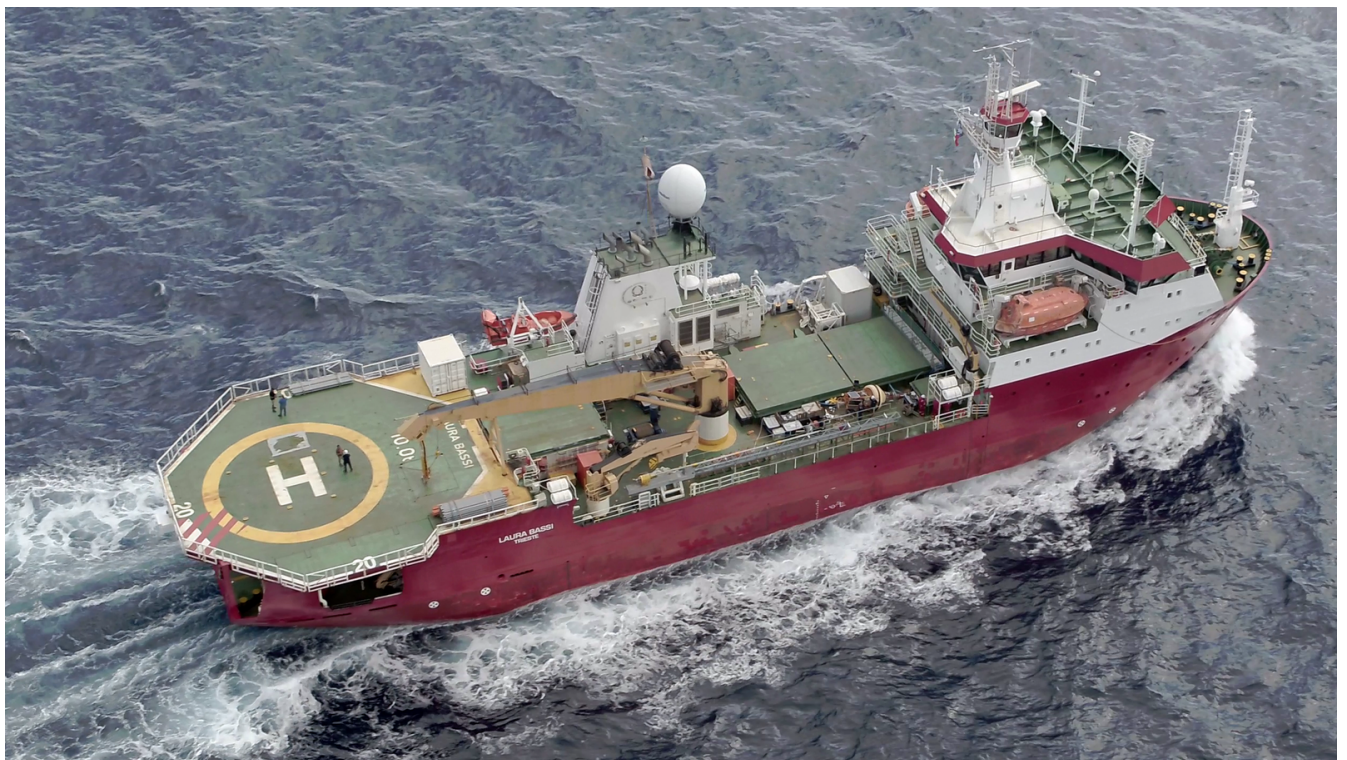


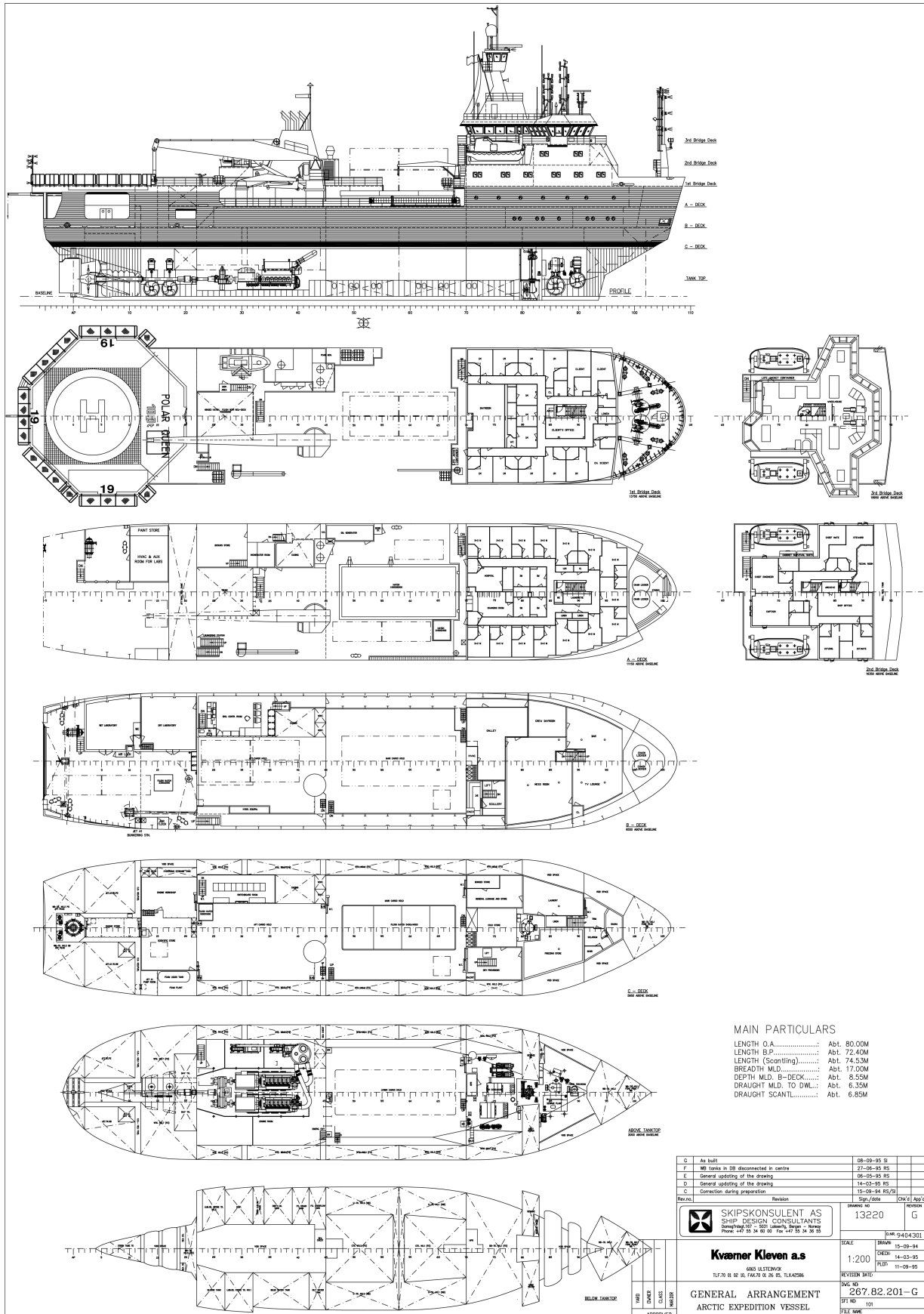
## ANNEX A: VESSEL'S CHARACTERISTICS

R/V LAURA BASSI	
Yard	Kverner Kleven Leirvik, Norway
Built	1995
Flag	Italy
Call sign	ZDLS1
IMO No.	9114256
Owner	National institute of Oceanography and Applied Geophysics - OGS
Operator	Argo Diamar



Aerial view of the research vessel Laura Bassi

# General Arrangement



CLASS NOTATION	
RINa C ⚡	
special service - research ship - unrestricted	
⚡ AUT-UMS; ⚡ DYNAPOS DP2 ; HELIDECK	
ICE CLASS IA; WINTERIZATION (temp -30 °C)	
PRINCIPAL DIMENSIONS	
Length O.A.	80.00 m
Length B.P.	72.40 m
Breadth mld.	17.00 m
Depth mld. (to B-deck)	8.55 m
Draught Scantl.	6.85 m
DWT	1910 tonnes
GRT	4028
Port of registry - No	Trieste - 807
CAPACITIES	
Fuel Oil	1250 m <sup>3</sup>
Fresh Water	165 m <sup>3</sup>
Kerosene (Jet A1)	160 m <sup>3</sup>
MACHINERY AND PROPULSION	
Main Engines	
Make	Bergen Diesel
Type	BRG 6
Rated Power	2 x 2280 kW @ 720 rpm
Main propulsion	
C/P Propeller:	1 o# in Nozzle
Make	Ulstein
Blades	4
Bollard pull	100% pitch - 75 tonnes
	75% pitch - 62 tonnes
	50% pitch - 44 tonnes
Auxiliary Engines	
Make	Mitsubishi
Type	S6R-MPTK
Rated Power	2 x 590 kW/1800 rpm

THRUSTERS	
Bowthruster 1	600 kW
Bowthruster 2	800 kW
Azimuth fwd	800 kW (retractable)
Sternthruster 1	600 kW
Sternthruster 2	600 kW
ROLL REDUCTION	
2 x integrated roll reduction tanks	
HIGHLIGHTS FOR CHARTERER'S SPECIAL USE	
<i>Water supply:</i>	
<ul style="list-style-type: none"> <li>• Uncontaminated sea water supply</li> <li>• Freshwater production: 2 x 25m<sup>3</sup> Fresh Water Production</li> </ul>	
<i>Hydraulic Power Pack:</i>	
<ul style="list-style-type: none"> <li>• 2 x 120 ltr/min – 210 Bar, outlets in cargo holds and on deck</li> </ul>	
<i>Gate Valve:</i>	
<ul style="list-style-type: none"> <li>• DN400 (16") in fwd HPR trunk</li> </ul>	
<i>Utility SWB:</i>	
Utility SWB's in engine work shop	
Utility SWB no1, 450V - 630 A / Conn. 2 x 100A, 2 x 250A and 1 x	
Utility SWB no2, 450V - 630 A / Conn. 2 x 100A, 1 x 250A and 1 x	
<i>Distribution boxes in cargo holds and aft deck:</i>	
Total 450 V - 320A (each box 160 A)	
Total 230 V - 160A (each box 160 A)	
ELECTRICAL PLANT	
Shaft Generators	
Make	AVK
Rating	2 x 2 200 kW
Auxiliary Generators	
Make	Mitsubishi
Rating	2 x 590 kW
Emergency Generators	
Make	Mitsubishi - AVK
Rating	1 x 152 kW, 3 x 450 V, 60 Hz
Emergency generator	
El. Distribution	
440 V, 230 V and 110 V all 60 Hz	

## WORKSPACE AND DECK AREAS

<b>Tank top:</b>	
Distributed load	5.3 t/m <sup>2</sup>
Container loads	3 tiers 20 TEU max stack weight 72 t
Cargo handling vehicles with max axle load 15 t and single pneumatic tyres.	

<b>C-Deck cargo area:</b>	
Distributed load:	1.65 t/m <sup>2</sup>
Cargo handling vehicles with max axle load 15 t and single pneumatic tyres	

<b>B-Deck aft deck</b>	
Distributed load	5.0 t/m <sup>2</sup>

<b>A-Deck</b>	
Distributed load	1.65 t/m <sup>2</sup>
Container loads	1 tiers 20 TEU max weight 24t
Cargo handling vehicles with max axle load 15 t and single pneumatic tyres	

## DECK EQUIPMENT

<b>Main Crane</b>					
Maker:		Norlift			
Type		GPCO 900 – 5020 straight boom			
Design		LRS, Ch. 3 Section 2			
Specification					
Capacity	Outreach	Seastate	Fall	Hook speed loaded	Hook travel
50t	20m	NA	Four	8 m/min	62m
50t	10m	1	Four	8 m/min	62m
50t	8.4m	2-3	Four	8 m/min	62m
34t	8.4m	5-6	Four	8 m/min	62m
25t	20m	-	Two	16 m/min	125m
12.5t	21m	5-6	Single	32 m/min	250m
Aux 5t	19m	NA	Single	60 m/min	40m

<b>Work Crane</b>					
Maker		Norlift			
Type		GPFO 160 – 0510 folded jib crane			
Design		LRS, Ch. 3 Section 2			
Specification					
Capacity	Outreach	Seastate	Hook speed empty	Hook speed loaded	Hook travel
5t	10m	6	90m/m	37m/min	35m

<b>Provision crane</b>	
Maker	Norlift
Type	GP
Specification	2 t / 7 m

<b>Aft deck crane</b>	
Maker	Norlift
Type	Telescopic boom
Specification	10 t / 5m
Winch capacity	2.75t
hook travel	15 m

<b>Hatches</b>	
A-deck	14 x 6 m
B-deck	14 x 5.4 m (flush)
Helideck	7 x 6 m (flush)

<b>HELIDECK</b>	
D-Value	19.5 m
Make take off and landing wight	Designed for Super Puma

## MANOEUVRING, NAVIGATION AND COMMUNICATION

<b>Dynamic Position System:</b>	
<ul style="list-style-type: none"> <li>• Kongsberg K-Pos 21 + CJOY Remote Joystick</li> <li>• Simrad LTW MK 8-15S Modified ( 500m )</li> <li>• Seatex Seapath 200</li> <li>• Seatex DPS 132</li> <li>• STARFIX RTCM Correction Receiver</li> <li>• MBX-4 IALA RTCM Correction Receiver</li> <li>• MDL Fanbeam MK 4.2 Position Sensor</li> <li>• HPR HiPAP 501</li> <li>• HPR 410 Standard</li> <li>• Interface to APos System</li> <li>• Interface to DGPS NO.2</li> <li>• 3 x Seatex MRU-5</li> <li>• 3 x Anschutz Gyro</li> <li>• Serial NMEA outputs Available</li> <li>• Dief Wind Sensor Anemometer – 879</li> <li>• 2 x Gill Sonic DP Wind Sensor</li> <li>• Rudder, Thruster &amp; Propulsion Control</li> <li>• Propulsion Control</li> <li>• Rudder Control</li> <li>• Thruster Control</li> <li>• ERN 99, 99, 96</li> </ul>	

Navigation
Integrated Bridge System – Kelvin Hughes IBS Paperless Bridge
<ul style="list-style-type: none"> <li>• Kelvin Hughes IBS</li> <li>• Kelvin Hughes - X Band Manta Digital Radar</li> <li>• Kelvin Hughes - S Band Sharpeye Radar</li> <li>• Kelvin Hughes MDP-A2-ABAA ECDIS System (not certified)</li> <li>• Bridge Watch Monitoring System</li> <li>• 3 x Anschutz STD 20 Gyros</li> <li>• Skipper GDS 101 Echo Sounder</li> <li>• Kelvin Hughes MDP-A1 Slave radar</li> <li>• Furuno Doppler Current indicator CI-600G</li> <li>• Kelvin Hughes MDP-A2 Route Planning Station</li> <li>• DGPS 1 - Furuno GPS90 GPS/ Seatex DPS 123</li> <li>• DGPS 2 - Seatex Seapath 200</li> <li>• Kelvin Hughes SEM 200 Autopilot</li> <li>• Sperry Naviknot 350 E Speed Log</li> <li>• Seatex HMS 100 Helicopter Motion and Weather</li> <li>• Helicopter Transponding System</li> <li>• Maneuvering Joystick System: Ulstein PosCon</li> <li>• Navigation Information Network - ADB / LAN</li> </ul>
1 X Becker Rudder Tenfjord Steering gear
<b>Scientific Bridge Equipment</b>
<ul style="list-style-type: none"> <li>• Simrad EA 600 Hydrographic Echo Sounder</li> <li>• AME 2006 Shipbourne Three Component Magnetometer</li> <li>• Automatic Weather Reporting Station</li> <li>• UK Meteorological Measuring Equipment</li> </ul>
<b>Navigation Information Network</b>
LAN: 4 access CISCO switch working at ISO/OSI level 2
1 CISCO switch level 3 + 1 Palo Alto Firewall
WIFI: 6 access point - one for each bridge and in the dry lab.

COMMUNICATION
Communication and Radio Equipment including GMDSS for Area 4
<ul style="list-style-type: none"> <li>• Console N</li> <li>• HF Radio 2</li> <li>• Taiyo Auto RDF</li> <li>• Watch Receiver</li> <li>• Weather Fax</li> <li>• Console Q1</li> <li>• Sailor Inmarsat C - LRIT Compliant</li> <li>• HF Radio 1</li> <li>• Console Q2</li> <li>• Console C</li> <li>• VHF No. 1</li> <li>• Console A</li> <li>• Broadgate S-VDR</li> <li>• Console G</li> <li>• Kelvin Hughes UAIS</li> <li>• Console R2</li> <li>• VHF No. 2</li> <li>• Console R3</li> <li>• VHF No.3</li> <li>• Helicopter Beacon</li> <li>• Areonautical VHF</li> <li>• Console M</li> <li>• LP2 Domestic Supply</li> <li>• EMP2 Emergency Switchboard Supply</li> <li>• UPL1 Eaton 3KVA MKV</li> <li>• UPL2 Eaton 3KVA MK</li> </ul>
<ul style="list-style-type: none"> <li>• Immarsat Fleet 77 Satellite Communications</li> <li>• VSAT C-band Ku-band Satellite Communications</li> <li>• Iridium Certus Satellite Communications</li> <li>• Immarsat FleetBB Satellite Communications (Optional)</li> </ul>

## ACCOMODATION

High standard accommodation comprising facilities such as:  
 Reception area, ships office, change room, recreation area, trim room, sauna, mess, TV/Crew dayroom, charterer's lounge, launderettes, laundry, client office

Crew: 24 berths

Available for charterers

2 single client rep. cabin = 2

4 cabins x 2 berths = 8

9 cabins x 3 berths = 27

6 cabins x 4 berths = 24

Total 61 berths

All cabins with toilet and shower

Hospital: 1 berth

## LIFESAVING AND RESCUE EQUIPMENT

Lifesaving and rescue equipment according to SOLAS

Life boats: 2 x Harding MCB24CR - 40 persons

Life boat davits: 2 x Vestdavit H-7000

M.O.B. Boat: 1 x Palfinger 6.3 m

M.O.B. Boat davit: 1 x Vest Davit P-3000, with shock damper.

Life rafts: 8 x RFD (each 20 men).

Survival suits: 80 off

Lifejackets: 80 off

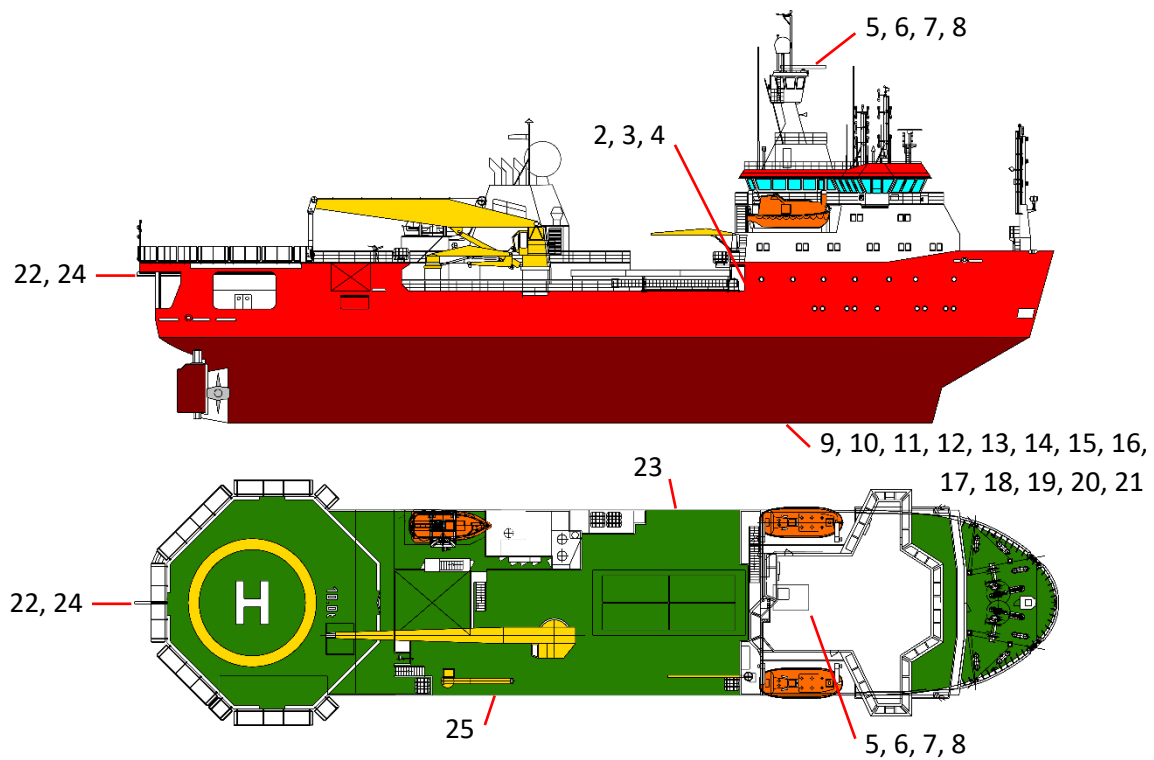
EEBD's: 6 off

Smoke Hoods: 38 o# (2 per SPP Cabin)

Fire Extinguishing:

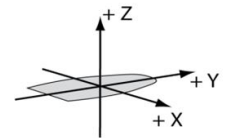
Accommodation	Flexifog Fixed Fire
	Dampening System
	CO2, Dry Powder and AFF Extinguishers
Galley, Paint store, and Sw Board	CO2
Cargo Holds	AFF Hi Ex Foam
Engine Room	AFF Hi Ex Foam
Helideck	AFF Low Ex Foam

## VESSEL'S OFFSETS



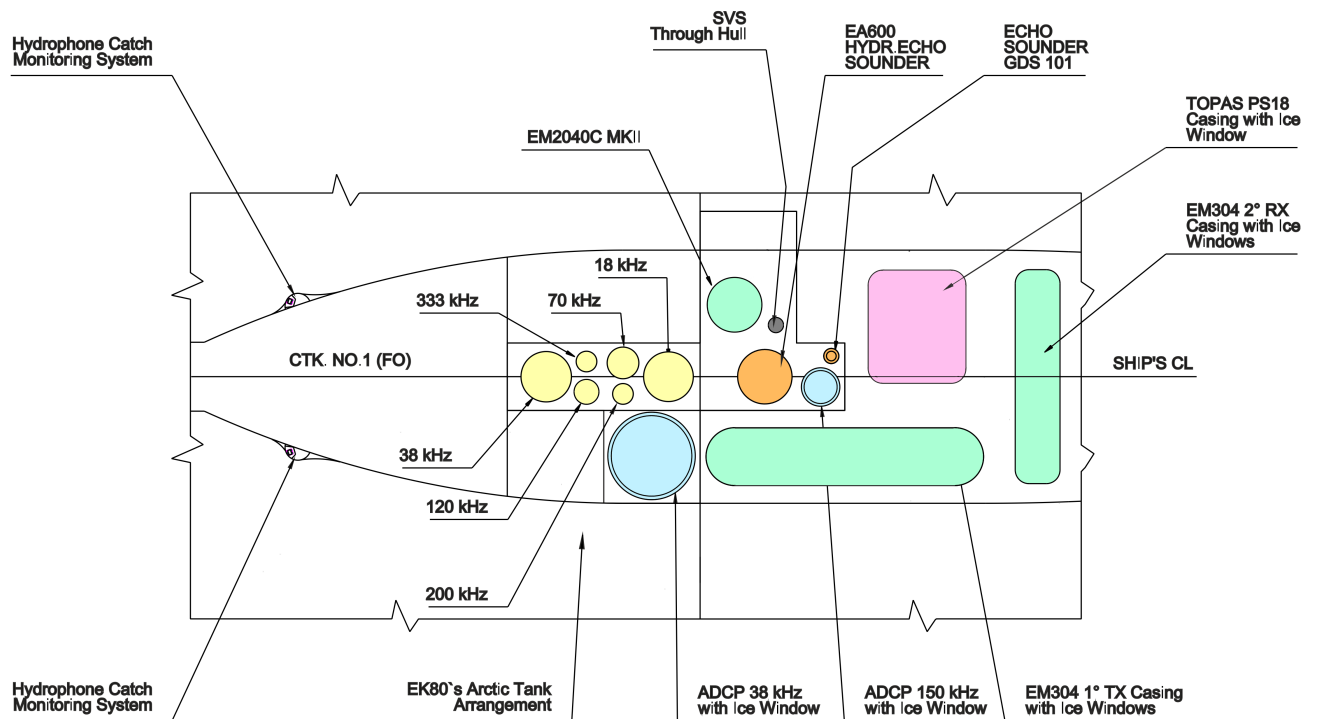
#	Equipment	x	y	z
1	Zero offset	0.000	0.000	0.000
2	MRU1	-0.375	0.025	0.103
3	MRU2	0.279	0.029	-0.043
4	MRU3	0.739	0.047	0.100
5	SEAPATH200 bow	1.992	2.861	29.006
6	SEAPATH200 stern	1.914	0.354	28.953
7	SEAPATH380 bow	2.053	3.612	28.945
8	SEAPATH380 stern	1.925	-0.405	28.861
9	EM2040	0.574	-0.767	-7.978
10	TX EM304	2.777	0.828	-7.433
11	RX EM304	1.624	3.628	-7.420
12	EK80 18 kHz	1.614	-1.729	-7.443
13	EK80 38 kHz	1.613	-3.501	-7.471
14	EK80 70 kHz	1.416	-2.385	-7.495
15	EK80 120 kHz	1.832	-2.915	-7.501
16	EK80 200 kHz	1.865	-2.387	-7.502
17	EK80 333 kHz	1.393	-2.916	-7.504
18	TOPAS	0.899	1.878	-7.407
19	EA600	1.614	-0.326	-7.442
20	ADCP 150 kHz	1.771	0.4820	-7.495
21	ADCP 38 kHz	2.763	-1.969	-7.481
22	STERN	0.000	-54.200	-
23	SVP 1	8.400	-35.000	-
24	SVP 2	0.000	-54.200	-
25	CORING	-4.000	-15.000	-

### SIGN CONVENTION



## ANNEX B. SCIENTIFIC EQUIPMENT

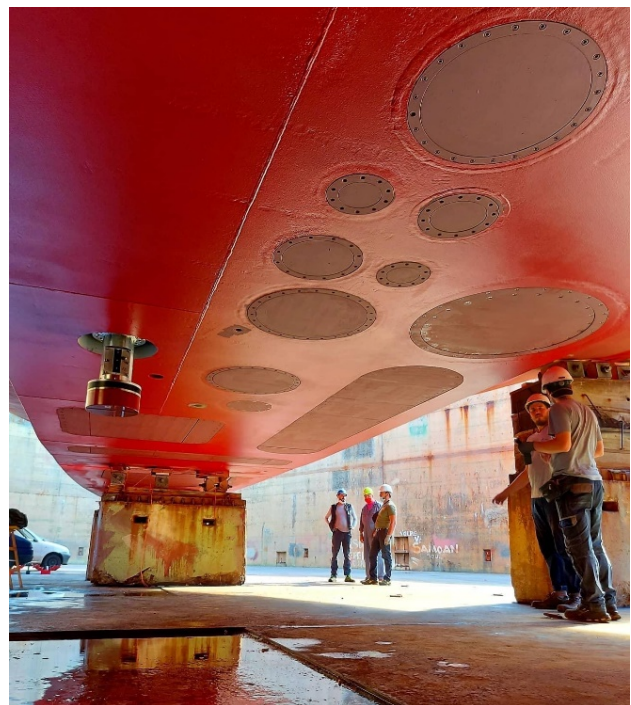
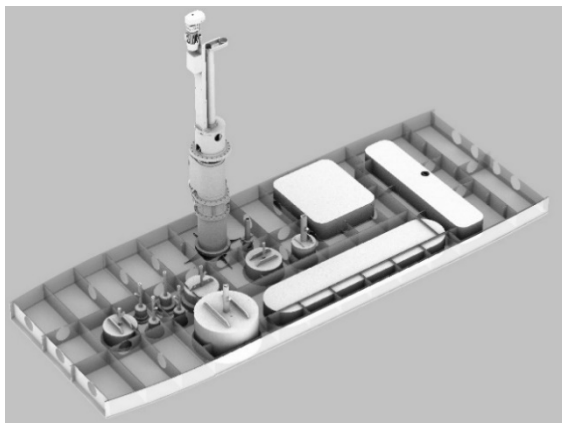
### ACOUSTICS SYSTEMS



Top: Plan view of the view of the keel block where the transducers are hosted. In yellow the scientific equipment; in orange the ship echosunders.

Bottom right: the keel after the installation of the transducers was completed.

Bottom left: 3D model of the block





# ACOUSTIC SYSTEMS SINCHRONIZATION

Equipment	Sinchronizing Unit			
Manufacturer	Kongsberg Maritime			
Model	K-Sync			
Installation	Rack mounted			
Max No. of systems	16			
Trigger period calculation	From external depth			
List of controlled equipment	Type	Model	Frequency range (KHz)	Group
	SBES	EK80	18-38-70-120-200-333	2
	MBES	EM2040	200-400	1
	MBES	EM304	26-34	1
	SBP	TOPAS PS18	1-6	3
	ADCP	OS 150	150	1
	ADCP	OS 18	38	4



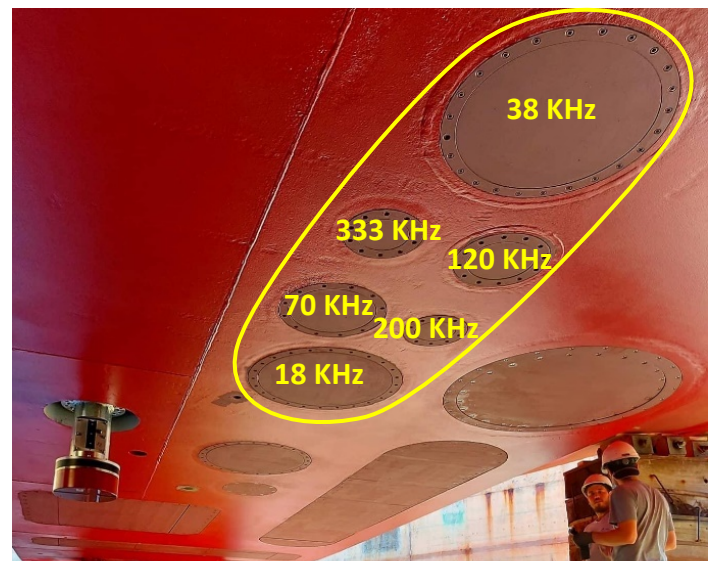
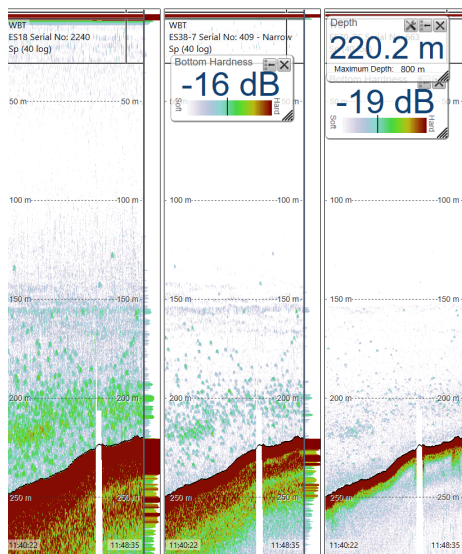
The screenshot shows the K-Sync software interface. On the left, the 'System control' panel shows the system is 'Running'. The 'System status' section displays 'Current depth (m): 270.29' and 'Depth source: NMEA DPT'. Below this is a 'Status log' with several entries regarding transmission failures for EK80 and EM 304. The 'User configuration profiles' section shows 'Very shallow (< 200 m) (default)' selected. The 'Echo sounder status' table is as follows:

Enabled	Unit	Status	Maximize ping (s)	Active period (s)
<input checked="" type="checkbox"/>	EK80	ACTIVE	0.702	
<input checked="" type="checkbox"/>	EM 2040	STANDBY	0.630	
<input checked="" type="checkbox"/>	EM 304	ACTIVE	1.480	
<input checked="" type="checkbox"/>	Topas PS18	ACTIVE	0.552	
<input checked="" type="checkbox"/>	OS 150	ACTIVE	0.500	
<input type="checkbox"/>	OS 38	DISABLED	5.000	

The main window displays a 'Trigger group status' graph with time on the x-axis (79:28:57 to 79:30:02) and depth on the y-axis. It shows trigger events for EK80, EM 2040, EM 304, Topas PS18, OS 150, and OS 38. On the right, 'Display settings' are configured with a 'Period' of 5 s and 'Show group marker' checked. At the bottom, the 'Trigger group schedule' shows a grid of active (green) and inactive (grey) states for each system across 16 groups.

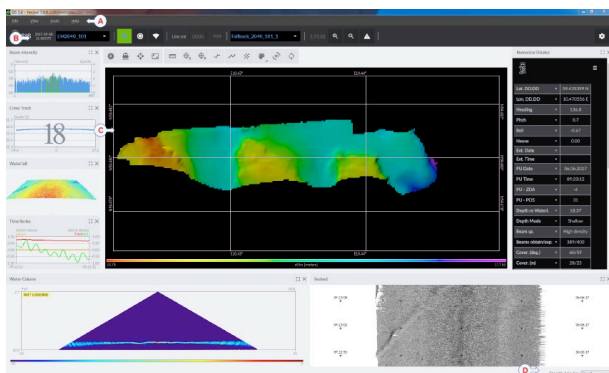
## SCIENTIFIC ECHOSOUNDING FOR FISHERIES

Equipment	Multifrequency Single Beam Echosounder					
Manufacturer	Kongsberg Simrad					
Model	EK 80 scientific echosounder					
Installation	Keell mounted					
No. of transducers	6					
Model	ES18	ES38-7	ES70-7C	ES120-7C	ES200-7C	ES333-7
Resonant frequency	18 KHz	38 KHz	70 KHz	120 KHz	200 KHz	333 KHz
Circular beamwidth	11°±2°	7°	7°	7°	7°	7°
Directivity	D: 300±20%	NA	D: 650	D: 650	D: 650	NA
	10 log D: 25±1 dB	NA	10 log D: 28 dB	10 log D: 28 dB	10 log D: 28 dB	NA
Equiv. two-way beam angle	Ψ: 0.020	NA	Ψ: 0.009	Ψ: 0.009	Ψ: 0.009	Ψ: 0.009
	10log Ψ: -17±1dB	NA	10 log Ψ: -21 dB	10 log Ψ: -21 dB	10 log Ψ: -21 dB	10 log Ψ: -21 dB
Side lobes	< - 18 dB	-21 dB	< - 23 dB	< - 23 dB	< - 23 dB	-16 dB
Back radiation	< -35 dB	- 35 dB	< -40 dB	< -40 dB	< -40 dB	-30 dB
Transmitting response (dB re 1 μPa per V@1m)	182±2	184	185	185	185	180
Receiving sensitivity (dB re 1 V per μPa@1m)	-174±2	-176	-190	-190	-190	-194
Max source level (dB re 1 μPa@1m)	NA	230	NA	NA	NA	217
Max input pulse power	2000 W	2000 W	1000 W	1000 W	1000 W	100 W
Max cont. input power	100 W	100 W	10 W	10 W	10 W	NA

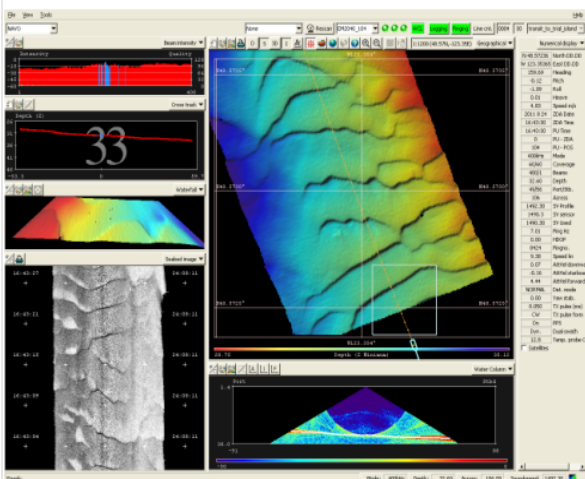


## MORPHOBATYMETRY – DEEP WATER

Equipment	Multibeam echosounder
Manufacturer	Kongsberg
Model	EM 304
Installation	Keel mounted
Nominal frequency	30 KHz
Operating frequency	26-34 KHz
Swath width	Typically 5.5 times the depth, or more than 9 km
Number of swath	2 swaths per ping
Pulse length	0.4 ms CW to 200 ms FM effective pulse length
Number of transmit sectors	16 frequency coded transmit sectors per ping / 8 per swath
Available models	0.5 degree, 1 degree, 2 degrees and 4 degrees
Number of receiver beams (per ping)	1600 beams, 0.5 degree RX and 1 degree RX 1024 beams, 2 degree RX 512 beams, 4 degree RX
Beam focusing	On transmit and receive
Realtime motion stabilization	Roll: $\pm 15^\circ$ Pitch: $\pm 15^\circ$ Yaw: $\pm 15^\circ$
Sounding pattern	Equidistant and equiangular
Gain control	Automatic
Mammal protection	Gradual start up transmit ramp
Deliverables	Bathymetric data Seabed imagery data Water column data Extra depth detections

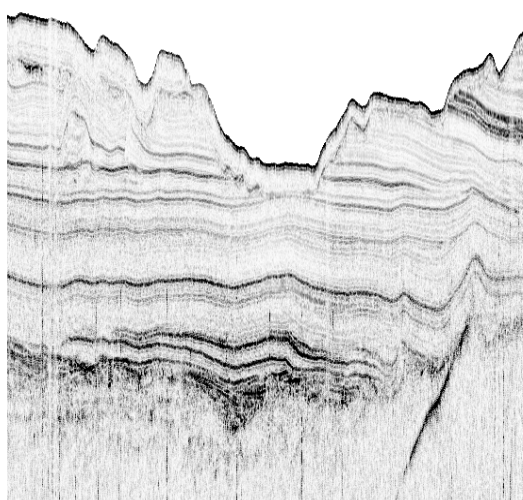


MORPHOBATYMETRY – SHALLOW WATER	
Equipment	Multibeam echosounder
Manufacturer	Kongsberg
Model	EM 2040c MKII
Installation	Drop pole mounted
Frequency range	200 to 400 kHz in steps of 10 Hz
Beam width	1° x 1° at 400 kHz
Max ping rate	50 Hz
Swath coverage	Up to 140° (5.5 times water depth)
Beam patterns	Equiangular, equidistant and high density
No. of beams per ping	400
Roll stabilized beams	± 15°
Pitch stabilized beams	± 10°
Yaw stabilized beams	± 10°
Depth range	Up to 520 m at 200 kHz
Pulse type	Continuous Wave (CW) / Frequency Modulated (FM – chirp)
Pulse lengths	
	CW 14, 27,54, 135, 324 and 918 μ
	FM 3 and 12 ms
Water columns logging	Yes



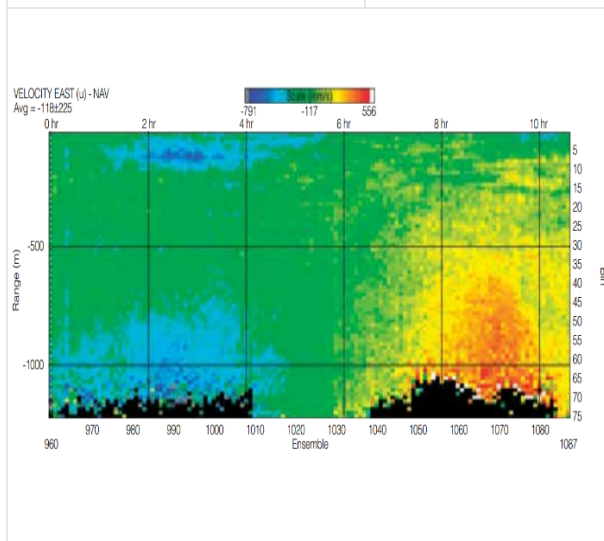
## SUB BOTTOM PROFILING

Equipment	Sub bottom profiler
Manufacturer	Kongsberg - Geoacoustic
Model	Topas PS18
Installation	Keel mounted
Primary frequency	15-21 KHz
Secondary frequency	0.5 – 6 KHz
Output power	>32 KW
Beamwidth primary	~3.5°
Beamwidth secondary	~4.5° x 4.5°
Source level	~209 dB ref. to 1 $\mu$ Pa@1m
Dynamic range	>110 dB
Range resolution	<0.15 m
Available pulse types	Continuous Wave (CW), Ricker, Frequency Modulated (FM -Chirp)
Depth range	<20 - >11000m
Beam steering	80° across / 20° along
Navigation input	NMEA 0183 (UDP)
Depth / slope input	NMEA 0183 (UDP)
Real time processing	TVG, Digital band pass filter, Deconvolution, Matching filters, etc.
Synchronization unit	K-sync



## PHYSICAL OCEANOGRAPHY – ACOUSTIC DOPPLER CURRENT PROFILER

Equipment		Acoustic Doppler Current Profiler - ADC				
Manufacturer		Teledyne RD Instruments (TRDI)				
Model		Ocean Observer III				
Installation		Keell mounted				
No. of transducers		2				
Model		Ocean Surveyor				
		38 KHz		150 KHz		
		Vertical res. cell size	Max Range	Precision	Max Range	Precision
Water Profiling	Long Range Mode	4			>350 m	30 cm/s
		8			>400 m	16 cm/s
		16	>1000 m	30 cm/s		
		24	>1000 m	20 cm/s		
	High Precision Mode	4			>225 m	15 cm/s
		8			>250 m	8 cm/s
		16	>900 m	15 cm/s		
		24	>950 m	10 cm/s		
Profile Parameters		Velocity Accuracy	$\pm 1\% \pm 0.5 \text{ cm/s}$		$\pm 1\% \pm 0.5 \text{ cm/s}$	
		Velocity range	-5 to 9 m/s		-5 to 9 m/s	
		Number of depth cells	1-128		1-128	
		Max ping rate	0.4 m		1.5 Hz	
Echo intensity Profile		Vertical Resolution	Depth cell size, configurable			
		Dynamic Range	80 dB			
		Precision	$\pm 1.5 \text{ dB}$			
System power		Power	1400 W			
Transducer		Beam angle	30°			
		Configuration	4-beam, phased array			



## SEABED SAMPLING

Equipment	OSIL piston corer
Maximum core length	15 m (5 x 3 core barrels)
Internal core diameter	100 mm
Total weight	1500 Kg
Winch	Ibercisa
Cable length	6000 m
Cable diameter	12 mm

