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中油油服油田技术服务国际研讨会
CNPC Service International Technical Seminar
14-17 October 2019 • Tianjin, China

Introduction to Geophysical Exploration of CNPC Service

Shi Jicheng

15th October, 2019

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Technology and Innovation



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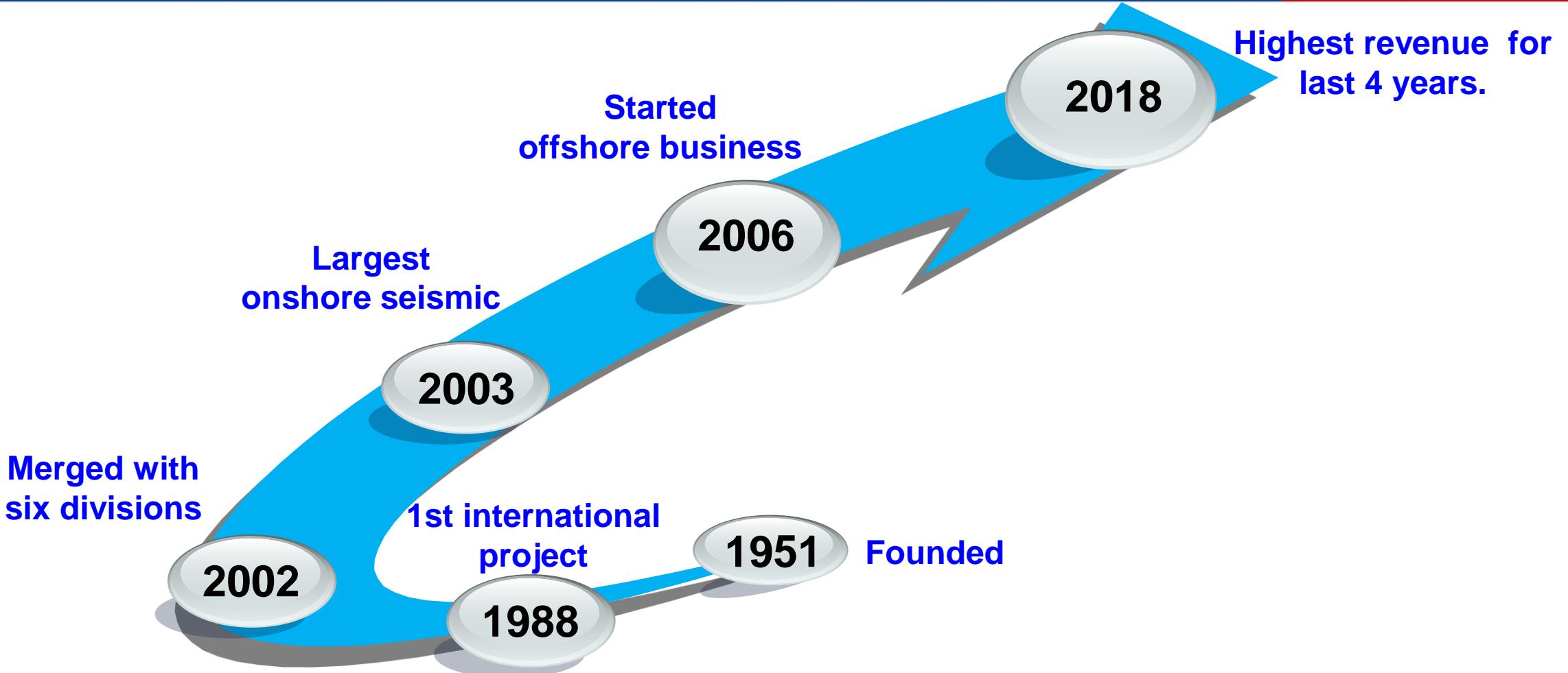
Applications



4

Summary

History



Capability

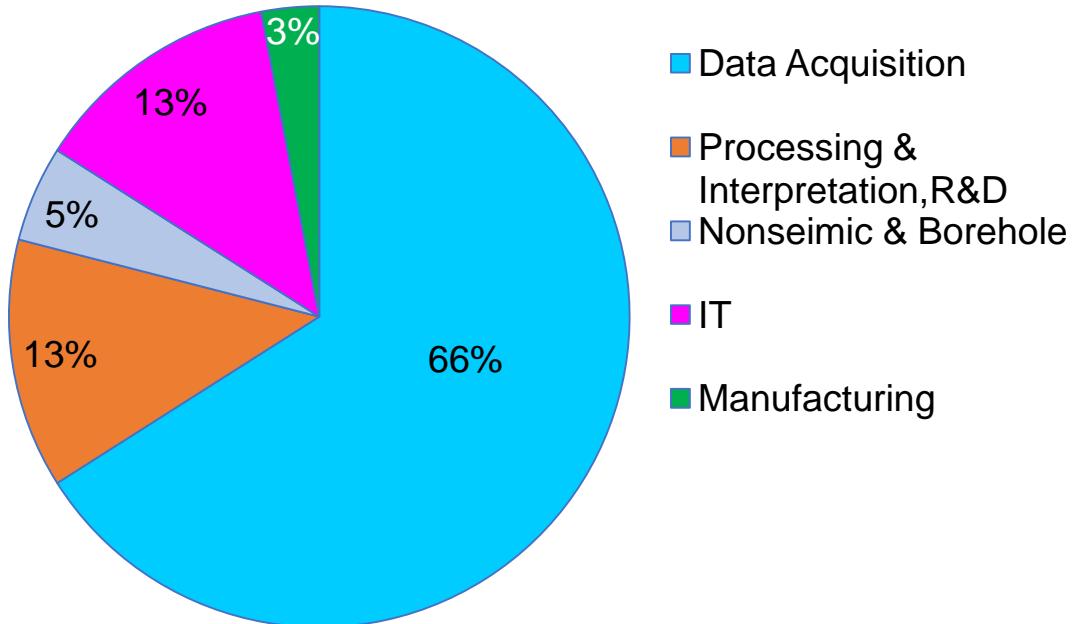
Items	Quantity
Seismic Crews	164
Streamer Vessels	2
OBN Vessels	4
VSP Crews	11
GME Crews	22
Total	203

2D seismic acquisition: >200,000 km

3D seismic acquisition: >100,000 sq.km

Capability

Employees in core business



- Data Acquisition
- Processing & Interpretation, R&D
- Nonseismic & Borehole
- IT
- Manufacturing



1/3 of employees are technical staff



Training Centers
2 in China,
8 overseas



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Capability

Acquisition Equipment



- 508 , 428, 408,G3i, Node, etc.
- Totally 1.5+ million channels



- EV56, KZ-28LF, KZ-28, AHV-IV, NOMAD65, etc.
- Totally 830+ vibrators



- 6 Vessels (Streamer/OBN)
- 23 Streamers/6 OBN crews;



- Portable, Truck mounted rig
- Totally 10,000+ sets

P&I Capability and Software



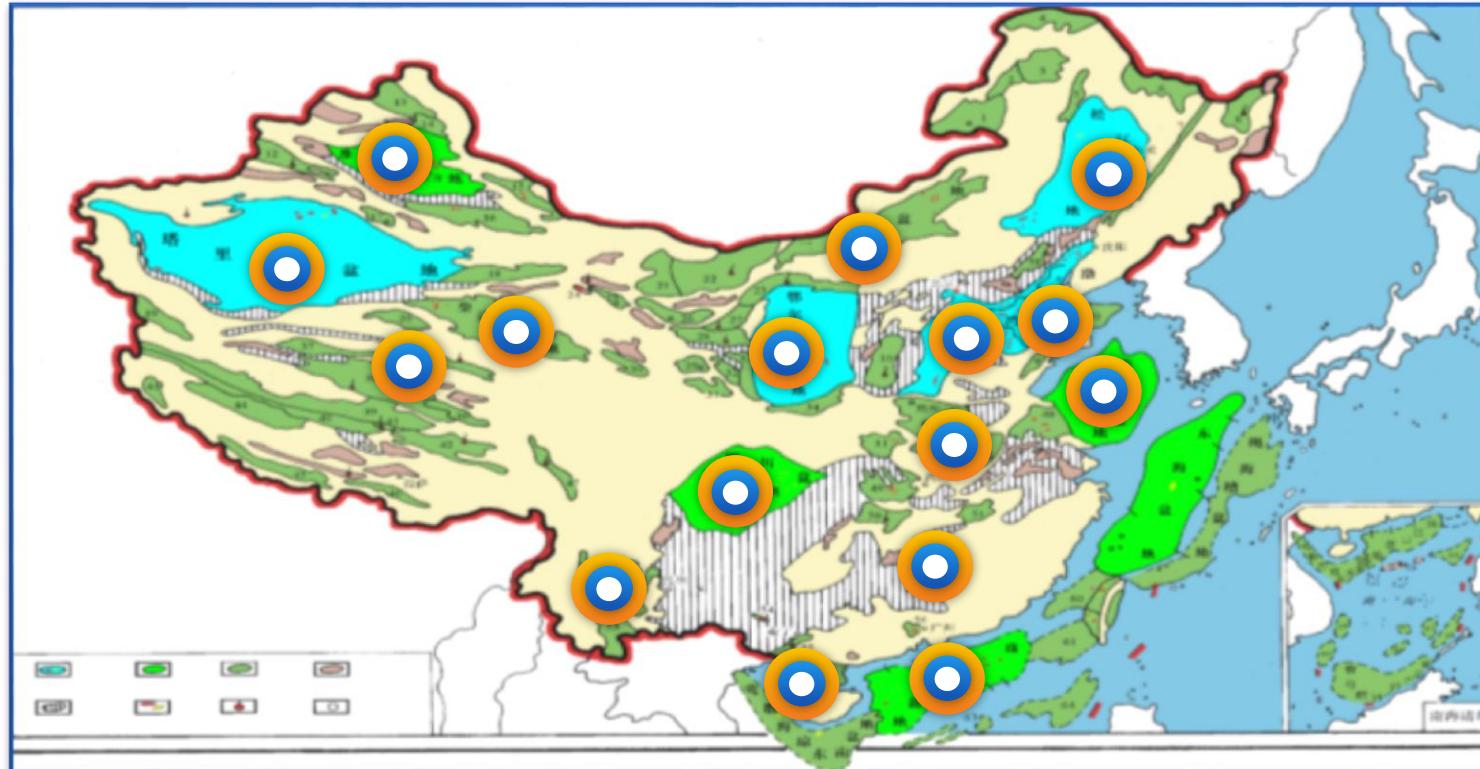
- 20,000+ CPUs, 2,200+ GPUs
- 600+ Workstations
- Computing Capacity: 30P flops
- Storage Capacity: 120+ PB
- Con: 300K 2D + 200K 3D/year
- PSM: 100K 2D + 50K 3D/year



- P & I : GeoEast
- Acquisition : KLSeis



Domestic Operations



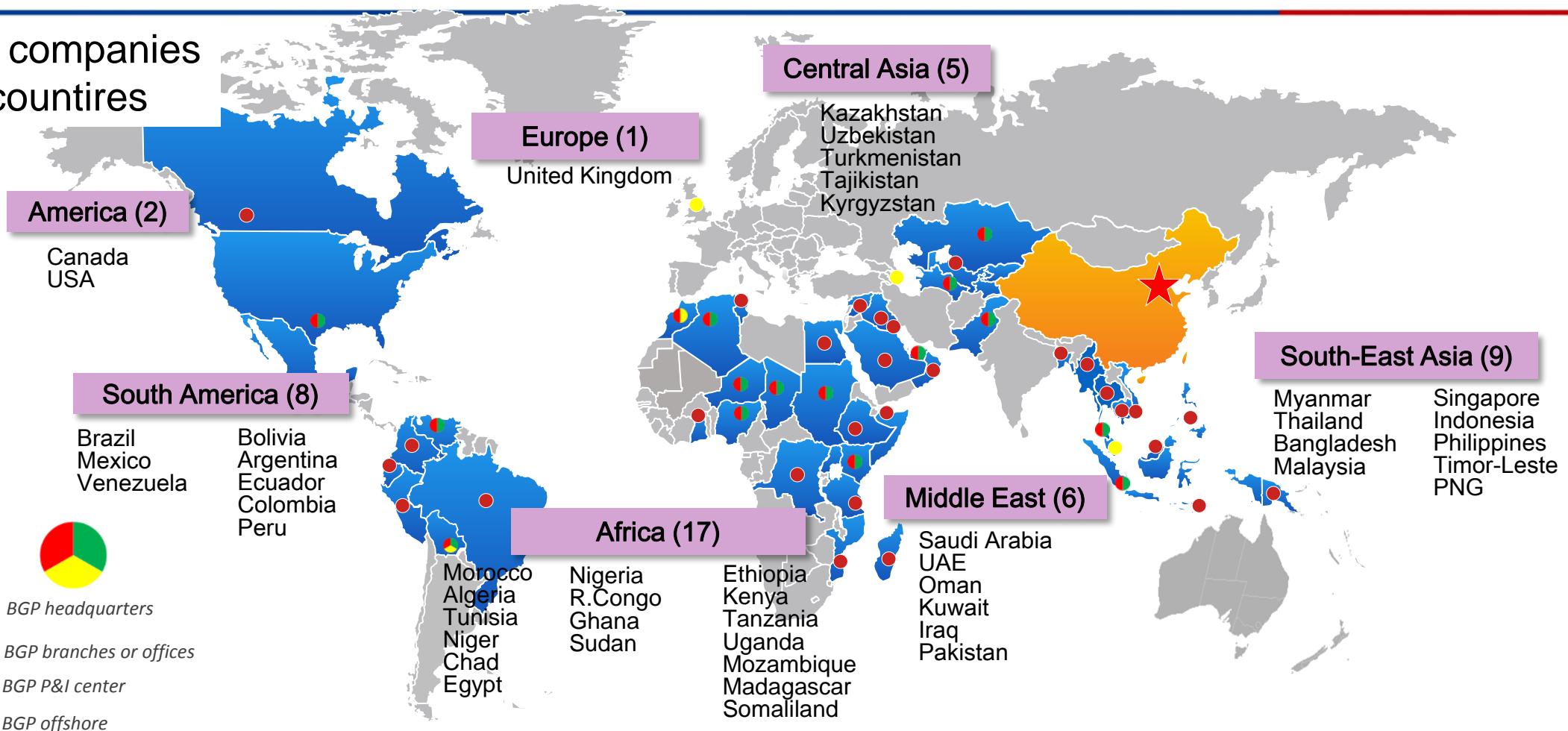
- 100% involvement in the discovery of the major Oil & Gas fields in China
- Over 100 crews operating in different basins.



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Overseas Operations

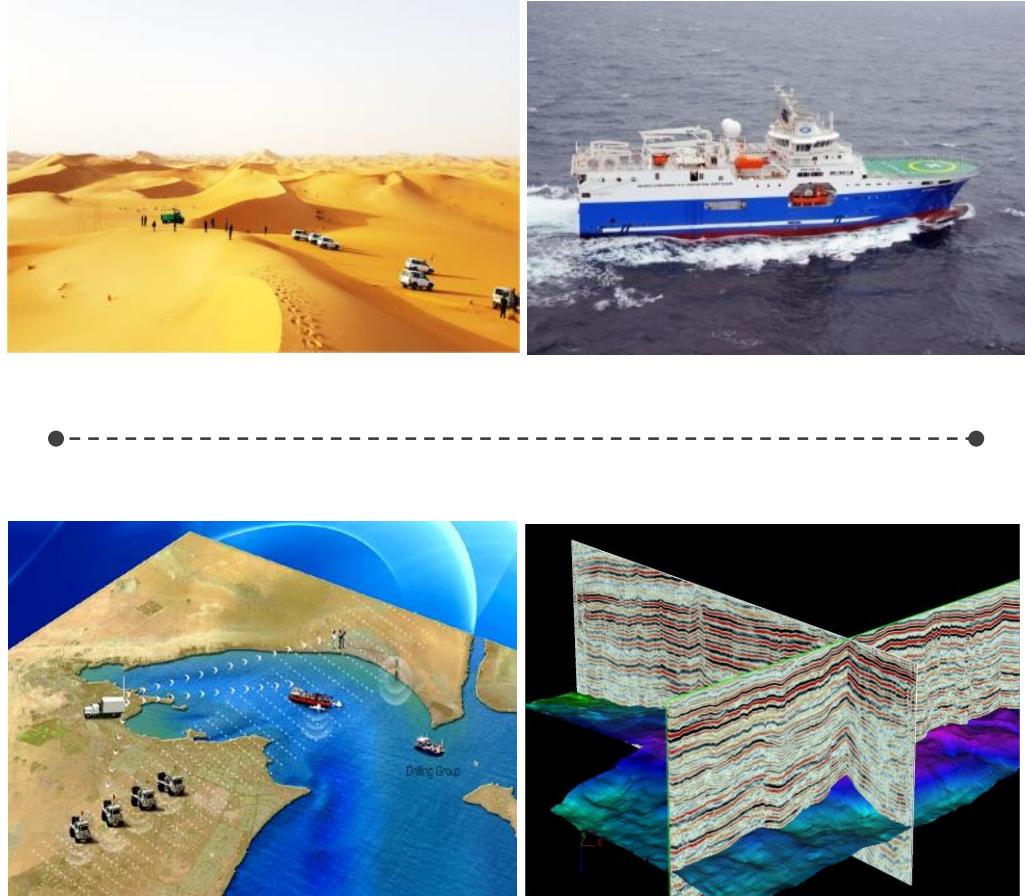
- 300+ companies
- 70+ countries





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Integrated Service





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Seismic Data Acquisition

- 60+ years' land experiences
- 40+ years' TZ seismic
- 15+ years' leading land seismic
- 10+ years' with streamer/OBN

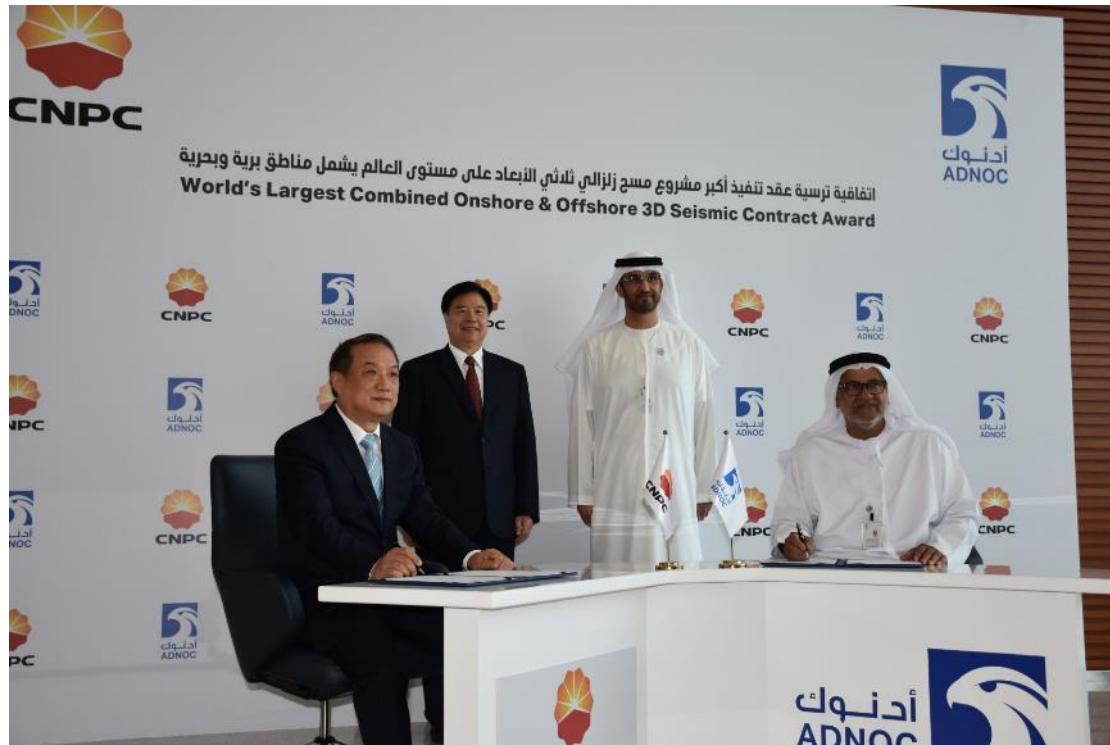




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Seismic Data Acquisition

- World largest 3D Seismic Contract awarded on July 19th, 2018



Shailaja A. Lakshmi July 20, 2018

UAE's Adnoc Awards USD 1.6bln Contract to China's CNPC



Image: ADNOC

Upstream Director, and Gou Liang, President of BGP.

The signing was witnessed by Dr Sultan Ahmed Al Jaber, UAE Minister of State and ADNOC Group CEO, and His Excellency Wang Yilin, Chairman of CNPC.

Dr. Al Jaber said: "The announcement of the world's largest continuous 3D seismic survey, and, with it, the deployment of cutting-edge exploration technologies is an important step in realizing the full potential of Abu Dhabi's conventional and unconventional oil and gas resources as we deliver on our 2030 smart growth strategy."

The Abu Dhabi National Oil Company (ADNOC) has awarded contracts worth AED 5.88bn (US \$1.6bn) for the world's largest continuous 3D onshore and offshore seismic survey, covering an area up to 53,000 square kilometres, as the company continues to identify and unlock new opportunities and maximize value from its hydrocarbon resources and deliver on its 2030 smart growth strategy.

Adding to the 2D and 3D seismic data already acquired across Abu Dhabi, the new seismic survey will cover an area of up to 30,000 km² offshore and 23,000 km² onshore.

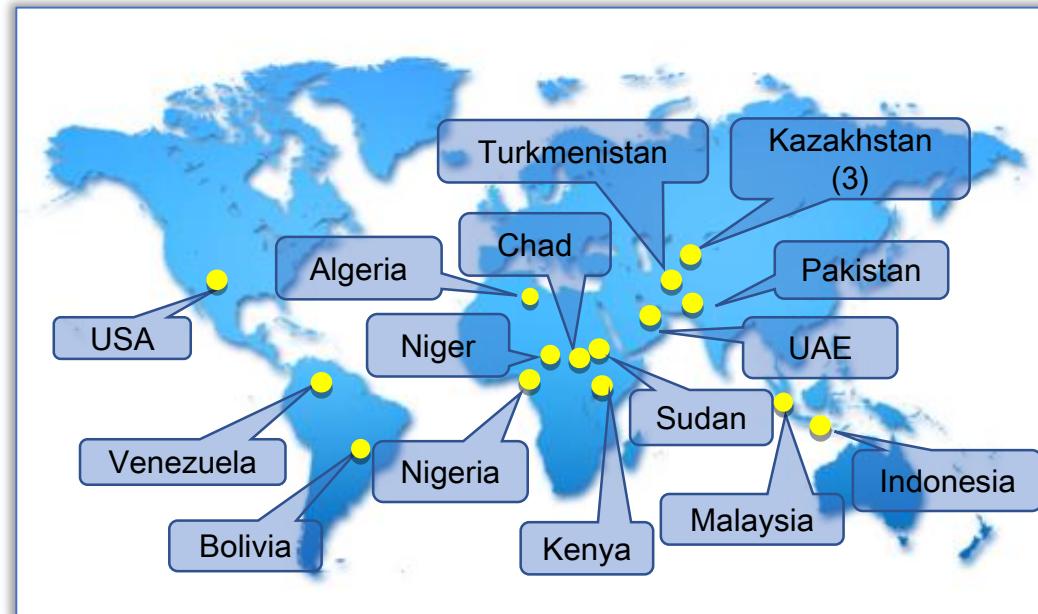
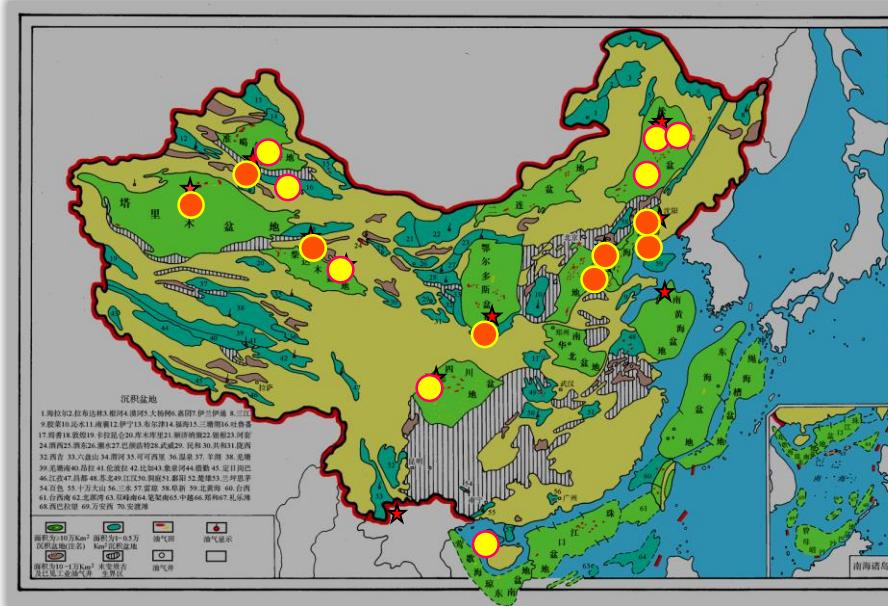
The contract has been awarded by ADNOC to BGP Inc., a subsidiary of China National Petroleum Company (CNPC), who are represented in the UAE by Al Masaood Oil Industry Supplies & Services Co.

The agreement was signed on the eve of a State Visit to the UAE by China's President Xi Jinping, by Abdulmunim Al Kindy, ADNOC's



Data Processing and Interpretation

- 16 G&G/P&I centers in China
- 18 data P&I centers in 16 countries

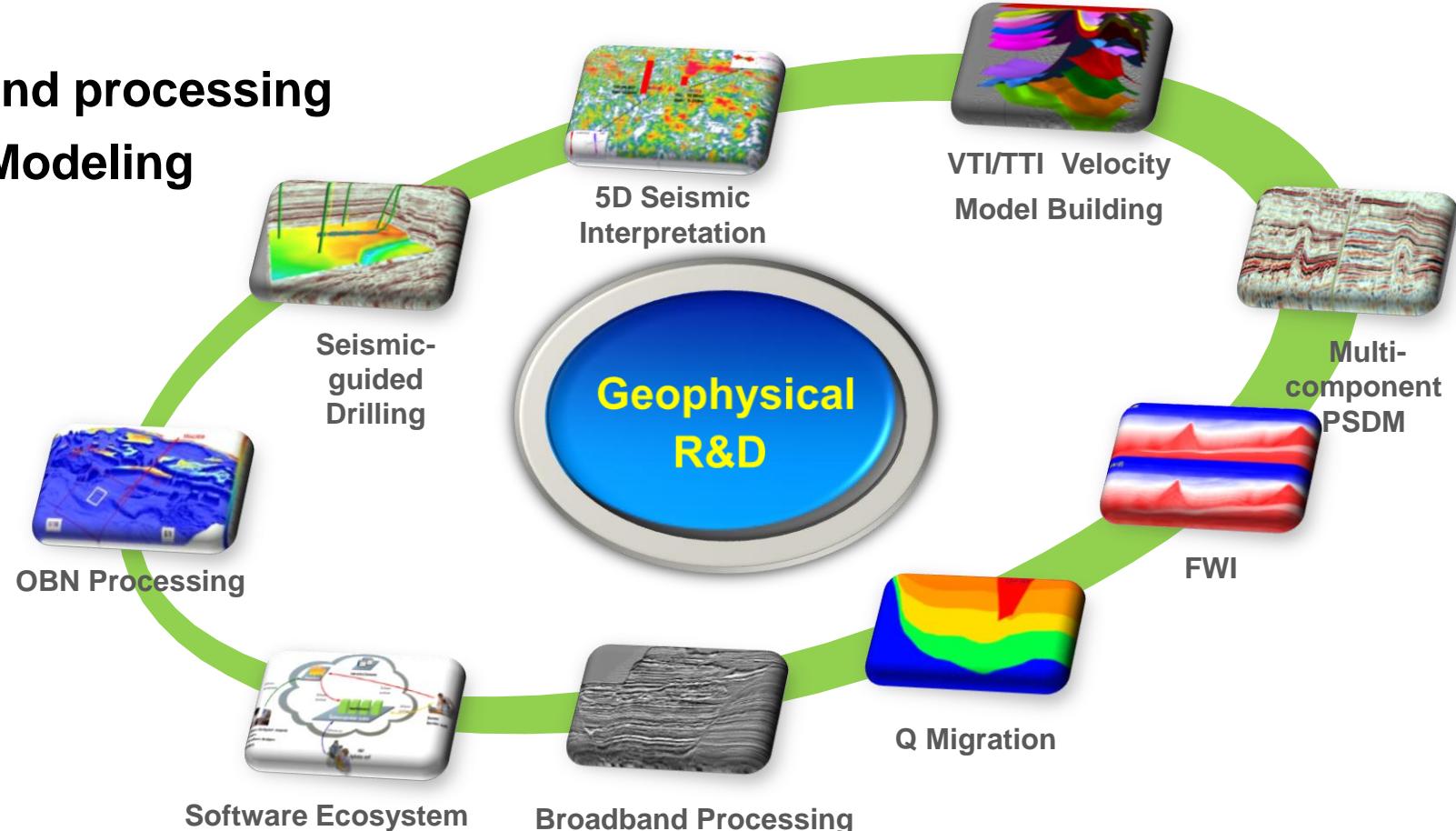




Geophysical R&D

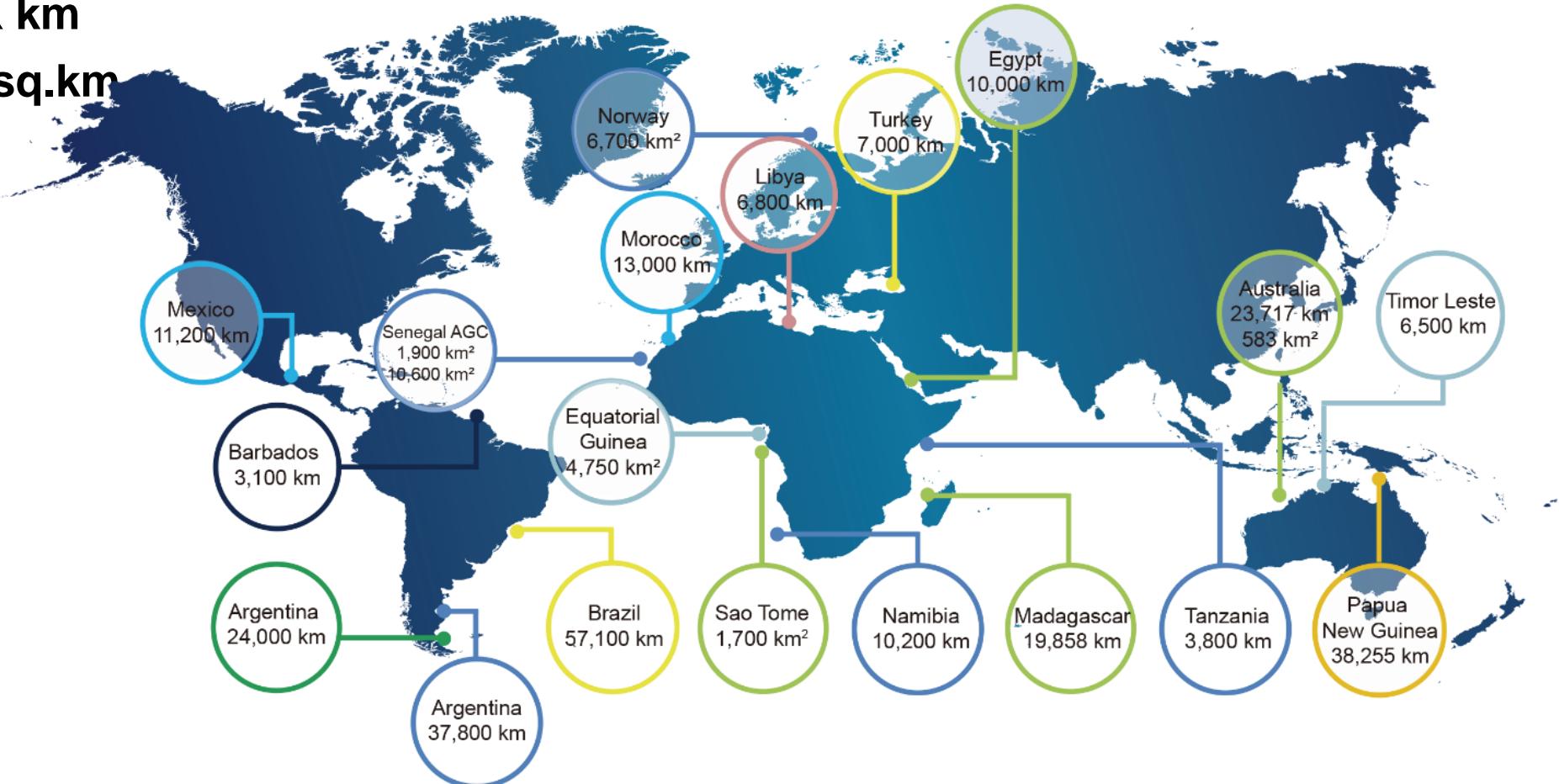
Focus on:

- OBN & Broadband processing
- FWI & Velocity Modeling
- MC PSDM



MC Data Library

- 2D: over 393K km
- 3D: over 26K sq.km
- 34 Surveys
- 21 countries





IT Services

- 10 main businesses
- Around 3000 professional employees
- Serving 30 companies/institutions in 39 countries



Oil and gas IOT solution

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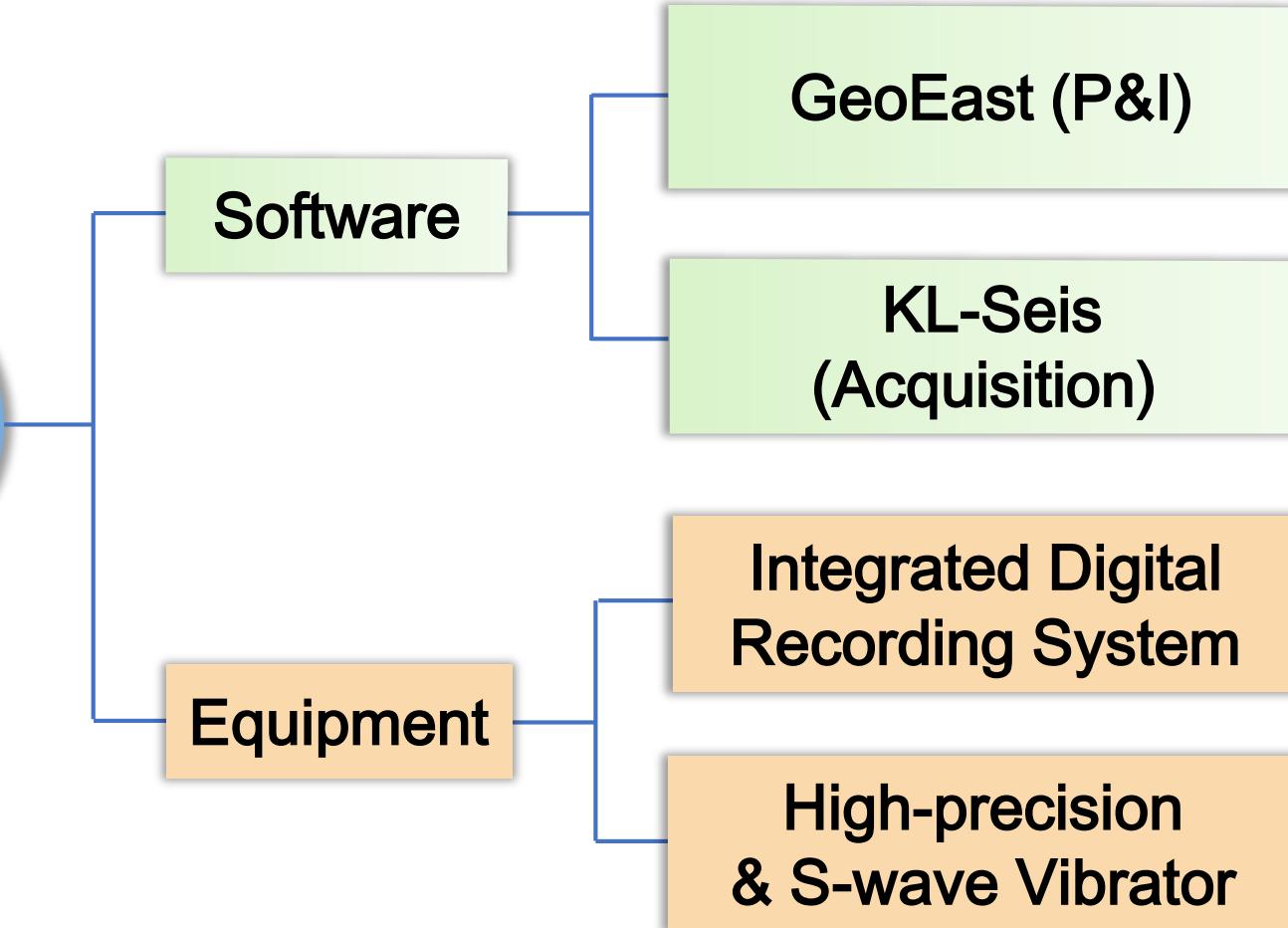
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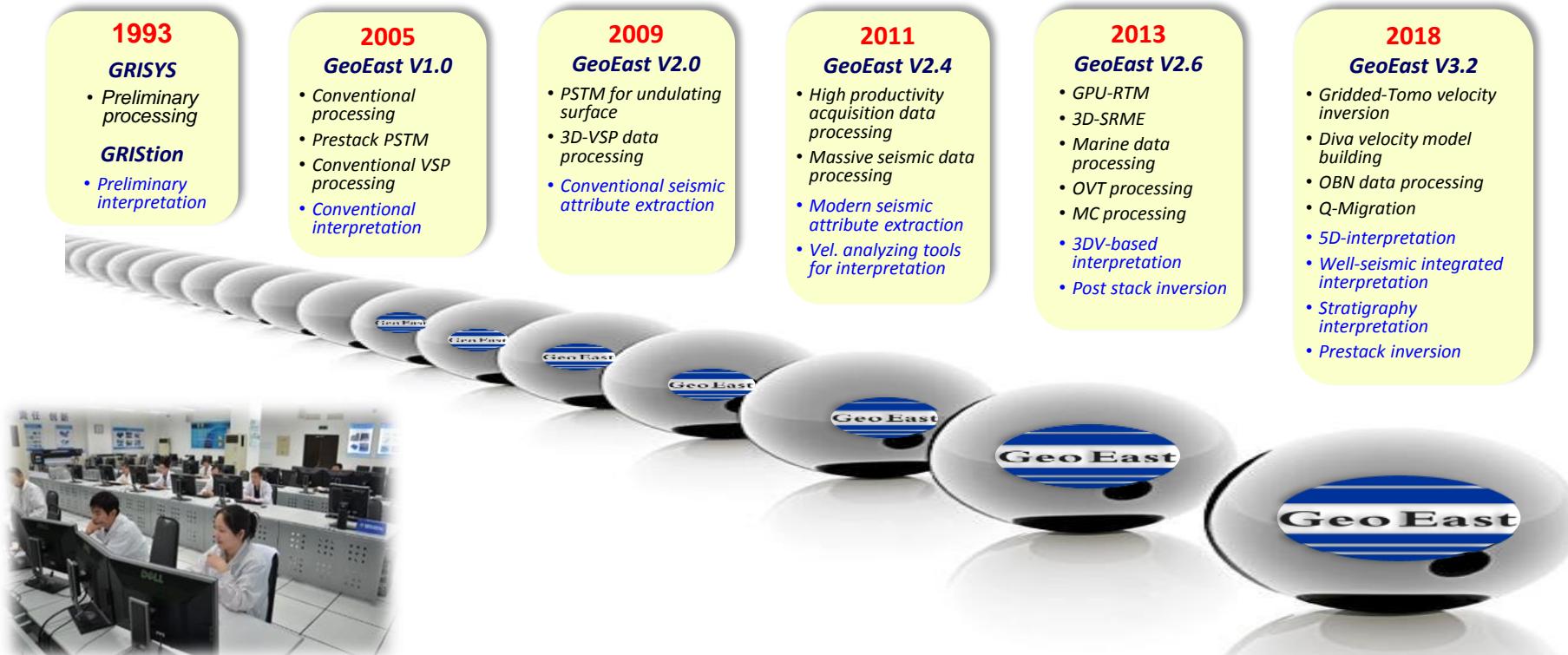
Summary

Software & Equipment



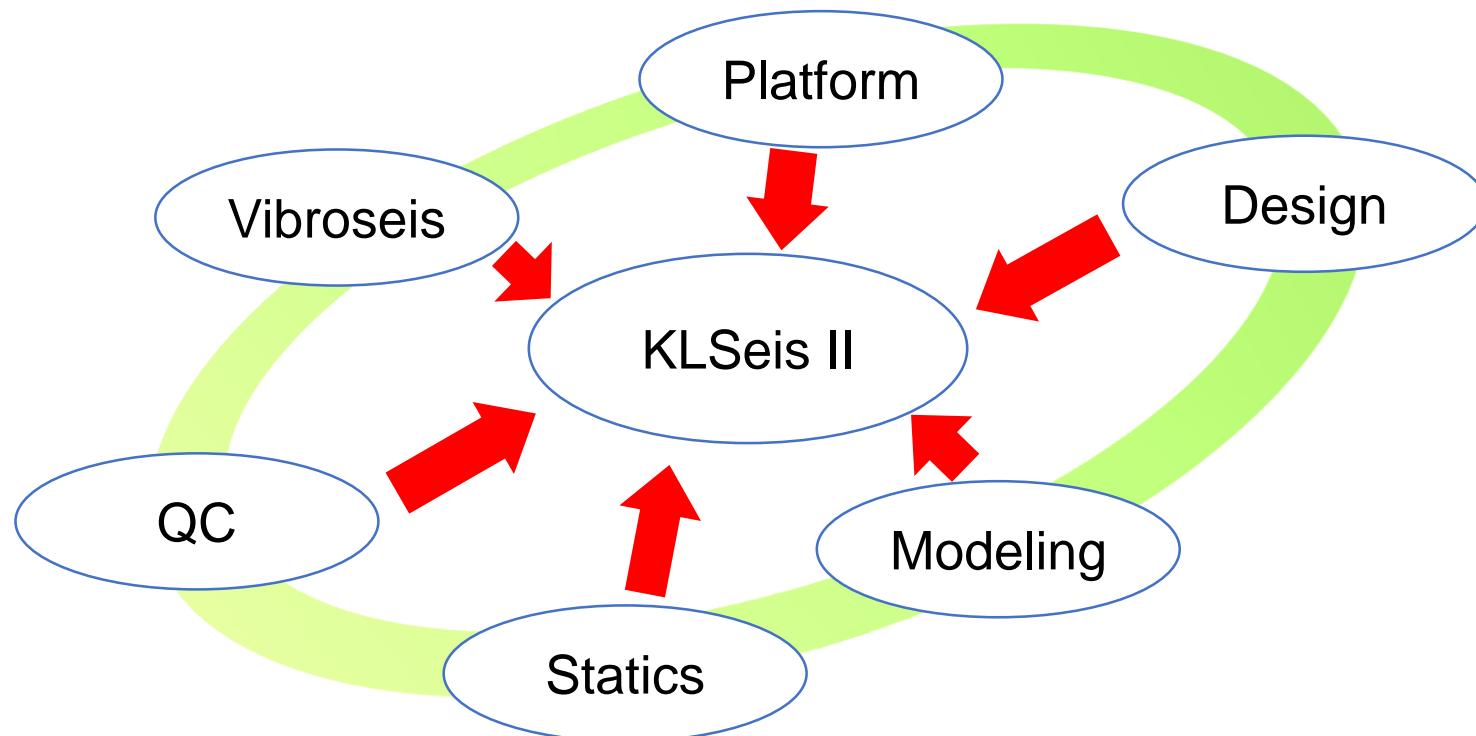
Software R&D

GeoEast - Integrated Software of Processing and Interpretation



Software R&D

KLSeis - Acquisition Integrated Software



Equipment Manufacturing

- **New generation vibrator**
 - EV56 High-precision Vibrator
- **Recording system**
 - G3i 240,000 channels real-time @2ms
 - Quantum - 50 days operation
 - HAWK - 30 days operation
- **Ultra-sensitive Distributed Acoustic Sensing**
 - uDAS VSP



Equipment Manufacturing

GPR- new OBN

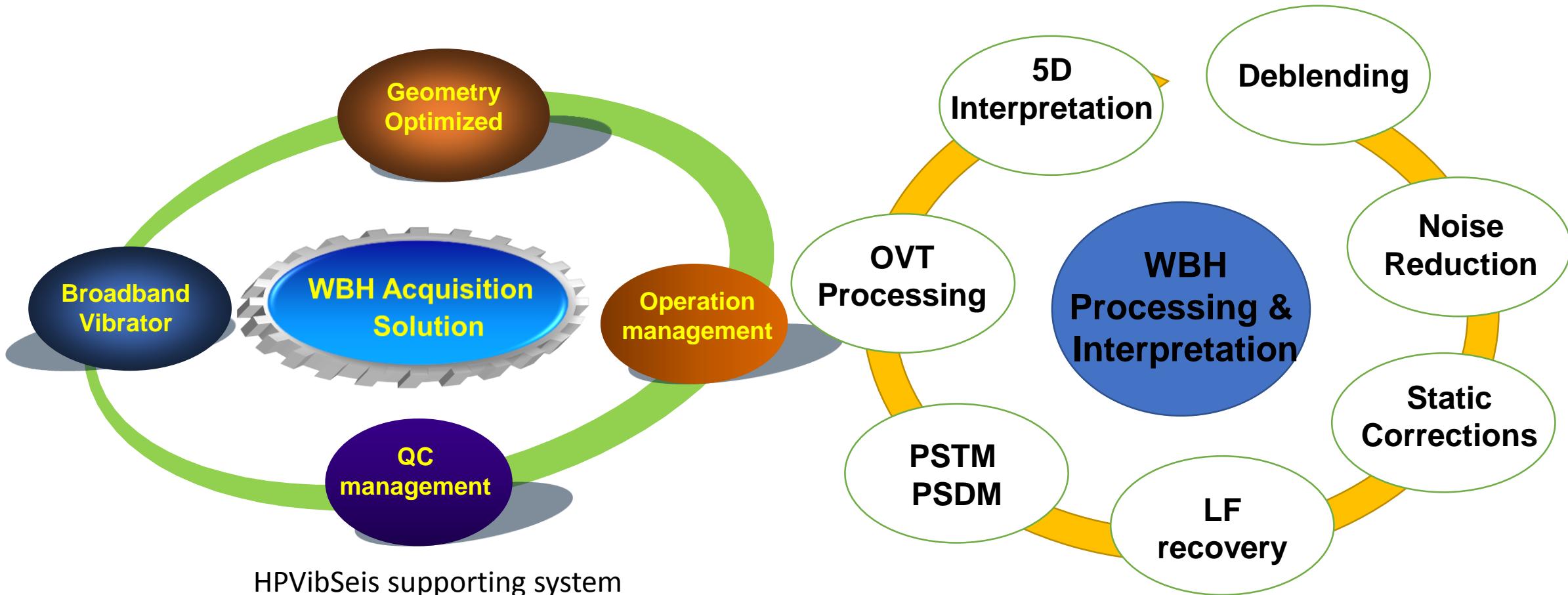
Launched on Sep. 15th at SEG 2019 San Antonio together with SERCEL.

Main features:

- MEMS digital sensor
- 1500m water depth
- 50 days battery



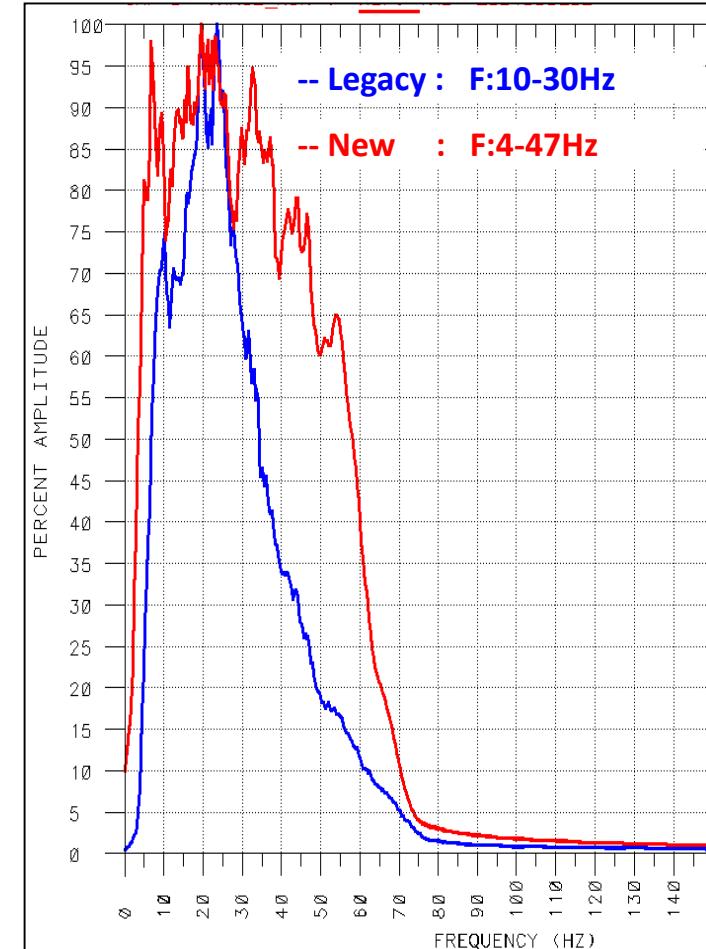
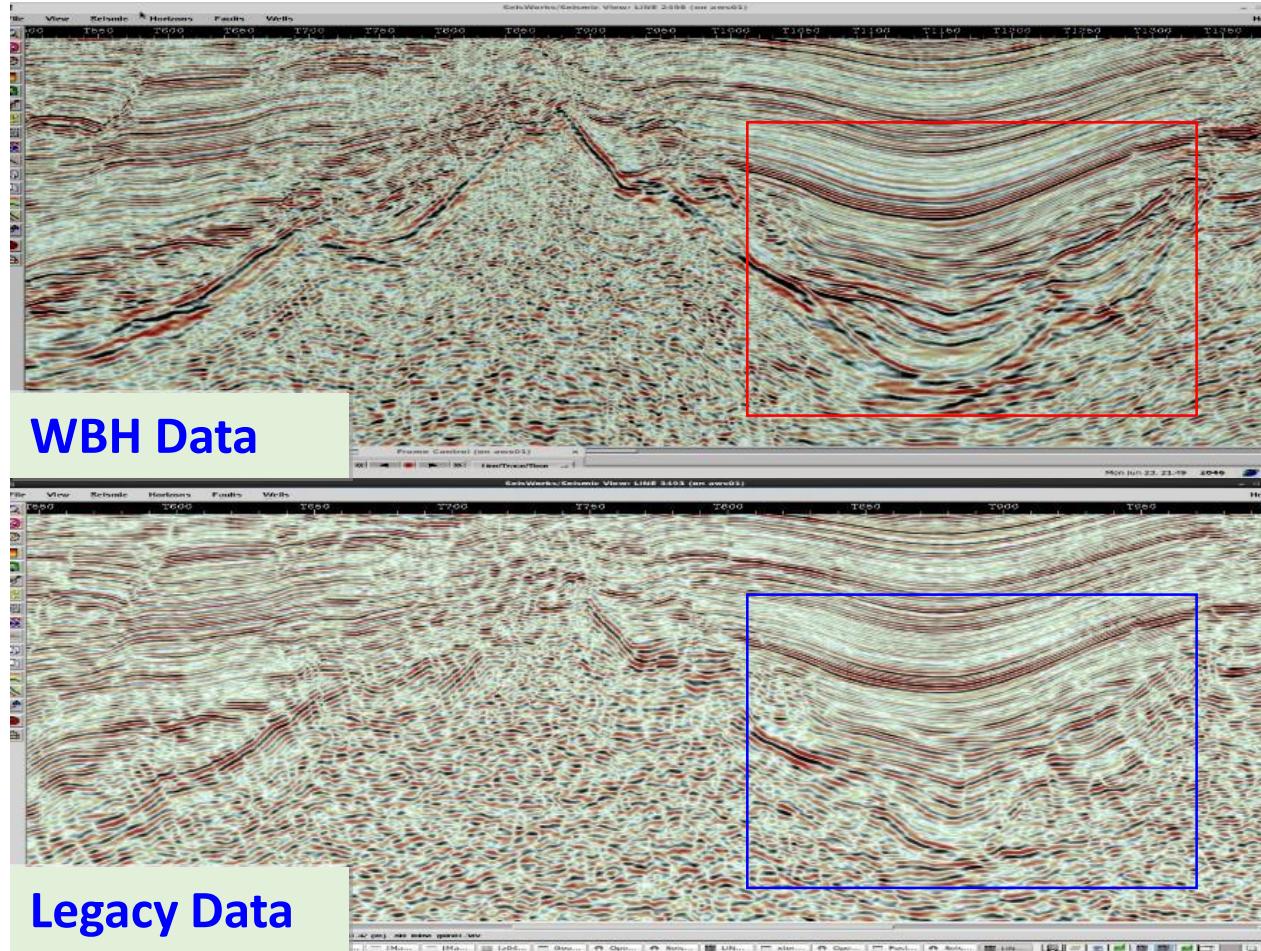
WBH (Wide-azimuth, Broadband and High Density)





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WBH

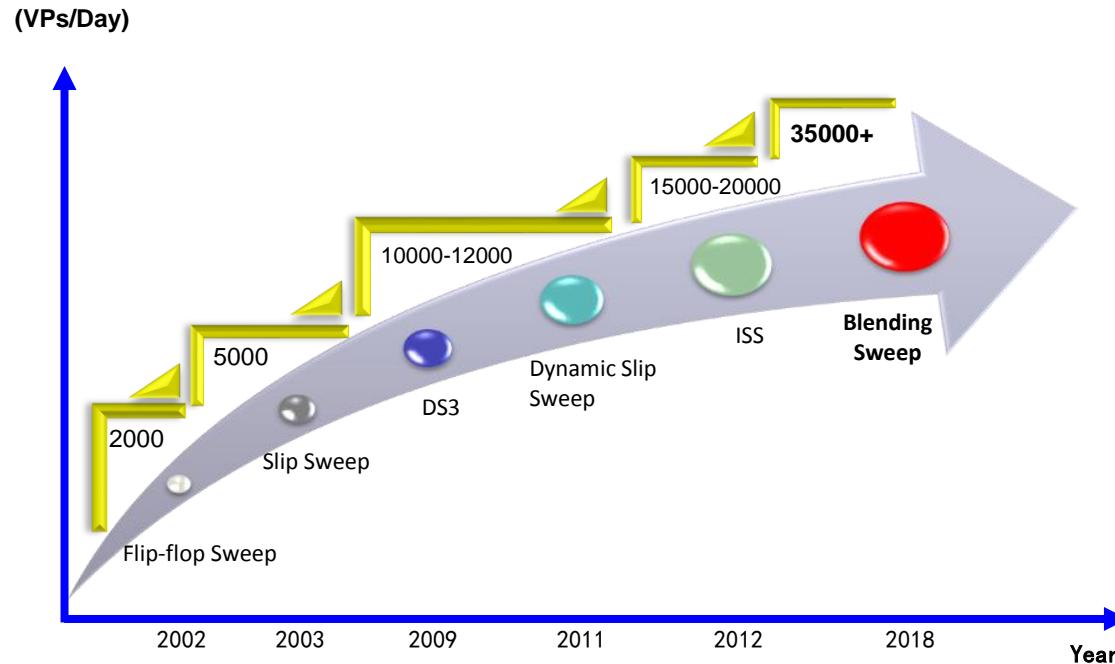




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HPVibSeis (High Production Vibroseis Acquisition System)

- Improve imaging **quality** → High density data
- Reduce exploration **cost** → High productivity



Challenges

Complicated Operational management

Solutions

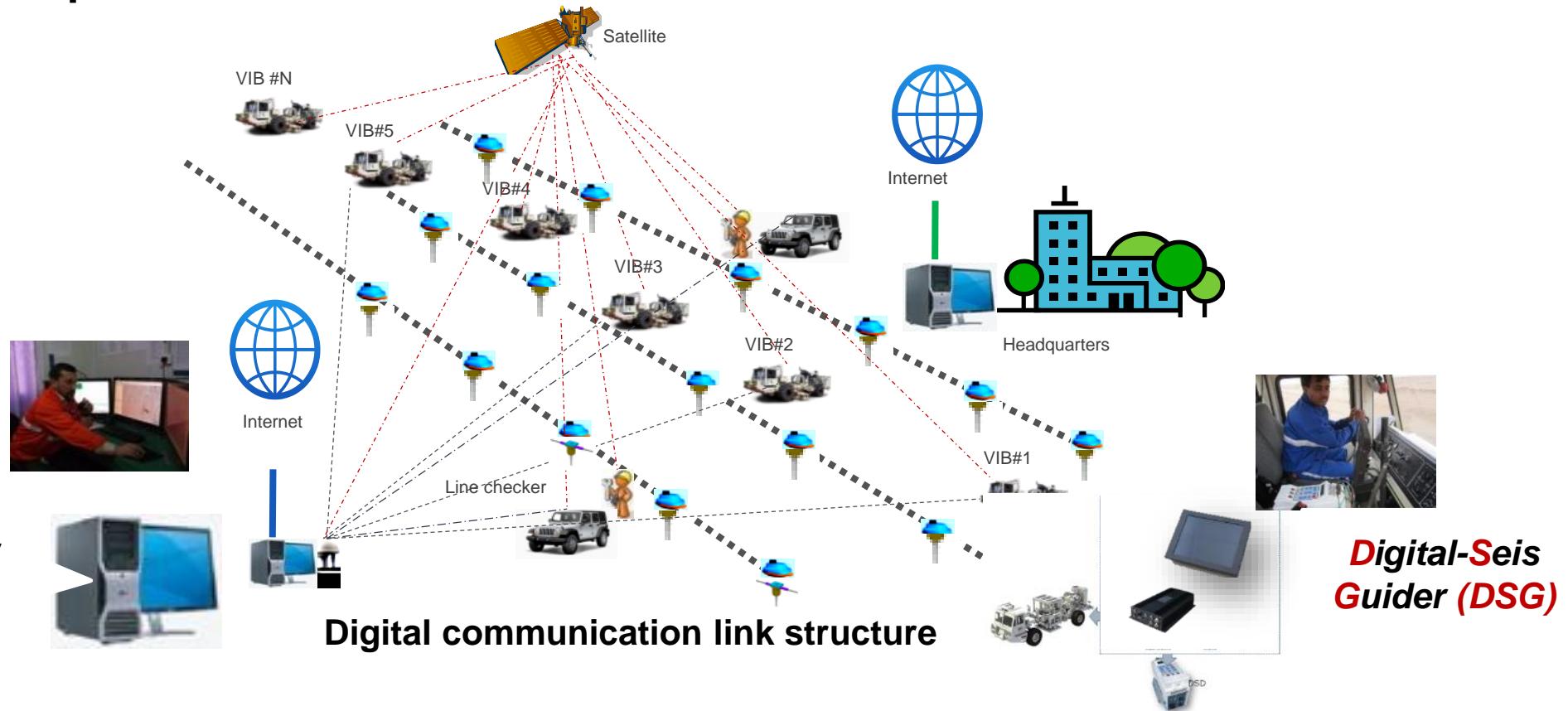
DSS
(Digital Seis System)

Massive data QC and management

KLSeis-RTQC (Real time)
KLSeis-SeisPro (In door)

HPVibSeis

DSS: Developed in 2011

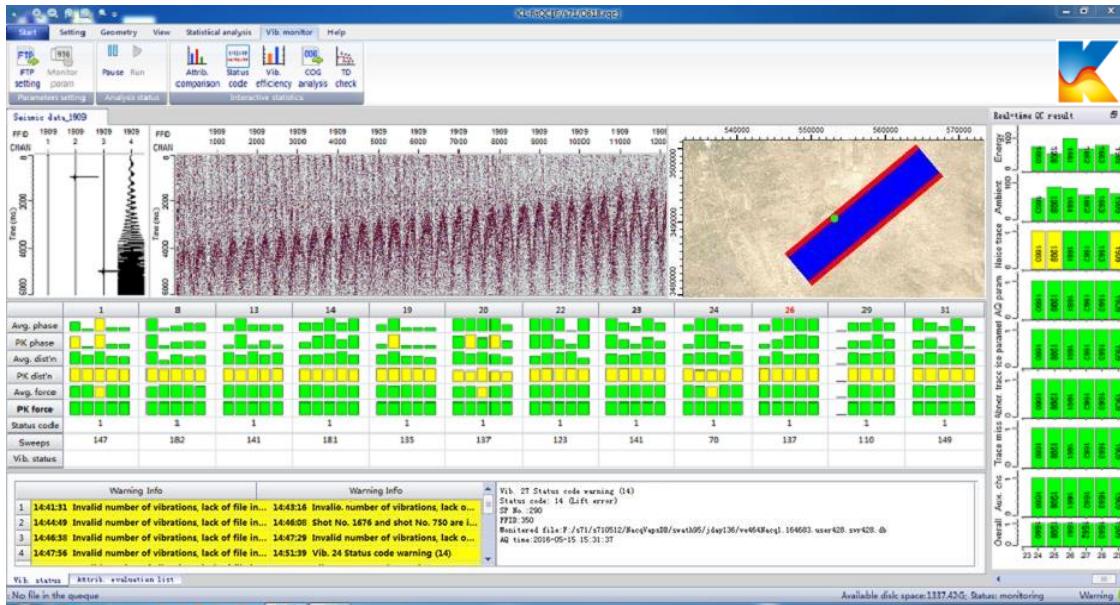




HPVibSeis

Real time QC and management- KL RTQC

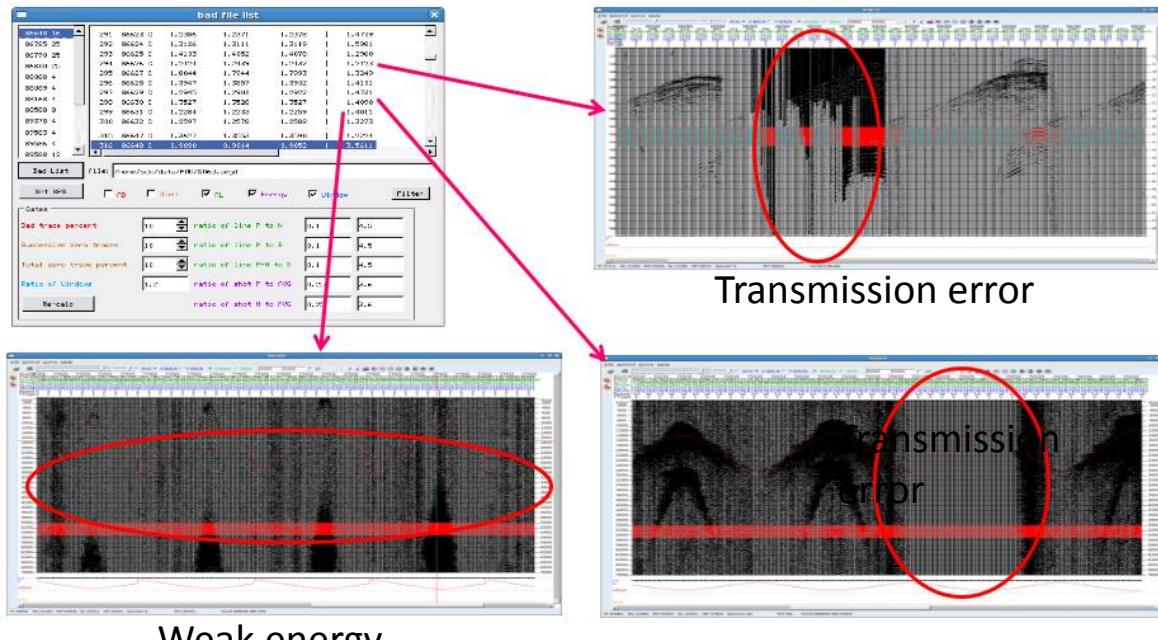
- Vibrator QC
- Frequency QC
- Parameter QC
- Spread QC
- Auxiliary channel QC
- Geometry QC
- Noise QC
- Remote real time QC
- Energy QC



**Data transferring rate: >200MB/s;
60K channels @ 40,000 VPs/day**

Indoor QC and Management- KL SeisPro

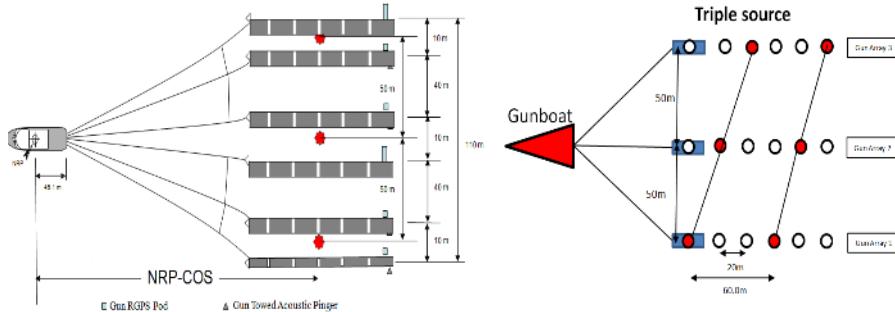
- Daily copying capability: $\geq 30\text{TB}$
- Fast data QC while copying



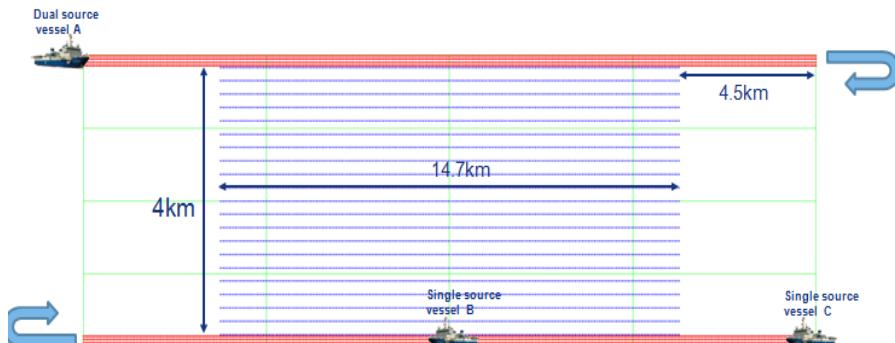


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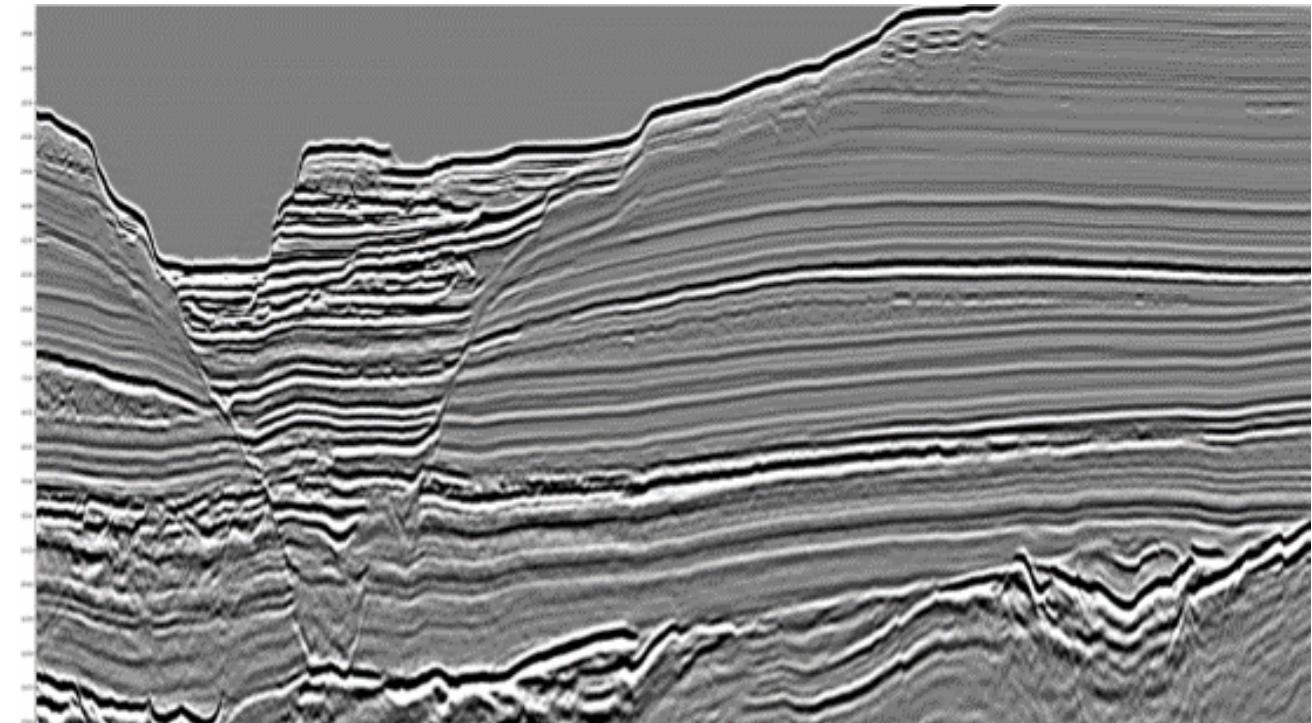
Offshore Seismic



Triple source shooting



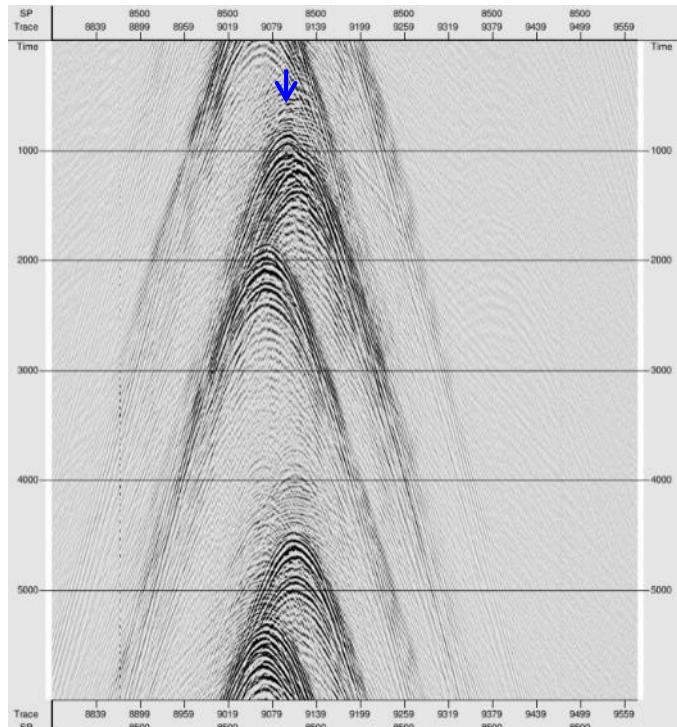
- Continuous recording
- Simultaneous shooting



- Multi-level source
- Broadband Processing

Deblending Processing

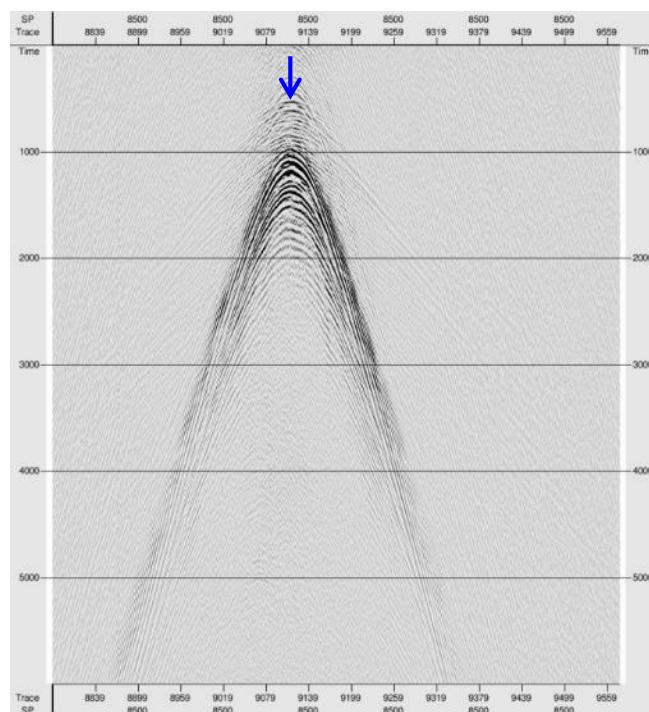
Deblending processing: Separating signals and noises in blended acquisition.



Blended data

Shot gather

De-blending

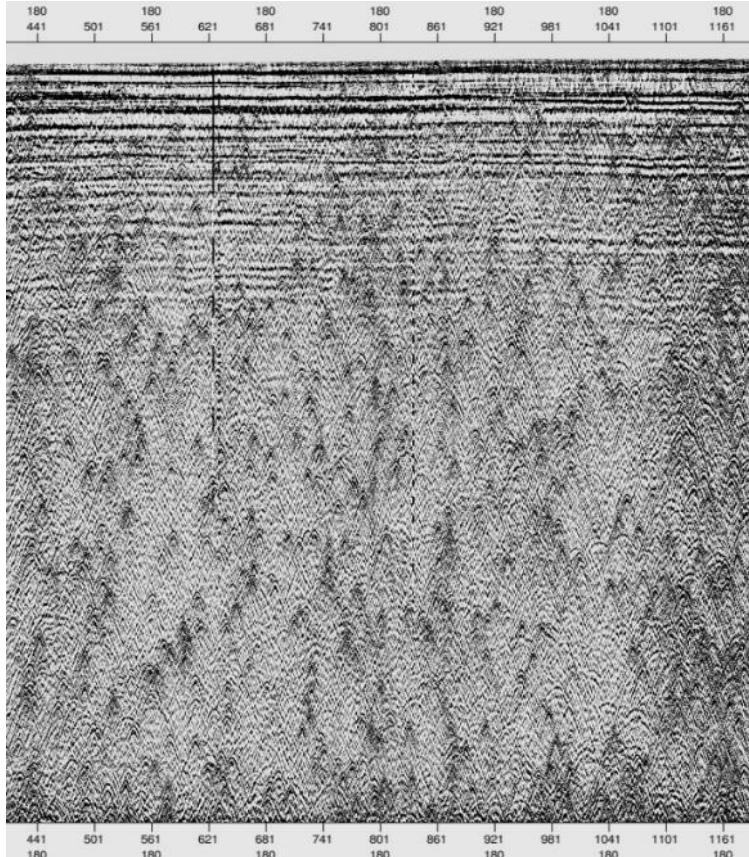


Separated signal



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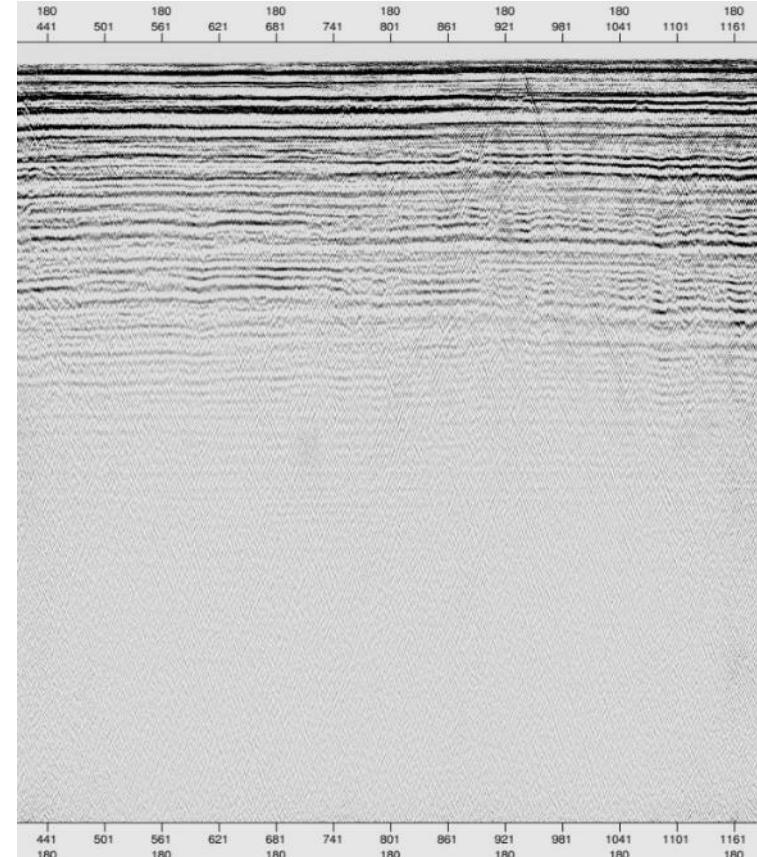
Deblending Processing



Blended data

Brute-stack

De-blending



Separated signal

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Case 1: Ultra-high productivity in ME

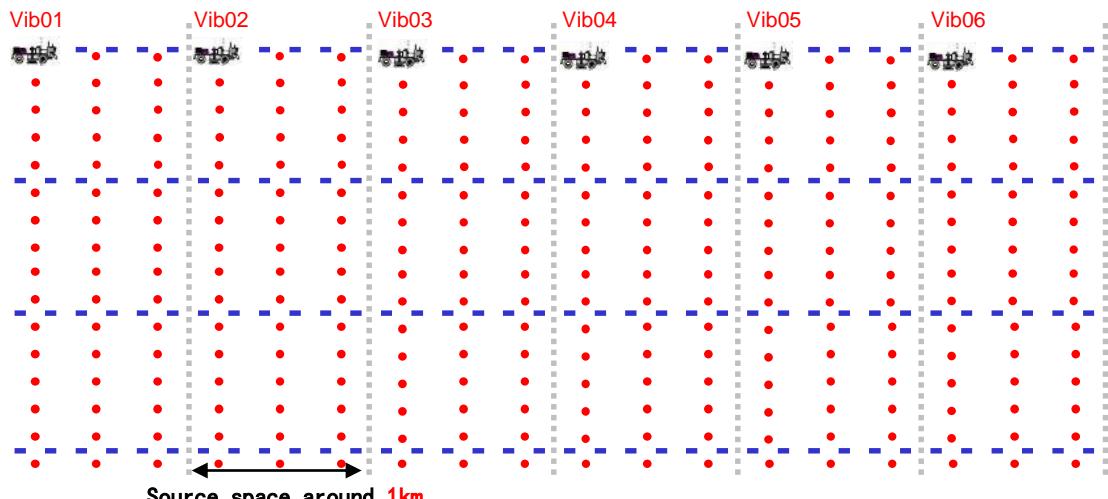
- Challenges

- Active Channels>50,000
- Terrain
- HP



- Effective Vib Management-DSS

- Vib position & status
- Vib QC
- Task assignment



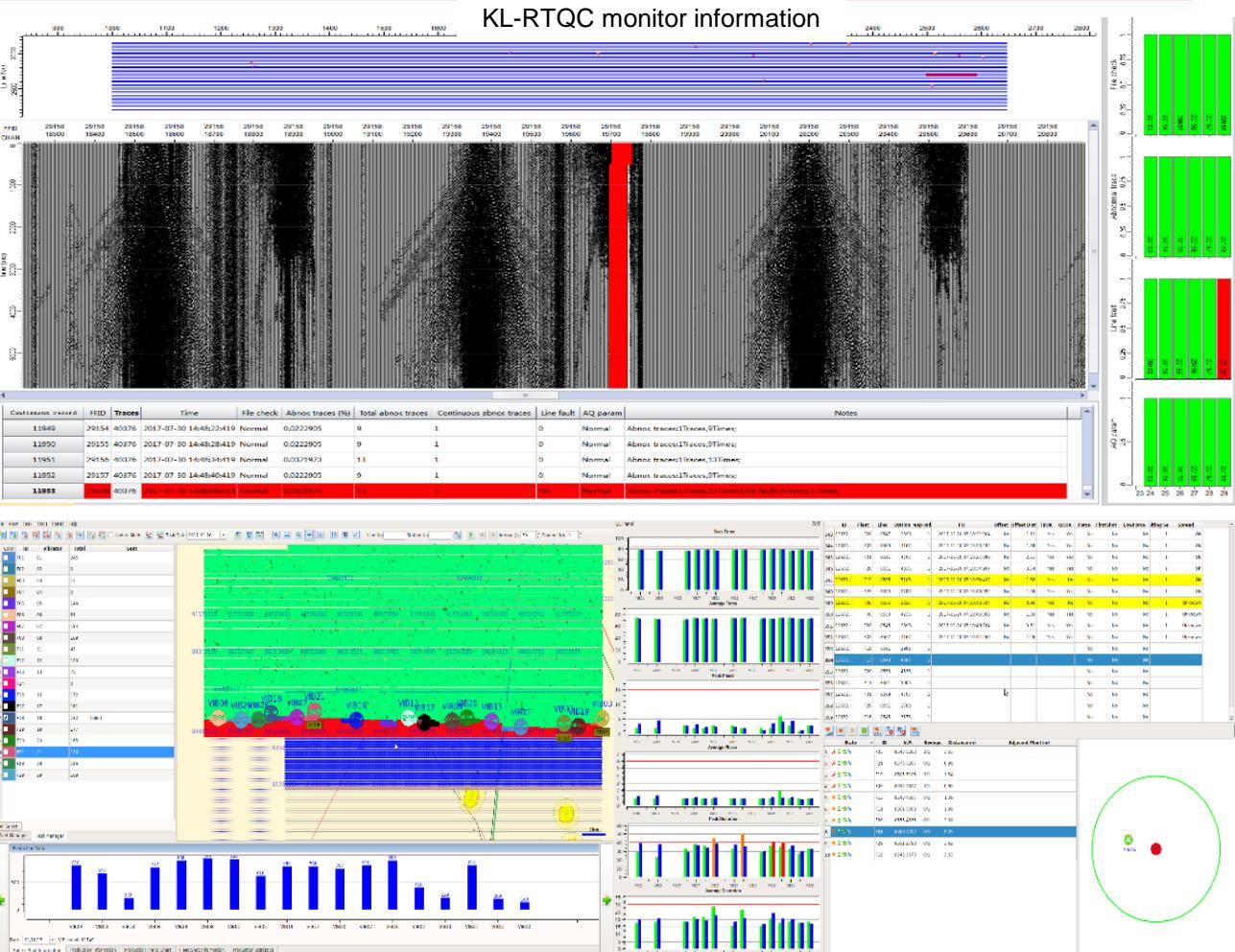
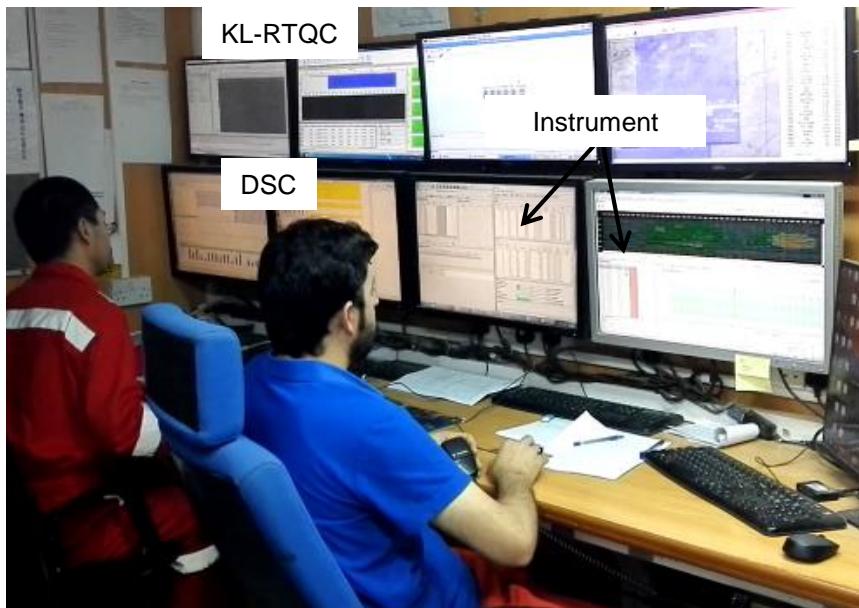


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Case 1: Ultra-high productivity in ME

- Data quality ensured

- Real QC-RTQC
- On-site QC-SeisPro





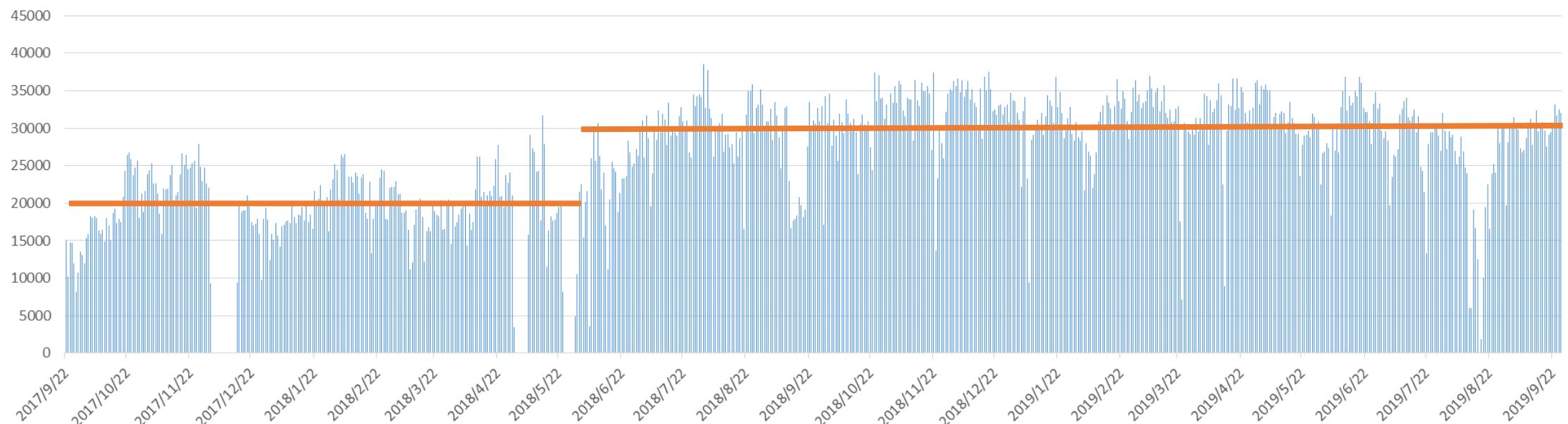
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Case 1: Ultra-high productivity in ME

- UHP production
- Safe operation

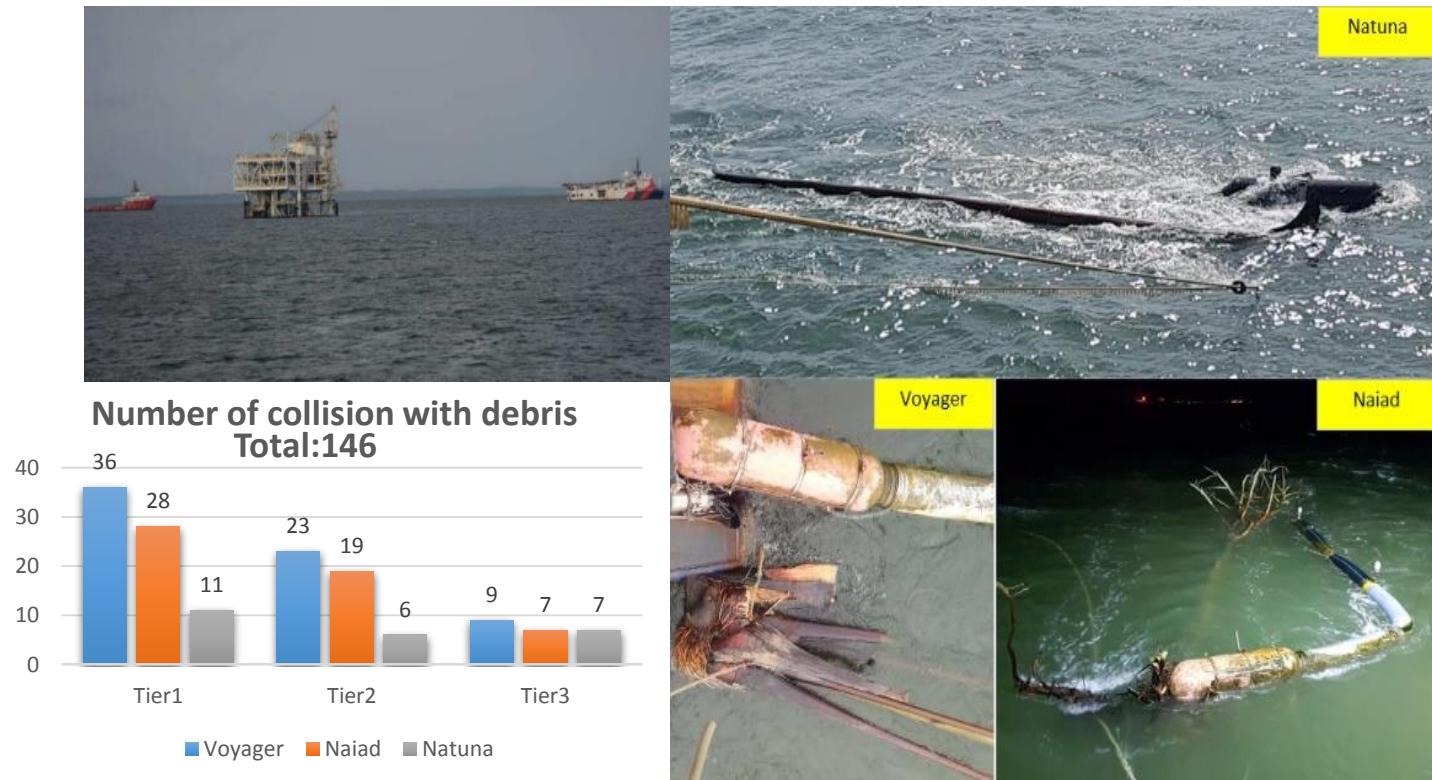


UHP Daily Production Statistics (September 2017- September 2019)



Case 2: OBN acquisition in SE Asia

- Largest OBN survey by then
- Marvelous challenges
 - Remote worksite
 - Strong current shallow water
 - Fishing debris,
 - Corrosive environment,
 - Oil&gas platforms/pipelines





Case 2: OBN acquisition in SE Asia

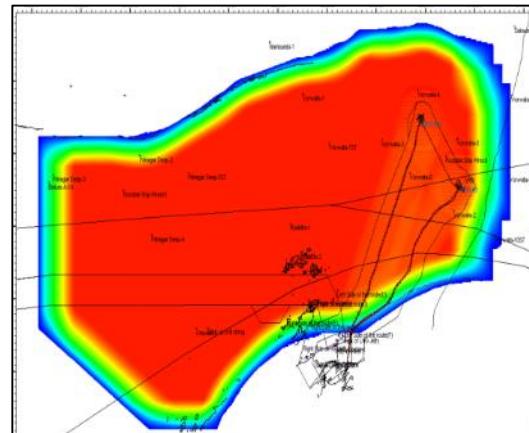
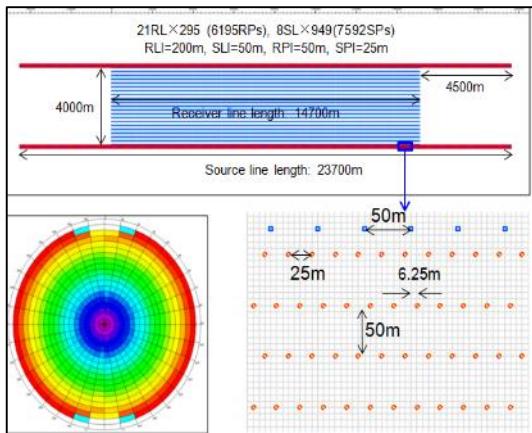
- Total operational vessels: 12
 - Source vessels: 3
 - Node handling vessels: 2
 - Ping vessels: 3
 - Chase boats: 2
 - Crew boats: 1
 - Supply Vessels: 1
- Automatic node handling system : 2 (self built)
- Onboard data processing system:
 - 400+ CPU
 - 1.5PB NAS/Node Vessel



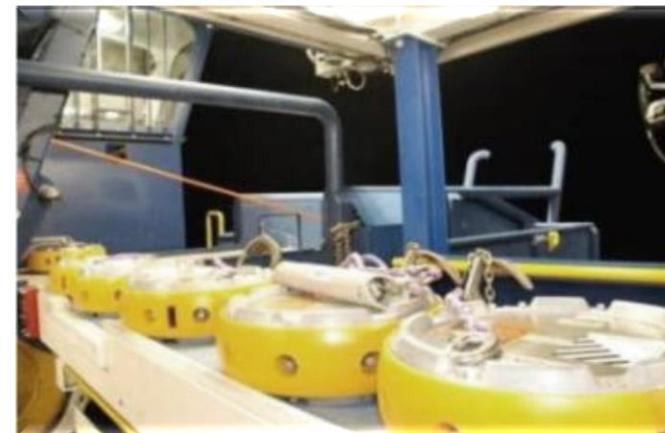
Case 2: OBN acquisition in SE Asia

- HP acquisition

- ISS(Independent Simultaneous Shooting) with 3 source vessels
 - Average daily shot >15,000
 - Highest >26,000



- Large spread: 21RLx295RP
 - High Fold: 6000+, 1695 with 4500m
 - Full azimuth.
 - High efficiency: ISS
 - Large data volume: 8TB/day
 - Numerous nodes: 8600
 - Large Fleet: 12 vessels, 500 people.



Case 2: OBN acquisition in SE Asia

Reportable HSSE Indicators

<u>A.1</u>	<u>Survey Total</u>
Seismic Vessel (s) / Crew Exposure Hours	747000
Total Sub-contractor Exposure hours	1118184
Total Hours Worked	1865184

Exposure Hours (BP) - Not included in Crew Exposure Hours

<u>Group</u>	<u>Survey Total</u>
BP Exposure Hours	81336

Exposure Hours (Third Party) - Not included in Crew Exposure Hours

<u>Group</u>	<u>Survey Total</u>
Third Party	32016

Exposure Hours (Visitors) - Not included in Crew Exposure Hours

<u>Group</u>	<u>Survey Total</u>
Visitors	4632
<u>A.2</u>	<u>Survey Total</u>
Fatality	0
Days Away from Work Case	0
Total days lost from all DAFWC this period	0
Restricted Work Case	0
Medical Treatment Case	0
Total Recordable injuries	0
First Aid Case	4
Recordable Occupational Illness Case	0
Recordable Environmental Incident	0
Recordable Financial Loss	0
Recordable Non Financial Loss	0



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Summary

- ✓ One of leading geophysical service companies
- ✓ Technology Innovation as first priority
- ✓ Full chain services of geophysical exploration
- ✓ Seismic acquisition under all surface conditions
- ✓ To be integrated geophysical solution provider



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Thank you for your attention !