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Technical Survey

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Foreword

International standards for humanitarian demining programmes were first proposed by working groups at an international technical conference in Denmark in July 1996. Criteria were prescribed for all aspects of demining, 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 and the International Standards for Humanitarian Mine Clearance Operations were developed. A first edition was issued by the UN Mine Action Service (UNMAS) in March 1997.

The scope of these original standards has since been expanded to include the other components of mine action and to reflect changes to operational procedures, practices and norms. The standards were re-developed and renamed as International Mine Action Standards (IMAS) with the first edition produced in October 2001.

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, therefore, is the office within the United Nations responsible for the development and maintenance of IMAS. IMAS are produced with the assistance of the Geneva International Centre for Humanitarian Demining.

The work of preparing, reviewing and revising IMAS 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/>. Individual IMAS are reviewed at least every three years to reflect developing mine action norms and practices and to incorporate changes to international regulations and requirements.

Introduction

This standard should be read in conjunction with IMAS 07.11 Land Release and 08.10 Non-technical survey.

Technical survey is an important means of identifying, confirming and improving definitions of the boundaries of hazardous areas and the nature and distribution of their contents. Well planned and justified technical survey methodologies help ensure that any further interventions are necessary and efficient and may allow the confident release of land without the need for further technical interventions. Technical survey may be carried out as an independent activity or it may be integrated with clearance operations.

The purpose of technical survey is to provide evidence for analysis to support the land release decision-making process. It is an intrusive process, using survey and clearance assets, typically into a suspected or confirmed hazardous area, although it may also be used as a method for the initial investigation of areas under some circumstances. Although technical survey may be a separate activity, it is often integrated with clearance and can be undertaken before, during and after clearance, depending upon the local circumstances and information needs of decision-makers.

Any technical survey methodology should be planned such that it provides a very high level of confidence that if hazard items are present they will be indicated. The performance of survey assets against different hazard types should be monitored, through the collection and analysis of appropriate performance data, to develop evidence-based assessments of confidence levels for the indication of targets.

Technical survey does not happen in isolation. It should be planned, implemented and adjusted in light of information obtained through non-technical means, including non-technical survey, and as a result of new information discovered during the technical survey. It should be appropriate to the specific circumstances and conditions associated with the operational site and will often be closely integrated with full clearance. Technical survey is the primary method for defining accurately and with confidence the extent of areas that require clearance, and may be used to support decisions about when and where it is appropriate to stop clearance.

Whenever possible, targeted technical survey is preferable to systematic survey. Circumstances where so little is known about the potential threat that it is impossible to develop a targeted approach should generally be subject to further non-technical effort. Where systematic technical survey is implemented it should be planned such that it provides the desired level of confidence that if hazard items are present at least one piece of evidence of their presence will be encountered and indicated.

Physical evidence of the presence of Explosive Ordnance (EO) is the primary source of 'hard' data for analysis about the nature and distribution of hazard items and their relationship with the surrounding environment. As such it is of the utmost value within the land release process and should be treated with the greatest care and attention. There is only one opportunity to record such data; it should not be wasted. Accurate and consistent collection, recording and reporting of data is a basic requirement of any land release process. Standards for such data collection should be defined by NMAAs.

This standard provides guidance and sets out minimum requirements for technical survey so that appropriate national standards can be developed.

Technical Survey

1. Scope

This standard establishes principles and provides guidance on the conduct of technical survey in the land release process and details responsibilities and obligations of National Mine Action Authorities and the mine action organisations involved.

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, definitions and abbreviations

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 “**Land Release**” describes the process of applying all reasonable effort to identify, define, and remove all presence and suspicion of EO through non-technical survey, technical survey and/or clearance. The criteria for “all reasonable effort” shall be defined by the NMAA.

The term “**National Mine Action Authority**” (NMAA) refers to the government entity, often an inter-ministerial committee, in an EO-affected country charged with the responsibility for the regulation, management and coordination of mine action.

Note: In the absence of a NMAA, 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 MAC or, less frequently, a NMAA.

The term “**Suspected Hazardous Area**” refers to an area where there is reasonable suspicion of EO contamination on the basis of indirect evidence of the presence of EO.

The term “**Confirmed Hazardous Area**” refers to an area where the presence of EO contamination has been confirmed on the basis of direct evidence of the presence of EO.

The term “**Non-technical Survey**” refers to the collection and analysis of data, without the use of technical interventions, about the presence, type, distribution and surrounding environment of EO contamination, in order to define better where EO contamination is present, and where it is not, and to support land release prioritisation and decision-making processes through the provision of evidence.

The term “**Technical Survey**” refers to the collection and analysis of data, using appropriate technical interventions, about the presence, type, distribution and surrounding environment of EO contamination, in order to define better where EO contamination is present, and where it is not, and to support land release prioritisation and decision making processes through the provision of evidence.

The term “**Targeted Investigation**” refers to the investigation during technical survey of certain areas within a SHA/CHA that are more likely to contain EO.

The term “**Systematic Investigation**” refers to a systematic process of applying technical survey in a SHA/CHA. It is typically used where there are no areas within the SHA/CHA that are more likely to contain EO, than others.

The term “**All Reasonable Effort**” describes what is considered a minimum acceptable level of effort to identify and document contaminated areas or to remove the presence or suspicion of EO. “All reasonable effort” has been applied when the commitment of additional resources is considered to be unreasonable in relation to the results expected.

Cancelled land (m²)

A defined area concluded not to contain evidence of EO contamination following the non-technical survey of a SHA/CHA.

Reduced Land (m²)

A defined area concluded not to contain evidence of EO contamination following the technical survey of a SHA/CHA.

Cleared land (m²)

A defined area cleared through the removal and/or destruction of all specified explosive ordnance hazards to a specified depth.

4. General Requirements

4.1. Principles of technical survey

- a) The technical survey methodology should satisfy safety requirements
- b) No technical survey should be carried out unless an assessment of what is likely to be found in the area has been carried out, making use of all relevant data, information and analysis
- c) The technical survey methodology should provide a high degree of confidence that, if the assessed contamination is present, evidence of its presence will be encountered
- d) Targeted technical survey should be preferred over systematic technical survey
- e) The technical survey methodology should reflect any need to preserve information about the nature and distribution of contamination
- f) Details of what was found and where, and what was done and where, should be recorded and reported with sufficient accuracy to satisfy applicable standards and allow meaningful analysis of the type, nature and distribution of contamination within its surrounding environment
- g) The quality of technical survey should be monitored to allow improvement to technical survey procedures and practice and to establish and maintain confidence in the quality of information provided and land released

4.2. Technical survey process

An SHA is defined on the basis of indirect evidence of the presence of EO. A CHA is defined on the basis of direct evidence of the presence of EO. The quality and detail of such evidence will vary from area to area and will determine how accurately, and with how much confidence, the boundaries of SHAs and CHAs can be defined.

The principle of a graduated response indicates that a SHA should normally be subject to non-technical survey before assets are committed to technical survey. Non-technical survey should include the identification and recording of information suitable to help develop targeted, as well as systematic, technical survey.

Planning for technical survey requires:

- a) Review of all available information relating to the area and any SHAs/CHAs
- b) Analysis of contamination characteristics and typical distribution at sites within the region/theatre of operations
- c) Assessment of the types of contamination likely to be present and their likely density and distribution within the area
- d) Confirmation of information collection requirements, as defined in NMAA, as well as any additional requirements specific to the site or circumstances
- e) Consideration of the performance of available assets against the expected contamination types in the technical survey role (which may not necessarily be the same as the performance of those assets in the clearance role)
- f) Identification of areas that would justify targeted investigation
- g) Development of a technical survey approach that satisfies the principles described in 4.1 above

During the conduct of technical survey there should be frequent reviews in light of what is discovered, or when significant additional information becomes available from other sources. In particular reviews should be conducted whenever any new information becomes available that implies a change in any of the assessments and assumptions used in the development of the technical survey plan. Any changes to the technical survey plan resulting from such reviews should be documented, including the reasons for the changes.

Integration of technical survey with clearance potentially offers significant opportunities to increase the efficiency with which land is confidently and reliably released. Deciding if and when to switch from technical survey to clearance, when to switch from clearance back to technical survey, and when it is appropriate to stop technical operations altogether, is fundamental to the success, efficiency and credibility of the land release process. Criteria associated with such switching/stopping decisions should be developed, reviewed and updated, in light of evidence about the nature and distribution of contamination and should be specific to local circumstances and conditions.

Definitions of fade out and buffer zones should reflect the type of contamination present and the typical distribution and density of associated devices, based on evidence collected during technical survey and clearance operations, as well as information about tactics and use by combatants. Such definitions should be reviewed and updated at appropriate intervals to take into account new evidence collected during field operations.

NMAAs should consider delegating authority to take decisions about fade out and buffer zones to the most appropriate level.

Any marking or fencing associated with the technical survey should be established in accordance with the requirements of IMAS 08.40.

Results from the monitoring of land following cancellation, reduction or clearance should be used to assess the effectiveness of technical survey, to identify areas for improvement and to maintain confidence in technical survey within the land release process.

4.3. Information collection, recommendations and reporting

Information collected during technical survey has three main purposes:

- i. To confirm the presence of EO and to define more accurately the nature and extent of its distribution;
- ii. For analysis to help decision-makers take valid and efficient decisions within the land release process; and
- iii. To establish and maintain confidence in the reliability of decisions to release land amongst stakeholders, including local people.

The needs of information users (for prioritising, planning etc.) will often be similar, but will also be subject to variation depending upon the specific circumstances associated with the area and with wider considerations at the regional, national or programme level. A technical survey will not succeed in achieving its aims if it does not satisfy the needs of information users.

During a technical survey the following information should be collected as a minimum:

- a) Details of any evidence of the presence, extent and likely density of EO contamination;
- b) details of the type, location, depth and condition of any EO encountered during the survey;
- c) new evidence confirming, or calling into question, existing recorded evidence;
- d) details of the ground and environment in terms of slope, topography, soil, metal contamination, vegetation, any changes to the ground since hazard items were laid/deployed (such as erosion, deposition of soil by wind/flooding, landslides), nearby infrastructure and weather or climate factors that may be significant.

In addition to the information above, a detailed site plan (sketch, digital map of the area, aerial photograph, etc.) should also be prepared. The plan should include as a minimum:

- e) exploratory lanes (if used), area covered by technical survey assets, and safe access routes;
- f) reference points, bench marks, turning points and intermediate points as applicable;
- g) location of visible EO contamination and the pattern (if known);
- h) locations(s) of any mine or ERW found/destroyed earlier, or during the technical survey;
- i) prominent natural features such as high ground, water courses, trees, etc.; and
- j) prominent man-made features within the area;
- k) any other information likely to be helpful to information users and analysts;

Data collection should satisfy the minimum data/information collection requirements detailed in IMAS 07.11. Appropriate means, satisfying accuracy requirements specified by the NMAA, should be used to measure and record location and position data.

5. Output from technical survey

5.1. General

The outputs from a technical survey include:

-
- a) definition of any area containing EO contamination;
 - b) additional information for planning the initial clearance of any area identified as containing EO contamination;
 - c) evidence (gathered through all reasonable effort) which may be sufficient to determine and demonstrate, to the satisfaction of the land users, that an area is free of EO contamination; and
 - d) additional information for the establishment of priorities for future action.

5.2. Recommendations

The technical survey report may make recommendations about:

- a) adjustments to SHA/CHA boundaries in light of evidence discovered during the survey;
- b) the suggested depth of clearance for specific areas where EO contamination is identified; and
- c) the resources recommended to carry out follow-on activities, such as clearance, including assets to be used in specific areas.

5.3. Reduction by technical survey

Land may be released through reduction when it can be shown that “all reasonable effort” has been applied to identify, define and remove all presence and suspicion of EO, and that the application of further effort would be unreasonable in relation to the results expected.

For land to be reduced through technical survey it is necessary to show that the efforts applied could reasonably have been expected to identify evidence of the presence of contamination if it had been present. In order to do so authorities, organisations and agencies should be able to show that:

- a) The assessment of expected contamination was reasonable;
- b) The technical survey assets used, and the methodology employed, were appropriate to the potential contamination assessment; and
- c) Areas where no contamination was found could, therefore, be reasonably assessed as presenting no evidence for the presence of contamination.

Assessments, decisions and actions should be documented in accordance with requirements stated in NMAS.

5.4. All reasonable effort

A condition for the release of land through reduction by technical survey is that “all reasonable effort” has been applied up to and including the survey and that it can be demonstrated with high confidence that there is no evidence of EO contamination in the area. IMAS 07.11 further explains the concept of “all reasonable effort”.

Examples of effort that would reasonably be expected in relation to technical survey include, but are not limited to:

- a) Making efforts to understand the nature and characteristics of contamination within the area of operations;
- b) Demonstrating that the performance of survey assets against hazard types has been monitored, reviewed and reflected in technical survey plans and operations;

- c) Providing evidence that appropriate planning took place, using all available information and analysis, reflecting understanding of the nature and characteristics of contamination as well as the performance of different survey assets;
- d) Applying appropriate quality management efforts to the people, equipment, procedures and information associated with the technical survey process; and
- e) The taking of decisions by competent and authorised people, on the basis of analysis and review of all available information.

The application of “all reasonable effort” relies upon an integrated system that addresses all aspects of the planning, operational, review and decision making stages. Applying a great deal of effort in one respect alone is unlikely to satisfy the requirement if effort is not also applied in all other respects.

6. Technical survey methods

6.1. General

Technical survey is a process of collecting information to support decision-making processes at various levels within organisations and programmes. Any asset and methodology proposed for technical survey should satisfy the requirements of paragraph 4.1.

Different survey assets offer different advantages and disadvantages. When considering which assets and methodologies are appropriate, authorities, planners and operators should carefully consider the importance of preserving information to support subsequent decision-making. High quality information is likely to lead to high quality, and therefore confident, decision-making. In particular, efficient decisions about when to stop technical activity may benefit from the preservation of information about what was found where during the technical survey, and/or subsequent clearance operation.

Assessment of the performance of different assets in the survey role should take into account:

- a) Safety aspects of the asset;
- b) The probability that the asset will indicate the presence of a hazard item;
- c) The extent to which the asset will preserve information associated with hazard items and other aspects of the surrounding environment;
- d) The speed and cost with which the asset can undertake the technical survey function; and
- e) The suitability of the asset in light of the surrounding environment, infrastructure and climate.

The decision to deploy an asset in a technical survey role should be documented in terms of the suitability of that asset against the assessed hazard type.

6.2. Accreditation of technical survey assets

Assets used for technical survey should be specifically accredited for the role. Where appropriate, assets should be accredited against specified hazard types. Accreditation should be based on evidence of the capability of the asset in the technical survey role, including the likelihood that it will indicate the presence of hazard items. Indication may be achieved by the asset alone, or when the asset is used in defined and approved methodologies (such as when one asset follows up another).

The use of assets as clearance devices, including their capability to indicate, remove, destroy or detonate devices should be assessed and accredited separately.

6.3. Classification of survey assets

Classification of survey assets, in terms of confidence that they will indicate the presence of hazard items if they are present, should be based upon a combination of:

- a) An assessment of the logic of the asset's process for indicating the presence of hazard items; and
- b) Evidence collected during trials and during on-going operations.

Over time the confidence level should reflect evidence to a greater extent than logical assessment. In order to do so it should be required that operators collect and report data about the performance of different assets against different hazard types during field operations, as well as any trials.

Confidence levels should be reviewed at appropriate levels to take into account up to date information about the performance of assets.

Where different assets exhibit different confidence levels, authorities may choose to use combinations of assets in order to achieve acceptable cumulative levels of confidence.

6.4. Targeted and Systematic Surveys

Wherever possible, targeted technical survey should be preferred to systematic technical survey. In areas where it is not possible to conduct a targeted investigation of the area, the form of the systematic investigation should reflect an assessment of the possible type and distribution of contamination items that might be present.

Targeted technical survey should reflect available information about the expected presence of hazard items and take into account analysis of the wider context of contamination within the theatre of operations.

To achieve high levels of confidence in the results of technical survey, the survey methodology should be developed to ensure that:

- a) The definition of any target area is based upon an analysis of available information, and takes into account any appropriate buffer zones;
- b) Survey lanes or routes should not be able to pass through a contamination area without identifying at least one piece of evidence, if contamination is in fact present; and
- c) The separation of survey lanes or routes should not be so great as to allow survey assets to pass either side of a contamination area.

Prior to starting a systematic technical survey, planners should carry out a review of the available information to determine:

- a) Whether it is possible to conduct a targeted survey; or
- b) Whether the collection of additional non-technical information might allow a targeted survey.

The technical survey methodology should be developed to reflect any information about the hazard types that might be present at the site and the type and capability of available survey assets.

The technical survey methodology should define the proportion of the ground requiring investigation (up to 100% in some cases), the width, arrangement and separation of any investigation lanes and any requirement for follow up by other assets.

All survey operations should be subject to frequent review on the basis of the availability of new evidence (or the lack of new evidence) to identify opportunities to achieve land release objectives as efficiently as possible.

7. Survey team requirements

Technical survey should be carried out by competent staff, using appropriate equipment (accredited where appropriate), in compliance with prevailing safety and operational standards, and in accordance with approved methodologies satisfying the requirements of NMAS.

Technical survey teams should include sufficient resources and capabilities to carry out technical activity effectively and efficiently, and to engage in communication with local authorities and other interested parties.

Technical survey operations should be subject to internal and external Quality Management. IMAS 07.40 provides further guidance.

8. Documentation

The information that is collected, recorded and reported by technical survey teams is an essential component of the land release process. If the quality of the data or information gathered during the technical survey is poor, or if high quality data is poorly recorded and reported, then the land release process will be inefficient and may lose credibility with stakeholders.

Authorities, organisations and agencies should ensure that technical survey documentation satisfies quality requirements and reflects the needs of all information users. Appropriate quality management systems (including QA and QC of information aspects) should be established and implemented in relation to the collection, recording, reporting and analysis of information associated with technical survey. Any shortcomings in the quality of technical survey data, information and documentation should be investigated and appropriate corrective and preventive action taken.

Technical survey teams should be given the opportunity to compare the results of their technical surveys with any subsequent information resulting from clearance or other technical interventions.

The format of reports used during technical survey should be defined in NMAS. The report should identify operational decisions made during the technical survey, as well as the evidence that was the basis for the decision making. The evidence obtained from a technical survey may be summarised in a survey report, but all raw evidence should be retained and safeguarded by an appropriate authority.

Information should be collected and recorded in a systematic manner. Whenever possible, use should be made of standard and proven information management systems and GIS. Guidance on information management can be found in IMAS 05.10.

Location maps should be used to indicate the extent of identified EO contamination, and to mark reference points, landmarks or other significant features. Information should be recorded electronically, or marked on a topographical map, a satellite image or on a trace. If topographical maps are not available information should be recorded on locally produced maps.

Detailed maps should show all identified EO contamination locations/areas and detail of the location and identification of survey markers and the hazard marking system. Other relevant information to assist planners, analysts and decision-makers should be included.

The information recorded during technical survey should form part of the documentation required for handover to organisations conducting further technical survey or clearance and for the final release of land.

9. Responsibilities and obligations

9.1. National Mine Action Authority

The NMAA shall:

- a) develop national standards for technical survey consistent with the land release policy;
- b) accredit organisations as fit to undertake technical survey;
- c) prepare and publish standards and guidelines for technical survey including:
 - i) quality assurance and quality control to be applied to technical survey contracts and agreements;
 - ii) documentation for technical survey; and
 - iii) accuracy requirements for positional data;
- d) use the information collected through the technical survey process to prepare tasking orders and annual work programmes and to improve overall understanding of the nature and form of contamination;
- e) define liability issues relating to the clearance operator, the individuals undertaking the technical survey, and the local community, in accordance with national legislation; and
- f) monitor the quality of land release outputs from technical survey.

9.2. Demining organisation

The organisation undertaking technical survey shall:

- a. gain (from the NMAA, Mine Action Centre or equivalent) accreditation needed to conduct technical survey;
- b. apply the national standards for technical survey. In the absence of national standards, the organisation shall apply the IMAS standards, or such standards as are specified in their contract or agreement;
- c. develop SOPs for the implementation of technical survey;
- d. collect the necessary information as required by the technical survey documentation;
- e. where applicable, conduct a formal handover of surveyed sites to organisations conducting follow-on activities;
- f. maintain and make available documentation as specified by the NMAA or Mine Action Centre or equivalent; and
- g. consult closely with both men and women of the affected communities about all decisions made during technical survey.

In the absence of an NMAA or similar authorities, the organisation should assume additional responsibilities. This includes assisting the host nation during the establishment of a NMAA and Mine Action Centre or equivalent and in framing standards for technical survey, including quality assurance and quality control.

Annex A (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 04.10 Terms and definitions;
- b) IMAS 07.30 Accreditation of demining organizations;
- c) IMAS 07.40 Monitoring of demining organizations;
- d) IMAS 08.10 Non-technical Survey;
- e) IMAS 08.20 Technical Survey;
- f) IMAS 09.10 Clearance requirements;
- g) IMAS 09.11 Battle area clearance;
- h) IMAS 05.10 Information management for mine action;
- i) IMAS 08.30 Post-clearance documentation ;
- j) IMAS 08.40 Marking mine and ERW hazards;
- k) IMAS 09.50 Mechanical application

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.

Amendment record

Management of IMAS amendments

The IMAS series of standards are subject to formal review on a three-yearly basis, but this does not preclude amendments being made within these three-year periods for reasons of operational safety and efficiency or for editorial purposes.

As amendments are made to this IMAS they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the IMAS by the inclusion under the edition date of the phrase “incorporating amendment number(s) 1”.

As the formal reviews of each IMAS are completed new editions may be issued. Amendments up to the date of the new edition will be incorporated into the new edition and the amendment record table cleared. Recording of amendments will then start again until a further review is carried out.

The most recently amended IMAS will be the versions that are posted on the IMAS website at www.mineactionstandards.org.

Number	Date	Amendment Details
1	1 Mar 2010	1. UNMAS address updated. 2. NMAA definition updated. 3. Inclusion of a note in Clause 3 that ERW includes unexploded submunition. 4. Minor changes to ensure gender issues. 5. Removal of Annex B from the IMAS series and re-naming Annex C to B and D to C.
2	1 Mar 2013	1. Reviewed for impact of IATG development (Aug 2012). 2. Updated introduction. 3. Inclusion of new definitions for NTS, TS, cancelled land, reduced land and cleared land. 4. Incorporation of term ‘reduce/reduction’ throughout the document. 5. General editing of text throughout. 6. Relabelled the IMAS 08.20. 7. Updated normative references in Annex A. 8. Removed Annex B, C and D.
3.	26 July 2018	1. ‘Mines/ERW’ replaced with ‘explosive ordnance’ or EO throughout. 2. Updated scope to reference NMAA, page 2. 3. Updated normative references in Annex A.