



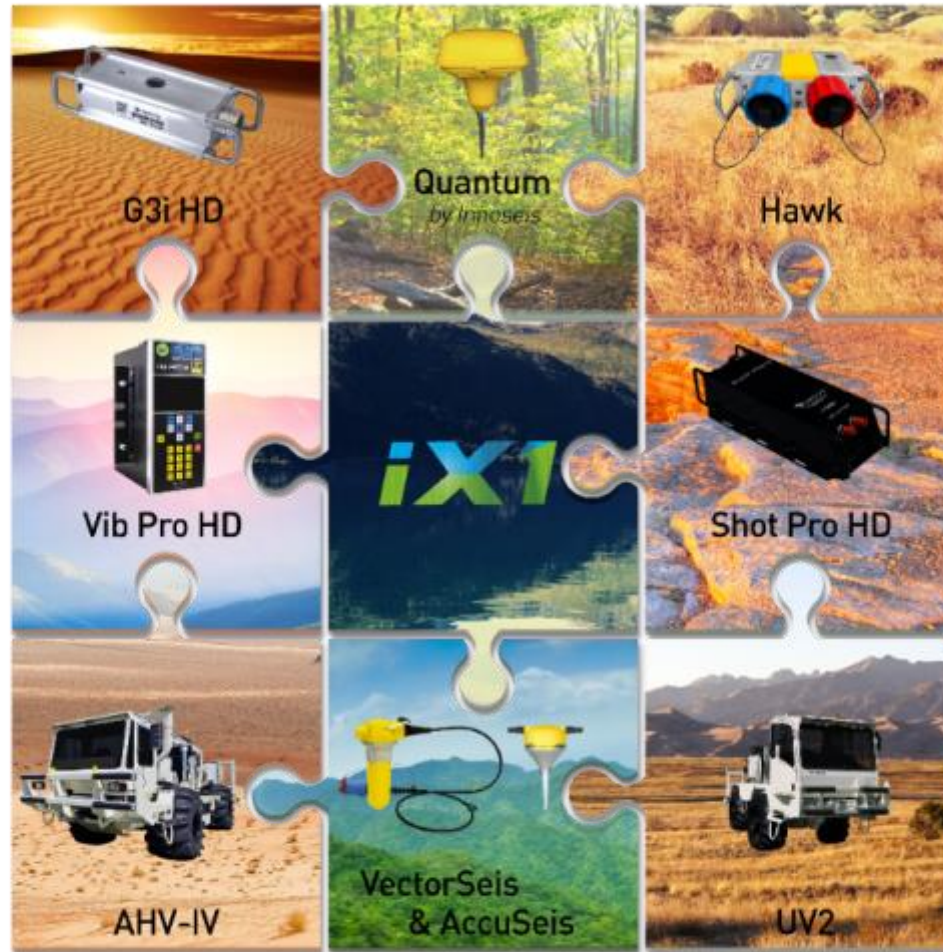
Quantum seismic nodes -
A step change in seismic data
acquisition onshore Europe.

CEEC Meeting February 2021

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Inova Geophysical is the leading international supplier of an integrated family of seismic data acquisition products



Sampling and Fold – how they effect the image of the subsurface

The drive behind increasing the number of receiver channels/sensors recorded

SPATIAL SAMPLING
(Density of receivers)

Direct impact on
reservoir *resolution*



COARSE



MEDIUM



DENSE

FOLD
(Number of times each
subsurface point sampled)

Direct impact on data
Signal-to-Noise ratio



LOW



MEDIUM

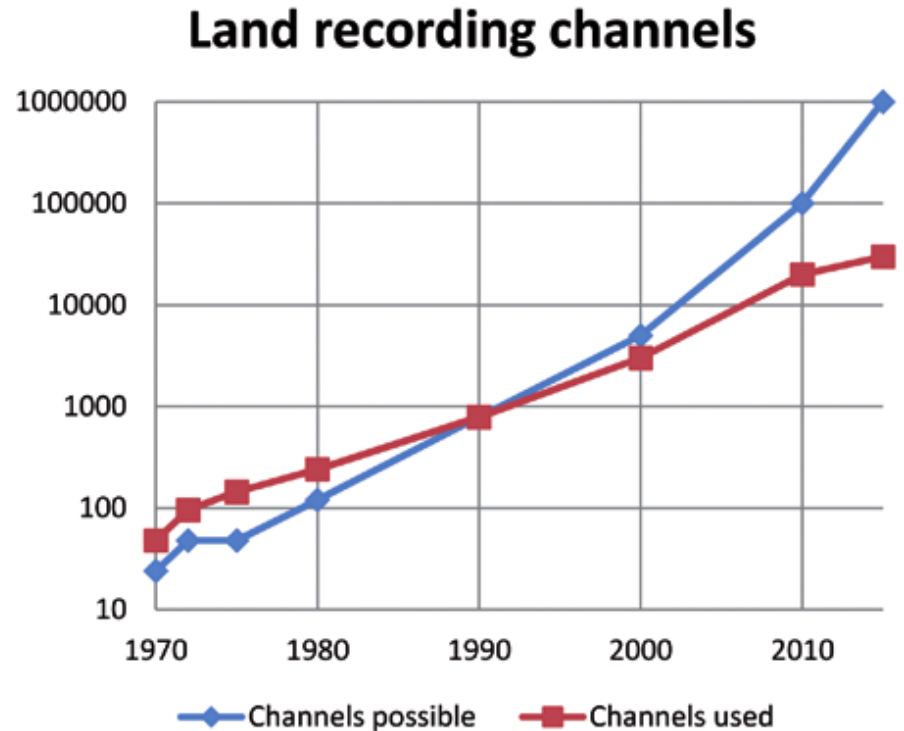


HIGH

Industry Trend

Crew channel count limited by cost and logistics problems.

- Traces per km² increases by 10x every 10 years
- “Higher trace density leads to better quality images”
- - J. Etgen, SEG 2015
 - Increase receiver effort rather than source effort
 - Shift from arrays to single point receivers
- **“Shell's vision is for seismic surveys to be run using as many as 1 million channels”**
 - Dirk Smit, VP Geoscience Shell, EP Mag



Source: M. Lansley, First Break Vol 31, 2013

The Problem

Limited scalability due to using cabled recording systems especially in Europe.



Solution – cable free recording

Evolution of technology

- **Generation #1 Cableless (1990s to 2000+)**

- Opseis Eagle, I/O RSR, Fairfield Telseis / BOX
- Limited channel count, poor runtime, heavy
- Complex VHF



- **Generation #2 Cableless (2005 to 2017+)**

- GSR / GSX, Z-Land, Hawk, Unite, RT2
- Higher channel count, better runtime, smaller, lighter
- Blind or QC or even RT data
- High system reliability (99% trace recovery typical)



The next problem

Replaced cable problems with battery problems



Seismic Acquisition Technology Step Change - Quantum

Generation #3 All-In-One Nodes (2017 and beyond)

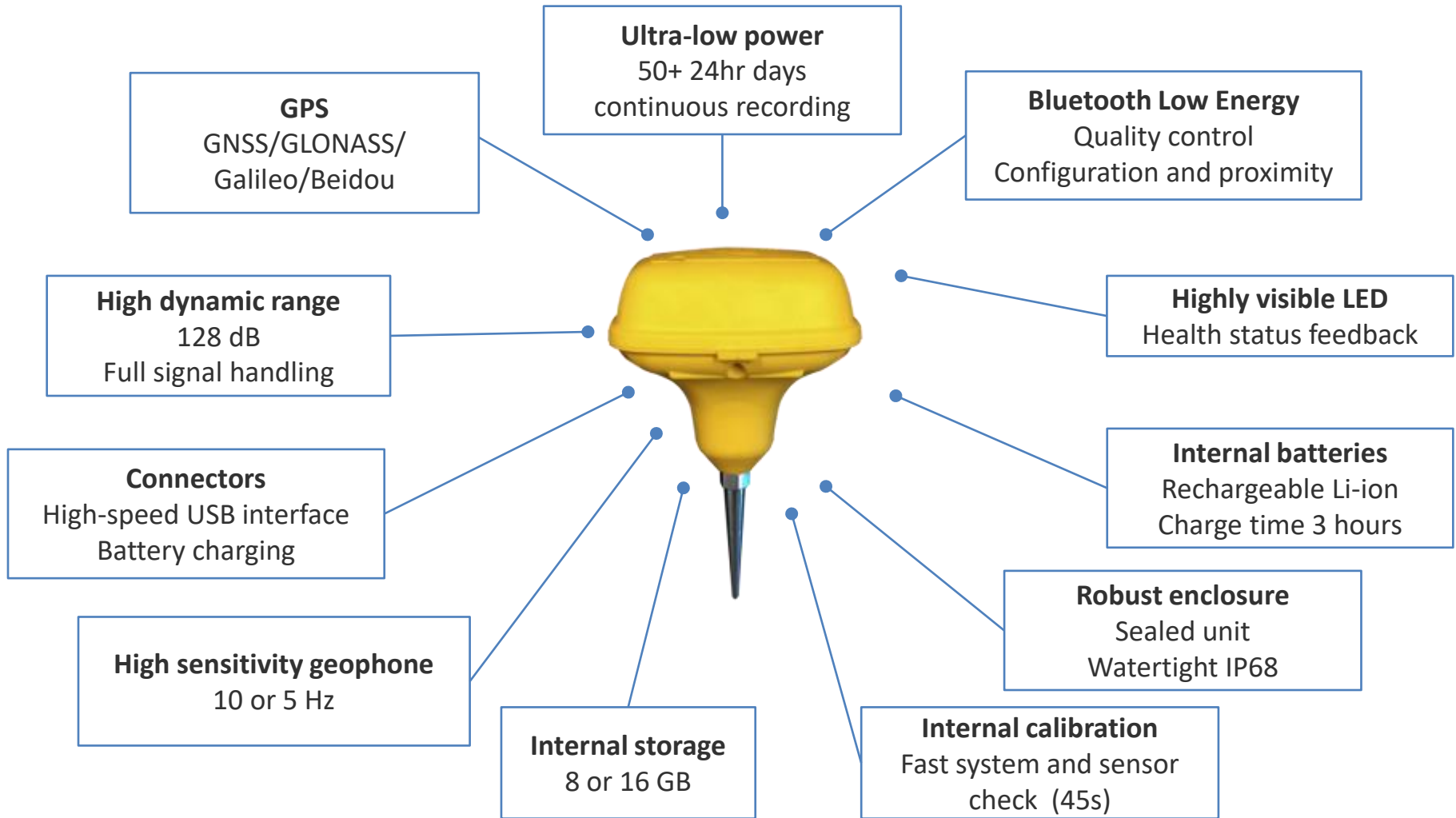
- Longer battery life – 50 days
- Reduced size and weight
- Easy deployment
- Lower cost operations (less complexity)
- Opportunities for automation



Quantum Overview

Key Features

QUANTUM

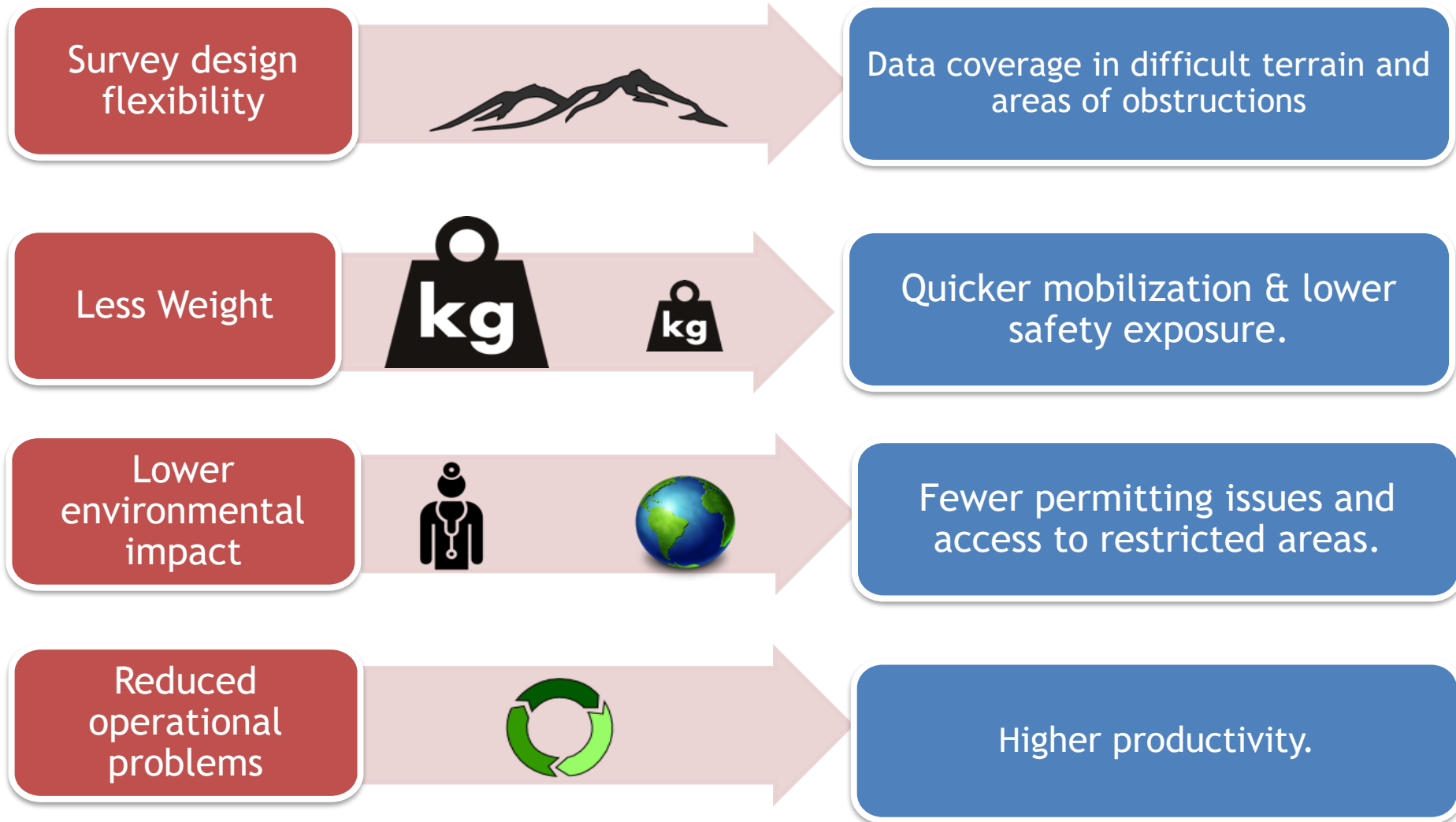


Seismic Node technology previously presented in 2018 by Brad Coram , VP Mitcham Industries, at the 50th Anniversary Scout group meeting

- Benefits compared to traditional cable systems:
 - 80% reduction in equipment weight
 - 75% reduction in vehicles required
 - 50% reduction in personnel



Quantum gives significant other operational benefits



UV2 complements Quantum

New Small Vibrator



- Upgraded mini-vibrator design (7.9m x 2.21m)
- Up to 26,000lbf theoretical peak force generation
- Improved low-frequency performance (1-4 Hz)
- Very broad frequency bandwidth (1-400 Hz)

Opportunities

Low environmental impact

- Environmental sensitive areas
 - National parks, game reserves
 - Archaeological or historical sites
 - Populated areas, towns & villages
 - Agricultural activity

- Low impact solution
 - Simple, lightweight buried nodes
 - Easy deployment (like a geophone)
 - Reduced line cutting and preparation
 - Lower “social cost” for oil companies
 - Allows oil companies access to new targets



Successful 2D and 3D operations in environmentally sensitive areas

Operations in Sicily using a combination of Quantum and UV2 vibrators.



Multiple Quantum surveys conducted across Europe in last 2 years



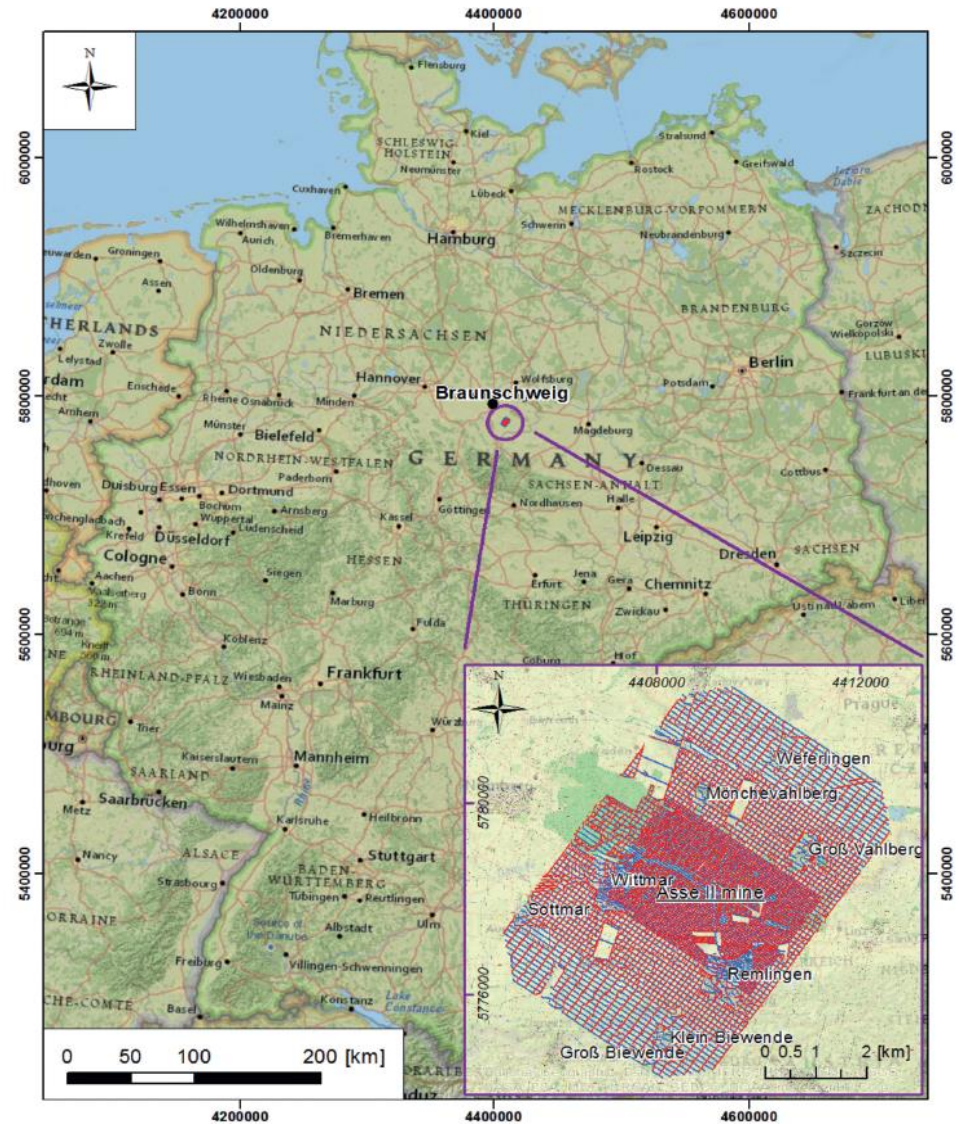
Highest live channel data acquisition survey in Europe to date.

- Asse 3D survey – Germany
 - Complex geology
 - Environmentally sensitive area
 - Short operational window
 - 40,000 active channels

For more details:

Published January 2021 EAGE First Break

“Quantum nodal system – 3D Asse survey success story” Jerzy Trela et al.



Courtesy of Geofizyka Torun S.A & Bundes- 16
Gesellschaft für Endlagerung mbH

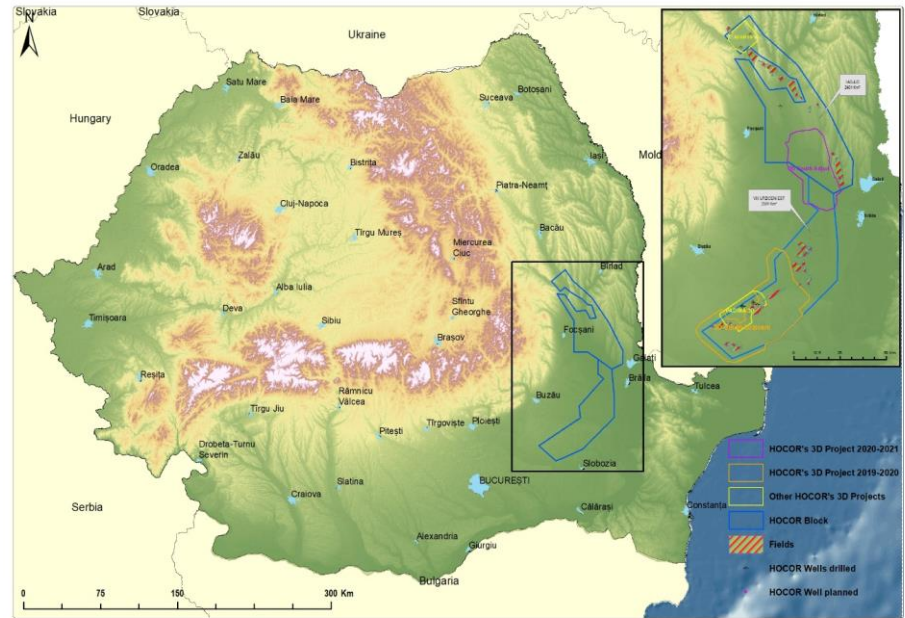
Largest single season seismic data acquisition project completed in Europe to date.

- **Urziceni 3D Romania**

- Heavily cultivated area
- 43 communities and 126,000 landowners
- Natura 2000 restrictions
- Winter season operations
- 1,600 sq. kms. In 5 months.

More details:

- Published January 2021 EAGE First Break ““Optimization of 3D seismic data acquisition operations – South Urziceni, Romania” A.Clark et al.



The result:

Substantial improvements in subsurface image quality

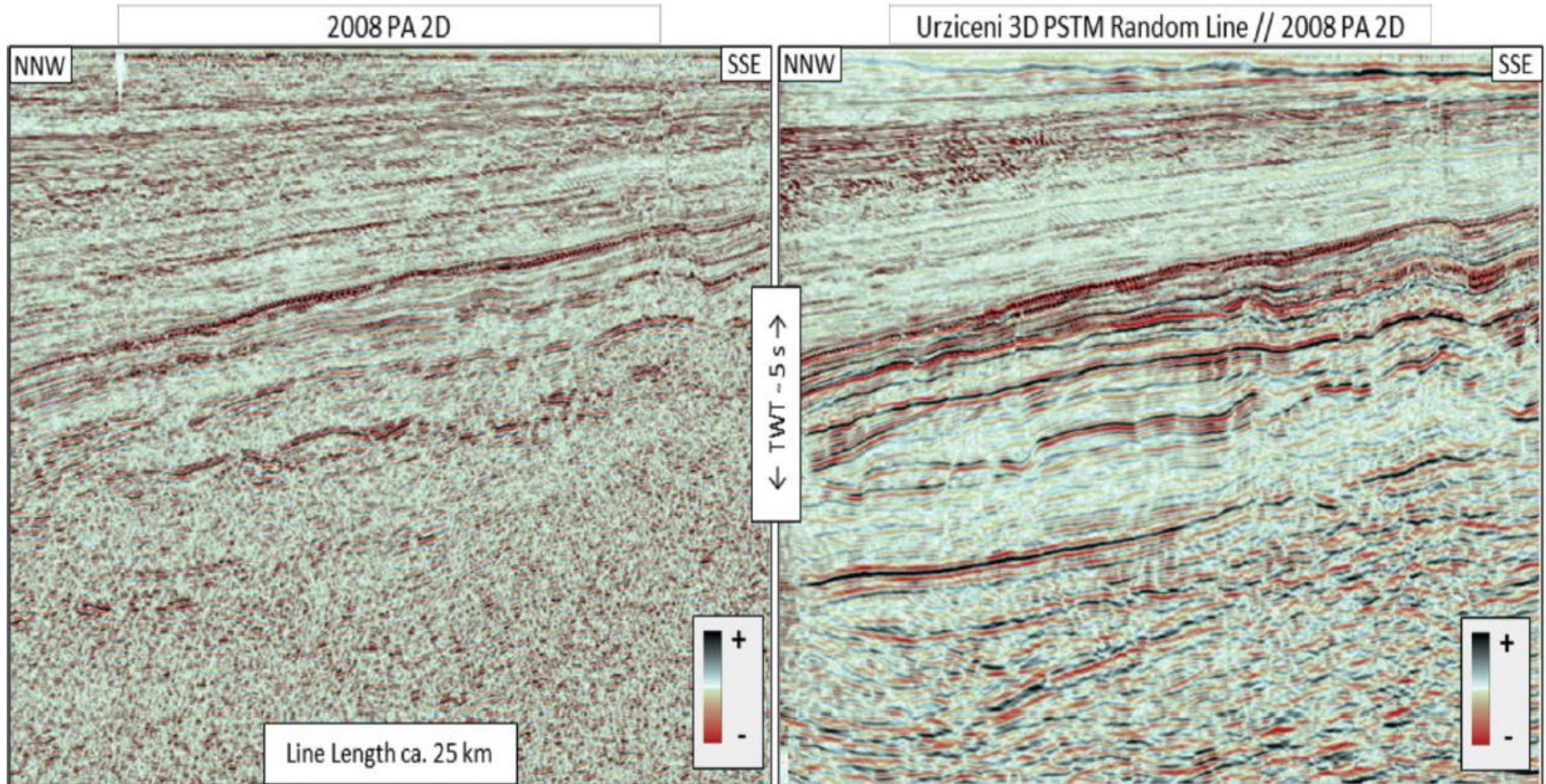


Figure 6 Data comparison of late 2008 vintage 2D and S. Urziceni 3D 2020 Final Pre-Stack Time Migration.

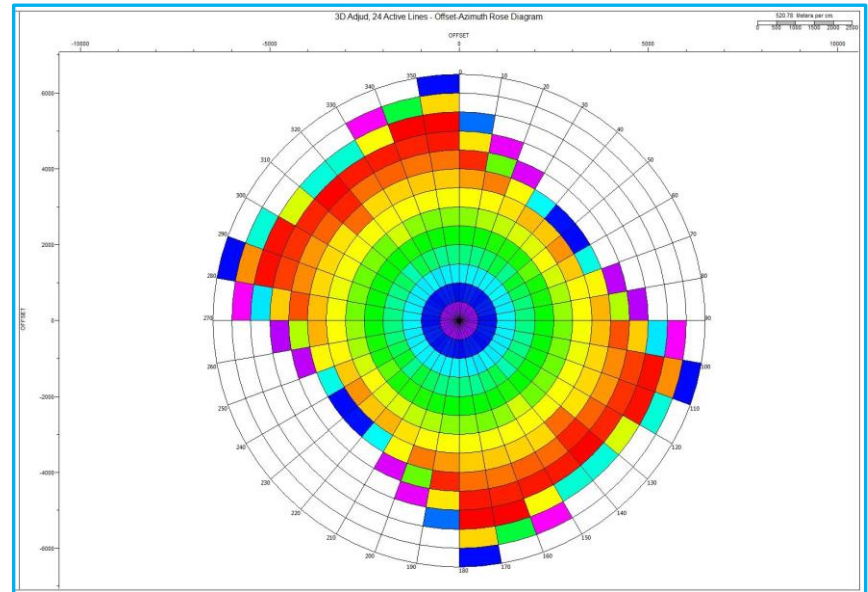
Other benefits

Improved offset and azimuth distribution

Improved data sets for

- attribute analysis
- anisotropy studies for fracture detection,
- and AVO analysis.

Improved offset and azimuth distribution



Summary

- Quantum seismic nodes are a proven technology
- More efficient operations are delivering
 - Quicker surveys
 - Lower costs per unit of data
 - Improved subsurface imagery
- Improved access to environmentally sensitive areas
- More than 70,000 channels available with contractors in Europe
- Plus 25,000 available for rental from Mitcham Industries
- For more information please see the Inova website (www.InovaGeo.com) or contact Andrew Clark (Andrew.Clark@InovaGeo.com)



Thanks for use of images to:
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