International Test and Evaluation Program
for Humanitarian Demining

ITEP Work Plan

2000 - 2007

Portfolio of the ITEP Participant's finalised test and evaluation activities [1].

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ITEP Secretariat
Hosted by the Royal Military School
31 Avenue de la Renaissance
B-1000 Brussels
Belgium
Email: secretariat@itep.ws
Website: www.itep.ws

[1] This document is complemented by the ITEP Work Plan 2008, which provides an overview of all ongoing and planned test and evaluation activities by the ITEP Participants for 2008.

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1 INTRODUCTION

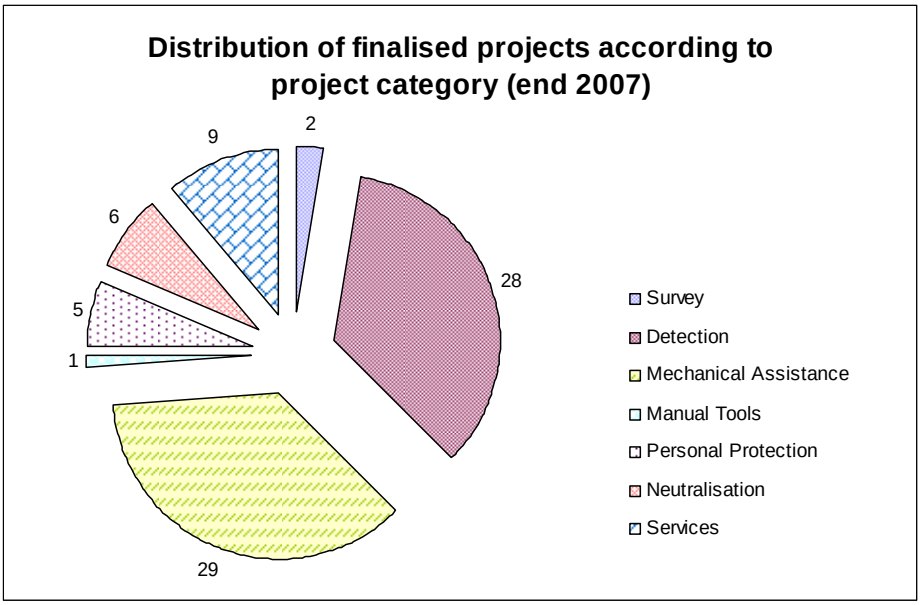
ITEP was created as a response for the desire to strengthen worldwide demining efforts and it seeks to achieve this through active co-operation among the Participants and also with other agencies and organisations. These efforts are realised through the ITEP Work Plan. Its aim is to increase efficiency by avoiding duplications and feeding lessons learned back into the process. The output is to publish test results and to release them worldwide.

The ITEP Work Plan 2008 reflects the ongoing and planned national or collaborative projects among the ITEP Participants. The ITEP Work Plan 2000 – 2007 summarises all test and evaluation activities carried out by the ITEP Participants since the creation of ITEP, and that were completed by the end of 2007[2]. The ITEP Work Plan 2000 – 2007 document also includes for each completed activity a reference to the final report and a short summary of the project conclusions.

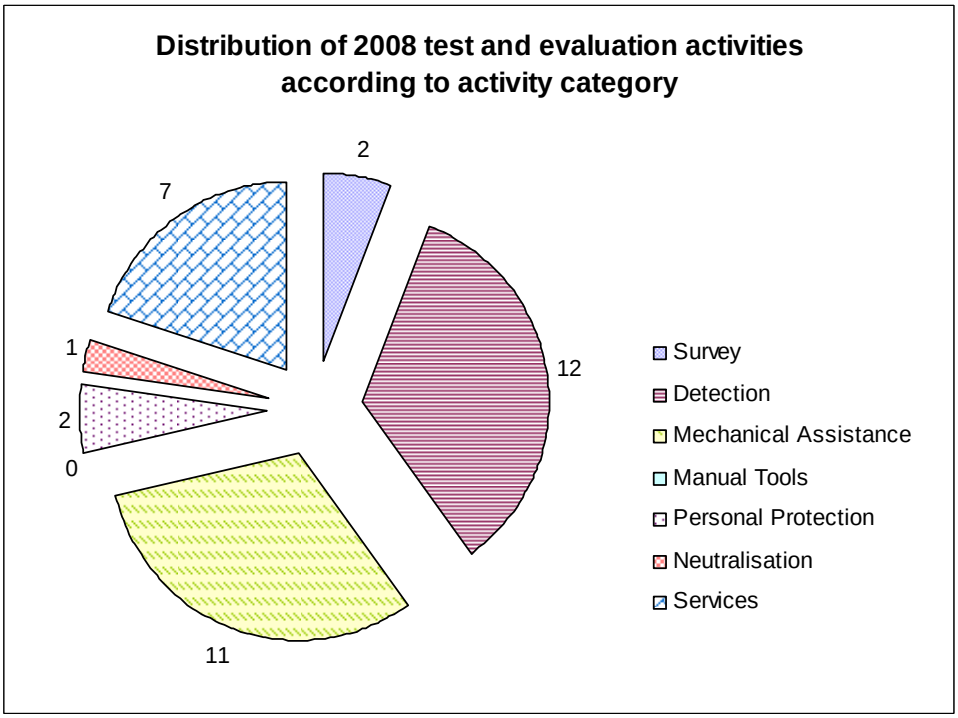
For clarity and management purposes, the Work Plan is divided into six technical programs: survey, detection, mechanical assistance, personal protection, manual tools and neutralisation. A separate program has been added to cover services provided by the ITEP Secretariat or some ITEP project management groups. The Services program includes amongst others capacity building activities, involving mainly training and advice on test methodology to entities in mine affected countries.

The following graphs provide an idea of the number and type of projects that have been included and finalised since the set-up of ITEP (*Graph1).* The number of ongoing and planned activities for 2008 is presented in *Graph 2*. Details of the current ITEP projects can be found in the ITEP Work Plan 2008 document.

[2] Some projects were included in the Work Plan by ITEP Participants, but were later postponed and/or cancelled. These projects are not listed in the ITEP Work Plan 2000 – 2007 document but are available in the searchable web database (http://www.itep.ws/activities/itep_workplan/search_workplan.php)



Graph 1



Graph 2

The ITEP Work Plan documents are available at the *ITEP website* (http://www.itep.ws/) and distribution is also assisted by the UNMAS and GICHD. All ITEP project descriptions can also be consulted via a searchable web database (http://www.itep.ws/activities/itep_workplan/search_workplan.php), which is frequently updated with new project information provided by the ITEP Participants. It is therefore recommended to consult the ITEP Work Plan database whenever the latest information on ITEP test and evaluation activities is required.

2 OVERVIEW OF FINALISED TEST AND EVALUATION PROJECTS AT THE END OF 2007

2.1 Summary statistics

Category	*Trials/Tests completed*	*Archived*	*Total*	
			Number	*Percentage*
Survey	**2**	**0**	**2**	**3**
Detection	**9**	**19**	**28**	**35**
Metal detector	3	6	9	
Ground Penetrating Radar	1	2	3	
Trace explosives	1	2	3	
Multi-sensor	2	4	6	
Others	2	5	7	
Mechanical Assistance	**4**	**25**	**29**	**36**
Manual Tools	**0**	**1**	**1**	**1**
Personal Protection	**0**	**5**	**5**	**6**
Neutralisation	**1**	**5**	**6**	**8**
Services	**0**	**9**	**9**	**11**
Total	***16***	***64***	***80***	***100***

2.2 Summary description

2.2.1 SURVEY

Project Nr	Title	Lead
	Methodology	
	Test and Evaluation	
1.2.1	Develop, test and evaluate a Minefield Marking Kit. *Trials/tests completed*	US
1.2.3	Test and evaluation of EOD IS Survey, a computerised support system for mine action survey. *Trials/tests completed*	SE

2.2.2 DETECTION

Project Nr	Title	Lead
	Metal detector	
	Methodology	
2.1.1.1	CEN Workshop Agreement on test and evaluation of metal detectors. *Archived*	DE/*BAM* (2006-2007), EC/*JRC* (2002-2005)
2.1.1.2	Reliability model for metal detector evaluation. *Archived*	DE/BAM
2.1.1.4	Soil characterisation for assessment of metal detector performance. *Archived*	CA
2.1.1.7	Joint project **Metal detectors for humanitarian demining - Development potentials in data analysis methodology and measurement technology** (HuMin/MD). *Completed*	DE
2.1.1.8	Reliability Model for Test and Evaluation of Metal Detectors *Trials/tests completed*	DE
	Test and Evaluation	
2.1.2.3	Systematic test and evaluation of metal detectors - STEMD *Archived*	DE/*BAM* (2006), EC/*JRC* (2004-2005)
2.1.2.4	Assessment of Ultra Low Power Detector. *Archived*	UK
2.1.2.5	Evaluation of Metal Detector Arrays for Humanitarian Demining. *Trials/tests completed*	CA
	Output	
2.1.3.1	Metal Detector Trials: Detector Test Results and their Interpretation. *Archived*	EC/*JRC*
	Ground Penetrating Radar	
	Methodology	
	Test and Evaluation	

2.2.2.1	Test and evaluation of existing Ground Penetrating Radar detectors. *Archived*	EC/JRC
2.2.2.2	Integrate and test and evaluate the man portable Energy Focused Ground Penetrating Radar (EFGPR). *Archived*	US
2.2.2.5	Test and evaluation of HUMUS, a research platform for a man portable Ground Penetrating Radar with classification capability. *Trials/tests completed*	SE
Trace explosives		
	Methodology	
	Test and Evaluation	
2.3.2.3	Test and evaluate the Mechem MEDDS and Nomadics Fido Detectors. *Archived*	US
2.3.2.4	Pre-Trial assessment of the Inscentinel system using bees for detection of explosives. *Archived*	UK
2.3.2.5	Test and evaluation of explosive detection dogs (EDD) for UXO clearance. *Trials/tests completed*	SE
Multi-sensor		
	Methodology	
	Test and Evaluation	
2.4.2.2	Test and evaluation of QinetiQ and ERA portable mine detectors. *Archived*	UK
2.4.2.3	Incorporate and test and evaluate acoustic vibration sensing in the Handheld STAnd-off MIne Detection System (HSTAMIDS). *Archived*	US
2.4.2.4	Assessment of the next generation of the ERA dual-sensor mine detector. *Archived*	UK
2.4.2.6	Handheld STAnd-off MIne Detection System (HSTAMIDS) Operational Field Trials and Demonstration. *Trials/tests completed*	US
2.4.2.7	Test and evaluation of dual sensors (TEDS). *Archived*	EC/JRC
2.4.2.8	Test and evaluation of two mobile UXO detection systems. *Trials/tests completed*	SE
Others		
	Methodology	
2.5.1.2	Multi Sensor Mine Signatures (MSMS). *Archived*	EC
	Test and Evaluation	
2.5.2.1	Infrared (IR) polarimetrics for detection of mines and tripwires. *Archived*	SE
2.5.2.3	Development of a camera system for faster area reduction. *Archived*	NL
2.5.2.4	Solar battery charging system (SBCS) *Archived*	US
2.5.2.6	Test and evaluation of magnets *Trials/tests completed*	SE
2.5.2.7	Magnetic clutter reduction quantification. *Trials/tests completed*	NL
2.5.2.8	Upgrade and test and evaluate the Geophex GEM-3 electromagnetic handheld sensor. *Archived*	US

2.2.3 MECHANICAL ASSISTANCE

Project Nr	Title	Lead
	Methodology	
3.1.2	Selection of surrogate target(s) for mechanical equipment test and evaluation. *Archived*	CA
3.1.5	CEN Workshop Agreement on test and evaluation of demining machines. *Archived*	SE
	Test and Evaluation	
3.2.1	Conduct test and evaluation trial of the mechanical equipment Armtrac 100. *Archived*	UK
3.2.2	Mechanical mine clearing device for anti-personnel mines MV-4. *Archived*	SE
3.2.3	Test and evaluation of small flail devices: Mini-Flail XM2670-A3 and Knee-Link Flail. *Archived*	CA
3.2.4	Conduct test and evaluation trials of mechanical equipment. *Archived*	US
3.2.5	Test and evaluation of the "MANTIS" Mine Clearing Survivable Vehicle (MCSV). *Archived*	US
3.2.10	Test and evaluation of Mechanical Assistance Equipment (MAE) for demining. *Archived*	DE
3.2.11	Test and evaluation of the Survivable Demining Tractor and Tools (SDTT) roller. *Archived*	CA
3.2.12	Rhino System. *Trials/tests completed*	US
3.2.14	Sifting Excavator (Mechanical Mine Sifter, Deep Buried Mine Excavator). *Archived*	US
3.2.15	Performance and survivability test of the mini-flail DIANA. *Archived*	SE
3.2.16	Field trial of the Minelifta Mk2. *Archived*	UK
3.2.17	Performance and survivability test of the Minecat 140. *Archived*	SE
3.2.18	Trial of the Armtrac 75 (Pre-Trial Assessment). *Archived*	UK
3.2.19	Tantra machines *Trials/tests completed*	US
3.2.22	Test and evaluation of the Bozena-4. *Archived*	CA
3.2.23	Test and evaluation of the RM-KA 02. *Archived*	CA
3.2.24	Test and evaluation of the Tempest Ground Penetrating Flail. *Trials/tests completed*	UK, CA
3.2.29	Test and evaluation of hammer heads for flail machines. *Archived*	SE
3.2.30	Test and evaluation of the Scanjack flail *Archived*	US
3.2.32	Pre-Trial Assessment (PTA) of the Digger D-2 *Archived*	CA
3.2.33	Bozena 5 Flail Test and Evaluation *Archived*	CA
3.2.34	MineWolf Test and Evaluation *Archived*	CA
3.2.35	MV 10 Test and Evaluation *Trials/tests completed*	CA
3.2.37	Mine Clearing Rake for small areas (MCR) *Archived*	US

3.2.41	Demonstration trial of the MV-4 and Bozena-4 mini-flails at the IMATC. *Archived*	CA
3.2.42	L90 AFEL and ALLU Crushing-Screening Bucket Test and Evaluation *Archived*	SE
3.2.44	Test and evaluation of the Mini MineWolf *Archived*	DE

2.2.4 MANUAL TOOLS

Project Nr	Title	Lead
	Methodology	
	Test and Evaluation	
4.2.1	Instrumented prodder product development path, phase A. *Archived*	NL

2.2.5 PERSONAL PROTECTION

Project Nr	Title	Lead
	Methodology	
5.1.1	Methodology for test and evaluation of Personal Protective Equipment (PPE). *Archived*	US
5.1.2	CEN Workshop Agreement (CW 26) on Test Methodology for Personal Protective Equipment (PPE) for use in Humanitarian Mine Action (HMA). *Archived*	SE, GICHD
	Test and Evaluation	
5.2.1	Test and evaluation of mine protective boots. *Archived*	US
5.2.2	Exploratory tests of personal protective equipment *Archived*	CA
5.2.3	Test and Evaluation of Personal Protective Equipment (ROFI) *Archived*	SE

2.2.6 NEUTRALISATION

Project Nr	Title	Lead
	Methodology	
	Test and Evaluation	
6.2.2	Development and test and evaluation of a Propellant Torch System (PTS). *Archived*	US
6.2.3	Develop and test and evaluate a High Performance Foamed Nitromethane Mine Neutralization System. *Archived*	US
6.2.4	Test and evaluation of pyrotechnical mine neutralisation means. *Archived*	DE
6.2.7	Test and Evaluation of pyrotechnical mine neutralisation means. *Archived*	SE
6.2.8	Mine Identification/Excavation System by Waterjet. *Trials/tests completed*	US
6.2.9	Humanitarian demining mine neutralisation technology evaluation. *Archived*	US

2.2.7 SERVICES

Project Nr	Title	Lead
	Input	
7.1.1	Investigate current criteria used to select equipment for test and evaluation. *Archived*	UK
7.1.5	Systematic inventory of test and evaluation activities, capabilities and needs in South Eastern Europe. *Archived*	EC/JRC
	Output	
7.2.6	Support to GICHD Study on Manual Demining. *Archived*	UK
7.2.7	Assistance to Test and Evaluation of COTS metal detectors. *Archived*	UK
7.2.8	Technical Consultancy to the Mines Advisory Group (MAG). *Archived*	UK
7.2.9	Follow up on CMAC request for advice on procedures for test and evaluation of demining equipment. *Archived*	SE
7.2.10	Support to the Japan Science and Technology Agency test and evaluation of dual-sensors in Croatia (Part One) *Archived*	DE
7.2.11	Support to the mechanical demining equipment demonstration at the 2007 Humanitarian Demining International Symposium *Archived*	CA
7.2.12	Support to the Japan Science and Technology Agency test and evaluation of dual-sensors in Croatia (Part Two) *Archived*	BE, CA

2.3 Project descriptions, including conclusions

2.3.1 SURVEY

Project Nr 1.2.1	
Title	Develop, test and evaluate a Minefield Marking Kit.
Description	Develop a mined area identification system (e.g., signs, pickets and fencing materials to clearly identify the minefields) from available commercial components that are easily adaptable to a wide variety of mine-afflicted countries. The identifying tools need to be constructed of weather resistant material, made of unattractive materials to pilferage, low maintenance and low cost, and conform with existing UN, as well as other recognised international standards. Once developed, the prototypes will be tested in real minefields.
Aim	Develop, test and evaluate a better minefield marking/identification system. Outcome - Mined Area Marking tool and test and evaluation report.
Request	Users, Donors, NMAAs, NGOs.
Category	Survey
Type	Test and Evaluation
Equipment	Minefield Marking Kit (MMK)
Development	COTS
Time frame	2003-01-01 to 2006-06-01
Place	United States, US CECOM-RDEC, NVESD, Countermine Division, Ft. Belvoir, VA, Humanitarian Demining Test Facility Ft. AP Hill, VA, and other countries.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Trials/tests completed
Comments	The project organised a workshop on Mined Area Marking in Pretoria, South Africa, on June 24-25, 2003. The *minutes* are available on the ITEP Reports website.
Results/conclusions	

Project Nr 1.2.3	
Title	Test and evaluation of EOD IS Survey, a computerised support system for mine action survey.
Description	Field test of the *EOD IS Survey system*. The system aims at transmitting collected information from the minefield directly to the International Management System for Mine Action (IMSMA) and at receiving updates from IMSMA to the field system.

Aim	Test and evaluate the capability: • to store field data in a pocket PC with a directly wireless transmission to a database (*IMSMA*) using IR or Bluetooth and • to receive updates from the IMSMA database to the handheld field system.
Request	Users, NMAAs, NGOs.
Category	Survey
Type	Test and Evaluation
Equipment	*EOD IS Survey* (Pocket PC, Digital camera, GPS, GPS / Binoculars)
Development	Prototype/Demonstrator
Time frame	2004-01-01 to 2004-12-31
Place	Switserland: GICHD (IMSMA), Sweden: SWEDEC (EOD IS), Chile, Albania, Ecuador, Peru, Guinea-Bissau
Lead nation	Sweden
Partners	*GICHD*
Point of contact	Per-Henrik Aberg (SWEDEC), per-henrik.aberg@mil.se or Alan Arnold (IMSMA), a.arnold@gichd.ch
Web site	http://www.swedec.mil.se/index.php?lang=eng&c=news&id=21231
Status	Trials/tests completed
Comments	• The *field test system* has been deployed in several mine affected countries (Chile, Albania, Ecuador, Peru, Guinea-Bissau). Preliminary results from the field indicated that the system was meeting or exceeding expectations in all areas. • The final test report is under development by the GICHD.
Results/conclusions	The EOD-IS Survey constitutes the basis of the *IMSMA handheld field data collection kit* . An improved and more powerful EOD-IS Survey tool is under development.

2.3.2 DETECTION

Project Nr 2.1.1.1	
Title	CEN Workshop Agreement on test and evaluation of metal detectors.
Description	This *CEN Workshop 07* is a process for creating a CEN Workshop Agreement (CWA) on the test and evaluation of metal detectors. It also includes training and experimental verification.
Aim	To achieve a comprehensive CEN Workshop Agreement (CWA) that improves the quality of metal detector test and evaluation.
Request	European Commission, ITEP, CEN.
Category	Detection - Metal detector
Type	Methodology
Equipment	N/A
Development	N/A
Time frame	2002-01-01 to 2007-12-31

Place	N/A
Lead nation	Germany/*BAM* (2006-2007), European Commission/*JRC* (2002-2005)
Partners	Belgium, Canada, Germany, Netherlands, Sweden, United Kingdom, United States, *UNMAS*, *GICHD*, *CEN*
Point of contact	Christina Mueller, Christina.Mueller@bam.de or Dieter Guelle, Dieter.Guelle@bam.de
Web site	
Status	Archived
Comments	• Full meetings of the Workshop (CEN Workshop 07) were held in December 2001 and April 2002. A Drafting Working Group met in June and September 2002 to progress the CEN Workshop Agreement. The third (and final) full CEN Workshop meeting took place in December 2002, approving the bulk of the Agreement. • The EC/JRC, original project coordinator, transferred the Workshop Secretariat to Germany/*BAM*, as the EC/JRC stopped all activities related to test and evaluation of humanitarian demining equipment as of the 1st of January 2006. • The Workshop was not formally reconvened in 2005/2006, it being considered more valuable to accumulate further experience with the existing CWA. • In the course of 2007, BAM has drafted a document, which should be considered as a Field User Guide for the CWA 14747. As BAM has stopped all activities related to test and evaluation of humanitarian demining equipment at the end of 2007, the Field User Guide will be handed to the ITEP Secretariat during 2008 for publication via the ITEP website. • After consultation with the original Workshop 07 participants, CEN has decided to extend the original CWA 14747 for another period of 3 years. It will be republished as CWA 14747 - Part one.
Results/conclusions	• The first issue of the *CEN Workshop Agreement CEN CWA 14747-2003 Test and Evaluation of Metal Detectors* was published in June 2003 and can be accessed at the ITEP website • Training and experimental verification of the CEN CWA 14747 - 2003 during a systematic test and evaluation campaign of COTS metal detectors (STEMD, ITEP Project 2.1.2.3) provided user feedback in order to review and update the 2003 document . Some first results of the experimental verification process were published in *Development Tests for Measuring the Detection Capabilities of Metal-Detectors*, available in the ITEP reports database. More recent experimental verification results and lessons learned can be found in the *Laos*, *Mozambique* and *Croatia* STEMD final reports. • Work has also continued on the procedure to test the effect of problematic soils on the performance of metal detectors. Details can be found in the report *Identifying and Obtaining Soil for Metal-Detector Testing* and the above-mentioned STEMD final reports, all available on the ITEP reports webpage. A separate CEN Workshop 07 activity (ITEP Project 2.4.1.2) on soil characterisation has started in November 2006 and intends to finalise the CWA 14747 - Part Two (soil characterisation) by mid 2008. • The article *Standardised Test and Evaluation of Metal Detectors* provides an overview of the CWA and can be accessed on the ITEP reports website.

Project Nr 2.1.1.2	
Title	Reliability model for metal detector evaluation.
Description	A proposal to investigate the application of reliability measures developed in NDT (Non Destructive Testing), to the detection of mines with metal detectors.
Aim	To design a standard way of making **statistical** evaluations of metal detector performance (in particular, detection reliability).
Request	Users of metal detectors.
Category	Detection - Metal detector
Type	Methodology
Equipment	Different types of metal detectors.
Development	COTS
Time frame	2003-01-01 to 2004-05-31
Place	• Germany: BAM (Berlin), Technical Centre 52 (German Army), • European Commission: JRC • Croatia: Centre for Testing, Development and Training (CROMAC - CTRO).
Lead nation	Germany/BAM
Partners	European Commission - Joint Research Centre (EC/JRC), CROMAC - Centre for Testing, Development and Training (CROMAC - CTRO)
Point of contact	Christina Mueller, christina.mueller@bam.de
Web site	
Status	Archived
Comments	• The project started in spring 2003 and has executed three series of metal detector trials. The last trial was carried out in the German Army WTD52 test facilities of Oberjettenberg in November 2003. • A *workshop* was held in December 2003 to discuss the results of the trials. *Conclusions and recommendations of the workshop* are available on the ITEP Reports website and the full proceedings can be accessed at the above-listed website. • Preliminary results have been published in the article *Proposals for Performance Demonstration and Modular Reliability Assessment for Humanitarian Demining*, available on the ITEP reports website, and final results have been published in the *Journal of Mine Action* and a *SPIE 2004 Conference paper.* • The project was archived in 2004. A continuation of this project (*Project 2.1.1.8*) started in April 2005
Results/conclusions	The *final report* is available on the ITEP reports website. The report includes a series of lessons learned for planning and executing reliability trials of metal detectors. The general conclusions state the following: • The trials were excuted according to the *CWA 14747:2003*. Some adaptations to the reliability testing section of the latter document are recommended, most important the orthogonal design of the test in combination with the use of ROC diagrams and POD curves. • No significant differences were found between the detection performance of either time-domain and frequency domain detectors or between specimens of the

	same detector model. • Experienced, skilled and active deminers should operate the detectors during the testing. • Simple approximate formulas for error bars are suitable for statistical representation of the field data. • The purpose of the reliability test is a comparison between detectors and not an estimate of the true performance of the detectors in the field.True performance in the field is higher than during the reliability tests, mainly due to a series of human factors.

Project Nr 2.1.1.4	
Title	Soil characterisation for assessment of metal detector performance.
Description	Canada conducted a study in order to define the information currently available in the numerous soil databases and to define the parameters and level of effort required to launch a longer term study. The longer-term study will examine the data requirements that are pertinent to metal detector performance, identify gaps in databases, and propose a field collection plan to cover the mine-affected countries.
Aim	To produce a database of soil characteristics which would assist developers and users to predict metal detector performance and associated problems in a geographical region.
Request	Developers, users
Category	Detection - Metal detector
Type	Methodology
Equipment	N/A
Development	N/A
Time frame	2004-06-01 to 2005-10-01
Place	Various, Bosnia and Herzegovina
Lead nation	Canada
Partners	European Commission - Joint Research Centre (EC/JRC)
Point of contact	Yoga Das, Yoga.das@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	• Placing a contract has been a difficult and lengthy process. The contract was finally signed in October 2004. • Work on organizing and georeferencing of the soil samples and populating the database has been completed. • Laboratory measurement of magnetic properties following training and equipment provided by Canada with help from Cranfield University has also been completed. • The Joint Research Centre(JRC) of the European Commission (EC) has contributed resources and awarded a contract to Cranfield University in the UK for detailed analysis of the soil magnetic susceptibility data.

Results/conclusions	• The short term study was completed in March 2003. Results of this short term study were summarised during the discussion day **Soil Electromagnetic Characteristics and Metal Detector Performance**, held at the European Commission (EC) Joint Research Centre (JRC) in December 2002. The *minutes* of this discussion day are available on the ITEP reports website. • The *UK National Soil Resources Institute*, under contract from the JRC/EC, has provided analysis of the data and produced a *report*, incorporating soil magnetic susceptibility maps of Bosnia and Herzegovina, which is available on the ITEP website. A CD-ROM containing the physical and magnetic-susceptibility data of all recovered/measured soil samples can be obtained from the *DRDC-Suffield*.

Project Nr 2.1.1.8	
Title	Reliability Model for Test and Evaluation of Metal Detectors
Description	Verify a proposal for optimum reliability trial design and evaluation strategies for test and evaluation of metal detectors under realistic field conditions, and set up of a modular model for optimization.
Aim	Achieve a realistic and affordable standard testing procedure, including the local Standard Operating Procedures, which allows to select the best suited device for specific application cases.
Request	Users of Metal Detectors
Category	Detection - Metal detector
Type	Methodology
Equipment	Different types of metal detectors.
Development	COTS
Time frame	2005-05-01 to 2007-12-31
Place	*BAM-Berlin*, *CROMAC-Centre for Testing, Development and Training (CTRO) Benkovac test facility* in Croatia
Lead nation	Germany
Partners	Croatia (CROMAC - Centre for Testing, Development and Training), German Research Project HuMin/MD (*ITEP Project 2.1.1.7*)
Point of contact	Christina Muller, Christina.Mueller@bam.de
Web site	
Status	Trials/tests completed
Comments	• This project is a continuation of the *ITEP Project* 2.1.1.2, which was archived in 2004. • The main trial took place from the 9th to the 31st of May 2005 in Benkovac, Croatia at the CROMAC-Centre for Testing, Development and Training (CROMAC - CTRO) test field. Results of this trial were discussed during a *Round Table discussion* held in Berlin, December 2005. Additional trials at the Benkovac test site in Croatia were organised during October 2006 and the final project results were discussed at the *January 2007 BAM-ITEP Workshop*. The final project report is due to be published at the end of February 2008. • In the course of 2007, BAM developed a software package to process metal

	detector reliability trial test data. This software will be made available via the ITEP website in 2008. • BAM stopped all activities related to test and evaluation of humanitarian demining at the end of 2007.
Results/conclusions	The *doctoral thesis of M. Gaal* provides an overview of the trials, together with detailed descriptions and a discussion of the trial design and obtained results. The focus of the thesis is mainly on the maximum detection height measurement and the detection reliability test. • Other results can be found in the articles *Reliability Tests for Demining* and *Trial Design for Testing and Evaluation of Metal Detectors Used in Humanitarian Landmine Clearance* published at the ITEP reports webpage.

Project Nr 2.1.2.3	
Title	Systematic test and evaluation of metal detectors - STEMD
Description	Systematic test campaign in order to assess the capabilities of the available commercial-off-the-shelf metal detectors. A two-stage approach was followed: • Test and evaluation under laboratory conditions, using the European Commission Joint Research Centre (EC/JRC) test facilities in Ispra and the tests described in the CEN Workshop Agreement for standardised metal detector testing (*CWA 14747-2003*), and • In-field tests in several mine-affected regions (South East Europe, Southern Africa, South East Asia), under realistic conditions using the CWA protocol. The latter opportunity was also used to collect environmental data influencing the suitability of metal detectors.
Aim	Assist mine action programme managers to make informed choices of metal detectors and to stimulate metal detector users to provide feedback on the CEN Workshop Agreement for standardised metal detector testing (CWA 14747-2003).
Request	Users, NMAAs, GICHD, UNMAS.
Category	Detection - Metal detector
Type	Test and Evaluation
Equipment	CEIA MIL-D1, CEIA MIL-D1/DS, EBINGER EBEX 421 GC, EBINGER EBEX 421 GC/LS, EBINGER EBEX 420 H-Solar, GUARTEL MD8+, FOERSTER MINEX 2FD 4.500, FOERSTER MINEX 2FD 4.500.01, FOERSTER MINEX 2FD 4.530, FOERSTER MINEX 2FD 4.510, MINELAB F3, MINELAB F1A4, MINELAB F1A4 UXO, SCHIEBEL ATMID, VALLON VMH3, VALLON VMH3(M), VALLON VMC1, VALLON VMH3CS, VALLON VMH3 CS UXO, SHRIMT M90, AKA-Condor 7252, AKA-Vector 7260
Development	COTS
Time frame	2004-01-01 to 2006-12-31
Place	European Commission - Joint Research Centre (EC/JRC), Laos, Mozambique, Croatia
Lead nation	Germany/*BAM* (2006), European Commission/*JRC* (2004-2005)
Partners	*GICHD*, *UNMAS*, United Kingdom, Belgium, Netherlands, *CROMAC - CTRO* (Croatia), *UXO-LAO* (Laos), *IND* (Mozambique), *CSIR* (South-Africa).

Point of contact	Dieter Guelle, Dieter.Guelle@bam.de or Christina Muller, Christina.Mueller@bam.de
Web site	
Status	Archived
Comments	• This project was complementary to Project 2.1.1.1 (CEN Workshop Agreement on test and evaluation of metal detectors), which focuses on training and experimental verification of the test and evaluation methodology described in the CWA 14747-2003. Supporting research on soil characterisation issues was also carried out within the framework of the STEMD project (see article on *soil reference height* available in the ITEP reports database) • *A comprehensive summary* of all three STEMD trials is available as an annex in the *GICHD Metal Detectors and PPE Catalogue 2007*.
Results/conclusions	• The first regional field trial (blind trial) was carried out in Laos during October-November 2004 with as main objectives to assess the current existing metal detectors, provide UXO-LAO with performance data for selection of future equipment and extend the application of the CWA 14747-2003 to small items of UXO. The *test report* is available on the ITEP reports website. • The second regional trial took place in May 2005 in Mozambique. It consisted of training on the CWA 14747-2003 and included tests concerning environmental influence (temperature, humidity, soil, EM interference, etc.) on metal detection. No blind trials were carried out in this regional trial.The associated *test report* is also available on the ITEP website. A report *summary article* has been published in the Journal of Mine Action. • The third and last regional trial, originally planned to take place in autumn 2005 was postponed by JRC/EC due to contractual difficulties and was finally carried out in September - October 2006 with Germany / BAM leading the trials. The Croatia STEMD trial was a reliability trial as well, and included several new detector models. It further looked more in detail at the human factor and its influence on the recorded metal detector performance. The *final report* of this last STEMD trial has been published at the ITEP website. • The *final report* on all metal detector laboratory tests conducted at the JRC within the STEMD project during the period November 2003 - January 2006 is also available at the ITEP website.

Project Nr 2.1.2.4	
Title	Assessment of Ultra Low Power Detector.
Description	Conduct a preliminary assessment of the Ultra Low Power Detector from Quest Technology Ltd. with the view to carrying out a more comprehensive trial dependant on the result.
Aim	Assessment of the Ultra Low Power Detector.
Request	United Kingdom Department for International Development (DFID).
Category	Detection - Metal detector
Type	Test and Evaluation
Equipment	Ultra Low Power Detector from *Quest technology Ltd.*
Development	Prototype/Demonstrator

Time frame	2004-03-01 to 2004-05-31
Place	United Kingdom
Lead nation	United Kingdom
Partners	
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	
Results/conclusions	• In February 2004, an initial assessment of the detector indicated that it would be worthwhile carrying out more intermediate testing, in accordance with the *CEN Workshop Agreement CWA 14747*. The results of the latter testing are documented in the *test report* published on the ITEP website. • In general, the report concludes that the Quest Technology Ltd. prototype detector shows promise as a simple, lightweight low power metal detector provided its detection performance, user interface and mechanical design can be more fully developed. • In light of the test results, further development and modifications, as specified by Quest Technology Ltd. in chapter 5 of the test report, will be carried out.

Project Nr 2.1.2.5	
Title	Evaluation of Metal Detector Arrays for Humanitarian Demining.
Description	Vehicle mounted metal detector arrays provide a capability to rapidly detect landmines on roads, tracks and open terrain. Using the CEN *CWA 14747* and the procedures developed by *The International Pilot Project for Technology Co-operation (IPPTC) report* on hand-held metal detectors, several vehicle mounted MD arrays will be tested and evaluated.
Aim	To provide a test and evaluation report on vehicle mounted metal detector arrays that are specifically designed for the detection of landmines.
Request	Users, donors
Category	Detection - Metal detector
Type	Test and Evaluation
Equipment	*Schiebel* VAMIDS, *Vallon* VMV8, Ebinger MD array, MineLab *STMR*
Development	COTS
Time frame	2006-02-28 to 2007-12-31
Place	Defence Research and Development Canada (*DRDC - CCMAT*
Lead nation	Canada
Partners	The Netherlands, Germany, United States
Point of contact	Kevin Russell, Kevin.Russell@drdc-rddc.gc.ca
Web site	
Status	Trials/tests completed

Comments	• During 2006, both the Vallon VMV8 and the Schiebel VAMIDS systems were evaluated at the Canadian Centre for Mine Action Technology (DRDC - CCMAT). Both Germany and The Netherlands provided direct assistance during the evaluation. • In the last two weeks of October 2007, the MineLab 3m STMR system and the Ebinger MD array were evaluated at DRDC - Suffield with the assistance of the Netherlands. The Ebinger MD array was made available to DRDC by the U.S. Humanitarian Demining Research and Developement Program • The final report, to be compiled and released in April 2008, will provide details on the cross-section variability, depth sensitivity (i.e. target detectability), speed dependency, repeatability and noise immunity of metal detector arrays.
Results/conclusions	

Project Nr 2.1.3.1	
Title	Metal Detector Trials: Detector Test Results and their Interpretation.
Description	A review of metal detector trials since 1997.
Aim	To analyse the results of the trials that have been performed to date to see what general conclusions can be drawn regarding detector performance in field trials, given knowledge of the detector type and its properties as measured in laboratory trials. The analysis will include a discussion of the implications for the test protocol *CWA 14747* and recommendations for further improvement.
Request	European Commission -Joint Research Centre (EC/JRC)
Category	Detection - Metal detector
Type	Output
Equipment	N/A
Development	N/A
Time frame	2006-01-01 to 2006-03-31
Place	European Commission - Joint Research Centre (EC/JRC)
Lead nation	European Commission
Partners	
Point of contact	Adam Lewis, adam.lewis@jrc.it
Web site	http://serac.jrc.it/
Status	Archived
Comments	The *final report* is available on the ITEP website. It collects the information split amongst the various reports published during the period 1997 - 2006 and analyses this information from a technical point of view to draw conclusions, amongst others, on the main factors influencing metal detector performance.
Results/conclusions	

Project Nr 2.2.2.1	
Title	Test and evaluation of existing Ground Penetrating Radar detectors.
Description	• Interested Ground Penetrating Radar manufacturers and research organisations will be invited to test their equipment. • Results and used methodologies will then be used for the definition of test and evaluation standards together with developers and operators.
Aim	Develop test and evaluation standards for Ground Penetrating Radar used for humanitarian demining.
Request	Users and donors.
Category	Detection - GPR
Type	Test and Evaluation
Equipment	Various
Development	N/A
Time frame	2002-01-01 to 2003-12-31
Place	Various
Lead nation	European Commission/JRC
Partners	Belgium, Netherlands, Sweden, United States
Point of contact	Adam Lewis, adam.lewis@jrc.it
Web site	
Status	Archived
Comments	As the main use of Ground Penetrating Radar for the future will be as part of a (multi)dual-sensor system, it was decided to archive this activity and focus on the test and evaluation of multi(dual)-sensors incorporating Ground Penetrating Radar (see Projects 2.4.2.4, 2.4.2.5, 2.4.2.6 and 2.4.2.7).
Results/conclusions	• The EC Joint Research Centre (JRC) has launched the process by organising a *workshop on Ground Penetrating Radar* in September 2002. This workshop was followed by a related workshop, focused on test and evaluation of Ground Penetrating Radar and the establishment of terrain suitability maps for Ground Penetrating Radar in March 2003, also at JRC, Ispra. The *proceedings* of this workshop have been published on the EC/JRC Humanitarian Demining website. • A meeting, with as main objective to try and kick-off a procedure to draft a best practise for test and evaluation of Ground Penetrating Radar was then held during the 2nd International Workshop on Advanced Ground Penetrating Radar (IWAGPR) in May 2003, Delft, the Netherlands. No agreement was reached between the different participants. However, as a result of this meeting, the Netherlands and the United States agreed to compile *a short draft document on the test and evaluation of Ground Penetrating Radar*, which is available on the ITEP Reports website.

Project Nr 2.2.2.2	
Title	Integrate and test and evaluate the man portable Energy Focused Ground Penetrating Radar (EFGPR).
Description	Integrate and implement real time advanced multi-Automatic Target Recognition (ATR) and information fusion into Ground Penetrating Radar to enhance ATR capabilities. Will increase mine detection capabilities and reduce false alarm rates.
Aim	Test and evaluate an improved Ground Penetrating Radar prototype as a mine detector comparing the EFGPR to the *GEM- 3*, *Stolar EDIT-2 and Stolar EDIT-3*. Outcome - Improved prototype and test report.
Request	Users, NMAAs, NGOs.
Category	Detection - GPR
Type	Test and Evaluation
Equipment	*Energy Focusing Ground Penetrating Radar (EFGPR)*
Development	Prototype/Demonstrator
Time frame	2002-03-01 to 2002-12-31
Place	United States, CECOM-RDEC, NVESD.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *test report* is available on the ITEP website. The EFGPR was tested as part of a trial of four systems: the Geo-Centers Energy-Focused Ground-Penetrating Radar (EFGPR), Geophex Mine Detector and Discriminator (GEMâ€“3), and Stolar Electromagnetic-Wave Detection and Imaging Transceivers (EDITâ€“2, EDITâ€“3). The test report includes the following conclusions: • The EPGR performance was better on road than off road. AT mines were detected at higher rates than AP mines, regardless of depth and metal content. • For the GEM-3, the ATâ€“LM mine category was the most challenging for detecÂtion. The road condition generally had little impact on detector performance, except for the APâ€“LM category, where the probability of detection was lower off road. The GEM-3 was generally very sensitive to objects of higher metal content. • The Stolar EDIT-2 performance had a detection rate for AT mines that was higher than for AP mines. Within the AT and AP categories, the detection rates for metal mines were slightly higher than those for low-metal mines. Off road, AP detection was better than on road, but AT detection was worse. • The Stolar EDIT-3 had a detection rate for AT mines was higher than for AP mines. Within the AT and AP categories, the detection rates for metal mines were slightly higher than those for low-metal mines. In most cases, the road condition did not affect the EDIT-3 performance significantly, except for the APâ€“M category where the probability of detection was higher off road.

Project Nr 2.2.2.5	
Title	Test and evaluation of HUMUS, a research platform for a man portable Ground Penetrating Radar with classification capability.
Description	Field test of the research platform HUMUS developed at the Swedish Defence Research Agency, FOI. The system has an advanced signal processing capability for real time detection and classification of AT mines.
Aim	Test and evaluate a Ground Penetrating Radar with advanced real time signal processing as a mine detector. Outcome - Improved algorithms for target detection and classification and test report.
Request	Users, NMAAs, NGOs.
Category	Detection - GPR
Type	Test and Evaluation
Equipment	HUMUS
Development	Research/Development
Time frame	2003-10-01 to 2003-10-30
Place	Sweden, SWEDEC
Lead nation	Sweden
Partners	European Commission - Joint Research Centre (EC/JRC)
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Trials/tests completed
Comments	A *news item* on the trial is available on the SWEDEC website.
Results/conclusions	The report is available in Swedish. The English translation is under development.

Project Nr 2.3.2.3	
Title	Test and evaluate the Mechem MEDDS and Nomadics Fido Detectors.
Description	Test and evaluate the Mechem Explosive, Drug, Detection System (MEDDS) and Nomadics Fido TNT detector in live minefields in Croatia for validation.
Aim	Develop, test and evaluate an area reduction system based on vapor detection. Outcome - Test report.
Request	Users and donors.
Category	Detection - Trace explosives
Type	Test and Evaluation
Equipment	*Mechem Explosives and Drug Detection System (MEDDS)*, *Fido*
Development	Prototype/Demonstrator
Time frame	2002-04-01 to 2003-06-30

Place	United States, CECOM-RDEC, NVESD, and Croatia.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *test report* is available on the United States Humanitarian Demining Program and the ITEP Reports website. *Some of the results* are also discussed in a Journal of Mine Action publication. The test report states that five comparative test samplings have taken place in Croatia at the designed test site. In every sampling both MEDDS and Fido detected the presence of explosive vapour. This pointed towards the ability of both systems to detect the presence of trace explosives in an area containing landmines. In retrospect the test field layout did not allow for the clear identification of areas free of landmines with any amount of certainty. Taking into consideration that both MEDDS and Fido have been designed as area reduction systems rather than mine detection systems, the focus should have been on such areas. It is recommended that a more effective test/test field be used to remedy this situation in the future to determine areas free of landmines with a greater degree of certainty.

Project Nr 2.3.2.4	
Title	Pre-Trial assessment of the Inscentinel system using bees for detection of explosives.
Description	Conduct a preliminary assessment of the Insense system using bees for detection of explosive detection with the view to carrying out a more comprehensive trial dependant on the result.
Aim	Assessment of the Inscentinel system using bees as a method of explosive detection.
Request	United Kingdom Department for International Development (DFID).
Category	Detection - Trace explosives
Type	Test and Evaluation
Equipment	*Inscentinel system*
Development	Prototype/Demonstrator
Time frame	2004-01-04 to 2004-01-09
Place	United Kingdom
Lead nation	United Kingdom
Partners	
Point of contact	David Lewis, baric@btconnect.com
Web site	

Status	Archived
Comments	An initial visit to the Inscentinel Laboratories in order to perform a pre-trial assessment (PTA) took place in January 2004. Release of the PTA report for publication is currently being considered.
Results/conclusions	• The Pre-Trial Assessment (PTA) concluded that the technique appears to have potential for use in mine detection as a convenient and cost effective alternative to dogs, although at the time of the visit the system was limited to laboratory use only (see *summary of notes*). Support for further development of the techniques was recommended. • Further testing of the inscentinel system for demining purposes will depend on the future development of the product.

Project Nr 2.3.2.5	
Title	Test and evaluation of explosive detection dogs (EDD) for UXO clearance.
Description	The project will assess the potential of explosive detection dogs to find UXO in range clearing operations.
Aim	Test report
Request	SWEDEC
Category	Detection - Trace explosives
Type	Test and Evaluation
Equipment	Dogs
Development	COTS
Time frame	2005-04-01 to 2006-12-31
Place	Sweden
Lead nation	Sweden
Partners	
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Trials/tests completed
Comments	• Dog detection methods are considered to be a dual-use clearance technology. Assessment of their potential for UXO clearance of ranges can have important spin-offs for the humanitarian landmine clearance problem. • Monthly tests were carried out, in the same test area using different dogs. The tests were blind for the dog handler.
Results/conclusions	• Some preliminary results of the long-term study are listed here: - Dogs only indicate objects containing explosives and skip metal scrap. - Search time and area covered are directly related to the number of indications. - Two dogs per team are used. Single indications are sometimes false (probably due to contamination by TNT), but double indications are always true. Hence, two dogs provide a much higher probability of detection than one. • The final report of the long-term study is available in Swedish. The English translation is under development

	• A *summary report* of a shorter study carried out in November 2006 to assess the potential of long leash Explosive Detection Dog teams to assist in the clearance of former shooting ranges is available on the ITEP website. • A *report* on a test by the Mines Advisory Group (MAG) to investigate the feasibility of integrating Explosive Detection Dogs (EDD) into UXO clearance activities in the Lao PDR has also been made available at the ITEP reports website.

Project Nr 2.4.2.2	
Title	Test and evaluation of QinetiQ and ERA portable mine detectors.
Description	To conduct independent development tests on two government funded projects on portable handheld mine detectors using Ground Penetrating Radar and Metal Detector technologies.
Aim	Test reports.
Request	Developers and the funding organisation.
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	QinetiQ handheld mine detector (*Portable Humanitarian Mine Detector, PHMD*) and ERA handheld mine detector (*Minetect*).
Development	Prototype/Demonstrator
Time frame	2002-07-01 to 2003-12-31
Place	United States, Humanitarian Demining Test Facility, Ft. AP Hill, VA.
Lead nation	United Kingdom
Partners	United States
Point of contact	David Lewis, baric@btconnect.com or Lee Offen, lee.offen@nvl.army.mil
Web site	
Status	Archived
Comments	Full reports of the initial tests executed at the United States test facility A.P. Hill in 2002 will not be released publicly because they contain commercially sensitive information.
Results/conclusions	• A *trial report* on the QinetiQ Portable Humanitarian Mine Detector (PHMD) 2003 US Trials is available on the ITEP Reports website. The report concludes that the initial results are encouraging, and that the increased number of scans per square will assist greatly in determining the presence of mine-like objects. However, further work is required to reach the full potential of the PHMD sensor. • A *summary report* on the 2002 US trials with the ERA Dual Sensor is available at the ITEP reports webpage. The 2003 trials did not deliver significantly different results from the 2002 trials. Trial results are also included in an *article on the Minetect*, presented at the EUDEM2-SCOT, 2003 Conference and available at the ITEP reports webpage.

Project Nr 2.4.2.3	
Title	Incorporate and test and evaluate acoustic vibration sensing in the Handheld STAnd-off MIne Detection System (HSTAMIDS).
Description	Incorporation of a confirmation sensor into the Handheld STAnd-off MIne Detection System (HSTAMIDS) using acoustic vibration sensing technology to characterise buried land mines. The confirmation sensor could raise the HSTAMIDS Probability of Detection (Pd) and lower the False Alarm (Fa).
Aim	Upgrade, test and evaluate the modified Handheld STAnd-off MIne Detection System (HSTAMIDS) mine detector. Outcome - Prototype hardware and test report.
Request	Users, Donors, Developer, Manufacturer.
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	*HSTAMIDS*
Development	Prototype/Demonstrator
Time frame	2003-04-01 to 2006-03-01
Place	United States, CECOM-RDEC, NVESD, Humanitarian Demining Test Facility, Ft. AP Hill, VA.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *final report* is available at the ITEP website. The report describes the vibrometer system, the data collection and data analysis. Acoustic vibration data from a variety of mine and clutter types were collected to support the evaluation of hardware and algorithm performance, development and training of the target classifier, and ultimately, to assess the feasibility of implementing a handheld vibrometer mode within the HSTAMIDS. Data analysis using a trained classification algorithm shows that mines can be distinguished from clutter better than 85% of the time, while maintaining the HSTAMIDS initial detection at 100%, and hence validates the feasibility of implementing a handheld radar vibrometer within the HSTAMIDS platform. Future efforts should include complete integration of the vibrometer mode within the HSTAMIDS architecture and extensive data collection to further develop the robustness of the classifier.

Project Nr 2.4.2.4	
Title	Assessment of the next generation of the ERA dual-sensor mine detector.
Description	Assessment of the ERA/Vallon MINETECT/MINEHOUND mine detector. A first trial will be executed in UK with the following objectives: • Verify and compare the performance of the latest models of the ERA dual sensor detector (MINETECT and MINEHOUND),

	• Train new operators and enhance the training package, and • compare the detection performance of new and experienced operators. A second trial phase will be run in-country and will consist of a long term test (several months) of the detector in a real demining scenario. It is envisaged that the detector will be evaluated during Mines Advisory Group (MAG) and Norwegian Peoples Aid (NPA) field operations.
Aim	Assessment of the next generation of the ERA dual-sensor mine detector.
Request	United Kingdom Department for International Development (DFID).
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	ERA dual sensor mine detector (*MINETECT* and MINEHOUND TM VMR1).
Development	Prototype/Demonstrator
Time frame	2004-12-01 to 2006-03-31
Place	UK (QinetiQ Hurn test site), Cambodia, Angola, Bosnia
Lead nation	United Kingdom
Partners	*Mines Advisory Group (MAG)*, *Norwegian Peoples Aid (NPA)*, Belgium, Canada, Germany, European Commission - Joint Research Centre (EC/JRC), The Netherlands, United States
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	• The trial detection data sheets were made available to the trial participants for their own analysis. • Additional research on electromagnetic soil property variability and its effect on the detection performance of a dual-sensor system was carried out by the Netherlands in the framework of this project. Results have been published in the ITEP reports/publications database (*article 1*, *article 2*). • The ERA/Vallon dual-sensor mine detector trials are supporting the efforts of the ITEP working group on T&E of dual(multi) sensors (WGMS) to draft a best practice for T&E of dual(multi) sensor mine detectors. In this context some *additional tests* were also carried out by the Netherlands during the in-country MineHound trial in Cambodia.
Results/conclusions	• For the tests executed at the Hurn test facility during the first project phase, a *test report abstract* was made available. The full report can be obtained from DfID. • The *final report* of the in-country trials in Cambodia, Bosnia and Angola is available on the ITEP website. Over 3000 alarm encounters in live minefields were recorded during the trials. 100% of the mines encountered in live minefields with the existing in-service metal detector were detected by deminers using the MINEHOUND TM. Furthermore, an overall improvement of greater than 5 to 1 in false alarm was obtained in the live minefields. • Two separate internal ITEP reports have been published documenting the lessons learned from the participation of ITEP invigilators in the MINEHOUND detector trial, as well as comments on the ITEP invigilator tasks/role. • The in-country trials with operational deminers contributed to optimising the

	production design and the MINEHOUND TM was jointly prepared by *ERA Technology* and *Vallon GmbH* for product release (*MINEHOUND TM VMR2*) at the end of 2006.

Project Nr 2.4.2.6	
Title	Handheld STAnd-off MIne Detection System (HSTAMIDS) Operational Field Trials and Demonstration.
Description	This project will deploy the current Handheld STAnd-off MIne Detection System (HSTAMIDS) for field trials and demonstrations in a variety of humanitarian demining locations. In 2005 and 2006, the system was deployed to Thailand, Namibia and Afghanistan for field trials and demonstrations.
Aim	Operational field trial (test and evaluation) of the Handheld STAnd-off MIne Detection System (HSTAMIDS) handheld detector. Outcome - Demonstration and test report.
Request	Users, Donors, NMAAs
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	Handheld STAnd-off MIne Detection System (*HSTAMIDS*)
Development	COTS (fielded military system, to be used in humanitarian demining by special arrangement with the U.S.Department of Defense)
Time frame	2004-01-01 to 2007-06-31
Place	Thailand, Namibia, Afghanistan
Lead nation	United States
Partners	Canada, Netherlands, Sweden, United Kingdom, Thailand Mine Action Center (*TMAC*), *Halo Trust*, People Against Landmines (*MgM*)
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Trials/tests completed
Comments	• *The Thailand*, Namibia and Afghanistan field trials were completed at the end of 2005. • *Emerging results* from the Thailand trial were made available in the summer of 2005. • *Emerging results* from the Namibia trial were made available in the spring of 2006. • A *summary article* on the trials has been published in the Mine Action Technology Newsletter, issue 4. The final trial reports are expected to be released soon.
Results/conclusions	

Project Nr 2.4.2.7	
Title	Test and evaluation of dual sensors (TEDS).
Description	Test and evaluate available new dual sensors for humanitarian demining, first in laboratory conditions and later in more realistic conditions in one mine affected country.
Aim	Validation of the potential of such advanced detection equipment for humanitarian demining applications and development of test standards.
Request	European Commission, end users.
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	MINEHOUND TM, (HSTAMIDS), (ALIS), SHRIMT M90
Development	Prototype/Demonstrator
Time frame	2005-01-01 to 2006-06-30
Place	European Commission - Joint Research Centre (EC/JRC), Ispra
Lead nation	European Commission - Joint Research Centre (EC/JRC)
Partners	
Point of contact	Adam Lewis, Adam.lewis@jrc.it
Web site	
Status	Archived
Comments	• The European Commission - Joint Research Centre (EC/JRC) contributed to the UK-led dual-sensor testing (*Project 2.4.2.4*) during the second half of 2005. • Copies of the MINEHOUND TM and the SHRIMT M90 were procured and tested. Originally it was also planned to test the HSTAMIDS dual sensor. However, the HSTAMIDS remains under ITAR restrictions, preventing free sale, and publication of test results except with the US State Department approval. As the EC/JRC contract to conduct test and evaluation of humanitarian demining equipment ended at the end of 2005, this project has been terminated without testing the HSTAMIDS. • The Ec/JRC organised a demonstration of the HSTAMIDS and the ALIS at the JRC/EC test lanes.
Results/conclusions	The *final report* is available at the ITEP website. The report confirms that the HSTAMIDS and the MINEHOUND TM dual-sensor detectors are fully developed products with credible performance, the HSTAMIDS being slightly more mature. The SHRIMT model 90 is a fully developed product but with lesser performance, especially with regard to its radar. ALIS is an advanced concept with very interesting capabilities but at an earlier stage of development. The most important conclusion is that dual-sensor technology has moved ahead significantly during the last three years and devices have now reached high levels of technology readiness.The dual sensor remains a leading candidate for improving efficiency, providing that the cost-benefit balance can be shown to be favourable.

Project Nr 2.4.2.8	
Title	Test and evaluation of two mobile UXO detection systems.
Description	The two systems to be tested are vehicle-mounted dual sensor systems based on a pulsed electromagnetic system and a passive magnetometer.
Aim	Test and evaluate the two techniques in order to select the most suitable system for clearing of UXO (20 mm calibre and larger) down to 3 m depth in old shooting ranges in Sweden.
Request	Swedish National Fortification Administration.
Category	Detection - Multi-sensor
Type	Test and Evaluation
Equipment	Blackhawk UXO Services and Countermine Operations AB
Development	Prototype/Demonstrator
Time frame	2004-02-25 to 2006-12-31
Place	Sweden, SWEDEC
Lead nation	Sweden
Partners	
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Trials/tests completed
Comments	• Because these tests were part of the Swedish equipment procurement process it was difficult to actively involve ITEP members in the test. However, interested ITEP members were invited to attend the tests as observer. • The report is available in Swedish. The English translation is under development.
Results/conclusions	

Project Nr 2.5.1.2	
Title	Multi Sensor Mine Signatures (MSMS).
Description	Extension of the existing database of measurements made at the EC Joint Research Centre (JRC) test site with new sensors and further data from previously used sensors.
Aim	Provision of sensor and background environmental data for research and development in data fusion and similar techniques.
Request	Developers and manufacturers.
Category	Detection - Others
Type	Methodology
Equipment	N/A

Development	N/A
Time frame	2002-01-01 to 2003-12-31
Place	European Commission - Joint Research Centre (EC/JRC)
Lead nation	European Commission
Partners	Belgium (RMA), Germany (DLR, FGAN, Kayser-Threde GmbH)
Point of contact	Adam Lewis, adam.lewis@jrc.it
Web site	http://demining.jrc.it/msms/
Status	Archived
Comments	
Results/conclusions	• The *final report* is available on the ITEP reports and the MsMs website. • During the lifetime of the project (2000-2003) a large amount of data has been acquired whereby the test field has been scanned by all the main mine sensor types, with the exception of sensors for explosives detection. For the first time the data has been made available to the public, essential in-order to transfer the data to the sensor fusion community. • It is recognized that the use of the database has been less than expected. The size of the research community in data fusion is large but only a few people are working on demining and they are often contractually restricted to specific data sets. With hindsight it would have been preferable to establish closer links with specific data fusion research groups in the project definition phase. It is indeed very difficult for the fusion community to interpret the data correctly without direct access to the people who measured it, and it is very difficult for the measurement teams to document all details required for optimal fusion without direct access to the people who want to fuse it.

Project Nr 2.5.2.1	
Title	Infrared (IR) polarimetrics for detection of mines and tripwires.
Description	Field test of promising technology for detection of surface laid mines and trip wires under investigation at the Swedish Defence Research Agency, FOI.
Aim	Test and evaluate the usefulness of the polarimetric information in thermal imaging as a detection technique. Outcome - Test report.
Request	Users, NMAAs, NGOs.
Category	Detection - Others
Type	Test and Evaluation
Equipment	N/A
Development	Research/Development
Time frame	2003-10-01 to 2003-10-31
Place	Sweden, SWEDEC
Lead nation	Sweden
Partners	
Point of contact	Anders Tengbom, anders.tengbom@mil.se

Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	The Netherlands executed similar tests with polarised visible light for AT landmine detection. For more information on the latter tests see *Project 2.5.2.3*.
Results/conclusions	The *test report* can be found on the ITEP reports webpage. The report concludes that, with the present equipment, it is very difficult to distinguish man-made objects from the surrounding terrain and that it is not possible to detect tripwires. Furthermore, the analysis of the images has proven very time-consuming. SWEDEC therefore concludes that the localisation of landmines is more accurately done using binoculars than using the IR polarised light from the Thermovision 900 camera. SWEDEC is of the opinion that it is difficult to see how the tested system could contribute to mine and UXO detection in a rational and cost-effective way.

Project Nr 2.5.2.3	
Title	Development of a camera system for faster area reduction.
Description	In this project a low cost camera system that uses polarisation features of visible light is developed for faster area reduction and/or road clearance. The camera system will be mounted on a mechanical minefield area reduction asset or on a mechanical road clearance asset. The automatic detection system will give an audible alarm in order to let the operator stop the mechanical asset before it detonates a mine.
Aim	Development and implementation of a camera system for faster surface-laid mine detection.
Request	
Category	Detection - Others
Type	Test and Evaluation
Equipment	Polarised Camera System for landmine Detection (Visible light camera system, mounted on a mechanical mine clearance or mine detection asset)
Development	Research/Development
Time frame	2003-07-01 to 2005-10-31
Place	The Netherlands Engineers Education and Training Centre of the Royal Netherlands Army (OTC Genie).
Lead nation	The Netherlands
Partners	Halo Trust
Point of contact	Wim de Jong, Wim.deJong@tno.nl
Web site	
Status	Archived
Comments	The concept has been developed and tested in a static setup during the summer of 2003. Field demonstrations of the demonstrator system, i.e. a visible light polarisation camera mounted on a moving vehicle, at a Royal Netherlands Army test site in the Netherlands, have been carried out in June and October 2005.

Results/conclusions	• Results of the landmine detection tests with a static visible light camera are detailed in the interim report *Development of Camera System for Landmine Detection: Results of Phase 2*, which is available at the ITEP Reports webpage. The interim report concludes that on the basis of the test results with the static visible light camera, the use of polarisation features for the detection of AT mines seems feasible. However, attention should be paid to the robustness of the polarisation against environmental factors. • The final project report *Development and construction of a camera system for landmine detection*, also available on the ITEP website, includes a description of both the demonstrator camera system and the demonstrations that have been given with the system. The report concludes that the constructed polarisation camera is applicable in landmine detection scenarios, as well as in other detection scenarios, i.e. road proving, road-side inspection and detection of improvised explosive devices. • The following project results have been accomplished: - A polarisation camera, without any moving parts, has been constructed. This camera is robust and can be mounted on a moving platform. The camera is a unique polarisation measurement system. - Detection software has been developed. With this software, landmines can be detected automatically in images that are recorded with the polarisation camera. The detection results can be visualised in the recorded images. - Two field demonstrations have been given with the camera system mounted on a wheel loader. At these demonstrations, recordings have been made of surface laid mines. Enhanced polarisation contrast has been shown in real time. Mines have been detected automatically in off-line processing.

Project Nr 2.5.2.4	
Title	Solar battery charging system (SBCS)
Description	In the 2002 U.S. Humanitarian Demining Research and Development User Requirements Workshop, deminers identified the need for rechargeable battery technology. The project will modify a commercial suitcase-sized solar battery charging system for use in humanitarian demining. The UN Accelerated demining Programme (ADP) will perform field trials in Mozambique.
Aim	Modify and test and evaluate a solar battery charging system (SBCS) as an alternative battery replacement. Outcome - Prototype hardware and test report.
Request	Users, Donors, NGOs, NMAAs, Developer, Manufacturer, UN Accelerated Demining Program (ADP) Mozambique.
Category	Detection - Others
Type	Test and Evaluation
Equipment	Commercial suitcase-sized solar battery charging system.
Development	Prototype/Demonstrator
Time frame	2003-03-01 to 2006-10-01
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Ft. AP Hill, VA, and Mozambique.
Lead nation	United States
Partners	IND (Mozambique)

Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	A short *report* describing the solar battery charging system and its capabilities is available at the ITEP reports website.The SBCS is a complete Photo Voltaic (PV) power generation, processing, storage and conversion system in a convenient compact package. The kit consists of a main system case, a large storage case with wheels and a 12 VDC storage battery case. The Power Suitcase with External Connectors can be operated in dusty and adverse environments. The SBCS underwent an operational field evaluation in Mozambique in October 2004. User feedback was collected for incorporation of upgrades into the SBCS.

Project Nr 2.5.2.6	
Title	Test and evaluation of magnets
Description	The project consists of two modules. The first module will be executed by SWEDEC, upon request by the GICHD, and will assess basic permanent magnet capabilities (power, stand-off, etc.) for clutter removal purposes. The second module will be carried out by Sweden as part of the program to assess suitable techniques for UXO clearance of test ranges and will also evaluate electro-magnets.
Aim	Test report
Request	GICHD, SWEDEC
Category	Detection - Others
Type	Test and Evaluation
Equipment	Various permanent and electro-magnets
Development	COTS
Time frame	2005-02-15 to 2006-09-30
Place	Sweden
Lead nation	Sweden
Partners	GICHD
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?dontaddcount=1&id=11931
Status	Trials/tests completed
Comments	
Results/conclusions	• The *test report* on the trial with the permanent magnet is available on the ITEP reports webpage. The report attempts to provide answers to the following questions: - What is the practical sweep height for a magnet, - At which magnetic flux density is all metal that is lying on the soil surface or close to the soil surface picked up and is it depending on the fragment size,

	- Is it possible for a magnet to pull up fragments buried in the soil and if so how is it dependent on depth, fragment size, magnet strength and soil compaction. • Further results are planned to be published in a GICHD study on the use of magnets, which will be released in the future. A summary of the SWEDEC trial with permanent magnets can also be found in a *related presentation* at the 2005 NDRF Summer Conference. • The trials with large electro-magnets have also been completed and the associated test report is available in Swedish. The English translation is under development.

Project Nr 2.5.2.7	
Title	Magnetic clutter reduction quantification.
Description	Selection of hand-held permanent magnet suitable for removal of metallic clutter that is on the minefield surface. Set-up of training procedure for the use of the magnet by indigenous deminers. In-country recording of the reduction of metallic clutter on the ground surface for metal detectors by using the selected magnet, to be done in actual demining operations by NGOs in three representative countries world-wide. Analysis of the data, reporting with statement on the clutter reduction factor of the magnet and recommendations on the use of magnets for clutter reduction.
Aim	Quantification of the metallic clutter reduction by the use of a hand-held magnet in humanitarian demining operations.
Request	*GICHD*, *UNMAS*
Category	Detection - Others
Type	Test and Evaluation
Equipment	Hand-held permanent magnet and magnet-tools
Development	Prototype/Demonstrator, COTS
Time frame	2006-08-01 to 2008-04-30
Place	*TNO*, The Hague, The Netherlands; Cambodia; Angola
Lead nation	The Netherlands
Partners	Cambodian Mine Action Centre (*CMAC*), Norwegian People Aid (*NPA*)
Point of contact	Arnold Schoolderman, arnold.schoolderman@tno.nl
Web site	
Status	Trials/tests completed
Comments	• Preliminary results of the first trial in Cambodia, which took place during the last quarter of 2006, are available in an article published in the *Mine Action Technology Newsletter, Issue 5* • During May - June 2007 a second data acquisition phase in an area clearance operation was carried out in the Kwanza Sul province in Angola, with the assistance of Norwegian People Aid (NPA). The third and final two-month data acquisition phase in a road clearance operation, also with NPA in the Angolan Malanje province took place in October - November 2007. • A *presentation* on the magnetic clutter reduction quantification project was given at the UXO Countermine Forum 2007

Results/conclusions	The final report will be published in the first quarter of 2008.

Project Nr 2.5.2.8	
Title	Upgrade and test and evaluate the Geophex GEM-3 electromagnetic handheld sensor.
Description	Further refine the mine classification codes based on the strength and weakness of each discrimination code, develop operational codes for real-time mine detection and classification, and, write a new operation software for the palmtop in an environment similar to Windows.
Aim	Upgrade, test and evaluate the Geophex GEM-3 mine detector. Outcome - Prototype hardware and test report.
Request	Users, Donors, NMAAs, NGOs.
Category	Detection - Others
Type	Test and Evaluation
Equipment	*Geophex GEM-3*
Development	Prototype/Demonstrator
Time frame	2002-04-01 to 2004-06-30
Place	United States, CECOM-RDEC, NVESD, Ft. AP Hill, VA.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *test report* is available on the ITEP website. It concludes that the GEM-3 was overall more sensitive to mines and characterized clutter with larger metal content, as well as to mines buried less deeply. Because of their low metal content and greater burial depths, mines in the ATâ€“LM category had a probability of detection significantly lower than those for the other three mine categories. The road condition generally had little impact on the mine probability of detection. The background false alarm rate was significantly higher off road than on road, and the probability of detection for emplaced clutter was lower off road than on road. The GEM-3 also did a good job discriminating specific mines that it detected, and in many cases, was able to identify mine models with few if any misclassifications.

2.3.3 MECHANICAL ASSISTANCE

Project Nr 3.1.2	
Title	Selection of surrogate target(s) for mechanical equipment test and evaluation.
Description	Available surrogate mines/test devices will be assessed for the ability to provide realistic and reliable test and evaluation data. Factors such as repeatability, ease of use, cost, and realistic response to machine action will be assessed. Input from ITEP partners, and users will be required.
Aim	Recommend surrogate mine targets which are practical and suited for providing reliable performance data of mechanical demining equipment.
Request	Users, developers, test and evaluation agencies.
Category	Mechanical Assistance
Type	Methodology
Equipment	N/A
Development	N/A
Time frame	2002-12-02 to 2006-12-31
Place	Various
Lead nation	Canada
Partners	
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca or William Roberts, William.Roberts@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	New test targets (*WORM - Wireless Operated Reproduction Mines*) to meet the *CEN Workshop Agreement on T&E of Demining Machines (CWA 15044)* requirement have been developmed during 2004-2005. Results of trials with these targets show that the data is very similar to the results seen when using the live-fuze-inert-body targets at SWEDEC. Details can be obtained from CCMAT.
Results/conclusions	• Some test results of the performance of Mechanical Reproduction Mines (MRMs) are given in the *ProMac BDM48 test report*, available on the CCMAT and ITEP Reports webpages. Note that CCMAT no longer uses the Mechanical Reproduction Mines. It now uses the above-mentioned WORM targets for all testing of mechanical demining equipment. • For detailed information on the WORM targets please refer to Geoff Coley (tel: +1 403 544 4046) or William Roberts (tel: +1 403 544 4756).

Project Nr 3.1.5	
Title	CEN Workshop Agreement on test and evaluation of demining machines.
Description	The CEN Workshop is a process for creating a *CEN Workshop Agreement (CWA)* on the test and evaluation of mechanical equipment used in humanitarian demining. The three main topics that will be covered are: • the definition of specifications for performance testing and survivability testing in repeatable conditions, • the definition of performance specifications for target mines and • the definition of specifications for acceptance tests including field performance, logistics, operator safety, and the operational classification of machines.
Aim	To achieve a comprehensive CWA that improves the quality of the test and evaluation of mechanical equipment used in support of humanitarian mine action such as ground preparation, removal of vegetation, and clearance.
Request	European Commission, ITEP, CEN.
Category	Mechanical Assistance
Type	Methodology
Equipment	N/A
Development	N/A
Time frame	2003-06-03 to 2004-10-31
Place	Sweden/SWEDEC and Croatia/CROMAC-CTRO
Lead nation	Sweden
Partners	Canada, Germany, United Kingdom, United States, *UNMAS*, *GICHD* and *CEN*, CROMAC - Center for Testing, Development and Training (*CROMAC - CTRO*), Norwegian People Aid (*NPA*), International Trust Fund for Demining and Mine Victim Assistance (*ITF*), Manufacturers (Scandinavian Demining Group, DD Special Vehicles Ltd., Dok Ing d.o.o)
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	• The kick-off of the CWA process was held on the 3rd of June 2003, with the presentation of the Business Plan. The first two technical meetings for the CWA12 were held concurrently at SWEDEC in Eksjo, Sweden, from the 15th to the 18th of September. During these two meetings the first steps towards a CWA for performance testing, survivability testing and also the definition of test targets required for these tests were laid down. Representatives of the user community, GICHD, manufacturers of demining machines, donors and the testing agencies attended these meetings. Five ITEP participants were represented. The third CEN Workshop meeting has been organised in cooperation with the Croatian Mine Action Centre (CROMAC) in Zagreb, Croatia, and took place from the 14th to the 16th of October 2003. It had as main aim the consolidation of what had been proposed so far, together with the development of the technical basis for specification of acceptance tests. • A draft CEN Workshop Agreement (CWA) was distributed at the beginning of January 2004 for final revision before delivery to *CEN* and *IMAS*. A last meeting of the CWA 12 Workshop on demining machines was held from the 19th to the

	20th of April 2004 in Sibenik, Croatia in order to review the comments received on the distributed draft CWA. At the end of the latter Workshop all participants agreed on the draft text, which was submitted to CEN in May 2004.
Results/conclusions	The formal process followed by the workshop in the development of the Workshop Agreement has been endorsed by the National Members of CEN. The *CWA Test and Evaluation of Demining Machines (CWA 15044:2004)* has been officially published by CEN in July 2004 and is available on the ITEP Standards webpage.

Project Nr 3.2.1	
Title	Conduct test and evaluation trial of the mechanical equipment Armtrac 100.
Description	Test and evaluation of the Armtrac 100 (performances, manoeuvrability and survivability) and provide information to the United Kingdom Department for International Development (DFID).
Aim	Test and measurement of global effectiveness of mechanical equipment.
Request	United Kingdom Department for International Development (DFID).
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Armtrac 100*
Development	COTS
Time frame	2002-01-01 to 2002-03-31
Place	United Kingdom
Lead nation	United Kingdom
Partners	Canada, European Commission - Joint Research Centre (EC/JRC), Sweden
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	
Results/conclusions	The *test report* is available on the ITEP Reports website. It is concluded that the Armtrac 100 Mini Flail is a well designed and capable machine. It demonstrated an ability to clear anti-personnel sized mines from terrain ranging from sandy topsoil to gravel track and heavy clay, but with limitations on clearance depth. The machine further demonstrated a good vegetation clearance ability and good mobility. The machine survived a limited range of live explosive tests, although these did not fully assess the safety of the operator.

Project Nr 3.2.2	
Title	Mechanical mine clearing device for anti-personnel mines MV-4.
Description	Test and evaluation of a lightweight remote controlled mechanical device capable of removing tripwires, reduce the amount of AP-mines and prepare ground to a depth of 10 cm for other mine clearing methods. The device is not constructed to withstand a blast from AT-mines. The test and evaluation will be done with one device. The device is meant to reduce the risk for personnel and enhance performance of other methods.
Aim	Test and evaluate the MV-4. Outcome - Test report.
Request	Sweden
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*MV-4*
Development	COTS
Time frame	2002-08-01 to 2002-12-31
Place	Sweden, SWEDEC.
Lead nation	Sweden
Partners	
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	
Results/conclusions	The *test report* is available on the ITEP Reports webpage. The MV-4 anti-personnel mine clearing device, in its initial form, did not fulfill the established requirements with regard to the automatic contouring. However, after modification of the clearing unit, the machine fulfilled all ground processing requirements formulated by SWEDEC for the destruction of anti-personnel mines.

Project Nr 3.2.3	
Title	Test and evaluation of small flail devices: Mini-Flail XM2670-A3 and Knee-Link Flail.
Description	The trial will provide statistical data on the performance of small flail equipment in the 3 to 5 tonne category. The data will be collected by having candidate mechanical equipment traverse prepared tracks, each having approximately 500 surrogate AP mines planted in them. The results will indicate the degree of coverage in terms of depth and area for each machine and the probability of detonating an AP mine. Vegetation clearing capability will be assessed on areas which present several types of vegetation cover including grass, medium- and high-density scrub and brush. The trial will further test a developmental model of

	a new flail hammer and linkage design and compare it to the performance of existing small flail equipment.
Aim	Test report.
Request	Donors, Developers
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Mini-Flail XM2670-A3, Knee-link Flail (Mine Hammer)
Development	Prototype/Demonstrator
Time frame	2002-06-01 to 2003-06-31
Place	Canada, Defence Research and Development Canada - Suffield (DRDC-Suffield)
Lead nation	Canada
Partners	
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	This project originally also included test and evaluation of expedient rollers. However, the at-home trials with the roller were halted, and efforts were focussed on performing controlled, repeatable, statistically useful tests in a field-test scenario (see Project 3.2.11).
Results/conclusions	• The *report on the Knee-Link Flail* and *the report on the mini-flail* are both available on the CCMAT and ITEP reports webpages. • The Knee-Link flail (Mine Hammer) test report concludes that the performance of the Mine Hammer was mixed. It did not do what it was originally reported to do which was to impact the ground and set off mine fuzes without breaking up either the ground or the mines (non-tilling mode). If the Mine Hammer is to be used in the tilling mode as demonstrated in the trials, further development or testing is not recommended as it is difficult to see what advantage the Mine Hammer offers over traditional flails. If the Mine-Hammer is to be used in the non-tilling (thumper) mode, issues related to the interaction between the working head, its rotational speed, its forward speed and the myriad of soil conditions that might be encountered will have to be worked out before another trial program to evaluate the effectiveness in that operating mode can be considered. • The XM2670-A3 Mini-Flail report concludes that the level of performance of the Mini-Flail, as it was provided for the test, was considerably lower than anticipated. The system suffered from overheating which caused it to shut down repeatedly. It was underpowered and was unable to climb even moderate slopes or to load itself back on its trailer. The flail also failed to trigger or damage a large number of mechnaical reproduction mines, and it performed poorly in simple weed/vegetation cutting tests.The report further includes a draft Statement of Requirements (SOR) for a mini flail (p. 53 to p.59).

Project Nr 3.2.4	
Title	Conduct test and evaluation trials of mechanical equipment.
Description	Test and evaluation of any promising technologies for mechanical assistance equipment for demining.
Aim	Test and measurement of global effectiveness of mechanical assistance equipment.
Request	United States, ITEP
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Improved Backhoe, Rhino, Severe Duty Vegetation Shredder (SDVS), Aardvark Mk IV, *ARTS*, TAZ II
Development	N/A
Time frame	2003-01-01 to 2005-12-31
Place	United States
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	At the moment of creation of the ITEP Work Plan, the project was inserted as an umbrella project for several ongoing test and evaluation activities of mechanical demining equipment. However, with progress of time the latter activities have been introduced in the Work Plan as separate activities, so that the present project description has become redundant. As several test reports are available, the project is considered as archived.
Results/conclusions	Reports of various tests can be found on the United States Humanitarian Demining Program and ITEP Reports websites: • *Improved Backhoe* • *Rhino Earth Tiller* • *The Severe Duty Vegetation Shredder* • *Aardvark Mark IV* • *All-Purpose Remote Transport System (ARTS)* • *Tractor Accessorized Zerriest Series II (TAZ II)*

Project Nr 3.2.5	
Title	Test and evaluation of the "MANTIS" Mine Clearing Survivable Vehicle (MCSV).
Description	The *Mine Clearing Survivable Vehicle (MCSV)* is a commercial-off-the-shelf vegetation clearing system. This project will evaluate the performance of the MCSV and of each of the tools separately.

Aim	Proof of Performance trial of the Mine Clearing Survivable Vehicle (MCSV). Outcome - Test report.
Request	Users, Donors, NGOs, NMAAs
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Mine Clearing Survivable Vehicle (MCSV), MANTIS*
Development	Prototype/Demonstrator
Time frame	2002-03-01 to 2005-06-30
Place	United States
Lead nation	United States
Partners	United Kingdom
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	• The design of the MCSV draws heavily on the strengths of the *Survivable Demining Tractor and Tools (SDTT)* concept and benefits from the experience of four years of SDTT field use. • Improvements carried out from 2002 onwards have been completed. The test and evaluation has started in 2004: - Feb 2004: Pearson Blast Test Wheels (Limited Functional-Technical) - Aug-Dec 2004: Operational Field Evaluation (Proof of Performance). ITEP personnel from the United Kingdom took part in the second phase of the Proof of Performance testing in December 2004 - Oct 2005 - Oct 2006: Nicaragua (Operational Field Evaluation)
Results/conclusions	• The Survivable Demining Tractor and Tools (SDTT) segmented roller has been field tested under the ITEP banner by Canada and the United States (*ITEP Work Plan* Project 3.2.11). The concerned *test report* can be found on the CCMAT and ITEP Reports webpages. • The *report* covering a two week trial in 2004 with the Mine Clearing Survivable Vehicle (MCSV) and a complement of 12 demining and area preparation tools is available on the ITEP website. Report summary: Survivability against AP mine blasts for the MCSV, the operator, the mine roller, and the SETCO tires was demonstrated by detonating 250 gram (1/2 pound) TNT charges initiated by a small AP mine under the mine roller and SETCO tires of a moving MCSV. The ability to detonate most AP mines with the mine roller and remove AT mines with the Rotary Mine Comb was demonstrated in simulated minefields in moderate to heavy vegetation. The vegetation clearing and area site preparation tools demonstrated the capability of the system for vegetation cutting and removal, and the removal of downed trees, surface metal, and buried mines and UXO. The results of the performance demonstration assessment clearly show, for the soil and vegetation within the limits of that found at the test site, that a single prime mover (the MCSV) with a well thought-out selection of tools can prepare an area for demining, remove antipersonnel (AP) and antitank (AT) mines, and leave an area ready for quality assurance proofing and subsequent use. • During 2006 the MCSV/MANTIS system will be deployed in Nicaragua for operational field evaluation.

Project Nr 3.2.10	
Title	Test and evaluation of Mechanical Assistance Equipment (MAE) for demining.
Description	Ongoing program/activities of the *Bundeswehr Technical Center for Weapons and Ammunition* (WTD 91) to test commercial-off-the-shelf Mechanical Assistance Equipment (MAE) in accordance to urgent military and/or humanitarian (German Foreign Office) need. Time and technical expenditure depending on the specific requirements, eg. clearing of AP mines and/or AT mines.
Aim	To proof the effectiveness of the clearing system and the resistance against blast effects.
Request	German Army (or Foreign Office)
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Minebreaker 2000/2, Mine-Guzzler, Hydrema MCV 910, MineWolf, Rhino
Development	COTS
Time frame	2002-01-01 to 2006-12-31
Place	Germany, *Bundeswehr Technical Center for Weapons and Ammunition* (WTD 91)Meppen.
Lead nation	Germany
Partners	
Point of contact	Joachim Sigmund, JoachimSigmund@Bundeswehr.org
Web site	
Status	Archived
Comments	• At the moment of creation of the ITEP Work Plan, the project was inserted as an umbrella project for all test and evaluation activities of mechanical demining equipment by the *Bundeswehr Technical Center for Weapons and Ammunition* (WTD 91). Trials are executed whenever new systems become available and there is a requirement to test them. However, from 2007 onwards the trials have been introduced in the Work Plan as separate activities, so that the present project description has become redundant. Because several test reports are available, the project is considered as archived. • Based on the results of the trials at WTD 91, one Minebreaker system has been acquired and is operational in Afghanistan since September 2002
Results/conclusions	Test reports of completed trials are available on the ITEP Reports website: • *Hydrema MCV 910* • *Minebreaker(test with dummy mines), 2002* • *Minebreaker (test with life AT mines), 2002*. • *Mine-Guzzler* • *Rhino* • Note that although a similar test report for the MineWolf exists (date: 2001), Germany decided not to publish it on the ITEP Reports website because a completely new version of the MineWolf is in the meantime operational in the field. Tests with the new version of the MineWolf have been executed by the WTD 91 in February 2004, and the corresponding test reports are available on

	the ITEP Reports website: • *MineWolf - Clearing of Live Mines. Final Report* and • *Mine-Clearing Vehicle MineWolf. Biomechanical Assessment of Mine-Clearing Tests with Live Mines*

Project Nr 3.2.11	
Title	Test and evaluation of the Survivable Demining Tractor and Tools (SDTT) roller.
Description	In-country test and evaluation using a roller designed for use with the *Survivable Demining Tractor and Tools (SDTT)*. Trials will be done in a variety of typical terrain and vegetation conditions and using a variety of patterns/number of passes. Both mechanical reproduction mines and live AP mines will be used in the trials.
Aim	Provide quantitative data on roller effectiveness in neutralising mines; assess potential for area reduction using rollers; attempt to assess dog/roller mix effectiveness. Outcome - Test report.
Request	Thailand Mine Action Centre (*TMAC*) and other users, *GICHD*.
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Segmented rollers for use with the *Survivable Demining Tractor and Tools (SDTT)*.
Development	Prototype/Demonstrator
Time frame	2003-04-01 to 2003-05-01
Place	Thailand
Lead nation	Canada
Partners	United States, Thailand Mine Action Centre (*TMAC*)
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca or Charles Chichester (US), charles.chichester@nvl.army.mil
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	The Survivable Demining Tractor and Tools (SDTT) will be further evaluated in operational field trials in Thailand by the United States (see Project No. 3.2.5).
Results/conclusions	The *test report* is available on the CCMAT and ITEP Reports webpages.The overall conclusion is that the Survivable Demining Tractor and Tools (SDTT) roller, when operated under a Standard Operating Procedure similar to that used in the trials (and by the Thailand Mine Action Centre), is unlikely to be useful as a demining tool all by itself. Its usefulness in combination with other demining approaches, or as an area reduction or a risk reduction tool will depend on individual circumstances including available resources, terrain, vegetation, and possibly even clearance level requirements. Each end user will have to evaluate the results of this trial to determine whether the SDTT segmented roller can be used to advantage in that user

Project Nr 3.2.12	
Title	RHINO System
Description	The *system* is a remote controlled tiller system used for large area AP mine clearance and area reduction. Incorporation of a large loop detector for AT mine detection is a projected improvement.
Aim	Refurbish, test and evaluate the modified Rhino as an area reduction system. Outcome - Improved hardware and test report.
Request	Users, Donors, NGOs, NMAAs, Developer, Manufacturer.
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Rhino*
Development	COTS
Time frame	2003-02-01 to 2008-12-31
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Humanitarian Demining test facility, Ft. AP Hill, VA, and Azerbaijan.
Lead nation	United States
Partners	Azerbaijan National Agency for Mine Action (*ANAMA*)
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Trials/tests completed
Comments	The Rhino system has undergone several years of development and test and evaluation: • Contractor development of prototype unit for soil remediation (Exploratory) • Dec ember 97, Germany - NVESD sponsored mine clearance and blast testing (Limited Functional - Technical) • 2000 - Jordan (Operational Field Evaluation) • NVESD/IDF joint clearance tests in Israel (Proof of Performance) • NVESD test of area reduction using Rhino in mixed minefields (Proof of Performance) • August 2004 - NVESD test of AT mine screen (Proof of Performance) • 2005 - 2008 - Azerbaijan Operational Field Evaluation
Results/conclusions	A *report on previous area reduction tests with the Rhino earth tiller* is available at the United States Humanitarian Demining Program publications webpage and the ITEP reports webpage.

Project Nr 3.2.14	
Title	Sifting Excavator (Mechanical Mine Sifter, Deep Buried Mine Excavator).
Description	The Mechanical Mine Sifter is a system based on a novel technique to mechanically excavate deeply buried mines. It has completed an Operational Field Demonstration in Honduras. Based upon the success of the field demonstration, further testing will be carried out using a high mobility excavator as host platform.

Aim	Improvements based on in-country operational field trial of the Mechanical Sifter. Outcome - Prototype hardware and test report.
Request	Users, Donors, NGOs, NMAAs
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Sifting Excavator
Development	COTS/Prototype
Time frame	2003-02-01 to 2006-06-30
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Humanitarian Demining test facility, Ft. AP Hill, VA and Honduras
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	The Sifting Excavator (Deep Buried Mine Excavator) is the product of several years of development and test and evaluation: • 2000 - NVESD trials with the Shinn vegetation shredding system (Exploratory) • 2001 - Armoring and explosive fragment testing operator compartment and wheels (Limited Functional - Technical) • May 2003 - Backhoe based exploration of digging concepts of deeply buried AT mines (Exploratory) • Aug 2003 - AT mine blast testing against system protection shield (Limited Functional - Technical) • Sep 2003 - Blind demining of mixed test minefield according to planned SOPs (Proof of Performance) • Dec 2003 - Honduras (Operational Field Evaluation).
Results/conclusions	A *report* on 2003 trials with the Deep Buried Mine Excavator can be found on the United States Humanitarian Demining Program and ITEP Reports webpages. A *summary article* on the operational trials in Honduras has been published in the Journal of Mine Action. The development tests showed that the overall process developed using this multi-tool excavator-based system, produced an extraordinarily reliable means of dealing with the mine threat. The development testing, however, did not explore the threat to the sifting buckets from the detonation of AP-mines or AT-mines. Furthermore, it was concluded that the process is greatly enhanced by the availability of additional support equipment. The two most undesirable aspects of the mine clearance process with the described equipment are the pace of operations and the complete rearrangement of the landscape resulting from the excavation. As slow as the excavation process is, there is no known alternative for finding mines so deeply buried in mineralised soil.

Project Nr 3.2.15	
Title	Performance and survivability test of the mini-flail DIANA.
Description	• Repeatable performance tests in artificial test lanes (gravel, sand and topsoil) with as test targets AP mine with live fuses. • Survivability tests against AP mines.
Aim	To achieve comprehensive test results to be presented to the demining community and/or to be used for further improvements.
Request	Manufacturer
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Diana 44T
Development	Prototype/Demonstrator
Time frame	2003-08-18 to 2003-08-27
Place	Sweden, SWEDEC.
Lead nation	Sweden
Partners	United Kingdom
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	Because the machine arrived late to the test site, some changes had to be implemented in the original test plan. As a consequence the survivability test could not be executed.
Results/conclusions	The *test report* is available on the ITEP Reports website. It concludes that the main areas of concern are the poor ability of the vehicle to maintain a constant flailing depth and a constant speed. This gives rise to unreliable clearance ability, especially as the engine power is believed to be inadequate for the flailing depth that the manufacturer claims is feasible. Furthermore, it is stated that the Diana offered no mechanism for adjusting the flailing depth and suffered from severe vibrations through the entire machine.

Project Nr 3.2.16	
Title	Field trial of the Minelifta Mk2.
Description	Field trial of the Corus Minelifta Mk2 as follow on from the 2001 trial in the United Kingdom (*test report* available on the ITEP Reports website). This will be a collaborative test between Corus, NPA and QinetiQ over a period of two to three months.
Aim	To assess the operational ability of the Corus Minelifta Mk2 (reliability, logistics, etc.).
Request	Manufacturer and United Kingdom Department for International Development

	(DFID).
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Minelifta Mk2*
Development	Prototype/Demonstrator
Time frame	2003-06-01 to 2003-08-26
Place	Stojcevac and Brcko, Norwegian Peoples Aid (NPA), Bosnia and Herzegovina.
Lead nation	United Kingdom
Partners	Norwegian People Aid (*NPA*)
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	The assessment period was from the 10th of June 2003 to the 26th of September 2003. Further work by Norwegians People Aid (NPA) using Minelifta was expected to be ongoing during October and November 2003. Reports on this period can be obtained from Mr. G. Ashton at Corus, Scunthorpe, United KIngdom.
Results/conclusions	• The United Kingdom test team took an advisory/monitoring role visiting the site at the start, mid-way through and at the end of the trial. The *test report* is available on the ITEP Reports website. • The report concludes that the Minelifta is a well-designed machine, which showed good productivity and reliability within the tasks that it was set. Further improvements are recommended to suit ground preparation for Quality Assurance checks and therefore increase efficiency and make it more versatile. As with most mechanical clearance processes the application of this equipment has to be taken in the context of the mine threat, type of terrain, climatic and environmental conditions and of the overall demining operation.

Project Nr 3.2.17	
Title	Performance and survivability test of the Minecat 140.
Description	• Repeatable performance tests in artificial test lanes (gravel, sand and topsoil) with as test targets AP mine with live fuses. • Survivability tests against AP mines.
Aim	To achieve comprehensive test results to be presented to the demining community and/or to be used for further improvements.
Request	The manufacturer.
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Compact Minecat 140
Development	Prototype/Demonstrator
Time frame	2003-08-01 to 2003-08-31

Place	Sweden, SWEDEC.
Lead nation	Sweden
Partners	Canada
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	
Results/conclusions	• The *test report* can be found on the ITEP Reports website. The main conclusion of the report is that the Minecat 140, in its current configuration, lacks sufficient armour protection to be useful in demining operations, and it may be marginal in terms of engine power for the vehicle drive. Much more significant were the positive aspects of the Minecat 140. In particular, the flail head demonstrated a good ability to cut to a smooth, skip-zone-free depth, and was effective in triggering and destroying antipersonnel mine targets. With the provision of protective armour, and a possible upgrade to the drive engine, the Minecat 140 has the potential to be a useful and effective tool in the mini-flail category. • The Minecat manufacturer NoDeCo provided *comments on the test report*, which can also be found on the ITEP reports website. NoDeCo has in the meantime made some modifications to the Minecat 140 based on the results of the test. Furthermore, related to the armouring conclusions in the test report, NoDeCo has opted for the offer on request of an additional add-on armouring kit, which can be optimised depending on the intended use.

Project Nr 3.2.18	
Title	Trial of the Armtrac 75 (Pre-Trial Assessment).
Description	Pre-Trial Assessment of the Armtrac 75, in order to assess if the machine is sufficiently mature for further testing according to the *CEN Workshop Agreement on Test and Evaluation of Demining Machines (CWA 15044:2004)*.
Aim	To assess the basic operational ability of the Armtrac 75.
Request	United Kingdom, Department for International Development (DFID).
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Armtrac 75*
Development	Prototype/Demonstrator
Time frame	2004-02-01 to 2005-12-31
Place	United Kingdom
Lead nation	United Kingdom
Partners	
Point of contact	David Lewis, baric@btconnect.com
Web site	

Status	Archived
Comments	• The pre-trial assessment of the Armtrac 75 trial was completed and it was decided that the manufacturer requires to carry out further modifications prior to submitting the machine to a full CWA 15044 testing regime . • The execution of a second pre-trial assessment (PTA) is awaiting developments by the manufacturer. The execution of performance and survivability tests will depend on the results of the second PTA.
Results/conclusions	The *report* on the Armtrac 75 assessment, phase 1 is available on the ITEP reports webpage.The report concludes that the conducted tests demonstrated the ability of the machine to clear both mines and vegetation, albeit with limitations. It highlights a number of important characteristics of the machine, both positive and negative. It was recommended that the machine speed be reduced by a factor of at least 4 before the machine should be considered for proceeding to phase 2 of the assessment process which will constitute of repeatable mine clearance performance testing under more controlled conditions.

Project Nr 3.2.19	
Title	Tantra machines
Description	Develop, build, and test and evaluate a multi-tool vegetation/mine clearance prototype integrated onto an existing BV206 rubber tracked, tandem-chassis, all-terrain vehicle. The foreseen attachments are a Seppi-Mulcher, a tree extractor, an ammo-fork, a bucket, angled-clearance dozer blade and a Mini-Rotar bucket.
Aim	Development of a manned and unmanned platform to clear mines and vegetation. Outcome - Prototype hardware and test report.
Request	Users, Donors.
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Tantra* (Manned or unmanned BV 206 with multiple attachments)
Development	COTS
Time frame	2004-01-01 to 2005-12-31
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Ft. AP Hill, VA.
Lead nation	United States
Partners	People Against Landmines (*MgM*)
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Trials/tests completed
Comments	
Results/conclusions	The test report is under development.

Project Nr 3.2.22	
Title	Test and evaluation of the Bozena-4.
Description	Test and evaluation of the Bozena-4 according to the recently approved *CEN Workshop Agreement 12 on Demining Machines (CWA12)*.
Aim	Test report
Request	The Manufacturer
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Bozena-4*
Development	COTS
Time frame	2004-06-01 to 2006-12-31
Place	• Machine inspection and pre-trial assessment: Manufacturer facilities in and around Krupina, Slovakia and Hurn facility in United Kingdom. • Performance and Survivability tests: Sweden, SWEDEC • In-country Performance test and Acceptance test: Thailand • In-country Acceptance test: Sudan
Lead nation	Canada
Partners	*TMAC*, United Kingdom, Sweden, United States.
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	• Results of the pre-trial assessment and the first phase testing were *published* on the ITEP reports webpage. The second phase testing (performance tests - SWEDEC) was carried out during the second half of 2004 and the *test report* is also available at the ITEP reports webpage. • Additional performance tests were carried out in Thailand in order to assess to which extent the results of an in-country performance test reflect the results obtained from a detailed performance test according to the CWA 15044. The testing of the Bozena-4 and MV-4 in Nairobi (*ITEP Project 3.2.41*) revealed serious problems with doing tests in non standard soil conditions. The associated test report argued that mine-surrogate results, and possibly even fibreboard results, in such conditions are invalid and misleading. The soil conditions used in the Bozena-4 tests in Thailand were very much like those in the Nairobi trial. Hence, the same argument about the validity of the results applies and therefore the report for theThailand portiion of this trial was cancelled. • The machine completed a 6 month operational testing period in Thailand, but due to unforeseen circumstances, was only used for a very small amount of time and thus did not generate useful field experience information. • Canada donated the Bozena-4 machine to *MAG* for use in Sudan where it would undergo an acceptance test at the end of 2006. Due to logistics and other problems, it was not possible to conduct a suitable acceptance test.
Results/conclusions	The above mentioned reports conclude that the Bozena-4 successfully triggered or neutralized most of the targets in the test (worst case: 46 of 50 targets and best case: 49 of 50 targets). The machine further demonstrated the ability to dig uniformly across the width of the flail head and to the necessary depth. The survivability test showed that the skids are vulnerable to damage should they

	trigger AP mines of 180 g TNT or more. In the event that the chains/hammers trigger an AT mine, the Bozena-4 appears able to survive the effects of a blast of up to 8 kg without any significant damage. Furthermore, it is stated that the machine did not exhibit any breakdown or maintenance problems during the tests and that the machine tool attachments can be changed very quickly producing a flexible, multi-purpose machine.

Project Nr 3.2.23	
Title	Test and evaluation of the RM-KA 02.
Description	Test and evaluation of the RM-KA 02 according to the recently approved *CEN Workshop Agreement 12 on Demining Machines*.
Aim	Test report
Request	The manufacturer
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*RM-KA 02*
Development	COTS
Time frame	2004-06-01 to 2005-06-30
Place	• Machine inspection and pre-trial assessment: Manufacturer facilities in Slavonski Brod, Croatia and Hurn facility in United Kingdom. • Performance and Survivability tests: Sweden, SWEDEC.
Lead nation	Canada
Partners	United Kingdom, Sweden, United States
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	As this is a remote control machine there is no requirement for an operator survivability test. Depending on the available data, there may be no need for a machine survivability test either.
Results/conclusions	• The pre-trial assessment and the first phase of the testing program have been completed and are described in the corresponding *test report* available on the ITEP website. The test results of the performance tests and a brief survivability test are described in a separate *test report*, available on the CCMAT and ITEP websites. • In general the RM-KA 02 is considered to be a very capable, well built machine. The two most critical areas which the trial team recommend for attention are a lower speed setting to avoid skip zones in difficult soil, and an automatic terrain following system for the flail head. From the test methodology perspective, improvements to the fibreboard tests are suggested.

Project Nr 3.2.24	
Title	Test and evaluation of the Tempest Ground Penetrating Flail.
Description	The test consists of two parts: • Test and evaluation of the Tempest Ground Penetrating Flail in Cambodia (maneuverability, performance and survivability) in collaboration with MAG, and • Performance testing according to the CWA 15044:2004 at ITEP test facilities.
Aim	• To conduct a full set of in-country trials following the *CWA on Test and Evaluation of Demining Machines (CWA 15044:2004)* as close as possible within the time and logistical constraints. • To inform MAG as to the suitability of operating the Tempest Ground Penetrating Flail in an area such as Cambodia, and • To assess to which extent the results of an in-country performance test (first trial) reflect the results obtained from detailed performance tests using a statistical representative number of test targets (second trial).
Request	*MAG*, the United Kingdom Department for International Development (DFID), Defence Reserach and Development Canada (*DRDC (CCMAT)*
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Tempest* Ground Penetrating Flail (GEF), the *Standard Vegetation Flail*, *Large Magnet Head*, *Promac* Slasher Head
Development	COTS
Time frame	2005-01-31 to 2005-09-30
Place	Cambodia, Sweden (Norra Kulla test range)
Lead nation	United Kingdom, Canada
Partners	Sweden, Mines Advisory Group (*MAG*)
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Trials/tests completed
Comments	
Results/conclusions	• The pre-trial assessment was completed in December 2004. • The in-country trials were carried out in February 2005 and the corresponding *trial report* is available on the ITEP website. • The in-country trial was focused primarily on the Ground Engaging Flail (GEF) rather than on the mature, well proven vegetation cutting system. Other attachments were also assessed, such as the standard vegetation flail head, the large magnet and the Promac slasher head. • The conclusions drawn from the trial results in Cambodia were that the Tempest Mk V system is in general a versatile machine with a number of different tools that can be easily fitted instead of the flail. It is compact and easily transportable. The GEF adds an extra capability to the vegetation clearance role more commonly associated with the Tempest system. Several recommendations for improvement are also included. Of the other tools assessed during the trial the conclusion was that the Promac Slasher head and the large magnet head had very specialised roles. There would therefore be few occassions where the other attachments (GEF, standard vegetation flail combined with small magent) would not adequately suffice.

	• The *second trial* was carried out during September 2005 at the Norra Kulla test range in Sweden and results are expected to be published by March 2008.

Project Nr 3.2.29	
Title	Test and evaluation of hammer heads for flail machines.
Description	New designs of hammer heads, including alternative materials, will be tested in order to evaluate their performance as compared to the standard hammer heads used on the *Scanjack* and *MV-4 flails*.
Aim	Test report
Request	*SWEDEC*
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Flail hammers
Development	Prototype/Demonstrator
Time frame	2005-04-01 to 2005-12-31
Place	Sweden
Lead nation	Sweden
Partners	
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	
Results/conclusions	• The *final report* is available on the ITEP website. Additional reports are available in Swedish from High-Engineering and Scanjack AB. • The studies and trials showed that the weight distribution and centre of gravity of the hammers are essential for an optimal performance of the flail tool. The report makes recommendations for the hammer wear plate diameter, thickness and weight. Furthermore, the tests demonstrated that flail hammers made from wrought iron performed at least as well as the original steel flail hammers, decreasing the operational costs of the flail considerably. In order to further reduce the flail operational costs, it is also recommended to select flail hammers with detachable chains as the latter wear out less fast than the hammers heads and can hence be reused.

Project Nr 3.2.30	
Title	Test and evaluation of the Scanjack flail
Description	Test the Scanjack flail clearance capability, mobility, survivability and current training methods
Aim	Test report
Request	Users, donors
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Scanjack 3500 flail*
Development	COTS
Time frame	2005-06-01 to 2005-12-30
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Ft. AP Hill, VA.
Lead nation	United States
Partners	Sweden
Point of contact	Lee Offen, Lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *test report* lists the following results: • The Scanjack executed the terrain driving course and vegetation cutting exercises with no difficulty. • It was outside the parameters of this test to determine the likelihood of mine detonation by the Scanjack 3500. However, all mine simulants recovered showed clear evidence of hammer strikes. This indicates that the dual flail system does a thorough job of flailing the ground. The system demonstrated a tendency to run over or throw the mine simulants designed to replicate real AP and AT mines when executing the mine lanes. In an operational environment this would not matter if the flail detonated all mines in its path. • Station keeping was difficult for the operator in a dusty environment. The tested vehicle was not fitted with GPS, which will be offered as optional equipment on the latest generation (Ref 2.0 System Description). • The system demonstrated the ability to detonate blast resistant mines. This is the only flail system tested by the Countermine Division that has demonstrated the ability to detonate blast resistant mines. One was detonated, one was thrown and neutralized. Given that the mine detonated when the flail was operating at a 12 centimeter depth, it is possible the likelihood of detonation could be increased if the operator consistently holds the flail at a 12 cm depth. The flail successfully detonated the 22 pound steel cased AT mine and sustained minimal damage that was repairable within 5 minutes. The overall conclusions are that the Scanjack 3500 seems to be a mature and well designed large flail with more than sufficient horsepower. It operated flawlessly throughout the test with no maintenance failures. Further testing would be required to determine its ability to detonate AP and AT landmines.

Project Nr 3.2.32	
Title	Pre-Trial Assessment (PTA) of the Digger D-2
Description	The *CEN Workshop Agreement for Test and Evaluation of Demining Machines (CWA 15044)*recommends a PTA prior to submitting the machine to a full testing scheme. The PTA will consist of an evaluation of the machine mobility, a rule of thumb assessment of the equipment performance and an estimate of the clearance rates of both mined and vegetated areas.
Aim	To perform tests and use best engineering judgement in order to present basic evidence as to the maturity and applicability of the equipment in humanitarian demining.
Request	Manufacturer
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Digger DTR Demining Technologies Digger D-2*
Development	COTS
Time frame	2006-06-01 to 2006-12-31
Place	Tavannes, Switzerland
Lead nation	Canada
Partners	
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	• Contacted by manufacturer in mid 2005. Visit of manufacturer in late January 2006. • The Pre-Trial Assessment (PTA) took place on the 19th and 20th of September 2006 at and nearby the manufacturer
Results/conclusions	• The *PTA final report* and *report abstract* are available at the ITEP website. The PTA highlighted a number of positive and negative characteristics of the machine, and further resulted in some recommendations to the manufacturer. It was concluded that the Digger D-2 has the potential to be a valuable tool for the demining community. Furher tests and/or field trials by a prospective user are therefore recommended. • Follow-up testing according to the CWA 15044 guidelines is planned for 2007 (ITEP Project 3.2.43) • The Digger D-2 was also *accredited* in October 2006 by the Mine Action Office of the United Nations in Sudan.

Project Nr 3.2.33	
Title	Bozena 5 Flail Test and Evaluation
Description	*CWA 15044* Performance and Survivability Tests, followed by Acceptance Test (as applicable) for Bozena 5.
Aim	To establish baseline CWA 15044 performance characteristics of Bozena 5.
Request	Defence Research and Development Canada (*DRDC - CCMAT*) and Manufacturer
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	Way Industry Bozena 5 Flail
Development	COTS
Time frame	2006-04-24 to 2006-12-31
Place	*Cerovac test site* (Croatia)
Lead nation	Canada
Partners	*SWEDEC* (Sweden) and *CROMAC - CTRO* (Croatia)
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	
Status	Archived
Comments	• An informal CWA 15044 Pre-Trial Assessment had already partially been done as part of the Canadian procurement exercise. Some prior tests had also been conducted by CROMAC - CTRO. • CWA 15044 based performance testing occurred at the CTRO Cerovac site in Croatia in May and June 2006. Trial conditions prevented the trial from being done strictly in accordance with CWA15044. The test report describes the ways in which the trial deviated from CWA15044. • Before and during the trial, Canada provided training to CROMAC - CTRO personnel on the use of the *WORM test targets* • The CWA 15044 performance test was followed by a one-day CROMAC - CTRO designed acceptance test, which effectively doubled as a survivability test. • The machine has been donated by Canada to Bosnia and Herzegovina.
Results/conclusions	The *final report* is available at the ITEP website. It gives a description of the machine, the test methodology and results (including data sheets and pictures). The main conclusions can be summarised as follows: • The Bozena-5 is a well-built machine that appears to be easy to operate and maintain. It has adequate power for both ground penetration and vegetation cutting. • The mine neutralisation performance of the Bozena-5 ranged from a low of 42/50 to a high of 50/50 targets neutralised. The tests with the poorest performance had several unrecovered targets that were assumed to be live. • The Bozena-5 had good survivability against several AP and one detonated AT mine. • The Bozena-5 is a capable machine with good performance characteristics. The suitability of this machine for a particular operation would best be determined by a local acceptance test as suggested by the CEN Workshop

	Agreement CWA 15044.

Project Nr 3.2.34	
Title	MineWolf Test and Evaluation
Description	*CWA 15044* Performance Test for MineWolf.
Aim	To establish baseline CWA 15044 performance characteristics of MineWolf for both flail and tiller heads.
Request	*CCMAT* (CA)
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	RUAG Land Systems MineWolf
Development	COTS
Time frame	2006-06-01 to 2006-12-31
Place	*Cerovac test site* (Croatia)
Lead nation	Canada
Partners	*CROMAC - CTRO* (Croatia)
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	
Status	Archived
Comments	• CWA 15044 performance testing was carried out in September 2006 at the Croatian Mine Action Center (CROMAC) Centre for Testing, Development and Training *CROMAC - CTRO*) . Canada and Croatia cooperated to conduct this ITEP trial. • The CWA 15044 performance test was followed by a one-day annual recertification test designed by CROMAC - CTRO. • The MineWolf Machine is provided with both tiller and flail attachments to be used as part of a System, interchangeable dependent on conditions. However, due to limitations in test resources it was only possible to evaluate the tiller attachment. • No survivability tests were executed as this machine has already been extensively tested against explosive threats (see report *MineWolf - Clearing of Live Mines* and *Mine Effects to Flail and Engine Armor Shields of the MineWolf*).
Results/conclusions	The *MineWolf tiller test report* is available at the ITEP reports webpage. The main conclusions are as follows: • The machine had sufficient power for the task of ground penetration. In addition, the tiller configuration removes the possibility of the type of skip zones experienced by a chain flail. • The depth control on the MinWolf was effective when used. • The overall effectiveness of the MineWolf would likely have been higher with a lower forward speed. The average speed maintained during the trial (956 m/hr) may be adequate to prepare the soil for follow-on operations, but should be reduced for clearance operations. • The MineWolf tiller is a capable machine that displayed good performance

	under the test conditions. Comments by the machine manufacturer in response to a draft version of the report are included in *Annex E* of the main report.

Project Nr 3.2.35	
Title	MV 10 Test and Evaluation
Description	*CWA 15044* Performance Test for MV 10.
Aim	To establish baseline CWA 15044 performance characteristics of MV-10 for both flail and tiller heads.
Request	Defence Research and Development Canada (*DRDC - CCMAT*)
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	DOK-ING MV 10
Development	COTS
Time frame	2006-09-04 to 2006-12-31
Place	*Cerovac test site* (Croatia)
Lead nation	Canada
Partners	*CROMAC - CTRO* (Croatia)
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Trials/tests completed
Comments	The CWA 15044 based performance testing was started in June 2006 and was completed in September 2006. The final report is under development and will be available by March 2008
Results/conclusions	

Project Nr 3.2.37	
Title	Mine Clearing Rake for small areas (MCR)
Description	This project will develop a small low cost mine clearing rake (area preparation plow) with digging teeth and a chain dragging system to plow through already prepared soil and lift all small objects and mines to the surface.
Aim	Develop, test and evaluate a small, low cost mine clearing rake. Outcome - Prototype hardware and a test report.
Request	Users, Donors, NMAAs, NGOs.
Category	Mechanical Assistance
Type	Test and Evaluation

Equipment	Mine Clearing Rake (Area Preparation Plow)
Development	COTS
Time frame	2006-01-01 to 2007-01-01
Place	United States, US CECOM-RDEC, NVESD, Countermine Division, Ft. Belvoir, VA, Humanitarian Demining Test Facility Ft. AP Hill, VA, and other countries (TBD).
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	The *final report* is available at the ITEP website.The test was designed to assess the ability of the Mine Clearing Rake (MCR) to uncover and lift mines from two different demining environments. The test was limited to assess performance against anti-personnel mines. Three distinct humanitarian demining phases were considered for assessing the MCR's capabilities: area preparation, demining, and quality assurance. The first two were considered poor choices for the MCR as it required driving the primary power source (tractor) over potentially mined ground. The test was designed to assess the potential of the MCR for quality assurance.The report concludes that based on the performance of the MCR during this operational evaluation test, it should not be considered for use in Humanitarian Demining operations.

Project Nr 3.2.41	
Title	Demonstration trial of the MV-4 and Bozena-4 mini-flails at the IMATC.
Description	The trial will evaluate the in-country performance of the MV-4 and Bozena-4 mini-flails for the local conditions. It will also assess the effect of the hammer wear on the flail performance.
Aim	The main trial aims are as follows: • to evaluate the in-country performance of the MV-4 and Bozena-4 for conditions local to the IMATC and similar to those in Southern Sudan, • to quantitatively assess the effect of hammer wear on the flail performance and • to compare the *CWA 15044* performance testing in controlled environment with in-country testing. This will be the third trial (previous trials: Tempest in Cambodia â€“ *ITEP Work Plan* Project 3.2.24 and Bozena-4 in Thailand â€“ *ITEP Work Plan* Project 3.2.22) during which the CWA 15044 performance testing in controlled environment is compared to in-field testing and should allow to formulate a final conclusion on the topic.
Request	UNMAS, user
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*MV-4*, *Bozena-4*

Development	COTS
Time frame	2006-10-01 to 2006-10-31
Place	*International Mine Action Training Centre*, Nairobi
Lead nation	Canada
Partners	Sweden, United Kingdom, Belgium
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	
Status	Archived
Comments	
Results/conclusions	• The *final report* is available at the *DRDC/CCMAT* and ITEP websites. The report gives a full account of the trial set-up, the problems encountered for the specific local conditions (extremely hard soil) and other important lessons learned. It further provides performance data for flush buried mine targets, as well as detailed information on the obtained ground penetration profiles. The report concludes that neither machine was able to penetrate the extremely hard soil consistently or reliably to depths beyond 11 cm. It was further not possible to draw clear conclusions regarding the effects of hammer wear on the performance due to changing machine parameters throughout the trial. • A *summary article* describing the trial and focussing mainly on lessons learned is also available at the ITEP website.

Project Nr 3.2.42	
Title	L90 AFEL and ALLU Crushing-Screening Bucket Test and Evaluation
Description	The ALLU bucket will be assessed as to its suitability to excavate ground in an anti-personnel blast mine environment, and its capacity to mechanically neutralise AP mines. The test and evaluation will also provide insight as to the ALLU capabilities, function and performance.
Aim	To identify a potential mechanical ground processing method for mine contaminated areas, outside the standard scope of systems and technologies currently available, to deal with cases where deep buried mines, full excavation methodologies and minimum metal mine types would effectively render standard procedures redundant.
Request	Swedish Rescue Service Agency (SRSA)
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*ALLU SCH 4-25 Crushing and Screening Bucket* fitted on a Volvo L90 Armoured Front End Loader (AFEL)
Development	Prototype/Demonstrator, Research/Development
Time frame	2006-10-29 to 2006-11-10
Place	Norra Kulla Testing Facility, SWEDEC, Eksjö¶, SWEDEN
Lead nation	Sweden

Partners	GICHD
Point of contact	John Morrissey, johnmineaction@yahoo.co.nz or Anders Tengbom, anders.tengbom@mil.se
Web site	
Status	Archived
Comments	• Visits were made by representatives of the manufacturer of ALLU, Ideachip Oy, Hollola, Finland and by a GICHD Representative. • The test and evaluation was conducted by the *SRSA* in conjunction with *SWEDEC*
Results/conclusions	The *final report* is available at the ITEP reports website. The test report describes the system concept, trial set-up, results and findings in detail. The overall conclusions are as follows: • Given correct ground and terrain conditions the system consisting of an ALLU bucket fitted on an armoured front end loader has the ability to perform well within AP mine contaminated areas. The system would prove extremely useful, and versatile, in cases where standard clearance methodologies would be rendered ineffective due to high metal contamination, extensive use of minimum metal mine types, deeply buried mines and shifting soil conditions. • The system is highly capable in the activation and neutralisation of AP landmines, if the points raised during the trials are carefully addressed, recommendations incorporated and strict guidelines for the employment of the system are implemented. This coupled with thorough internal and external quality assurance methods, will ensure the system is capable of providing *clear ground*.

Project Nr 3.2.44	
Title	Test and evaluation of the Mini MineWolf
Description	Performance and survivability testing of the *Mini MineWolf* flail and tiller according to the *CWA 15044 test protocol*. • Performance testing of the Mini MineWolf flail and tiller will be carried out in specially built test lanes containing *WORM* test targets and fibreboards to determine the machine ground processing depth. The effect of hammer wear on the flail and tiller performance will also be assessed. • The survivability testing of the flail and tiller will be carried out against life anti tank mines TM-46, TM-62, PT Mi-Ba-III and DM 21.
Aim	Performance and survivability test of the Mini MineWolf
Request	German Army
Category	Mechanical Assistance
Type	Test and Evaluation
Equipment	*Mini MineWolf*
Development	COTS
Time frame	2007-08-01 to 2007-12-31
Place	*Bundeswehr Technical Center for Weapons and Ammunition* (WTD 91) , Meppen
Lead nation	Germany

Partners	Canada
Point of contact	Joachim Sigmund, JoachimSigmund@bmvg.bund.de
Web site	
Status	Archived
Comments	This trial is part of an ongoing program by the *Bundeswehr Technical Center for Weapons and Ammunition* (WTD 91) to test commercial-off-the-shelf Mechanical Assistance Equipment (MAE) in accordance to urgent military and/or humanitarian (German Foreign Office) need.
Results/conclusions	• The *final test report* is available at the ITEP reports webpage. The report concludes that the Mini MineWolf demining machine with both attachments is suited for the clearance of antipersonnel and antitank mines. It achieved good results in the performance tests. The total Mini MineWolf clearance rate was approximately 99 % at an operating speed between 781 m²/h and 1595 m²/h. No major damage occurred during the clearance runs (survivability tests) and all necessary repairs could be performed on site the same day. • The above final report mentions a deficiency of the *WORM test target system* related to the battery mounting. During the tests, the battery was torn off the mounting several times. This subsequently resulted in discrepancies concerning the evaluation of the WORM mines. A ruggedization of the WORM system battery mounting is therefore recommended.

2.3.4 MANUAL TOOLS

Project Nr 4.2.1	
Title	Instrumented prodder product development path, phase A.
Description	The technology demonstrator version of an instrumented prodder system developed in Canada is tested in the Netherlands under controlled conditions. The performance of its material indication feature is determined for mine-like objects from different types of wood, plastic, metal and stone buried in 6 different soil types. In the analysis of the results aspects such as the prodding angle (the angle between the prodder and the soil surface), the used prodding force, the hardness and the stickiness of the soil are regarded.
Aim	To provide guidance to the product development path of the instrumented prodder. The ultimate project aim is the introduction of the instrumented prodder by one or more NGOs. One of the activities in the project consists of the test and evaluation of the different versions of the instrumented prodder that will become available during the product development path.
Request	Users
Category	Manual Tools
Type	Test and Evaluation
Equipment	Instrumented prodder
Development	Prototype/Demonstrator
Time frame	2002-07-01 to 2003-12-31
Place	The Netherlands, TNO-Physics and Electronics Laboratory.
Lead nation	The Netherlands
Partners	Canada

Point of contact	Arnold Schoolderman, schoolderman@fel.tno.nl
Web site	
Status	Archived
Comments	A users group has been created in which experts and end-users on both military and humanitarian demining are represented. This users group has contributed to a document on demining scenarios in which an instrumented prodder may have a surplus value and on the user requirements for such an instrumented prodder.
Results/conclusions	• A summary of the test results can be found in the article *Instrumented Prodder: Preliminary Results of the Technology Demonstrator Evaluation* on the ITEP Reports website. • The final *test report* can also be found on the ITEP Reports website. • From the test results it is concluded that material identification of buried objects with the technology applied in the instrumented prodder is possible. The use of the instrumented prodder is limited to the softer soil types, just as the conventional prodder. The performance of the current version of the instrumented prodder is affected by the stickiness of the soil: in sticky soil, such as clay, the material identification by the prodder is unreliable. • The sponsor of the project, the Netherlands Ministry of Defence, decided to stop the funding for the continuation of the Instrumented Prodder development. The reasons for this decision are the disappointing results of the current version of the Instrumented Prodder, the technical risk of the development and the expected limited use of the Instrumented Prodder in demining operations. The Netherlands Ministry of Defence expects that the Instrumented Prodder (after completion of the development path) will not be accepted by deminers and sees no surplus value of this device in both humanitarian and military demining operations. Moreover it is foreseen that other alternative mechanical tools for the manual prodder will be available in the near future.

2.3.5 PERSONAL PROTECTION

Project Nr 5.1.1	
Title	Methodology for test and evaluation of Personal Protective Equipment (PPE).
Description	Develop standard test protocols to evaluate and rank the performance of Personal Protective Equipment (PPE). The work will include the development of test equipment, instrumentation and test procedures to test PPE against the effects of AP blast mines. Injury criteria will also be considered and proposed. Furthermore, the work will be divided in upper-body (above the waist) and lower-body (below the waist) methods.
Aim	To establish methods, equipment and procedures for test and evaluation of Personal Protective Equipment.
Request	Users, Donors, NGOs, NMAAs, Manufacturers, Developers.
Category	Personal Protection
Type	Methodology

Equipment	Various
Development	N/A
Time frame	2002-05-01 to 2004-06-30
Place	United States, Canada
Lead nation	United States
Partners	Canada
Point of contact	Lee Offen (US), lee.offen@nvl.army.mil or Matt Braid (Ca),
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	• This activity is a continuation of past co-operation between the United States and Canada that generated an extensive Personal Protective Equipment testing database built upon several hundreds of tests. • Two reports on trials conducted to look at deminer position and its relationship to injury potential mat be included after the project is archived.
Results/conclusions	• A report describing a methodology for test and evaluation of Personal Protective Equipment (PPE) has formally been provided to the ITEP Executive Committee for review and acceptance as the initial test and evaluation standard for testing PPE. The *report* is available on the United States Humanitarian Demining Program and ITEP Reports websites. • The information published in the report *Test Methodologies for Personal Protective Equipment Against Anti-Personnel Mine Blast* issued by the *NATO Panel on Human Factors and Medicine (HFM 089/TG024)* is also based on the United States/Canadian work.

Project Nr 5.1.2	
Title	CEN Workshop Agreement (CW 26) on Test Methodology for Personal Protective Equipment (PPE) for use in Humanitarian Mine Action (HMA).
Description	Existing test methodologies for PPE are reflecting the threat military personnel and police are facing, which is different from the threat encountered by deminers active in HMA. This project will, following the procedure of a CEN Workshop: • define the threat for personnel in HMA and establish reliable replicable simulated threats, • define specifications for determining the mechanical suitability of finished PPE used in HMA, • define a test methodology for PPE in HMA, • establish specifications for recording the results of tests in a uniform manner, and • determine ergonomic criteria and constraints required by the HMA end-user.
Aim	The aim of the workshop agreement is: • to give the HMA users of PPE a way of testing PPE in order to establish if it fulfils the requirement for the specific working situation, • increase the possibilities for PPE manufacturers to meet the user requirements and hence develop more suitable PPE, reducing accidents and increasing the effectiveness of HMA, • to be included in the *International Mine Action Standards (IMAS)*.

Request	Users in HMA, UNMAS, European Commission.
Category	Personal Protection
Type	Methodology
Equipment	N/A
Development	N/A
Time frame	2006-04-01 to 2007-12-31
Place	CEN Management Centre - Brussels, *GICHD*
Lead nation	Sweden, GICHD
Partners	Canada, Germany, the Netherlands, Croatian Mine Action Centre (CROMAC), UNMAS, CEN, PPE Manufacturers (Med-Eng Systems Inc., Oriental Demining Technology Service, KODE Design AS, ROFI Industry AS, SATRA Technology Centre), Massachusetts Institute of Technology - *MIT*, PPE Users (INTERSOS, Danish Demining Group - DDG, Norwegian People Aid - NPA, Swiss Foundation for Mine Action - FSD), Daping Hospital of the Third Military Medical University.
Point of contact	Kaj Horberg, kaj.horberg@telia.com or Tim Lardner, t.lardner@gichd.ch
Web site	
Status	Archived
Comments	• The responsibility for the workshop was equally carried by the *Swedish Standardisation Institute (SIS)* and the *GICHD*. The chair was a co-chaired of two specialists in HMA issues: Kaj Horberg, SIS, responsible for administration and organisation; Tim Lardner, GICHD, responsible for technical coordination. • *The first CEN Workshop meeting* was held at the GICHD on the 5th and 6th of September 2006, where the basis for the CEN Workshop Agreement (CWA) was designed. There were approximately 25 participants, representing manufacturers, end-users and test institutions. *The second meeting of the WS* was held from the 5th to the 6th of December 2006 during which a second draft of the CWA was further developed. The third and last technical meeting took place at the CEN Management Centre from the 13th to the 14th of March 2007, during which a final draft CWA was agreed upon. Following a period of public consultation, during which the draft document approved by the CEN Workshop was available at the CEN website for public comments, the final CWA was compiled and submitted to CEN at the beginning of September 2007.
Results/conclusions	• A study on deminer position supporting the development of the CEN Workshop Agreement on Test and Evaluation of Protective Equipment was executed by SWEDEC in 2006. The aim of the study was to determine the distance and the angle to describe the position of the deminer in the CEN Workshop Agreement. The analysis used video footage of deminers at work in different locations and from different organisations. A *summary of the study* is available at the ITEP website. • The CEN Workshop Agreeement was published by CEN at the end of December 2007 as *CWA Humanitarian mine action (HMA) - Personal protective equipment (PPE) - Test and Evaluation (CWA 15756:2007)* and is also available on the *ITEP Best Practices and Standards page*.

Project Nr 5.2.1	
Title	Test and evaluation of mine protective boots.
Description	Survey and test and evaluation of commercially available mine protective boots. Develop and validate a standard test protocol to measure the effect of shock/blast and compare the effects between unprotected and protected situations.
Aim	Test and evaluate protective mine boots. Outcome - Survey of commercially available mine protective boots and test report.
Request	Users, Donors, NGOs, NMAAs
Category	Personal Protection
Type	Test and Evaluation
Equipment	Commercially available mine protective boots: Med-Eng Spider Boot, Ro-Search Combat Boot, Wellco Enterprises Inc. Blast Boot, BFR V-40, Wellco Over Boot, DIS Design/Anonymate Combat Boot, Zeman Shoe Ltd. Combat Boot, Force Ware GmbH Combat Boot, Aigis Engineering Solutions Ltd. Combat Boot, Samad Rubber Works Ltd. Platform Boot, Fevam America Inc. Platform Boot
Development	COTS
Time frame	2000-08-01 to 2003-12-31
Place	United States, CECOM-RDEC, NVESD, HD Test Facility, Ft. AP Hill, VA.
Lead nation	United States
Partners	Canada
Point of contact	Lee Offen (US), lee.offen@nvl.army.mil or Chris Weickert (CA), Chris.Weickert@drdc-rddc.gc.ca
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	• The U.S. Department of Defense (DoD) Humanitarian Demining Research and Development program completed a trial in 2000 using 5 commercially available mine protective boots and an improvised sandal (Lower Extremity Assessment Program - LEAP). • Defence Research and Development - Suffield (DRDC-Suffield) and CCMAT completed a series of tests in August 2003 that looked at 5 different commercially available demining boots. That work also considered boot fragmentation as a separate issue.
Results/conclusions	• The final *LEAP report* is available at the ITEP website. The research and tests executed during the LEAP have demonstrated that currently available landmine protective footwear does not prevent severe injury but potentially reduces injury severity against some AP mines. The report discusses the change of injury pattern in a cadaver model wearing mine protective footwear during AP blast mine detonation. It further presents the analytical methodology developed to assess mine protective footwear and injury severity associated with blast mines across the spectrum of threat. • A *summary report* on the DRDC-Suffield work is also available at the ITEP reports website. This summary report lists the test results obtained for all boots and concludes, amongst others, that likely none of the boots tested in the

	presented trial are acceptable in most humanitarian demining theatres. Furthermore, it is noted that the fragmentation threat posed by the boots will require deminers to protect themselves accordingly with both upper and lower body armour.

Project Nr 5.2.2	
Title	Exploratory tests of personal protective equipment
Description	Initial investigation into the effectiveness of the Fevam America Inflatable Sapper Platform and the Mechem Mine Mattress. Both devices are intended to reduce the probability of triggering an AP mine.
Aim	Pre-trial assessment to verify the claim of the manufacturer and to guide possible future test and evaluation of the devices.
Request	CCMAT
Category	Personal Protection
Type	Test and Evaluation
Equipment	Fevam America Inflatable Sapper Platform, Mechem Mine Mattress
Development	Prototype/Demonstrator
Time frame	2004-10-01 to 2004-11-01
Place	Swedec, Norra Kulla test site
Lead nation	Canada
Partners	Sweden, United Kingdom
Point of contact	Geoff Coley, geoff.coley@drdc-rddc.gc.ca
Web site	http://www.suffield.drdc-rddc.gc.ca/Facilities/CCMAT/index_e.html
Status	Archived
Comments	
Results/conclusions	The *test report* is available at the CCMAT and ITEP websites. It concludes that although the tests were not sufficient in number or in thoroughness to draw definitive conclusions about the performance of either product, both the Mechem Mine Mattress and the Fevam Inflatable Boot Platform showed promise in decreasing the probability of triggering certain AP mines. There appears to be merit to the idea of a more exhaustive set of trials which would examine, at a minimum, different types of mines. It would also be worthwhile to investigate any possible protection that might be provided to the user.

Project Nr 5.2.3	
Title	Test and Evaluation of Personal Protective Equipment (ROFI)
Description	Perform blast test on visors and other PPE according to the CEN Workshop Agreement on Test and Evaluation of Protective Equipment (CEN Workshop 26 - *ITEP Project 5.1.2*).
Aim	To validate the development of the CEN Workshop Agreement on Test and Evaluation of Protective Equipment and to produce data on the blast performance of visors and other PPE equipment
Request	User, SRSA, UNMAS
Category	Personal Protection
Type	Test and Evaluation
Equipment	ROFI face mask, ROFI Armadillo body armour
Development	Prototype/Demonstrator
Time frame	2007-08-01 to 2007-11-31
Place	SWEDEC (Sweden)
Lead nation	Sweden
Partners	*Swedish Rescue Service Agency (SRSA)*
Point of contact	Anders Bredelius, anders.bredelius@mil.se
Web site	
Status	Archived
Comments	
Results/conclusions	• The trial was financed by the SRSA and conducted at SWEDEC. The blast tests consisted of a short set of shots against a PPE system provided by *ROFI*. The tested PPE system was the *Armadillo body armour* (armour in two pieces protecting lower and upper torso respectively) and a *face mask*. • The final *test report* is available at the ITEP website. The report concludes that the ROFI Armadillo body armour and ROFI face mask comply with the requirements of the blast test as specified in the CEN Workshop Agreement on Test and Evaluation of Personal Protective Equipment used in Humanitarian Mine Action (*CWA 15756*).

2.3.6 NEUTRALIZATION

Project Nr 6.2.2	
Title	Development and test and evaluation of a Propellant Torch System (PTS).
Description	Develop a system that can penetrate and neutralize all AP and AT hardened landmines. The concept is based on rocket technology that uses a very high temperature pyrotechnic/propellant (4000 K) and is also able to initiate rapid combustive neutralization of all explosive charges in less than one minute.
Aim	Improve, test and evaluate the Propellant Torch System (PTS) for mine neutralization. Outcome - Prototype hardware and test report.
Request	Users, Donors, NGOs, NMAAs, Developer, Manufacturer.
Category	Neutralization
Type	Test and Evaluation
Equipment	Propellant Torch System (PTS)
Development	COTS
Time frame	2002-05-01 to 2003-09-30
Place	United States, CECOM-RDEC, NVESD.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	• The *summary report* on the 2003 trial has been published on the ITEP website. Torch penetration was a function of the propellant.Generally, the standoff and angle of attack was found to be critical in achieving a successful neutralization, particularly for the AP bounding fragmentation mine which has two casings. Using two torches simultaneously reduced the burn time and increased the likelihood of successful neutralization (e.g. the AT blast, steel casing mine). For light AP mines (less than about 150 g.), the mine was displaced by the torch jet without being penetrated. A torch with a lower thrust may be necessary for these types of mines. • Results from tests with the Propellant Torch System, and other neutralisation devices, can also be found in the publication *In-Situ Landmine Neutralization by Chemical versus Thermal Initiation: Deminer Preferences*, available on the United States Humanitarian Demining Program and ITEP webpages. • Results of more recent tests with the PTS can be found in the April 2005 report *Operational Evaluation Test of Mine Neutralisation Systems*.

Project Nr 6.2.3	
Title	Develop and test and evaluate a High Performance Foamed Nitromethane Mine Neutralization System.
Description	Develop a new nitromethane formulation and redesign of delivery system to improve the current LEXFOAM delivery system. Proposed improvements are related to effectiveness to thick cased landmines; ability to produce foams below 0 degree C; elimination of foam degradation at hot weather; short mixing time for solutions of Unit A and Unit B; and easiness to initiate the system. Develop a new nitromethane formulation and redesign of delivery system to improve the current LEXFOAM delivery system. Proposed improvements are related to effectiveness to thick cased landmines; ability to produce foams below 0 degree C; elimination of foam degradation at hot weather; short mixing time for solutions of Unit A and Unit B; and easiness to initiate the system. Test and evaluate the improved system.
Aim	Develop, test and evaluate a High Performance Foamed Nitromethane Mine Neutralization System. Outcome - Prototype hardware and test report.
Request	Users, Donors, NGOs, NMAAs, Developer, Manufacturer.
Category	Neutralization
Type	Test and Evaluation
Equipment	NMX-foam
Development	COTS
Time frame	2002-05-01 to 2004-12-31
Place	United States, CECOM-RDEC, NVESD, Humanitarian Demining Test Facility, Ft. AP Hill, VA.
Lead nation	United States
Partners	*Golden West Humanitarian Foundation*
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	Previous field trials in Kosovo and Cambodia with the old Hand-Held Explosive Foam System, confirmed the validity of the Foamed Nitromethane (NM) concept, but identified certain weaknesses. A requirement emerged for a new foamed NM formulation, which retained the basic characteristics of the hand-held system and builds upon its strengths. The new system and formulation that was developed, called NMX-foam (for NitroMethane eXplosive foam), develops more explosive power to attack blast mines and incorporates the modifications recommended from trials with the old system in order to maximize its practicality.
Results/conclusions	• The results of the 2003 NMX-foam developmental trials are available in a *summary report*, published at the ITEP website. The trial confirmed the improved effectiveness of the new NMX-foam System against both thin-walled and thick-walled AP mines, as well as some types of AT mines. Results suggest that thin-walled AP mines of any type can be destroyed by a single can or less of NMX-foam. AT mines and thick-walled (fragmentation) AP mines generally require one to two cans to ensure complete detonation. Operational tests are needed to

	optimize the use of NMX-foam regarding different combinations of charge size and placement. • Results of more recent tests with the NMX-foam System can be found in the April 2005 report *Operational Evaluation Test of Mine Neutralisation Systems*.

Project Nr 6.2.4	
Title	Test and evaluation of pyrotechnical mine neutralisation means.
Description	Program to test available, off-the-shelf pyrotechnical non-explosive means like FIRE ANT (United Kingdom) etc.
Aim	To proof the effectiveness of pyrotechnical means against different types of mines, surface-laid and buried. Especially non-explosive effectiveness has to be proofed.
Request	Army and Foreign Office (for humanitarian purposes).
Category	Neutralization
Type	Test and Evaluation
Equipment	DM29 Ignition Charge -Fire-EOD-PT, FireAnt A210, Hyper Heat Mine Flare
Development	COTS
Time frame	2003-01-01 to 2004-08-31
Place	Germany, Bundeswehr Technical Center for Weapons and Ammunition (WTD 91)
Lead nation	Germany
Partners	Sweden
Point of contact	Christoph Thelen, ChristophThelen@bwb.org
Web site	
Status	Archived
Comments	This project was coordinated with similar activities undertaken by Sweden (*Project 6.2.7*).
Results/conclusions	The *final report* is available in the ITEP reports database. The report concludes that no safe method for non-explosive (low order) clearance of AT mines using ignition charges and (thermite) demining flares could be found. It further details the results for the tested charges/flares related to: • Chemical-Technical testing, • Thermal signature measurements, • Penetration performance in a laminar target, • Parameter optimisation using an AT mine TM-46 as target, and • Initiation tests of experimental demolition charges using a thermite flare.

Project Nr 6.2.7	
Title	Test and Evaluation of pyrotechnical mine neutralisation means.
Description	Program to test pyrotechnical non-explosive means (commercial-off-the-shelf and techniques under development) for military and/or humanitarian use.
Aim	To test and evaluate the effectiveness of pyrotechnical means against different types of mines and UXO. The aim is to start a deflagration process and minimise the risk for detonation.
Request	Army (humanitarian purposes).
Category	Neutralization
Type	Test and Evaluation
Equipment	Disarmco Ltd. thermite charges (Hurricane, Storm, LTT and TSID 2000), FOI and other products.
Development	COTS
Time frame	2002-12-01 to 2003-12-31
Place	Sweden, Defence Material Administration, Test Range Karlsborg, Sweden.
Lead nation	Sweden
Partners	Germany, United Kingdom.
Point of contact	Anders Tengbom, anders.tengbom@mil.se
Web site	http://www.swedec.mil.se/article.php?id=15061
Status	Archived
Comments	Further activities will be executed in collaboration with Project 6.2.4.
Results/conclusions	• Two test reports, for the *Disarmco Ltd. thermite charges* and the *FOI thermite lances* respectively are available on the ITEP Reports website. • The results of the trials with the DISARMCO Ltd. Charges were good and have demonstrated that the use of thermite charges in many cases constitutes an efficient manner to render AT-mines and unexploded ordnance harmless. The DISARMCO Ltd. Hurricane, Storm and LTT charges have proven to be very efficient against anti-tank mines. The trials have shown that the mines were destroyed in an efficient manner by using two or more thermite charges. The TSID 2000 charges have proven to be very efficient against thin-walled shells. The performance against ammunition with thicker shell bodies is more uncertain. • Further test and evaluation has shown that there is no relevant use for thermite charges in humanitarian demining. Therefore, the project will be closed down.

Project Nr 6.2.8	
Title	Mine Identification/Excavation System by Waterjet.
Description	The current successfully tested Waterjet prototype produces a stream of high-pressure water used to clear soil away from mines or suspected objects in extremely hard soils. The goal of the 2004 effort is to further develop the waterjet soil-removing tool by ruggedizing the unit and integrating it onto a robotic

	platform containing an infrared (IR) sensor. Once integrated, the robotic systems water jet will spray streams of hot water over the topsoil covering suspected mines and detect the heated mines using the IR sensor. Test and evaluation of the prototype is part of the project.
Aim	Integrate and test and evaluate an infrared sensor equipped unmanned ground vehicle mounted waterjet. Outcome - Prototype hardware and test report.
Request	Users, Donors
Category	Neutralization
Type	Test and Evaluation
Equipment	Ruggedized waterjet on unmanned ground vehicle with infrared sensor.
Development	Prototype/Demonstrator
Time frame	2004-01-01 to 2007-07-31
Place	United States, CECOM-RDEC, NVESD, Ft. Belvoir, VA, Ft. AP Hill, VA.
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Trials/tests completed
Comments	The final test report is under development.
Results/conclusions	

Project Nr 6.2.9	
Title	Humanitarian demining mine neutralisation technology evaluation.
Description	This project is intended to identify, test and evaluate various off-the-shelf mine/UXO neutralization technologies. The goal is to minimize the candidate technologies to those which neutralize mines/UXO via low-order deflagration, or via detonation. Low-order deflagration mine neutralization (i.e. neutralization through burning) will remain the most important neutralization tool for the foreseeable future.
Aim	Evaluation of COTS mine/UXO technologies. Outcome - Test reports
Request	Users, Donors, NMAAs
Category	Neutralization
Type	Test and Evaluation
Equipment	FireAnt, Hyperheat Mine Flare, Propellant Torch System, Pyropak, Pyro-Torch System, Thiokol Demining Flare, FIXOR, HELIX, Kinepak (Kinepouch and Kinestik), Liquid Explosive Pouch, NMX-foam, PESCO Humanitarian Demining Perforators, SM-EOD 20, SM-EOD 33, A-Systems Laser Deflagration System (ASLD), MineBurner, Mine Disarmer
Development	COTS/Prototype
Time frame	2004-01-01 to 2004-12-31

Place	United States
Lead nation	United States
Partners	
Point of contact	Lee Offen, lee.offen@nvl.army.mil
Web site	http://www.humanitarian-demining.org/
Status	Archived
Comments	
Results/conclusions	• The *test report* is available on the ITEP reports website. The report provides a detailed description of the different systems tested and of the applied test protocol. It further presents the test results for each system separately, as well as a results summary. Next to system performance, the report also discusses other essential factors such as costs, transport and storage aspects and training. • As a general conclusion the report states that all mine neutralization systems evaluated were successful in their ability to neutralize antipersonnel and antitank mines. However, all systems have limitations in target set applicability, transportation restrictions, or cost. Given the right target set, any one of the systems evaluated during this test could do the job and be used with confidence by humanitarian deminers, military, and explosive ordnance disposal personnel.

2.3.7 SERVICES

Project Nr 7.1.1	
Title	Investigate current criteria used to select equipment for test and evaluation.
Description	Preliminary investigation by the United Kingdom of current criteria used to select equipment for test and evaluation.
Aim	To establish an ITEP policy for the selection of mine action equipment for test and evaluation.
Request	United Kingdom Department for International Affairs and ITEP Executive Committee.
Category	Services
Type	Input
Equipment	N/A
Development	N/A
Time frame	2002-01-01 to 2002-06-30
Place	United Kingdom
Lead nation	United Kingdom
Partners	
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	
Results/conclusions	The *report* can be found on the ITEP Reports website.

Project Nr 7.1.5	
Title	Systematic inventory of test and evaluation activities, capabilities and needs in South Eastern Europe.
Description	The inventory will be executed through questionnaires, in-country visits and an in-country workshop.
Aim	To collate information on current projects and existing test and evaluation capabilities that support demining efforts in South East Europe and to identify needs.
Request	ITEP executive Committee.
Category	Services
Type	Input
Equipment	N/A
Development	N/A
Time frame	2001-04-01 to 2001-11-30
Place	South East Europe
Lead nation	European Commission - Joint Research Centre (EC/JRC)
Partners	Canada, Belgium
Point of contact	Adam Lewis, adam.lewis@jrc.it
Web site	
Status	Archived
Comments	
Results/conclusions	The *report* is available on the ITEP Reports website.

Project Nr 7.2.6	
Title	Support to GICHD Study on Manual Demining.
Description	Provision of a test engineer to assist GICHD in the field trial element of their study
Aim	ITEP support to GICHD
Request	*GICHD*
Category	Services
Type	Output
Equipment	N/A
Development	N/A
Time frame	2004-11-01 to 2004-11-30
Place	Mozambique
Lead nation	United Kingdom

Partners	GICHD
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	• A senior engineer assisted GICHD in the Mozambique field trials. • The trial report was submitted to GICHD in February 2005 and results have been included in the report *Comparative Trials of Manual Mine Clearance Techniques, Mozambique, 2004*, which is available on the ITEP website. A summary of the latter trial report has also been included in the *GICHD study of Manual Mine Clearance<>*
Results/conclusions	

Project Nr 7.2.7	
Title	Assistance to Test and Evaluation of COTS metal detectors
Description	Assist the *Cambodian Mine Action Centre* Chief Technical Advisor in setting up a test protocol for the test and evaluation of a number of Commerciual-Off-The-Shelf metal detectors.
Aim	Provide advisory service
Request	Cambodian Mine Action Centre (CMAC)
Category	Services - Capacity Building
Type	Output
Equipment	Metal detectors
Development	N/A
Time frame	2004-08-01 to 2004-08-31
Place	Cambodian Mine Action Centre (CMAC)
Lead nation	United Kingdom
Partners	Cambodian Mine Action Centre (CMAC)
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	
Results/conclusions	ITEP technical staff from the UK provided assistance at short notice to the CMAC Chief Technical Advisor. This assistance was in the form of providing advice on setting up the trial protocol based on ITEP methodology. The report was completed by CMAC for internal use only.

Project Nr 7.2.8	
Title	Technical Consultancy to the Mines Advisory Group (MAG)
Description	Provide engineers and scientists to assist *MAG* in analysing operating procedures for in service equipment and to investigate other mechanical solutions to mine clearance operations.
Aim	Provide advisory service
Request	Mines Advisory Group (MAG)
Category	Services - Capacity Building
Type	Output
Equipment	Various mechanical and detection equipmet
Development	N/A
Time frame	2006-03-01 to 2006-03-31
Place	Laos, Vietnam
Lead nation	United Kingdom
Partners	MAG
Point of contact	David Lewis, baric@btconnect.com
Web site	
Status	Archived
Comments	This project was funded by QinetiQ
Results/conclusions	Two reports, of which the abstracts (*Laos consultancy*, *Vietnam consultancy*) have been made available publicly, have been written by QinetiQ staff and passed to MAG. More detailed information can be made available subject to MAG permission.

Project Nr 7.2.9	
Title	Follow up on CMAC request for advice on procedures for test and evaluation of demining equipment
Description	On invitation by the Cambodian Mine Action Centre (*CMAC*) ITEP representatives attended the Japan International Co-operation System *JICS/CMAC trials* of Japanese mechanical demining equipment in August 2006 and of dual-sensor detection equipment in November 2006 with as main aim to provide comments and advice on the trial procedures
Aim	Provide comments and advice on the trial procedures
Request	Cambodian Mine Action Centre (CMAC)
Category	Services - Capacity Building
Type	Output
Equipment	N/A

Development	N/A
Time frame	2006-08-01 to 2006-11-31
Place	Cambodian Mine Action Centre (CMAC), Test Site in Siem Reap
Lead nation	Sweden
Partners	Canada, the Netherlands, United States, Cambodian Mine Action Centre (CMAC)
Point of contact	Curt Larsson, curt.larsson@mil.se
Web site	
Status	Archived
Comments	
Results/conclusions	• A description of the JICS/CMAC trial activity can be found at the *CMAC website* and on the JICS website pages *three* and *four*. • More information on the trial can also be found in the corresponding news items published on the ITEP website: - *ITEP observers attend the CMAC trials of Japanese dual-sensor detection equipment* - *ITEP observers attend the CMAC trials of Japanese mechanical demining equipment* • The ITEP Participants provided observations and comments to CMAC without prejudice to the trial or the equipment under trial. The corresponding presentations can be found on the *ITEPnet* : - CMAC Detection Systems Test Observations and Comments, A. Schoolderman, B. Malmberg (24.11.2006) - U.S. Input to ITEP Assistance to CMAC Dual Sensor Technology Evaluation, R. Doheny (16-11-2006) - CMAC Equipment Test: Observations and Comments, C. Larsson, C. Weickert, C. Wolgast, G. Coley (16.08.2006) • For more details on the ITEP advisory role, please contact Curt Larsson.

Project Nr 7.2.10	
Title	
Description	Support to the Japan Science and Technology Agency test and evaluation of dual-sensors in Croatia (Part One)
Aim	Provide advice to the *Japan Science and Technology Agency* (JST) on test methodology during the trial of Japanese dual-sensor systems at the (*CTRO*) Benkovac test site in Croatia, and collect additional test data concerning the performance of the dual-sensor detectors as compared to a single metal detector, as well as on the human factor
Request	Provide advice on the test methodology in order to obtain a realistic test procedure which allows for a comparison of four different dual-sensor systems and a metal detector. Collect data on the human factor.
Category	*Japan Science and Technology Agency* (JST, Japan), CROMAC - Centre for Testing, Development and Training (*CTRO*)
Type	Services

Equipment	Output
Development	Japanese dual-sensor detectors
Time frame	Prototype/Demonstrator
Place	2006-01-15 to 2006-03-09
Lead nation	CROMAC - Centre for Testing, Development and Training (CTRO - *Benkovac test facility*
Partners	Germany
Point of contact	United Kingdom
Web site	Christina Mueller, Christina.Mueller@bam.de
Status	
Comments	Archived
Results/conclusions	• The 2006 JST trial in Croatia is a continuation of *Japanese national trials* with Japanese dual-sensor mine detectors. It also contributes to the development of comparable performance features and tests for dual sensor systems.
	• An *international workshop* was held on the 16th of February 2006 in Benkovac to discuss the preliminary results.
	The *final report* of the Japanese trials at Benkovac is available at the ITEP website. The trials demonstrated that the tested Japanese dual sensors improve the probability of detection for minimum-metal mines such as a PMA-2 buried in mineralised soil and have a potential for discriminating landmines from metal fragments. On the other hand, it was learned that the most important issue to be solved for practical use of these systems is the reduction in operation time. It was also concluded that further work is necessary on the development of a method to evaluate the human factor when using dual-sensor detectors which produce images to be interpreted by the operator/deminer.

Project Nr 7.2.11	
Title	Support to the mechanical demining equipment demonstration at the 2007 Humanitarian Demining International Symposium
Description	To assist with the preparation and execution of the side-by-side demonstration of mechanical demining machines held during the *fourth Humanitarian Demining International Symposium*
Aim	Provide assistance during the establishment of the demonstration lanes and collection of ground penetration depth data
Request	CROMAC - Centre for Testing, Development and Training (*CTRO*)
Category	Services
Type	Output
Equipment	9 mechanical demining machines from 6 manufacturers in three categories (light, medium and heavy)
Development	COTS

Time frame	2007-03-01 to 2007-04-27
Place	CROMAC - CTRO
Lead nation	Canada
Partners	CROMAC - Centre for Testing, Development and Training (*CTRO*)
Point of contact	Chris Weickert, Chris.Weickert@drdc-rddc.gc.ca
Web site	http://www.ctro.hr/konferencija/eng/
Status	Archived
Comments	• The fourth Humanitarian Demining International Symposium took place from the 23th to the 27th of April 2007. The highlight of the event was the side-by-side demonstration on the 25th of April of the following machines: MV-4, MV-10, RM-KA-02, MineWolf, Mini MineWolf, Bozena-4, Bozena-5, Hydrema 2500/770, and Samson 300 • Canada supported the CROMAC - CTRO during preparation of the demonstration lanes as well as during data collection on the day of the event. Fibreboards were inserted in all demonstration lanes in order to assess the ground penetration profile of the participating machines. Data processing was carried out by the CROMAC - CTRO. • A *summary paper* of the Symposium can be found in the Mine Action Technology Newsletter, Issue 6.
Results/conclusions	The results of the side-by-side demonstration will be published in the Symposium Book of Papers

Project Nr 7.2.12	
Title	Support to the Japan Science and Technology Agency test and evaluation of dual-sensors in Croatia (Part Two)
Description	Observe and provide comments to the *Japan Science and Technology Agency* (JST) on the used test methodology during the October 2007 trial of Japanese dual-sensor systems at the (*CTRO*) Benkovac test site in Croatia. This trial was originally planned by ITEP, with the JST as partner and including several other dual sensor detectors, but was later cancelled (ITEP project 2.4.2.12). JST decided to go ahead with the trial testing the Japanese developed dual-sensor systems only. The trial was carried out by the Croatian Mine Action Centre - Centre for Testing, Development and Training (CROMAC-CTRO) in cooperation with the JST.
Aim	Observe and comment on the test procedures, and provide feedback on the test protocol to the trial entities and the ITEP community. The trial protocol used by the JST/HCR-CTRO for this dual-sensor trial was the draft ITEP test protocol originally compiled for the cancelled/postponed ITEP dual sensor detector trial
Request	*Japan Science and Technology Agency* (JST), Croatian Mine Action Centre - Centre for Testing, Development and Training (CROMAC - *CTRO*)
Category	Services
Type	Output
Equipment	ALIS, LAMDAR IV mounted on the Gryphon together with the MineLab F3 mounted on the Gryphon, LAMDAR IV mounted on the Gryphon together with CEIA MIL-D1 mounted on the Gryphon

Development	Prototype/Demonstrator
Time frame	2007-10-01 to 2007-12-31
Place	CROMAC - CTRO *Benkovac test facility*
Lead nation	Belgium, Canada
Partners	Japan Science and Technology Agency (*JST*), Croatian Mine Action Center - Centre for Testing, Development and Training (*CROMAC - CTRO*), Germany - BAM
Point of contact	Chris Weickert, Chris.Weickert@drdc-rddc.gc.ca or Michel Dirickx, Michel.Dirickx@rma.ac.be
Web site	
Status	Archived
Comments	
Results/conclusions	• Descriptions of the CROMAC - CTRO/JST trial can be found at the *trial website*, the *CROMAC - CTRO website* and an *ITEP website news items* • The ITEP Observers provided observations and comments to the JST without prejudice to the trial or the equipment under trial. They further also gave feedback to the ITEP test community in the following reports which are available on the *ITEPnet*: - Report on the Croatia trial of Multi-Sensor Systems (October 2007), Y. Das - Tests of ALIS-PG and Gryphon at Benkovac, Croatia, 22-26 October 2007, Y. Yvinec • Germany - BAM provided assistance to CROMAC - CTRO with the trial data processing.