PROJECT TITLE:	**EA Field & OGGS Pipeline Survey**
DOCUMENT TITLE:	**HAUV3 Mobilisation and Demobilisation Procedure**
DOCUMENT NUMBER:	**23-0022-ENG-PR-001**
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ABBREVIATIONS

Abbreviation	Definition
A	Amp
AUV	Autonomous Underwater Vehicle
BMS	Business Management System
CD	Crane Driver
CP	Cathodic Protection Survey
DoB	Depth of Burial
DPO	Dynamic Positioning Operator
ES	Equipment Supervisor
GPS	Global Positioning System
HAUV3	Hybrid Autonomous Vehicle
HSE	Health, Safety and Environment
ISO	International Standards Organisation
kg	Kilogramme
m	metre

Abbreviation	Definition
mm	Millimetre
OSHAS	Occupational Health and Safety Assessment Series
PPE	Personal Protective Equipment
PTW	Permit to Work
P&T	Pan & Tilt
QHSE	Quality Health Safety & Environment
TBT	Tool Box Talk
Te	Tonne
TRA	Task Risk Assessment
USBL	Ultrashort Baseline
V	Volt
VM	Vessel Master
VTS	Vessel Traffic Services

REFERENCE DOCUMENTS

Ref No.	Document Title	Document Number
[101]	Management of Change Procedure	HS-PR-009
[102]	Permit to Work System Isolation Requirements	HS-PR-015
[103]	Risk Identification and Management	HS-PR-003
[104]	Tool Box Talks	HS-FM-001
[105]	Project HSE Plan	HS-PL-001
[106]	Project HIRA	HS-RA-001
[107]	HAUV Equipment Readiness Procedure	ASS-PR-010
[108]	HAUV3 Operations Procedure	23-0022-OPS-PR-001
[109]	HAUV3 Launch & Recovery Procedure	23-0022-OPS-PR-002
[110]	Survey Operations Procedure	23-0022-SUR-PR-001
[111]	HAUV Garage Loading Procedure	23-0022-OPS-PR-005
[112]	HAUV3 Pre/Post Dive Checklist	23-0022-OPS-SCL-001
[113]	HAUV3 Project Integration Guide	23-0022-SUR-PR-002
[114]	Project Execution Plan (PEP)	FESL-SPDC-WEP-1909/2201

1 INTRODUCTION

Modus have been contracted by Fadfae Engineering Services Ltd. to conduct a geophysical survey and pipeline inspection of the Offshore Gas Gathering System Pipeline System from RPA platform in EA field to the Bonny landfall, EA field infield pipelines and the Bonga Gas export line.

The survey operations will be carried out using the HAUV3 vehicle operating in tethered mode. The vehicle will be launched from a 3rd party vessel. Please refer to HAUV3 Operations Procedure [108] and Survey Operations Procedure [110] for a more detailed overview of the scope of work.

Mobilisation and demobilisation will be the responsibility of the client, Fadfae, however, Modus will support activities and provide advise/ supervision where necessary.

1.1 PURPOSE OF DOCUMENT

The purpose of this document is to define and control the mobilisation and de-mobilisation of the HAUV3 with the use of client supplied LARS, containers & vessel.

The intention of this procedure is to ensure that the operations meet all necessary contractual requirements and conform to all relevant project HSEQ requirements.

1.2 SCOPE

Although Fadfae are responsible for all mobilisation and demobilisation activities, Modus crew will be required to provide technical support and advise when mobilising and demobilising the HAUV spread to and from the vessel.

1.2.1 MOBILISATION ACTIVITIES

Key activities that will require support from Modus during the mobilisation are listed below.

1.2.1.1 AUV Setup

- Setup HAUV control cabin
- Integrate SSS, TSS 660, MBES and FIGS CP to HAUV
- Perform Quayside deck checks
- Verify survey surface PHINS see checklist
- Load HAUV into subsea garage
- Interface HAUV garage to LARS snubber and latch.

1.2.1.2 Quayside Wet Test

- Ensure appropriate PTW is raised
- Configure HAUV buoyancy
- Perform pre-dive checks, see HAUV pre-dive checklist
- Position Vessel at HAUV launch positioning
- Perform full communication checks
- Confirm all survey, navigation and logging systems are fully operational with relevant survey data entered to the survey database.
- Vessel confirmed to be in DP mode.
- Garage and HAUV lifted overboard using the LARS A-frame
- Garage & AUV lowered to the seabed

- HAUV flown out of garage on tethered setup
- Relevant subsea equipment and sensor checks is performed as per FESL-SPDC-OGS-EG-PEP-0001
- HAUV is recovered see FESL-SPDC-OGS-EG-PEP-0001– operational procedure for HAUV launch and recovery
- Perform post dive checks check - see HAUV pre and post dive checklist

1.2.2 DEMOBILISATION ACTIVITIES

Upon completion of the inspection activities, all personnel and equipment shall be safely recovered to the Vega Bless. This shall occur on completion of a thorough check to ensure all inspection items have been accounted for.

Fadfae will be responsible for closing out all relevant running permits related to the project prior to departure from the worksite.

Modus will advise Fadfae on the most efficient way to uninstall the HAUV spread, and everything will then be packed back into the original packaging ready for shipment back to the UK.

2 RESPONSIBILITIES

2.1 COMPETENCE

All personnel working on the project will be suitably qualified to carry out the scope of work. CVs of all offshore personnel will be shared with the client to ensure that the required standards are met. All offshore personnel will have all the relevant certifications and medicals in place prior to mobilisation.

2.2 KEY RESPONSIBILITIES

Role	Responsibilities
Project/Support Manager	• Shall be responsible for ensuring this procedure is implemented for work scopes under their jurisdiction
HAUV Manager	• Shall be responsible for ensuring all personnel are SQEP
HSEQ Manager	• Shall be responsible for ensuring that all HSEQ procedures are adhered to
HAUV Supervisor	• Shall be responsible for ensuring this procedure is adhered to by applicable personnel under their jurisdiction
Crewing Manager	• Shall be responsible for instructing Third Party Agencies (supplying personnel to Modus) of the requirements of this procedure and ensuring full alignment
HAUV Pilot Technicians	• Shall be responsible to comply with the procedure for mobilising & demobilising equipment

All employees and contractors are responsible for effectively managing risk. All office, project, technical, and operational personnel are expected to identify hazards, understand consequences of potential incidents, and respond appropriately as part of their regular duties.

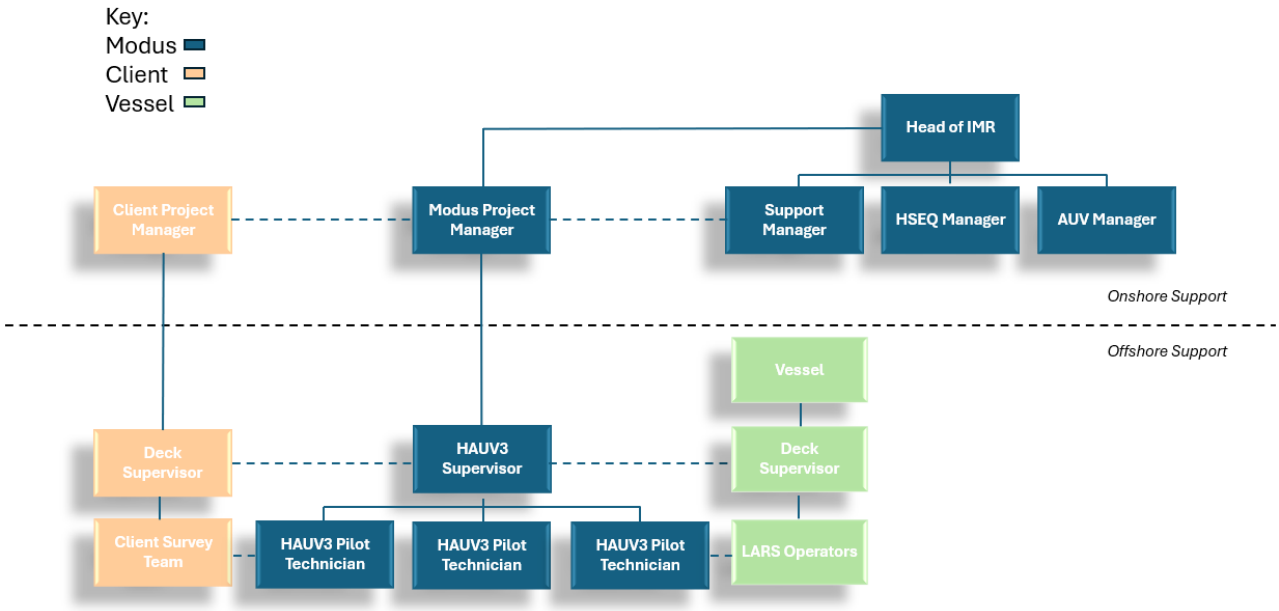
3 ORGANISATION

3.1 GENERAL

The following personnel will be required to be available either physically onsite, or remotely, where possible, during the Mobilisation/Demobilisation operations:

- 1x Project Manager
- 1x HSEQ Manager
- 1x HAUV Supervisor
- 3x HAUV Pilot Technicians
- 1x Surveyor
- 1x Crane Operator
- 1x Banksman/Controller

3.2 ONSITE ORGANOGRAM



3.3 COMMUNICATION

The primary form of communication between all parties and the HAUV3 crew will be via Clear COMM's / VHF radios. UHF radios may be utilised if required as a secondary or backup means of communication. It is especially important that the emergency channels are agreed, communicated to relevant parties, and tested prior to the commencement of operations.

For launch and recovery operations during mobilisation wet tests, the primary form of communication will be via UHF radio. The secondary form of communication will be hand signals/verbal face to face.

The vessel will have sufficient Wi-Fi on board to allow external communications back to the onshore support team when required.

In case of an emergency or an urgent requirement, there will be a dedicated onshore Duty Manager who will always be accessible by mobile phone. The Duty Manager role will rotate around the onshore management team on a weekly basis, and the dedicated individual will be clearly communicated to the offshore team.

3.4 CONTACT DETAILS

3.4.1 EMERGENCY CONTACT DETAILS

In the event of an emergency, the HAUV3 Superintendent should be immediately informed so that emergency procedures may be brought into operation.

The Modus Emergency number is **+44 (0) 1325 387 478**

3.4.2 MODUS CONTACT DETAILS

Onshore, the primary Modus project contacts will be:

Job Title	Name	Contact Details
Project Manager	Anthony Brown	Email: anthony.brown@modus-ltd.com Office: +44 (0) 1325 387 455 Mob: +44 (0) 7518125387
Support Manager	Derren Plaister	Email: derren.plaister@modus-ltd.com Office:+44 (0) 1325 387 481 Mob: +44 (0) 7570304381
HSEQ Manager	Adrew Millichap-Bell	Email: Andrew.Millichap-Bell@modus-ltd.com Office:+44 (0) 1325 387 449 Mob: tbc
Project Engineer	Joe Griffiths	Email: joe.griffiths@modus-ltd.com Office: +44 (0) 1325 387 507 Mob: +44 (0) 7834 104 834

3.4.3 CLIENT CONTACT DETAILS

Job Title	Name	Contact Details
Client Representative	TBC	Email: tbc Mobile: TBC
Project Engineer	Bright Adieze	Email: bright.adieze@fadfae.com.ng Mobile: +31 6 1310 7532
Survey Team Lead	Daniel Osarobo	Email: surveyteamlead@fadfae.com.ng Mobile: TBC

3.4.4 THIRD PARTY CONTACT DETAILS

Job Title	Name	Contact Details

4 HSEQ

All work described within this document shall be performed in accordance with requirements given in the Modus Business Management System (BMS) which is accredited in line with ISO:9001, ISO:14001 and OSHAS:18001 Standards.

The work shall in addition be performed in accordance with the requirements given in the Contract.

All internal documents for the project relating to this subject are referenced in the table of references at the front of this document and should be read in conjunction with this procedure. Any additional task related safety awareness that needs to be highlighted will be addressed in the body of this document.

4.1 WARNINGS, CAUTIONS & NOTES

This operating procedure will include interspersed warnings, cautions and notes, these are used to direct the readers attention to specific information.

4.1.1 WARNINGS

A WARNING is used to alert the reader to operational or maintenance activities that may, under certain circumstances, represent a threat to safety and health. A warning precedes the paragraph or procedure which gives rise to such a threat.

4.1.2 CAUTIONS

A CAUTION is used to alert the reader to operational or maintenance activities which, may under certain circumstances, cause damage to equipment and/or material. A caution precedes the paragraph or procedure to which it refers.

4.1.3 NOTES

A **Note** contains information of a specific or general nature and is printed immediately after the paragraph to which it refers.

4.1.4 SYMBOLS

The following symbols may be used throughout this document:

	**WARNING** RISK OF PERSONAL INJURY.
	**WARNING** RISK OF PERSONAL INJURY DUE TO MOVING PARTS.
	**WARNING** TAKE PRECAUTIONS AGAINST STATIC ELECTRICITY.
	**WARNING** RISK OF ELECTRIC SHOCK.
	**WARNING** RISK OF PERSONAL INJURY DUE TO HEAVY OBJECT.
	**WARNING** WEAR PROTECTIVE CLOTHING AND EQUIPMENT.
	**Caution** Risk of damage to equipment.
	Tool Box Talk Required

4.2 RISK ASSESSMENTS

All operations will be executed in accordance with ref [103]: HS-PR-005, Risk Identification & Management Procedure.

The Modus specific Risk Assessment should identify the risks associated with specific elements of Modus operational activities. The Risk Assessment also identifies the controls required, which also consider the different human behaviour traits that are exhibited performing the same task under different conditions. The Risk Assessment shall be completed by the Team Leader/Chairman and a minimum of two experienced personnel in the activity to be assessed.

A Project HIRA will be completed prior to operations (Ref. [106]).

4.3 MANAGEMENT OF CHANGE

In the event of any unplanned circumstances which affect this procedure, then this procedure can be changed to ensure the safety and efficiency of the operation. Any change to this procedure will be performed in accordance with the Modus Management of Change Procedure, HS-PR-009, (Ref. [101]), and in clear understanding between the involved parties.

4.4 TOOLBOX TALKS

Toolbox Talks are always required at the start of each shift and/or during shift if required. These should be repeated at shift handovers (if applicable). TBT's, ref [104]: HS-FM-001 Toolbox Talks, are identified within Procedure Task Plans.

Relevant operating procedures and associated risk assessments must be reviewed during the TBT.

4.5 PERMIT TO WORK

All vessel-controlled operations and related work when mobilising onto the vessel will be controlled and co-ordinated using the vessel PTW system, as required. The implementation of the vessel PTW is the responsibility of the Vessel Captain. Modus will ensure that all applicable works undertaken are conducted in full compliance with the vessel PTW system.

The need to conform to these requirements should be clearly highlighted within the vessel induction, which will be undertaken by all Modus personnel embarking on the support vessel.

4.6 STOPPING OPERATIONS

All team members are permitted and encouraged to stop an evolution/operation if they deem it to be unsafe, dangerous, risk of personnel injury, risk of damage to an asset or infrastructure, at no point will any blame be placed on the individual calling a stop.

Two example methods of stopping an evolution/operation are shown below, however, the methods to be used during the project will be fully briefed during the onboard kick off meeting:

4.6.1 ALL STOP

This method of stopping an evolution/operation is the most urgent and is normally initiated by the way of depressing an emergency stop or calling **"ALL STOP"** over the preferred communication medium. All operations, vessel moves will be instantly stopped and the reasons investigated.

4.6.2 CONTROLLED ALL STOP

This method is to be used if the ALL STOP is not appropriate and will bring evolution/operation to a controlled and safe stop for e.g. reducing the speed of a vessel move to gradually bring the vessel to a stop, likewise with the HAUV. This action would normally be initiated by calling for a **"CONTROLLED ALL STOP"** over the preferred communication medium.

5 VESSEL DETAILS

The HAUV3 spread will mobilise onto the Vega NBA Bless, specific survey equipment that will be mobilised onto the Vega NBA Bless can be found in the Survey Operations Procedure [110]. Vessel information can be found in **Appendix A**, and Deck Layout can be found in **Appendix B**.

Figure 1: Vega NBA Bless

Flag:	Liberia
Built:	2008
Length Overall	70.70m
Breadth	16m
Draft	7.20m
Displacement	4,862T

6 MOBILISATION LOCATION

The mobilisation of the HAUV3 spread will be onto the Vega NBA Bliss at Brawal Jetty in Port Harcourt, Nigeria. Further details on the port can be found in by following the below link.

Brawal Oil Services Ltd (brawaloilserviceslimited.com)

7 EQUIPMENT LIST

7.1 HAUV3 SYSTEM

The HAUV3 Spread is comprised of the following equipment which will be mobilised onto the Vega NBA Bless.

Item	Dimensions (mm)				Qty.	Drawing Ref.
	Length (mm)	Width (mm)	Height (mm)	Weight (kg)		
HAUV3	4300	1700	1400	2580	1	36-4162801(1)
Sepro Tether Winch	2380	1700	2200	2200	1	
HAUV3 Maintenance Stand	2100	1816	1400	163	1	

Refer to Survey Operations Procedure [110] for details on survey equipment being mobilised.

7.2 ADDITIONAL EQUIPMENT

Item	Dimensions (mm)				Qty.	Drawing Ref.
	Length (mm)	Width (mm)	Height (mm)	Weight (kg)		
SMD LARS c/w modified snubber					1	
Modular Subsea Garage (Client Supplied) **Must be fitted with 2 off USBLs for heading monitoring**	5044	2444	2350.8	1350Kg	1	B0038
20ft Stores Container (Client Supplied)	6006	2440	2620	10500	1	N/A
20ft Control Container (Client Supplied)	6006	2440	2620	10500	1	N/A

7.3 ORDER OF INSTALLATION

During HAUV3 system installation, the following lift sequence is recommended.

- Tether Winch
- Subsea Garage
- HAUV3 Work Stand
- HAUV3
- Control Container items

Note: All shipping crates are to be offloaded and stored shoreside ready for de-mobilisation.

Note: The installation will be load tested on completion of mobilisation in accordance with DNVGL Standards.

This sequence is intended as a guide so that the installation and commissioning of the equipment may be conducted in an efficient manner during the mobilisation. It is possible that some lifts and items may be conducted outside of this sequence if it becomes practical or a good use of time to do so.

8 MOBILISATION OF EQUIPMENT

8.1 EQUIPMENT READINESS

Prior to the commencement of mobilisation activities ensure that the HAUV3 Equipment Readiness Procedure (Ref. [107]) and all survey equipment integration to the vehicle has been completed.

Reference Survey Operations Procedure for more information regarding configuration of survey equipment (Ref. [110]).

8.2 SEA FASTENINGS

Installation of the HAUV3 Spread to the vessel requires a bolted and/or welded seafastening connection to the vessel structure in order to transmit the operating loads onto the vessel structure. These seafastenings must satisfy the guidelines set out by IMCA (IMCA R009 (ROV Mobilisation) & IMCA R018 (ROV Installation on Vessels).

8.3 POWER REQUIREMENTS

The MODUS provided equipment power requirements are as follows:

- PSU – 32A, 3 phase, 440V 6h Socket.
- Sepro Winch 1 – 32A, 3 phase, 440V, 6h Socket.
- Battery Charger – 32A, 1 phase, 230V Socket.
- General use – 2 off 32A, 1 phase, 230V Sockets.
- SCU – 16A, 1 phase, 230V Socket.

8.3.1 Vessel Power Supply

The HAUV3 spread will use the vessels power supply, Fadfae are responsible for providing all cable runs and connectors to the Modus equipment.

8.4 Additional Required Services

- Sepro Winch Cooling water
  - Water inlet & outlet point 2” BSP female connection
  - Water supply 335l/min, pressure loss 0.2 bar, Max inlet pressure 10 bar
  - Water type: Seawater

- Fresh water supply for washing of HAUV3
- WiFi Internet
- Telephone line
- Clear-Comms (or similar) system

8.5 Lifting Operations

All equipment lifts are to be performed using the vessel crane under the direction of Modus personnel. All lifts are to have a designated lift plan completed by a competent person prior to mobilisation.

When performing general lifts on spread equipment:

- Prepare lift plan
- Perform TBT prior to lift.
- Identify the lift path and end position.
- Ensure all personnel are familiar with the operation.
- Connect rigging in accordance with the lift plan.

Ensure all personnel are clear of the lift path.

8.6 HAUV Integration

The HAUV is to be mobilised and integrated i.a.w the PEP [114] and **Appendix C**

9 FUNCTION TESTING

9.1 GENERAL TESTING

Following installation, HAUV3 and associated deck equipment shall be function tested to prove system operational status. This will be done in accordance with the Pre/Post-Dive Checklist [112] found in **Appendix D**.

9.2 SEPR01 WINCH GENERAL TESTING

Following installation, the winch shall be function tested to prove system operational status, by testing the paying in and paying out functions.

The following actions should be completed post installation of the winch before paying in/out.

- Check the winch post installation and make sure all fixing bolts are correctly torqued.
- Check that tether is properly wound on to the tension sheave wheels and correctly routed through the overboard sheave.
- Ensure no foreign objects such as dirt or grease, have fallen on to the drum or tension sheave wheels
- Check that the drum and tension sheave wheels run smoothly
- Check that the cooling water flows freely and is not spraying directly on to any motor, gear box or junction box.

9.3 WET TEST

9.3.1 TASK OVERVIEW

The following task plan outlines the steps to be taken in performing the wet tests. Additional tests may be carried out at sea if necessary.

The order and exact content of the wet tests are at the discretion of the Modus HAUV3 Supervisor. Regardless of the changes made to the test programme, the aim will always remain to prove that the system is operational and all relevant personnel are familiar with the system prior to commencing operational dives. Any safety critical actions must not be omitted from the operations.

9.3.2 OPERATIONAL COMMUNICATIONS

The primary form of communication between all parties and the HAUV will be via Clear Comms/VHF Radios. UHF radios may be utilised if required as a secondary or backup means of communication. It is especially important that the emergency channels are agreed, communicated to relevant parties, and tested prior to the commencement of operations.

For lifting operations, the primary form of communication will be via UHF radio. The secondary form of communication will be hand signals/verbal face to face.

9.3.3 LAUNCH & RECOVERY LOCATION

The distance the launch and recovery location will be away from any subsea assets will be stipulated in line with vessel operational requirements and the PEP [114].

Launch and Recovery locations will be as directed by Client Representative/Survey. Survey will be responsible for identifying the location of any subsea infrastructure and assets in these areas. These locations will be publicised at the relevant daily briefings and information disseminated accordingly.

9.3.4 WEATHER & SEA STATE

The ultimate decisions in regard of standby due to weather, sea state, currents and visibility shall be that of the Vessel Manager, Party Chief/Superintendent and the HAUV Supervisor jointly. In the event of disagreement however, the ultimate decision to launch/recover the HAUV or Garage is that of the HAUV Supervisor.

Hs and wind speed only play a part in the environmental conditions to be considered when determining if HAUV is operable in a given scenario. The decision to operate HAUV is dependent upon all the conditions at the time and how the vessel is behaving in that scenario. In all cases, the safe limit to launch, recover or operate HAUV will be judged by the HAUV Supervisor on a case-by-case basis.

For operational control a workability limit of approximately Hs<1.5m is recommended.

9.3.5 CURRENTS

The actual launch & recovery and operational limit will depend on several factors including, but not limited to, current direction and vehicle payload.

In all cases the decision to launch HAUV/Garage or abort a dive in any current, regardless of what may be indicated by any current monitoring device will be made by the HAUV Supervisor and will be considered on a case-by-case basis.

9.3.6 VISIBILITY

HAUV is designed to operate in reduced and even zero visibility. However, under some circumstances, a minimum level of visibility may be required to continue operations safely.

If under such circumstance's visibility is not sufficient to continue, operations will be suspended and the HAUV Supervisor will inform the Party Chief/Superintendent. Operations will resume as soon as visibility conditions permit.

9.3.7 VEHICLE TEST TASK PLAN

This test is intended to confirm that the main vehicle functions are operational, although thorough testing may not be possible due to constraints of the test site.

Step	Task	Action	Executed
Note	**The purpose of this task plan is to detail the actions to be taken to safely perform the HAUV3 function test operations.**	INFO	N/A
1. 	Prior to any work starting, all personnel must undergo relevant safety inductions according to the site that the work is carried out on. This will include but not be limited to, the following topics: • Explanation of the Permit to Work (PTW) System • Explanation of Tool Box Talk requirements • Explanation of Hazardous Observation Card System • PPE Requirements • Security arrangements • Lift plans, sequence of lifts and TRAs • Area barrier arrangements during lifting operations.	HAUV Supervisor	
2. 	**Undertake Toolbox talks with the relevant personnel. Command and control structure agreed. Toolbox Talks to be undertaken at the commencement of each shift or prior to complex tasks to review and update safety and operational requirements.**	HAUV Supervisor	
3. 	Ensure that all Permits to Work and TRAs & Lift Plans and associated certificates are in place prior to commencing operations and communicated via Toolbox Talk (signed evidence required). If required, ensure PTW are renewed and put into place for the commencement of each shift.	HAUV Supervisor	
4.	Ensure barriers are erected around the launch & recovery site prior to work commencing.	HAUV Supervisor	
Note	All rigging described below can be changed at the discretion of the HAUV Supervisor to suit the conditions during the recovery. Suitable rated rigging must always be used.		

9.3.7.1 **Pre-Requisites**

Step	Task	Action	Executed

1.	• HAUV buoyancy configured as per project requirements (positive/neutral/negative) i.a.w. AUT-HV3-BT
	• ToolBox Talk complete
	• PTW Raised and in force
	• Barriers & Cordons in place and deck is clear of non-essential personnel
	• HAUV Loaded into garage
	• Garage to be fitted with 2 off USBL beacons
	• Full communications check completed between all relevant parties
	  ○ HAUV Supervisor
	  ○ HAUV Control
	  ○ Survey
	  ○ Deck Supervisor
	  ○ LARS Winch operator
	  ○ Tether Winch operator
	  ○ Bridge
	• HAUV Pre-dive checks complete
	• HAUV Tether Winch check complete and in MANUAL mode.
	NOTE: During operations, all comms to be limited to only the personnel directly involved in controlling the operation.
		HAUV Supervisor	

2.	Confirm all survey / navigation / logging systems are fully operational, with relevant survey data entered to the survey database.	HAUV Supervisor	
3.	• Vessel to be in DP mode at launch location and positioned correctly for launch & recovery. **Ensure that position is such that currents will not pull the HAUV/tether back into the side of the vessel.** **NOTE:** Supervisor to ensure Vessel Master/ understands the vessel best heading “blow off” condition.	Bridge	

9.3.8 PROCEDURE

Step	Task	Action	Executed
1.	Launch the HAUV in accordance with [109] 23-0022-OPS-PR-002 HAUV3 Launch & Recovery Procedure **Note: All HAUV systems are to be operated at the splash zone including:** • **All thrusters** • **Cameras & P&T units** • **All surveillance equipment** • **Transponder/responder if water depth allows** • **Confirm vehicle auto heading function is operational and that gyro heading is correctly displayed.** • **Ensure Wi-Fi communications with the vehicle function correctly.**	EC	
2.	Undock the HAUV from the Subsea Garage	EC	
3.	Confirm thruster operation and control.	EC	
4.	Carry out pilot familiarisation.		
5.	Deploy until HAUV3 is on the surface of the water. Ballasting check may now commence, with HAUV3 connected to the winch.	EC	
6.	Verify that HAUV3 is trim. If leaning excessively, recover to trailer and adjust buoyancy/ add weights accordingly to restore trim, before returning to the water.	EC	
INFO	**NOTE: The recovery and deployment of HAUV3 for the purpose of trimming it is expected to take a significant amount of time. A substantial number of deployments and recoveries are to be anticipated.**	Info	
7.	Ensure HAUV3 GPS is operating and showing the correct location.	EC	
8.	Operate cameras and P&T units to ensure all are operational.	EC	
9.	Operate all other surveillance equipment and ensure that the control system relays information correctly.	EC	
10.	Confirm vehicle auto heading function is operational and that gyro heading is correctly displayed.	EC	
11.	Confirm operation of transponder and responder (if water depth allows).	EC	
12.	Confirm that “HAUV3 Surface” are correctly receiving data and communications from HAUV3 and survey equipment.	EC	
13.	Ensure WiFi and radio communications with the vehicle also functioning (if applicable).	EC	

Step	Task	Action	Executed
14.	Continue test dive as time and operational constraints allow so operators can familiarise with vehicle controls.	EC	
15.	On completion of tests, dock the HAUV in the subsea garage.	EC	
16.	Recover the garage and HAUV in accordance with [109] 23-0022-OPS-PR-002 HAUV Launch & Recovery Procedure.	EC	
Task Completed			

10 DEMOBILISATION

Following completion of the project work scope, the vessel will make passage to the predetermined de-mobilisation location.

In agreement with the Party Chief and Vessel Master, the HAUV3 Supervisor may start demobilisation preparations during the transit back to port. No Sea-fastenings may be removed during transit.

All materials, labour and quayside resource should be prepared for the arrival of the vessel to ensure efficient demobilisation of the equipment.

On commencement of demobilisation at port, disconnection and removal of equipment is generally the reverse sequence of the mobilisation sequence. Modus and Client responsibilities remain the same as for mobilisation regarding disconnection of services and removal of seafastenings.

In removing seafastenings, hot work is not permitted to Modus equipment – i.e. bolted seafastenings must be released by removal of bolts, and welded seafastenings must be released by cutting the installed seafastening plates only.

The MODUS equipment will be packed into the same shipping containers as used for outbound shipping, all manifests are to be updated and supplied to the Client/Modus Logistics department in good time.

Prior to the commencement of demobilisation activities ensure that the HAUV3 Equipment Readiness Procedure (Ref. [107]) demob section has been completed and sent to the Project Manager.

APPENDIX A – VESSEL DETAILS

10,800 BHP / 121 TBP / DP2 / AHTS Call Sign: 3FBG2

Class Notation BV: I+ HULL + MACH Tug; Fire Fighting Ship 2; Unrestricted Navigation; DYNAPOS AM/AT R

Principal Particulars	
Flag	Liberia
Year Built	2008
Place Built	Guanhai Shipbuilding, P. R. China
Design Draft	5.40 m
Max Summer Draft	6.20 m
Gross Tonnage	2,532.0 T
Net Tonnage	759.0 T
Deadweight (Max Draft)	2,454.0 T @ 6.20 m draft
Displacement	4,862.0 T
IMO No.	9489883
Design	Conan Wu & Associates 70 m. A.H/OSV

Dimensions	
Length Overall	70.70 m
Beam Overall	16.00 m
Depth Moulded	7.20 m

Performance	
Max Speed	12.00 kts
Economical Speed	10.00 kts

* Subject to actual weather and operating conditions

Cargo Deck	
Deck Cargo Area	469.9 m²
Deck Cargo Dimension	37.0 m x 12.7 m
Deck Cargo Capacity	800.0 T
Deck Strength	5.5 T/m²
Reefer Points	8 (4 x 440v, 2 x 230v)

Capacities	
Fuel Tank	967.0 m³
Fresh Water *	598.8 m³
Drill Water *	598.8 m³
Ballast Water *	598.8 m³
Mud Tank *	524.6 m³
Brine Tank *	524.6 m³
Dry Bulk Tank	270.4 m³ (in 4 tanks)

* Indicates tanks with shared capacity

Discharging Rates	
Drill Water/Pump	1 x 150 m³/hr@90 m head
Fresh Water/Pump	2 x 150 m³/hr@90 m head
Fuel/Pump	2 x 150 m³/hr@90 m head
Brine/Pump	1 x 150 m³/hr@90 m head
Liquid mud/Pump	1 x 150 m³/hr@90 m head
Dry Bulk Tank	1 x 50 m³/hr@60 m head

Accommodation	
1 – Berth Cabins	4
2 – Berth Cabins	8
4 – Berth Cabins	5
Total (POB)	40

Main Engines &	
Main Engines	Bergen 2 x 5,400 BHP
Shaft Generators	Bergen 2 x 1,730 kW each
Diesel Generators	Caterpilar 2 x 590 kW @ 3 x 440 V 60 Hz
Emergency Generators	Caterpilar 1 x 99 kW

Thrusters & Propulsion	
Bow Thruster	Rolls-Royce 1 x Tunnel Thruster @ 735 kW (11.0 Rolls-Royce1 x FPP Retractable (13.5 T) Thruster
Stern Thruster	Rolls-Royce1 x Tunnel Thruster @ 735 kW (11.0
Propellers	MAN 2 x CP Propellers in fixed nozzles
Rudders	MAN 2 x independent high lift flat type

Deck Crane	
Fixed Crane	SWL 6.2 T @ 5.0 m radius SWL 5.0 T @ 15.0 m radius

Anchor Handling/Tow Equipment	
Tow/Anchor Handling Winch	Rolls-Royce 1 x Double Drum Waterfall, Low
Stall Pull Capacity	300.0 T
Brake Holding Capacity	450.0 T
Tow Drum Capacity	2,000 m x 76 mm dia. wire
Anchor Handling Capacity	2,000 m x 76 mm dia. wire
Secondary Winch Capacity	2,000 m x 76 mm dia. wire
Storage Reel Capacity	1 x 2,000 m x 76 mm dia wire
Tugger Winch	Rolls- Royce 2 x 15.0 T each
Capstan	2 x 10.0 T each
Shark Jaws	2 x Karmoy (SWL 300.0 T)
Tow Pins	2 x Karmoy (SWL 160.0 T)
Stern Roller	5.0 m x 2.5 m dia (SWL 350.0 T)
Gypsies	1 x 76.0 mm + 1 x 90.0 mm
Chain Locker	2 x 74.0 m³

Tow/Anchor Handling	
Main Tow Wire	1,330.0 m x 76.0 mm dia wire
Spare Tow Wire	1,490.0 m x 76.0 mm dia wire
Anchor Handling Wire	525.0 m x 76.0 mm dia wire

Mooring Equipment	
Anchor	2 x AC14; 1,920 kg each
Anchor Chain	2 x 412.5 m x 46.0 mm dia
Anchor Windlass	14.0 T @ 13.0 m/min

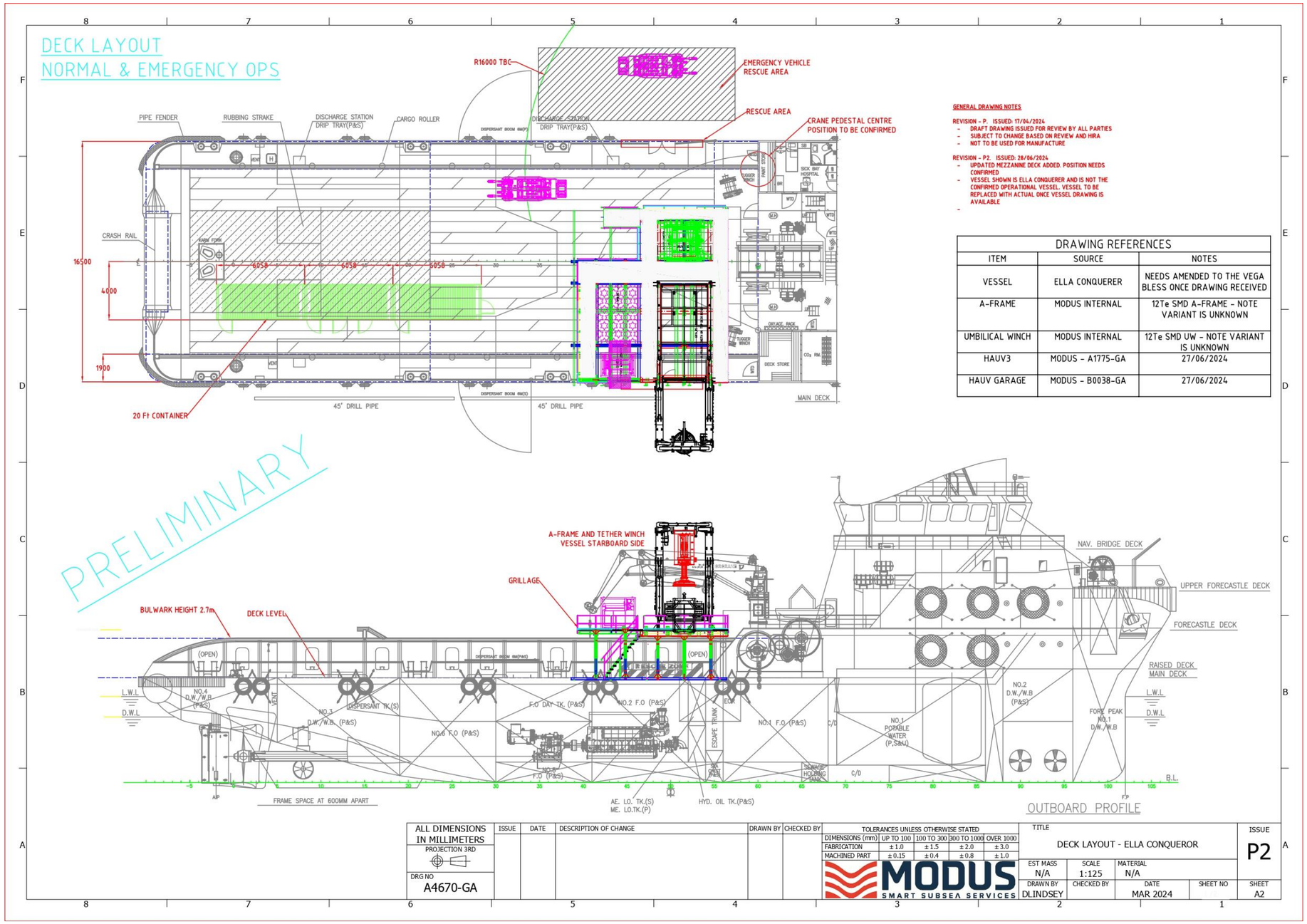
Dynamic Positioning	
DP Class	DP 2, Converteam ADP-2 system
References	2 x DGPS + 1 x Cyscan

Fire Fighting and Rescue	
Firefighting System	FiFi 2
FiFi Pump	2 x 3,700 m³/hr
FiFi Monitors	4 x 1,800 m³/hr
Spray Booms	2 x 6.0 m
Dispersant Capacity	NIL
Foam Capacity	NIL
Rescue Boat	1 x 10 man/rigid/110 hp
Life Rafts	6 x 25 man
Life Buoys	10
Life Jackets	105

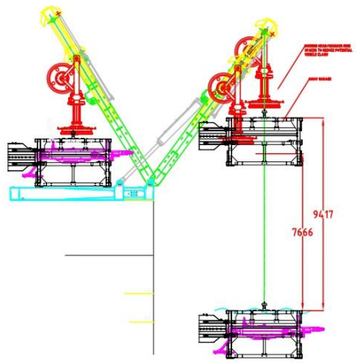
Particulars given herein are believed to be correct but not guaranteed. Owner reserves the rights to amend specifications without notification.

APPENDIX B – VESSEL DECK LAYOUT

The deck plan shown below is for the Vega Bless but based on the Ella Conquerors GA due to the unavailability of the correct .dwg file, **this deck plan is preliminary and for reference use only**.



DECK LAYOUT
NORMAL & EMERGENCY OPS



RECOVERY NOTES
NORMAL OPS
- OUTBOARD AF AND LOWER GARAGE TO SEABED
- HAUV DOCKS IN GARAGE
- RECOVER GARAGE TO A-FRAME AND LATCH
- ROTATE SNUBBER FOR GARAGE INBOARDING
- INBOARD AF AND LAND GARAGE & HAUV

PERSONNEL
- HAUV PILOT
- A-FRAME & MAIN WINCH OPERATOR
- TETHER WINCH OPERATOR

EMERGENCY OPS / DEAD VEHICLE
- LAUNCH FRC
- WALK TETHER AROUND TO VESSEL PORT SIDE
- HOOK-UP HAUV ON VESSEL PORT SIDE TO DECK CRANE; INCLUDE 2X TAG LINES
- USE DECK CRANE TO INBOARD HAUV AND LAND ON MAINTENANCE STAND ON DECK

PRELIMINARY

ALL DIMENSIONS IN MILLIMETERS	ISSUE	DATE	DESCRIPTION OF CHANGE	DRAWN BY	CHECKED BY	TOLERANCES UNLESS OTHERWISE STATED			
PROJECTION 3RD						DIMENSIONS (mm)	UP TO 100	100 TO 300	300 TO 1000	OVER 1000
						FABRICATION	± 1.0	± 1.5	± 2.0	± 3.0
DRG NO						MACHINED PART	± 0.15	± 0.4	± 0.8	± 1.0
PART NO.						MODUS SMART SUBSEA SERVICES				

TITLE				ISSUE
DECK LAYOUT - ELLA CONQUEROR				P2
EST MASS	SCALE	MATERIAL		
N/A	1:125	N/A		
DRAWN BY	CHECKED BY	DATE	SHEET NO	SHEET
DLINDSEY		MAR 2024		A2

APPENDIX C – HAUV INTEGRATION

MODUS SMART SUBSEA SERVICES

PROJECT TITLE:	OGGS Pipeline			
DOCUMENT TITLE:	HAUV3 Project Integration Guide			
DOCUMENT NUMBER:	23-0022-SUR-PR-002			
CURRENT REVISION:	Issued For Use 1.0			
DATE:	19/06/2024			
REVIEW	**PREPARED**	TBA/SJQ		
	CHECKED	GCO		
	APPROVED	RAL		

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HAUV3 Project Integration Guide

23-0022-SUR-PR-002

Revision	Date	Description of Change	Page No(s)
0.1	19/06/2024	Issued for Internal Review	ALL
1.0	19.06.2024	Issued for use	All

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FIGURES

HAUV3 Project Integration Guide

23-0022-SUR-PR-002

1 INTRODUCTION

The purpose of this document is to describe the setup and lessons learnt during trials at Sunderland Dock, UK in June 2024.

Trials were conducted to follow as closely as possible to how the system will be setup and operated in Nigeria, as a result may need updating onsite if things change.

2 HAUV3 OVERVIEW

Figure 1: HAUV3

2.1 VEHICLE EQUIPMENT

The HAUV3 has been configured for pipe survey operations and is supplied with the following equipment installed specifically for these operations are listed below:

- FIGS
- TSS660
- R2Sonic 2024 Dual Head MBES
- Edgetech 2205
- Tritech Gemini

The vehicles standard equipment:

- SPRINT-nav w/ Syrinx DVL
- MiniIPS
- Valeport µSVS
- Novatel OEM 729 GNSS
- Imagenex 881L profiling sonar. OAS
- Sonardyne AvTrak 6
- PT90 Emergency beacon

2.2 General Wiring & Connections Layout

The below diagram is a simplified drawing of connections require to be made to & from the vehicle during mobilisation. More details on each can be found later in this document.

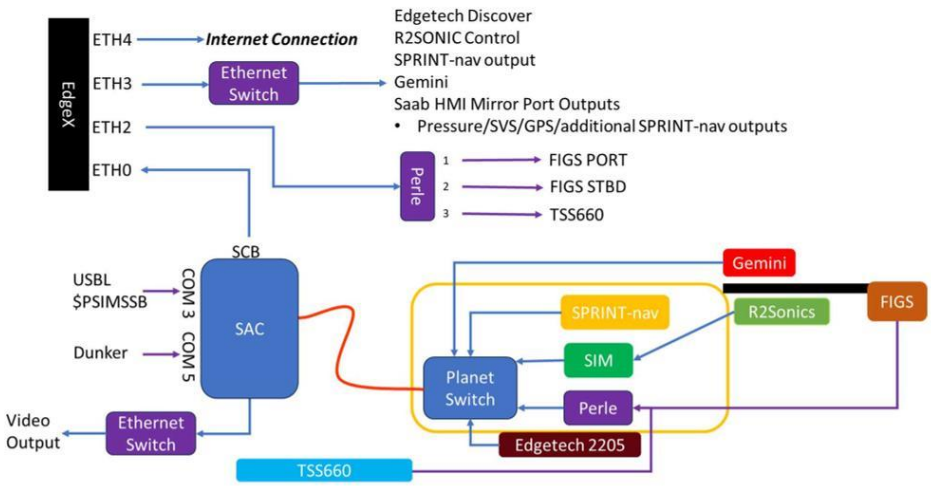


Figure 2 General Wiring Layout & Connections

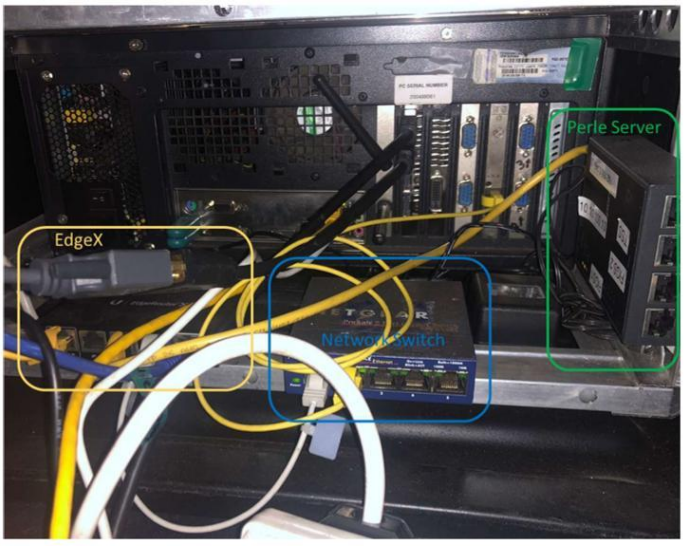


Figure 3 Rear of Reports PC

2.3 SENSOR TRIGGERING

The triggering of MBES, DVL and Edgetech 2205 is controlled by the vehicles internal trigger board. This ensures there is no interference between to different acoustic systems.

The below table has some basic settings that have been used in the past to collect good quality data.

	5Hz Ping Rate			8Hz Ping Rate			10Hz Ping Rate		
	Period	Offset	Active	Period	Offset	Active	Period	Offset	Active
DVL	200	100	20	250	60	20	200	50	20
R2Sonic	200	0	10	125	0	10	100	0	10
Edgetech	200	50	10	250	30	10	200	20	10

Table 1 Previous Trigger Settings

These settings can be found in the Settings > Trigger within the HMI software.

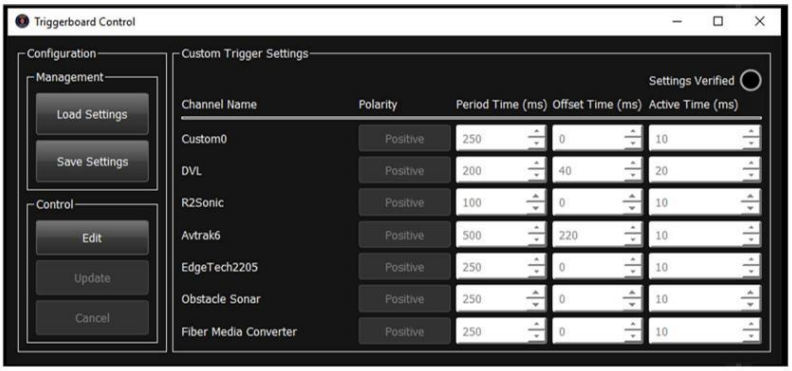


Figure 4 Saab HMI Triggerboard Control

To activate the sensors the trigger board needs enabling in the Saab HMI Control window, DVL will also need setting to triggered.

Figure 5 Saab HMI DVL Triggering

3 FADFAE INTERFACING

The onboard survey team will need to connect their network to ETH3 on the EdgeX router and set the NIC IP address to the below, in order to be able to receive telemetry and data feeds from the vehicle.

IPv4 Address – 192.168.200.90

Subnet – 255.255.255.0

Default Gateway – 192.168.200.1

Serial data from the FIGS and TSS660 is transmitted from the vehicle to the surface via a pair of Perle Serial to Ethernet convertors. The topside unit connects to ETH2 on the EdgeX router. The provided RJ45 to 9D converters should work but as we didn't have a FIGs for testing, they may require a null modem/re-soldering. This was checked with a laptop and serial program through the vehicle compared against the pin outs for the FIGs so should work.

The USBL $PSIMSSB input required by the SPRINT-nav needs a serial connection to com 3 on the SAC.

3.1 NETWORK INTERFACING

IP Address	Description
192.168.200.90	Survey system needs an ethernet connection with a static IP address for reception of UDP traffic, R2Sonic and SSS/SBP control
 192.168.200.135 192.168.200.134 192.168.200.136	R2sonics GUI Setup Sim Head 1 Head 2
192.168.0.244:20501	Output - Sonardyne LNAV via Saab mirror ports
192.168.0.244:30502	Output - Parascientific Pressure Sensor – via Saab mirror ports
192.168.0.221:4001 (TCP)	Output – PD6 DVL data (Either Saab HMI or survey depending on LNAV performance)
192.168.0.222:4093	Output - Sonardyne LNAV output – direct from SPRINT-nav
192.168.0.223:18055	Output - GGA & ZDA direct from onboard GPS card

Table 2 Network Interfacing

Additional outputs can be setup in the SAAB HMI if required.

3.2 SERIAL INTERFACING

Location	Port	Description
SAC	3	Input - USBL $PSIMSSB @ 9600 8-N-1
Perle	3	Output - TSS660
	2	Output - FIGS 2
	1	Output - FIGS 1

Table 3 Serial interfacing

4 SPRINT-NAV AND LODESTAR SOFTWARE

4.1 CONNECTING TO THE SPRINT-NAV

The Lodestar software is located the desktop of the RAC.

On the RAC you can connect via serial com 5, baud 115200 8-n-1 (with CARUS closed to free up the com port) or IP 192.168.0.222:4000 (IP preferred).

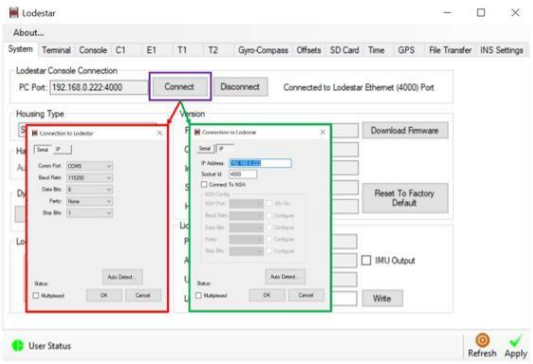
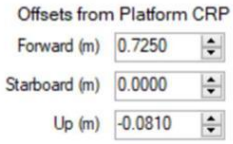


Figure 6 Lodestar Connection

From here you are able send/retrieve the config for the SPRINT-nav, send manual commands and set up various parameters.

Onsite you will need to set the beacon code and lever arms for the beacon position, once these are known, within the terminal tab.

To set USBL beacon position, **relative vehicle CRP**, this can be calculated from dimcon report that accompanies this report and the Saab offset drawings. The Lodestar software contains help and description of the sign conventions for this.



SUSBL LA ***FWD STBD UP*** VEH

To change beacon ID, where XX is your beacon code.

SUSBL TPDR 1 XX

To save any changes into the memory, use the below, otherwise changes will revert after a vehicle restart.

SYS SAVE FLASH

4.2 SPRINT SOFTWARE FOR MONITORING

It is possible to use the Sprint software to monitor the INS performance, unfortunately this comes with a few foibles. **As such, we don't recommend using this for anything other than diagnostics.** Sonardyne are currently investigating the issues and hopefully in the future we can use this to monitor the INS all the time.

Open the Sprint software, ensuring the Sprint dongle connected to the PC. Under Configure > SPRINT > Connection, set the IP address to 192.168.0.222 and port 4000 and 'Connect'.

Figure 7 Sprint software connect to SPRINT-nav

Under Tools open Terminal, from here we need to send commands down to the SPRINT-nav. These commands enable data to be passed from the SPRINT-nav to the Sprint software, allowing us to monitor the INS performance.

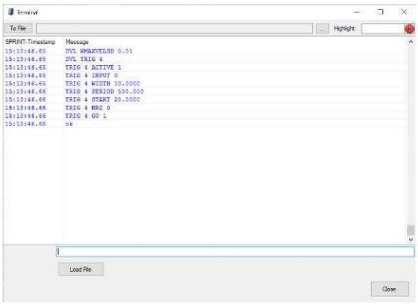


Figure 8 Sprint software Terminal window

The necessary commands are:

OP 4000 NET TCP MSG INGGA 1.000 RP 1 SRC 1

OP 4000 NET TCP MSG + SON2 5.000 RP 7

OP 4000 NET TCP MSG + SON2 5.000

OP 4000 NET TCP MSG + NAV 2.000 RP 7 SRC 1

OP 4000 NET TCP MSG + TEMP 0.500

LOG 4000 NET TCP MSG CIMU NAVCAL NAVQUAL PMAT DXMAT TMS PRDSONDEPM PRDDPT PRDDIGIQM PRDDIGIQPSI PRDDIGIQKPA PRDDIGIQO WINSON PRDSVX2DBAR PRDXDEPTH TRG CMD DVL LBL GPS PSONLBLBCN SVS PSONSS ALARM DBG TXT CPU UART SETTINGS BIST SUSBL XPOS OBSTZMD OBSTGPSPOS OBSTSUSBL OBSTXPOS OBSTPDEPTH OBSTSVS OBSTDVL OBSTLBL OBSTZUPT PWRSTAT PHMAT LSZDA PRDKELLBIN OBSTLBLFIX VSVI

These commands are in a text file supplied in the job data pack, meaning they can be sent on mass to the SPRINT-nav using the 'Load File' function in the Terminal window. With these commands sent, the LEDs in the Sprint software should appear green.

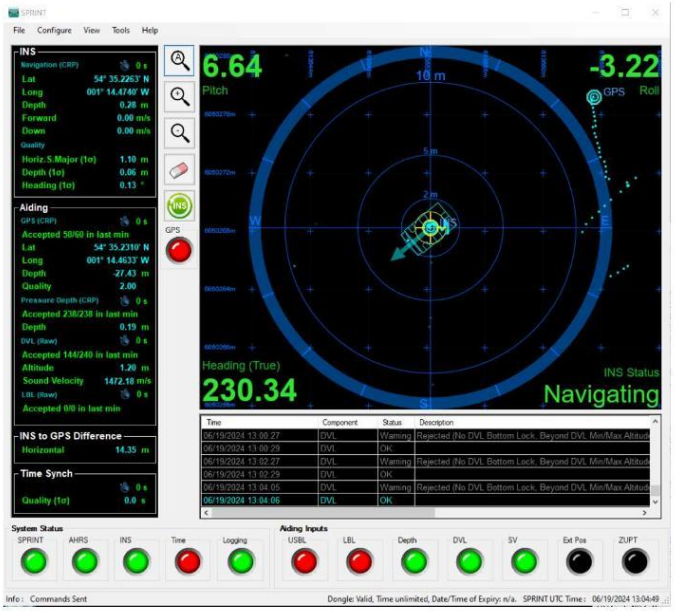


Figure 9 Sprint software

Under normal circumstances you are able to configure the inputs/outputs for the SPRINT-nav from here. Unfortunately, this is not the case for us and you shouldn't open any of the configuration windows in the Sprint software. The only way to configure the SPRINT-nav is via manual commands.

If the additional commands we entered into the SPRINT-nav to get the Sprint software displaying data are not removed before shutdown of the vehicle, at vehicle reboot we will lose all comms with the unit. Meaning no data in the HMI or going to survey, rendering the vehicle essentially dead.

To avoid this, the master command list should be uploaded prior to shut down, to set the SPRINT-nav back to default operation and making it ready for the next dive. Section 4.3 deals with how to recover the SPRINT-nav in case of comms dropout.

4.3 ADVANCED RECOVERY OF SPRINT NAV WITH COMMS DROPOUT TO UNIT

If the sprint nav loses all comms, it can be recovered to a useable state without the need for a vehicle reboot. On the RAC, close CARUS and connect to the serial port com 5 at 9600 baud using 6G terminal as per Figure 10

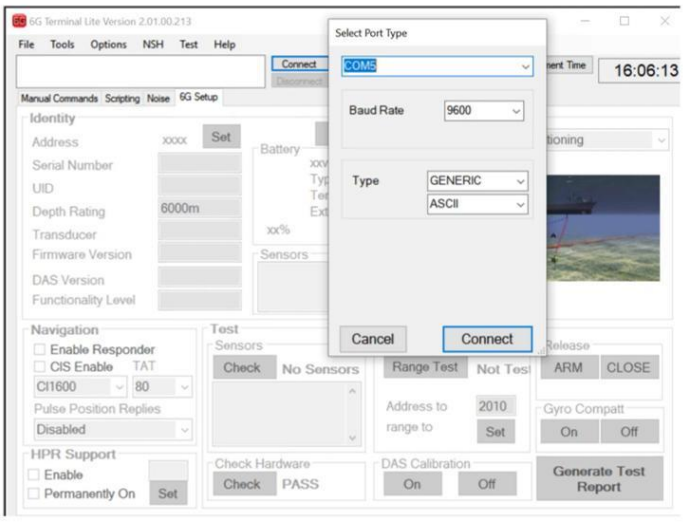


Figure 10 Sprint Nav Comm settings for UNLK

Once connected go to the manual command tab and enter ***UNLK.*** This will perform a reset of the unit which takes approximately 3 minutes, once it shows 'Loading Firmware ……..", followed by random characters then the unit should be operational again as shown in Figure 11

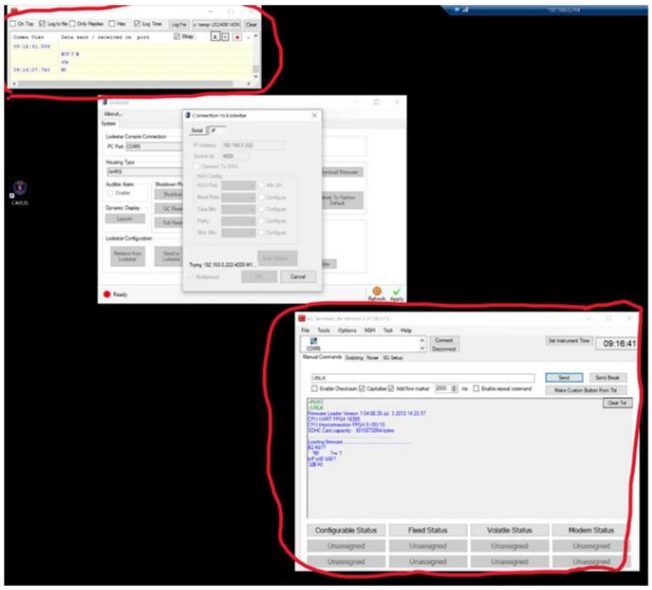


Figure 11 Showing successful reset of sprint after comms blackout

4.4 ONSITE DIMCON

From talks with Subsea100 we have been informed that the vehicle will undergo a dimcon once it arrives in country. For this we will need to zero the previously calculated mounting angles, found in the 'Offsets' tab. Once complete, we should be supplied with a new set of C-Os which can be entered back into the Lodestar software, remembering to press 'Apply' for changes to take effect.

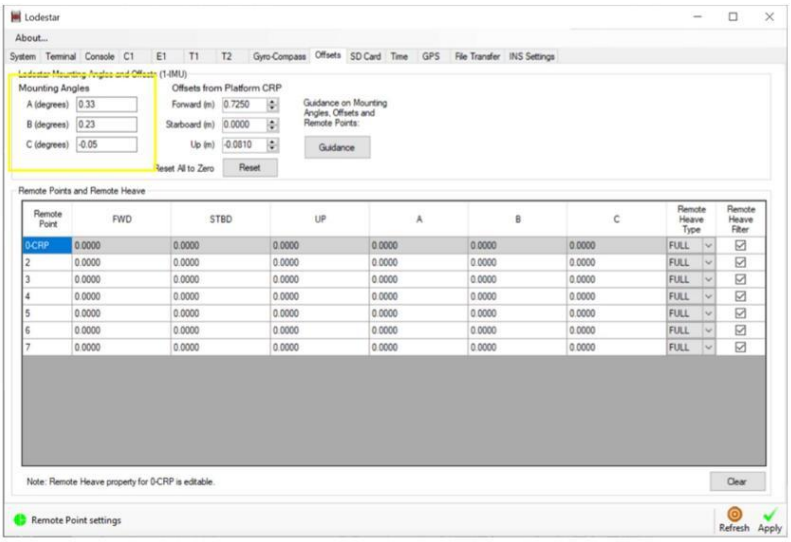


Figure 12 C-O Settings

4.5 USBL Input & Activation

The SPRINT-nav requires a USBL input while in the water, this needs feeding into the SAC on com port 3 baud 9600 8-n-1 (labelled in the rear panel). The SPRINT-nav is expecting a $PSIMSSB.

Figure 13 USBL Input Settings

When a $PSIMSSB message is received in the Saab HMI, under Navigation > USBL you will see the Input section populate with a position. To send this to the sprint you need to select the correct transponder code, activate 'Send USBL on Ethernet' and set the update period to the lowest possible period (8s is the maximum allowed by the software). It appears to send it out when it receives the data but this needs to be confirmed on the job.

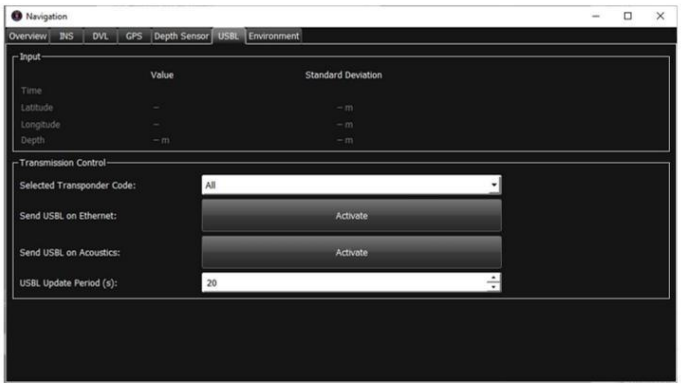


Figure 14 USBL Transmission to SPRINT-nav

To tell the SPRINT-nav to use the USBL input for aiding, you need to active it in the Control > INS Use Sensors so the LED goes green.

Figure 15 SPRINT-nav USBL activation in Saab HMI

Back in the Navigation window you should see the LED for USBL blink in the 'Sensors In Use' window, indicating that the message has been received and accepted.

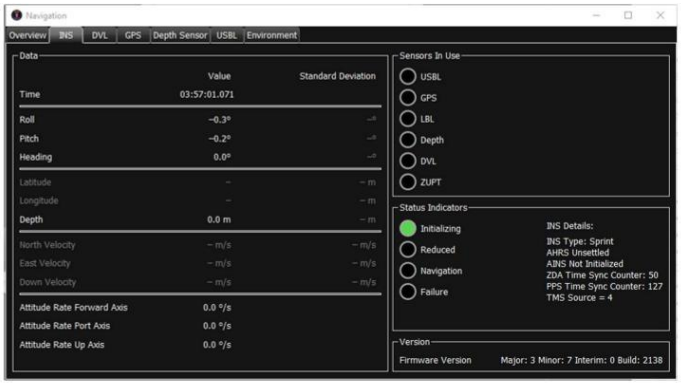


Figure 16 INS Sensors In Use

4.6 File Transfer

To retrieve log files from the Lodestar software, go to the 'File Transfer' tab and choose a location for the files to be save. Then navigate to the date then time you need in the 'Lodestar SD Card Explorer' windows and 'Upload to PC', this process can take a while and is best performed when the vehicle is on deck for an extended period. Ensure you use the IP connection to the lodestar as it takes a significant amount of time to transfer over serial.

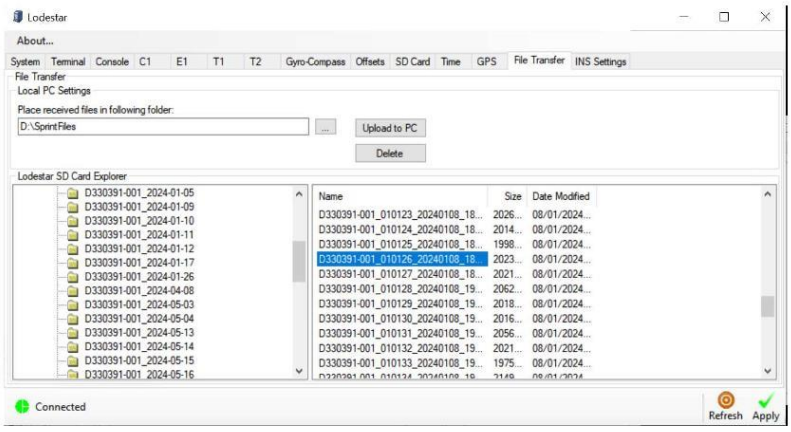


Figure 17 Lodestar Files Transfer

4.7 RAC/SPRINT-nav Com Port Lockout

During Sunderland trials we have had two occurrences where the HMI is not receiving the LNAV string from the SPRINT-nav at system boot. This has been due to com 5 on the RAC locking up and hasn't cleared after a vehicle restart, we believe this is due to the continuous output from the SPRINT-nav onto that com port.

To clear this, we need to stop the output of the LNAV string from the SPRINT-nav console port. Connect to the RAC via Remote Desktop, open the Lodestar software and connect via IP. On the console tab delete the LNAV output and apply the changes.

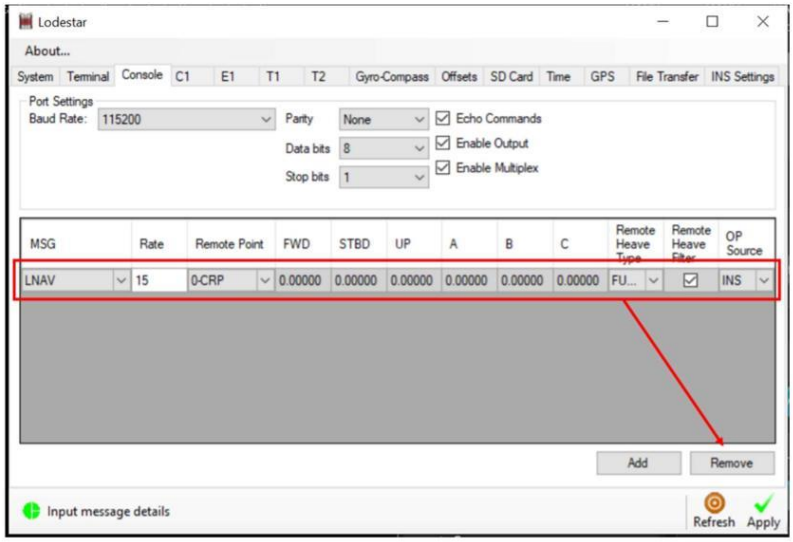


Figure 18 Lodestar Com Port Disable

Reboot the RAC and then you should have access to the com port. Open the Lodestar software and connect via serial on com 5 and the LNAV output can be added back to the console port. Apply the changes and restart CARUS.

5 SSS/SBP Discovery

The Saab HMI sends ZDA, Sonardyne LNAV and SVS directly to the Edgetech subsea unit via the mirror ports. The Edgetech has an IP address of 192.168.100.132.

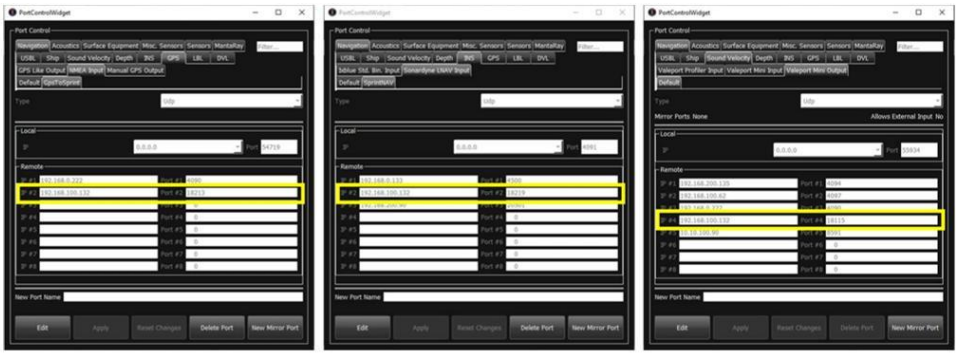


Figure 19 ZDA, Sonardyne LNAV and SVS output to Edgetech

The SSS/SBP is operated using the Discover Software, you will need to use the version supplied with this document as it has been modified by Edgetech for use with HAUV3. Once powered on, you can check under Control > Diagnostic Information that there is connection to the unit and data is being received.

Port1 –Sonardyne LNAV

Port 2 – ZDA

Poer 3 – SVS (out of water this will show an error, so don't worry)

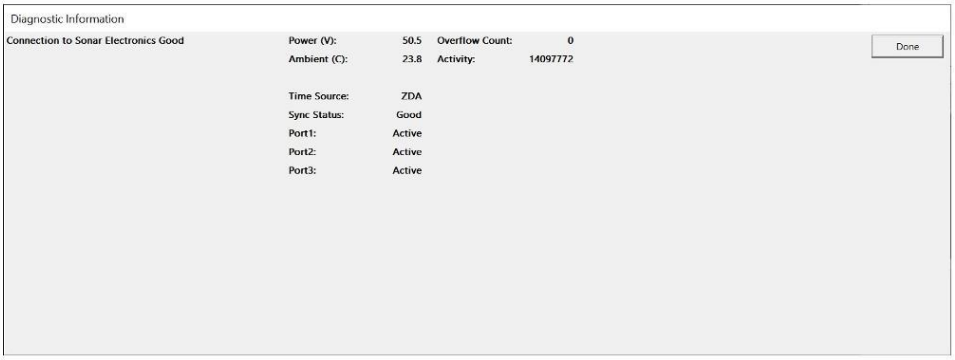


Figure 20 Discover Connection & Serial Data Diagnostic Information

During pre-drive checks we will need to perform a rub test on the SSS to prove that it is operational. Firstly, the trigger board will need to be enabled and the Edgetech power channel turning on. In the Discover software on the Sidescan Control tab check the top two boxes, this will turn on the Very High and High frequency SONARs respectively. The Discover software only allows 2 frequencies to be used at a time, it is my understanding that we will using the higher frequencies for better resolution, at the expense of range. This tab also allows you to set the operating range, this and any tuning required to get the best data quality will be the responsibility of the on-board survey crew.

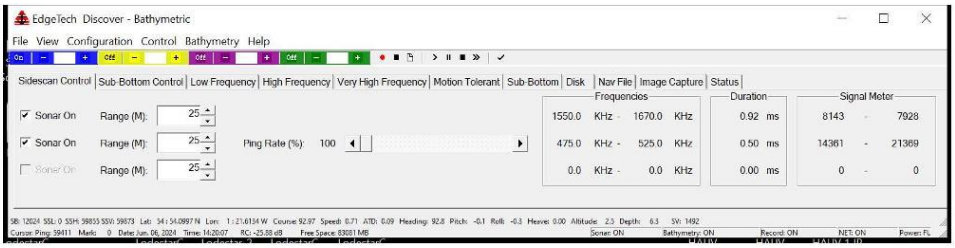


Figure 21 Discover SSS SONAR On

Once 'On' rub each receiver fast a few times firmly.

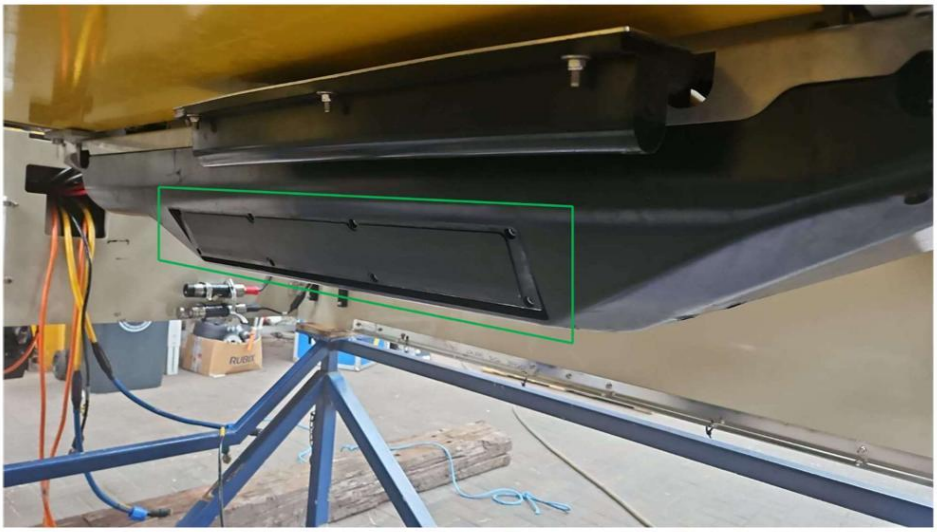


Figure 22 SSS Receiver Face

On the waterfall displays you will see a horizontal line that corresponds when which receiver was rub, this should look like the below image if working correctly.

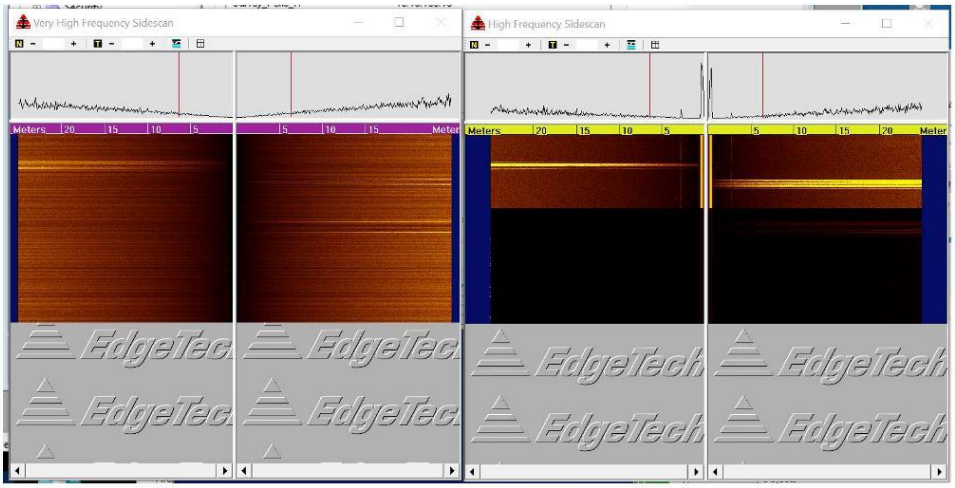


Figure 23 Rub Test Results

To test the SBP, go to the Sub-Bottom Control tab and check the Transmit on box. You should then be able to hear the unit 'ticking', which indicates the unit is working. The unit needs to be in the water before it can be correctly tested, but this method proves it is transmitting.

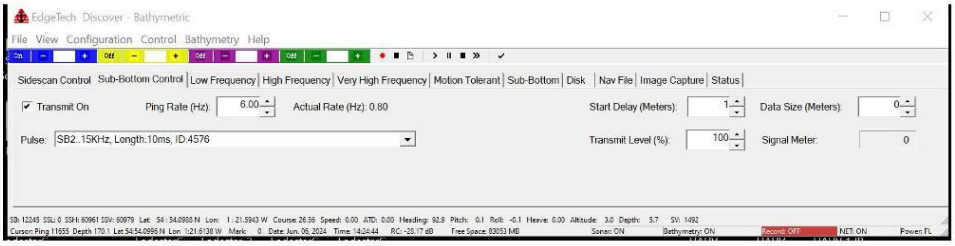


Figure 24 Discover SBP Transmit On

The recording directory is set under the Disk tab, you can also start/stop recording from here or from the top bar. When recording is inactive the bottom bar of Discover will show Record:Off and is highlighted red as seen in Figure 24 Discover SBP Transmit On, when recording is active it displays Record: On as seen in Figure 24 and Figure 25.

Figure 25 Discovery Recording Setup

6 R2SONIC

6.1 VEHICLE CONNECTIONS

The SONAR heads are connected into ports on the starboard forward pod of the vehicle. The port head (H1) connects into B1 and the starboard head (H2) into A2.

6.2 R2SONIC GUI

The below screenshot shows the IP addresses to be used in the R2Sonics GUI. As the heads used in testing are not going on the project the serial numbers will need updating in the GUI during mobilisation. Serial numbers are displayed with the “Discover” button is pressed. **NOTE** the sim will be the same but the heads different as theses are provided in country.

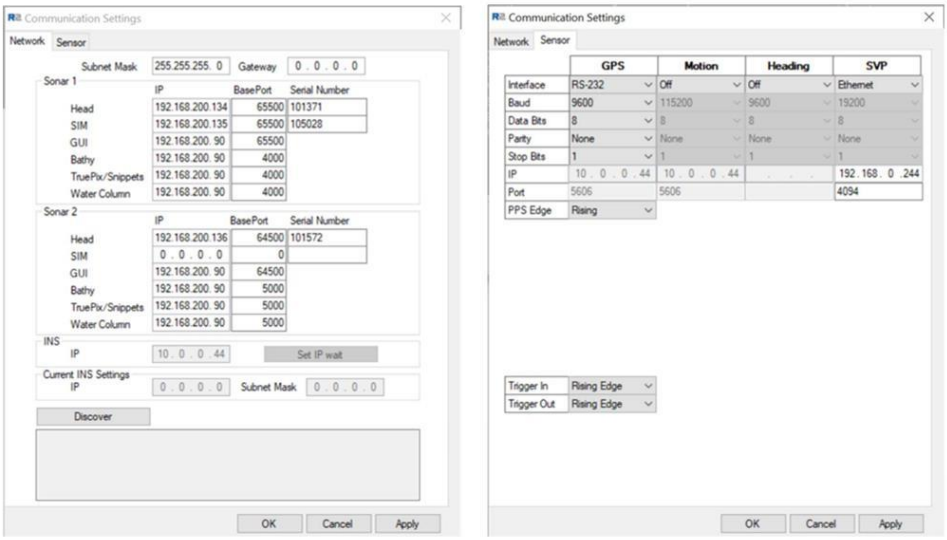


Figure 26 R2Sonic Network & Sensor Settings

The R2Sonics have GPS/ZDA and SVP interfaced, the settings can be seen below. GPS/ZDA is direct from the onboard NovAtel card, and the SVP is mirrored by the Saab software. Settings can be seen in the below screenshot.

The survey team should setup NaviScan to use the following IP addresses and port numbers to receive the data.

Head 1 (Port)	Head 2 (Starboard)
0.0.0.0:4000 Bathy	0.0.0.0:5000 Bathy
0.0.0.0:4006 Snippets/Backscatter	0.0.0.0:5006 Snippets/Backscatter

7 FIGS

The FIGS system is interfaced into the vehicles Perle Server through bulkhead B3 on the starboard forward pod, Figs 1 connects to port 1 and Figs 2 connects to ports 2 on the Perle Server.

8 TSS660

The TSS660 system is interfaced into the vehicle Perle Server through bulkhead B2 on the starboard forward pod on the topside Perle Server data is transmitted via port 3 and should be connected to the computer that is running DeepView.

9 VIDEO OUTPUT

There are 2 options for video output from the vehicle, depending on what recording equipment the survey team are using. Direct IP Stream from the cameras or the AXIS Decoders that convert the IP streams in a DVI and composite output. **NOTE** they are currently configured for composite.

Camera	IP address	Network address
Camera 1 – Rear Colour	192.168.0.201	rtshp://192.168.0.201/axis-media/media.amp
Camera 2 – FWD B/W Colour	192.168.0.202	rtshp://192.168.0.202/axis-media/media.amp
Camera 3 – FWD Fisheye	192.168.0.203	rtshp://192.168.0.203/axis-media/media.amp
Channel 5 - HD Camera	192.168.0.205	rtshp://192.168.0.205/axis-media/media.amp

Table 4 Camera IP Streams

The AXIS Video Decoder have a default IP address of 192.168.0.90 when factory reset, login is root & root. Four have been preconfigured for the cameras currently fitted to the vehicle.

Camera	AXIS Decoder Network address
Camera 1 – Rear Colour	192.168.0.206
Camera 2 – FWD B/W Colour	192.168.0.207
Camera 3 – FWD Fisheye	192.168.0.208
Channel 5 - HD Camera	192.168.0.209

Table 5 AXIS Decoder IP Address

The below screenshots show the configuration of the decoders, as they are currently setup.

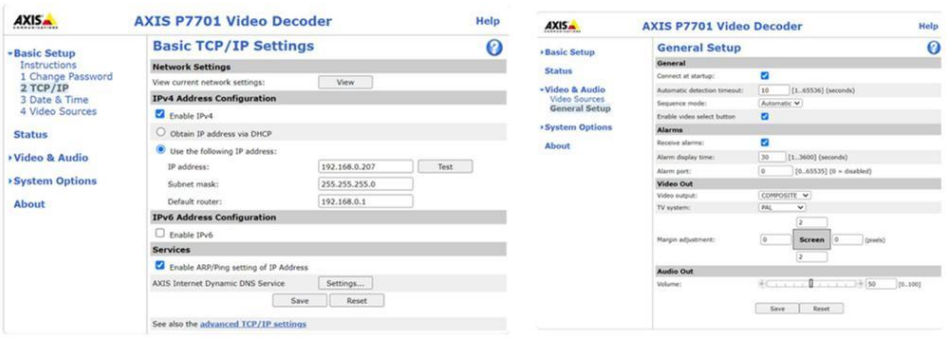


Figure 27 AXIS Decoder IP & General Setup

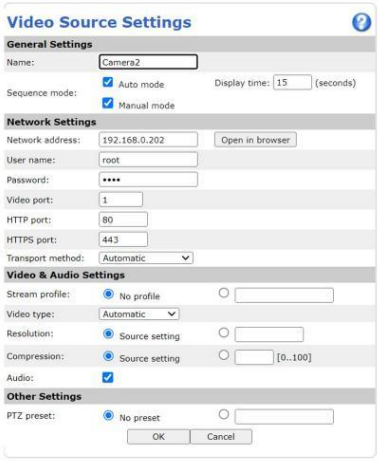


Figure 28 AXIS Decoder Video Source Settings

10 GEMINI

The Gemini is connected into bulkhead C1 on the starboard forward pod. The software located on the reports PC.

Gemini IP address is 192.168.0.131 and when the powered the Advanced tab will show the SONAR information in green, showing the unit is working.

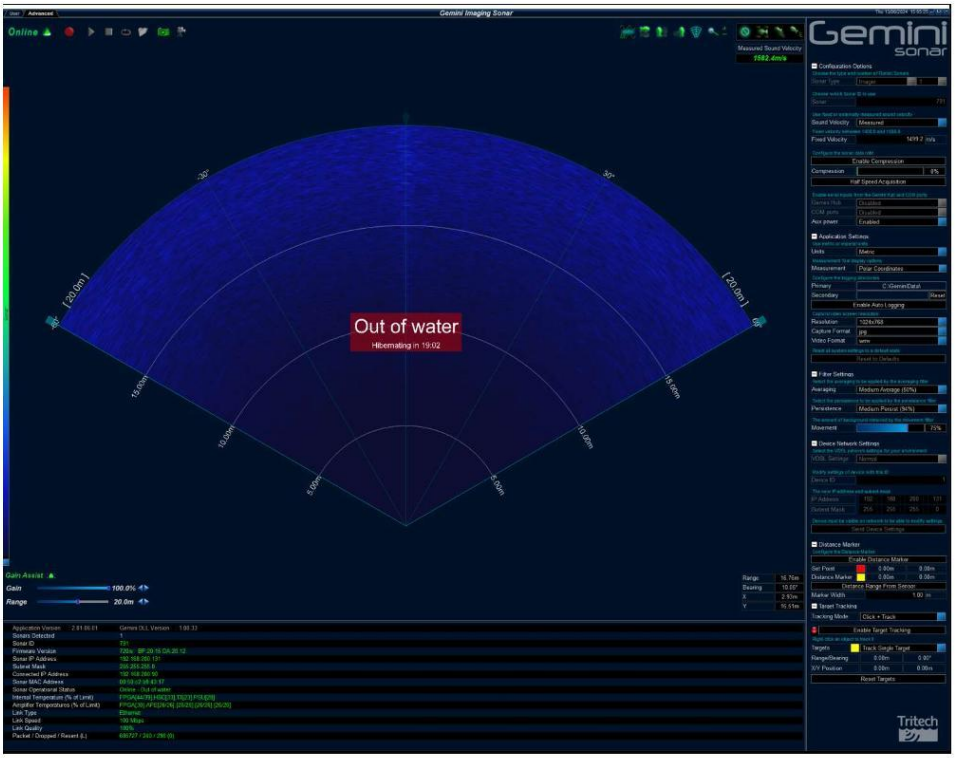


Figure 29 Gemini Advanced Tab

11 EDGEX ROUTER

If the survey team stop receiving all network traffic (including serial data from the Perle) at any point, the problem could be that the EdgeX router has crashed. It acts a gateway for all the data leaving the vehicle and the only option is to power down/up the unit to unfreeze it.

This happened once during the Sunderland Trials and the reboot cleared the issue within 5 minutes.

12 DAILY BACKUPS

The backup Saab logs/video from the SAC and RAC should be performed each evening prior to shut down, and transferred to the NAS drive that is being shipped with the spread.

I would also suggest downloading the SPRINT-nav files at the same time.

APPENDIX D – PRE/POST DIVE CHECKLIST

HAUV3 Pre & Post Dive Checklist

23-0022-OPS-SCL-001

HAUV3 Pre & Post Dive Physical Checklist							
Project:		**Dive No:**		**Date:**		**Time:**	
Operator:				**Accepted by:**			

Tools Required	
The following tools will be required:	
• Diaphragm puller tool (SM9 Thruster) (mod-12273) • Diaphragm puller tool (Tilt motor) (MOD-12245) • Fresh water hose (Post Dive only)	• Deck communications • Sonardyne i-Wand • Ulyser PT 9-Ninety tester

Physical Checks

WARNING - POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT:

MAKE SURE THE PSU IS NOT SWITCHED ON AND THE START KEY IS NOT INSERTED.

	Pre-Dive	Post-Dive	Comments
Caution Risk of damage to equipment. Fit / Remove Start Key	☐	N/A	
Log battery state of charge & charge if necessary	%	%	
Record Battery Voltage Levels	☐	☐	Stbd: Pt Fwd: Pt Aft:
Thrusters – Ensure HV is off and thrusters are not enabled			
• Check propellors are secure and nozzles are fitted correctly.	☐	☐	
• Check thrusters are free from debris.	☐	☐	
• Check Thruster oil levels using the diaphragm puller tool.	☐	☐	
Ensure that at least one hole is visible on the puller tool. • Rotate propellers several turns.	☐	☐	
Check Tilt Unit oil level using the diaphragm puller tool. Ensure that at least one hole is visible on the puller tool.	☐	☐	

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HAUV3 Pre & Post Dive Checklist

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Physical Checks

	Pre-Dive	Post-Dive	Comments
Transformer and Tether checks			
• Check transformer oil level using the diaphragm puller	☐	☐	
• Ensure Fibre Optic Connector O-Ring is present & in good order	☐	N/A	
• Check Tether Chinese finger/Cortland grip is secure	☐	☐	
Check that all cameras are correctly fitted and secure, remove lens caps and clean lenses with soapy water.	☐	☐	
Check all lights are correctly fitted and free from damage.	☐	☐	
Check air bleed screws are tightened:			
• EPOD	☐	☐	
• Antenna Pod	☐	☐	
Confirm Bulkheads and Harnesses are secure and ensure blanks are fitted where necessary.	☐	☐	
Check all anodes and replace if necessary	☐	☐	
Check for corrosion on all housings, bulkheads, equipment and brackets	☐	☐	
Check that buoyancy blocks and Rear Wing are correctly fitted, secure and not damaged.	☐	☐	
Check additional any equipment is correctly fitted and secure.	☐	☐	
Test PT9 Ninety with Ulyser tester, approx. 3.5v.	☐	N/A	
Check operation of Transponder with iWand ping check.	☐	N/A	
Fit recovery strop: ensure cable ties are part snipped.	☐	N/A	
Fit the deployment hook and insert the release pin. (if applicable)	☐	N/A	
Set recovery poles with carabiners held open, cable tie's part snipped.	☐	N/A	
Rinse AUV with fresh water	N/A	☐	

HAUV3 Pre & Post Dive Checklist

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Control Cabin Desk/Survey Checks

	Pre-Dive	Post-Dive	Comments
Confirm the HMI displays all relevant screens for operations			
Confirm Emergency Mission is set and appropriate	☐	N/A	
Check correct versions of SAC, RAC and PAC are loaded	☐	N/A	
Confirm that RAC PAC & SAC have sufficient free space:	☐	N/A	
Check with surveyor to run RoboCopy and delete old log files	N/A	☐	
Test Wi-Fi Comms to HAUV.	☐	N/A	
Test Fibre Comms to HAUV	☐	N/A	
Test Radio Comms to HAUV (if applicable).	☐	N/A	
Test the survey/sensor suite:			
• FiGS system (switch off o/c)	☐	N/A	
• TSS660 system	☐	N/A	
• Edgetech SSS (switch off o/c)	☐	N/A	
• SBP	☐	N/A	
• Gemini MBES (switch off o/c)	☐	N/A	
Test thrusters, checking for correct function and orientation:			
• OCB	☐	N/A	
• POCB	☐	N/A	
Check Lamps operation / Lamps off	☐	☐	
Check Obstacle Avoidance Sonar (HMI to Thrust mode) / OAS off	☐	☐	
Check the camera tilt unit operation and is free from fouling.	☐	☐	
SprintNav (Gyro): Operational	☐	N/A	
DGPS:			
• Check Operational	☐	N/A	
• Check Corrections Requested	☐	N/A	
• Check Beam assigned in Novatel	☐	N/A	Assign Appropriate Beam

Control Cabin Desk/Survey Checks (Cont'd)

		Pre-Dive	Post-Dive	Comments
Trigger Board – Settings verified & Trigger Enabled				Settings
•	DVL	☐	N/A	
•	MBES	☐	N/A	
•	SSS/SBP (if applicable)	☐	N/A	
DVL – On & Triggered		☐	N/A	
Depth Sensor	Zeros on Navigation Tab	☐	N/A	
UV-SVP/SVS	Zeros on Navigation Tab	☐	N/A	

Winch (if Applicable)

	Pre-Dive	Post-Dive	Comments
Winch pay out / pay in.	☐	N/A	
Check that guide tubes are greased.	N/A	☐	
Cooling water turned on / off.	☐	☐	
Rinse drum with fresh water	N/A	☐	

HAUV3 Pre & Post Dive Checklist

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Off Deck Checks

			Pre-Dive	Post-Dive	Comments
Turn On / Off strobe and confirm operations (If applicable).			☐	☐	
Remove / Refit the Iridium magnet (Confirm Emails)			☐	☐	
SprintNav Status – Navigation Mode			☐	N/A	
IXSEA Logger – Set Logging (If applicable)			☐	N/A	
Low Voltage:					
•	Lights	Enabled	☐	N/A	
•	Tilt Unit	Enabled	☐	N/A	
•	Cameras	Enabled	☐	N/A	
•	Video	Enabled	☐	N/A	
•	OAS	Enabled	☐	N/A	
High Voltage					
	**WARNING - POSSIBILITY OF FATAL ELECTRIC SHOCK AND DANGER TO PERSONNEL AND EQUIPMENT:** CORRECT PPE IS TO BE WORN WHEN HANDLING THE TETHER WITH HV SUPPLIES SWITCHED ON				
Thrusters	Enabled		☐	N/A	
Deck Mode	Selected		☐	N/A	
Thruster Enable	Selected		☐	N/A	
Zero Pitch & Roll	Selected		☐	N/A	

Splash Zone/Water Borne Checks

		Pre-Dive	Post-Dive	Comments
SprintNav	Just prior to going subsea, turn off GPS input	☐	N/A	
OAS	Operational	☐	N/A	
Depth Calibration		☐	N/A	
•	Deck Mode Selected	☐	N/A	
•	Settings DEPTH CAL AT SURFACE Selected	☐	N/A	
DVL	Operational (Launch type dependent)	☐	N/A	
Depth Sensor	Meaningful values on Navigation tab	☐	N/A	
UV-SVP/SVS	Meaningful values on Navigation tab	☐	N/A	
FiGS	Meaningful values	☐	N/A	
Edgetech	Image correct (Launch method dependent)	☐	N/A	
Gemini	Image correct (Launch method dependent)	☐	N/A	

NOTES FOR ABOVE CHECKS: