

TECHNICAL REPORT: NEW LOW-IMPACT GEOPHYSICAL EXPLORATION STRATEGIES

1. Introduction and State of the Art of Terrestrial Seismic Acquisition

Several companies now specialize in low-environmental-impact ground seismic acquisition, using miniaturized, cable-free technologies (autonomous nodes) or passive measurement methods. These innovations significantly reduce deforestation, heavy vehicle traffic, and carbon emissions in the field.

Key Players and Technologies in the Sector

Manufacturers and suppliers of nodal technologies

- **STRYDE:** Market leader in small terrestrial seismic receivers. Its sensors ("nodes") weigh only 150 grams. They allow for deployment entirely on foot, eliminating the need for clearing land.
- **Sercel (with LISS):** Sercel has acquired the start-up Low Impact Seismic Sources (LISS). It markets the Tuned Pulse Source (TPS™) technology, a low-frequency pneumatic source that reduces acoustic and environmental impact compared to traditional impact methods.

Service and Acquisition Companies

- **Explor:** A seismic acquisition company that uses technologies with a near-zero environmental footprint. It favors hand-carried nodes and suitable energy sources to eliminate the need for bulldozers.
- **TenzorGEO:** Specialist in passive low-frequency seismic (LFS). Its method uses no active energy sources (no dynamite, no vibratory trucks). It simply listens to the Earth's natural vibrations, making the environmental impact completely neutral.
- **Oceania Geo:** A geophysical services company offering low-impact, customized surveys. It combines high-mobility, lightweight energy sources with wireless receivers to protect ecosystems.

2. Comparative Analysis: Passive Seismic vs. Lightweight Active Nodes

The choice between passive seismic and lightweight active nodes depends primarily on your imaging objectives, budget, and terrain constraints.

Summary of Guidelines

- Passive seismic imaging excels for continuous environmental monitoring and deep imaging at a low operational cost, without requiring an artificial source.
- Lightweight active nodes offer significantly higher imaging resolution, targeted imaging, and high field productivity due to rapid deployment coupled with a vibratory or explosive source.

Synoptic Comparative Table

Criterion	Passive Seismic	Lightweight Active Nodes
Source	Natural / Ambient	Artificial (Vibrator/Dynamite)
Resolution	Low to Medium	Very High
Field Logistics	Lightweight (Single entry)	Moderate (Light nodes + Source crew)
Regulatory Constraint	Very Low	High (Shot/vibration permits)
Acquisition Duration	Long (Days to Months)	Short (Hours to Days)

3. Technological Breakthrough: Coupling Seismic Nodes and RSS-NMR

The combination of nodal seismic acquisition (active and passive) and **RSS-NMR** (Remote Sensing Survey - Nuclear Magnetic Resonance) technology represents a major breakthrough in reducing the costs of mineral, oil, or hydrogeological exploration.

The Geo-scientific Synergy

- **[RSS-NMR]** —> Direct identification of fluid nature (Water/Oil) = maximum reduction of dry hole risk.
- **[Nodal Seismic]** —> 3D mapping of geological structures and traps, the "sweet spots".

Avoiding a single unnecessary drill hole saves millions of euros. *Note: Additional operational advantage of being able to conduct this initial phase in discrete ("Spy") mode, without immediate need for a heavy exploration permit.*

4. Exploration Strategies and Decision Making

- **Option A (Traditional Sequential Approach):** Phase 1: Large-scale deployment of passive nodes (12 to 24 months with permits). Phase 2: Application of RSS-NMR only on anomalies. Phase 3: Active nodes on the final zone.
- **Option B (Optimized 'Sweet Spots' Approach - Recommended):** Phase 1: RSS-NMR deployment over 100% of the block without initial need for heavy permits to locate areas of interest. Phase 2: Use of active nodes restricted exclusively to sweet spots to guide precise drilling. Saves 12 to 18 months on the global schedule.

5. Comparative Campaign Schedule

Synergy: RSS-NMR + Active Nodes

Operations	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1. Permits & EIA	X	X	X	X	X	X						
2. RSS-NMR Acquisition				X	X	X						
3. Analysis & NMR Targets					X	X						
4. Node Deployment							X	X	X	X		
5. Seismic Acquisition								X	X	X		
6. Retrieval & QA/QC									X	X		
7. Processing & Inversion										X	X	X

6. Light Seismic Source Technology Catalog

- **Track-Mounted Mini-Vibrators (e.g., EnviroVibe):** Weight 1.5 to 5 tons. Low ground impact, ideal up to 1500-2000 meters.
- **Portable Electromagnetic Vibrators:** Less than 100 kg. Man-portable, ideal for ultra-sensitive areas.
- **Accelerated Falling Weight (AWT):** 200 to 500 kg coupled on quad. Investigation up to 1000 meters.
- **Ambient Noise Interferometry (ANT):** Exclusive use of Earth's natural noise. Absolutely zero source impact and cost.

7. Eco-Responsible Commitment and Regulatory Impact

Technique / Source	Carbon Footprint	Plant Destruction	Eco-Score
Passive Seismic (ANT)	Ultra-Low	None	10/10
Electromagnetic Vibrator	Very Low	None	9/10
Drop Weight (Quad)	Weak	None	8/10
Traditional Seismic Explosives	Very Strong	Massive	1/10

RSS NMR — THE SIMPLE WAY OF EXPLORATION

GEO-NMR.NET | Exploration by satellite

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