



## **VESSEL & SYSTEMS SPECIFICATION**

### **2D SEISMIC RESEARCH VESSEL**

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# 1. INTRODUCTION

This specification report is intended to describe in details a 2D seismic survey vessel named “NORDIC ENERGY”; built in 1984 in Germany and rebuild in 2007 in Poland; completely outfitted and equipped for continuous seismic survey operations. The vessel was designed and built with primary emphasis to health, environment, safety and safe working environment for personnel onboard.

The specification gives extra importance on the seismic equipments and the related seismic systems onboard.

## 1.1. GENERAL SPECIFICATION

### 1.1.1. Flag & Port of Registry

The vessel is flying under the flag state and Port of Registry of Panama

### 1.1.2. Classification

The vessel is registered and shall be maintained to meet the minimum requirements of Lloyds Registry - 100A1 Research Seismic Vessel LMC.

### 1.1.3. Regulations

The vessel shall be maintained in full compliance with all International Conventions, Resolutions and their latest amendments, in addition to applicable flag state requirements. These includes, but not limited to:-

1. National Authorities rules and regulations for unlimited trades.
2. Safety requirements regarding general arrangement, mechanism and safety equipment for seagoing Vessels.
3. SOLAS 1997 with later amendments including ISPS code.
4. Load Line Convention 1966, with amendments.
5. MARPOL 1973/1978 Regulations, with amendments
6. International Convention on Tonnage Measurements 1969.
7. International Convention for Preventing Collision at Sea 1972, with amendments.
8. Rules and regulations governing navigation through the Panama Canal and Suez Canal, including its Tonnage Regulations.
9. The Vessel shall be equipped for area A3 acc. to GMDSS rules, and according to International registration 1973 and Radio regulations 1982.
10. SSAS, Ships Safety Alarm System

All necessary certificates will be kept on board.

## 1.2. MAIN TECHNICAL SPECIFICATION

### 1.2.1. Main dimensions

Length Overall	: 64.67	m
Length Between Perpendiculars	: 56.091	m
Breadth (Moulded)	: 13.80	m
Depth (Moulded)	: 9.20	m
Draft	: 5.20	m
Air Draft (to highest antenna)	: 29.50	m

### 1.2.2. Tonnage

Gross Tonnage	: 2281 Tonnes
Net Tonnage	: 684 Tonnes
Deadweight	: 690 Tonnes

### 1.2.3. Cargo Capacities

Fuel Oil (MGO)	: 390 m3
Fresh Water	: 40 m3
Fresh Water Maker	: 5 Tons/day approx.

### 1.2.4. Speed & Endurance

Speed, Max, in calm sea	: 13 knots
Speed, Economy, in calm sea	: 10 knots
Fuel Consumption at 12 knots	: 13.4 Tons
Fuel Consumption at 5 knots	: 9.4 Tons
Pulling Capacity at 5 knots	: 48.2 Tons
Operational Endurance	: 30 days up
Fuel Endurance during survey	: 30 days up

## 2. MACHINERIES and EQUIPMENTS

### 2.1. VESSEL ENGINES

#### 2.1.1. Main Engine

The vessel is fitted with 2 Stork Wartsila 9F240 Diesel Engine with performance capacity of 1550 BHP, 1145 kW each.

Each engine is connected on a single CPP Propeller in Kortnozzle.

#### 2.1.2. Auxiliary Engine

One (1) unit of Mitsubishi Diesel, model S6R2-MPTA with capacity of 757 BHP at 1500 rpm.

Each cylinder has its own cylinder head and the engine has large inspection covers on the crankcase and oil pan in order to accommodate easy maintenance of the engine.

Close Loop cooling system is used for the Auxiliary engine.

#### 2.1.3. Power Supply

Main electrical power is at 380 Volt / 50 Hz. All electrical installation, systems, equipment, switch gear etc. shall fully comply with Class rules and requirements from Authority.

Main engines are powered by a generator with capacity of 650 kW.

#### 2.1.4. Propulsion System

- Type: Controllable Pitch Propeller (CPP) DMR 1764 kW
- Propeller Control: Remote
- Number of Blades: 4
- Material: Bronze, of Hob, Steel Blades
- Diameter: 2.9 m

## 2.2. DECK EQUIPMENTS

### 2.2.1. Cranes

The vessel is fitted with two knuckle boom deck cranes, one at Forward and one at Aft.

- Forward Crane: ATLAS, 2 Tons @ 10 m / 6 Tons @ 6 m
- Aft Crane: ATLAS, 1 Ton @ 3 m

### 2.2.2. Winches

- Streamer Winch: Plimsoll, 12 km capacity, 2007
- Umbilical Winch: Plimsoll, 2 noz double, 2007
- Auxiliary Winches: Brevini, 2 x 4.3 tons capacity

## 2.3. CREW EQUIPMENTS

### 2.3.1. Accommodation

There are cabins to accommodate a total of 40 crews onboard + 2 Hospital bunks, consisting of:

1-men cabins	: 10
2-men cabins	: 14
4-men cabins	: 1

All cabins and other facilities onboard the vessel are fully air-conditioned.

Laundry room is complete with 2 washing machines and 2 tumble dryers.

### 2.3.2. Life Saving Appliances

All life saving appliances are according to SOLAS requirements:-

- Life Rafts : 1 x Viking, 20 men  
: 2 x RFD SURVIVA MK III, 20 men  
: 1 x RFD SURVIVA MK III, 6 men
- Fast Rescue Boat : 1 x FRC, 10 men
- Life Boat : 1 x MOB boat, 6 men
- Lifebuoys : 8 pieces + 7 reserves
- Life Jackets : 62 pieces + 15 reserves
- Immersion Suits : 52 pieces (including 6 pcs in FRC)

### 2.3.3. Fire Fighting Appliances

All fire fighting appliances are according to SOLAS requirements:-

- Fireman's Outfit : 2 pieces
- Breathing Apparatus : 2 x SPIROMATIC 90
- Fire Detection : Salwico CS 4000 Monitoring System
- Fire Hoses : 23 pieces (on each deck and engine room)
- Main Foam Pump : 30 m3/hr, 12 bar
- Main Fire Pump : 2 x 40, 135 m3/hr, 8/4 bar
- Fire Extinguisher : 8 x CO2 – 5kg  
: 2 x CO2 – 50kg  
: 49 x Powder – 12kg  
: 8 x Foam – 9L

### 3. NAVIGATION and COMMUNICATION EQUIPMENTS

#### 3.1. NAVIGATION EQUIPMENTS

- Radar No. 1 : Sperry Marine Bridge Master X-Band
- Radar No. 2 : Sperry Marine Bridge Master S-Band
- ECDIS : C-Map
- Gyro Compass : 2 x Anschutz STD 22
- Auto Pilot : Anschutz Pilot Star D
- DGPS : Leica MX-420
- Speed Log : SKIPPER – EML224
- Echo Sounder : FURUNO
- Navtex Receiver : JMC, NT-900
- AIS : TRON UAIS TR-2500
- Chart Plotter : Telchart
- GMDSS : Thrane & Thrane, SAILOR RT-5022, Max power 25W.  
GMDSS installation in accordance to IMO regulations  
for vessel operating within Sea Area A3.

The Bridge navigation equipment, such as the Gyrocompass, echo sounder, and DGPS, may be co-shared for the seismic navigation department, for survey positioning purposes.

#### 3.2. COMMUNICATION EQUIPMENTS

- Radio Class / Category : MF / HF
- Transmitter / Receiver : Main (MF), Thrane & Thrane, SAILOR HC4500B  
: Reserve (MF), Thrane & Thrane, SAILOR HC4500B  
: Main (VHF), Thrane & Thrane, SAILOR HT4610B  
: Main (DSC), Thrane & Thrane, SAILOR HT4610B
- Radio Portable (VHF) : 3 x SAILOR SP3300
- Radar Transponder : 2 x Jotron, SART 9.2 – 9.5 GHz
- EPIRB : Jotron, TRON 45SX / TRON 40S
- Searchlight : 1 x NHS200H
- Inmarsat F : Thrane & Thrane, Capstan Fleet 77
- Inmarsat C : 2 x Thrane & Thrane, Sailor TT – 3000E
- VSAT : Seatel DAC 2200

## 4. SEISMIC EQUIPMENTS

### 4.1. SEISMIC SOURCE

#### 4.1.1. Air Guns



- Manufacturer : ION, USA
- Type : Sleeve Gun
- Number of Array : 1
- Number of Sub-array : 4
- Source Volume (Max.) : 5120 cu.inch
- Operating Pressure : 2000 PSI
- Floating System : Sausage Buoy
- Gun Controller : DigiShot
- Timing Resolution : 0.1 ms

Figure 1: ION Sleeve Gun

Each source sub-array will have at least two depth detectors, two Near Field Phones, and two High Pressure Indicators.

Digital Source Control, DigiShot, is used in order to deliver high quality signature, due to all signals are carried digitally to and from the Gun Control Module – typically located within 1 meter of the gun.

All changes done to the source are to be communicated to the Gun Mechanics on duty and recorded in the observer's log

#### 4.1.2. Air Compressors

Two (2) ARIEL JGJ/4 compressors are used due to its durability and easy maintenance.

- Rated Power: 1240 BHP, 925 kW
- Rated RPM, Max: 1800 rpm
- Rated RPM, Min: 900 rpm
- Compression: 23000 lbs
- Stroke: 89 mm
- Air capacity: 51 m3/min ~1800 cfm



Figure 2: ARIEL JGJ Compressor

The units are placed on resilient mounts within the compressor room, whereby adequate air supply/ventilation is maintained to allow all compressor units to operate simultaneously

#### 4.1.3. Generators

Two (2) CUMMINS KTA-38-G5 generators, 12 cylinder, pressure lubricated, 4 stroke diesel engine giving the generator an output of 906 kW at 1500 rpm to supply power at 50Hz.

## 4.2. SEISMIC STREAMER

### 4.2.1. Streamer Cable



Figure 3: ION Solid DigiSTREAMER

Solid streamers are used for data acquisition due to its non-liquid nature which promised to provide both reduced self-noise and consistent buoyancy benefits.

- Manufacturer : ION, USA
- Streamer Type : Solid Streamer
- Max Length : 12,000 m
- Length per Section : 100 m
- Group Interval : 12.5 m
- Hydrophones per Group : 14 x Teledyne TB-2311E
- Breaking Strength : 30,000 lb
- Bend Radius : 0.9 m

### 4.2.2. Depth Controller



Figure 4: DigiCourse Compass Bird 5011

Depth measurement and depth control of the streamer is done by positioning of “birds” which are attached onto the streamer cable and linked to onboard Positioning Control System.

- Manufacturer : DigiCOURSE
- Type : Compass Birds 5011E
- Operating Depth : 0 m – 122 m
- Heading Sensor : Compass model 321
- Depth Sensor : Model 483

Birds are used in conjunction with other depth controller devices, such as tail buoys, acoustics, depth transducers, GPS, etc. to provide an accurate streamer positioning at all times during operations.

## 4.3. SEISMIC SYSTEM

### 4.3.1. Seismic Data Recording System

- Manufacturer : ION, USA
- Model : MSX, 24 bit
- Module Type : 16-channel electronic streamer module
- Channel Capacity : Max. 960 channels per single streamer
- Max Record Length : 100sec (4ms), 50sec (2ms), 25sec (1ms)
- Recording Media : Single 3590 tape/multiple 3590/RAID Disk
- Data Transmission : Fiber Optic



The recording system consists of a Human Computer Interface (HCI workstation), a Control Module, a Power Unit, Auxiliary Traces, Interface Units, Deck Equipment and Peripheral Equipment.

The Control Module consists of an acquisition module and a processor software module that can be installed on the HCI workstation or on a separate workstation.

The MXS system is also used to assess noise strips to determine noise levels.

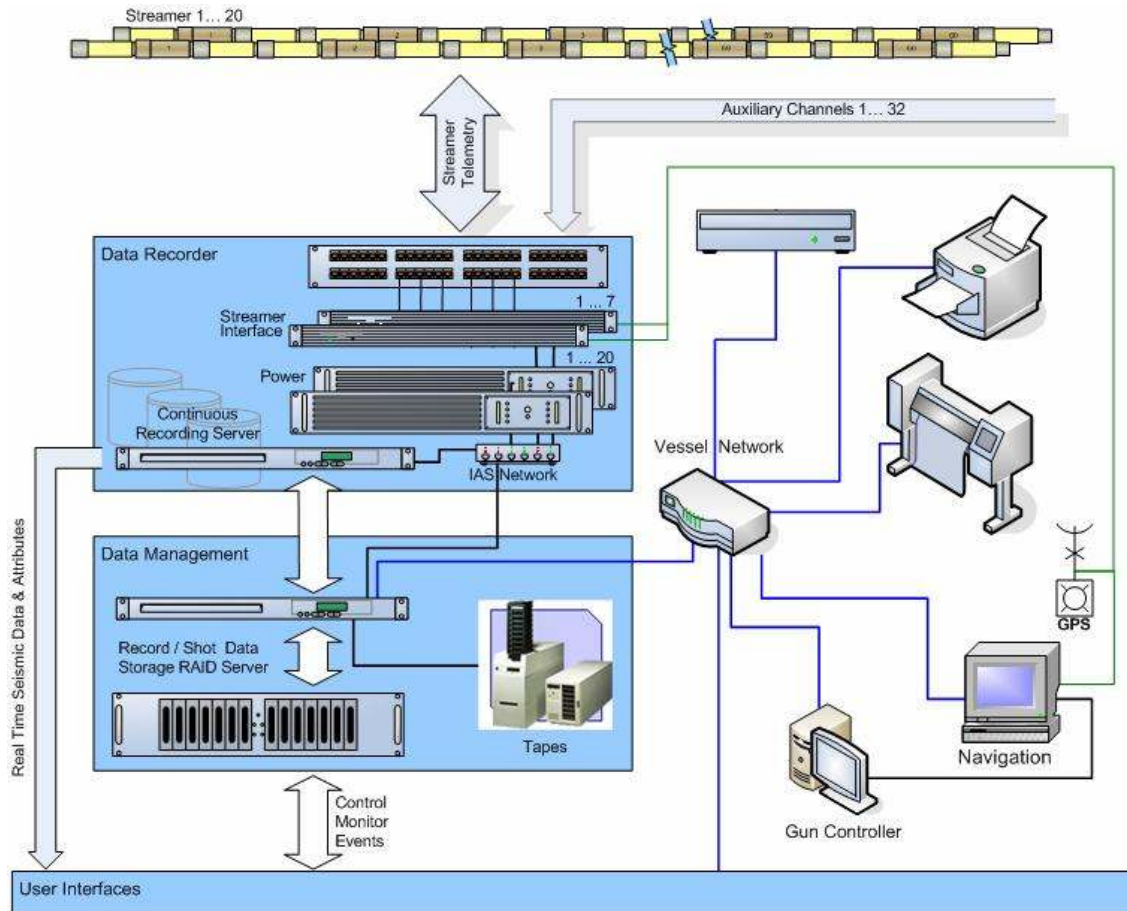


Figure 5: DigiStreamer Seismic Recording System Configuration

#### 4.3.2. Seismic Navigation System

The vessel is equipped with “SPECTRA” real time navigation system by Concept Systems Ltd.

The navigation system shall compute and display real-time vessel position and velocity, by incorporating some, if not all measurements from the following systems:-

- Radio Navigation System
- Gyro Compass
- Echo Sounder
- Differential Global Positioning System (DGPS)

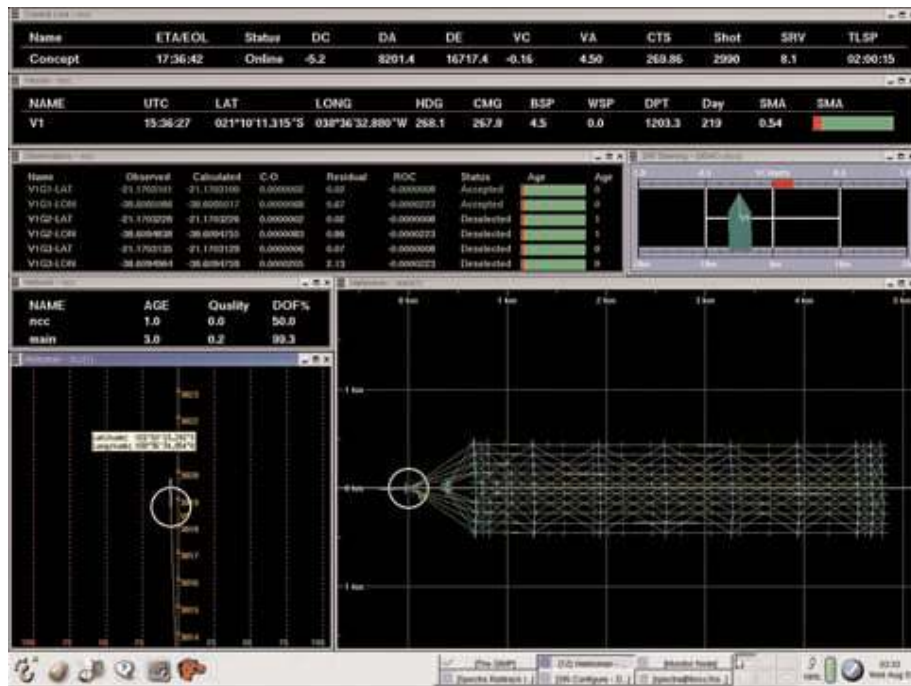


Figure 6: Typical navigators display on SPECTRA

Data is recorded on tape and hard copies printed through the navigation computer, if necessary.

For Precise Point Positioning (PPP), “Veripos Ultra” navigation system by Subsea 7 is used. This system offers high accuracy position globally by eliminating main GPS errors sources such as satellite orbit, satellite clock, troposphere, ionosphere and multi-path.

#### Navigation Data Processing System

Combined with the SPECTRA system above, another Concept Systems Ltd product, “SPRINT”, is used for navigation data processing onboard vessel.

The result of this processing system usually consists of:-

- Comparison of vessel, tail buoy, source, and receiver group records
- Presentation of results in statistical, time series, or spatial summary format
- Comparisons of water depth and cable depth
- Header verification

#### 4.3.3. Seismic Data Processing/QC System

The Vessel uses ProMAX software technology by Landmark, which is designed to bring the user closer to the seismic data with visualization tools that allow rapid viewing of pre-stack and post-stack seismic data.

Knowledge-based seismic data processing leverages your understanding of the geology to guide seismic data analysis and parameter selection in order to optimize seismic processing sequences. ProMAX workflows facilitate construction of the optimum seismic image of the geologic target.

The ProMAX seismic data processing family includes a complete suite of geophysical applications for 2D, 3D, VSP and depth imaging.

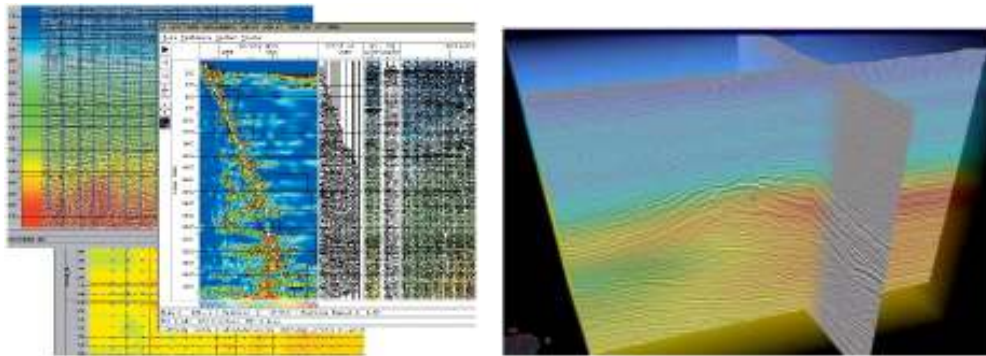


Figure 7: ProMAX Interface



## 7. LIST of REFERENCES

This vessel specification report is made with information from various sources, mainly the following:-

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- Suppliers/Vendors' websites:

- ✓ Ariel Corporation Website : [www.arielcorp.com](http://www.arielcorp.com)
- ✓ Cummins Website : [www.cumminspower.com](http://www.cumminspower.com)
- ✓ ION Website : [www.iongeo.com](http://www.iongeo.com)
- ✓ Mitsubishi Engine Website : [www.mitsubishi-engine.com](http://www.mitsubishi-engine.com)
- ✓ Subsea 7 Website : [www.subsea7.com](http://www.subsea7.com)
- ✓ Veripos Website : [www.veripos.com](http://www.veripos.com)
- ✓ Wartsila Website : [www.wartsila.com](http://www.wartsila.com)