



Dual Sensor for Humanitarian Demining and its Application to Cluster Munition

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A dual sensor for humanitarian demining is defined as a combined sensor of electromagnetic induction sensor (EMI sensor) and ground penetrating radar (GPR). The dual sensor ALIS which we have developed at Tohoku university, Japan has a capability of visualization of buried objects by the hand-scanned EMI sensor and GPR [1]. It uses Synthetic Aperture Radar (SAR) processing for visualization of buried object by GPR. We are supporting the humanitarian demining activities in Ukraine by supplying dual sensors [2].

We trained Ukrainian deminers the operation of the dual sensor in Cambodia in January 2023 and in Poland in July 2023. Currently, 54 units of the sensors have been delivered to Ukraine. During these trainings, we discussed with the deminers on the effective use of the visualization function of the sensor. The most important advantage of the visualization is its capability of discrimination of metal fragments from Antipersonnel landmines (AP-mine). It will shorten the time for excavating the buried objects. In addition, we think vitalization images can provide more information about the buried objects, and it will improve the safety of the excavation.

Recently, we are also working in Colombia and Laos. Although Cluster munitions are prohibited for those nations that ratified the Convention on Cluster Munitions, adopted in Dublin, Ireland, in May 2008, many of explosive bomblets ejected from the cluster bombs are remaining in soil in countries such as Cambodia and Laos [3]. ALIS has been mainly used for imaging buried anti-personnel mines such as PMN-2 and Type72, but we are now investigating the advantage of ALIS for detection of buried metal objects such as bomblets.



Figure 1. ALIS and a model of bomblet.

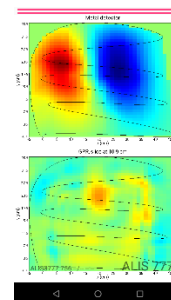


Figure 2. ALIS image of a model of bomblet buried in sand

Figure 1 shows the main body of ALIS and a model of bomblet. The model of bomblet is made of steel, having the same size and the shape of a real bomblet. Figure 2 shows one of the examples of images of EMI sensor and GPR obtained by ALIS. The model of bomblet was buried at 15cm in sand in laboratory condition. We can clearly find the image of the bomblet in EMI sensor and GPR. The bomblet is made of steel, and the response to EMI sensor is very strong. On the other hand, GPR image is sometimes not very clear, compared to the images of AP mines. We think it is due to the semi-spherical shape of the bomblet, whose radar cross section is smaller compared to AP-mines.

References

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- [2] <https://www.jica.go.jp/ukraine/english/office/topics/230124.html>
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