

## GENERAL DESCRIPTION

*ALIS* has been developed by the Centre for Northeast Asian Studies at the Tohoku University which is now planning its commercial production.

*ALIS* is a hand-held dual-sensor system, which consists of a metal detector and a ground-penetrating radar (GPR). A unique feature of *ALIS* is its visualization function of detection readings from both the metal detector and GPR. Operators can easily identify buried mines on the visualized image.

The system is based on a commercial metal detector, MIL-D1 (CEIA) and an impulse GPR (ALSI-PG) or a stepped-frequency GPR (ALIS-VNA). The full features of MIL-D1 are available, for example the soil compensation function and the pinpointing capability. The GPR antennas are integrated into the search head together with metal detector coils. The control unit holds all the electronics and a rechargeable battery and is designed to be shouldered. The colour LCD display provides the survey results both from the metal detector and the GPR as images. Audio alert is also available for the metal detector indication using an earphone.



ALIS at the test site

## **WORKING METHODOLOGY**

The dual-sensor technology using metal detector and GPR provides discrimination capability of mines from metal clutter. The metal detector and the GPR in this system are supposed to be 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 shapes of the objects. Small pieces of metals do not appear in the GPR images, while objects whose size is comparable to a mine are visible. The operator can find these shapes in the GPR images, which are horizontal slices of the underground at different depths, and can compare them with the image from the metal detector.

## **POWER SUPPLY**

ALIS employs a Li-ion rechargeable battery 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 using only the metal detector mode). 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 an AC cable.

## **DETECTORS IN USE**

Two sets of ALIS-PG and three sets of ALIS-VNA have been manufactured. The two ALIS-PGs were used in minefield tests by CROMAC in Croatia for six months. Several prototypes of ALIS were manufactured before these five sets. They were tested in controlled conditions in Afghanistan, Cambodia, Croatia and Egypt.

## **FACTORY SUPPORT**

No information yet available.

## **MAINTENANCE SUPPORT**

No information yet available.

## **TEST AND EVALUATION**

- > The system has undergone several trials, eg in Croatia in 2006 (report available at: [www.itep.ws/pdf/JapaneseTrialsCroatia2006.pdf](http://www.itep.ws/pdf/JapaneseTrialsCroatia2006.pdf)), in Cambodia in 2006 and again in Croatia in 2007 (report available at: [www.itep.ws/pdf/TestDualSensorJST\\_CTRO2007.pdf](http://www.itep.ws/pdf/TestDualSensorJST_CTRO2007.pdf)).
- > A long-term evaluation campaign on QC/QA process (using ALIS as a detection tool) has been conducted in real mine fields by the Croatian Mine Action Centre – Centre for Testing, Development and Training in 2008.
- > The metal detector in the ALIS system has been tested many times as a stand-alone detectors, eg the STEMMD trial in Croatia in 2005 (report available at: [www.itep.ws](http://www.itep.ws)).

## **REPORTED LIMITATIONS AND STRENGTHS**

As the ALIS is the final stage of R&D no further information is available.

### GENERAL DESCRIPTION

*ALIS-EMI* is an add-on system, which can be fitted to any metal detector (with digital output, i.e., RS232C, USB required). One prototype has been made.

The ALIS-EMI provides a visualisation function to a hand-held metal detector. Operators can easily identify buried mines on the visualised image on a colour LCD display of a palmtop PC. Audio alert is also available for the metal detector indication using the earphone. A CCD (closed circuit digital) camera can be equipped on a metal detector pole, and no modification to the metal detector is required.



ALIS-EMI

ALIS at the test site

### WORKING METHODOLOGY

The operation of ALIS-EMI is like that of conventional metal detectors, except that the operator can see an image from the metal detector superimposed on the ground surface picture. Compared to the conventional audio signal, the visualized signal can show much more information to the operator.

The advantages of visualisation include:

- > Very weak signals can be enhanced on the image, which avoids missing objects.
- > Discrimination of two mines close together is possible, by the shape of the visual response.

Power supply to the metal detector and the ALIS-EMI is separated. ALIS-EMI can be installed on any small palmtop PC, powered by the PC.



ALIS Sensor head



ALIS at the test site

**DETECTOR**

1. Brand	TOHOKU University
2. Model	ALIS
3. Version	ALIS-PG/ALIS-VNA
4. Used detection technology	Continuous wave (CW) Electromagnetic induction (EMI) & ground-penetrating radar (GPR)

**DIMENSIONAL DATA**

5. Working length	
> min. length	1,070 mm
> max. length	1,600 mm
6. Search head	
> Size	External Ø 260 mm
> Weight	0.78 kg
> Shape	Circular
7. Transport case	
> Weight	5 kg
> With equipment (full)	15 kg
> Dimensions	0.8 x 0.5 x 0.6 m
> Hard   Soft case (material)	Hard
8. Weight, hand-held unit	2 kg
9. Weight, carrying (operational detection set)	8 kg
10. Weight, additional equipment	—
11. Weight distribution   Balance	Well balanced Optimised for continuous operation
12. Other specifications	Knob sensitivity adjustment for EMI Mode switch botton (EMI/EMI+GPR)

**SYSTEM STATUS AND DEPLOYMENT**

13. Status (Development   In production)	Development (final phase)
14. Detectors   Systems in use to date	—
15. Other types   Models	ALIS
16. Location of use	—

**ENVIRONMENTAL INFLUENCE**

17. Humidity (limitations)	< 80 %
18. Temperature (limitations)	
> Storage	-20° C to +60° C
> Operational	0° C to +40° C
19. Water resistant (Yes / No)	IP 54
20. Shock   Vibration resistant	Not tested
21. Environmental Compensation	Automatically
22. Operational hours   Operating endurance	
> low temperature (around 0° C)	> 3.5 h
> medium temperature (around 20° C)	> 3.5 h
> high temperature (higher than 30° C)	> 3.5 h

## DETECTION OPERATION

23. Calibration   Set-up	
> Auto   Manual	Automatic
> Duration	No limit
24. Detection range   Sensitivity details   Detection performance   Working depth	
> Small metal content mines (type of mine)	Optimised according to the mines and soils
> Anti-tank mines (type of mine)	Optimised according to the mines and soils
> ERW (please specify)	Optimised according to the mines and soils
25. Output indicator	Sound (EMI)   Display (EMI and GPR)
26. Pinpointing feature	Dual tone
27. Adjustment of search head angle	0° up to 95°
28. Soil influence	No influence for EMI
29. Best use in	
> Sand	Yes
> Peat	Yes
> Clay	Yes
> Ferruginous soil (laterite)	Yes
30. Optimal sweep speed	Any speed for EMI   20 cm/s for GPR
31. Search coil   Antenna	Circular (EMI)   Spiral (GPR)
32. Limitations	Extremely inhomogeneous soil, large terrain variation
33. Interference (with other detectors)	No

## POWER

34. Power supply   Source	Rechargeable battery
35. Operating time	> 3.5 h
36. Power supply	
> weight	0.7 kg
> no. of batteries   size   type	1 of LI-ION rechargeable battery
> rechargeable	Yes
> other	AC drive and external battery charge possible

## COSTS

37. Price	
> for one detector on request	
> reduction for higher quantity	
38. System price	
> with training	
> spare parts	
> extended warranty	
39. Total	
40. Possibility to rent/lease	

## OTHERS

41. Duration of warranty	
42. Additional equipment	
43. Additional technical data   information	
44. Compliant standards	

**DETECTOR**

1. Brand	TOHOKU University
2. Model	ALIS-EMI
3. Version	1
4. Used detection technology	Electromagnetic induction (EMI)

**DIMENSIONAL DATA**

5. Working length	
> min. length	
> max. length	
6. Search head	(As of the attached sensor)
> Size	
> Weight	
> Shape	
7. Transport case	
> Weight	—
> With equipment (full)	—
> Dimensions	—
> Hard   Soft case (material)	—
8. Weight, hand-held unit	13 x 9 x 5 cm (PC)
9. Weight, carrying (operational detection set)	0.5 kg (PC)
10. Weight, additional equipment	—
11. Weight distribution   Balance	
12. Other specifications	

**SYSTEM STATUS AND DEPLOYMENT**

13. Status (Development   In production)	In production
14. Detectors   Systems in use to date	
15. Other types   Models	
16. Location of use	

**ENVIRONMENTAL INFLUENCE**

17. Humidity (limitations)	
18. Temperature (limitations)	
> Storage	
> Operational	
19. Water resistant (Yes / No)	
20. Shock   Vibration resistant	
21. Environmental Compensation	
22. Operational hours   Operating endurance	
> low temperature (around 0° C)	
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