Summary of Results for the COTS Handheld Landmine Detector Technical Assessment
Conducted at the JUXOCO Detector Calibration Site
7-15 October 2002

1. Background.

From 7 through 11 October 2003, the Joint Unexploded Ordnance Coordination Office hosted a technical assessment of 6 different commercial off-the-shelf (COTS) handheld landmine detectors. The assessment was conducted at the Joint Unexploded Ordnance (UXO) Coordination Office (JUXOCO) Data Collection Site located at Range 71-A, Fort A. P. Hill, Virginia. Six U.S. Marine Corps combat engineers served as the detector operators for the duration for the evaluation. All six Marines were non-commissioned officers with at least three years of service. Each was highly experienced in the employment of the AN/PSS-12 mine detector and had consistently spent at least four hours per month training and/or operating the AN/PSS-12. Each Marine is a qualified instructor at Engineer Training Area-3, is qualified to teach basic AN/PSS-12 characteristics and employment techniques, and received approximately 1 hour of training on his assigned COTS detector.

2. Equipment.

All six detector models utilized in the technical assessment are currently available for purchase directly from the manufacturer. The following detectors were evaluated:

Detector	Manufacturer
MIL D-1	CEIA
MINEX 2FD	Foerster
F3	Minelab
F1A4	Minelab
ATMID All Terrain Mine Detector	Schiebel
MIMID Miniature Mine Detector	Schiebel

3. Technical Assessment of Detector Capabilities.

The technical assessment was conducted in two phases:

Phase One. This phase assessed the detection capability of each handheld detector, and measured the ability of the operator to locate individual targets buried in known calibration lanes.

The evaluation consisted of employing the detector on known landmine detector calibration lanes at the JUXOCO calibration site. The landmine detector calibration lanes consist of 12 individual rows each containing between 13 and 22 individual cells. Each individual cell is one square meter and contains one of the following types of targets:

1. Anti-tank (A.T.) landmine
2. Anti-personnel (A.P.) landmine
3. Clutter (random wooden, metallic, or plastic objects)
4. Blank (no object was purposefully placed in the cell)

All targets are buried beneath between .01 and 4 inches of indigenous soil, clay-like silt. In order to ensure impartiality and prevent invalid detection results, the operators did not receive details on the exact contents of the calibration cells prior to, during or after the technical assessment. Nor did an operator use a given calibration lane more than once.

The results for Phase One of the technical assessment listed below include the probability of detection (PD) and probability of false alarms (PFA) for each system.

Minelab F3		
Probability of detection (PD)	**Probability of False Alarms (PFA)**	**Comparison**
1.000	0.039	Mines vrs. Clutter
1.000	0.130	Mines vrs. Blanks
1.000	0.061	Mines vrs. C&B

Table 3-2

Minelab F1A4		
Probability of detection (PD)	**Probability of False Alarms (PFA)**	**Comparison**
0.909	0.039	Mines vrs. Clutter
0.909	0.087	Mines vrs. Blanks
0.909	0.051	Mines vrs. C&B

Table 3-3

Phase Two. Work consisted of a four-day practical application. The Marines were given free reign to employ and evaluate the systems in tactical and administrative scenarios of their choosing. Phase Two provided user input on all facets of system design and operating capabilities. At the conclusion of the independent trial period, the Marines ranked the six detectors in terms of design, ease of operation, ease of set-up and calibration, detection capability, precision, and overall performance. In each of the categories, the detectors were comparatively ranked on a scale of 1 to 6 (1 being the highest and 6 being the lowest). The results of the comparative rankings are listed below in Tables 3-7 through 3-12. The overall performance ranking assigned by the Marines was verified against an average performance rating. The average performance rating was determined by calculating the average score of the first five categories (design, ease of operation, ease of set-up and calibration, detection capability, and precision). The average ratings are listed in table 3-13.

Design. Measures the overall design of the system in general terms of weight, size, storage and transport capability, and overall field durability.	
RANKING	**DETECTOR**
1	Minelab F3
2	Minelab F1A4

Ease of Operation. Measures the displacement of weight, ability to hear and recognize audible/visual alarms, and the ability to access control functions while operating the system for a prolonged length of time.	
RANKING	**DETECTOR**
1	Minelab F3
3	Minelab F1A4

Ease of Set-Up/Ground Balancing Capability. Measures ease of assembling and calibrating the system for local soil and environmental conditions.	
RANKING	**DETECTOR**
1	Minelab F3
2	Minelab F1A4

Detection capability. Measures the ability to detect a buried metallic target.	
RANKING	**DETECTOR**
1	Minelab F3
3	Minelab F1A4

Precision. The ability to discriminate between an actual target and clutter. In the context of this evaluation, precision also refers to the ability to determine the approximate size, type, and number of actual landmine targets.	
RANKING	**DETECTOR**
2 (TIE)	Minelab F3 Minelab F1A4

Relative Overall Performance. Overall evaluation based on the combination of ergonomic design, ease of operation, detection capability and precision of the given system. Overall performance is based on the opinion of the operators rather than the total sum of the five previous categories.	
RANKING	**DETECTOR**
1	Minelab F3
3	Minelab F1A4

Average Performance Rating						
	Design	**Ease of Operation**	**Ease of Set-up**	**Detection Capability**	**Precision**	**AVG. RATING**
Minelab F3	1	1	1	1	2	**1.2**
Minelab F1A4	2	3	2	3	2	**2.4**

Table 3-13