SERCEL

Seal 428

MARINE SEISMIC ACQUISITION SYSTEM

NEW GENERATION MARINE SEISMIC RECORDER

The Seal 428 is the new large capacity and high-resolution seismic data acquisition system designed for marine towed streamers acquisition. It derives its high reliability and versatility from Sercel's extensive experience in cable telemetry systems and from the use of the most advanced electronics and workstation technology.

The Seal 428 supports extremely long offset recording as well as an unlimited streamer number for increased productivity and data quality. The Seal 428 system has been designed to match the industry's expectations for true zero dead time continuous recording, crucial for multi-vessel acquisitions such as Wide Azimuth and undershooting.

The benefits from the most advanced software technology include a Client/Server architecture which allows the system to be fully accessible through the customer's intranet or via a secured internet login for monitoring or full control purpose.

Taking advantage of Sentinel®, the industry's only true solid streamer, and of Nautilus®, Sercel's streamer guidance and control system, and as a result of the outstanding noise performance when using this combination, the Seal 428 offers the highest efficiency and best quality seismic data recordable today.

FEATURES & BENEFITS

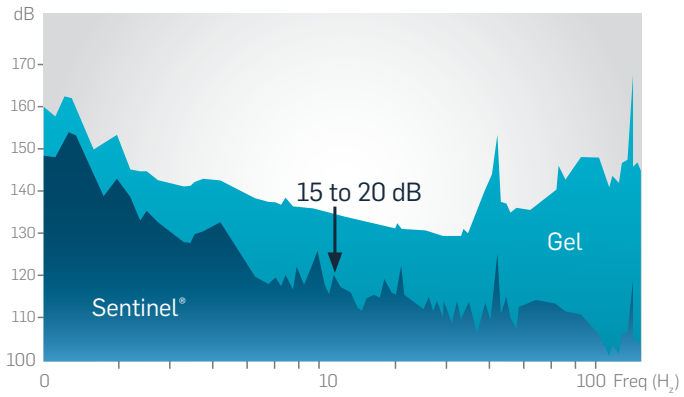
IMPROVED DATA QUALITY

Better signal

Sentinel is the only true solid streamer available in the market. The uniform ballast and the isolation techniques applied in Sentinel result in noise reduction, superior resistance to vibration and improved acoustic operation, resulting in excellent data quality in all types of weather conditions:

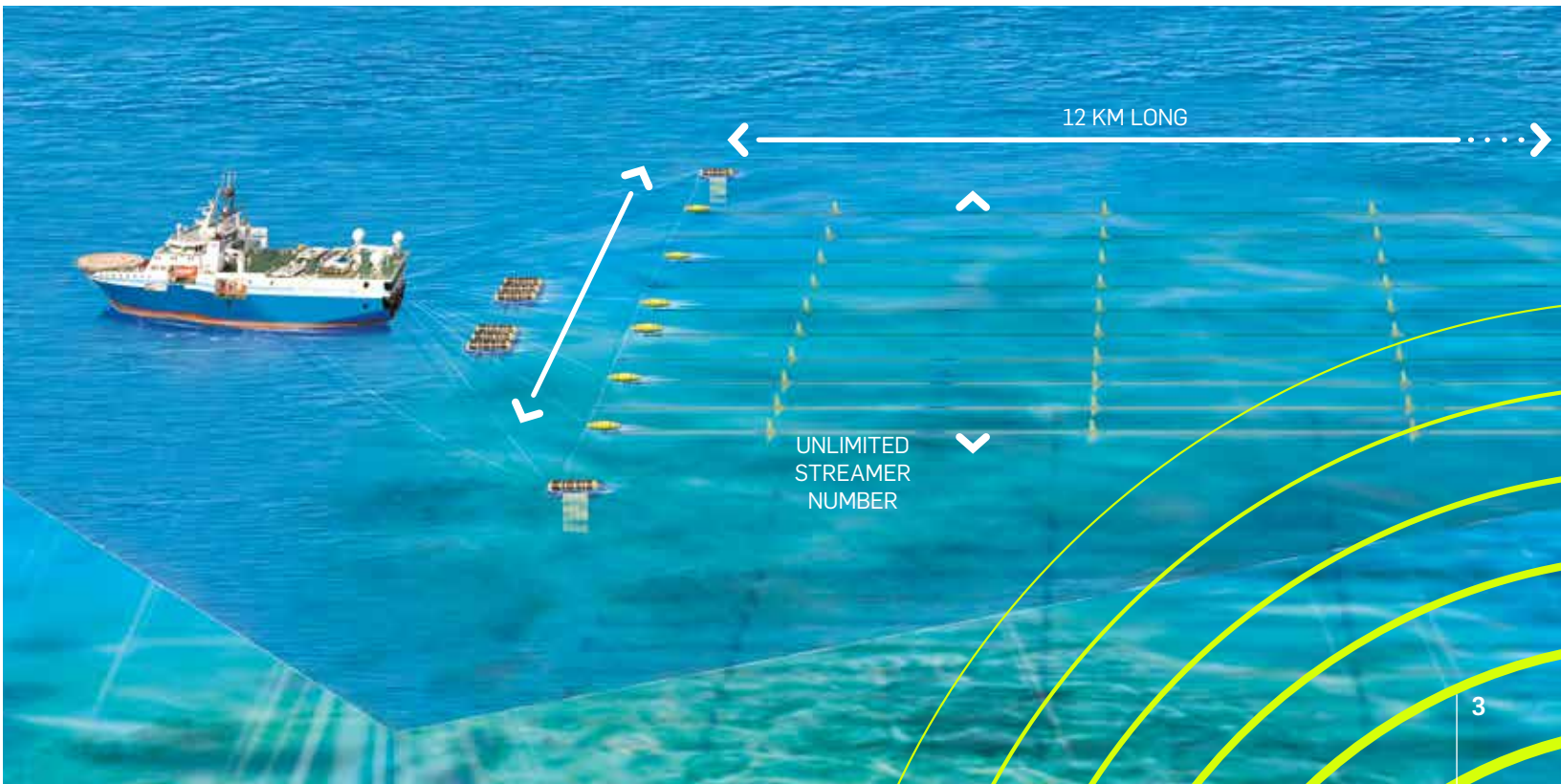
- Best signal/noise ratio compared to gel solutions
- Outstanding noise immunity in all sea states
- Unrivalled low frequency content

Streamer Vibration Isolation



Higher resolution

With an architecture based on an independent streamer philosophy, the channel limitation only depends on the server computation power.
Seal 428 is the only acquisition system able to manage an unlimited number of streamers for high density 3D purpose, and extremely long offset operations using streamers up to 12 km long.

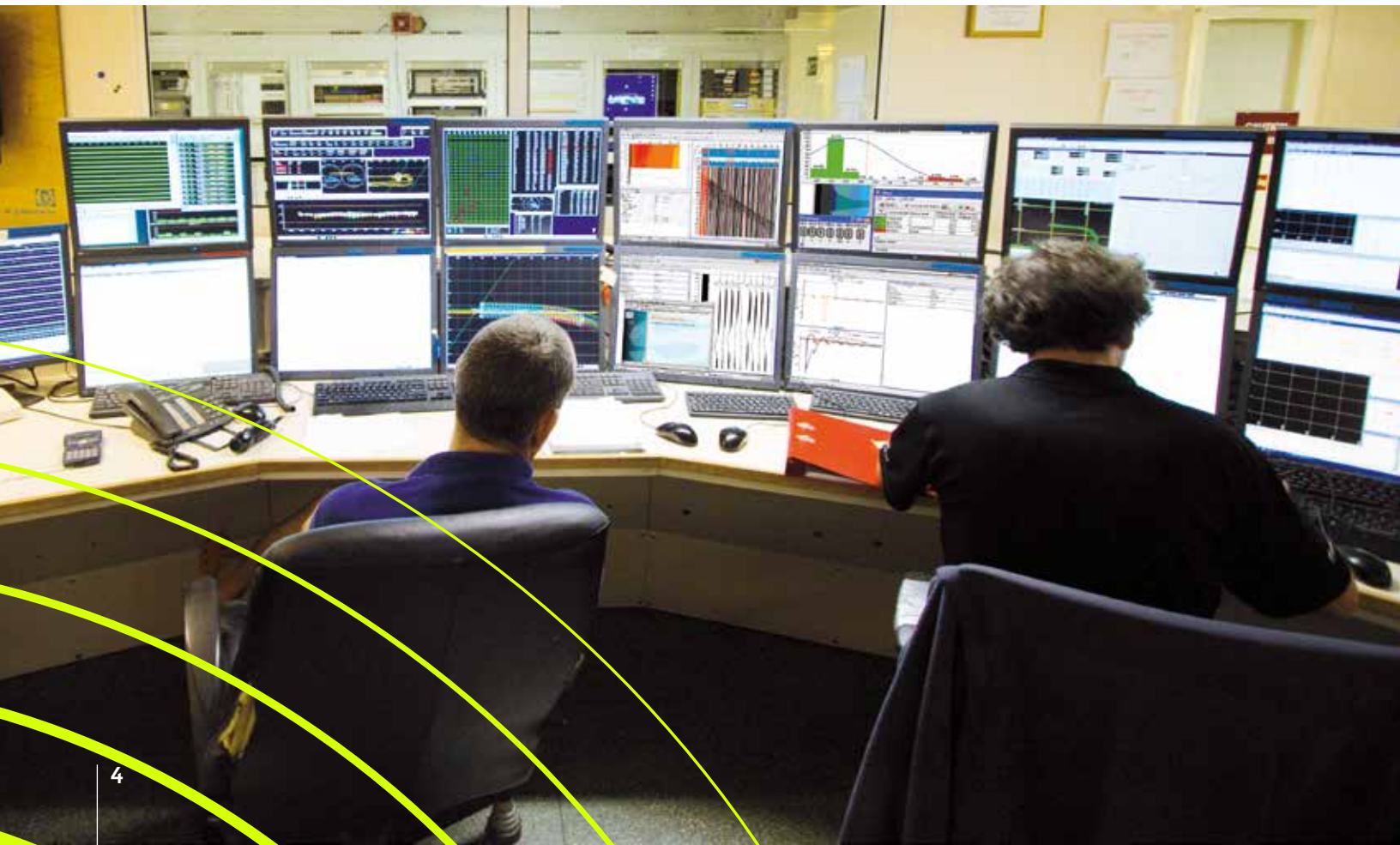


HIGH QUALITY CONTROL

Real-time QC

Keeping all the advantages provided by the Zero-Dead-Time architecture of the 400 Series and Seal central units, all QC functions are performed in parallel with the seismic data acquisition without slowing down 2D or 3D crew operations.

eSQC-Pro gives the ability to access and monitor the quality of the seismic data through the web from any authorized client computer.



Remote accessibility

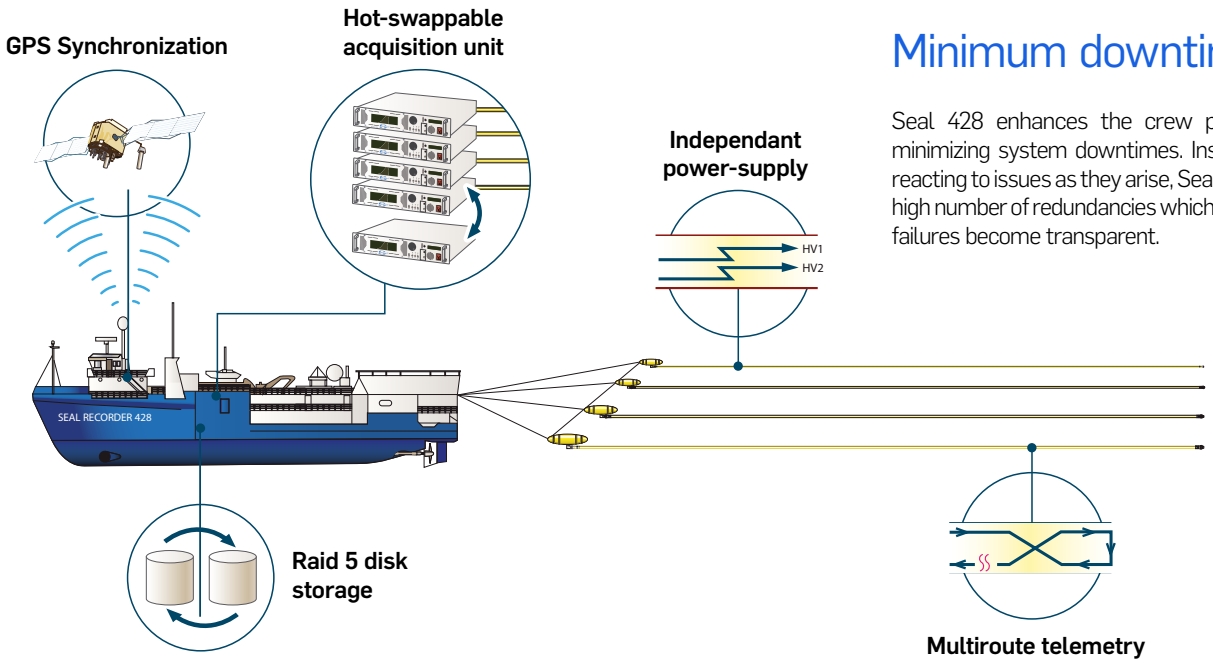
E-MAINTENANCE

REMOTE TROUBLESHOOTING

DATA QC

PARAMETERS AUDIT

ENHANCED PRODUCTIVITY



Minimum downtime

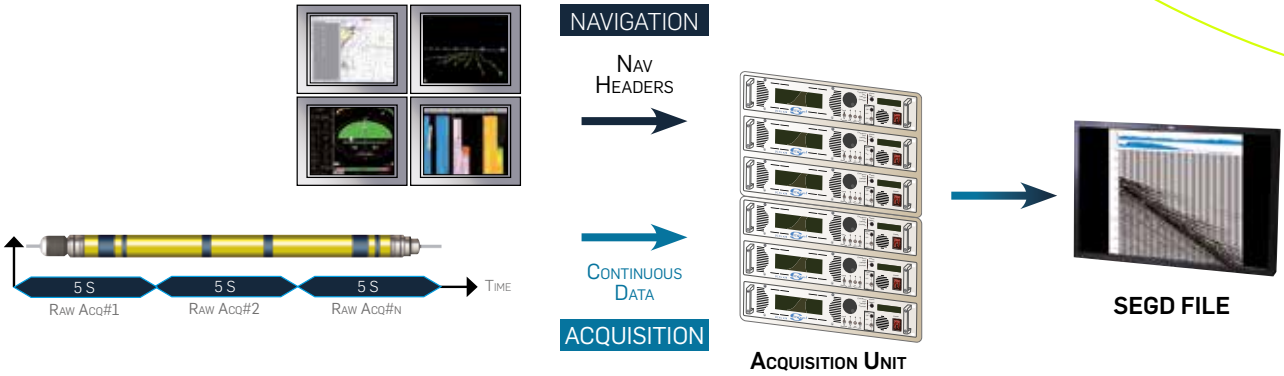
Seal 428 enhances the crew productivity by minimizing system downtimes. Instead of simply reacting to issues as they arise, Seal 428 includes a high number of redundancies which makes system failures become transparent.

Multi-vessel operation

To achieve an optimum image of the sub-surface, Seal 428 allows multi-vessel seismic acquisition thanks to GPS synchronized continuous recording.

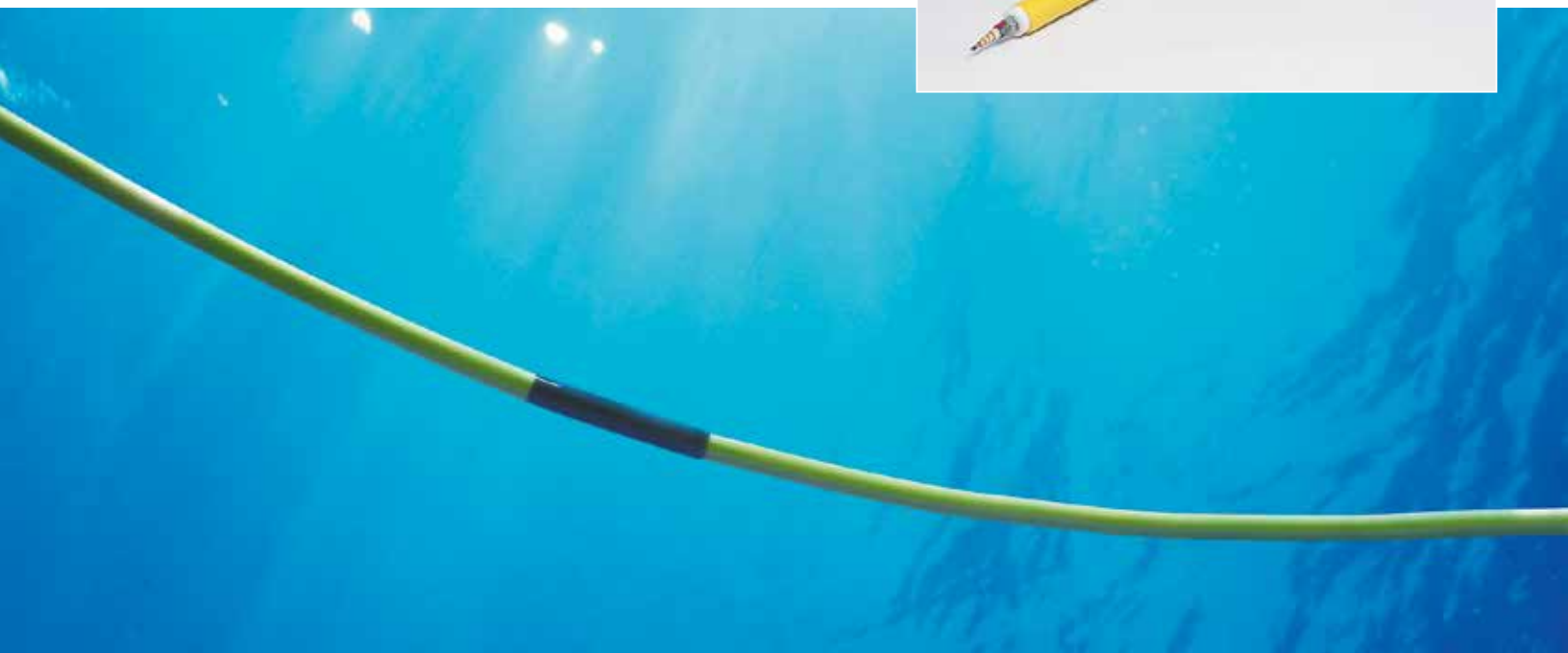
CONTINUOUS RECORDING

- FULLY SYNCHRONIZED (GPS)
- NO EXTERNAL TRIGGER NEEDED
- SYNCHRONIZATION THROUGH NAV HEADERS MESSAGES DIFFERED RECEPTION



Sentinel® reliability

Sentinel is the strongest marine streamer available today, capable of handling nearly twice the operating tension as traditional cables. Sentinel streamers are tough, with unmatched water-blocking, puncture and impact resistance, and a unique design that provides superior protection against hydrophone damage during retrieval and deployment.
Routine maintenance and repairs can be performed on-board which means fewer spares required.

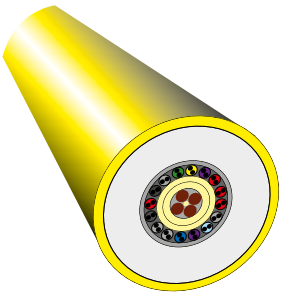


- FIELD PROVEN PERFORMANCE
- MOST RUGGED TRUE SOLID STREAMER

Sentinel® *RD*

Reduced Diameter Solid Streamer

- **CLEARER IMAGE**
  Best signal-to-noise ratio at low frequency
- **HIGHER PRODUCTIVITY**
  Outstanding noise immunity at all sea states



Sentinel *RD*

Sentinel *RD* has a reduced diameter, providing reduced cable drag and increased storage capacity onboard seismic vessels, which are some of the key aspects of the marine seismic operations. The new design of Sentinel *RD* also allows newly built vessels to be designed with smaller winches.
The latest member of the Sentinel family provides the same outstanding acquisition performance as its predecessor system, making it the best-in-class solid streamer available on the market today.

Sentinel *RD* specifications	
Nominal section length	150 m
Cable diameter	55 mm
Channels per section	12
Maximum operating depth	50 m
Maximum streamer length	15750 m

Sentinel® *HR*

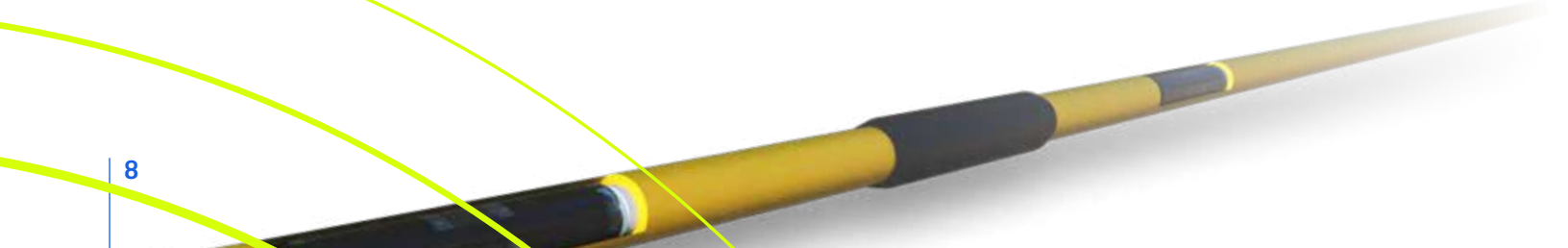
High Resolution Seismic Streamer

- **BEST IMAGING**
  3,125 m channel spacing
  Best signal-to-noise hydrophone performance
- **BEST PRODUCTIVITY**
  Up to 6,000 m streamer length
  Comb spread design capability
- **UNRIVALED RELIABILITY**
  Fully redundant design

Sentinel *HR* is the new Sercel solid streamer designed with a very short channel spacing for high resolution acquisition. It integrates the highest performing hydrophone configuration while benefiting from Sentinel's industry leading capabilities & reliability. It will provide the best imaging & will maximize your productivity.

Dedicated for shallow target applications and HR3D surveys, Sentinel *HR* will be an efficient tool for oceanology, geo-technical, civil engineering and reservoir characterization applications.

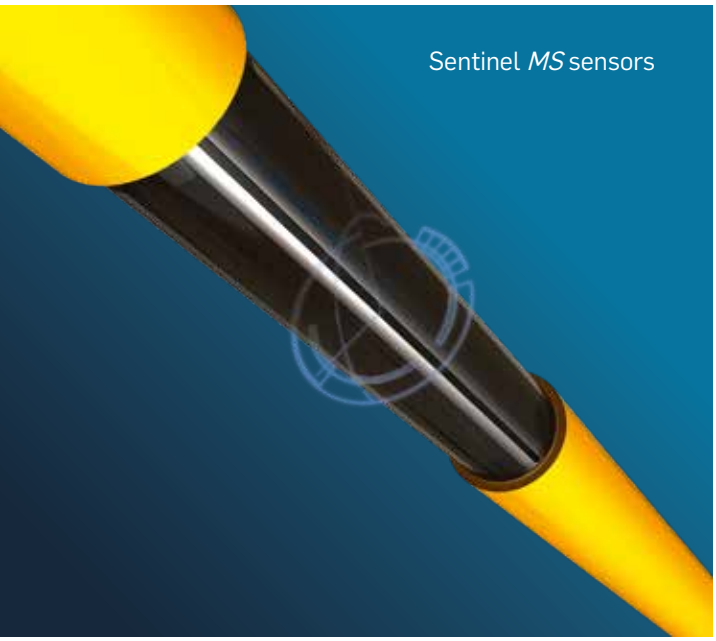
Sentinel *HR* specifications	
Section length	150 m
Section diameter	59.5 mm
Receiver group	3,125 m
Maximum operating depth	50 m
Maximum streamer length	6,000 m



Sentinel® *MS*

3-C multi-Sensor Broadband Streamer

- **BROADBAND IMAGING**
  3-C recording
- **BEST LOW FREQUENCY PERFORMANCE**
  Class leading Sentinel hydrophone
- **ENHANCED PROCESSING CAPABILITY**
  Accelerometer raw data recording


Sentinel *MS* sensors

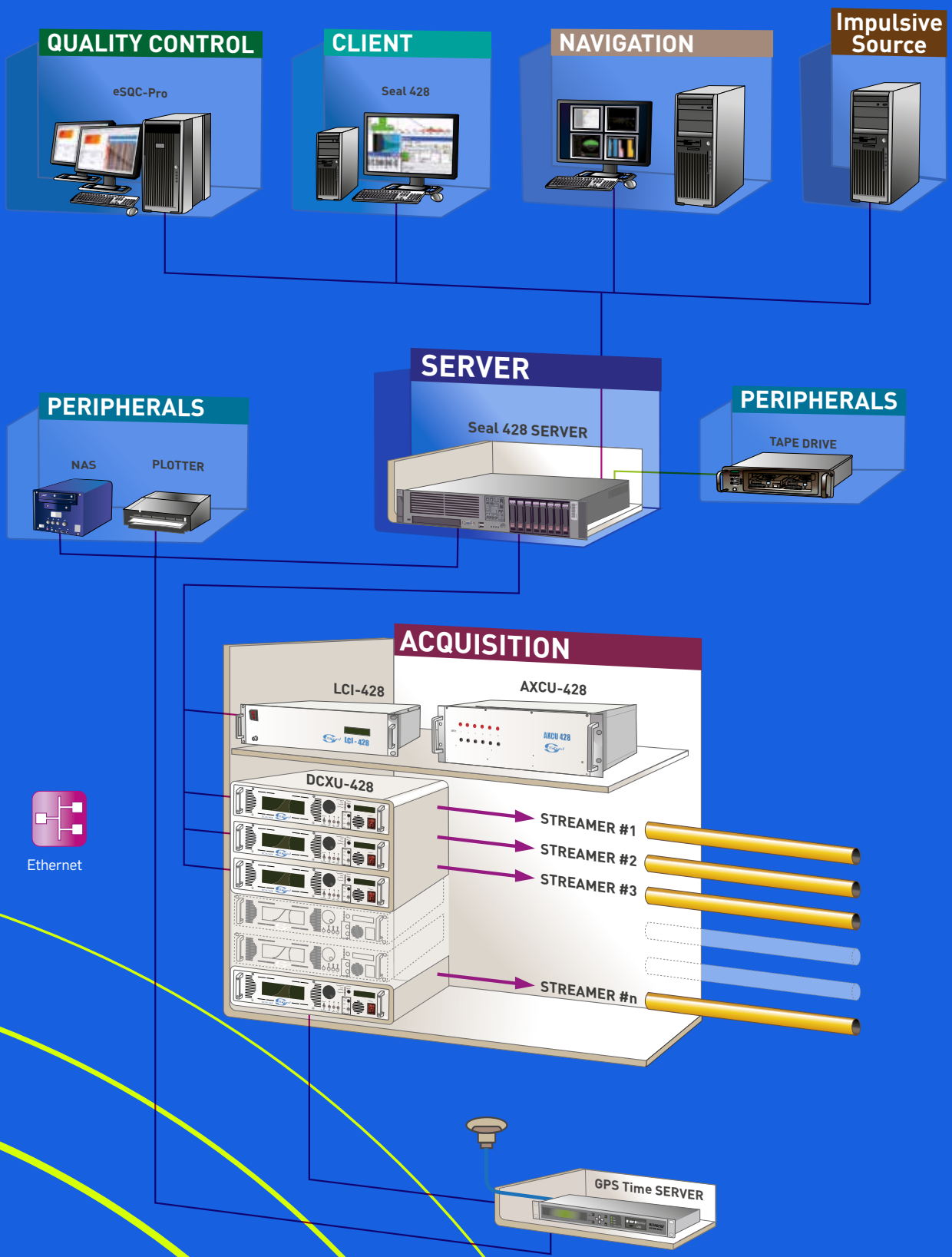
Sentinel *MS* is a new member of the industry standard Sentinel product line to offer multi-sensor acquisition along with the very best low frequency, low noise, and highest reliability solid streamer available today.
In addition to the field proven hydrophone performance, unique in the industry, the new multi-sensor streamer features two additional acceleration components, providing directive measurement for both cross line and vertical wave front.
Improving data quality and providing wavefield gradient, this new solution enables receiver ghost removal and the most advanced seismic data processing techniques.

Sentinel *MS* specifications	
Section length	150 m
Section diameter	59.5 mm
Receiver group	3 collocated components : • 1 hydrophone group • 1 vertical accelerometer group • 1 crossline accelerometer group
Receiver group spacing	12.5 m
Maximum operating depth	50 m
Maximum streamer length with full redundancy and zero dead time	8,000 m*
Operational model	Same as Sentinel and Sentinel *RD*

** With minimum compression ratio required : 53 % (figure depending on signal type, sea and environmental conditions)*


Hydrophone *Accelerometer Y* *Accelerometer Z*

SEAL 428 RECORDER



DCXU-428

STREAMER CONTROLLER

- Streamer oriented architecture: 1 unit per streamer
- Hot-swappable unit
- GPS-synchronization of seismic acquisition

GPS TIME SERVER

GPS RECEIVER USED FOR SYSTEM SYNCHRONIZATION

- Propagation of GPS time reference
- Tolerance to loss of PPS signal

Seal 428 SERVER

SEISMIC DATA RETRIEVAL, FORMATING, PROCESSING & EXPORT

- Read hat linux Operating System
- Up to 15TB RAID-6 local storage and power-supply redundancy

LCI-428

LINE ACQUISITION UNIT

- Electrical interface with navigation when using a physical T_0
- Management of auxiliary channels

AXCU-428

AUXILIARY CHANNEL UNIT

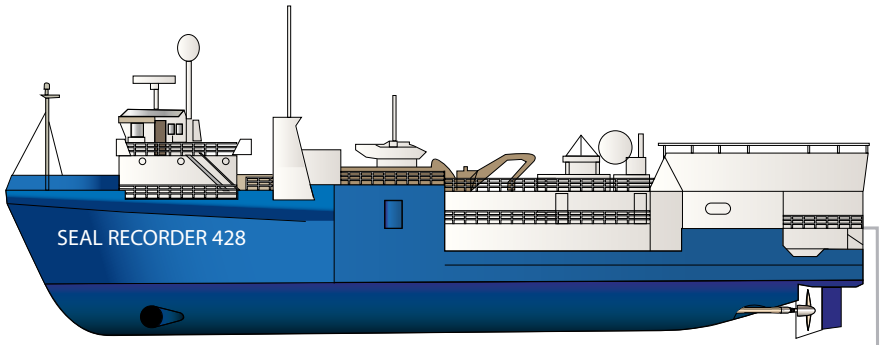
- Digitization of analog auxiliary channels
- 12 channels, extension available up to 60

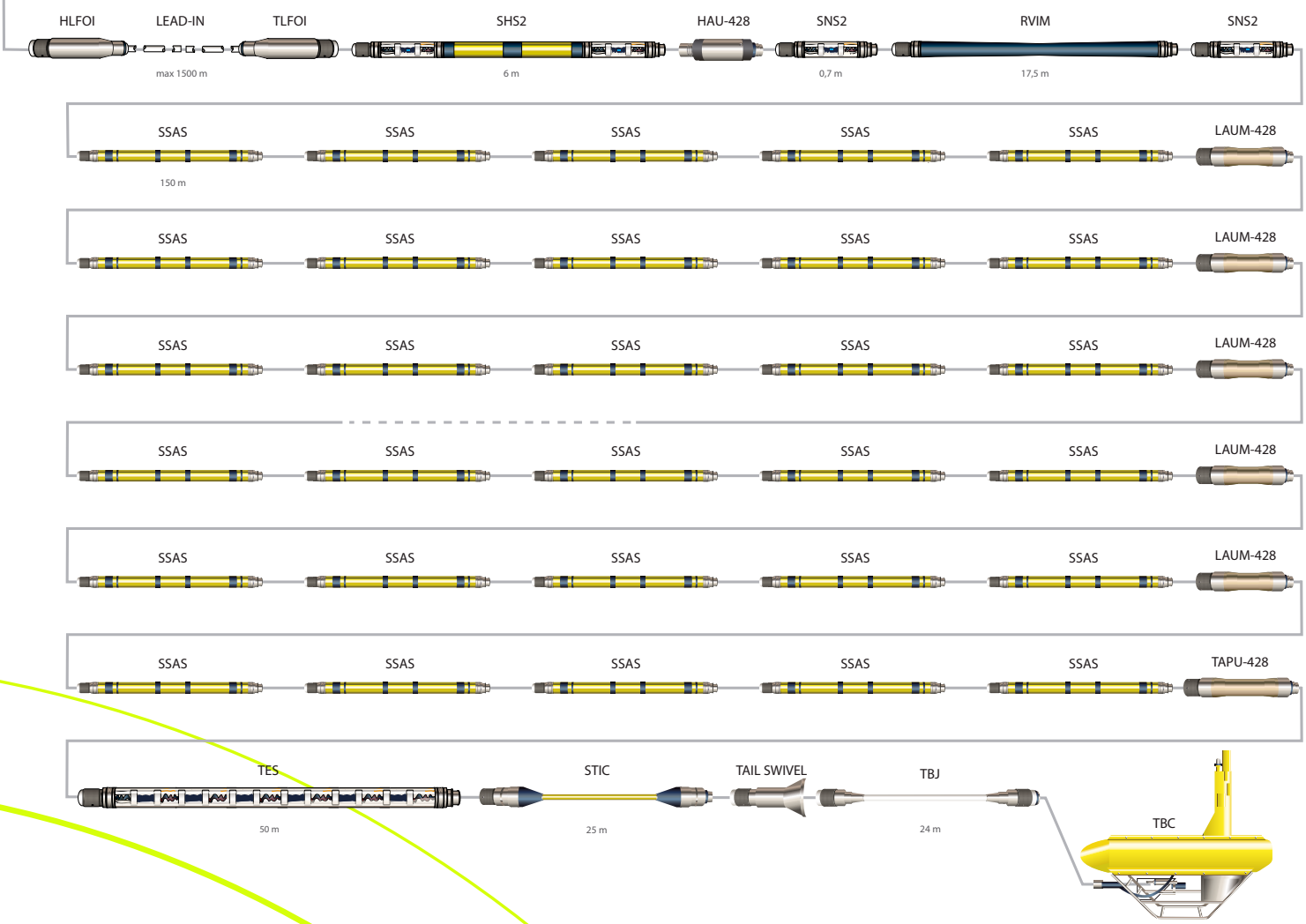
NAS

COMPLETE STORAGE SYSTEM SELF-CONTAINED IN A HOUSING CASE

- Up to 2 TB disk capacity
- 125 h of seismic data - 1000 ch@2 ms
- Raid 1 Disk feature

STREAMER ARCHITECTURE





› 100% Oil-free active and neutral sections

LEAD-IN

ARMOURED ELECTRO OPTICAL CABLE

- Traction resistance : up to 570 KN
- Length : up to 1900 m

SHS2

SHORT HEAD SECTION

- Flexible section
- Acceleration sensor for noise monitoring
- 2 Nautilus transducer
- 1 coil acoustic
- Length : 6 m

STIC

STREAMER TAIL INTERFACE CABLE

- Interface with the tail buoy
- Contains a breakable link
- Length: 25 m

HAU-428

HEAD AUXILIARY UNIT

- Streamer tensile stress measurement
- Head buoy power suppy as an option (HAPU-428)
- Length : 0,277 m

RVIM

RADIAL VIBRATION ISOLATION MODULE

- Isolation of vessel vibrations
- Length : 17,5 m

TES

TAIL ELASTIC SECTION

- Isolation of tail buoy vibrations
- Length : 50 m

LAUM-428

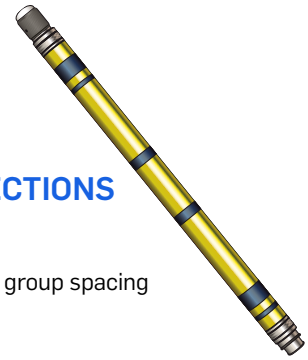
LINE ACQUISITION UNIT MODULE

- Data routing and power supply of active channels (60 ch max)
- Internal temperature monitoring
- Length : 0,256 m

TAPU-428

TAIL ACQUISITION AND POWER UNIT

- Data routing and power supply of the last active channels
- Tail buoy power-supply
- Length : 0,335 m



SSAS

SENTINEL ACTIVE SECTIONS

- Data acquisition sections
- Field repairable
- Customizable hydrophone group spacing
- Length : 150 m

SNS2

SHORT SECTION

- Short flexible section
- Ø70 mm / Ø50 mm and Male / Female option for use in Head or Tail
- Length : 0,717 m
- Nautilus transducer

SOFTWARE

Seal 428

Data acquisition software

Seal 428 software is a package that completely controls the seismic instrument spread and operations. It also performs all the requested computations before recording data onto tapes or disks. Taking benefits of its client/server architecture, Seal 428 allows secured remote access through Internet connections.

eSQC-Pro

Quality control software

eSQC-Pro is a powerful integrated tool for real-time QC of seismic data acquisition without slowing down production. Its client/server architecture allows real-time QC display on a remote standard PC through a secure Internet connection.

SGA

Signal graphic analyzer

SGA is the latest generation of Signal Graphic Analyzer QC Tool. Featuring a new user-friendly graphical interface and being able to work in real-time or standalone mode, SGA can be installed on any computer to perform detailed signals analysis. The software supports a wide range of graphical displays (amplitude, spectrum, distortion, phase,...) and is compatible with the latest SEG-D file revisions (rev 2.1 and 3.0).

NAUTILUS

FULLY INTEGRATED STREAMER STEERING SYSTEM

The three-in-one Nautilus device offers acoustic positioning, depth control and automatic steering in a single unit. Fully integrated and compatible with the whole Sentinel® products range, Nautilus is directly powered by the streamer and eliminates the costly need to service the battery.

With ultimate battery power conservation, and a much greater steering force, Nautilus reduces the line change and keeps a better control of any streamer configuration (3D, high resolution, fan mode, variable depth), resulting in maximum production with minimum infill acquisition to be performed.

Its in-line and revolutionary design reduces noise compared to conventional birds and allows quick installation during deployment.

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