Crawler Robots Meet NDT on Industrial Chimneys: GRP, Concrete, Stainless Steel and more

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Agenda

1. Introduction to Authors
2. The Background
3. Solutions Assessed
4. Methodology
5. Key Outcomes & Learnings

Introduction to Authors

Oliver Stewart

Business Development, HausBots LTD. Founded in 2019, and now supplying more than 40 customers in 20 countries, HausBots design and manufacture complex robotic solutions for inspection and maintenance of infrastructure.

Jean Marie Henault, PhD

R&D at EDF (Electricite de France). For more than 20 years Jean-Marie has spearheaded EDFs research into concrete inspection particularly focussed on ultrasonic techniques.

Steve Treguier

Deconstruction Business Manager. Steve began his career as a maintenance technician in 2009 with EDF, further specialising within decommissioning, working on a number of EDF projects and now is the co-site lead for the decommissioning this paper refers to.

Alexandre Druet

Deconstruction Officer at EDF With an EDF career spanning 18 years, Alexandre has also worked on a number of decommissioning projects, specialising in coal-fired plants. Alongside Steve, Alexandre is co-site lead.

Andrey Bulavinov

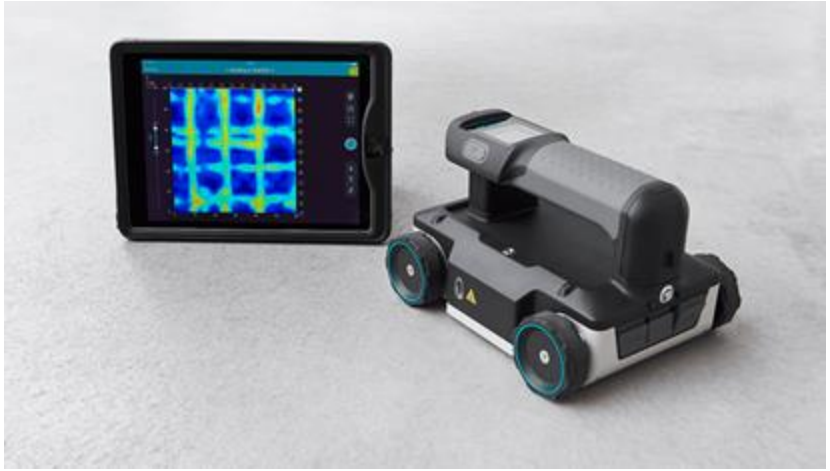
CEO at ACS-Solutions GmbH, an international provider of state-of-the-art ultrasonic testing instruments. Andrey is a Doctor of Engineering and deeply involved in research and commercialisation of ultrasonics for concrete

The Problem / Background

This project was a PoC integrating new NDT sensors to a crawler robot, collecting data for 3 days and the corresponding report

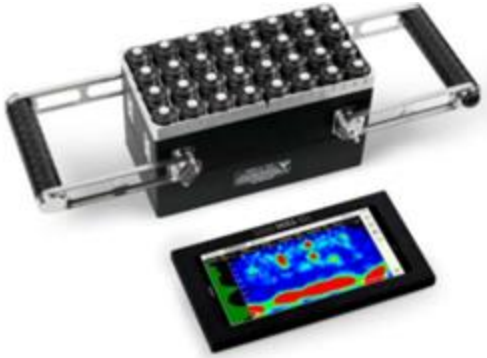
Solutions Assessed - NDT

1. NDT side
    a. MIRA - Ultrasonic Tomography
    b. GPR



Solutions Assessed - NDT

1. NDT side
    a. MIRA - Ultrasonic Tomography
    b. GPR



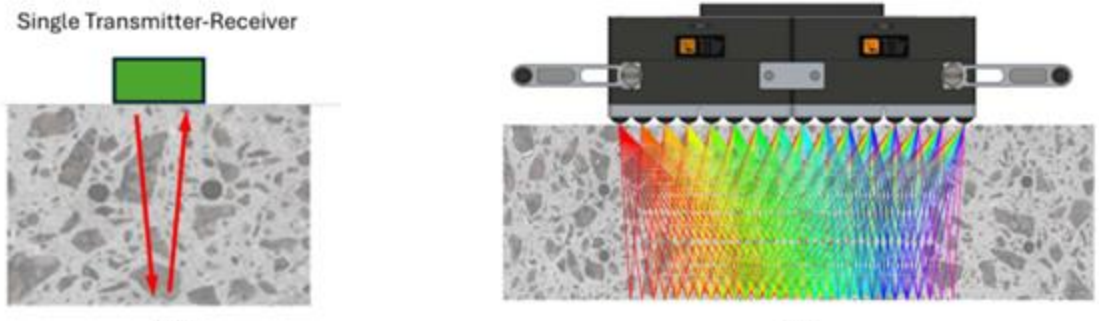


Figure 6. (a) Single pulse-echo signal sequence and (b) profile diagram of MIRA instrument and signal sequence from dry-point contact (DPC) transducers.

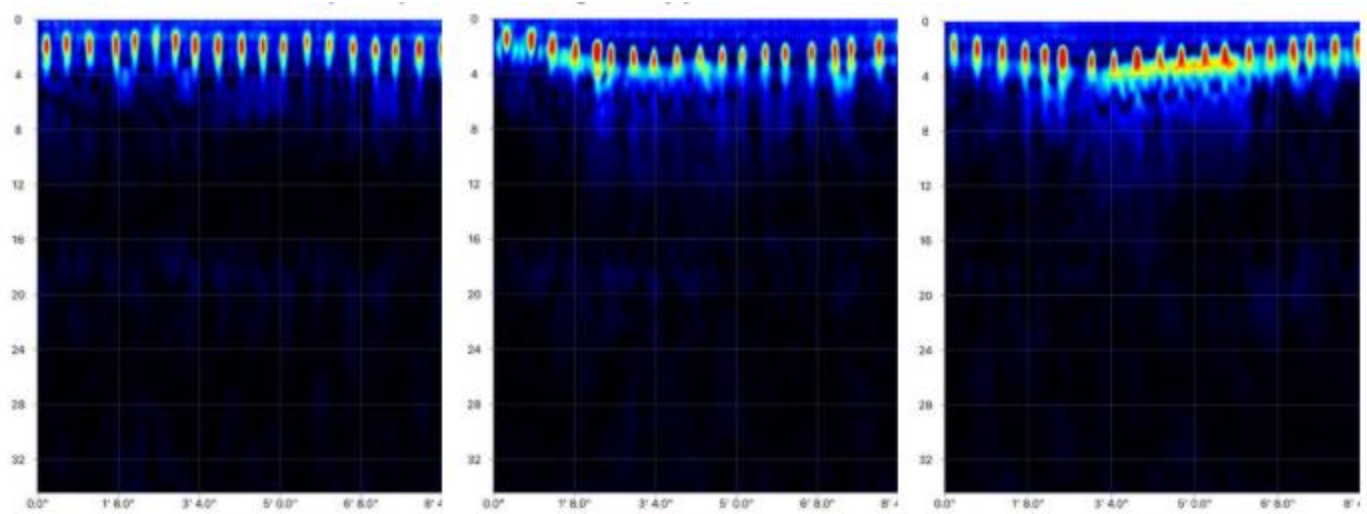
Solutions Assessed - Access

1. Access side
    a. Rope access
    b. Scaffolding
    c. Drone
    d. Magnetic crawler
    e. Suction crawler
    f. HB2 & HB3

HB2 & HB3 - Integrations

Methodology

Methodology



(a) (b) (c)

Figure 8. GPR scans for (a) Panel 3, (b) Panel 4, and (c) Panel 5. All measurements on the vertical axes are in inches. The red dots correspond to the reflections from steel bars. Note the changing depth of bars in (b) and (c), and the large reflection below the bars in (c).

Methodology

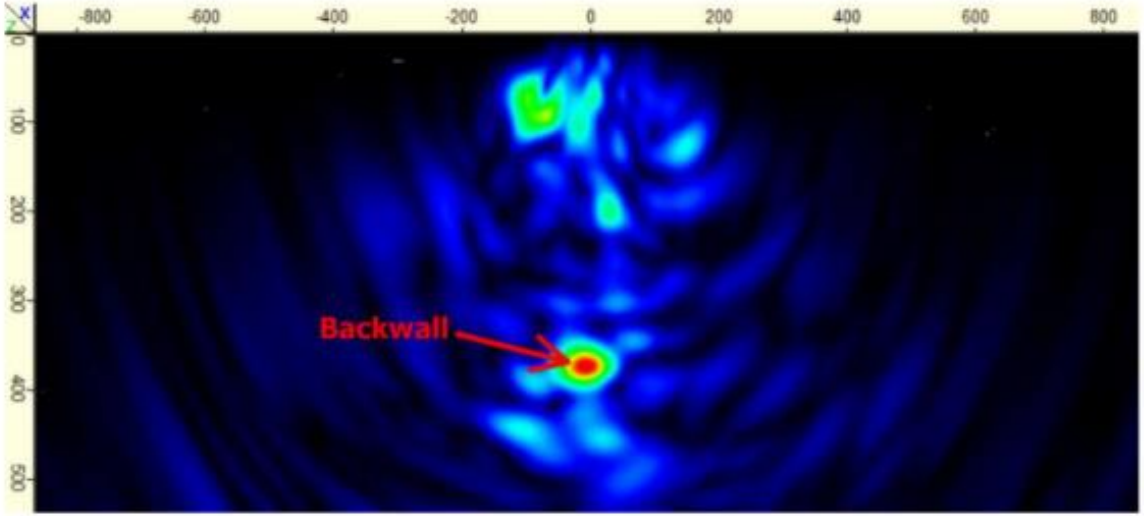
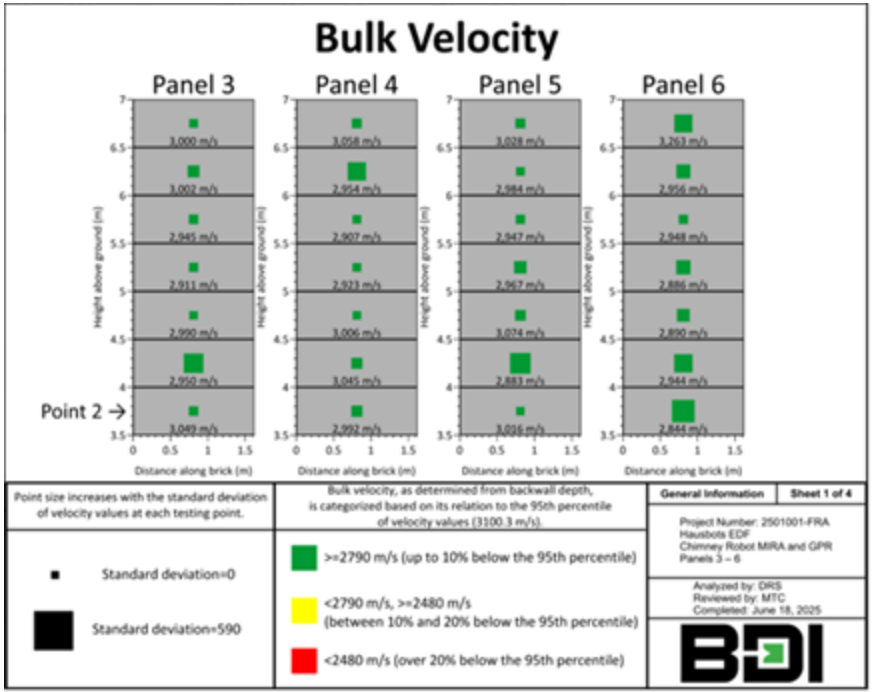
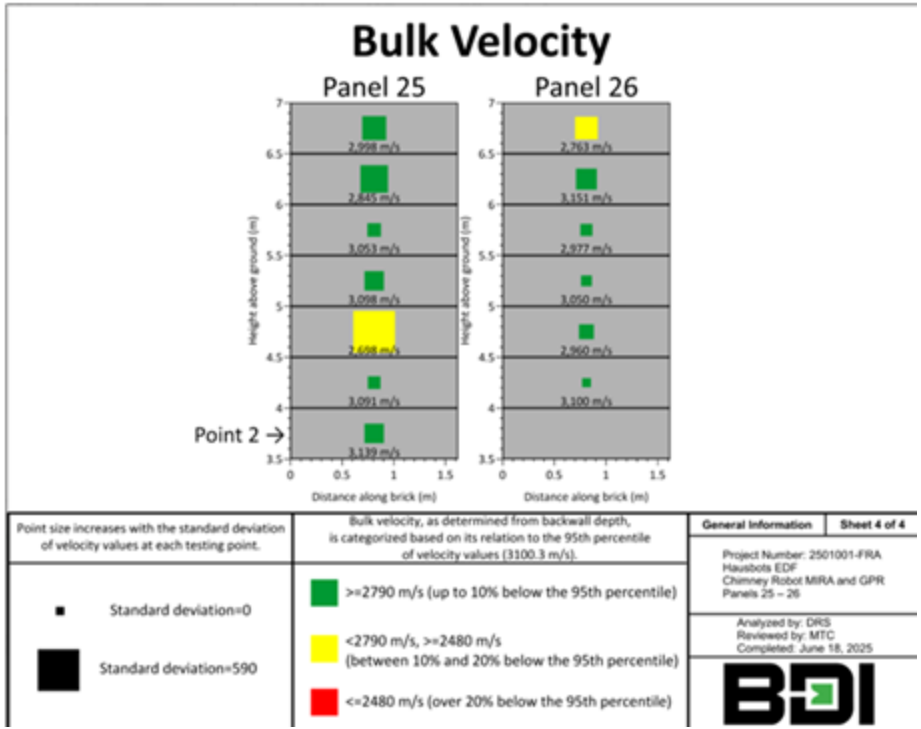


Figure 7. A sample backwall reflection from Panel 16, Point 2. Units on both axes are millimeters (mm).


Bulk Velocity
Panel 3
Panel 4
Panel 5
Panel 6
3.000 m/s
3.002 m/s
2.945 m/s
2.911 m/s
2.990 m/s
2.950 m/s
3.049 m/s
3.058 m/s
2.954 m/s
2.907 m/s
2.923 m/s
3.006 m/s
3.045 m/s
2.992 m/s
3.028 m/s
2.984 m/s
2.947 m/s
2.967 m/s
3.074 m/s
2.883 m/s
3.016 m/s
3.263 m/s
2.956 m/s
2.948 m/s
2.886 m/s
2.890 m/s
2.944 m/s
2.844 m/s
Point 2 →
Height above ground (m)
Distance along brick (m)
Point size increases with the standard deviation of velocity values at each testing point.
Standard deviation=0
Standard deviation=590
Bulk velocity, as determined from backwall depth, is categorized based on its relation to the 95th percentile of velocity values (3100.3 m/s).
>=2790 m/s (up to 10% below the 95th percentile)
<2790 m/s, >=2480 m/s (between 10% and 20% below the 95th percentile)
<2480 m/s (over 20% below the 95th percentile)
General Information
Sheet 1 of 4
Project Number: 2501001-FRA
Hausbots EDF
Chimney Robot MIRA and GPR
Panels 3 – 6
Analyzed by: DRS
Reviewed by: MTC
Completed: June 18, 2025
BDI


Bulk Velocity
Panel 25
Panel 26
2.998 m/s
2.845 m/s
3.053 m/s
3.098 m/s
2.698 m/s
3.091 m/s
3.139 m/s
2.763 m/s
3.151 m/s
2.977 m/s
3.050 m/s
2.960 m/s
3.100 m/s
Point 2 →
Height above ground (m)
Distance along brick (m)
Point size increases with the standard deviation of velocity values at each testing point.
Standard deviation=0
Standard deviation=590
Bulk velocity, as determined from backwall depth, is categorized based on its relation to the 95th percentile of velocity values (3100.3 m/s).
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General Information
Sheet 4 of 4
Project Number: 2501001-FRA
Hausbots EDF
Chimney Robot MIRA and GPR
Panels 25 – 26
Analyzed by: DRS
Reviewed by: MTC
Completed: June 18, 2025
BDI

Key Outcomes and Learnings

Thank you

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