Magnetic Resonance (MR) detection of explosives

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MRead
ACCURATE DETECTION

MagnaTerra

The world needs new detection technology to accelerate clearance

The requirement to be able to accurately identify explosives from clutter in humanitarian demining operations is a priority.

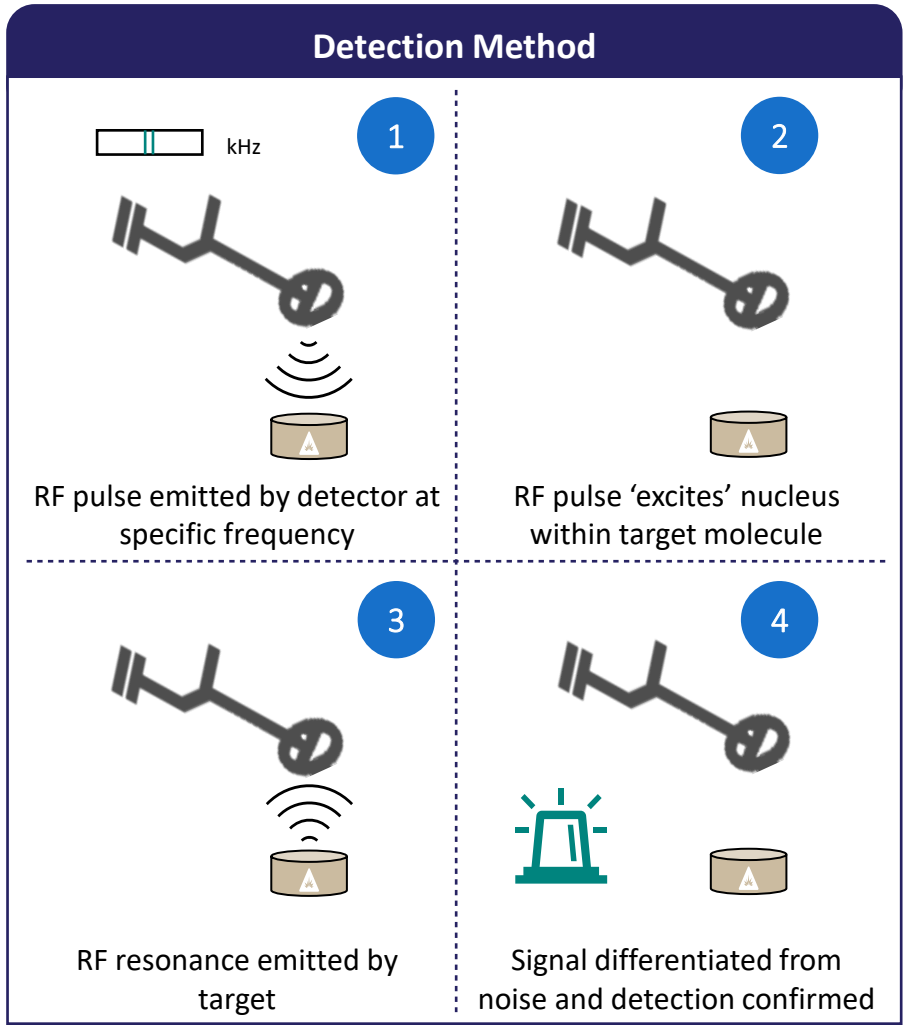
Humanitarian demining operations are currently hazardous and slow, in part due to excessive false positives from incumbent detection methods.

Direct detection of explosives is a game-changing technological advance

Working directly with NGOs is critical to understanding the obstacles in the use of current and new technologies [HALO, NPA]

Handheld explosives detection

- Magnetic Resonance (MR) is a highly discriminating method for explosives detection but difficult to implement:
  - Very low SNR
  - MHz band interference widespread
  - Temperature dependency can mask detection
- Two decades of research by the CSIRO (Australia) has addressed the major obstacles to effective detection
- The CSIRO technology was first proven in the minerals industry and then adapted for explosives/drugs detection
- MRead, with CSIRO, commenced development of a handheld system for humanitarian demining in 2023



Direct explosives detection

	MR	Trace
Measurement principle	Radio wave induced nuclear resonance in solid materials	IMS - Chemical separation based on ion mobility. *Complex mixtures can create false negatives/positives that require gas chromatography or mass spectroscopy to resolve.*
Sample presentation	Standoff – penetrating, in ground, non-metal encasement	Standoff - vapour collection into system
Sensitivity	Time and distance dependent – 50g at 13cm typical in <60s (IMAS)	Vapour concentration dependent – requires constant leakage at ppm/ppb levels into the atmosphere
Accuracy	Detection unique to molecule present – “fingerprint” for each explosive type	Subject to environmental influence.
Target limitations	Solid, crystalline materials – RDX, TNT, tetryl, ammonium nitrate	Wide range of explosives but subject to interference.

Handheld Prototype

- Mar. 2023- July 24: Developed a handheld prototype that resembles a metal detector
- Existing electronic systems were adapted to create a field portable detector
- Our first use-case is as a confirmation sensor, following metal detection and ground penetrating radar analysis
- The user interface and operating method allow use with minimal training of deminers
- Aug. 2024: Tested the MVP in Australia with RDX samples mimicking AP mines that were buried in test lanes with different soil types
- Nov. 2024: Trial with HALO in Cuito Cuanavale, Angola. Detection of AP and AT mines in test ground and Minefield 29.

Gen2 RDX Handheld

- **Compact electronics platform and new sensor**
  - Depth performance enhanced through new noise suppression hardware
  - Detection enhanced through new signal processing algorithms
  - Automated compensation for target temperature
  - Simple intuitive user interface
- Trials with The HALO Trust in southern Angola in Sep-Dec 2026
- Trials with NPA in Ukraine in Oct-Nov 2026
- TNT sensor trials in Q1 2027

Building new detection capabilities for humanitarian demining

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