SEG | WORKSHOP
Next Generation Geophysical Land & Shallow Water Acquisition Technologies
28 - 30 September 2026 | Abu Dhabi, UAE



# HSE Risk Reduction in Land Seismic Acquisition Using Autonomous Nodal Systems

## Evidence from a Large-Scale Campaign in the Middle East



**Keith Hutcheson**
**Operations & HSSEQ Manager, STRYDE**

# Outline

01
## Operating context
Hazards of desert acquisition

02
## Study approach
Task-based hazard modelling

03
## System comparison
Cabled vs nodal risk mechanisms

04
## Results
Relative HSE exposure by hazard

05
## Discussion
Residual risks and integration

06
## Conclusions
The HSE case for nodal adoption

# Desert seismic: a demanding HSE setting

### Large spreads

Wide spatial spreads across open desert terrain

### High mobility

Constant crew and vehicle movement along the spread

### Remote logistics

Long supply lines and extended medical response times

### Extreme heat

Heat stress and fatigue constrain safe working windows

**Cabled acquisition adds hazards:** cable handling, electrical distribution, line clearance and vehicle movements for spread troubleshooting.

**Autonomous nodes remove** surface cables and electrical infrastructure — fundamentally altering risk exposure.

# Approach: task-based hazard modelling

## 1 Model the field tasks

Realistic task-based hazard models for cabled and nodal operations in the same desert environment

## 2 Score hazard precursors

Precursor-based exposure scoring for each hazard category

## 3 Normalise and compare

Relative exposure indices, compared side by side for the two systems

### Six hazard categories

- Manual handling
- Slips, trips and falls (STF)
- Vehicle exposure
- Electrical
- Fatigue
- Environmental disturbance

# Two recording systems compared

### TRADITIONAL CABLED

## ≈40,000

channels, typically 9-12 geophones per channel

- Multi-kilometre cable corridors
- Connectors and electrical components
- Repetitive troubleshooting and heavy vehicle support



**4×**

receiver density

### AUTONOMOUS NODAL

## ≈160,000

nodes, hand-placed without cables

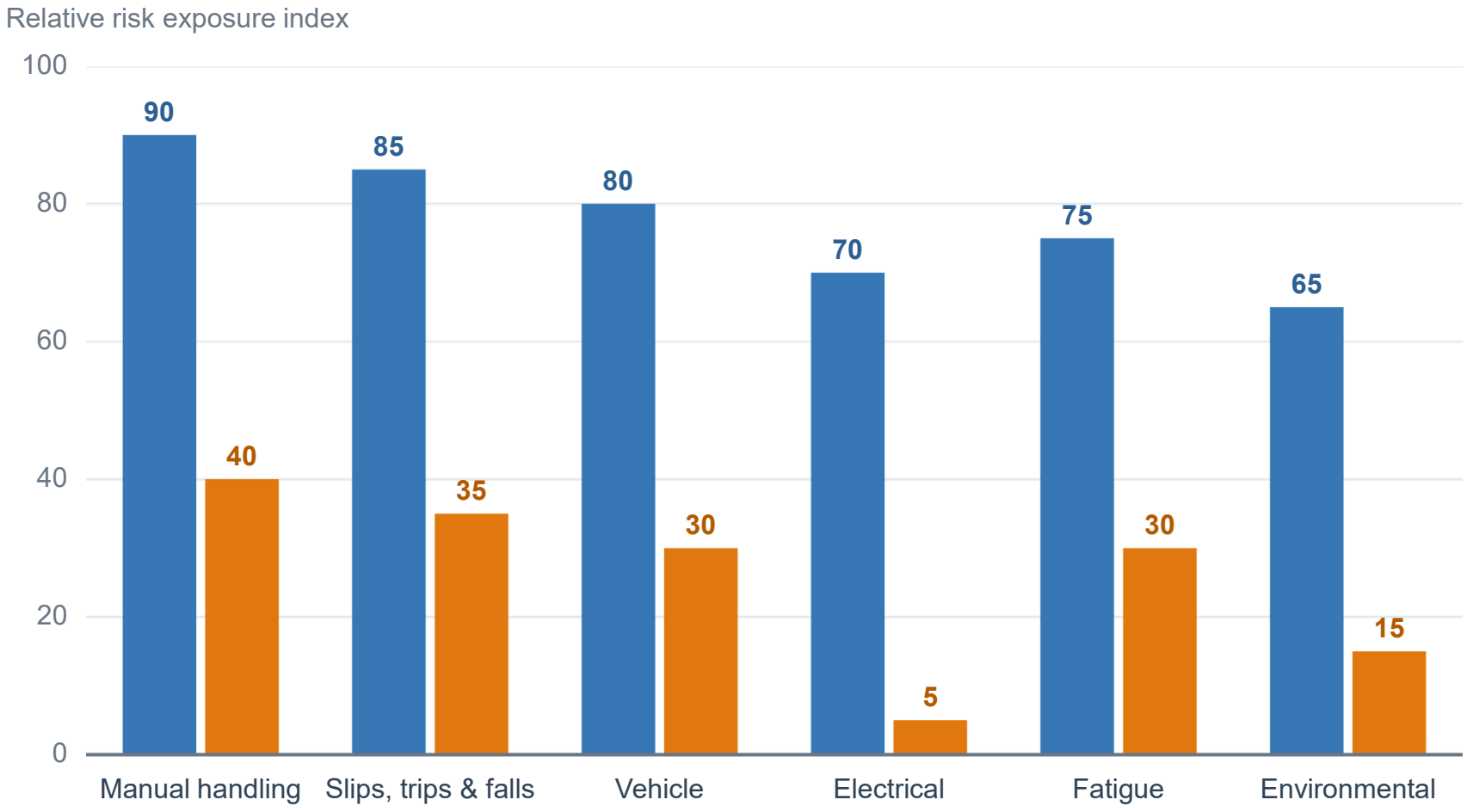
- No surface cables or electrical distribution
- Troubleshooting demand substantially reduced
- Minimal corridor clearance; fewer vehicle movements



# How each system drives HSE exposure

| Hazard driver | Cabled | Nodal |
|---|---|---|
| Manual handling | Cable lay-out, pick-up and repetitive troubleshooting | Hand-placed nodes; far less troubleshooting |
| Slips, trips & falls | Multi-km cable corridors and connectors | No surface cables across the spread |
| Vehicles | Heavy vehicle support for line operations | Fewer vehicle movements during production |
| Electrical | Power distribution, connectors, components | Largely eliminated; residual risk from damaged nodes & devices |
| Fatigue | Repetitive cable handling and troubleshooting in extreme heat | Less repetitive work; shorter campaign fits heat-exposure windows |
| Environment | Corridor clearance and heavy line traffic | Minimal clearance, less ground disturbance |

# Relative HSE exposure by hazard category




Cabled

Nodal

*Illustrative indices, normalised using precursor-based exposure scoring. Lower is better.*

# Where exposure fell most

## 40–70%

### Manual handling

Hand-placed nodes replace heavy cable handling

## 50–80%

### Slips, trips & falls

No cable corridors or connectors underfoot

## 50–70%

### Vehicle exposure

Fewer movements for line support and troubleshooting

## >90%

### Electrical hazards

No distribution; residual risk from damaged nodes and portable devices

Approximate reduction in modelled exposure, nodal relative to cabled. Fatigue and environmental disturbance were also reduced.

DENSITY WITHOUT ADDED RISK

# 4× the receivers.
# Less exposure.

Fatigue — closely tied to repetitive cable handling and troubleshooting — fell despite a four-fold increase in channels. Environmental disturbance fell as heavy vehicle line support was removed.

# Discussion: gains and residual risks

GAINS

## What nodal changes

- Productivity decoupled from cable-driven risk
- Less time-at-risk during retrieval
- Shorter campaigns that fit heat-exposure management windows

RESIDUAL RISKS

## What remains

- Vehicle mobility across the desert
- Heat stress
- Long medical response times in remote areas
- Low residual electrical risk from damaged nodes and portable devices

STILL ESSENTIAL

## What to integrate

- Desert logistics planning
- Vehicle monitoring systems
- Heat-stress programmes
- Damaged-node and battery handling procedures

# Conclusions

- Lower manual handling
- Reduced slips, trips and falls exposure
- Reduced heavy vehicle support
- Electrical distribution eliminated
- Lower environmental footprint

*…while supporting higher channel density and improved acquisition efficiency.*

**HSE risk reduction is a case for nodal adoption in its own right**

— alongside the imaging, cost and logistics benefits.



# Thank you

keith.hutcheson@stryde.io