CEN Workshop Agreements for Test and Evaluation of Humanitarian Demining Equipment

Overview article

ITEP Secretariat
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Introduction
The increase of humanitarian demining activities in the late nineties brought with it an awakening of the need for a standardized assessment of the equipment used in these activities. Although trials of the capabilities of the available demining equipment were already taking place, the lack of testing standardization made it difficult to cross-compare test results in order to determine which equipment was best-suited to any particular need. Test results were therefore frequently of limited use for the end-user community. It was within this context that the European Commission (EC) mandated the European Standardization Committee (CEN) in 2000 to establish standard methodologies for humanitarian demining. In order to fulfill this mandate the CEN Technical Committee created the technical working group 126 (CEN BT/WG126) to ensure co-ordination and to generate specific standardization initiatives. Since the establishment of the CEN BT/WG126, three standardization initiatives, in the form of CEN Workshops (CWs), have been run with the associated publication of three CEN Workshop Agreements (CWAs). A fourth Workshop is to start in June 2006 and updating of the previously published CWAs is also planned. This article intends to give an overview of the CEN Workshop process, the existing CWAs and the status of their application.

The CEN Workshop Approach

CEN has introduced the CEN Workshop, which is a mechanism and approach to standardization. It is intended as a process where clients can bring their standardization and technical specification requirements, and are given the opportunity to find a solution in an environment "tailor-made" for their needs. The Workshop concept provides an opportunity for any party faced with a technical challenge to find others in a similar situation and to develop a result by consensus, validated in an open arena.

The procedures for setting up and operating CEN Workshops are deliberately kept to a minimum and all the decision-making powers rest with the interested parties themselves, i.e. the Workshop participants. They cover their own costs and are responsible for the direction of the Workshop, as well as for the approval of the deliverables. The Workshop is an open process and the participants may include all market players (industry, service providers, administrations, users and consumers) which can come from any part of the globe, as opposed to the European Standards (ES) approach, in which only CEN member states represented by their national Standardization Bodies can take part.

1 A short version of this overview article will be published in the UNMAS/GICHD Technology Newsletter of June 2006.
The main activity of a CEN Workshop (CEN WS) is the development and publication of the CEN Workshop Agreement (CWA). The CWA is a technical agreement, developed within the framework of CEN and owned by CEN as a publication, which reflects the consensus of identified individuals and organizations that contributed to its contents. The CWA represents a lower level of consensus than that represented by the European Standard. While the latter is binding for participating partners and used as the basis for national standards, the CWA is endorsed and adopted by the interested parties on a voluntarily basis. Nevertheless, while the CWA is not specifically designed to support legislation or regulation, the CWA concept does not in itself preclude this possibility.

The task of the technical working group (CEN BT/WG 126) is to ensure co-ordination and to generate specific humanitarian mine action standardization initiatives. An officially confirmed co-ordination with the GICHD (Geneva International Centre for Humanitarian Demining) avoids duplication of standardization activities between CEN and UNMAS (United Nations Mine Action Service), and that the standards and specifications produced by CEN are eventually disseminated by GICHD and UNMAS in the form of IMAS (International Mine Action Standards), after decision by the IMAS Review Board.

As mentioned earlier, most costs of a CEN Workshop are carried by the attending parties. However, in view of the benefit for society at large, and in particular for the field practitioners, the EC EuropeAid Cooperation Office accepted to contribute a limited amount of funds to the standardization activities in humanitarian mine action. These funds are mainly used to cover the costs of the CEN WS administrative management, which is taken care of by the CEN WS Secretariat and to assure that the CEN WS has an adequate representation of field practitioners whose experience is considered essential to ensure that the requirements of the CEN specifications are realistic.

Published CWAs are publicly available, amongst others on the ITEP website, and can be used free of charge.

Since the creation of the CEN BT/WG 126, the following CEN Workshops have been completed, and the associated CEN Workshop Agreements have been published:

Two of the completed workshops are on test and evaluation of demining equipment. They were strongly supported by the International Test and Evaluation Program for Humanitarian Demining (ITEP), through active participation of the ITEP Participants’ experts, as well as the hosting of the respective CEN Workshop Secretariats by ITEP Participants’ entities. These two testing standards will be commented on in more detail in the next paragraphs. As the CWA 15464 is not of direct interest to the test and evaluation community, it is not further covered in this overview article.
The CWA 14747 and CWA 15044 have been included in the IMAS on test and evaluation of mine action equipment (IMAS 03.40) during the July 2005 amendment of the International Mine Action Standards (IMAS).

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**CEN Workshop Agreement, Test and Evaluation of Metal Detectors (CWA 14747, June 2003)**

This CWA has been prepared by the CEN Workshop 07 “Humanitarian Mine Action – Test and Evaluation – Metal Detectors”, coordinated by the European Commission (EC) Joint Research Centre (JRC), as part of an ITEP project (ITEP Work Plan, Project 2.1.1.1). The individuals supporting the technical consensus represented by the CWA 14747 were drawn from organizations representing metal detector manufacturers, R&D institutions with experience of metal detector testing and development, demining engineers, demining Non Governmental Organizations using metal detectors and Mine Action Centres of mine-affected countries. Participants came from 14 different countries, as well as from the EC, the GICHD and the United Nations.

The CWA 14747 provides guidelines, principles and procedures for test and evaluation of metal detectors. As far as possible, procedures for testing have been closely specified. The agreement applies to all hand-held types of metal detectors for use in humanitarian demining and is intended to be used for “commercial-off-the-shelf” (COTS) detectors, but many of the tests specified within it could be applied to detectors under development.

The order of the testing followed in the CWA follows a logic that begins with tests of the basic operating performance. These tests are in the most controlled conditions for which targets are in air, not soil. To achieve such controlled conditions requires equipment and conditions that are usually not available in field environments so many of these tests need to be performed by specialized laboratories. Analogue tests are however specified for less-controlled conditions. Next, the CWA describes tests on targets in soil –again as controlled as possible. Tests then follow that may be performed in the field with a minimum of equipment.

It should be noted that few users of the document will wish to, or be able to perform all of the tests specified. Different parts of the CWA are intended to be used by R&D laboratories, manufacturers, organizations needing to procure metal detectors, Mine Action Centres and metal detector users in the field. A user in the field, for example, may perform the detection reliability test, some of the tests of operational performance characteristics and some of the basic in-air and in-soil sensitivity measurements. Furthermore, users of the CWA who wish to conduct a trial of various metal detectors using the tests specified may also conduct a pre-trial assessment to exclude detectors at the beginning that clearly do not meet their requirements. Such a pre-trial would include one or more of the tests specified in the CWA, with acceptance levels set by the users according to their own requirements.

In order to help different users get the maximum benefit from the CWA, guidelines are provided under the form of a matrix (CWA 14747, Chapter 5.1) as to which CWA tests are
considered appropriate for different categories of trials, such as a consumer report trial\(^2\), acceptance trial\(^3\), in-field trial etc.

At the time of publication of the CWA 14747 (June 2003), it was recognized that further work would have to be done regarding 1) the understanding of the effect of the soil and how to best characterize it, and 2) a suitable way to measure detection reliability without using a huge number of targets. Several studies on the latter items have since been carried out. The soil characterization aspects were looked at in detail by different ITEP Participants, either in dedicated projects (ITEP Work Plan, Project 2.1.1.4) or as secondary research items in other projects (ITEP Work Plan, Projects 2.1.1.7, 2.1.1.2, 2.1.1.8). The latter two ITEP activities have primarily been run to look into how to devise a practical and statistically valid trial set-up in order to obtain operationally representative trial results. Furthermore, the practical use of the CWA 14747 has been verified during a recent large comparative trial of COTS metal detectors (STEMD, ITEP Work Plan, Project 2.1.2.3). Based on the research results obtained in the latter activities and the testing experience gained, a list of CWA 14747 updates is now being proposed. It is planned that the CEN Workshop 07 will reconvene in 2006 to work on an updated version of the CWA 14747\(^4\).

**CEN Workshop Agreement, Test and Evaluation of Demining Machines (CWA 15044, July 2004)**

This CWA has been prepared by the CEN Workshop 12 “Humanitarian Mine Action – Test and Evaluation – Demining Machines”, coordinated by the Swedish EOD and Demining Centre (SWEDEC), in close collaboration with the Geneva International Centre for Humanitarian Demining (GICHD) and the Croatian Mine Action Centre (CROMAC) as part of an ITEP project (ITEP Work Plan, Project 3.1.5). The CWA 15044 was developed by experts from different national testing entities (Canada, Croatia, Germany, Sweden, the United Kingdom, the United States), Mine Action Centres, Non Governmental Agencies and manufacturers. The GICHD and the International Trust Fund for Demining and Mine Victim Assistance were also represented.

The aim of the CWA 15044 was to create industry-accepted criteria for the testing, evaluation and acceptance of COTS mechanical equipment used in humanitarian demining. It should, amongst others, help users to find the key technique or the key combination of techniques best suited to a given mine-clearance operation.

In the CWA 15044 demining machines are defined as those machines whose stated purpose is the detonation, destruction or removal of landmines. It should be noted that this does not necessarily imply a fully demined area following passage of the machine. The machine could be a ground-preparation machine, primarily intended to improve the efficiency of subsequent demining activities.

\(^2\) A consumer report trial aims to test equipment against standard general tests, so that the results are of general interest to metal detector users. For further definition refer to IMAS 03.40 Test and evaluation of mine action equipment

\(^3\) An acceptance trial aims to test equipment against specific requirements of a customer, in order to make purchasing decisions, for example. For further definition refer to IMAS 03.40 Test and evaluation of mine action equipment.

\(^4\) To obtain more information on the updating of the CWA 14747, please contact Christina Muller (Christina.Mueller@bam.de).
The CWA 15044 provides a standardized methodology for test and evaluation of demining machines using a systematic and stepwise approach. It includes provisions and technical criteria for:

- **Performance Testing** – Testing to establish whether the machine and its tool(s) is capable of performing the role for which it is intended under comparable and repeatable conditions and to evaluate the manufacturer’s specifications.

- **Survivability Testing** – Testing of the explosive forces on the machine and operators. The explosive force used is based on the level of threat against which the machine is designed.

- **Acceptance Testing** – Testing to ensure that the machine is able to work in the environment where it is intended to be used. The criteria provide guidelines for local authorities when accrediting machines.

- **Test Targets** – The criteria provide testing agencies with guidelines to develop standardized test targets.

The CWA 15044 also provides a list of all information that should be provided by the manufacturer before testing. It further recommends a pre-trial assessment (PTA), but does not include specific guidelines. The PTA is a qualitative examination of the equipment looking at the different functions, suitability, basic operating parameters, capabilities, and manufacturer specifications and should answer the question “Is it suitable for continued testing?” The ITEP testing community recommends a PTA for all demining equipment that is taken into consideration for testing, prior to embarking on a full scale trial.

The below schematic illustrates the CWA 15044 test methodology.

![Test Methodology Diagram](image_url)

The test and evaluation procedures specified in the CWA 15044 should be viewed as minimum requirements. Additional or more stringent requirements can be imposed if appropriate. In these circumstances care should be taken that the changes do not compromise the intent of the tests or the ability to compare test results.

It is acknowledged that the current version of the CWA 15044 is written with an apparent bias toward flails and similar machines. However, it is noted that other machines including rollers could be tested equally well using the same procedures. In addition machines intended to
remove mines (versus triggering or breaking them), such as sifters, could be tested simply by modifying the proposed test sheets\textsuperscript{5}.

At the time of publication of the CWA 15044 (July 2004) it was recognized that the CWA concentrates on the testing of machines to clear mines, and that there is a need to expand future work to address a number of issues, including appropriate testing of ground preparation devices, enhancement of operator/crew safety testing, enhancement of mobility testing and performance degradation testing.

During 2005 and 2006 the CWA 15044 is being submitted to an experimental verification. Many demining assets have been trialed according to the CWA 15044 specifications in 2005 (ITEP Work Plan, Projects 3.2.18, 3.2.22, 3.2.23, 3.2.24) and a continuation of these trials is planned for 2006 (ITEP Work Plan, Projects 3.2.32, 3.2.33, 3.2.34, 3.2.35, 3.2.36, 3.2.41). Next to completing the baseline machine performance data for the currently available COTS mechanical demining equipment, these activities also collect feedback on the use of the CWA 15044, for which an update is planned in 2007\textsuperscript{6}. Important conclusions are further expected from comparative tests between CWA 15044 performance testing in controlled environment with in-field (in –country) testing (ITEP Work Plan, Projects 3.2.22, 3.2.24, 3.2.41)

**Future CEN Workshop Agreements for Test and Evaluation of Humanitarian Demining Equipment**

Standardization work on test and evaluation protocols will continue during 2006 thanks to, amongst other, the allocation of new EC funds to this aim.

In order to satisfy a long-standing user requirement, a CEN Workshop (CEN WS 26) on a Test Methodology for Personal Protective Equipment (PPE) for use in Humanitarian Mine Action (HMA) will kick-off on the 8\textsuperscript{th} of June 2006. The responsibility for the workshop will be equally carried by the Swedish Standardization Institute (SIS) and the GICHD. The latter co-chairs will take care of the administrative/organizational and technical co-ordination respectively. The main objectives of the CEN WS 26 are 1) to define the threat for personnel in HMA and establish reliable replicable simulated threats, 2) to define specifications for determining the mechanical suitability of finished PPE used in HMA, 3) to define a test methodology for PPE in HMA, 4) to establish specifications for recording the results of tests in a uniform manner, and 4) to determine ergonomic criteria and constraints required by the HMA end-user.

Originally, plans also existed to start a CEN Workshop on characterization of soils for electromagnetic sensors\textsuperscript{7}. As this Workshop’s objectives are partially overlapping with items to be covered during the planned update of the CEN Workshop Agreement, Test and Evaluation of Metal Detectors (CWA 14747), negotiations are ongoing to unite both activities.

\textsuperscript{5} i.e. deleting the reference to mines being triggered or neutralized and changing it to mines being successfully removed.

\textsuperscript{6} To obtain more information on the updating of the CWA 15044, please contact Goran Danielson (goran.danielsson@mil.se) or Geoff Coley (geoff.coley@drdc-rddc.gc.ca)

\textsuperscript{7} To obtain more information on the planned CEN Workshop on characterization of soils for electromagnetic sensors, please contact Marc Acheroy (Acheroy@elec.rma.ac.be)
It has further been decided that it is still premature to start a CEN Workshop on test and evaluation of dual (multi)-sensors, as there is currently no dual-sensor equipment commercially available for humanitarian mine clearance purposes. The proposed plan is for a CEN Workshop to be started in the course of 2007. During 2006 priority will be given to processing and analysis of data gathered during the 2005 dual sensor trial campaigns (ITEP Work Plan, Projects 2.4.2.6, 2.4.2.4) and further tests to be executed under the ITEP umbrella in the second half of 2006 (ITEP Work Plan, 2.4.1.3). It is hoped that the experiences and lessons learned in the 2005 – 2006 test campaigns will then provide a sound basis to start a corresponding CEN Workshop.

Contact points
The following contact points are available to provide advice on the planning and conduct of an evaluation according to the described CEN Workshop Agreements. Please do not hesitate to contact them when you are considering a trial of demining equipment or demining methods.

- ITEP Secretariat, secretariat@itep.ws
- ITEP Working Group on Test and Evaluation of Mechanical Assistance Clearance Equipment, Geoff Coley (geoff.coley@drdc-rddc.gc.ca) or Chris Weickert (Chris.Weickert@drdc-rddc.gc.ca)
- ITEP Working Group on Test and Evaluation of Dual (Multi) Sensors, Ian Dibsdall (imdibsdall@qinetiq.com) or David Lewis (dwlewis@qinetiq.com)
- GICHD, Al Carruthers (a.carruthers@gichd.ch)
- UNMAS, Noel Mulliner (mulliner@un.org)

References and links
- GICHD website (http://www.gichd.ch/)
- International Mine Action Standards – IMAS (http://www.mineactionstandards.org/imas.htm)
- ITEP website (http://www.itep.ws/index.php)
- ITEP Work Plan 2000 – 2005
- UNMAS website (http://www.mineaction.org/)
- Metal Detector Handbook, p.59 – p. 76
  (http://www.itep.ws/pdf/metal_detector_handbook.pdf)