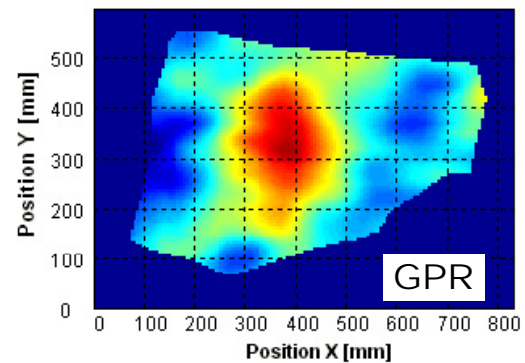
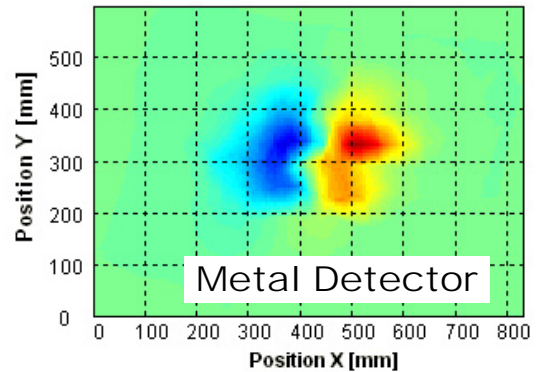


ALIS

- Innovation in Mine Detection -
Hand Held Dual Sensor for Humanitarian Demining



TOHOKU
UNIVERSITY



PMN-2 imaged by ALIS

ALIS is a hand-held dual sensor system, which consists of a metal detector and a ground-penetrating radar (GPR). The most unique feature of ALIS is its visualization function of the metal detector and GPR. Operators can easily identify buried mines on the visualized image. Audio alert is also available for the metal detector indication.

Dual Sensor technology using metal detector and GPR provides discrimination capability of mines from metal clutters. Small pieces of metals do not appear in the GPR images, while objects whose size is comparable to mine are visible. Operator can find those shapes in the images of GPR, which are horizontal slices of the underground at different depths, and can compare with the image from the metal detector. ALIS is the only one hand-held dual sensor in the world, which can provide visualized image of GPR and Metal Detector to the operator. This unique feature gives drastic reduction of false alarm rate, and improves the cost performance of humanitarian demining operation.

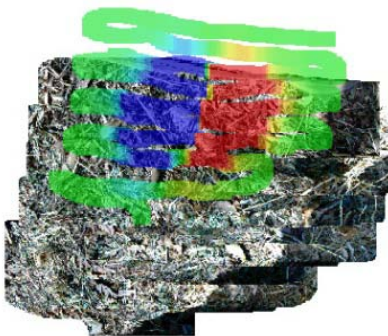


Operation of ALIS

ALIS operator training



Operation of ALIS is not very different from conventional metal detectors. Deminers who have experience of metal detector can use ALIS by 1-week training.



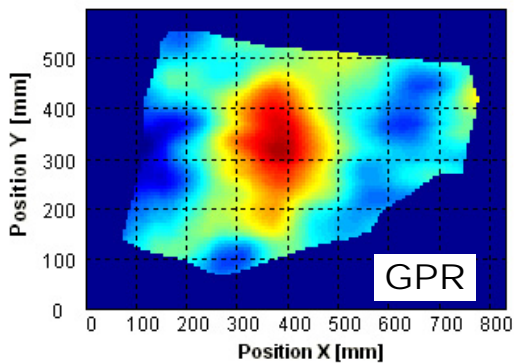
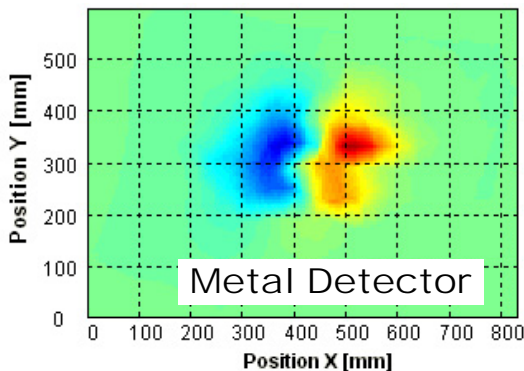
The ALIS deminer observe this image on PC screen while he scans the sensor head over the ground surface. Metal detector signal is indicated by Blue-and -Red stripe shown in the display, which also shows the locus of the sensor head.

Visualization and Signal Processing

The dual sensor technology using metal detector and GPR provides discrimination capability of mines from metal clutters. The metal detector and the GPR in this system are designed to be used as the primary and the secondary sensors, respectively. At first, the operator uses the metal detector by audio signal and pinpoints all the objects containing metal pieces. This procedure is the same as conventional metal detector. Then the operator scans the ALIS sensor head in 50cm x 50cm area above the points detected by the ALIS metal detector for GPR imaging. Scanning takes 1-2min, then data processing takes 10 second until the operator can see the visualized image of GPR. The operator will judge the shape of the object, Small pieces of metals do not appear in the GPR images, landmines are visible. GPR can also provide the depth of the mine.



Mines detected by ALIS



PMN-2 imaged by ALIS



Operation tests at real mine fields

has been conducted in Cambodia with a collaboration with CMAC (Cambodian Mine Action Center) since April 2009. 2 sets of ALIS were operated by ALIS-team of CMAC for two months, and more than 30 mines were detected.

For example during one month in July 2009, ALIS cleared 4,192 m² area, and detected 9 mines, which are all PMN-2 type. Metal detector detected 1,193 objects, and deminers judged 484 of them as possible mines, and 709 as metal fragments. This means, 709 points out of 1193 points (app. 60%), did not have to be prodded, and it can reduce the time of demining operation drastically. This is the most important capability of ALIS.





ALIS

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ALIS.htm](http://cobalt.cneas.tohoku.ac.jp/users/sato/ALIS.htm)

General Description

ALIS is a hand-held dual sensor system, which consists of a metal detector and a ground-penetrating radar (GPR). The most unique feature of ALIS is its visualization function of 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. The full features of MIL-D1 are available, for example the soil compensation function and the pinpointing capability. The GPR antennas are integrated into 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 color 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. The system is in the final stage of developments and commercial type of ALIS will be available soon.

Working Characteristics

The dual sensor technology using metal detector and GPR provides discrimination capability of mines from metal clutters. 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 mine are visible. Operator 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.

Test and Evaluation

The system has been tested several trials, e.g. in Croatia (2006, the report available at: <http://www.itep.ws/pdf/JapaneseTrialsCroatia2006.pdf>), in Cambodia (2006) and in Croatia (2007, the report available at: http://www.itep.ws/pdf/TestDualSensorJST_CTRO2007.pdf). A long term evaluation campaign in QC/QA process has been conducted in real mine fields by the Croatian Mine Action Centre – Centre for Testing, Development and Training (HCR-CTRO) in 2008. 2 sets of ALIS were operated by CMAC in Jun-July 2009 in Cambodia and more than 30 mines were detected. ALIS was also tested in controlled conditions in Afghanistan and Egypt.

