



**Warfighter Research in Mine Detection:
Improved Clutter Rejection with the An/PSS-14**

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Executive Summary

Purpose

This report describes the findings of five studies conducted to optimize the clutter rejection performance of the AN/PSS-14.

Introduction

Fielding of the AN/PSS-14 dual sensor mine detector to the US Army and Marine Corps is on-going. The AN/PSS-14's manufacturer, Cy Terra, is working closely with the system's Program Manager to upgrade the system's software as issues are identified.

In 2005, Lincoln University embarked on a research program focused on optimizing the performance of the AN/PSS-14 through research. The research has proceeded along two primary axes, training enhancement and robotic coupling. This report describes the findings of five independent research studies designed to assess training methods and robotic coupling.

Findings

In the first study, the duration of the program of instruction's (POI) effect on clutter rejection training was assessed. The primary improvement the AN/PSS-14 brings to mine detection is its ground-penetrating radar (GPR). The GPR allows trained operators to distinguish between mines and non-mine (clutter) targets. In this study, false alarm rates (FAR) were looked at. Clutter rejection performance was compared between a five-day and four-day program of instruction. Clutter rejection significantly increased and FAR significantly decreased with the four-day POI.

Study 2 focused on developing AN/PSS-14 operational expertise and training development support. This will be accomplished through the study of the kinematics of an AN/PSS-14 operator's movements when conducting a GPR short sweep over a target. Technological limitations in a key measurement instrument limited the intended level of assessment, however a re-designed study illustrated that the patterns of GPR response were highly dependent upon individual targets.

Study 3 was a task to construct a research robot capable of mounting and remotely operating an AN/PSS-14 during a robotic lane sweep. The robot was constructed and successfully trialed in navigating a mine lane using a Minelab F3 metal detector.

Study 4 was designed to investigate the reliability of GPR alerts over mine stimulants at various detector head heights and target burial depths. The results proved to be extremely variable across a range of conditions.

Lately, Study 5 investigated methods of skill sustainment training, comparing no practice and practice to a computer-aided instruction (CAI) system. Interestingly, as a group the research

participants receiving the CAI as their sustainment training performed the lowest on target detection when sweeping the test mine lane following sustainment training. A rationale for why the CAI group performed the least effectively is discussed.

Conclusions/Recommendations

- GPR response to mine stimulants is variable.
- GPR variability appears to be influenced by a number of factors, although predictability of when GPR response is likely to be varied remains elusive.
- Recommend continued research into the factors that result in variability of GPR alerts.
- A four-day POI is effective in teaching AN/PSS-14 operator skills.
- Recommend a larger-scale study to validate research results.
- Computer-aided instruction was not an effective sustainment tool for the conditions used in this study.
- Recommend the computer-aided instruction research be conducted again under different study conditions -- more delay between training and testing.
- Recommend the computer-aided instruction set-up change from a table, chair, and mouse set-up to a virtual mine lane and a replica of an AN/PSS-14 as the “mouse”.