Magneto-Inductive (MI) Technology Overview

WISEE 2019 Ottawa

Presented by:

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Ultra 'At a Glance'

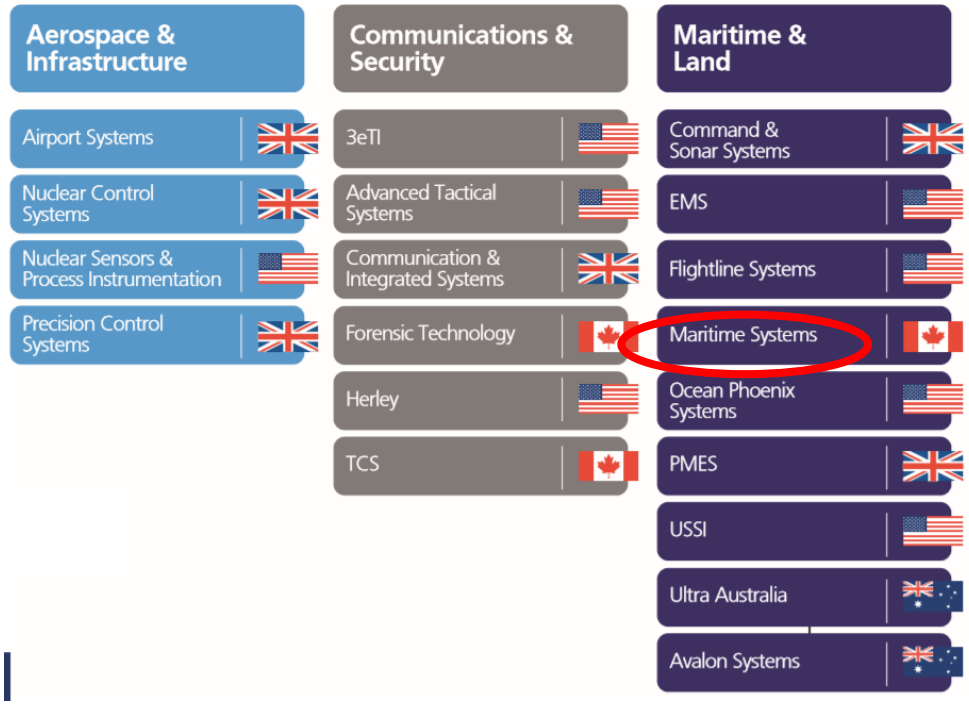
- FTSE 250 stock with strong financial track record

- Broad geographic reach and a wide customer base
- Operations in UK, USA, Canada, and Australia

What underpins Ultra's performance?

STRUCTURE AND CULTURE

- Agile, customer-focused organisation
  - Value knowledge of customers' need
  - Devolved authority and responsibility
  - Flat structure and minimum bureaucracy
  - Focused on innovation to achieve differentiation



Ultra Electronics Maritime Systems

More than 70 years experience in design, development, & manufacturing of sophisticated military systems for customers around the world

- Expendables
  - Sonobuoys
- Sonar
  - Towed Receiver Arrays (ships & submarines)
  - Low Frequency Active/Passive Sonar
- Magneto Inductive Signaling & Communications

MI Technology Overview

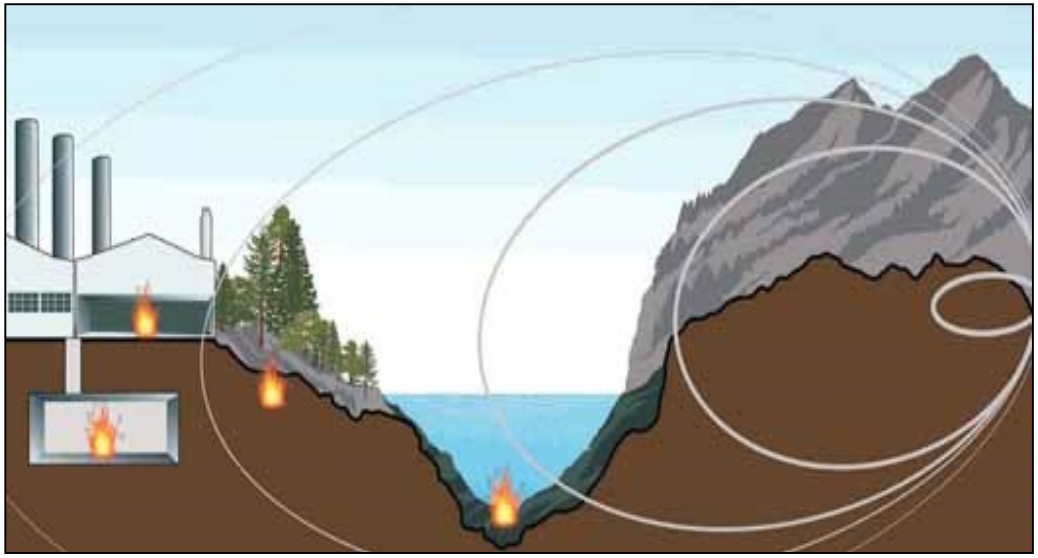
HISTORY

- Magneto-Inductive Systems Limited (MISL) had a 20+ year background in R&D, product development and manufacturing of MI products for military customers, primarily the US Department of Defense.
- MISL was acquired by Ultra in May 2008.
- Engineering, Business Development and Management is now integrated with Ultra in Dartmouth, NS.

MI Technology Overview

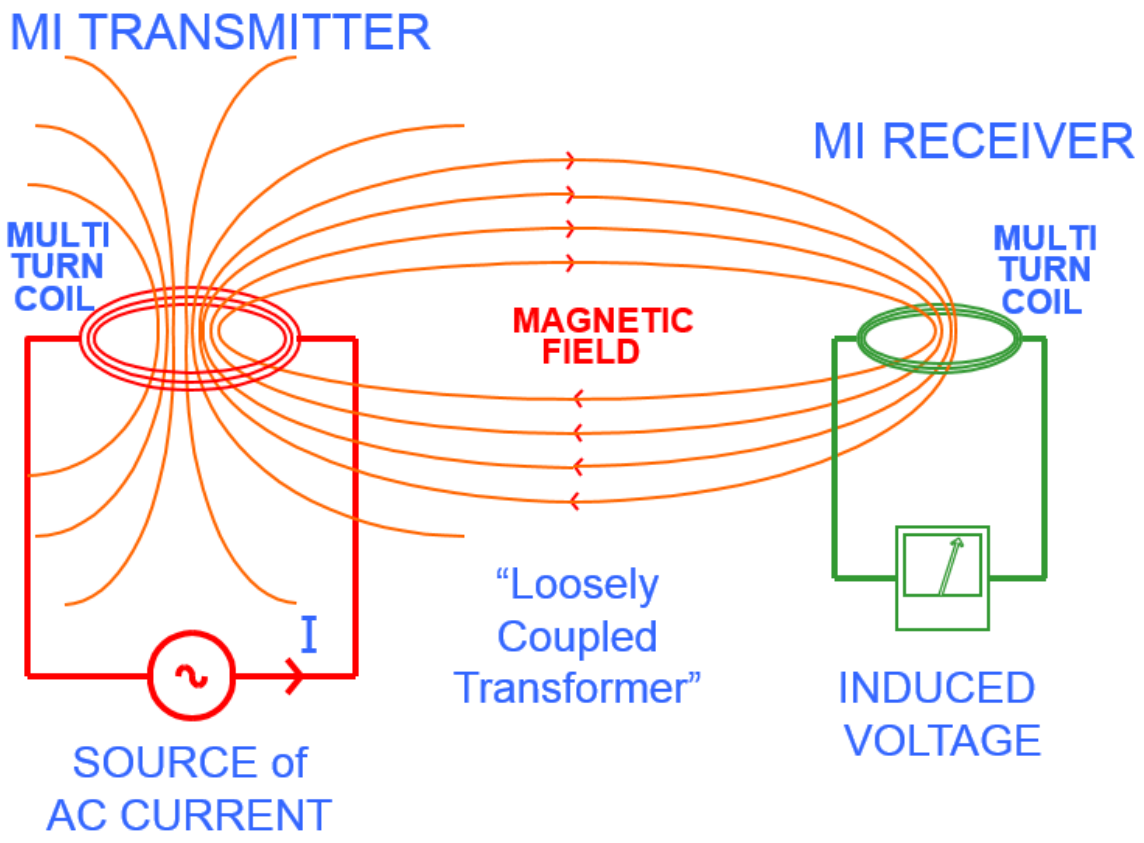
HOW IT WORKS - BASICS

- Uses Magnetic Fields for Signaling and Communication.
- Can transmit through almost anything: air, water, earth, rock, etc.
- Can be used for communication in “difficult” environments: underground caves/tunnels, mining and underground rescue, and in urban structures.
- Electrical conductivity of the medium attenuates the MI field strength (higher conductivity = higher attenuation).



MI Technology Overview

HOW IT WORKS – COMMUNICATION PRINCIPLES



MI Technology Overview

COMPARISON WITH RADIO COMMUNICATIONS

	MI	Common RADIO
Frequency	< 10 kHz	Most > 30 MHz, Minimum 3KHz
Range	50 m – 2 km	100m - many km
Directionality	Omnidirectional	Line of Sight
Electromagnetic Field used	Magnetic Magnetic Moment = Current * Area * Turns	Electric and Magnetic
Detection /Jamming	Difficult	Easy
Reflection Susceptibility	Minimal	Yes
Conductive Medium Effects	Minimal	Yes
Propagation Loss with distance	1/R^3	1/R^2

MI Technology Overview

PRODUCTS

DiverCOMM

- Frequency: ~ 5 kHz
- Range: Voice + data (2412bps): 100m
  Narrowband Data (25bps): 200m
- Applications: Military and Commercial Diver Communications

MI Technology Overview

PRODUCTS

Rockphone / TerraCOMM

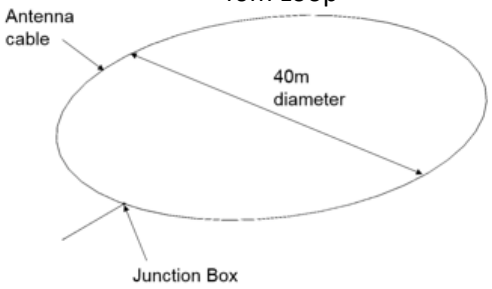
TerraCOMM™ Transceiver

- Frequency: ~ 5 kHz
- Range: Voice + data (2412bps): 100m
  Narrowband Data (25bps): 200m
- Applications: Mining / Tactical / Rescue Communications for through-earth voice and data communication system

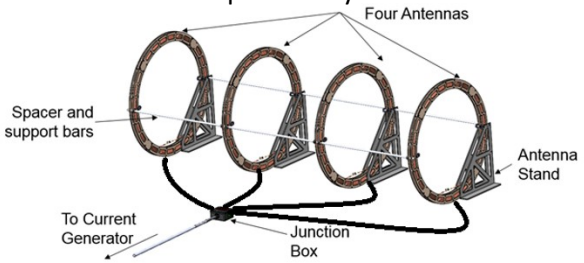
MI Technology Overview

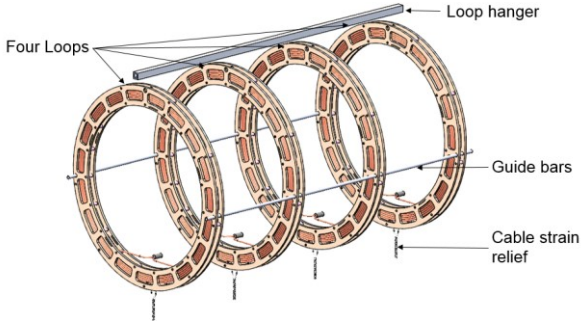
WIRELESS BLASTING WG200 – MULTIPLE ANTENNA OPTIONS

700 m range
40m Loop



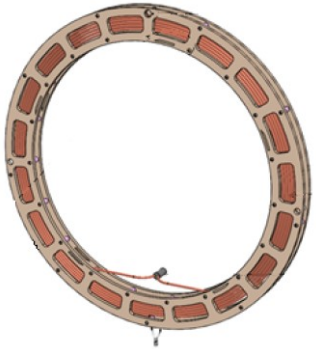
350 m range
1.5m Diameter Loops
Separated by 1.5 m





250 m range
1.04m Diameter Loops
Separated by 1.05 m

150 m range



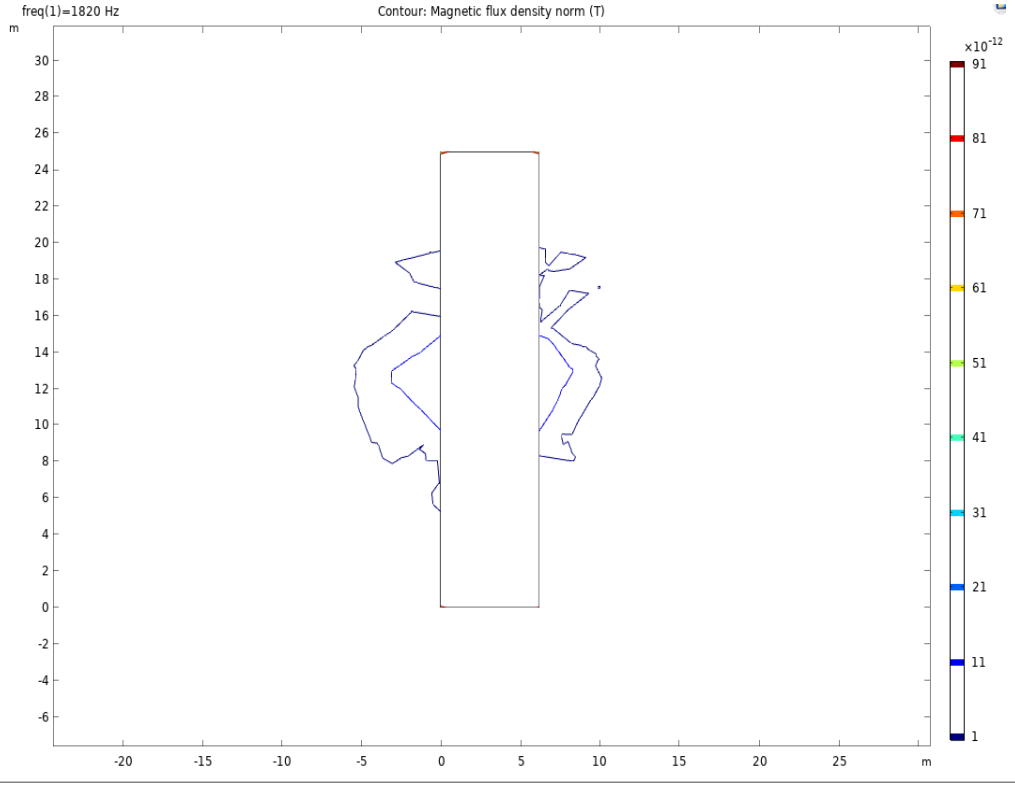
150 m range
1.04m Diameter Loop

50 m range
0.44m Diameter Loop

MI Technology Overview

SIMULATION 1 – TWO ANTENNAS (0.44M DIAMETER) IN ALUMINUM BOX

- **Power source:** 18.4 Amps-meters^2 *(Am^2)* at the center of the box (6.2 x 6.2 x 25 meters)
- **Aluminum thickness:** 0.25”
- **Max Distance:** As per the contour lines below, 10 picoTesla (pT) MI field strength is achievable 4 meters past the aluminum box.



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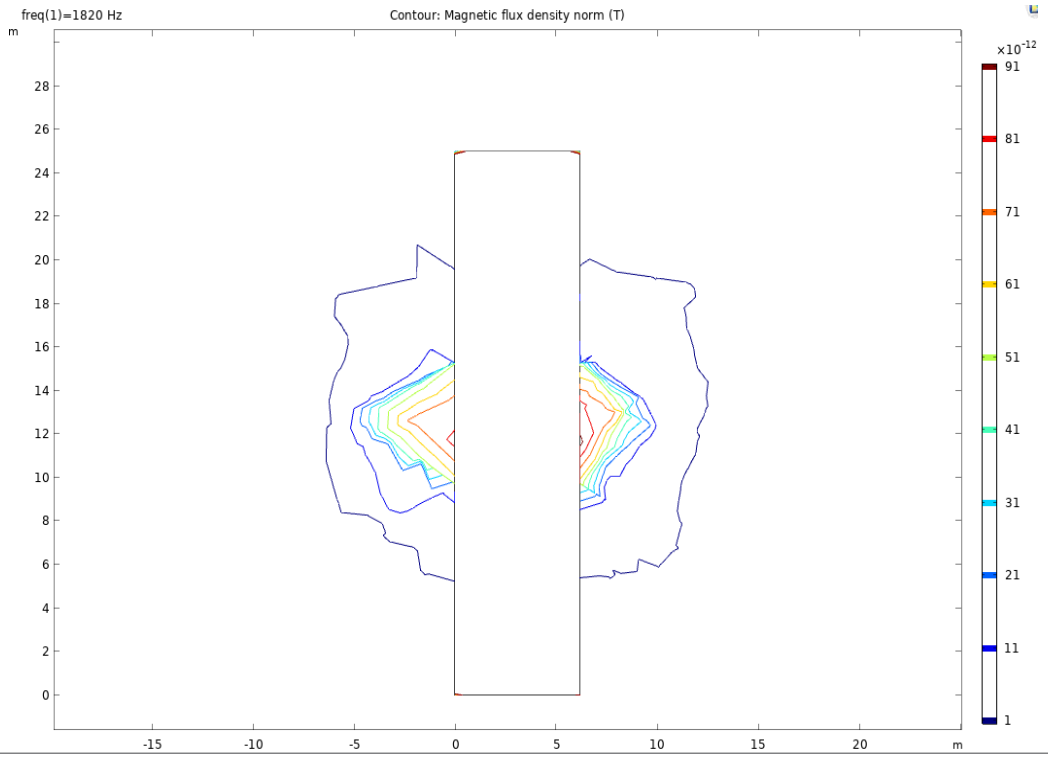
SIMULATION 2 – TWO ANTENNAS (0.44M DIAMETER) IN ALUMINUM BOX

- **Power source:** 18.4 Am^2 at the center of the box (6.2 x 6.2 x 25 meters)
- **Aluminum thickness:** 0.125”
- **Max Distance:** As per the contour lines below, 10 pT MI field strength is achievable 5 meters past the aluminum box. The increased density of the contour lines indicates stronger MI field outside of the box.



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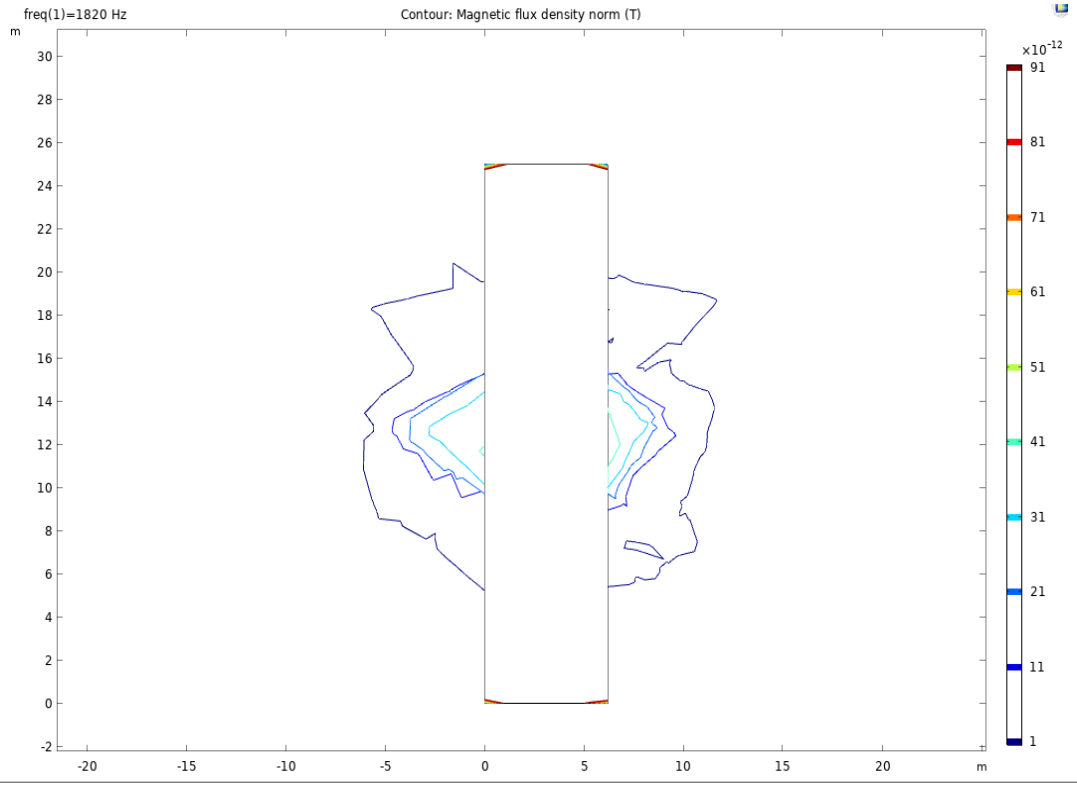
SIMULATION 3 – ONE ANTENNA (0.44M DIAMETER) IN ALUMINUM BOX

- **Power source:** 9.2 Am^2 at the center of the box (6.2 x 6.2 x 25 meters)
- **Aluminum thickness:** 0.125”
- **Max Distance:** As per the contour lines below, 10 pT MI field strength is achievable 5 meters past the aluminum box.



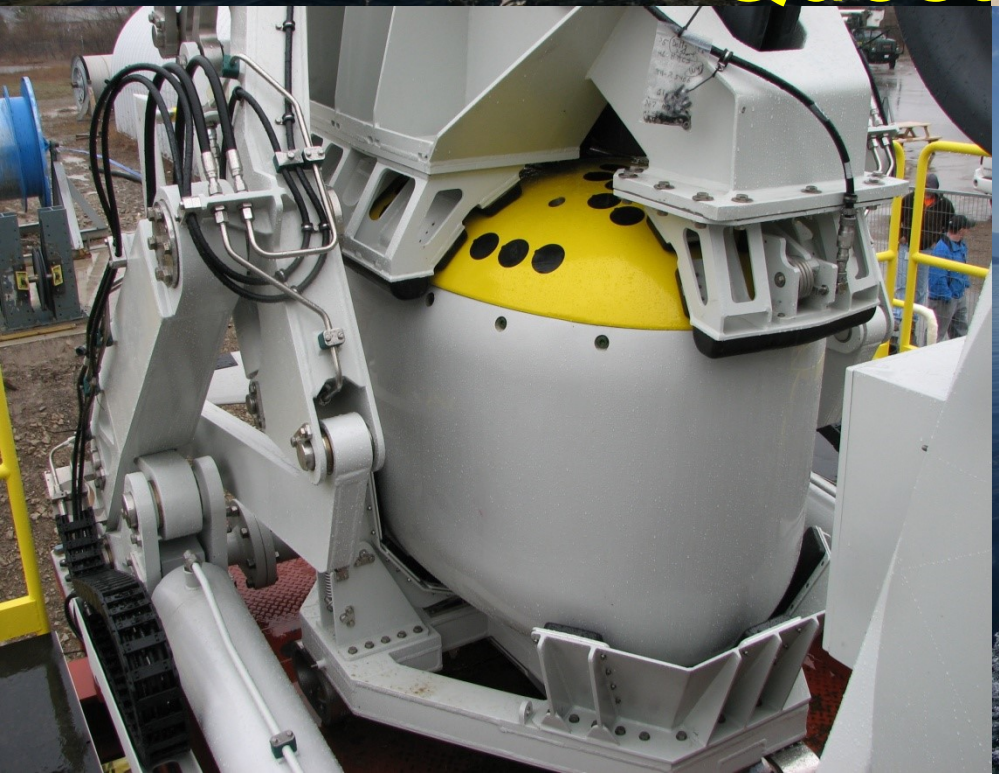
MI Technology Overview

CONCLUSION

- ULTRA's proprietary Magneto-Inductive technology supports several exciting product applications.

- It is being applied very effectively to wireless blasting systems in mines around the world, establishing new capabilities and a new market segment.

Questions?



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