General description

ALIS has been developed by Tohoku University, Japan, which now has a plan to produce it commercially.

ALIS is a hand-held dual sensor system, which is made up of a metal detector and a ground-penetrating radar (GPR). The most unique feature of ALIS is the visualisation function of the metal detector and GPR. Operators can easily identify buried mines on the visualised image.

The system is based on a commercial metal detector, MIL-D1 (CEIA), and an impulse GPR. The full features of MIL-D1 are still available, for example the automatic soil compensation function and the accurate pinpointing capability. The GPR antennas are integrated into the search head, together with the metal detector coils. The control unit holds all the electronics, including a rechargeable battery and is designed to be carried on the shoulders. The colour LCD display provides the scanning results from both the metal detector and the GPR as...
CMAC in Cambodia in mine fields, and we have demonstrated its capability of the identification of mines. The system is in the final stages of developments and we are planning commercialisation.

Working characteristics
The dual-sensor technology, using metal detector and GPR, provides discrimination capability of mines from metal clutter. The metal detector and GPR in this system are used as primary and secondary sensors, respectively. First, the metal detector detects and pinpoints all the objects containing metal pieces, and then the GPR depicts the shapes of the objects. Small pieces of metal do not appear in the GPR images, while objects whose size is comparable to mines are visible. Operators can find those shapes in resulting images of the GPR, which are horizontal slices of the underground at different depths, and can compare with the image from the metal detector. The detected object is recognised as a mine if the image appears to be shaped like a mine, and if the metal detector response matches the location of the mine body. Otherwise, it is metal clutter and can be excluded from the excavation process that would normally follow.

Detectors in use to date
Four sets of ALIS-PG were manufactured. Two of them were used in a test in real mine fields in Croatia for a period of half a year in 2007, by CROMAC. Then, two sets of ALIS-PG were used in Cambodia in Spring 2009 in real mine fields, for an evaluation test. This test was conducted by CMAC. ALIS has also been tested in controlled conditions in Afghanistan, Egypt and Cambodia.

Power supply
ALIS employs a Li-ion rechargeable battery held in the control unit. The battery drives all the units for more than 3.5 hours in the Dual sensor mode (The battery life can be longer if used only for the metal detector). The battery can be charged by connecting the AC cable to the control unit and also by the external charger. The system can also be driven by AC power supply.

Test and evaluation
The system has been tested in several trials, e.g. in Croatia in 2006, the report available under "Related Reports & Evaluations" in the right hand column. The overview was also published in Journal of ERW & Mine Action: maic.jmu.edu/journal/13.3/randd/takahashi_etal/takahashi_etal.htm (http://maic.jmu.edu/journal/13.3/randd/takahashi_etal/takahashi_etal.htm).
It was also tested in Cambodia (2006) and again in Croatia (2007), the report available under "Related Reports & Evaluations" in the right hand column.

A long term evaluation campaign in QC/QA process was conducted in real mine fields by the Croatian Mine Action Centre – (HCR-CTRO) in 2008.

ALIS attended two international evaluation tests, namely, DeFuse project in Denmark (2009) and ITEP test in Germany (2009), the test report available under "Related Reports & Evaluations" in the right hand column and at www.ctro.hr/universalis/148/dokument/bookofpapers_230851006.pdf.

Field evaluation tests have been conducted by CMAC in Cambodia since Spring 2009. These field tests have demonstrated the capability of the identification of mines by ALIS.

**Technical specification**

**Detector**

Model
ALIS-PG

Detection technology used
Hand-held dual sensor system

Detector systems
Dual sensor and GPR systems

**Dimensional data**

**Working length**

Min. length
1'070 mm

Max. length
1'600 mm

**Search head**

Size
260 mm

Weight
0.78 kg

Shape
CIRCULAR
Transport case

Weight
5 kg

With equipment (full)
15 kg

Dimensions
800 x 500 x 600 mm

Hard | Soft case (material)
HARD

Weight, Hand-held unit
2 kg

Weight, carrying (operational detection set)
8 kg

Weight, distribution/balance
kg

Other specifications
KNOB SENSITIVITY ADJUSTMENT FOR ELECTRIC MAGNETIC INDUCTION (EMI)/MODE SWITCH BUTTON (EMI/EMI+GPR)

System status and deployment

Status
In production

Detectors systems in use to date
Two systems are under test by CMAC

Location of use
Cambodia and Croatia

Environmental influence

Humidity (limitations)
< 80%

Water resistant
No

Shock/Vibration resistant
Not tested yet

Environmental compensation
Auto

Temperature (limitations)

Storage
60 to 60 °C
Operational

0 to 40 °C

**Operational hours/Operating endurance**

At around 0 °C
>3.5h
At around 20 °C
>3.5h
At around 30 °C
>3.5h

**Detection operation**

**Calibration / Set-up**

Auto/Manual
AUTO

**Detection range/Sensitivity details/Detection performance / Working depth**

Small metal content mines
APM/AVM

Anti tank mines
AVM

Output indicator (sound/display/other)
Sound (EMI) / Display (EMI and Ground Penetration Radar (GPR))

Pinpointing feature
Dual Tone

Adjustment of search head angle
0° up to 95°

Soil influence
No influence to EMI

Best use in
✔ Sand
✔ Peat
✔ Clay
✔ Ferruginous soil (laterite)

Optimal sweep speed
Any speed for EMI / 20 cm/s for GPR

Search coil/antenna
Circular (EMI)/Spiral (GPR)

Limitations
Extremely inhomogeneous soil, large terrain variation

Interference (with other detectors)
No
Power
Power supply/source
Rechargeable battery
Operating time
>3.5h

**Power supply**
Weight
0.7kg
Batteries
One of LI-ION rechargeable battery.
Rechargeable
Yes
Other
AC drive and external battery charge possible.

Costs

**Base price for the unit (US$)**
Reduction for higher quantity
No
Price with training
No

**Complete system price (US$)**
Possible to rent
No

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