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Guide to the research of mine action technology

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Foreword

In July 1996, international standards for humanitarian mine clearance programmes were proposed by working groups at a conference in Denmark. Criteria were prescribed for all aspects of mine clearance, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996 the principles proposed in Denmark were developed by a UN-led working group into *International Standards for Humanitarian Mine Clearance Operations*. A first edition of these standards was issued by the UN Mine Action Service (UNMAS) in March 1997.

This IMAS reflects changes to operational procedures, practices and norms which have occurred over the past three years. The scope of these standards has been expanded to include the other components of mine action, in particular those of mine risk education and victim assistance.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS is the office within the United Nations Secretariat responsible for the development and maintenance of international mine action standards (IMAS).

The work of preparing, reviewing and revising these standards is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at <http://www.mineactionstandards.org/>. IMAS will be reviewed at least every three years to reflect developing mine action norms and practices, and to incorporate changes to international regulations and requirements.

Introduction

Research is an integral part of the procurement process. Indeed, it is difficult to imagine any equipment in use in mine action programmes today, from mine detectors and GPS to protective visors and prodders, which have not been the result of some research activities. Without ongoing research it will not be possible to improve on the current generation of mine action equipment.

This standard explains the principles and processes of research.

Guide to the research of mine action technology

1 Scope

This standard establishes principles and provides background and introductory guidance on the research requirements for equipment for mine clearance tasks and processes.

2 Normative references

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3 Terms and definitions

A list of terms and definitions used in this standard is given in Annex B. A complete glossary of all the terms and definitions used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines.

- a) 'shall' is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard.
- b) 'should' is used to indicate the preferred requirements, methods or specifications.
- c) 'may' is used to indicate a possible method or course of action.

The term 'national mine action authority/authorities' refers to the government department(s), organisation(s) or institution(s) in each mine-affected country charged with the regulation, management and co-ordination of mine action. In most cases the national mine action centre (MAC) or its equivalent will act as, or on behalf of, the 'national mine action authority'. In certain situations and at certain times it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all of the functions, of a national mine action authority.

4 Research categories

4.1 Pure research

The term 'pure research'¹ normally refers to research activities that are not linked to any specific application. The outcome of pure research may eventually lead to a product, but its immediate aim is to establish generic principles.

4.2 Applied research

Applied research is focused at clearly defined problems and market opportunities. Its principal purpose is to establish the *feasibility* of applying technology to solve a clearly defined problem, within defined parameters such as cost, time and risk.

5 Research activity groups

Research involves four distinct groups of activities:

¹ Also occasionally referred to as 'basic' or 'strategic' research.

5.1 Analysis of the problem

The first research activity is an analysis of the problem. For mine action this should involve the collection, collation and analysis of all relevant factors which will enable the problem to be accurately defined and scoped. For mine action technology, this primarily involves an analysis of the Statement of Operational Need (SON). This important activity is often overlooked or conducted with insufficient effort.

5.2 Analysis of constraining factors

The second research activity involves an analysis of the factors which constrain the technology solution. Such limiting factors should include the operational imperative, the environmental conditions, the mine threat, manufacturing constraints and in-country support, (including maintenance and repair, operator skills and the availability of funding).

5.3 Analysis of potential technologies

The third research activity involves an analysis of potential technologies to determine their suitability, availability and affordability. This should include an assessment of the risk of using new components, materials, manufacturing processes and unproven software.

5.4 Communication of research results

The fourth activity involves communicating the results of the research to those who need to make decisions. Pure research may involve peer review to establish the necessary validity and authority. Peer review is normally exercised via academic and/or professional journals and conferences.

Applied research is normally presented to the project sponsor in-a formal report, reinforced where necessary with technology demonstrations. Technology demonstrations create a visible product, which helps to establish credibility and confidence in the findings of the research work. They are particularly relevant when the User needs convincing of the potential value of innovative or revolutionary technology.

6 Research facilities

6.1 Academia

Traditionally, most research has been conducted in universities and technical institutes of higher learning. Funding for such work has come from a number of sources, with an increasing reliance on external sources.

6.2 Industry

In recent years, as industries have become larger and more global, and as the market has required technology to evolve at an ever increasing pace, there has been a shift in applied research from academia to industry. In-house applied research (and product development) is common in industries such as pharmaceuticals, computer and aerospace, where product development is particularly dynamic. Applied research conducted in such circumstances may involve substantial investment, and is unlikely to be made readily available to potential competitors, even for humanitarian causes such as mine action

6.3 National facilities

Governments have developed national research facilities for strategic capabilities such as defence, nuclear power and public health. There is growing pressure to transfer more information into the public domain. This includes the results of government-sponsored research into mine action technologies, although the procedures for such sharing have yet to be fully developed.

6.4 International facilities

International research facilities are normally the result of two or more countries sharing facilities for mutual benefit. Such benefit may reduce the overall costs, or the objectives may have a political imperative.

In the case of the European Union (EU), the concept of common international facilities has evolved to cover a comprehensive range of issues of common interest to the member states and to maintain throughout the whole procurement cycle independent technical expertise. Research into mine action technology is supported by the European Commission's Joint Research Centre (JRC), Ispra in Italy. These facilities are at the same time the core of the participation of the European Commission to the International Test and Evaluation Programme for Humanitarian Demining (ITEP). Details of the role of JRC Ispra and a summary of ongoing research, evaluation and coordination activities are available at <http://demining.jrc.it/>

7 Operational analysis

Operational analysis (OA) is a field of research that applies scientifically-based quantitative and qualitative analysis to assist management decisions. OA is helpful in making informed and auditable decisions on future requirements. In such circumstances a series of plausible scenarios should be generated based on a logical progression of trends, events and consequences.

A structured approach is necessary to establish a shared vocabulary and set of common references. Effective OA is predicated on reliable, objective and consistent data, clear and justifiable assumptions, appropriate judgement, and valid mechanisms and decision support tools. Clearly, the results of OA depend critically on the data and initial assumptions and it is therefore crucial that they are based on recent mine action experience.

8 Research and development standards

The ITEP initiative is the first example of movement towards the development of international mine action R&D standards. This is supported by the European standards body, CEN, and the work of their Working Group (WG) 126. These technical standards will not be restricted to advanced sensors, but will have wider application within mine action R&D, and will be incorporated into IMAS at a later date.

9 Funding

Many promising technologies have not been exploited due to the lack of available funding. Although funds may exist, there is currently no formal mechanism to link donors to technology opportunities, and *vice versa*. Donors should expect new technologies to demonstrate measurable improvements over existing methods.

The funding of ambitious technology research projects poses a particular problem. Such research, particularly if it involves major demonstrations, may involve significant financial commitment and exposure to risk. Furthermore, investment in research requires a long term commitment, and existing methods of mobilising resources through UNHQ do not provide such a commitment from donors. There is thus a need to identify novel arrangements that satisfy the requirements of industry, research organizations, the user community and the donors.

10 Direction and control

10.1 National

At national level, decisions on the use of national resources and research facilities for the benefit of mine action are driven by government policy and perceived national interests. Although many governments have committed themselves to assisting victim states by providing the information and facilities needed to improve technology, they have yet to develop the national procedures for making the information and facilities readily available. National security, IPR (intellectual property rights) and funding limit the quantity and quality of information that can be made available.

10.2 International

At the international level there are a number of fora for developing international policies which provide direction (directly and indirectly) and cooperation on research. These mainly exist within existing regional, defence or trade groupings such as the EU, OAS, NATO, WEU and PfP

At the Washington Conference on Humanitarian Demining in May 1998, the EC and US agreed to work together (with other partners) on a wide range of technological initiatives, including the development of common R&D standards (see Clause 7) and a joint programme of international technology demonstration projects. This initiative is a good example of a formal arrangement to improve international cooperation in the research necessary for mine action technologies. ITEP is one of the concrete outcomes, but is still in the early stages of its development. The second one is the "Demining Technologies – Information Forum (DTIF), which was launched by Canada together with the European Commission and the USA. It has since been joined by UNMAS, GICHD and other nations. This Forum is beginning to provide a systematic, multi-disciplinary opportunity for the identification of demining technology gaps, for the synergistic exchange of ideas, for collaborative international programme co-ordination and planning and for the review of progress in the mine action technology area. Besides an electronic journal and facilitating technology focused workshops, DTIF will also provide a service as a technology information clearing house.

The UN has an obligation and the mandate to provide direction and guidance. The current UN policy paper on mine action technology provides general guidance on research principles and priorities and, in the future will give specific guidance on applied research activities.

11 Responsibilities and obligations

11.1 United Nations

The United Nations shall be responsible, within available resources, for:

- a) the development of strategic policy for the development of mine action technology;
- b) the coordination between donors, users, sponsors and developers; and
- c) the development of priorities and principles for investment in mine action technology.

The United Nations should be responsible, within available resources, for:

- a) the coordination of generic research activities;

11.2 National mine action authority

The national mine action authority shall be responsible for

- a) establishing and maintaining national standards, regulations and procedures for research into mine action technology. These procedures should be consistent with IMAS, and other relevant national and international standards, regulations and requirements;

- b) the selection and accreditation of the appropriate mine action technology specific to their national conditions and requirements, based on research results;

11.3 Mine action organizations / the Users

Mine action organisations (the Users) should:

- a) cooperate with other Users to ensure that relevant information on the use of particular technology is available to all stakeholders.

11.4 Donors

Donors should:

- a) ensure that research and development activities in mine action technology that they support is in accordance with the principles and priorities established by the United Nations;
- b) ensure that full and formal risk assessments are developed prior to investment in research and development activities; and
- c) ensure that the minimum duplication of effort exists between competing research and development programmes.

11.5 Research and development organisations and industry

The mine action technology research and development organisations and related industry should:

- a) liaise with research and development programmes in similar technology areas, (within the bounds of commercial confidentiality);
- b) aim to establish complimentary and focused, rather than competing, areas of research.

Annex A **(Informative)** **Normative references**

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

- a) IMAS 03.10. Guide to the procurement of mine action equipment; and
- b) IMAS 03.20. The procurement process; and
- c) IMAS 03.40. Test and evaluation principles.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (<http://www.mineactionstandards.org/>). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B (Informative) Terms and Definitions

B.1.1 applied research

research focused at clearly defined problems and market opportunities.

Note: Its principal purpose is to establish the feasibility of applying technology to solve a clearly defined problem, within defined parameters such as cost, time and risk.

B.1.2 collaboration

in the context of mine action equipment procurement, the term refers to an activity which applies solely to the procurement of common equipment by two or more organizations.

B.1.3 commercial off the shelf (COTS)

in the context of mine action equipment procurement, the term refers to an equipment that is available direct from the manufacturer and requires no further development prior to introduction into service apart from minor modifications.

B.1.4 cost-effectiveness

an assessment of the balance between a system's performance and its whole life costs.

B.1.5 development

the stage of the project (and its associated costs) prior to production concerned with developing a design sufficiently for production to begin.

B.1.6 donor

all sources of funding, including the government of victim states.

B.1.7 equipment

a physical, mechanical, electrical and/or electronic system which is used to enhance human activities, procedures and practices.

B.1.8 International Organization for Standardization (ISO)

Note: A worldwide federation of national bodies from over 130 countries. Its work results in international agreements which are published as ISO **standards** and **guides**. ISO is a NGO and the standards it develops are voluntary, although some (mainly those concerned with health, **safety** and environmental aspects) have been adopted by many countries as part of their regulatory framework. ISO deals with the full spectrum of human activities and many of the tasks and processes which contribute to **mine action** have a relevant standard. A list of ISO standards and guides is given in the ISO Catalogue [www.iso.ch/infoe/catinfo/html].

Note: The revised mine action standards have been developed to be compatible with ISO standards and guides. Adopting the ISO format and language provides some significant advantages including consistency of layout, use of internationally recognised terminology, and a greater acceptance by international, national and regional organizations who are accustomed to the ISO series of standards and guides,

B.1.9 investment appraisal

the process of defining the objectives of expenditure, identifying the alternative ways of achieving those objectives and assessing which way is likely to give best value for money.

B.1.10

national mine action authority

the government department(s), organization(s) or institution(s) in each mine-affected country charged with the regulation, management and coordination of **mine action**.

Note: In most cases the **national mine action centre** (MAC) or its equivalent will act as, or on behalf of, the national mine action authority.

Note: In certain situations and at certain times it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all the functions, of a national mine action authority.

B.1.11

operational analysis

operational research

a field of research that applies scientifically based quantitative and qualitative analysis to assist management decisions.

B.1.12

operational research

see operational analysis.

B.1.13

procurement

the process of research, development and production or purchase which leads to an **equipment** being accepted as suitable for use, and continues with the provision of spares and post design services throughout the life of the **equipment**.

B.1.14

prototype

an equipment, component or sub-component built as nearly as possible to the final design and build standard.

Note: Prototypes are used to aid development of the final production standard and/or to demonstrate performance or specification compliance.

B.1.15

pure research

research activities not linked to any specific application. The outcome of pure research may eventually lead to a product, but its immediate aim is to establish generic principles..

B.1.16

research

the systematic inquiry, examination and experimentation to establish facts and principles.

B.1.17

sponsor

the sponsor of an equipment trial is the authority requiring the trial to be carried out.

Note: This is most likely to be an international organisation, national mine action centre, donor or demining organisation.

B.1.18

standing operating procedures (SOPs)

standard operating procedures

instructions which define the preferred or currently established method of conducting an operational task or activity.

Note: Their purpose is to promote recognisable and measurable degrees of discipline, uniformity, consistency and commonality within an organization, with the aim of improving operational effectiveness and safety. SOPs should reflect local requirements and circumstances.

B.1.19

test and evaluation (T&E)

activities associated with the testing of hardware and software.

Note: Activities include the formation and use of procedures and standards, the reduction and processing of data and the assessment and evaluation of test results and processed data against criteria such as defined standards and specifications.

B.1.20

United Nations Mine Action Service (UNMAS)

the focal point within the UN system for all mine-related activities.

Note: UNMAS is the office within the UN Secretariat responsible to the international community for the development and maintenance of International Mine Action Standards (IMAS)

B.1.21

user

the individual or organisation that will operate the equipment.

Note: For the purpose of mine action, the user could also be defined as "a composite body of informed and authoritative opinions on the needs of national commercial and NGO users, today and in the future".