recorded measurements during the data recording process. Once you've reviewed it, you can click **[Continue]**.

---

2) Toggle the flow rate reference

Click this button to switch the flow rate reference between BT (Bottom Track), VTG, and GGA, and the icon will be displayed as the current flow rate reference.

3) Traffic summary table

Click this button to enter the traffic summary interface, where you can view the traffic summary table, traffic results table, and measurement test record table, and share and export. You can view and export the traffic summary information of historical test tasks.

4) **ADCP Launch/Stop**

Initiate or stop ADCP, start and end flow velocity measurements.

5) **Data logging/stopping**

Record and save quiz data.

6) **Flow velocity amplitude plot**

The depth information and flow velocity information of the river bottom during the navigation of the USV can be displayed.

7) **Common sensor information bar**

Speed, heading, flow velocity, flow direction, water depth, current rate, total flow, starting shore.

8) **ADCP connection status**

Displays the connection status of the current ADCP in real time.

4.8 HYDROGRAPHIC SURVEY PARAMETER SETTINGS

4.8.1 WORKING PARAMETER SETTINGS

The working parameters of the ADCP can be set on the working parameter setting page to calculate the flow information. The working parameters can be manually set for flow rate reference, bottom tracking, GGA, VTG, transducer draft, whether to enable external compass, external compass offset, and whether to connect external sounder. The setting takes effect in real time, and after setting, you can view the corresponding flow velocity amplitude map change in the lower left corner of the map. In addition, during the data recording process, only the flow rate reference can be modified, and other parameters cannot be modified. When the sounder is abnormal or not connected, the external sounder option cannot be modified.

1) **Flow rate reference**

   After the ADCP is successfully connected, you can manually switch between *Bottom Track*, GGA, and VTG.

2) **Transducer draft**

   Can be entered manually in meters

3) **External compass**

   When the outer compass is enabled, manually enter the offset of the outer compass in -° .

4) **External sounder**

   When the external sounder is activated, the bathymetric data measured by the sounder is obtained, and when it is turned off, the bathymetric data measured by the ADCP is obtained.

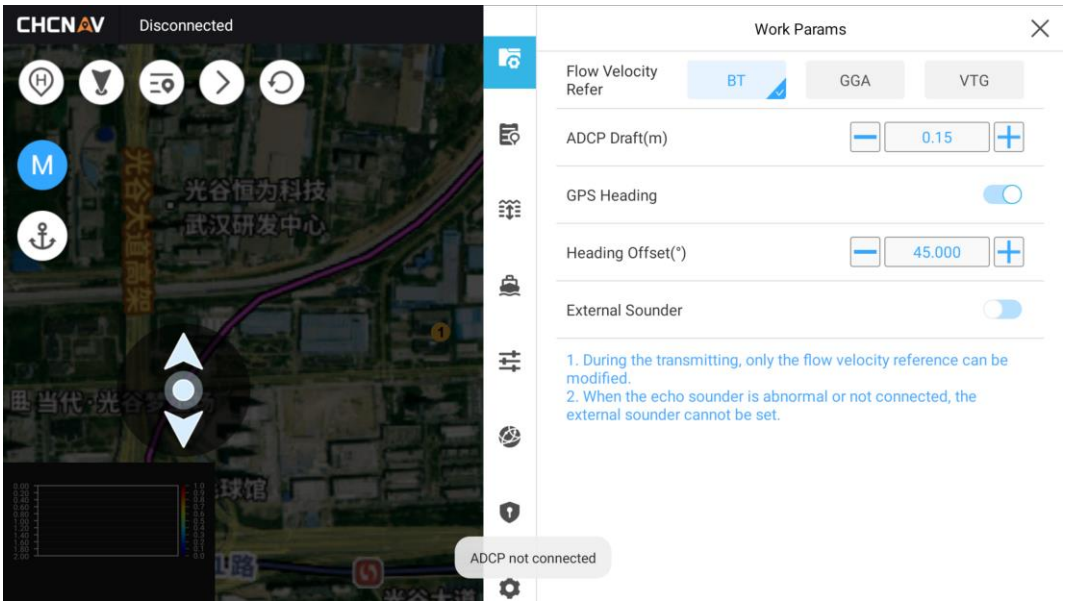


Figure 4.10: System Settings - Operating Parameters

4.8.2 SITE INFORMATION SETTINGS

The Site Information Settings screen is used to set the details of a hydrological test item. You need to manually enter the relevant information of the site, including the station name, station number, river name, and measurement unit information, including the measurement unit, measurement location, operator, survey ship number, water system, and remarks information.

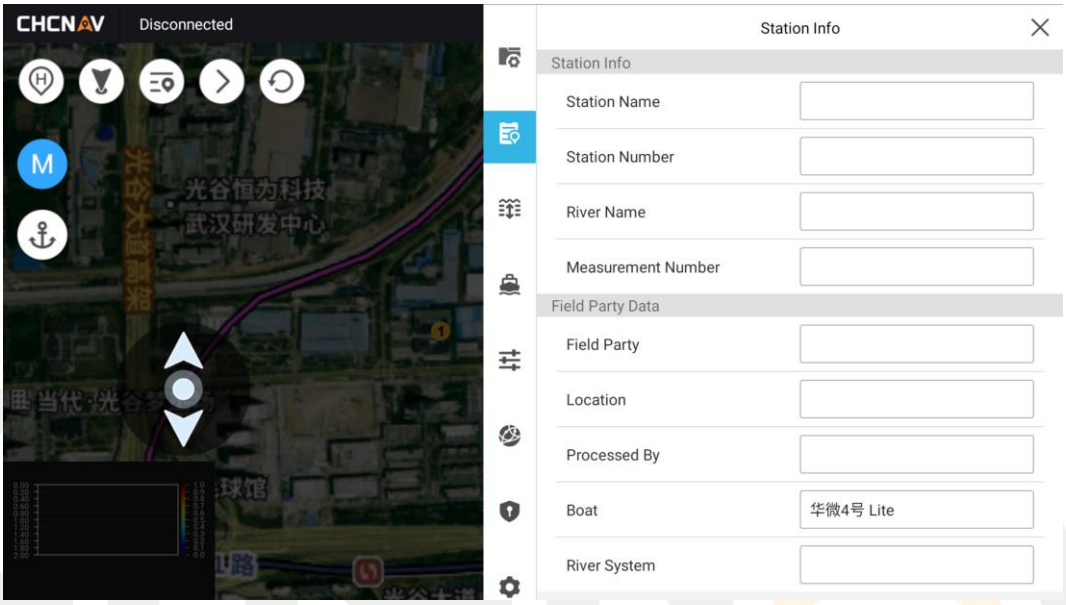


Figure 4.11: System Setup - Site Information

4.8.3 GENERAL SETTINGS

The general settings in hydrographic survey mode are the same as those for topographic surveys and are not covered in detail in this section.

4.9 HYDROLOGICAL DATA OUTPUT AND PROCESSING

After performing the hydrological test task, the recorded data will be given in the form of The *PD0* format is saved, while the bottom of the main interface displays a real-time flow velocity amplitude plot along with some key parameters. By clicking the Map Tool Flow Summary Table button, you can view the measurement test loading table, flow result table, and flow summary table specified in the **[Acoustic Doppler Flow Test Specification]**, and you can also export the Excel table and share the test data.

4.9.1 FLOW RATE FILE

The flow velocity file records the ADCP flow velocity measurements and is saved as*PD0* format. It is stored in the file directory of the quiz task. Flow rate files are stored in binary mode, and the data includes flow rate data, flow data, basic information, and depth data.

4.9.2 FLOW AGGREGATION

The software supports real-time generation of traffic reports, and at the same time, the corresponding tables are generated in real time according to the selected measurements. Click the **[Traffic Results]** button of the map interface tool to pop up the traffic summary page. The traffic summary interface contains three tables, namely the traffic summary table, the traffic results table, and the measurement test loading table. The user views the recorded measurements according to the traffic summary table and selects the measurement data that meets the requirements. Open the measurement selection interface through the **[Select Measurement]** button in the upper right corner to select the required measurement data, regenerate the table data, switch the **[Report Type]** to select the export process result table or the measurement test loading table, and switch different **[Flow Rate Reference]** to generate the data under the corresponding flow rate reference. Finally, the data is exported and shared.

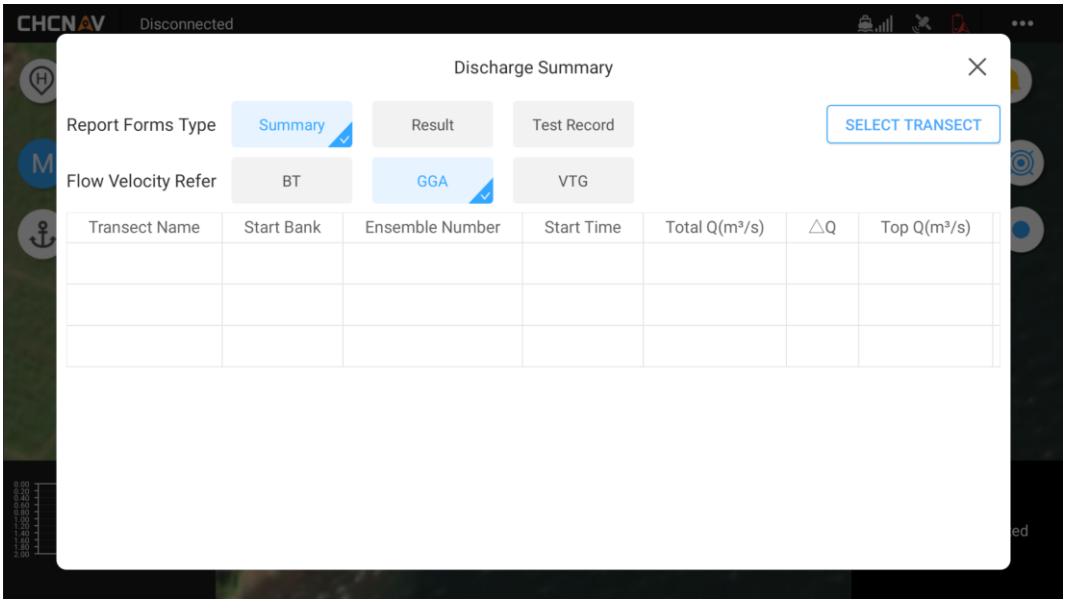


Figure 4.12: Traffic Summary Table

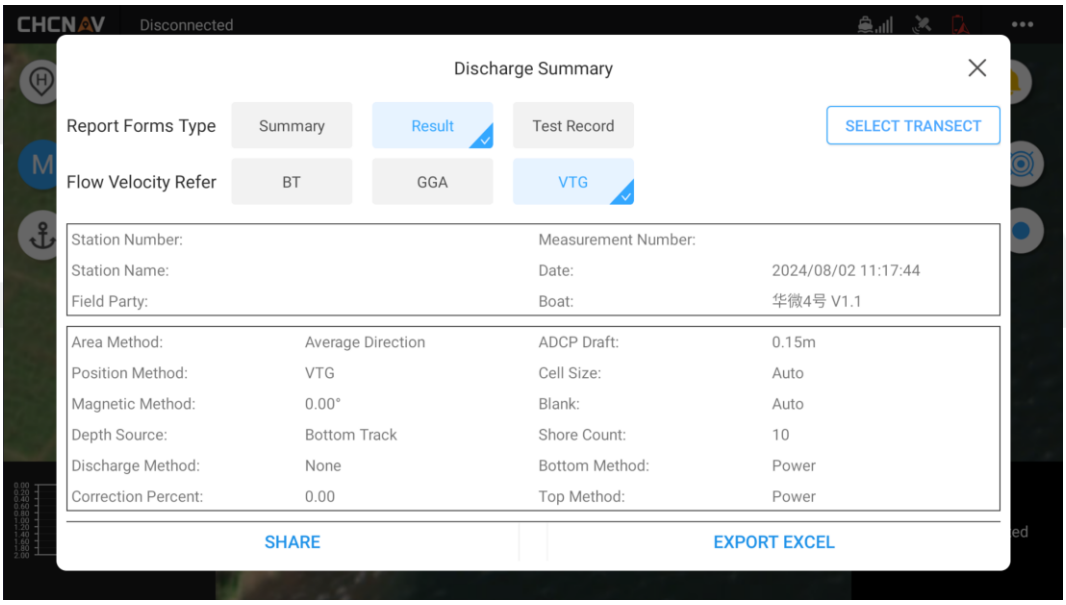


Figure 4.13: Flow results table

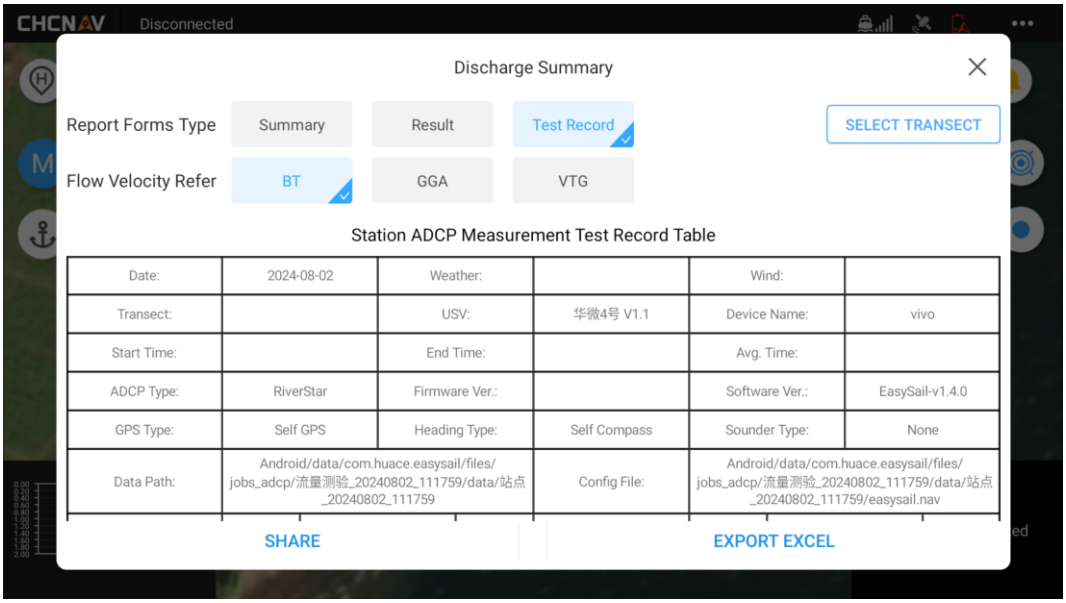


Figure 4.14: Flow Test Record Table

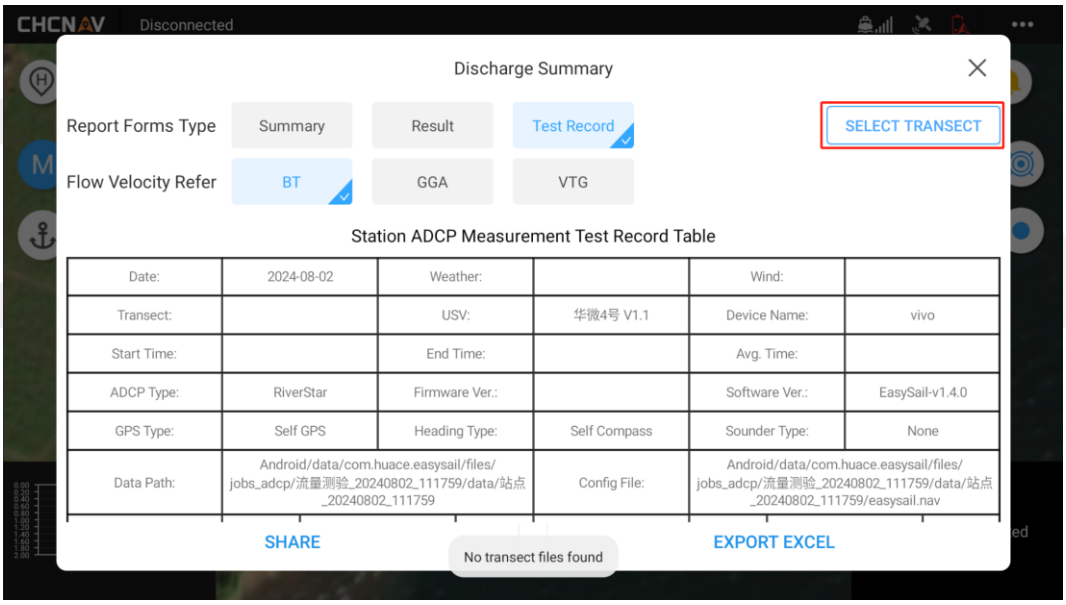


Figure 4.15: Measurement selection

4.9.3 DATA EXPORT AND SHARING

The software provides tabular data export and sharing functions, after selecting the data that meets the requirements, the user selects the corresponding data table type and flow rate reference, and clicks the **[Export Excel]** button to pop up the corresponding data report to the Excel file, and there will be [Export Successful] after the export is completed. As a reminder, the path to the export file is displayed at the bottom. After the export is successful, click the **[Share]** button to share the interface, select the Excel file to be shared, click **the [OK]** button, and share the Excel file through the generated

four-digit sharing code.

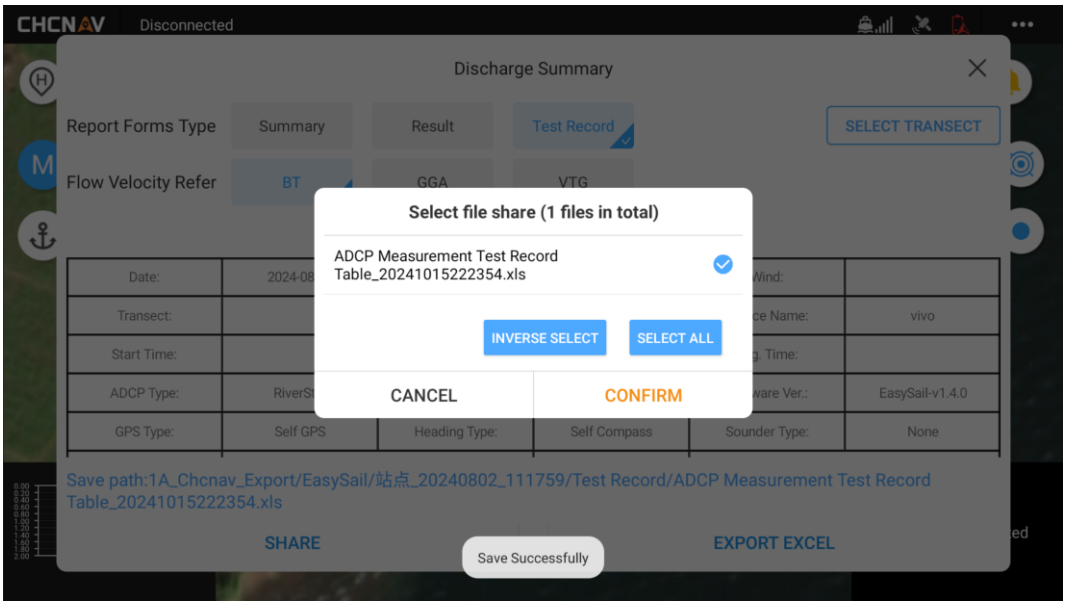


Figure 4.16: Results sharing

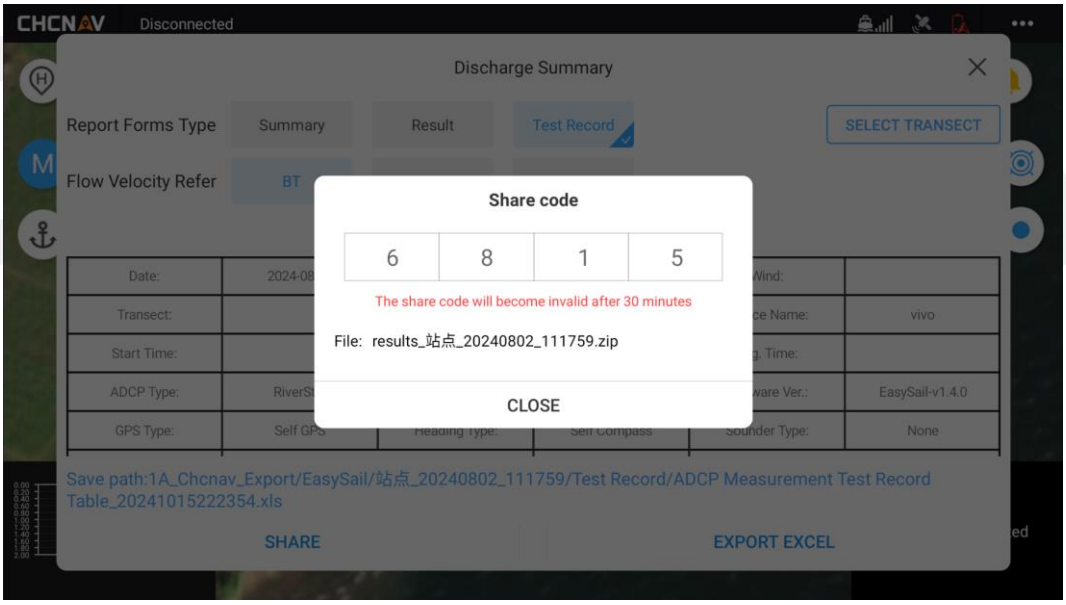
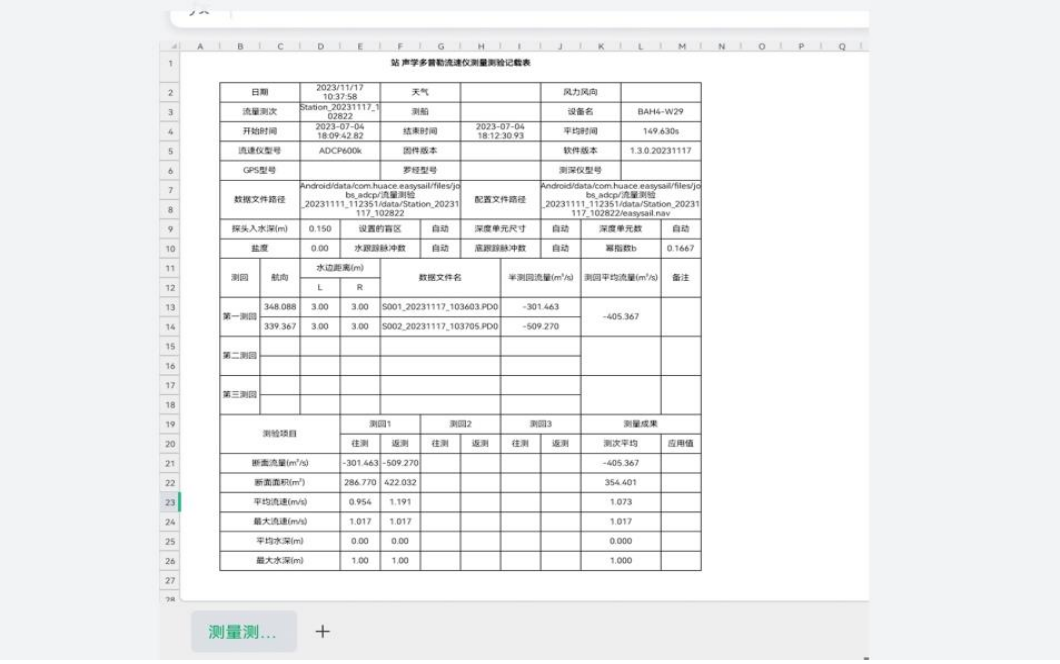


Figure 4.17: Survey File Selection Sharing Page



站声学多普勒流速仪测量测验记载表

日期	2023/11/17 10:37:58	天气		风力风向	
流量测次	Station_20231117_102822	测船		设备名	BAH4-W29
开始时间	2023-07-04 18:09:42.82	结束时间	2023-07-04 18:12:30.93	平均时间	149.630s
流速仪型号	ADCP600k	固件版本		软件版本	1.3.0.20231117
GPS型号		罗经型号		测深仪型号	
数据文件路径	Android/data/com.huace.easysail/files/jobs_adcp/流量测验_20231111_112351/data/Station_20231117_102822		配置文件路径	Android/data/com.huace.easysail/files/jobs_adcp/流量测验_20231111_112351/data/Station_20231117_102822/easysail.nav	
探头入水深(m)	0.150	设置的盲区	自动	深度单元尺寸	自动	深度单元数	自动
盐度	0.00	水跟踪脉冲数	自动	底跟踪脉冲数	自动	幂指数b	0.1667

测回	航向	水边距离(m) L	水边距离(m) R	数据文件名	半测回流量(m^3/s)	测回平均流量(m^3/s)	备注
第一测回	348.088	3.00	3.00	S001_20231117_103603.PD0	-301.463	-405.367	
	339.367	3.00	3.00	S002_20231117_103705.PD0	-509.270		
第二测回							
第三测回							

测验项目	测回1 往测	测回1 返测	测回2 往测	测回2 返测	测回3 往测	测回3 返测	测量成果 测次平均	测量成果 应用值
断面流量(m^3/s)	-301.463	-509.270					-405.367	
断面面积(m^2)	286.770	422.032					354.401	
平均流速(m/s)	0.954	1.191					1.073	
最大流速(m/s)	1.017	1.017					1.017	
平均水深(m)	0.00	0.00					0.000	
最大水深(m)	1.00	1.00					1.000	

测量测... +

Figure 4.18: *Excel* results table viewing

4.9.4 REAL-TIME OUTPUT

The software provides the function of real-time display of flow velocity data, and the user can click on the flow velocity amplitude map window at the bottom left of the map interface to enlarge the window during the collection process, and the flow velocity amplitude map displays information in real time during the recording process, including water depth, flow velocity, surface depth, bottom depth, river bottom depth and other information, and randomly tests the task for dynamic changes. Click the parameters at the bottom of the map interface to enter the parameter detail interface, which displays data such as flow information, hydrological information, and ADCP information in real time.

Figure 4.19: Flow velocity equivalence graph full-screen page

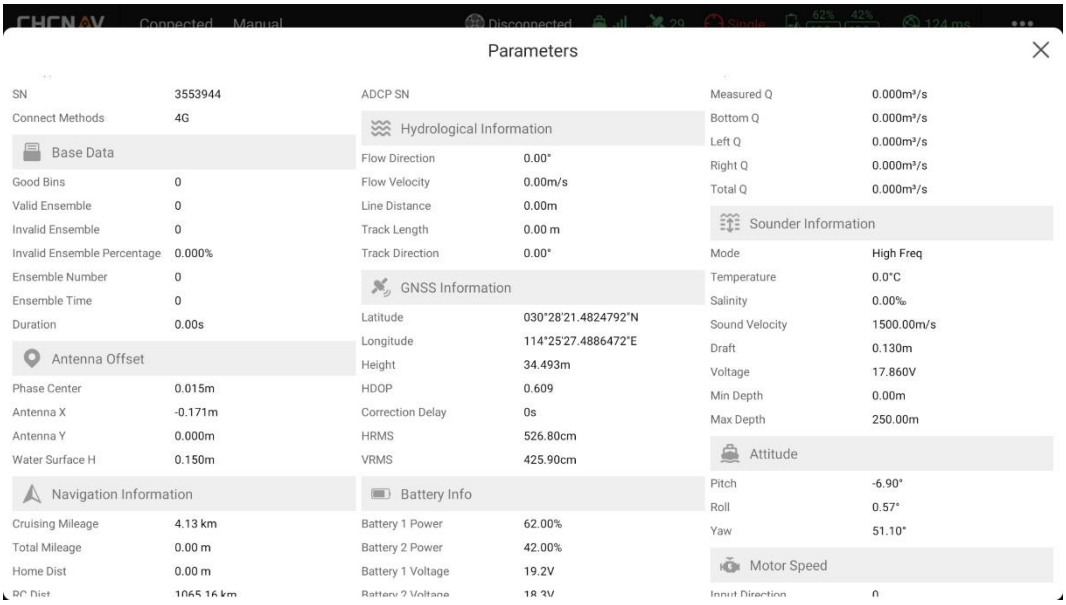


Figure 4.20: Detailed parameters

4.9.5 HISTORICAL DATA BACKTRACKING

The software supports viewing the elapsed data of the last test, after entering the test project, select the test task, and then click the traffic summary button to view the last test data, note that you can only view the last recorded test data, for example, the first time two times recorded, the second time three times recorded, the third time after entering the test project to select the test task, you can only view the second test data, so it is generally recommended to create a new test task when starting a new test task.

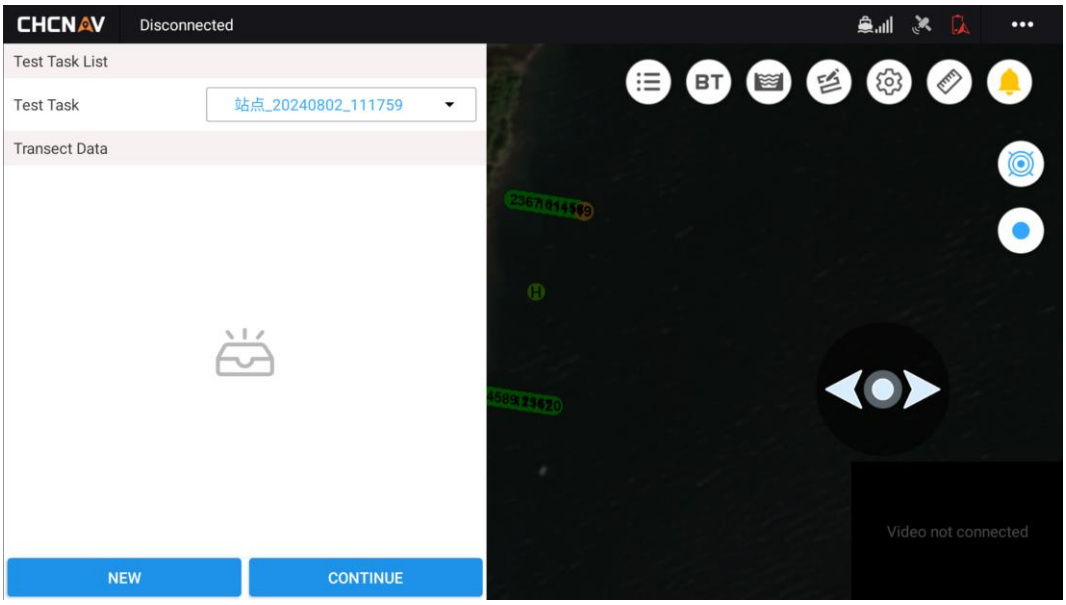


Figure 4.21: List of quiz tasks

CHCNAV
EASYSAIL

5. SOFTWARE SETTINGS

This section describes the general settings for *EasySail* software

CHCNAV
05.

5.1 COMMON SETTINGS - SI UNIT SETTINGS

Temperature and distance units can be switched in the general settings interface.

1) **Distance units**

   Meters, international feet, United States feet can be set.

2) **Temperature unit**

   It can be set in degrees Celsius °C and °F degrees Fahrenheit.

3) **Flow Units**

   Cubic meters per second, cubic international feet per second, cubic United States feet per second.

4) **Area units**

   square meters, square international feet, square United States feet.

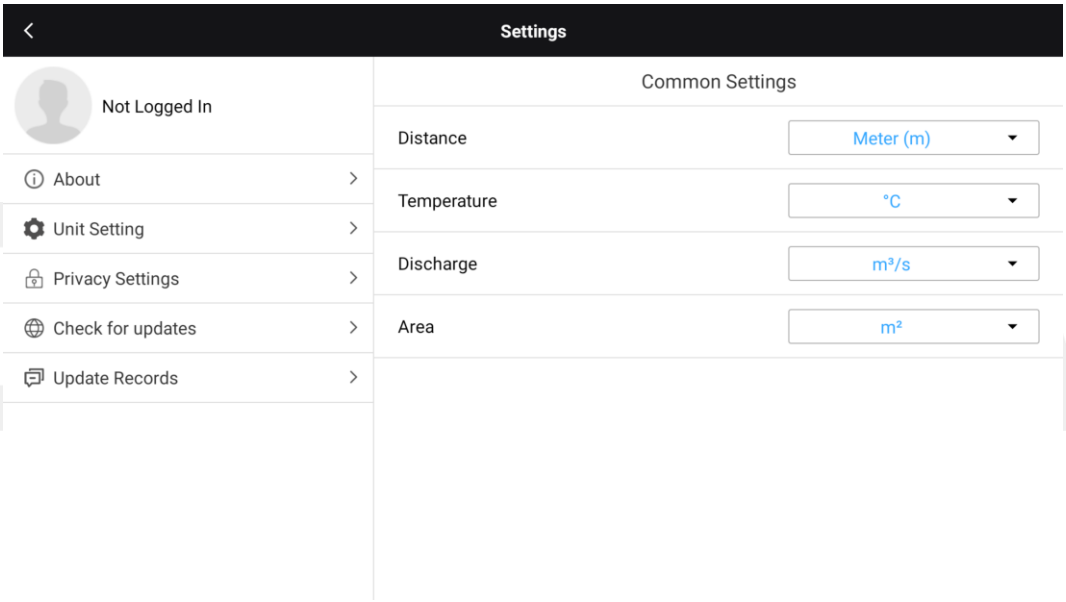


Figure 5.1: Software General Settings

5.2 PRIVACY SETTINGS

Displays the necessary permissions and information necessary for the operation of this software.

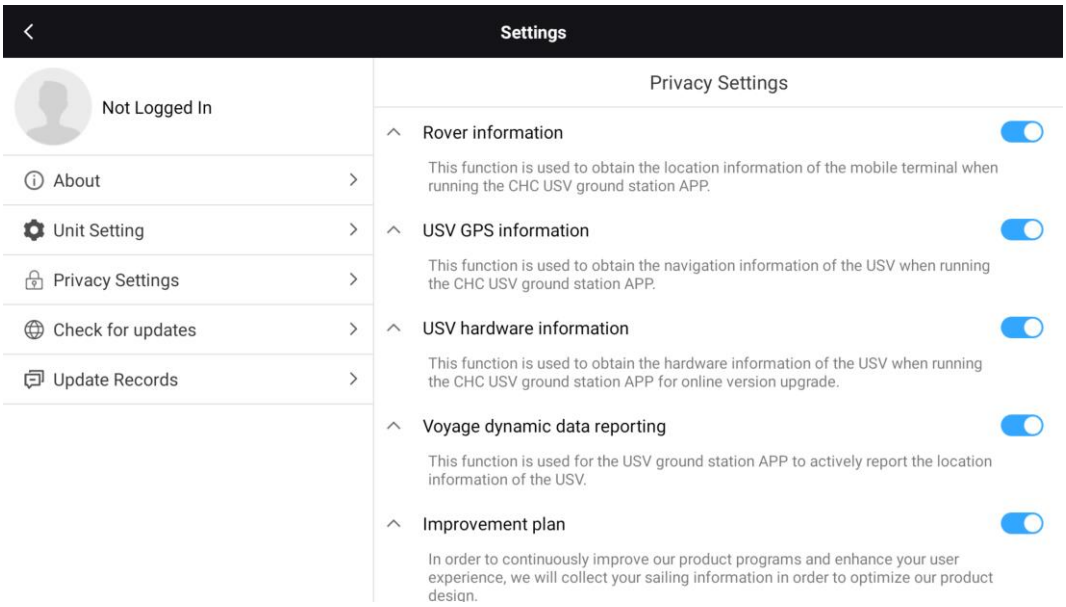


Figure 5.2: Software privacy settings

5.3 CHECK FOR UPDATES

Check the update interface to check the app version number, sounder firmware version number, GD100 platform firmware version number, control firmware version number, check and update app version and firmware version.

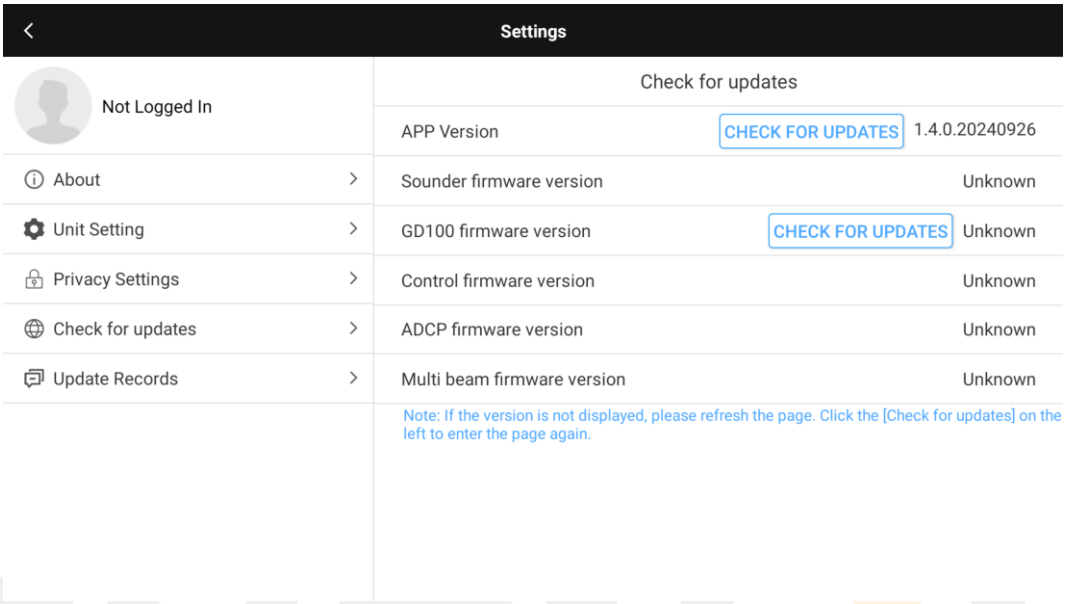


Figure 5.3: Checking for updates

5.4 IMPRINT

You can view the change notes for each version in the release notes.

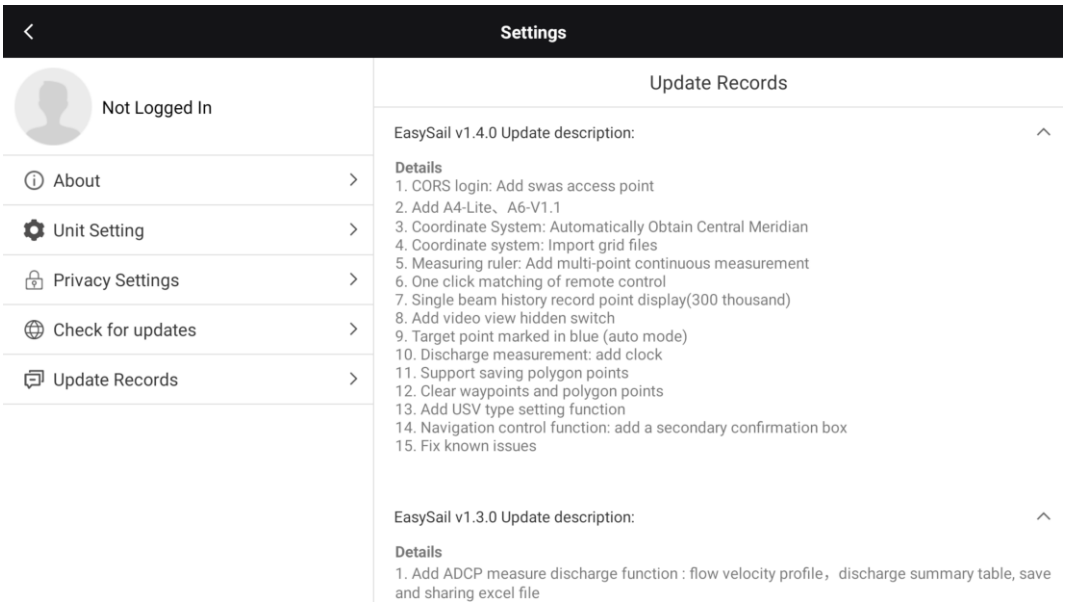


Figure 5.4: Release notes