

Revision History

Date	Revision Description (Reason/What)	Updated by
7/27/2023	This document was updated and adapted with a lot of identical information from the S250 Boat Book. Major updates were applied to the entire document	Fernando Ortiz/ LT Debroisse

CONTENTS

1. OVERVIEW	2
2. Secure Interference Sources.....	5
3. POS-MV STARTUP.....	14
4. Kongsberg STARTUP	24
5. HYPACK SETUP (No updates in March 2023).....	34
6. Hypack Auto Line Setup (If used)	38
7. Creating and Importing a .TIF from Caris into Hypack	41
a) Work Instructions.....	41
8. Sound Speed Manager Startup / Setup.....	45
Appendix I Lower 48 UTM Zones.....	52
Appendix II SOUND SPEED MANAGER SETTINGS AS OF 07/2023	53
Appendix III SIS Screen Shots.....	57
Appendix IV Familiarization with the Boat 2702 Network.....	64
Appendix V Daily Acquisition Log	65
Reference: Setting up the Data Transfer Folder	66

1. OVERVIEW

The purpose of this document is to ensure the consistent repetitive startup of critical survey equipment. Following all steps ensures uniformity between our data products.

Kongsberg EM-2040P Sonar Background and Author's Notes:

The Kongsberg EM2040 is installed on the starboard side, attached to an approximately 18" bracket below the hull. The sonar extends approximately 15" (38 cm) below the keel the launch. The Coxswain must always be aware of this and take extreme care for debris in the water and shoal areas. It has been tested that under relatively calm conditions, data quality is best under speeds of 9 knots, although along-track data density requirements should also be considered for maximum survey speed.

The sonar is an EM 2040P which operates at these frequencies: **200 kHz, 300 kHz, and 400 kHz**. Kongsberg sonars are operated via the proprietary software Seafloor Information System (SIS).

The Acquisition machine's login is as follows:

Login user name: **2702** password: **Ferdinand24***

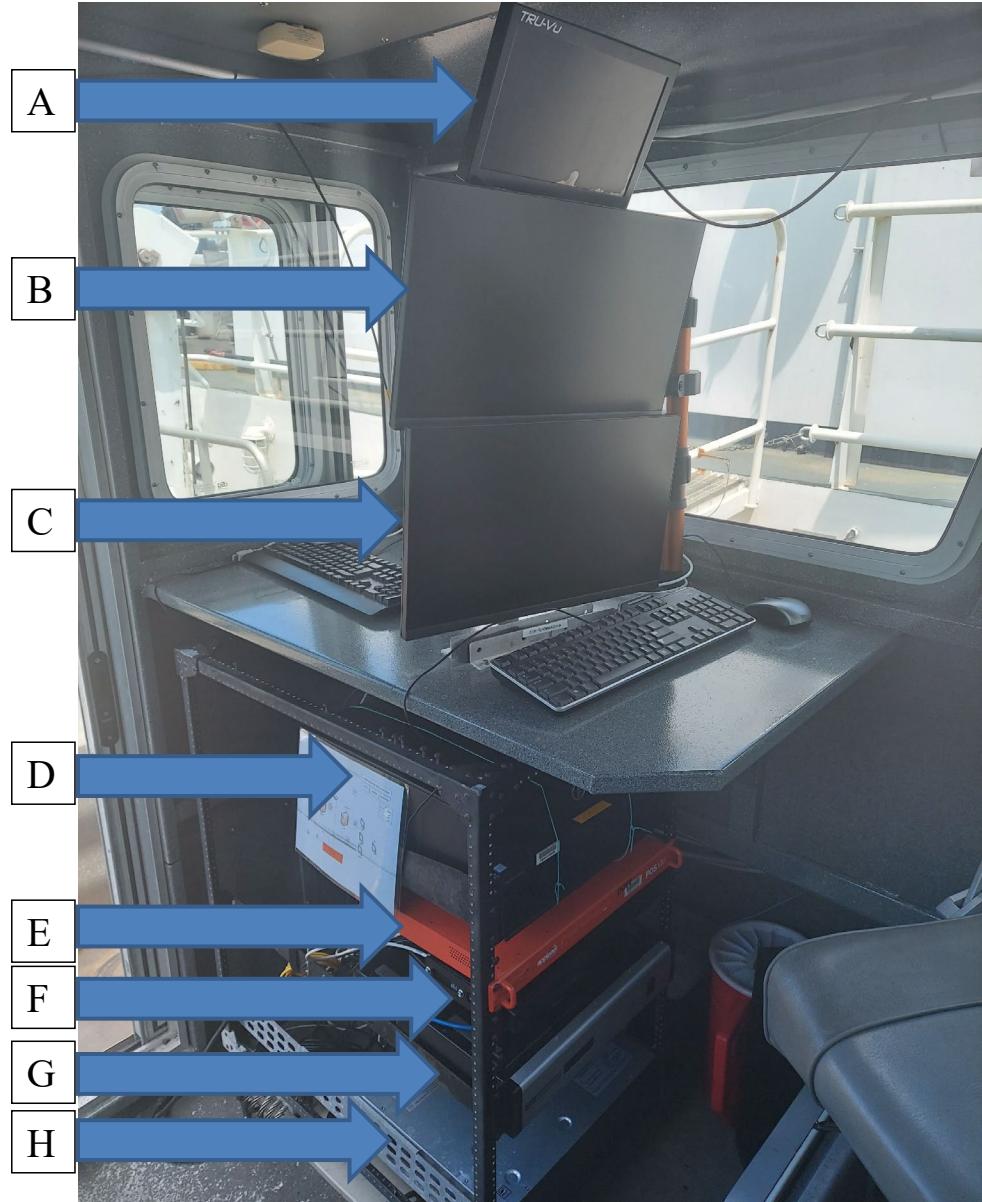
Security questions and Answers

Born: **New castle**

Nickname: **Coast Survey**

Pet name: **2702**

Survey Equipment



Commented [PJD1]: Update

Acquisition Station overview (See image above)

- A. Repeater screen to the Coxswain's TruView monitor
- B.C. Main monitor set where the SIS and Hypack – HySweep are displayed.
- D. Acquisition Station Computer. (Hypack and MV POSView, and Sound Speed manager)
- E. Applanix POS M/V
- F. Kongsberg Hydrographic Work Station (HWS).
- G. EM Processing Unit
- H. UPS

Starting everything up will occur in the following order:

- 1) UPS Unit
- 2) Acquisition Station Computer
- 3) POS M/V
- 4) Kongsberg HWS
- 5) EM Processing Unit

The following steps guide you through the startup process.

2. Secure Interference Sources

Secure the launch echo sounder (from the panel under the helm in the coxswain area). Failure to do this may result in noise in the sonar data. It is pertinent that the nadir depth is shown to the coxswain via HYSWEEP on the coxswain's display monitor.

Inverter Power – the Xantrex Freedom XC/2000 Sine Waver inverter normally remains ON when connected to shore power and when underway using the engines. This inverter will govern the DC/AC conversion as well as trickle charge both batteries (one for the ENGINE and one for the HOUSE), and supplies power to anything connected to the INVERTER panel up forward on the launch. If the Launch is left alongside w/o a connection (e.g. shipyard) for a long time, then turn this off (otherwise it will use a very small amount of power to monitor things, which may drain the batteries depending on how long (days) it sits without power. The image to the right is the screen on the inverter when on shore power and charging.



INVERTER breaker- powers all AC systems
(including survey)

Make sure this ON.
Otherwise the UPS
will not work

- a. 2702 Power distribution Box Configuration IN the DAVIT (on shore power) – this is also the same configuration you want when powering on survey equipment while in the davit to work on the computer, troubleshoot survey hardware that you need powered on etc. – no need to change anything here while in the davit on shore power.

Survey System Startup



HOUSE power – your Survey equipment on the racks, including the POS MV, PC, Sonar, power outlets, etc..

- b. Power distribution Box Configuration for IN the WATER (for underway surveying etc.)-
Everything is in the ON position (House, Engines, and inverter). This is also labeled under each switch itself. If you are just going to power on Boatee-boat things (e.g. personnel transfer, taxiing, etc.) you don't NEED to turn on the HOUSE power (bottom left red turn switch), only the ENGINE power (bottom right). But it won't hurt anything to turn them both on.
- c. Forward Panel settings for in the Davit and just on Shore power charging, not powering on Survey equipment.



- d. Forward Panel settings for in the Davit and just on Shore power charging, powering on and using Survey equipment.



- e. These breakers energize the outlets the equipment is connected to. The outlets are located behind the rack.



Once the launch is in the water, do the following to prepare the survey hardware on board for acquisition: Inverter Breaker Panel (located on the forward console of the launch Port side) - Turn on the left three left breaker switches (at least) to the ON position. You can turn all of them on, but two are just spares.

Rack Hardware Startup:

On the Rack, on the bottom – turn on the Uninterrupted Power Supply (UPS – just enough juice in case something happens with power and you need to save and close down your survey progress). On the Rack, turn on the Acquisition PC located in the topmost position of the rack (power button is on the front, upper Right). Allow it to boot and then login (the password is labeled on the monitor in the launch at the top).

On the Rack, turn on the POS MV/ Orange unit that is above the Kongsberg Processing Unit

On the Rack, power on the Kongsberg HWS (the small black box) and EM Topsides Processing Unit (the silver unit).

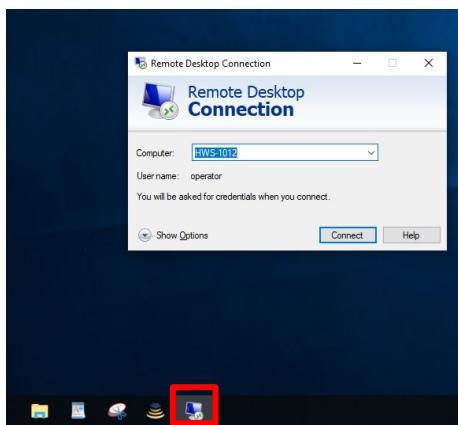


Survey System Startup

On the Coxswain panel (located beneath the helm) turn on the switch labeled 'TruView' in order to power coxswain screen.



Once everything is booted up, there is a remote connection between the EM2040P Hydrographic Work Station and the Acquisition Station Computer used during ACQ. Open it and log in.



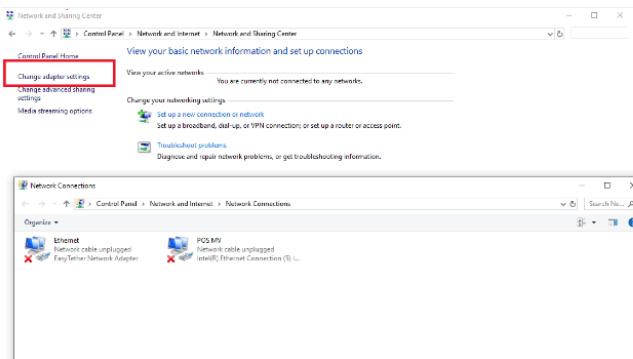
Computer: HWS-1012
Password: Ferdinand24*

1. Network set up, network settings, & integration

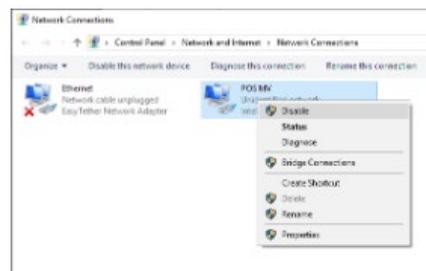
The following is a description on how the entire launch network setup should be. So unless something was uninstalled and/or removed, the system will have everything set and will only need to be powered on using the steps in the previous sections.

The launch 2702 acquisition PC is not, and should not be, put on the OMAO network, so **do not** activate windows etc. when prompted. Otherwise this will change and, most likely, nothing will be able to talk without always logging in as admin (ET credentials and CAC). You will need administrative rights *IF* the acquisition machine is on the network.

The quickest way to this location is through the control panel → Network and Internet → Network and sharing. Then select the option “change adapter settings”



For each Ethernet connected to the Acquisition machine, the network connected will be displayed as the image above. If it is not connected, or powered off, there will be a red X over the network. If there is a red X then you need to make sure the Ethernet cable is connected. If the icon and text is grayed out, the network is disabled. Right click and “Enable” if necessary.



If the networks are not named, they will appear as Ethernet 1 and 2 (from a reinstall etc.) You can rename them. Click on the Ethernet network you want and press "F2". This will allow you to rename the network.

To ensure that the correct Ethernet network is talking to the correct machine, follow the steps below and refer to the 2702 wiring diagram (located on the network and at the back of this document):

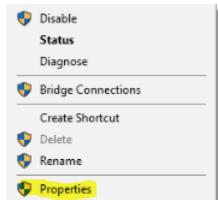
- Unplug all Ethernet cables from the Acquisition machine
- Plug in ONLY the POS Ethernet
- Ensure the Power is ON in the POS MV
- The Ethernet connection that no longer has a red X is the connection for POS MV
- Rename this Ethernet to POS MV
- Repeat these steps for the other Ethernet network and name it appropriately.

The next section will discuss networking each machine.

POS MV (**the IP Address in the following windows setup image is the IP address of the PC connected to the POS/MV - the IP address of the POS itself (as seen in MyPOS View) is 129.100.1.232. In order to connect the PC to the POS unit(and not just monitor the POS), the PC connected to the POS has to have an Ethernet adapter created that has the same first 3 sections of the IP address the same as the POS (192.100.1.). On FH launch 2702 this is "129.100.1.231". For reference, see the wiring diagram at the end of this document or on the network: P:\Survey_Storage\12_FOO_Only\Wire_Diagram\2702_2023_Wiring_Diagram.pdf ***)).

POWER ON POS MV (press the power button until you see it light up)

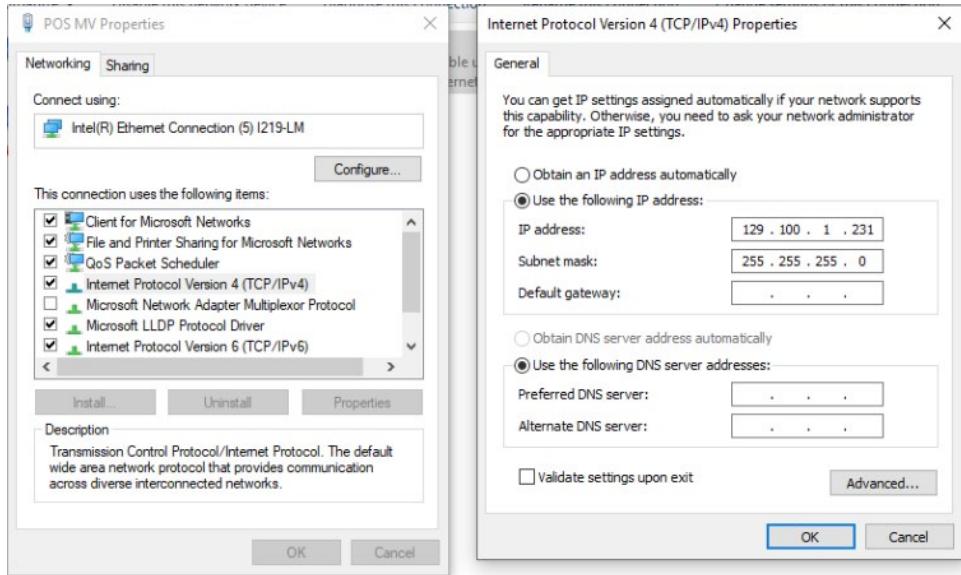
In the Network Connections "Right Click" on the POS MV network and open up Properties.



i. Within the Properties click on Internet Protocol Version 4, Select properties: Make sure the proper IP address and Subnet Mask is assigned as following:

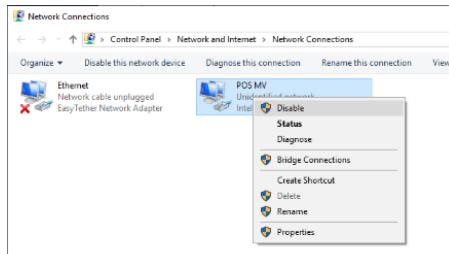
IP Address: 129.100.1.231
Subnet Mask: 255.255.255.0
Default gateway: Doesn't matter – can keep it blank

Survey System Startup



If you want to ensure that the networks was saved successfully, “right click” on the POS MV network in Network and Sharing and disable (this will turn the icon gray).

Then re-enable by right clicking on the icon again and click enable. This will reconnect the network. Repeat steps above to ensure the network has saved.



CMD prompt to ping the devices.

In the window search bar type “CMD” and open up “Command Prompt”

Within Command prompt type: ipconfig \all

This will show all the networks you have connected with their IP addresses, subnet mask and Default gateway

Ensure all the networks have the correct IP address, subnet mask and Default gateway

GENERAL TIP: to see the IP addresses of all the hardware IP addresses connected to the PC, at the CMD prompt type: arp -a (useful if you loan hardware (e.g. POS MV) and they change the IP address and don't tell you when you get it back):

The more You Know!

In order to see the IP addresses of all the hardware connected to the PC, at the CMD prompt type: arp -a This can be useful if you loan hardware, like your POS MV, to another ship and they change the IP address and don't tell you they did or what it is when you get it back and try to use it – without that information, you would never be able to your POS MV again.

```
Connection-specific DNS Suffix . : 
Description . . . . . : Intel(R) Ethernet Connection (5) I219-LM
Physical Address . . . . . : E4-54-E0-59-AF-5F
DHCP Enabled . . . . . : No
Autoconfiguration Enabled . . . . . : Yes
Link local IPv6 Address . . . . . : fc88::3503:ac74:45bb:83c2%12(PREFERRED)
IPv4 Address . . . . . : 129.100.1.231(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :
DHCPv6 TAID . . . . . : 00000000000000000000000000000000
DHCPv6 Client OUID. . . . . : 00-01-00-01-25-EC-59-9A-E4-54-E8-59-AF-5F
DNS Servers . . . . . : fe00::0:ffff:1:1
                      fe00::0:ffff:1:251
                      fe00::0:ffff:1:351
NetBIOS over Tcpip. . . . . : Enabled

Ethernet adapter Ethernet:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . :
Description . . . . . : EasyEther Network Adapter
Physical Address . . . . . : 02-60-54-74-68-73
DHCP Enabled . . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

C:\Users\l2702>arp -a

Interface: 129.100.1.231 ... 0xc
Internet Address Physical Address Type
129.100.1.255 ff-ff-ff-ff-ff-ff static
224.0.0.22 01-00-5e-00-00-16 static
224.0.0.251 01-00-5e-00-00-1b static
224.0.0.252 01-00-5e-00-00-fc static
239.255.255.250 01-00-5e-7f-ff-fa static
```

3. POS-MV STARTUP

- Turn on power POS M/V.



- FH logs to **Ethernet only**. Files are logged to the Acquisition Station Computer the local C:\GNSS_data\OPR-XXX-FH-YY\HXXXXXX\YYYY-DDD\ Folders.



- Open POSVIEW to ensure the proper IP address is entered.
 - i. POS **129.100.1.232**



*****IF THE POS MV/POSView IS ALREADY SET UP (should be), CAN SKIP TO “POS ACQUISITION” SECTION**

Setting up POS View

If the POS is not set up Load the POS CONFIG file (if this is the first time you are setting up POS Viewer or you are missing the CONFIG file skip to Setting up POS for the first time).

Open FILE->Load POS Config

- The Pos Config will be named POS_CONFIG_YYYY.NVM (or whichever year folder you find yourself when reading this).
- Located: P:\Survey_Storage\12_FOO_Only\Vessel_Config\2702 (or whichever year folder you find yourself when reading this).

Setting up POS for the first time

The launch 2702 Reference point is the Transducer, and the sonar EM2040P is fed by the POS MV through Hypack/Hysweep, as well as directly connected via COMM 1 and 2 from the POS MV to the EM2040P (see wiring diagram). As such, your offset values will need to be placed within the POS View:

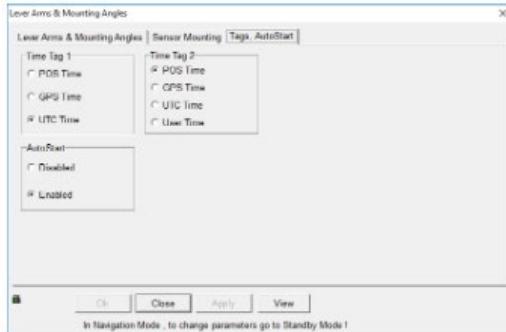
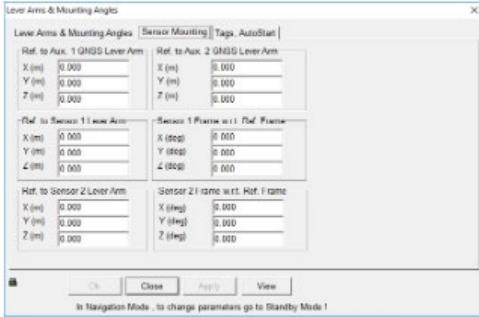
Set up Offsets

Settings – Lever arms and mounting

Lever Arms & Mounting Angles

Lever Arms & Mounting Angles		Sensor Mounting	Tags, AutoStart				
Ref. to IMU Target		IMU Frame w.r.t. Ref. Frame	Target to Sensing Centre	Resulting Lever Arm			
X (m)	0.744	X (deg)	0.700	X (m)	-0.008	X (m)	0.738
Y (m)	-0.244	Y (deg)	0.900	Y (m)	-0.031	Y (m)	-0.277
Z (m)	-0.916	Z (deg)	-0.100	Z (m)	0.130	Z (m)	-0.786
Ref. to Primary GNSS Lever Arm		Ref. to Vessel Lever Arm	Ref. to Centre of Rotation Lever Arm				
X (m)	0.220	X (m)	0.000	X (m)	0.000		
Y (m)	-0.766	Y (m)	0.000	Y (m)	0.000		
Z (m)	-3.441	Z (m)	0.000	Z (m)	0.000		
Notes:				Compute IMU w.r.t. Ref. Misalignment			
1. Ref. = Reference 2. w.r.t. = With Respect To 3. Reference Frame and Vessel Frame are co-aligned				<input type="checkbox"/> Enable Bare IMU			
<input checked="" type="button"/> Ok <input type="button"/> Close <input type="button"/> Apply <input type="button"/> View							
In Navigation Mode , to change parameters go to Standby Mode !							

Survey System Startup



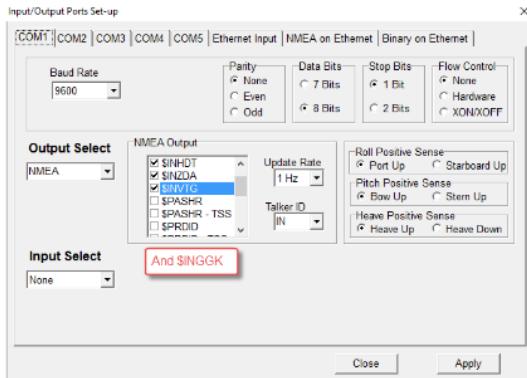
IMU w.r.t. reference frame box is where your Patch test offset values will be entered

Set up Comports

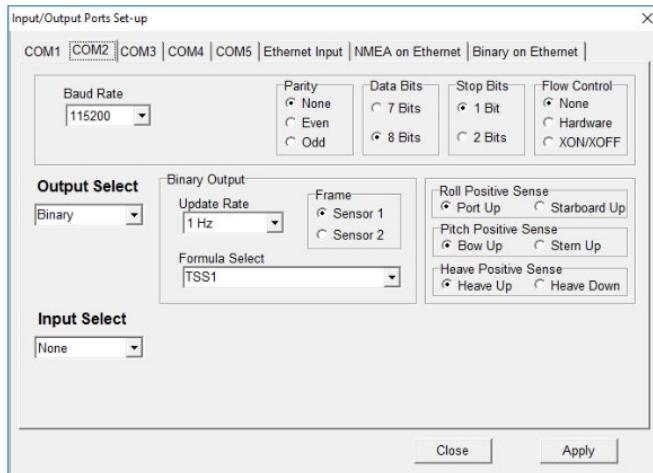
To ensure sonar EM2040P can communicate with POS set the following Comports to match the images below:

COM1, COM2, COM3, COM4 and COM5. Ethernet Input, NMEA on Ethernet and Binary on Ethernet

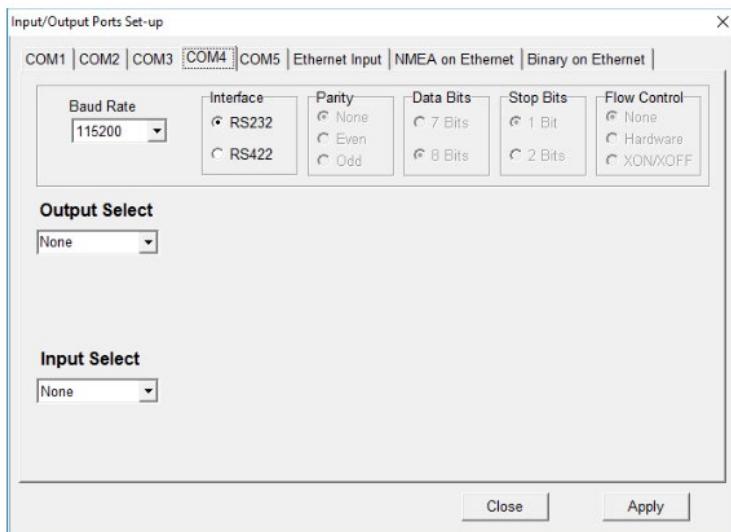
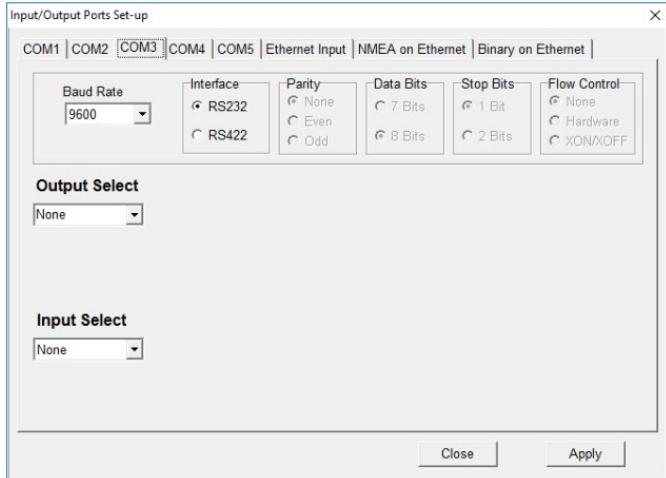
Survey System Startup

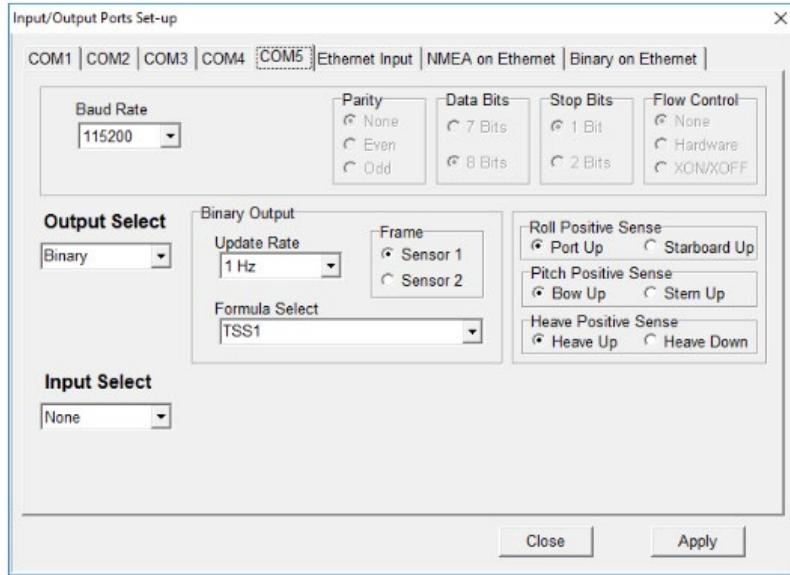


Make sure the \$INGGK is selected.



Survey System Startup





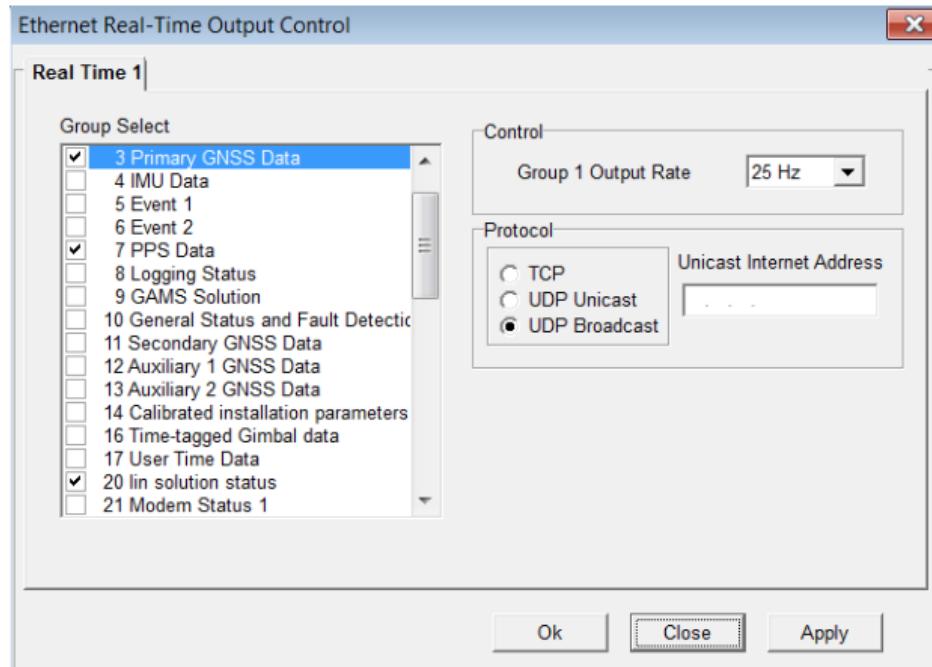
- Connect to POSMV by clicking on the connect button

Ethernet Logging...

- Select Logging -> Ethernet Realtime

Ensure the following messages are selected for broadcast with an output rate of 25Hz:

3. Primary GPS Data
7. PPS Data
20. lin solution status
102. Sensor1 navigation solution
111. Heave data
113. Heave data quality control

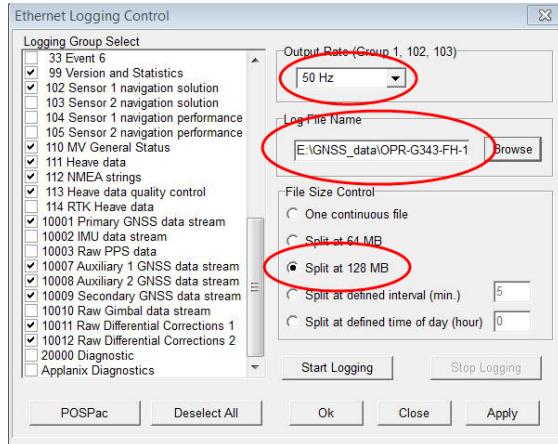


Select apply then close

Select **Logging -> Ethernet Logging**. Ensure the following logging groups are selected:

1. Navigation Solution
2. Performance Metrics
3. Primary GPS data
4. IMU Data
5. Event 1
9. GAMS Solution
10. General Status and Fault Detector
99. Version and Statistics
102. Sensor 1 Navigation Solution
110. MV General Status
111. Heave Data

- 112. NMEA Strings
- 113. Heave Data Quality Control
- 1001. Primary GPS data stream
- 1007. Auxiliary 1 GPS data stream
- 1008. Auxiliary 2 GPS data stream
- 1009. Secondary GPS data stream
- 1011. Raw differential corrections 1
- 1012. Raw differential corrections 2
- b. Set with an output rate of **50Hz**
- c. Set the file path for both the Port and STBD POS to log to the following location:
C:\GNSS_Data\OPR-XXXX-FH-YY\H#####\YYYY-DDD. File naming convention is
"YYYY_DDD_2702" **NOTE: PUT IN JUST THE FILENAME, NO EXTENSION.** The software will
append the .000, .001 etc. as it records files.
- d. File Size Control to "**Split at 128 MB**"
- e. Start logging data on the POS. Ensure data is logging by monitoring the file size in an explorer window. Refresh as necessary and ensure the file size is increasing.



- f. Press Start Logging and minimize the logging window.

After at least 5 minutes of continuous logging of POS MV data, you may commence with data acquisition.

Once finished with data acquisition, continue logging POS MV data for an additional 5 minutes after data acquisition is complete, click Stop Logging in the Ethernet Logging. At this point, the POS files are ready for application in the post-processing of true heave and/or SBET creation.

Survey System Startup

If any problems are experienced in the startup of the POS MV's that you suspect may be of a systems integration nature, call the FOO.

BEFORE AQUIRING ANY SONAR DATA!!!

- After at least 5 minutes of continuous logging of POS MV data, commence with MBES data acquisition.

AFTER YOU HAVE FINISHED LOGGING!

- Continue logging POS MV data for an additional 5 minutes after MBES data acquisition is complete, click Stop Logging in the Ethernet and or USB Logging Control windows. At this point the POS files are ready for application in the post-processing of true heave and/or SBET creation.
- If any problems are experienced in the startup of the POS MV's that you suspect may be of a systems integration nature, or call the FOO.

LOGGING INTERRUPTION OR ERROR:

- If there is any interruption in logging due to POS crash start everything up as you normally would.
- Name the POS files "YYYY_DDD_S250_A" continue down the alphabet if more crashes occur
- Wait 5 minutes after pressing "logging" before collecting any MBES sonar data.
- Contact the FOO and log the crash.

4. Kongsberg STARTUP

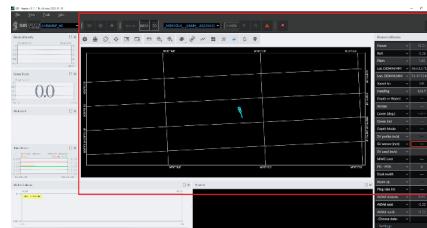
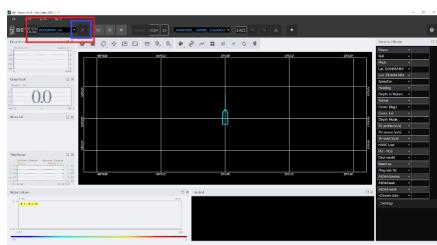
- Turn on the Kongsberg EM PU.



- Open SIS5 with an icon on the desktop. This brings you to the main display as shown below.



- Once the main Kongsberg screen will open. On the toolbar you should be able to click on the next to the selected echosounder. It may take a few minutes for the sonar to be available in SIS. In order to activate the sonar, the sonar head must be showing in the dropdown menu. Once the sonar is getting data from the POS, The positions and other various numerical displays will begin updating according to POS transferred information. See images below.



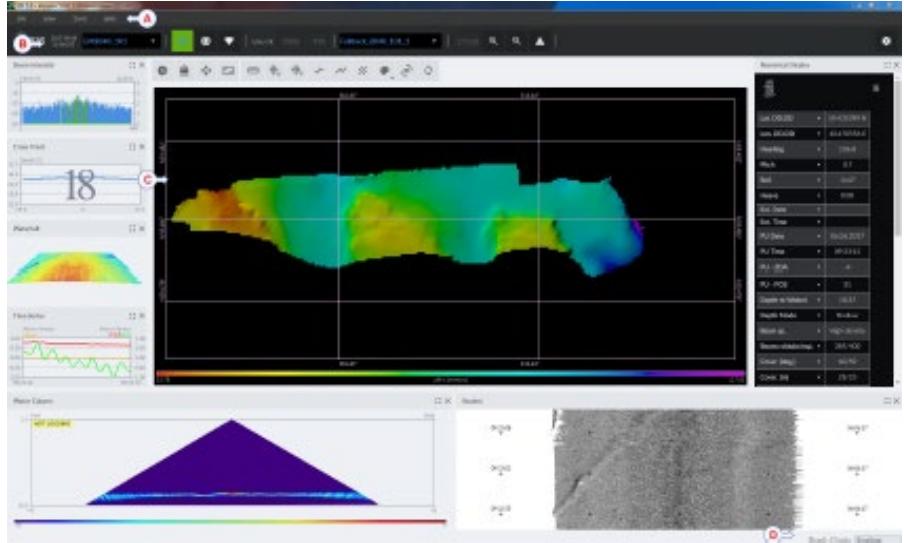
NOTE* If SIS crashes it may require to reboot the computer, or it more probably will require a hard reset of the PU's and a SIS shutdown prior to that. Inform the FOO.

Survey System Startup

A quick familiarization with the SIS system consists of specific visual elements that work together and the Top Toolbar.



- A** Logo and product name. This information identifies the brand and the product.
- B** Date and time See the current date and time in UTC.
- C** Echo sounder all the available echo sounders detected on the network at start-up are listed. There is a **#** in front of the detected echo sounders. This tag indicates that the echo sounder is not started. To start an echo sounder you need to select it from the list. The **#** tag is removed, indicating that the echo sounder has been selected.
- D** Run Select this button to start the selected echo sounder.
- E** Ping. The purpose of the Ping function is to enable or disable the SIS transmissions into the water. Such transmissions are often referred to as "pinging".
- F** Logging Select this button to start and stop logging. When the logging is on, raw data is stored to disk. The color of the button is green while logging and red when stopped.
- G** Water column logging Select this button to start and stop logging the water column data. When the logging is on, data is stored to disk. The color of the button is green while logging and red when stopped.
- H** Line count Select this button to start a new file with a new line number.
- I** Current line number shows the current line number.
- J** Time to automatic line change this section shows the time in minutes until a new file is started.
- K** Survey Select the survey, and see the selected survey in the list.
- L** Map scale this is the current map scale.
- M** Zoom in or out.
- N** Messages from the SIS system can be related to any type of hardware or software errors.
- O** Preferences Click to open the Preferences dialog box. (The depth measurement unit is meters and cannot be changed.)



A Main menu

The Main menu is located at the top of the presentation.

B Top bar

The top bar is located below the Main menu. The top bar contains information about which survey that is active, the selected echo sounder, and buttons that enable you to start logging and pinging, as well as the survey track line.

C Geographical view

The main purpose of the Geographical presentation mode is to show the geographical data.

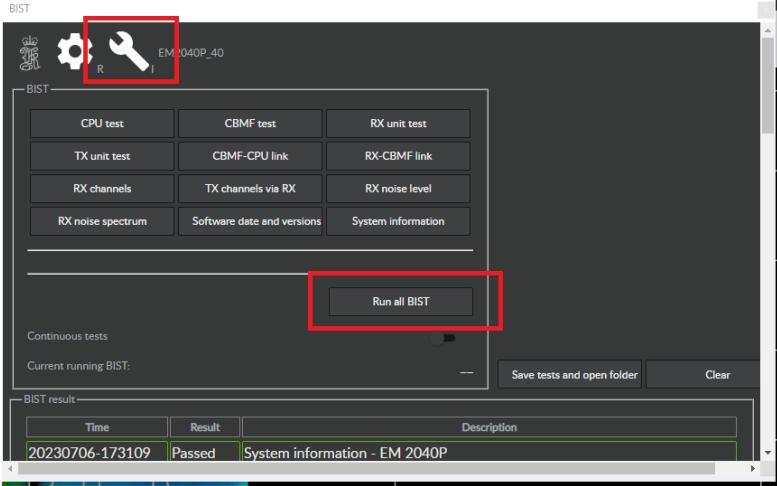
D Status bar

The status bar is located at the bottom of the presentation. You may select what to present on the status bar from the View menu.

d. Run a **BIST** before pinging.

Ideally, a BIST (Built-in Self-Test) should be run every day before acquisition, an appropriate time would be during the UTC Midnight switchover. **THE SYSTEM MUST BE STARTED AND PINGING OFF BEFORE TRYING TO RUN A BIST.**

Survey System Startup

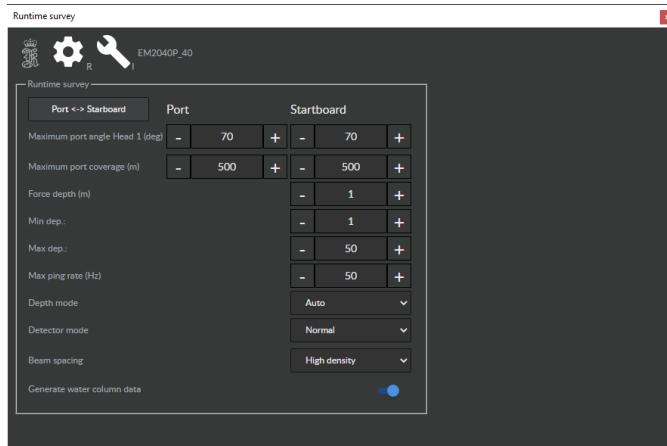


Once the test is done. An automatic temp folder will be created with some information similar to the one below. When the BIST test is completed, save the BIST test result by clicking the “Save BIST” button. The default directory to save to is on the C:\BISTS\). Just name the test with the current date or YYYY_DDD_BIST.

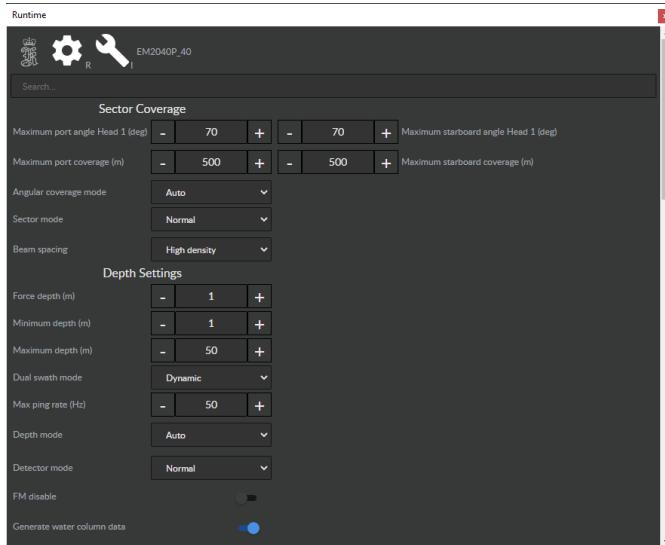
Name	Date modified	Type
20230706-173013-0-Passed-EM2040P_40-CPU-test----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173013-1-Passed-EM2040P_40-CBMF-test----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173013-2-Passed-EM2040P_40-RX-unit-test----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173028-3-Passed-EM2040P_40-TX-unit-test----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173031-4-Passed-EM2040P_40-CBMF-CPU-link----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173033-5-Passed-EM2040P_40-RX-CBMF-link----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173040-6-Passed-EM2040P_40-RX-channels----EM-2040P.txt	7/6/2023 17:30	Text Document
20230706-173102-7-Passed-EM2040P_40-TX-channels-via-RX----EM-2040P.txt	7/6/2023 17:31	Text Document
20230706-173106-8-Passed-EM2040P_40-RX-noise-level----EM-2040P.txt	7/6/2023 17:31	Text Document
20230706-173109-9-Passed-EM2040P_40-RX-noise-spectrum----EM-2040P.txt	7/6/2023 17:31	Text Document
20230706-173109-10-Passed-EM2040P_40-Software-date-and-versions---EM-2040P.txt	7/6/2023 17:31	Text Document
20230706-173109-11-Passed-EM2040P_40-System-information---EM-2040P.txt	7/6/2023 17:31	Text Document
20230706-173109-12-Passed-EM2040P_40-Save-BIST---EM-2040P.txt	7/6/2023 17:31	Text Document

e. Runtime parameters and survey settings

i. Survey parameter settings



ii. Runtime survey parameters



Survey System Startup

Runtime

Transmit control

Pitch stabilisation	<input checked="" type="checkbox"/>
Transmit angle along (deg)	- 0 +
Yaw stabilisation mode	Rel. mean heading
Heading filter	Medium
Frequency (kHz)	300kHz
Min. swath distance	- 0 +
External trigger	<input type="checkbox"/>

Survey System Startup

Runtime

Filters

Spike filter strength	Medium
Range gate size	Normal
Phase ramp	Normal
Penetration filter strength	Off

Special TVG

Slope filter

Aeration filter

Interference filter

Special amp. detect

Normal incidence corr: (deg) 10

Use Lambert's law

Transmit power level Normal

Water column X log 30

Water column TVG offset (db) 30

Add phase data Off

Sonar mode Off

Enable scope

Runtime

Simulator

Enable simulation

Simulator min depth (m) 5

Simulator max depth (m) 50

Simulator slant across (deg) 0

Simulator step along (%) 5

Sound Velocity

Sound velocity source Probe

Sensor offset (m/s) 0

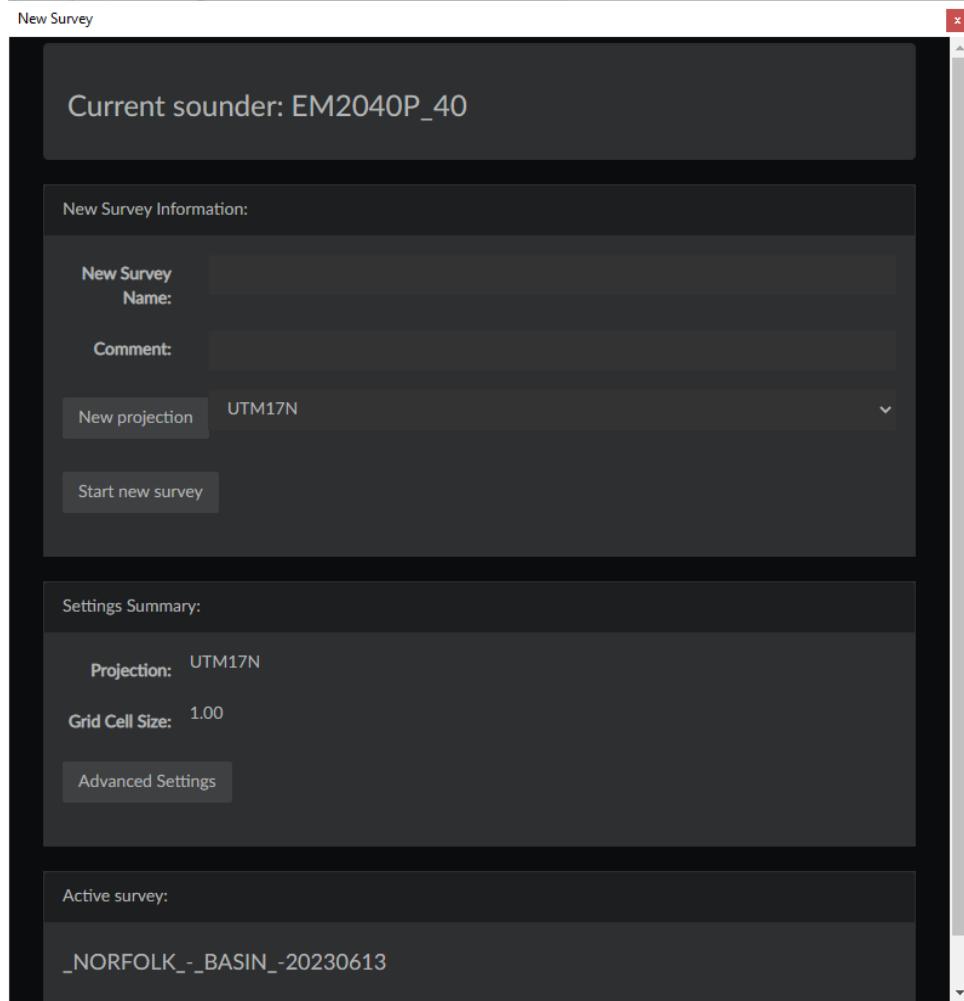
Filter (sec.) 60

Depth sensor

Depth sensor scale factor 1

iii. Creating a survey

Each sheet will need its own survey so that SIS knows where to log the .all files. In the **New Survey**, enter your sheet number followed by either a **_X** or **_M** (X for cross-lines, M for main-scheme). Change the **Number of grid cells in the settings summary to 1 - 4**.



Next, under **Advance Settings**,

Make sure the raw data files are set to the D: and C: drive as well as the survey data files

Check the boxes next to **SHIP**, **YEAR**, **MONTH**, and **DAY**. Next to Shipname enter **2702** and select **Save settings**.

Advanced Settings



Change advanced settings

Directory Management:

Data directory for raw
data files:

D:/sisdata/raw/

Data directory for
survey data files:

C:/sisdata/grids/

Storage-structure Management:

Data storage structure
for raw data files:

SURVEYNAME/SHIP/YEAR/MONTH/DAY

Clear structure

Select data storage
structure:

Year Month Day Name of ship Sounder type

Serial number

Shipname:

Name of ship:

2702

Append shipname to
raw-data files:



Save as:

Save Settings:

Save

Cancel

IMPORTANT: When you create a new survey you will need to start pinging and log one line or else the project won't work in the future. Delete the line after you set up the project.

Transferring files

SIS logs files on the Kongsberg computer on the **RawData (C:)** under **sisdata** so the .kmALL files will need to be copied from the C:\sisdata\RAWto a dedicated (and labeled) external HDD, and then plugged into a networked computer so the files can be transferred to the RAW (Q:) \YYYY\DATA_TRANSFER| folders for processing. Please see the [Data Management and Charlene Processing](#) document for detailed information.

Shutting Down SIS and the EM2040 PU's

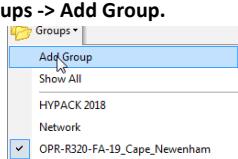
Ensure the sonar is "Not Logging" and "Not Pinging". In SIS either press File > Quit, or you can close SIS with the X in the upper right corner. Once SIS is closed, it is ok to power down the EM2040p PU in the electronics rack. Once data is transferred, the SIS machine can be shut down by going to start > Shutdown.

5. HYPACK SETUP (No updates in March 2023)

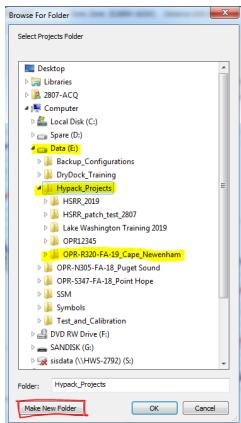
Hypack projects are held within Groups. We make a separate Group for each project, each year's HSRR activities and for any trainings or one off acquisition days. Each Group will have its own set of Geodetic Parameters that will automatically populate for any new project created within it. (This is why we need to create different groups.)

We save the Groups to the Data (D:).

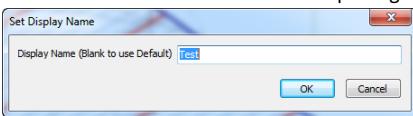
- Open the latest HYPACK 20XX project (Contact the FOO for what Hypack is the latest). The program will default to the last project that was open. To open a different project, Select the Project Manager tab and double-click on the Project you'd like to access.
- If you need to create a new group because you are starting a new project, Open **Hypack**. Select **Groups -> Add Group**.



- Browse to the Data drive and once you have clicked on **Hypack_Projects** select **Make New Folder**. Name it something that makes sense like **OPR-XXX-FH-YY_Location** or **Location_Training_YYYY**.



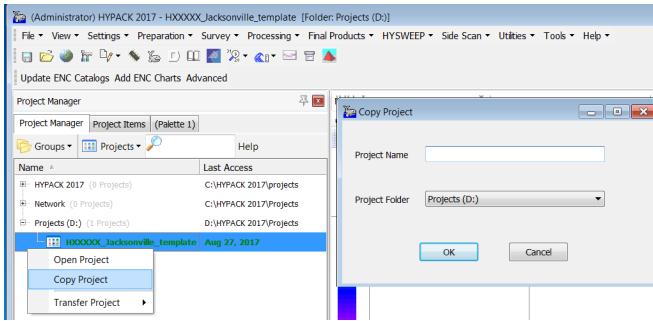
- You will also need to set the display name; this can be anything but you might as well make it the same name as the folder to keep things simple.



- Now you are ready to create a Project within your new Group.

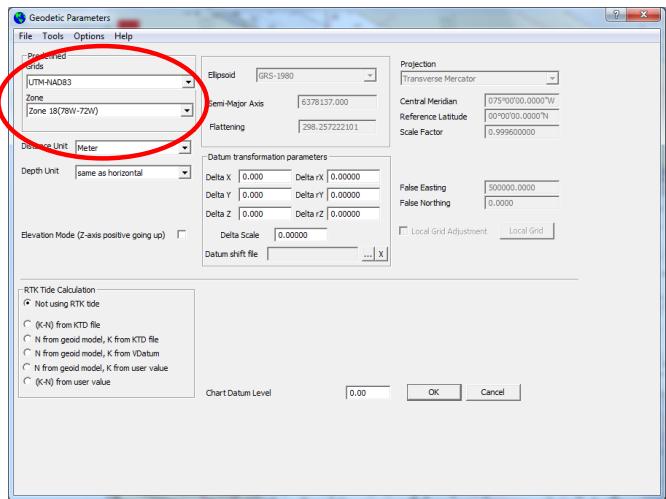
Survey System Startup

- f. Once you are in the correct group and the group is properly set to the Hypack Project Folder, you can make a new project. Click on **File -> New Project**. Change your project name to the name of your sheet (HXXXXX), and save it to the OPR number.



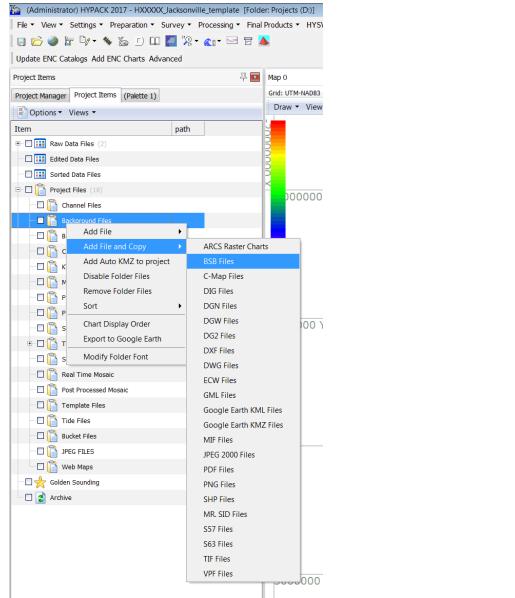
When this is finished, you will see this in the Project Manager tab.

- g. Check Geodesy to ensure correct datum and projection. **Preparation -> Geodetic Parameters** or select the Geodesy Icon. Refer to *Appendix II* for UTM zones if needed.

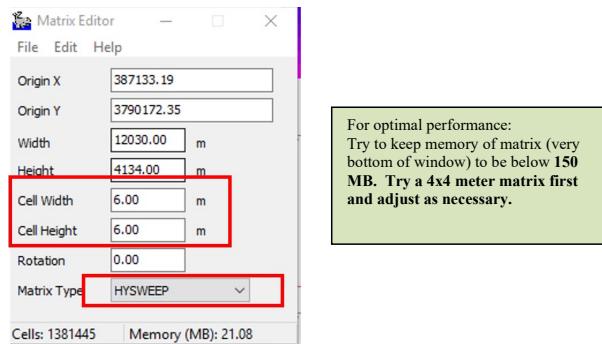


- h. Add project files as necessary. Most common files to add to a project are charts (.000) (ENC's ONLY PLEASE), geo-referenced images (.tif), planned line files (.lnw) and target files (.tgt). Utilize the **Add File and Copy** option to ensure the file is added to the project directory. Many files will already be present if the project template is used in creating new projects.

Survey System Startup



- i. Ensure matrix file is active for swath coverage display (create a new file if necessary).
- Preparation -> Editors -> Matrix Editor.** Set the Cell Width and Height at a resolution suitable for survey goals (**usually 4m**) and select the **Matrix Type = Hysweep**. Matrix files that are smaller than **150 MB** are more stable.



Consult **grid resolution tables** posted on forward end of charting table in Plot for guidance on HYSWEEP cell width and height.

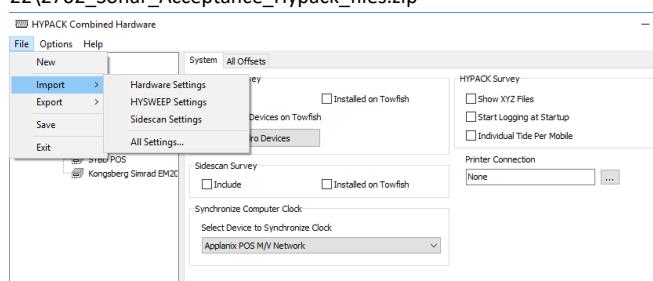
Survey System Startup

- j. Ensure HYSWEEP Hardware settings are configured appropriately. **If there are questions, talk to the FOO and/ or follow the steps below.**
- k. To look at setup PREPERATION -> HARDWARE SET UP or click the microchip button



- i. HYPACK Combined Hardware
 - ii. File → Import → All Settings, and select the .ini file with the most recent date located in the folder C:\HYPACK

22\2702_Sonar_Acceptance_Hypack_files.zip



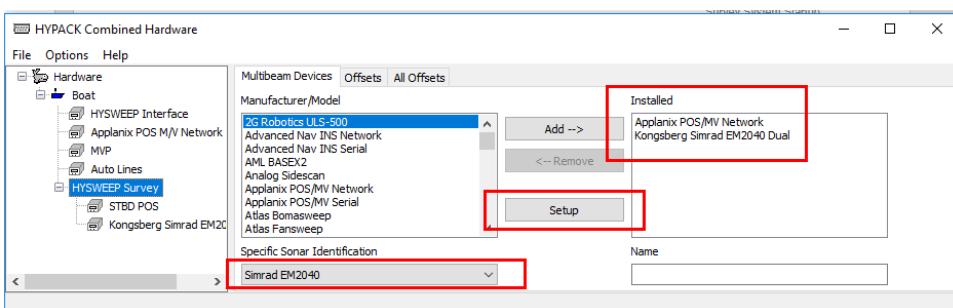
**SAVE YOURSELF
TIME BY
IMPORTING
THESE
SETTINGS**

file ->import->All Settings

These files are located on the Desktop:
C:\Hypack22\

Use Hardware Settings ZIP file with the most recent date / configuration

- . Select the desired sonar to be used under HYSWEEP Survey
- . Ensure it is enabled under the “Connect” tab. Ensure all unused systems are not enabled.
- . In the “Installed” window, click Setup



- vi. Close out of hardware settings and save if you made changes.
- vii. Select Survey → HYPACK Survey and HYSWEEP Survey to enter survey mode or click the whale



6. Hypack Auto Line Setup (If used)

Auto Lines is a tool in HYSWEEP survey that will drop dots based on an algorithm to calculate your next line/path (blue dots represent your future swath and red dots represent where your ship will be on that automatically generated line).

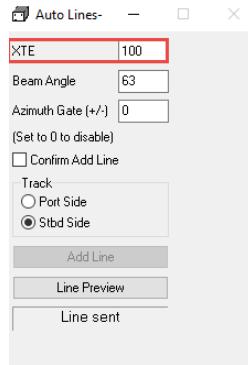
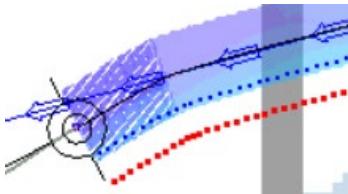


Image 1: High Line Approximation Error (XTE).

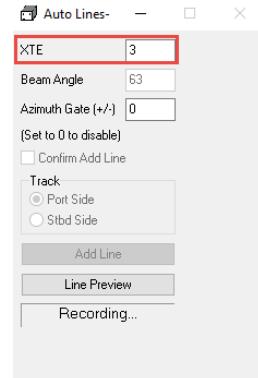


Image 2: Low Line Approximation Error (XTE).

In order for Auto Lines to create a detailed track, better for varying bathymetry, causing your swath to vary too, you need to have a lower value in the Line Approximation Error section (in Hypack this is confusingly the XTE section).

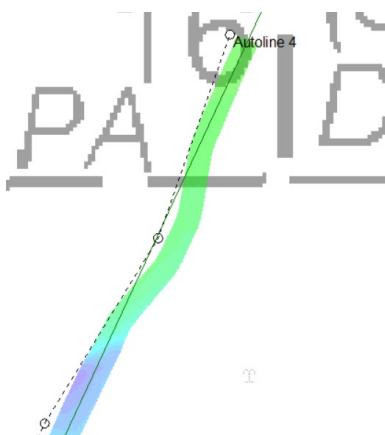


Image 3: Example of high Line Approximation Error (XTE). There is only one waypoint to represent the bend in the line. This would result in too much overlap if using this line when surveying. (Garbage)

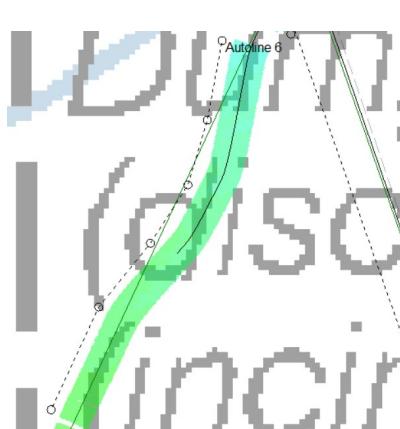


Image 4: Example of low Line Approximation Error (XTE). There are numerous waypoints to represent the bend in the line. This would result in just enough overlap if using the line when surveying.

After some testing with the XTE, we found a sweet spot with the following settings:

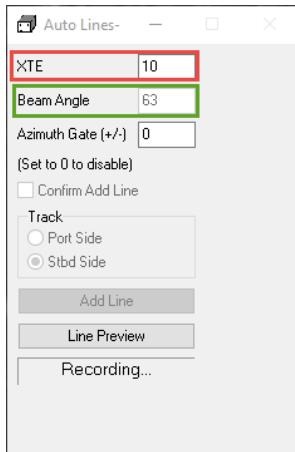
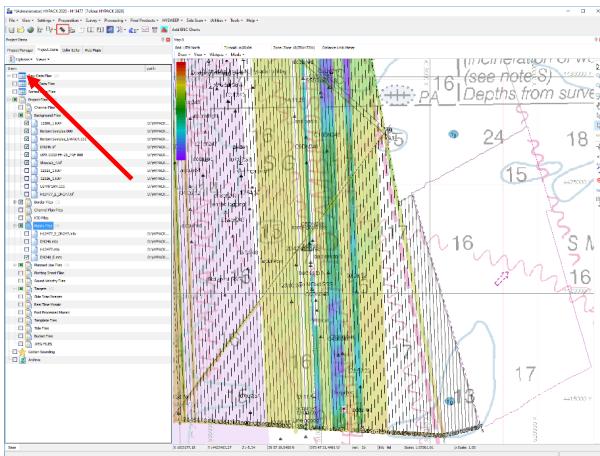
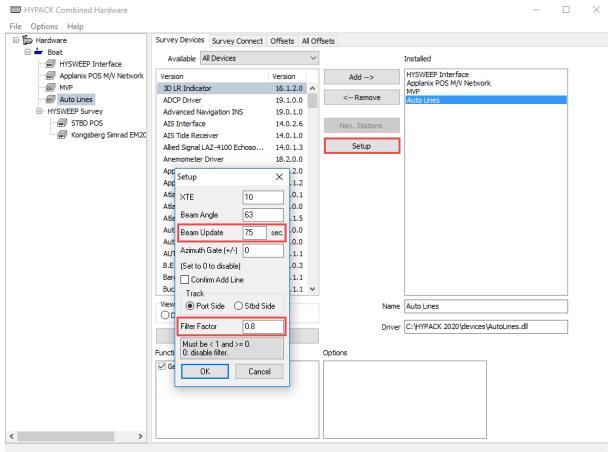


Image 5: Image from Auto Lines when running HYSWEEP. Adjust beam angle to get the swath overlap you need (generally an angle of 63-70 seems to work). A lower XTE value will produce more waypoints than higher values. You can manually adjust Track based on your next line direction, but Auto Lines will also alternate automatically. Only change these settings after ended logging in Hypack.

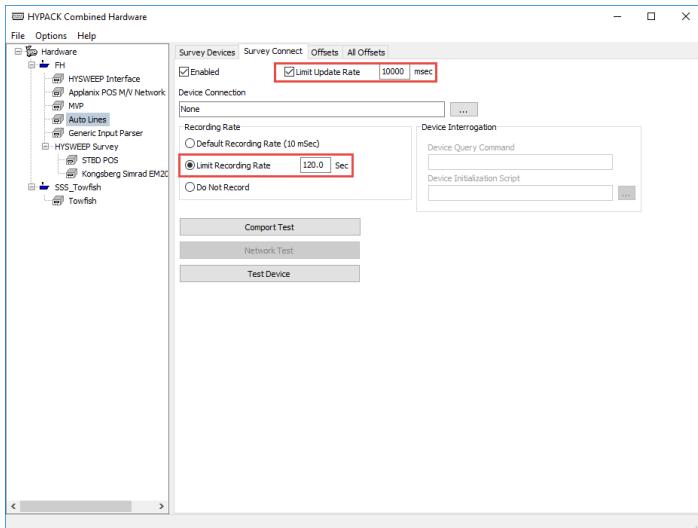
To get to hardware settings, you need to have HYSWEEP closed and they can be found under Hardware Setup in HYPACK. Auto Line can crash HYPACK, so play with beam update and other settings if having difficulties.



Survey System Startup



You can also change the settings in Survey Connect tab to help keep line file from getting too large and cause Hypack to crash.

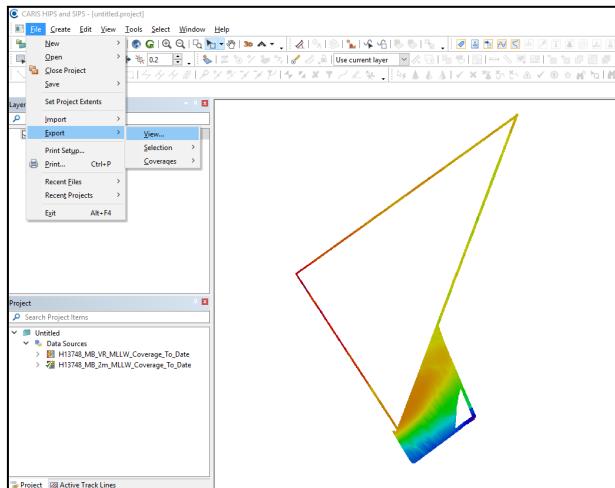


7. Creating and Importing a .TIF from Caris into Hypack

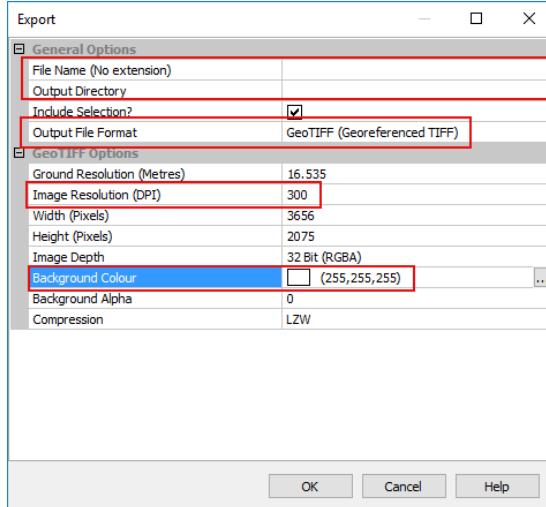
- Purpose
 - To provide guidance on the creation of geotiffs for import into Hypack and used to show previous coverage for planning and acquisition
- Background
 - These image files will be exported from CARIS HIPS & SIPS nightly by the data processors. They are critical for showing what's been covered and how much is left to be filled in. However, Hypack will only accept and display georeferenced raster images that are generated with the geotiff extension having only one 'f', i.e. 'tif'. There are multiple ways to generate GeoTIFFs in CARIS, but this is the primary method that will ensure the exported file will open in Hypack.

a) Work Instructions

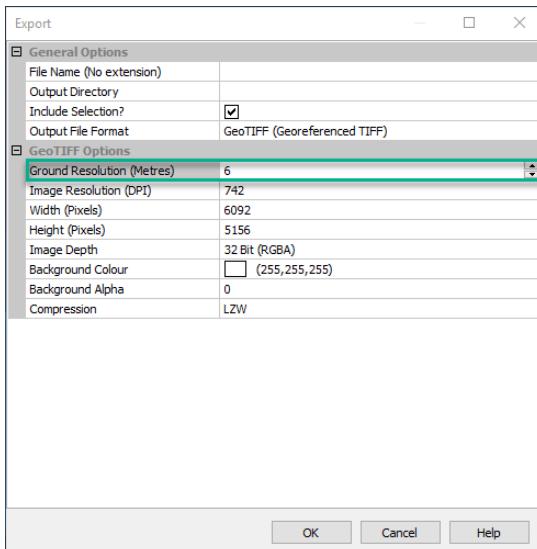
1. Open the surface coverage to be exported in CARIS HIPS or BDB.
2. Make sure the background is white.
3. Turn off all other layers. If other layers are still open, they will be exported along with the surface
4. Highlight the surface to be exported.
5. Select File > Export > View



6. Populate the Export dialogue as shown below. Leave all other fields as the default settings.
Recommend to save daily coverages to the following output directory:
P:\Survey_Storage\00_PROJECTS\202X\OPR-XXX-FH-XX\Surveys\HXXXXX\04_TIFF



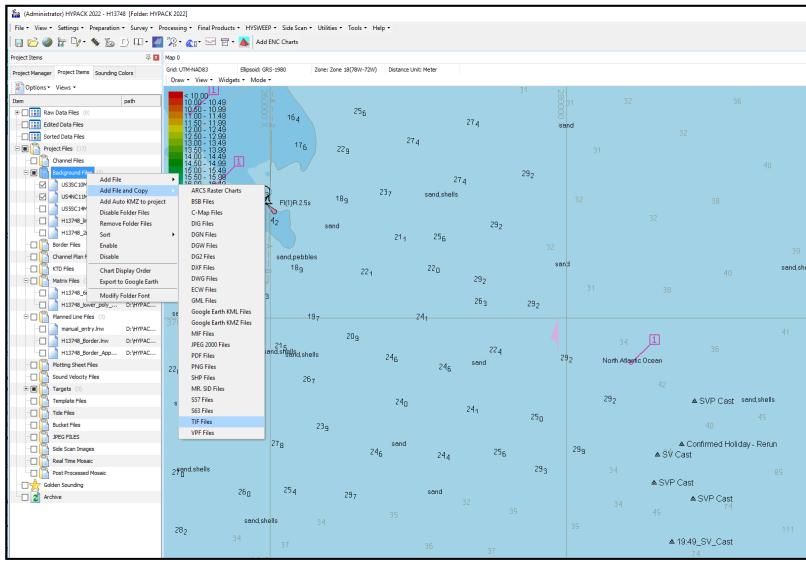
If you would like a higher resolution TIF output than what 300 DPI provides you can alternatively populate the "Ground Resolution (Meters)" field with the desired output resolution as shown below. This will change the Image Resolution (DPI) automatically.



- Once the export is complete, open the existing Hypack project on ACQ1. In the primary Hypack User Interface, right click on Background Files in the Project Items List tab on the left. Select Background File > Save and Copy > TIF files. Navigate to the location of the GeoTIFF and save it to

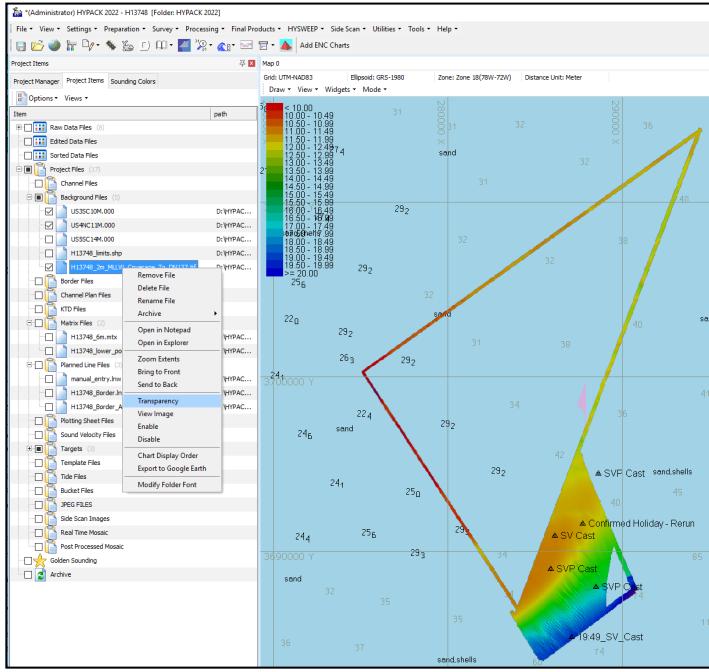
Survey System Startup

the existing Hypack project folder at D:HYPACK 2022\HXXXXX. If you fail to save the file to the appropriate Hypack project folder, then it will still be sourced from the original network location and may fail to open in the future.



8. Right click on the TIF file name under Background Files and change the transparency. An opaqueness of around 100 is a good starting point, but may need to be modified accordingly.

Survey System Startup



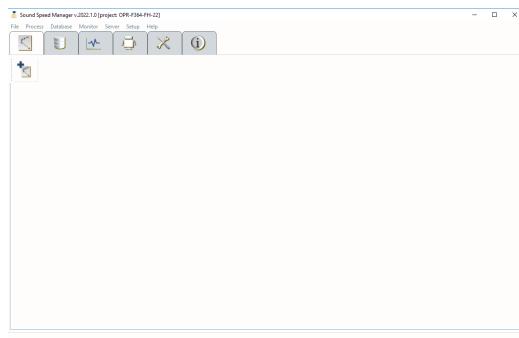
9. In order to see the coverage TIF in HYSWEEP, the image must be checked on. If you are still unable to see it in HYSWEEP, check the Layer Manager to determine visibility.

8. Sound Speed Manager Startup / Setup



- A. On ACQ PC open Sound Speed Manager. If Sound Speed Manager is unviable or uninstalled it can be accessed through Pydro22.

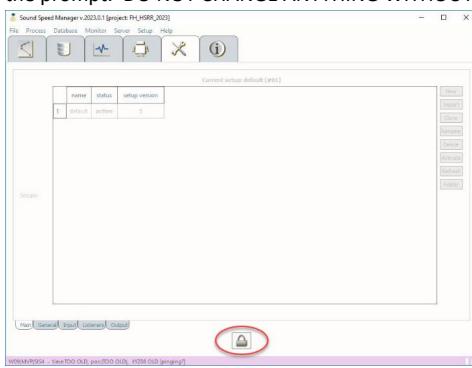
- B. When Sound Speed Manager is opened it will be blank as seen below



- C. First ensure the settings are all correct (check against screen shots found in Appendix II of this Boat Book. The only thing that should be different is the Project Number and Sheet Number.
D. To get to settings click the Wrench and Screw driver tool. You will need to UNLOCK the settings if you wish to change anything

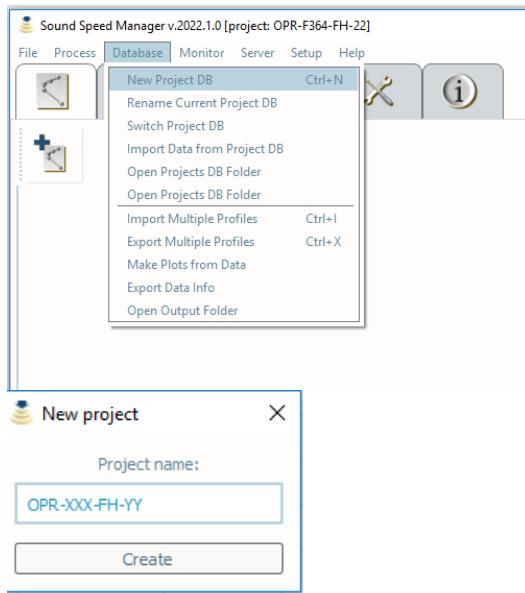


- E. If you wish to UNLOCK the settings click the Lock Button at the bottom of the screen and say yes to the prompt. DO NOT CHANGE ANYTHING WITHOUT CONSULTING THE FOO FIRST!



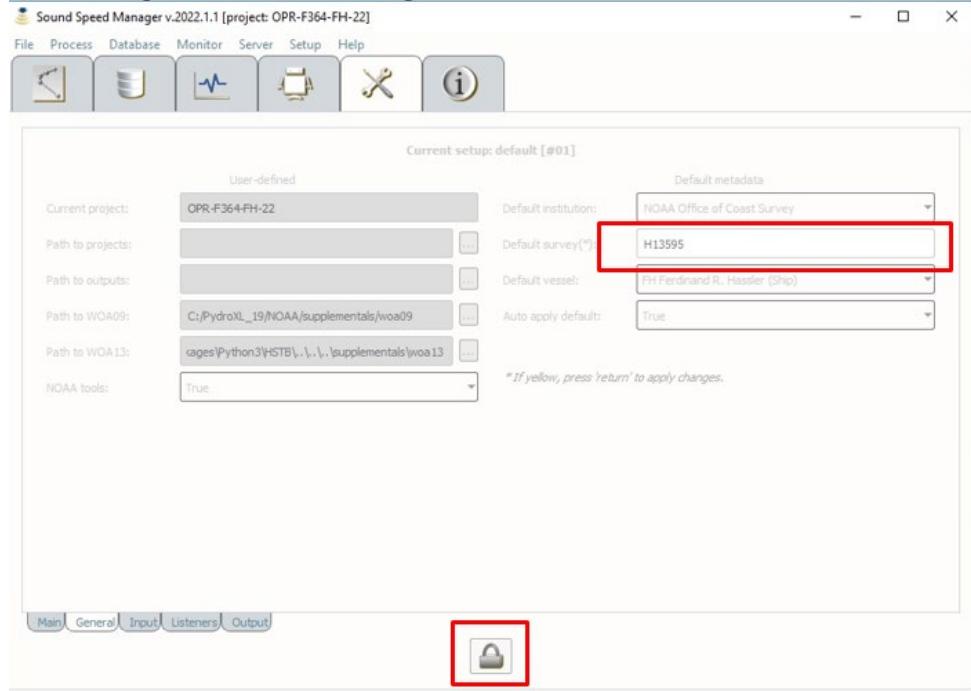
START A NEW PROJECT IN SOUND SPEED MANAGER

- Before the start of each new project you will need to make a new project in sound speed manager
- Database -> New Project DB (Ctl-N)
- Name the Project: OPR-XXX-FH-YY



Verify the default metadata for the Sound Speed Manager project. The default survey will remain as the last survey unless you update it. Verify that the default survey is the name of the sheet. If it needs to be updated, unlock the settings.

Survey System Startup



Survey System Startup

Sound Speed Manager v.2022.1.1 [project: OPR-C319-FH-21]

File Process Database Monitor Server Setup Help

Current setup: default [#01]

User-defined

Current project: OPR-C319-FH-21

Path to projects:

Path to outputs:

Path to WOA09: c:\ages\Python3\HSTB\.\.\.\supplements\woa09

Path to WOA13: c:\ages\Python3\HSTB\.\.\.\supplements\woa13

NOAA tools: True

Default metadata

Default institution: NOAA Office of Coast Survey

Default survey(*): H1399

Default vessel: FH Ferdinand R. Hassler (Ship)

Auto apply default: True

If yellow, press 'return' to apply changes.

Main General Input Listener Output

Import Sound Speed Cast:

- Click the Import Input Data button in the upper left hand corner

Sound Speed Manager v.2022.1.0 [pro]

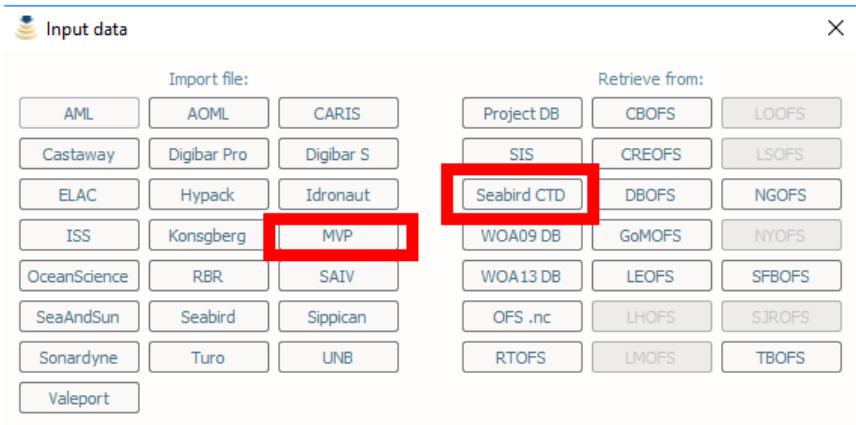
File Process Database Monitor S

Import Input Data

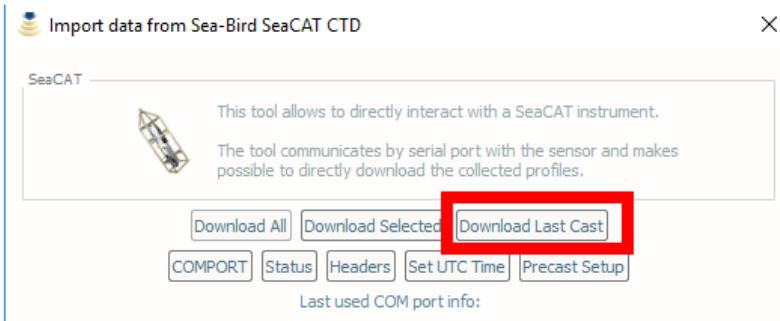
- 2702 primarily uses the Seabird CTD. After taking a cast with a CTD, **it should be plugged into the computer** to download the cast. THE SEABIRD CTD DATA CABLE IS PLUGGED INTO COM6, THE USB TO SERIAL CABLE IN THE BACK OF THE MVP COMPUTER

Survey System Startup

- To import a cast you select "Seabird CTD" under "Import File:" on the Input Data window and follow the steps.



- When downloading a new cast from a seabird CTD select Seabird CTD under "Retrieve from"
- Select Download Last Cast

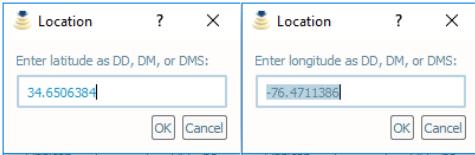


- Enter the LAT and LONG for the cast
NOTE Sound speed will auto fill this in but uses the current position of the boat when the cast is downloaded, not when the cast was actually taken. Be sure to check with the HYPACK target was dropped that this is the correct LAT LONG. Ensure the proper formatting:

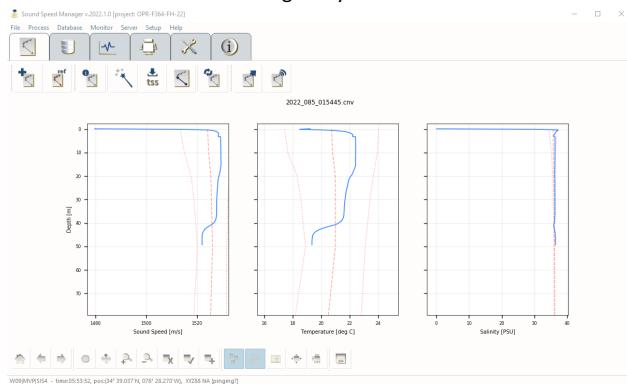
29/06/47.2072N, 88/43/41.5582W

Or you can put in the Lat / Long in Decimal Degrees (Longitude NEGATIVE) as seen in the image below (LAT (+/-)DD.dddddd, LONG (+/-)DDD.dddd):

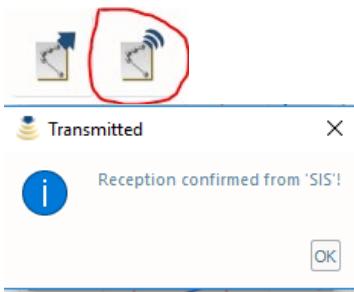
Survey System Startup



- The cast will finish downloading and your screen will look like below



- To transmit the cast to SIS select the “Transmit” button in the right hand corner of the cast
 - Once the cast has transmitted and been received by SIS. SSM will let you know with a prompt.
- Check SIS to make sure the cast is good. If the SV profile is RED or YELLOW you will need to take a new cast. If the SV profile is not colored the cast was good

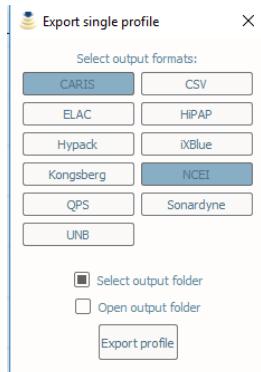


- To export the cast click the “Export Single Profile” button next to the transmit cast button



Survey System Startup

- Save the cast to CARIS and NCEI. You may have to save to others if a project or equipment requires it. Work with the FOO if this is the case



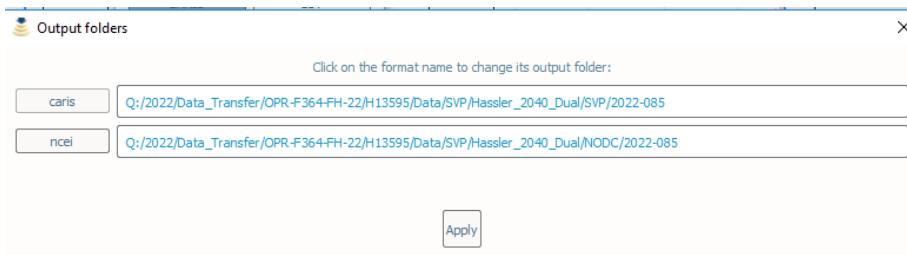
- The cast will go to a folder under the project. It will look like the following:

The Caris (.SVP) file goes here:

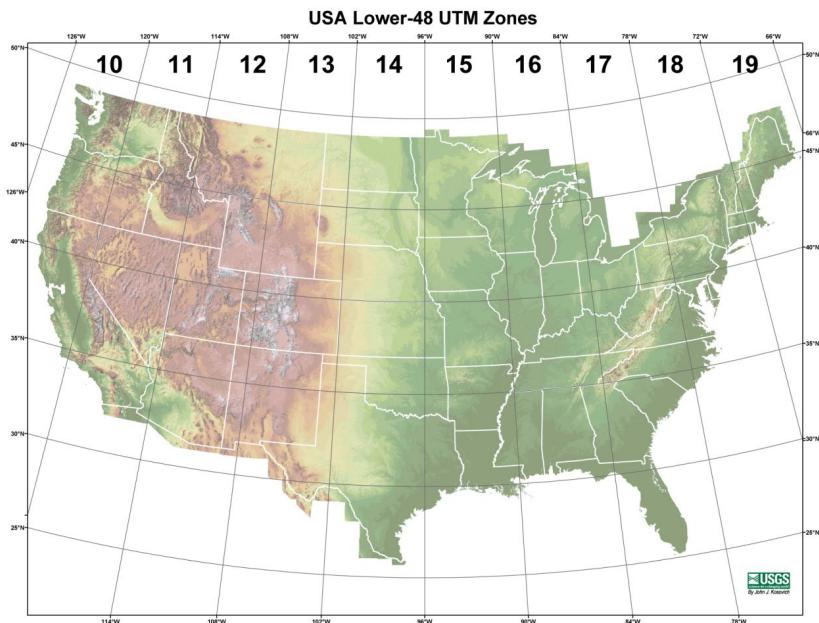
C:/20YY/Data_Transfer/OPR-XXXX-FH-YY/HXXXXX/Data/SVP/Hassler_2040_Dual/SVP/YYYY-DDD

The NCEI (.NC) file goes here:

C:/20YY/Data_Transfer/OPR-XXXX-FH-YY/HXXXXX/Data/SVP/Hassler_2040_Dual/SVP/YYYY-DDD



Appendix I Lower 48 UTM Zones



Appendix II SOUND SPEED MANAGER SETTINGS AS OF 07/2023**Main**

Sound Speed Manager v.2022.2.9 [project: 2040_SAT2023]

File Process Database Monitor Server Setup Help

Current setup: default [#01]

	name	status	setup version
1	default	active	5
2	SIS5	inactive	5

New Import Clone Rename Delete Activate Refresh Folder

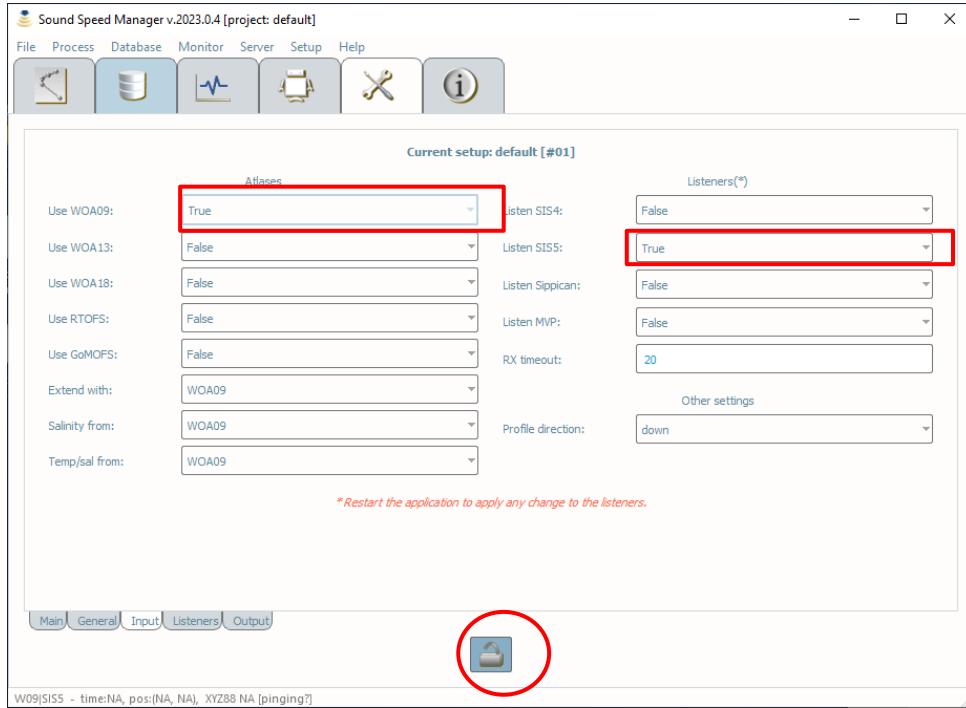
Setups:

Main General Input Listeners Output

W09|SIS5 - time:NA, pos:(NA, NA), XYZ88 NA [pinging?]

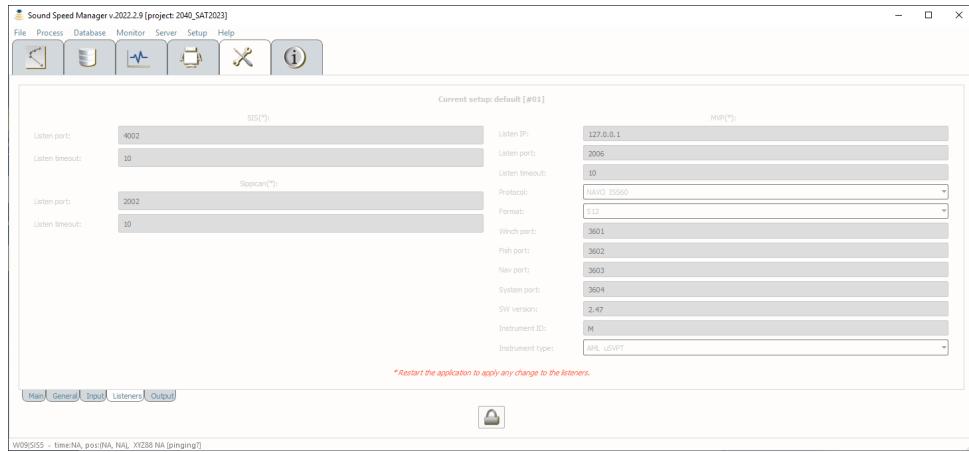
General

- Highlighted below are the Current Project and Default Survey. These two will be different depending on the project and survey you are on (unlock the lock and edit)
- BE SURE TO POPULATE THESE SO THAT THE CAST METADATA IS CORRECT.
- Project: OPR-XXXX-FH-YY Survey: HXXXX or(FXXXX,WXXXX, ect)

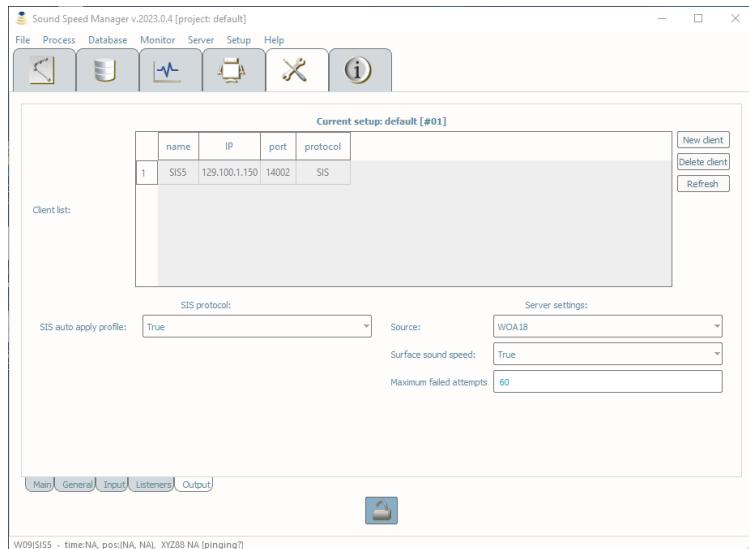


Survey System Startup

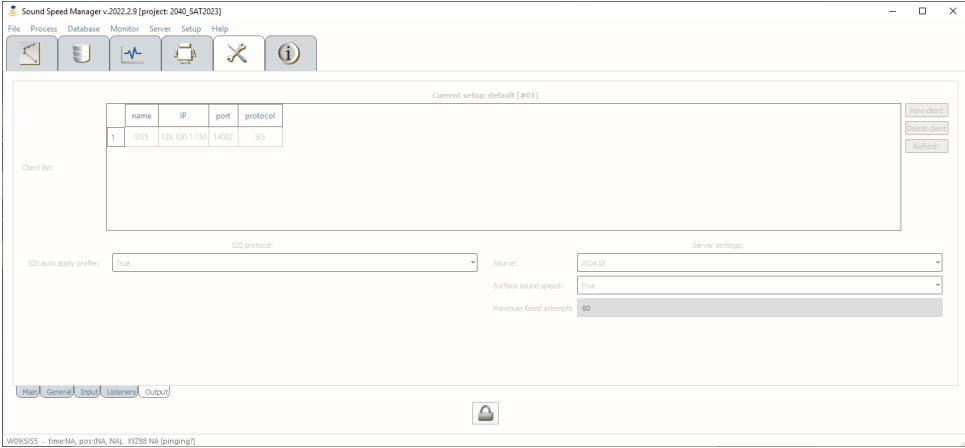
Listeners



Output



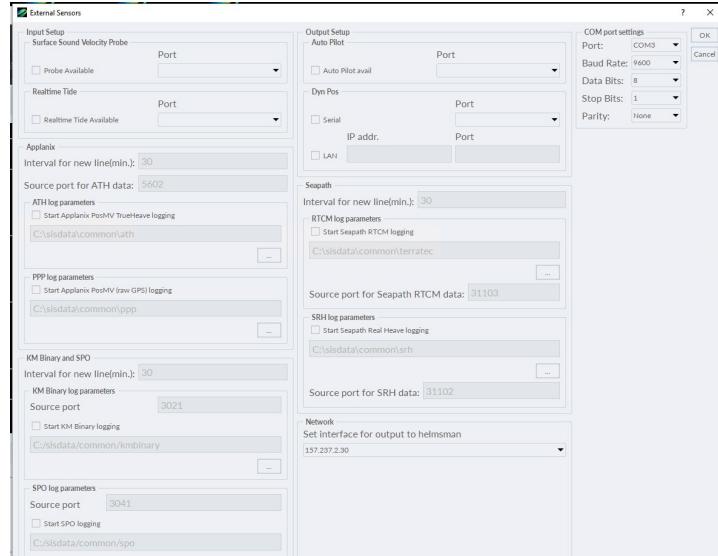
Survey System Startup



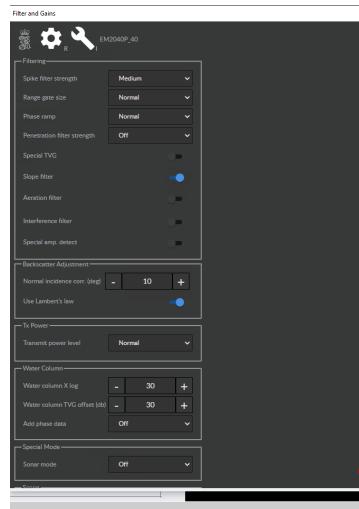
Appendix III SIS Screen Shots

INSTALLATION PARAMETERS

External Sensors



Filters and Gains



Survey System Startup

Backscatter Adjustment

Normal incidence corr. (deg)

Use Lambert's law

Tx Power

Transmit power level

Water Column

Water column X log

Water column TVG offset (db)

Add phase data

Special Mode

Sonar mode

Scope

Enable scope

Depth sensor

Depth sensor scale factor

Depths Settings

Depth Settings

EM2040P_40

Depth Settings

Force depth (m)

Minimum depth (m)

Maximum depth (m)

Dual swath mode

Max ping rate (Hz)

Depth mode

Detector mode

FM disable

Generate water column data

Extra detection

Extra detections

Extra Detections

	Start depth (%)	Stop depth (%)	Quality factor (%)	Reflectivity (dB)	Confidence level (dB)	Alarm threshold
Class 1	5	10	1.0	-60	10	5
Class 2	10	30	1.0	-60	10	5
Class 3	30	60	1.0	-60	10	5
Class 4	60	90	1.0	-60	10	5
Class 5	90	100	1.0	-60	10	5
Class 6	100	110	1.0	-60	10	5
Class 7	110	200	1.0	-60	10	5

Multi frequency Mode

EM® MultiFrequency Mode

	Swath 1	Swath 2	Swath 3	Swath 4	Swath 5
Frequency	None	None	None	None	None
Max port/starboard angle	60	60	60	60	60
Depth mode	Shallow	Shallow	Shallow	Shallow	Shallow
Detector mode	Normal				
Beam spacing	High density				

Network Setup

Network setup

Multicast address: 224.1.20.40

Multicast port: 6020

Secondary net address: 129.100.1.131

Secondary net subnet: 255.255.255.0

Processing unit IP: 157.237.20.40

Changes on this page can take up to 20 seconds to propagate in the system

Multiport

	UDP	TCP
#SCL #SKM #SVT #SVP #SPO #CPO	6020	-
-	-	-
-	-	-

Sector Coverage

Sector Coverage

Port <-> Starboard

Maximum port angle Head 1 (deg): 70

Maximum port coverage (m): 500

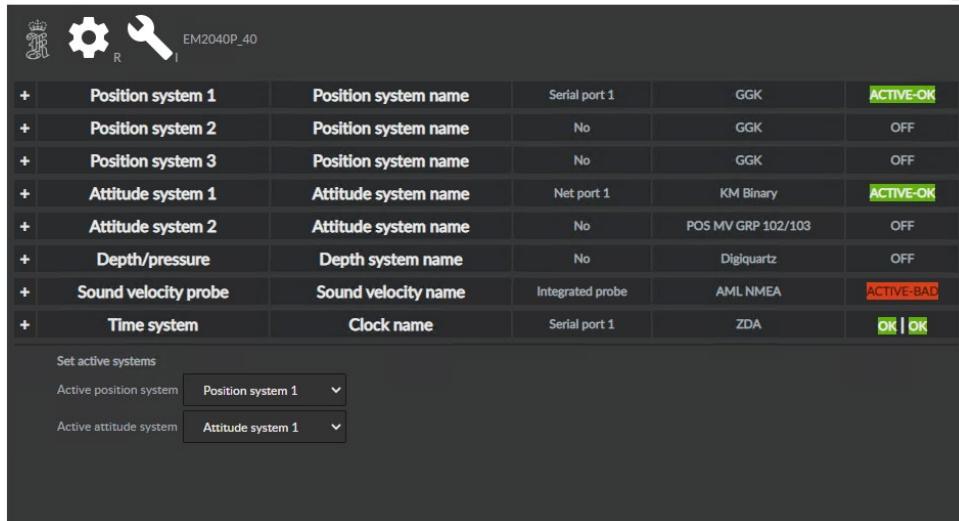
Angular coverage mode: Auto

Sector mode: Normal

Beam spacing: High density

Sensor Setup

Sensor setup



The screenshot shows the 'Sensor setup' interface for the EM2040P_40 system. At the top, there are icons for a gear, wrench, and shield, followed by the text 'EM2040P_40'. Below this is a table with the following data:

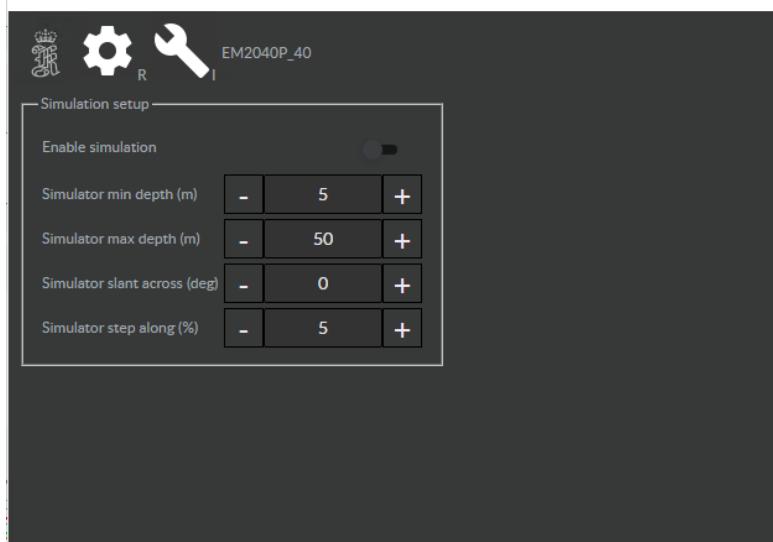
+	Position system 1	Position system name	Serial port 1	GGK	ACTIVE-OK
+	Position system 2	Position system name	No	GGK	OFF
+	Position system 3	Position system name	No	GGK	OFF
+	Attitude system 1	Attitude system name	Net port 1	KM Binary	ACTIVE-OK
+	Attitude system 2	Attitude system name	No	POS MV GRP 102/103	OFF
+	Depth/pressure	Depth system name	No	Digiquartz	OFF
+	Sound velocity probe	Sound velocity name	Integrated probe	AML NMEA	ACTIVE-BAD
+	Time system	Clock name	Serial port 1	ZDA	OK OK

Below the table, there is a section titled 'Set active systems' with two dropdown menus:

- Active position system: Position system 1
- Active attitude system: Attitude system 1

Simulator

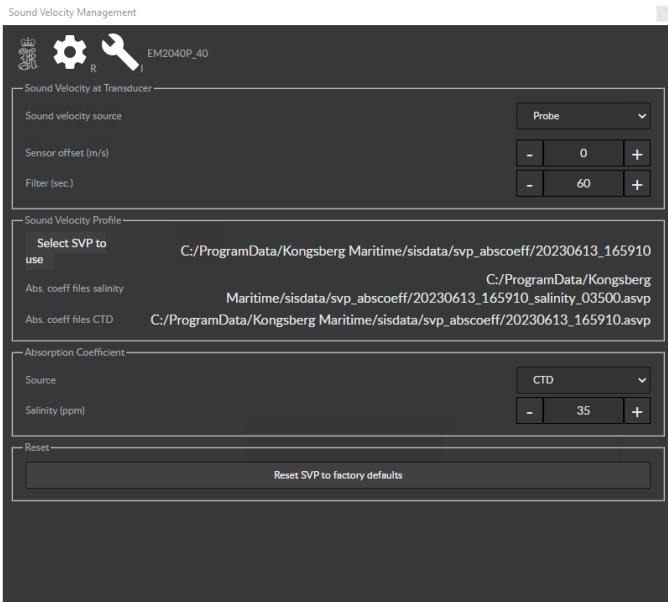
Simulator



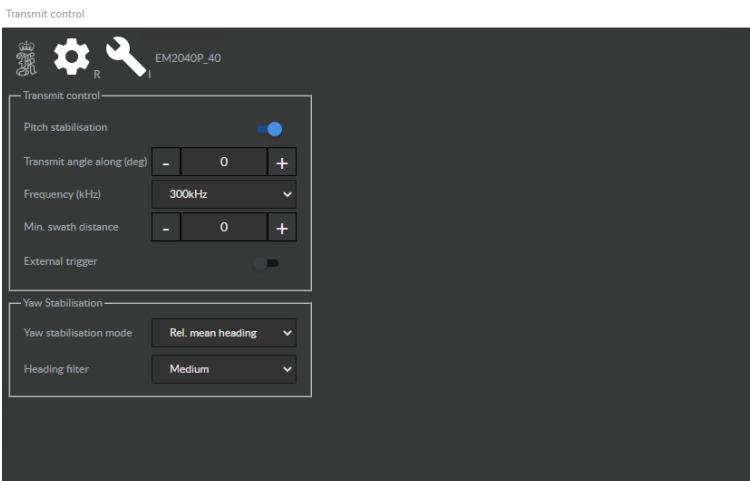
The screenshot shows the 'Simulator' interface for the EM2040P_40 system. At the top, there are icons for a gear, wrench, and shield, followed by the text 'EM2040P_40'. Below this is a section titled 'Simulation setup' containing the following parameters:

Enable simulation	<input checked="" type="checkbox"/>
Simulator min depth (m)	<input type="button" value="-"/> 5 <input type="button" value="+"/>
Simulator max depth (m)	<input type="button" value="-"/> 50 <input type="button" value="+"/>
Simulator slant across (deg)	<input type="button" value="-"/> 0 <input type="button" value="+"/>
Simulator step along (%)	<input type="button" value="-"/> 5 <input type="button" value="+"/>

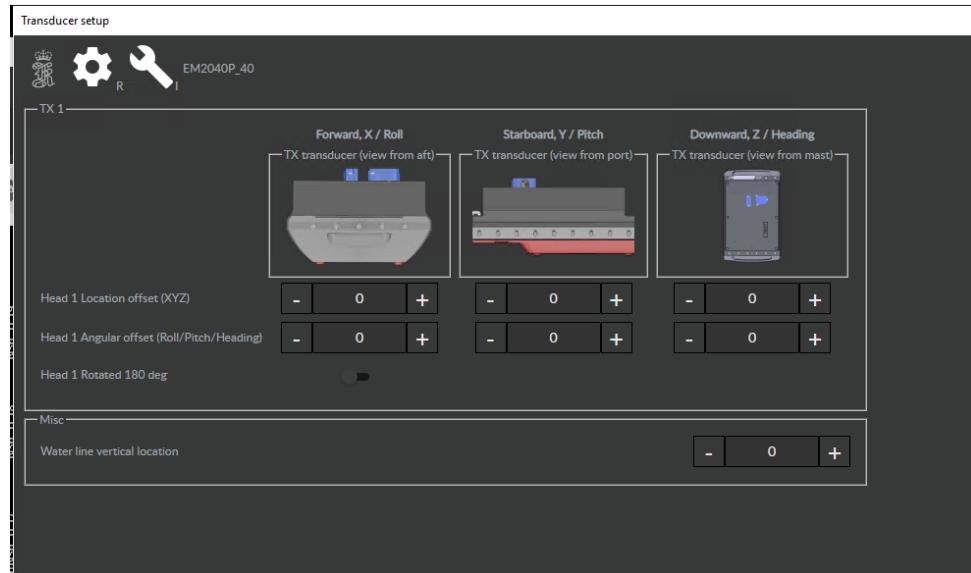
SV Management



Transmit control



NOTE: THE ANGULAR OFFSETS BELOW (FROM 2023 HSRR FINAL PATCH) WILL BE SUBJECT TO CHANGE EVERY YEAR AFTER HSRR ACTIVITIES.



Appendix IV Familiarization with the Boat 2702 Network

On 2702, the acquired bathymetry data is stored in the following location:

Acquisition Station Computer */.all files:

a. **RawData (C:)\sisdata\raw\HXXXXX**

- This is where all your raw MBES .all files are logged to on the SIS computer.

2. Positioning (POS) Files (on 2702 Acquisition computer):

a. **(C:)\GNSS_data**

- i. Create a project folder (*OPR-X###-FH-23*), sheet folder (*HXXXXX*), and day number folder (*2023-DDD*)

- This is where you will store all of your positioning files for each day of acquisition.

3. CTD casts files (on 2702 Acquisition computer):

a. **(C:)\CTDDATA\RAW\OPR-XXXX-XXX-XX\HXXXXX\YYYY-DDD**

• This is where you will store all of your sound speed files for each day of acquisition.

Appendix V Daily Acquisition Log

- A blank acquisition log exists on the ship acquisition computer's desktop:
 - *HXXXXX_Bank_Acquisition_Log_DDD*
- Save this to the "Acquisition Log" folder in the data directory you created
 - Rename it and fill out the survey-specific information at the top of the document

HXXXXX_Bank_Acquisition_Log_DDD.xlsx - Excel									
File Home Insert Page Layout Formulas Data Review View Acrobat Tell me... Sign in Share									
Clipboard	Paste	Font	Number	Conditional Formatting	Insert	Cells	Editing		
	Font	Number	Conditional Formatting	Insert	Cells	Editing			
1	Acquisition Log	S250-EM2040 DUAL DUAL	HXXXXX	v042014					
2		Vessel							
3	3/28/2022	087	Sublocality						
4	Date	Dn	Local Area		Wx		Depth Range		
5	"Change date only, watch magic happen"								
6							DGPS Beacon Location		
7							## kHz		
8	Personnel	0600-1800					DGPS Beacon Frequency (kHz)		
9									
10	Personnel	1800-0600					Heave Bandwidth Filter (secs)		
11									
12	Comments								
13									
14	-2 383								
15	Waterline		Lines Waterline applies to						
16									
17	Waterline		Lines Waterline applies to (if boat configuration changes)						
18	Waterline Measurement for input into SIS								
19									
20	2022.DDD_S250_A.000 first, 2022.DDD_S250_A.XXX last								
21	POS/MV filename(s)	YYYY_DDD_S250_A or B							
22									
23	Sound Velocity	(need only list first and last cast of the watch, and those with special features or problems. List when casts are transferred)							
25	MVP cast filename	LAT	Long	Time of Cast (UTC)	Remarks (QC: salinity, start of cast depth)				
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38	ADD NEW LINE				(MVP surface velocity should be within 2 m/s of SV70 sound velocity)				
40									
41	Sound Velocity Comments (Recommend - Profile Selection Method for data)								
42									
	DDD								

Reference: Setting up the Data Transfer Folder

Hassler utilizes a “Data Transfer” folder that holds all the daily data to facilitate data management. These folders are populated during day-change at UTC midnight and are where you will direct Charlene to look for the data before processing.

For the launch (2702) the create launch transfer drive Charlene tool will also need to be run on the external HDD used to transport launch data to the ship. The data on the launch transfer HDD will then be copied to the network “RAW” drive.

The folder structure on the 2702 launch’s network RAW drive is as such:

Q:\2023\DATA_TRANSFER\OPR-X###-FH-23\HXXXXX\Data\...

- Acquisition_Logs\FH_2702_2040p\2023-DDD
- MBES\FH_2702_2040p \2023-DDD
- Positioning\FH_2702_2040p\2023-DDD
- SVP\FH_2702_2040p\

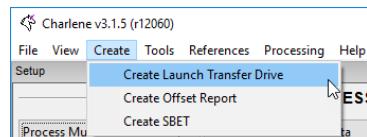
The folder structure on the Launch transfer external hard drive is as such:

(?):\2023\DATA_TRANSFER\OPR-X###-FH-23\HXXXXX\Data\...

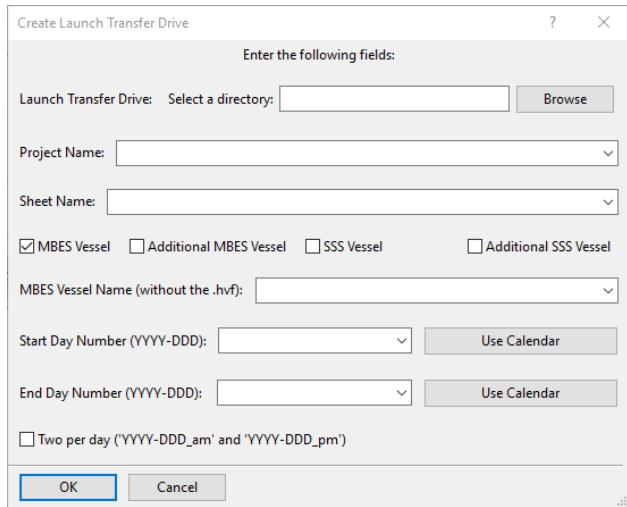
- Acquisition_Logs\FH_2702_2040p\2023-DDD
- MBES\FH_2702_2040p \2023-DDD
- Positioning\FH_2702_2040p\2023-DDD
- SVP\FH_2702_2040p\

You can use Charlene to set up a launch transfer drive in these folders so that the data will be organized by type and then by day number. (*A Julian Date Calendar is located in the front of the ship’s boat book*).

1. Click *Create > Create Launch Transfer Drive*
2. Replicate the following settings



Survey System Startup



1. *Select a directory: Q:\2023\Data_Transfer*
2. *Project Name: OPR-X##-FH-YY*
3. *Sheet Name: HXXXXXX*
4. *Check MBES Vessel*
5. *MBES Vessel Name:
a. FH_2702_EM2040P*
6. *Start Day Number: Enter the day number of the first day of acquisition.*
7. *End Day Number:
a. For one day only: Enter the same day number as "Start Day Number"
b. Do NOT create folders over multiple days if you do not know you will be acquiring data on those days, this makes data management more difficult with empty day number folders*
8. Click *OK* to finish.

When you transfer data at UTC midnight, simply copy and paste the files into the appropriate day number subfolder of the Data Transfer folder.

JULIAN DATE CALENDAR
PERPETUAL

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

JULIAN DATE CALENDAR
FOR LEAP YEARS ONLY

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	061	092	122	153	183	214	245	275	306	336	1
2	002	033	062	093	123	154	184	215	246	276	307	337	2
3	003	034	063	094	124	155	185	216	247	277	308	338	3
4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11
12	012	043	072	103	133	164	194	225	256	286	317	347	12
13	013	044	073	104	134	165	195	226	257	287	318	348	13
14	014	045	074	105	135	166	196	227	258	288	319	349	14
15	015	046	075	106	136	167	197	228	259	289	320	350	15
16	016	047	076	107	137	168	198	229	260	290	321	351	16
17	017	048	077	108	138	169	199	230	261	291	322	352	17
18	018	049	078	109	139	170	200	231	262	292	323	353	18
19	019	050	079	110	140	171	201	232	263	293	324	354	19
20	020	051	080	111	141	172	202	233	264	294	325	355	20
21	021	052	081	112	142	173	203	234	265	295	326	356	21
22	022	053	082	113	143	174	204	235	266	296	327	357	22
23	023	054	083	114	144	175	205	236	267	297	328	358	23
24	024	055	084	115	145	176	206	237	268	298	329	359	24
25	025	056	085	116	146	177	207	238	269	299	330	360	25
26	026	057	086	117	147	178	208	239	270	300	331	361	26
27	027	058	087	118	148	179	209	240	271	301	332	362	27
28	028	059	088	119	149	180	210	241	272	302	333	363	28
29	029	060	089	120	150	181	211	242	273	303	334	364	29
30	030		090	121	151	182	212	243	274	304	335	365	30
31	031		091		152		213	244		305		366	31

USE IN 2004, 2008, 2012, 2016, 2020, 2024, ETC.