

Public Security and Safety Technology

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Abstract. NDT methods have capability of application in wide range of human activities assuring quality by detecting defects that are to be regarded as a potential cause of incidents or damages and a threat to the life and nature at all.

In this paper will be presented a new scope and specific fields of NDT application where NDT has to be applied with the requirements of even higher sensitivity and related reliability than in conventional fields. The presentation encompasses NDT as a powerful source of methods for Antipersonnel mine detection (APMD) and the achievements in that application as well as for NDT application needed to ensure the security from threats, such as terrorism or from the impact and consequences of unintended incidents.

The significant NDT experts contribution is expected primarily for validation of methods in use and work on R&D for advanced technology in this field to develop the technologies and knowledge for building capabilities for application as well as the competitiveness of the European security and safety industry.

The paper gives a general overview presenting the Public security and safety technology as a scope of interest for NDT methods and discussing some possible platforms for activities to co-ordinate national, European and international security research and development effort in order to avoid unnecessary duplication and to explore synergies wherever possible.

Protection against terrorism such as Chemical, Biological, Radiological and Nuclear threat as well as non-destructive detection for neutralisation of explosive ordinance disposal (EOD), or improvised explosive devices(IED), and specially against WMD, can be efficient only if it is considered on an international level politically, technologically and financially Upon analysis of the situation it is evident that NDT research and development activities have to be strengthened and accelerated.

EFNDT WG5 organised with the aim to focus the activity of NDT experts to the humanitarian demining activities taking into attention the overall threat scenario broadened the focus from antipersonnel mine detection to Public Security and Safety Technology. This will be presented in the paper as a challenge to overcome the security and safety technology development problem for the benefit of citizens security while respecting fundamental human rights.

This requires increased and accelerated R&D and Education and mostly the awareness of the value of NDT for security and safety purposes.

Introduction

NDT methods can be applied to a wide range of human activities, assuring quality by detecting defects that are a potential cause of incidents or damages as well as a threat to human life and the environment. NDT is significant due to its preventative effects, preventing incidents and damages of all kind and degree of severity. This is why NDT methods and techniques are so widely and often used, in spite of the fact that some of the methods have restricted scope and that even their reliability is below expectations. The fact is that, in many cases, NDT methods are the only solution.

As an interdisciplinary field, NDT has benefited from capabilities that were developed in many other fields of science and technology leading to methods, techniques and instruments with greater sensitivity, user-friendliness and high operational speed as well. The applicability to complex materials and to assure quality and integrity of the materials or structures is being greatly increased.

Conventional fields where NDT is currently implemented with more or less reliable procedures are:

- pipelines,
- containers and pressure vessels,
- oil refineries and their output in transit,
- railways,
- offshore, ships, airplanes, satellites,
- roads, bridges, dams,
- energy plants, nuclear plants,
- polymers and composites
- dimensional measurements
- material characterization,
- objects of art and architecture

NDT is now a relatively mature field, even though the capability and reliability of many methods and procedures are still in the process of testing, validation and improvement. At this and other NDT conferences, there are many papers as results of continuous improvement to the methods, procedures or quality control systems that should be used regarding better sensitivity or probability and reliability of the results at all.

Looking forward, one can be certain that the further implementation of NDT could rely on one of the most pressing problems of modern society: Environmental protection, but within the context of sustainable development. Many countries are ready to meet this global challenge by making a public international commitment to environmental protection and by reorienting/transferring their Industries and Economies, including all necessary maintenance. The role of NDT in Environmental protection is the one which makes NDT control unavoidable and without alternative.

Over the last two decades, certain new fields were opened where NDT should be applied to the benefit of the Environment and the protection of human life. The requirements for sensitivity and reliability are even higher since the objects of detection are:

- mines
- unexploded objects
- hidden dangerous objects

As a result of conflicts, mine and other battlefield debris affect areas in around 90 countries world-wide today. These areas contain upwards of 80 million mines, which cause significant direct and indirect negative impacts on these areas inhabitants' – for example,

security, local and regional economies, and even politics. The negative effects range from physical and psychological impacts to missed economic opportunities, creating additional hardship in these areas/countries.

The International Community has started many initiatives on the level of both Governments and Civil organizations, not to mention the various very successful individual contributions toward the mine free world.

The international community set as its goal to overcome the mine problem in approximately 10-15 years in all mine affected countries. The Mine Ban Treaty is the international agreement that bans antipersonnel landmines and it was decided by the Ottawa Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Antipersonnel Mines and on Their Destruction in 1997. It was also very often cited by many leading politicians, governments and related institutions.

A few years later, we have to realize that the Ottawa Convention is more proof of well-intended wishes than a reality.

To contribute from the technical point of view and to support Humanitarian demining, EFNDT / WG5 Antipersonnel Mine Detection, APMD, (www.fsb.hr/ndt/wg5-apld) was organized to give NDT experts the opportunity to network themselves in the field concerned. As Convenor of this group, it is my pleasure that WG5 is very much appreciated by the EFNDT Board of Directors as an active contributor.

On the other hand, it is evident from all-around that we are faced with a newly significant and quite serious field of NDT application: the need for a speedy response to the growing threat of international terrorism and criminal activities. The news of new attacks and the devastating effects on victims surrounds us every day. We are witnessing increasing sophistication of terrorist groups using both proven old and innovative new technologies to reach their hideous goals.

NDT people have potential both in our expertise and our methodology to respond. We also have a responsibility to act in this way. The only thing we do not have yet was focus that will channel our energy and creativity and strive to stay a step ahead of them.

In spite of the fact that the mine problem has not been solved we should wider the scope since the knowledge on explosives may be applicable to both, demining and diagnostic of other explosive devices, so the activities of scientists/experts devoted to those areas could be rationalized

An extension from mine detection in humanitarian demining to other perilous objects includes demanding sharing of interdisciplinary knowledge and participation of a wider group of experts.

The step forward was done as our professional obligation to offer and apply powerful NDT methods in detection and diagnostic of all kinds of threats in civil environment. The extended scope includes also various kinds of Chemical, Biological, Radiological and Nuclear threats in the civil environment that can be weapon of mass destruction WMD.

The significant NDT experts' contribution is expected primarily for validation of methods in use and work on R&D for advanced technology in this field.

The substantial need in broadening of the scope of the EFNDT WG5 was accepted at EFNDT GA, Vienna, Nov.11. 2005 and working group of APMD is transformed to working group of Public Security and Safety NDT Technology, PS&SndtT.

For the NDT people it means that activities have to be strengthened and accelerated but for the people who are devoted to change politics and the world in aggressive way it means that some of their intentions will fail because of new NDT technology in prevention.

Security and Safety approach

Security in the EU and wider is a precondition of prosperity and freedom so security research activities should be co-operative and co-ordinated in order to avoid unnecessary duplication and to explore synergies wherever possible.

To build up the required capabilities activities should be concentrate on the threat aspects but also to awareness that R&D in NDT should be also focused on civil security application and that there are NDT methods that can effectively cope with threats and incidents.

Accepting the reality that no NDT single method can provide all the necessary information, up to now efforts are focused to integrate several methods to form multi-sensor system that would take advantage of the complementary capabilities. It could offer better probability of detection and increases the functionality as well. The selected methods and inspection requirements depend on the inspected conditions, site-scan accessibility and characteristics of the object under examination.

Challenge for the NDT experts is to develop the technologies and knowledge to ensure the security of citizens from threats such as terrorism and crime. R&D should be mission-oriented to technology and methodology development and validation. In the same time one should be very careful with implementation since highly motivated field teams under pressure to tackle the detection problem of mine/unexploded object or any other dangerous object as soon as possible, often use unproven methods which may cause great material damage and in the worst case loss of life.

Humanitarian demining should be used as an experience in implementation of methods and technology.

Humanitarian demining, what is roughly defined as a set of operations to be carried out in order to transform mine affected region into region safe for life, is a process which has to be improved in order to fulfilled the goal named. Humanitarian demining with the current technology would need more than thousand years and app. 30 billion dollars in order to achieve the proclaimed 'Mine free world' expected to be realized in 10-15 years.

The list of potential NDT methods includes, but is not limited to:

- *Acoustic,*
- *Electromagnetic induction,*
- *Vibration analysis*
- *Infrared imaging,*
- *Nuclear,*
- *Radar*

The field of implementation and the list of methods is still open and transfer of technology and methodology to locate APM or UXO and even WMD should be done with due concern about the consequences in capability and efficiency as well as reliability and accuracy of NDT methods and techniques used.

The advantage has to be given to the methods which can accelerate the procedure because of extremely dangerous working conditions and very high concentration needed in this work as it is now in practice.

As an example it is well known that there is not a problem to deactivate mines or other hidden dangerous object if they are detected and defined by type, parameters of location, size and orientation in soil/water, but NDT is needed to answer detect those parameters.

Protection against terrorism and crime by NDT methods is still in the very beginning and in this moment the ambition in the EFNDT WG 5 PS&SndtT is to prepare and motivate

NDT people and responsible persons to cooperate with NDT experts in process of research and development to avoid incidents and to mitigate threat potential consequences.

The relevance of Standards for the Public Security and Safety Operation

For any process, whether of product finalization or service completion one has to work in accordance with procedures. Directives, Rules and Standard are a valuable help in managing the process concerned.

Needless to say that for threats detection the goal must be a rate of reliability approaching perfection, i.e. 100%. Time is of less importance than accuracy. In such case, standardization of procedure is of great help.

NDT is generally considered 'special' in the sense that characteristics inspected are measured indirectly by methods which have inherent limitations, often under difficult inspection conditions in the field. The reliability of examinations is influenced by various factors. The results are obtained by day-2-day performance and it is very important to understand the difference between theoretical requirements and practical achievement.

We still do not have Standards even for Humanitarian Mine Clearance Operation that speaks about methods and no directives that all of us are obliged to follow. We have IMAS issued under the auspices of UN and is effective upon receipt. Other standards such as those issued by the host nation are to be complied with, provided they match or exceed those set out in this document, otherwise, these international standards will apply.

The following subjects are covered: Safety, Training and Qualifications, Survey, Minefield Marking, Mine Clearance Operations, Explosive Ordinance Disposal, Medical, Communications and Minefield Information Management.

According to the listed subjects, we can see that detection is not listed as the subject of this standard. The standard considered is a single and valuable attempt at setting rules in the work related to mine detection and de-mining so it is a sound foundation of standardization development within this field but let us consider some statement to understand the need of proper standardization in that field. For instance: "All personnel involved in clearance operations must receive the proper training, must be qualified, experienced and medically fit".

What is meant by "proper training" if we know that there is great difference in qualification for manual mine clearance versus mechanical, adding to this the possibilities of various methods which could be applied in both manners.

There is also the need for clear definition regarding protective equipment because the statement: "All personnel involved in mine clearance activities must wear adequate protective equipment when appropriate", does not explain who should stipulate appropriate situation.

One more example of that kind is related to the conditions in mine detection processes for which the standard prescribes that "working periods as an operation should be undertaken in daylight and dry condition," so the question is what happens with underwater mines, mines in houses, mills and storage, mostly under the ground level, where daylight can hardly be expected and dry conditions are practically out of question.

Of uppermost importance and of significant influence are points related to "Clearance standards", which state that an area is cleared when all mines and munitions have been removed and/or destroyed. All debris, from mines and munitions, such as fusing systems, percussion caps and other items that constitute an explosive hazard, is to be removed.

The area should be cleared of mines and UXO to a standard and depth which is agreed to be appropriate to the residual/planned use of the land, and which is achievable in terms of the resources and time available. The contractor must achieve at least 99.6% of the

agreed standard of clearance. It is very hard to believe that all mines could be cleared off. We have to define and agree upon that level of mine detection or clearance reliability and confidence which could be achieved regarding methods and procedures used and the conditions in the field. This agreed level should be linked to the result of methodology and technology achievement, and shall follow the methodology and technology advancement.

To introduce effective NDT quality system in APM detection and clearance and particularly in the protection against terrorism and crime dangerous objects it is necessary to work on standardization starting with clarification of appropriate terminology and definition, for mutual understanding and communication.

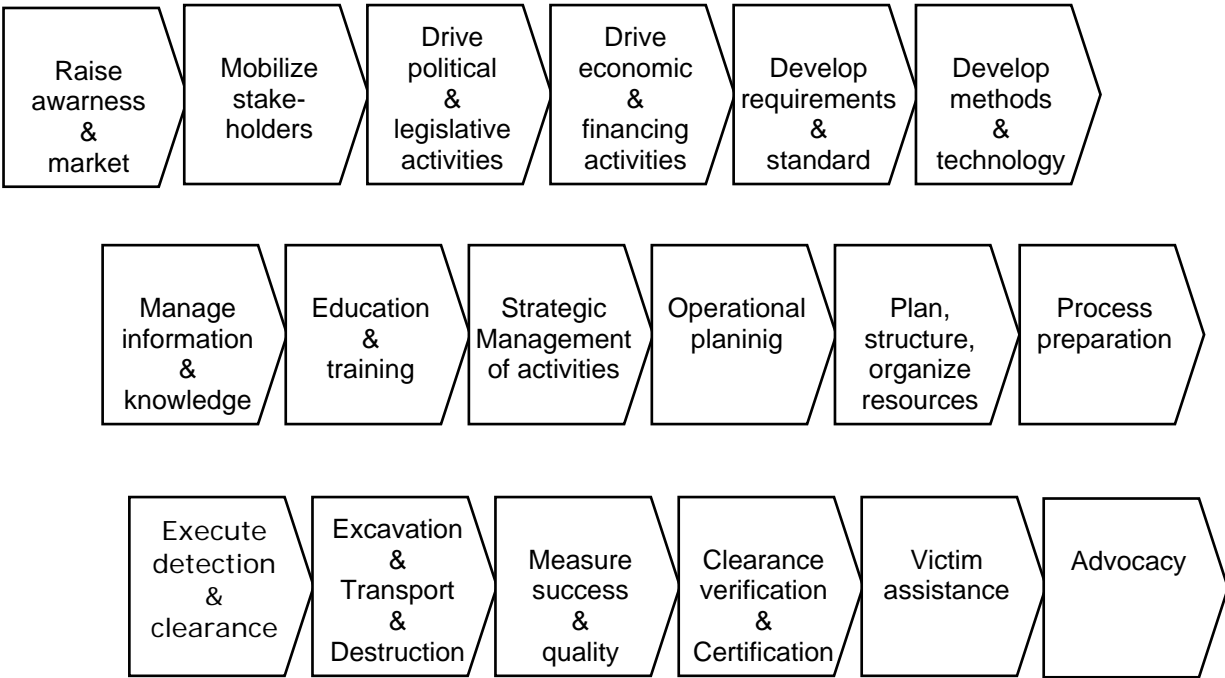
There are experiences from trials, when even though equipment, techniques and personnel were believed to be quite efficient, the actual results of certain NDT methods were unreliable. Working outside the laboratory and under stress of danger at work makes the task more difficult and special care should be paid to assure competitive procedures and personnel that understand and perform correctly all necessary tasks to obtain reliable results.

Conclusion

The search for smarter methods that can rapidly and inexpensively implement NDT methods in such a complex field of addressing emerging threats to preserve life will continue to present a challenge for NDT society. It must not be forgotten that implementation of NDT methods in any field needs general compliance of all system requirements i.e. systematic approach in transfer regarding NDT operations and necessary system reliability assurance.

R&D is needed for increase of efficiency, diminution of expenditure with new methods of detection and the quality in operation that will speed up the efficiency with no diminishing the reliability, but on the contrary, enhancing it.

Here presented Activity Chain illustrate inherent complexity of the process, often requiring multidisciplinary approach. The complexity of the mission are increasing a need for an efficient Security and Safety NDT operation requiring good organization, planning, guidance at all levels of operations and a technical know-how.



One of the most important initiatives in EFNDT WG5 is to move forward to meet the global demand for Security and Safety and to acknowledge the importance of relationships among the NDT Community, enhancing the role of NDT in the big task of service to the humanity, and healthy and productive environment both for the present and the future generations.