NATO STANDARD

ATP-106

WEAPONS ATTACK SIGNATURE AND PROTECTION SYSTEM EVALUATION

Edition A Version 1

MARCH 2019

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TECHNICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

20 March 2019

1. The enclosed Allied Technical Publication ATP-106, Edition A, Version 1, WEAPONS ATTACK SIGNATURE AND PROTECTION SYSTEM EVALUATION, which has been approved by the nations in the MILITARY COMMITTEE LAND STANDARDIZATION BOARD, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2635.

2. ATP-106, Edition A, Version 1, is effective upon receipt.

3.

4. This publication shall be handled in accordance with C-M(2002)60.

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
DEU	DEU reserves the right to have the equipment confirmed as "free from explosives" only by appropriately qualified personnel.
DNK	Sharing of incident and damage data will be subject to national restrictions and classification, and can only be shared bilaterally and under separate agreements.
SVK	SVK WIT capabilities will be limited to Level 1 only.
FRA	France will only be able to fully implement this STANAG once it has had non-nominal access to the CALDERA, VIPER and FERRET software solutions.
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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CHAPTER 1 INTRODUCTION

1.1 Background

Over a number of years in combat operations, increasing amounts of battle damage information and expertise has been gathered from attack scenes, ranging from estimation of explosive charge size to effectiveness of protection systems and the nature/severity of injuries sustained by military personnel. This information has been used to support scientific research to investigate what improvements were required in vehicle and personnel protection equipment. Processes and procedures for technical exploitation have been refined over time, and in parallel with advances in technology, to gather the most beneficial data.

1.2 Aim

The aim of this document is to provide guidance on collected best practice for gathering incident data, to facilitate sharing of knowledge between NATO partners. This data can be used to inform and underpin scientific research to further improve the performance of nations' equipment and thus the survivability of its military personnel. This document is intended as guidance for both specialist and non-specialist incident data gatherers.

It is appreciated that the hazards of an operational arena may affect the quantity and/or quality of the data that can be gathered at the incident scene, and the immediate safety of the military personnel must always override the aspiration for a comprehensive data set.

1.3 General Methodology and Document Roadmap

Technical exploitation is an activity that involves the use of a forensic mind-set to collect post-strike information and physical remnants of weapons used during an incident in support of wider military operations. Technical exploitation is conducted after Explosive Ordnance Disposal (EOD) teams have cleared the location and always within a security zone established by the unit commander in charge of the incident scene. While the physical process of exploiting the post-attack site begins at the site itself, full exploitation may involve additional intelligence experts, including but not limited to, the Weapons Intelligence Team (WIT), chemical exploitation analysts, fingerprint examiners etc.

A key component of a WIT task is the exploitation of threat munitions and weapon systems. One or both of these components may be present at an incident scene, which will provide the WITs with the opportunity to conduct data capture, forensic collection and fragment recovery. This information, fed back to activities undertaken by Levels 2 and 3 facilities, will underpin the technical characteristics of the incident, the effects and mode of employment of the threat munition(s).

This document consists of two main annexes, with specific evidence gathering procedures explained in each section. Figure 1 provides a flow diagram to describe how the document should be used.

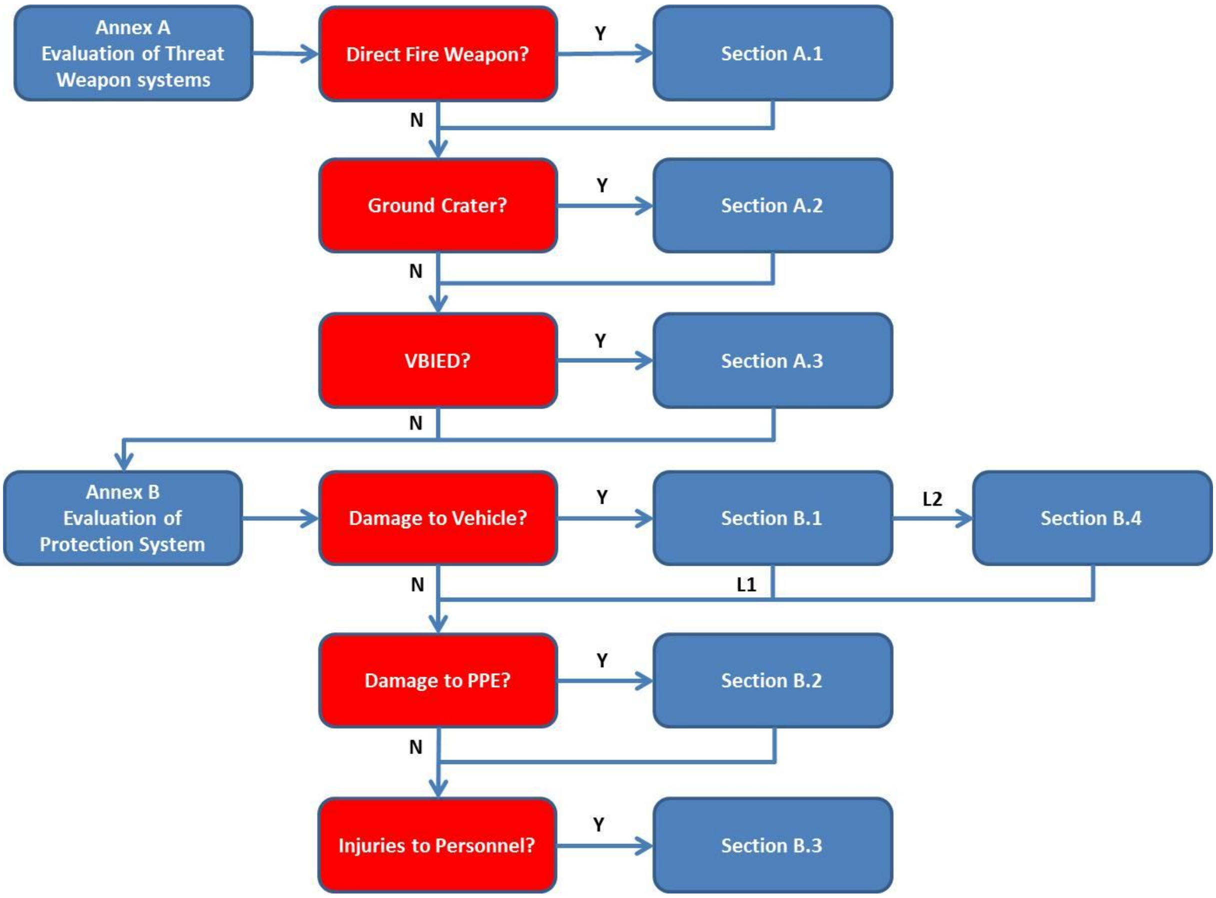

Figure 1: Data collection flow diagram

The sections contain the following information:

- A.1 – Direct-fire weapons post-initiation signatures
- A.2 – Post-blast crater analysis
- A.3 – Post-blast Vehicle-Borne IED signature collection
- B.1 – Expedient Level 1 inspection and recording of NATO vehicles damaged due to enemy action
- B.2 – The inspection and recording of NATO Personal Protective Equipment subjected to enemy action
- B.3 – The recording requirements for NATO injury data for incident exploitation
- B.4 – Detailed forward inspection and recording of NATO vehicles damaged due to enemy action

1.4 Descriptions of Technical Exploitation Levels[1]

Level 1

Level 1 (L1) technical exploitation is performed at the field or tactical level. Data and/or samples are collected at the incident scene, and rudimentary processing and analysis is undertaken where required/possible. Data collectors may be specialist personnel, such as WIT, or non-specialist personnel, who have been trained in rudimentary collection and preservation skills.

Level 2

Level 2 (L2) technical exploitation is performed at the theatre or operational level. Data and/or samples, which were collected at L1, are processed and analysed by forward-based laboratories in a permissive environment, by appropriately trained and qualified scientific/technical or military personnel.

Level 3

Level 3 (L3) technical exploitation is performed at the out-of-theatre or strategic level. Data and/or samples, which have gone through L1 and/or L2 processing and analysis, are returned to the home base[2] for in-depth analysis. Non-deployable techniques by appropriately trained and qualified scientific/technical or military personnel are utilised at this level.

It should be noted that as technology and methodologies progress, techniques previously only possible at L3 may become available at L2, with a similar cascade effect for L1. This should increase evidence gathering capability further forward.

[1] AIntP-10 Technical Exploitation, Edition A, Version 1, September 2015 used as a basis for these Level descriptions.
[2] This may or may not be located in the home nation, e.g. could be located in a friendly country near to the theatre of operations.

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CHAPTER 2 COMMON DATA GATHERING GUIDANCE

2.1 Equipment

The equipment required for a collection task will depend upon the exact data which is to be collected. Equipment common to all data collection will include:

- Notebook and pen/pencil
- Digital camera
- Tape measure/ruler
- Reference scale (to include in photographs)

Additional equipment, such as protractor, sealable plastic bags, shovel, may also be required for specific tasks. These are listed within the relevant annexes of this document.

2.2 Measurements

All measurements must be taken with regard to known reference points, the specific details of which are described within the relevant annexes of this document. Data collected may include features such as diameter, depth, angle, or penetration.

2.3 Photography

It is essential that photographs provide context of the damage incurred within the incident scene. This can be achieved by ensuring that the photographs are taken in a methodical manner and that each photograph contains some objects or components which are captured in adjacent photographs. Landscape format should be used throughout and a reference scale (or object of known dimensions) included. Specific guidance is provided within the relevant annexes of this document.

2.4 Photogrammetry

Photogrammetry is a technique which creates a 360° rendering of the subject from a series of sequential photographs. This can allow further analysis to be undertaken once the incident scene has been vacated. The methodology is described in detail at Annex A.2.

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ANNEX A EVALUATION OF THREAT WEAPON SYSTEMS

A.1. DIRECT FIRE WEAPONS POST INITIATION SIGNATURES

Introduction

Whilst conducting an investigation of the incident scene, a significant amount of data can be discerned from the signatures left on target armour systems by direct fire weapons. Collection of these signatures at L1 can enable the estimation of the weapon system by subsequent comparison with data from controlled tests. The identification of the weapon system will help to inform appropriate countermeasures.

Background

The impact of a direct-fire weapon system onto an armour target can leave a wide variety of damage features. The specific combination of damage features seen after a particular weapon strike, may be treated as a ‘fingerprint’, which can be compared to a database of reference images from controlled firings. Those shots from the controlled firings, which share the largest number of damage features with those seen in the weapons strike, may be used to suggest the type of weapon which has been encountered.

For example, the image from an incident on the left of Figure 2 shares a large number of damage features (fragment impact rings, small irregular main penetration) with that of a controlled firing of a RPG (Rocket Propelled Grenade) shown on the right. For this reason, the methodical collection of damage characteristics in this instance may lead to the correct identification of the incident as an RPG strike.

Figure 2: Comparison of a suspected RPG strike (LHS) to a controlled RPG strike (RHS)

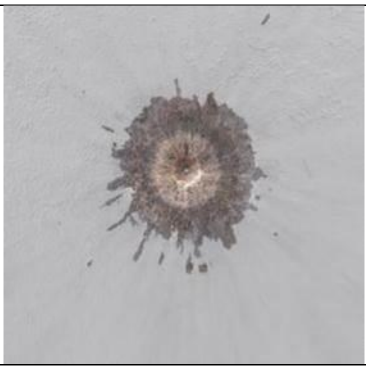
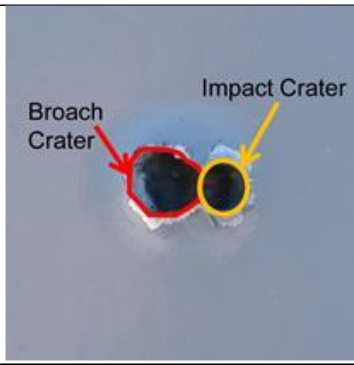
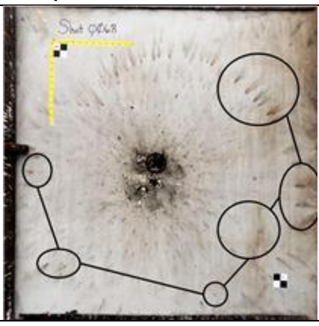
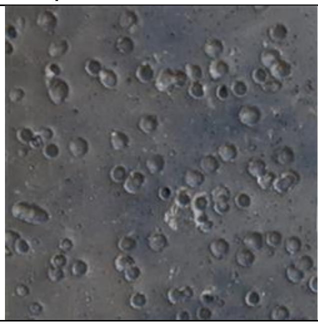
Post-Initiation Damage Features

Through a series of highly repeatable experiments[3] the following post-initiation damage features were identified to be the most important for post-initiation, direct-fire weapons identification:

a. Penetration
b. Perforation
c. Broaching
d. Cratering
e. Lobed cratering
f. Scorching
g. Splatter
h. Scarring
i. Copper Residue
j. Penetrator in hole
k. Fragment impact rings
l. Stapling
m. Petalling
n. Plugging
o. Ductile hole growth
p. Radial Fracture
q. Brittle Fracture
r. Spallation

Figure 3 provides examples and definitions for each of the damage features.

[3] The experiments providing this data were conducted under Project FERRET, which is led by US Army's National Ground Intelligence Center (NGIC) in close coordination with US Army's Engineer Research and Development Center (ERDC).

		
Penetration *The projectile has entered the armour system but not broken the rear surface of the system*	**Perforation** *The projectile has entered the armour system AND broken the rear surface of the system*	**Broaching** *An additional crater or impact hole is visible and attached to the main penetration hole*
		
Cratering *An secondary impact crater can be seen around the penetration hole*	**Lobed cratering** *Impact lobes can be seen around the outside of penetration hole*	**Scorching** *Dark burnt region around the penetration hole*
		
Splatter *Additional material other than scorching has been deposited onto the face of the armour*	**Scarring** *Multiple scars that look as if they have been gouged into the material*	**Copper Residue** *Copper residue can be seen around the marks left by the weapon system*

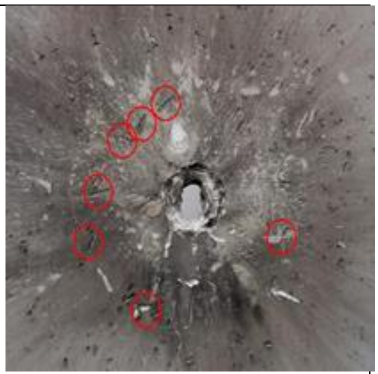
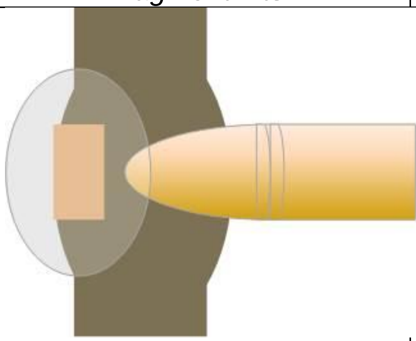
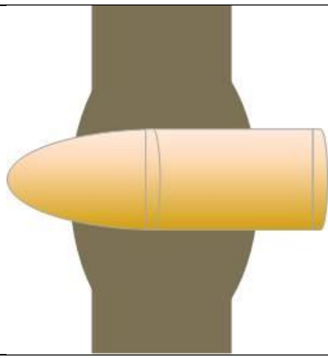
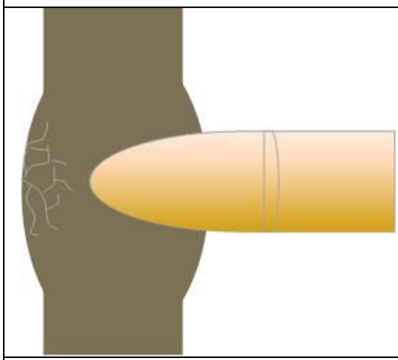
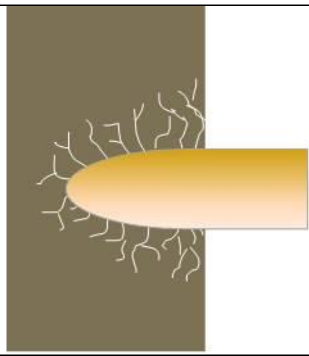
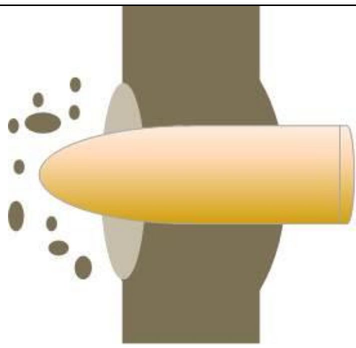
		
Penetrator in hole *The penetrator or slug from the weapon remains in the hole*	**Fragment impact rings** *Rings (may not be circular) left around the main penetrator due to multiple fragment hits*	**Stapling** *Long thin slits in the material, similar to staple marks*
		
Petalling *Material has curled where penetration has occurred in a flower formation*	**Plugging** *The round has 'pushed' a section of armour through the system like a cookie cutter*	**Ductile hole growth** *The material has stretched but no cracks are observed.*
		
Radial Fracture *No perforation. The material has stretched and radial cracks are observed on the back surface of the material*	**Brittle Fracture** *The material has fractured upon impact*	**Spallation** *The back surface of the material has fragmented*

Figure 3: Examples and definitions of key damage features

Post-Initiation Forensic Collection

The post-initiation forensic collection initially requires the operator to capture photographs of the impact of the weapon system on the armour target.

The photographs must:

a. Include the front face of the armour struck
b. Include all damage features potentially attributable to the event (e.g. weapon/jet exit points, fragments etc)
c. Be in the same plane as the armour under investigation (i.e. not at an angle)
d. Include a reference measurement (e.g. ruler) which is also a straight edge

The photographs should ideally:

a. Include a reference colour chart
b. Include images of other faces of the armour (e.g. back face)

In addition, the type of the target armour should be recorded. An example of how this information should be recorded is shown in Table 1. National caveats may restrict the ability to record specific armour details, but as much information as possible should be gathered. Operational limitations may further limit the information available, such as only the material of the armour front face being visible or accessible.

Armour Layer	1	2	3	4
Armour Type	Applique	Airgap	Base	Spall Liner
Armour Material	Steel	Air	Steel	UHMPE[4]
Armour Thickness	5 mm	10 mm	10 mm	20 mm

Table 1: Example method for recording the armour target onto which the weapon has impacted

[4] UHMPE is Ultra High Modulus PolyEthylene

For each armour face (i.e. each layer has two faces; front and rear) the operator must note, working from the apparent centre of the impact outwards, the nature and extent of damage features described in Figure 3. An example of how this information may be captured is shown in Table 2 corresponding to the example shown in Figure 4. Again it is noted that operational constraints may mean that only limited information may be available such as the damage features seen on the front face.

	Type	**Extent**
Damage Feature 1	Penetration	5 mm
Damage Feature 2	Cratering	10 mm

Table 2: Example method for noting individual damage features on a given armour face

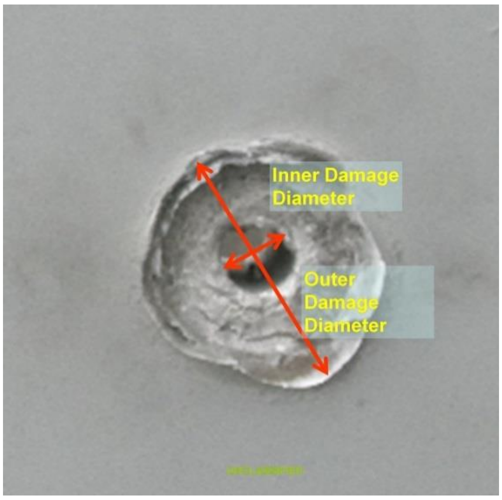


Figure 4: Picture illustrating measurements described in Table 2

It is also of value to record the azimuth (the angle between the impact vector and a line normal to the armour surface in the horizontal plane) and the elevation (the angle of impact above the horizontal plane) of the impact on the armour target. An explanation of these measurements is shown in Figure 5.

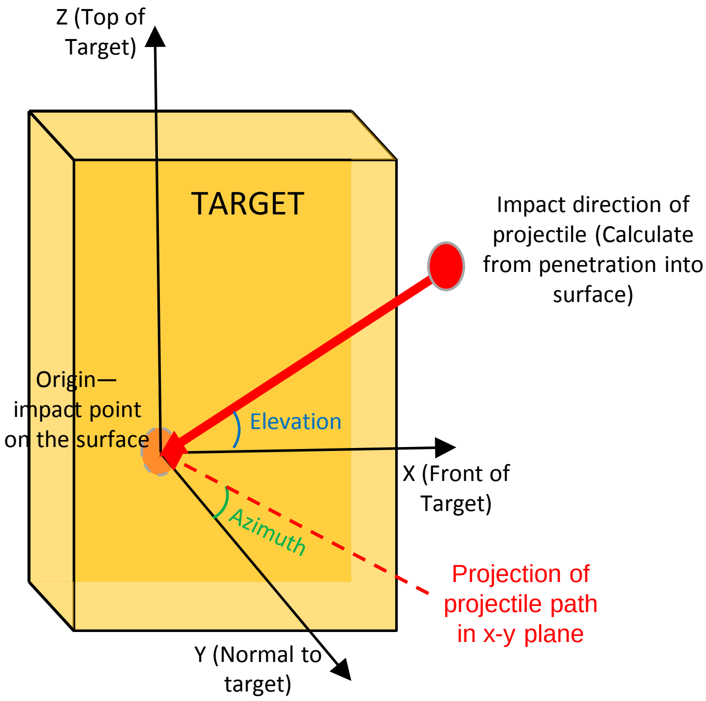


Figure 5: Azimuth and Elevation of impact

Although a number of methods exist for recording these values, the following steps provide a guide:

a. Place pen or other straight object in penetration hole.
b. Hold a protractor with the straight edge against the target material such the printed face of the protractor is facing the sky.
c. Use the protractor to measure the angle formed between the surface and the pen (azimuthal angle).
d. Hold a protractor with the straight edge against the target material such the printed face of the protractor is toward the front of the vehicle.
e. Use the protractor to measure the angle formed between the surface and the pen (elevation angle).

Many of the techniques used for data collection, which assist to determine the weapon system, are similar to those used when evaluating vehicle protection system performance (see Annex B.1). However, for simplicity all techniques are provided in full in the relevant sections.

Weapon Systems Estimation

Having collected either photography of the damage features or explicitly recorded them, a variety of techniques exist to make an assessment of the weapon system. Although it is beyond the scope of this document to discuss them in detail, all techniques essentially involve the comparison of the damage features collected to those seen in controlled tests. Those shots from the controlled firings, which share the largest number of damage features with those seen in the weapons strike, may be used to suggest the type of threat that has been encountered.

The original photography and/or damage features collected must be included in any report with the version number of the library or tool used for estimation.

Equipment

Those responsible for collecting the above information should carry sufficient equipment to enable the expedient measurements and classification techniques to be conducted. These may include: notepad and pen, digital camera, tape measure/ruler, protractor, string and reference scale for photography.

A.2. POST BLAST CRATER ANALYSIS

Introduction

Whilst conducting Level 1 investigation of an incident, a significant amount of data is able to be discerned from the signatures of craters left by explosive devices. Exploitation of these craters at Level 1 can enable the accurate estimation of the Effective-Net Explosive Weight (E-NEW) of the device to support further Level 2 or Level 3 exploitation activities. The Level 1 crater data collection will help to inform Tactics, Techniques and Procedures (TTPs), if evolving threats are identified.

Background

The estimation of effective explosive weight from blast attacks have, historically, been based upon personal experience. This has led to variations in the assessment approach and results. For the assessment of combat incidents, it is of high importance to achieve a low variance and high quality when using the following technical and tactical parameters that define an IED:

a. E-NEW
b. Depth of Burial
c. Explosive Type

Post-Blast Parameters

Through a series of highly repeatable experiments[5] the following post-blast observable parameters were identified to be the most important for post-blast crater analysis:

a. Soil moisture
b. Soil density
c. Soil classification
d. Apparent crater depth
e. Apparent crater diameter

The collection of these parameters allows the use of techniques to determine the effective explosive weight of explosive devices through accurate and consistent blast crater analysis.

In the following paragraphs the procedure for the collection of the MINIMUM data set required for an effective estimate of explosive weight will be described.

Crater Measurements. The minimum crater measurements required are as follows and shown in Figure 6:

[5] The experiments providing this data were conducted under Project CALDERA, which is led by US Army's National Ground Intelligence Center (NGIC) in close coordination with US Army's Engineer Research and Development Center (ERDC).

a. Apparent crater depth
b. Apparent crater diameter

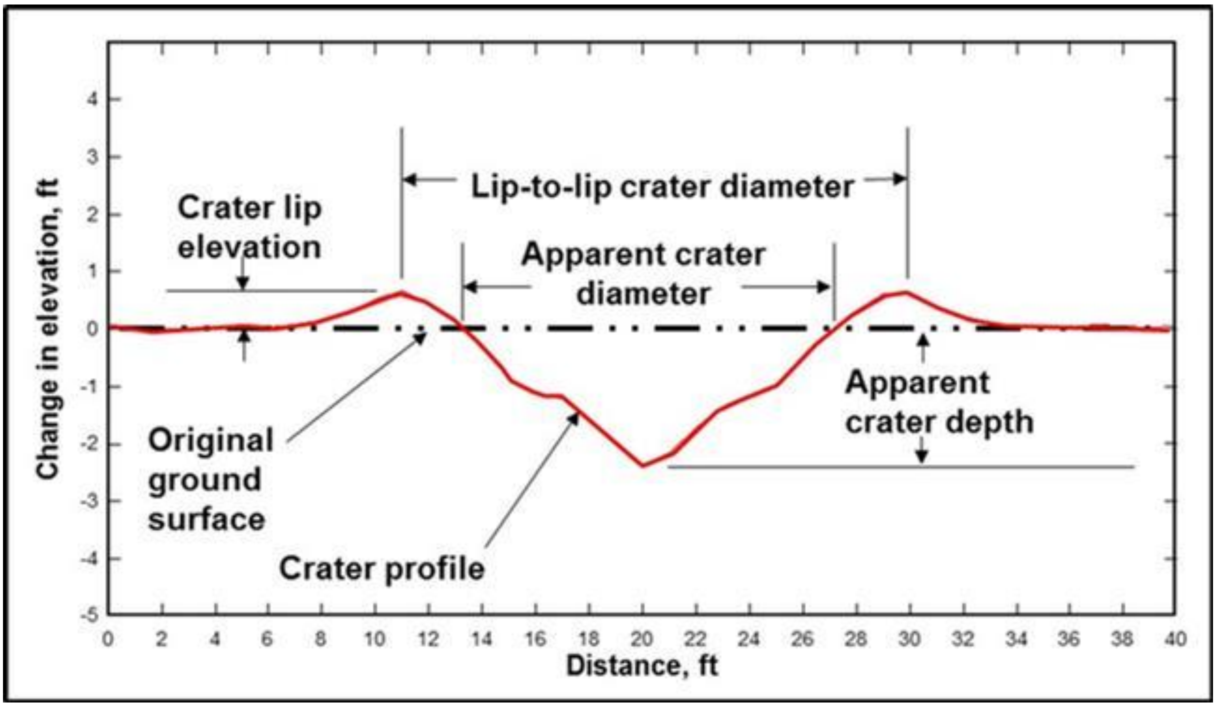


Figure 6: Crater measurement collection requirements

Soil Characteristics. On-site soil identification should be conducted as follows:

a. Estimate the density/compactness. These are categorized as loose, intermediate or dense.
b. Estimate the moisture. This is categorized as dry, intermediate or wet.
c. Estimate the classification/type of soil. These are classified as gravel, sand, intermediate/mixed gravel, intermediate/mixed sand, silts or clays as per Figure 7.

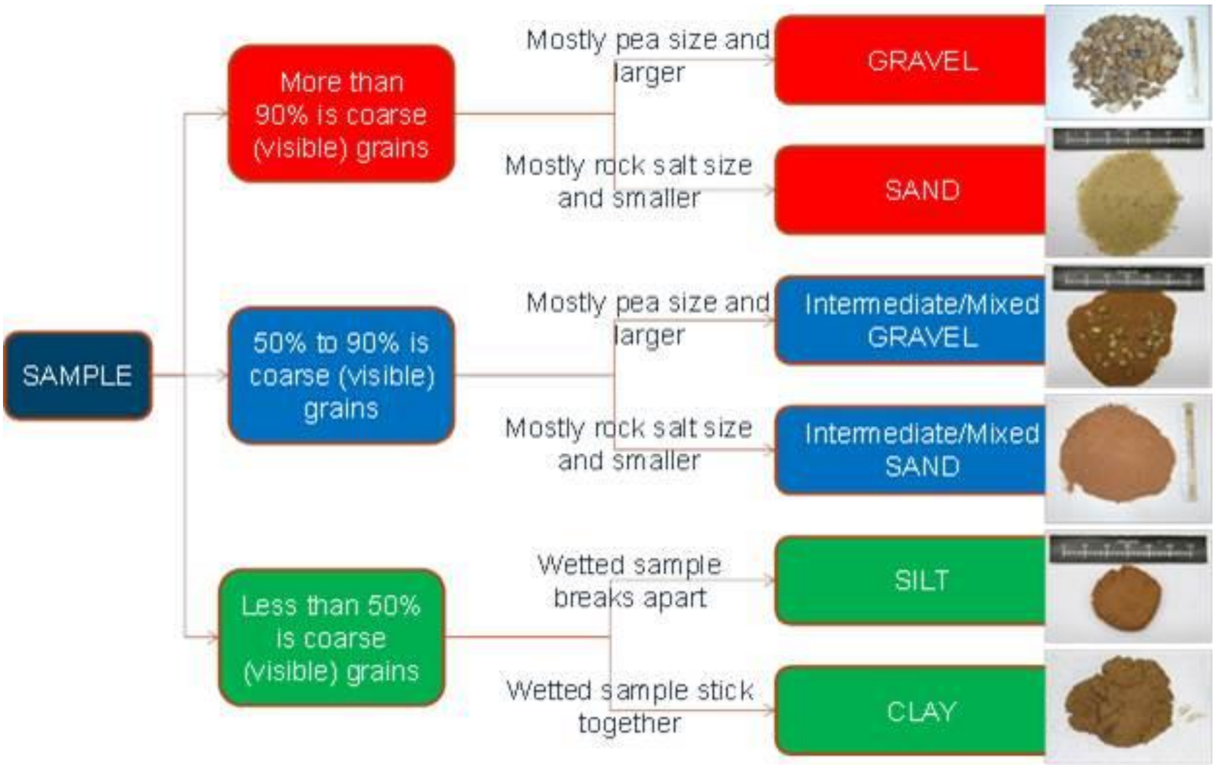


Figure 7: Soil Classification process

If the tactical situation permits, those responsible for collecting the information should also collect the following data at the incident scene.

Soil Classification Tests. Additional tests can be conducted to determine the presence/absence of coarse/fine grains:

a. Coarse material typically sinks in water whilst fine material is held in suspension. Placing a known amount of soil in a water container can allow this distinction to be made.
b. Coarse material can be felt as individual particles when rubbed between fingertips whereas fine grains feel more like a continuous powder.

Post Blast Soil Collection. As well as the recording of soil classification on-site, it may be possible for a recovered sample to be analyzed in more detail at Level 2 or 3. Although TTPs vary between nations, the following general rules should be adhered to when recovering soil samples for subsequent analysis:

a. Collect the largest sample possible.
b. Samples must be double-bagged and boxed.
c. A note or label must be placed between the two bags with a clear reference to the incident to ensure that the sample can be later connected to the event.

d. The note must also reference where (with reference to the crater) the sample was taken (e.g. nadir (lowest point), shelf, lip or virgin ground).
e. Where applicable, environmental licences must be completed and attached to each sample.

E-NEW Estimation

Having collected the minimum crater measurements and soil characteristics, the following methods can be used to estimate the effective net explosive weight:

a. Comparing the data directly to a library of experimental shots.
b. Using the concept of scaled depth of burial to interpolate between crater data derived from tests in a similar soil and with a similar explosive.
c. Deliver the collected minimum crater measurements and soil characteristics, including soil samples (if taken) to the L2 or L3 Exploitation facilities for further processing.

In either case, the original crater measurements must be stated in any reporting with the version number of the library, or tool used, for estimation.

Photogrammetry

Post-blast crater photographs may be used to complement the collection of physical crater measurements, or in a non-permissive environment act as a substitute. The photogrammetry technique requires the following:

a. **Digital Camera**. Most digital cameras are compatible with the software.
b. **Reference Scale**. A known scaled object (e.g. ruler) must be included in the view of some of the photos in the set. Once placed, this scale **must not** be moved.
c. **Collection Technique**. Photos are taken by circling around the outside of the crater in a series of side steps in either a clockwise or counter-clockwise direction. It is important that each photo overlaps the last to allow the computer code to ‘stitch’ the photos together. A simple rule of thumb is to make two circuits; one in which the entire crater is visible in every shot and a second one in which the lip and crater centre is in every shot. The photography sequencing can be seen in Figure 8:

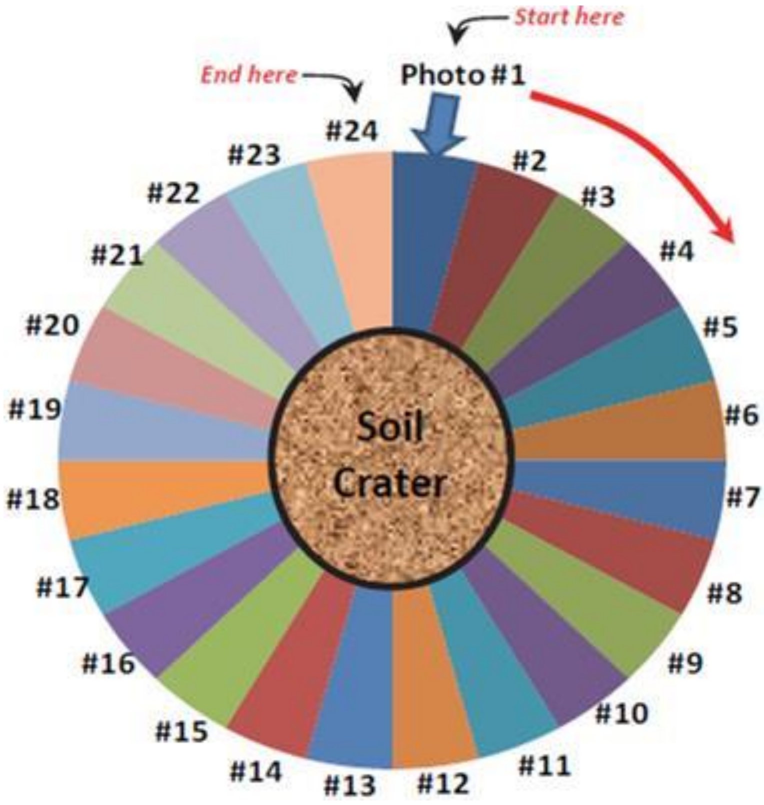


Figure 8: Crater photography technique

Equipment

Those responsible with collecting the information should carry suitable and sufficient equipment to enable the measurements and classification methodologies to be conducted. These may include: digital camera, string line holders, tape measure, folding ruler, string, reference flags, hand shovel, reference scale for photogrammetry, sealable plastic bags, container with water, and a hammer.

A.3. POST BLAST VEHICLE-BORNE IED SIGNATURE COLLECTION

Introduction

Whilst conducting L1 exploitation of an incident, a significant amount of data is able to be discerned from the signatures left by Vehicle-Borne Improvised Explosive Devices (VBIEDs hereafter). Collection of these signatures at L1 can enable the estimation of the effective explosive weight of the device to support further L2 or L3 exploitation activities. This information can help to inform force protection measures, including TTPs.

Background

The estimation of effective net explosive weight from VBIED attacks has, historically, been based upon personal experience. This has led to variations in the assessment approach and results. For the assessment of combat incidents, it is of high importance to achieve a low variance and a high quality, on the following technical and tactical parameters which define a VBIED:

a. Effective Net Explosive Weight
b. Standoff from intended target
c. Explosive Type

Post-Blast Parameters

Through a series of experiments conducted during several years[6], the following post-blast observable parameters were identified to be the most important for post-blast VBIED analysis:

a. Effective on intended target (both vehicles and infrastructure)
b. Remains of VBIED
c. Terrain classification (e.g. roadbed, dirt track etc)
d. Apparent crater depth
e. Apparent crater diameter
f. Effect on nearby civilian cars
g. Effect on nearby civilian infrastructure

The collection of these parameters allows the use of a consistent method to determine the effective net explosive weight of VBIEDs, by comparison to the same parameters collected during controlled experiments on VBIEDs of known effective net explosive weight.

[6] The experiments providing this data were conducted mainly under US Projects RED DWARF and IRON WARRIOR, led by US Army's National Ground Intelligence Center (NGIC) in close coordination with US Army's Engineer Research and Development Center (ERDC).

Post-Blast Forensic Collection

The most important factor in collecting the post-blast signatures of a VBIED discussed above is distance. An effective map of the incident scene is therefore essential.

Many of the objects involved in a VBIED attack, including the device itself, are often moving at the time of the event. The distance which certain objects have moved before and after the event is therefore sometimes a misleading indicator of effective explosive weight due to the contribution of their residual velocities.

(i) *Establish Ground Zero*

The most reliable datum for a scene is therefore the crater generated. This may therefore be used as the centre of the scene map and is often referred to as Ground Zero (GZ) or the Seat of Explosion (SOE).

(ii) *Measure Crater at Ground Zero*

The process for recording the crater and ground conditions is discussed in Section A.2 of this document and, for brevity, is not repeated here.

(iii) *Create Frame of Reference*

Unless otherwise explicitly stated any map of a VBIED incident scene will be assumed to represent the static, post-blast configuration.

Having established GZ, the next key step is to establish orientation. If a compass or GPS is available, it is preferable to note North with an arrow on the map. If this is not known, the orientation of the target vehicle, post event, can serve as a suitable substitute.

Once GZ and orientation are established on the map, the scene should then be mapped on a framework of concentric circles of 5m separation with their common centre at GZ. Photography is the ideal means of achieving this.

More sophisticated means of mapping the scene such as Unmanned Aerial Systems (UAS) may also be employed.

(iv) *Photograph Scene*

Photography of any items listed previously in the post-blast parameters should be obtained, along with any other items which the operator considers of relevance. A minimum of two photographs of each object must be obtained: one of the facet exposed to the blast and a second facing GZ in which the object is included.

(v) *Map Scene*

For effective analysis, it is essential to know the location of each photograph in relation to the frame of reference previously established. A number of methods exist for achieving this. The first is to include a reference to the distance vector from GZ in the photograph, perhaps a card featuring a compass and written distance. The second is to note an arrow on the scene map showing the origin and direction of the photograph, annotated with the camera-assigned number of the image.

(vi) *Additional information on objects*

The previous 5 steps are sufficient to collect the MINIMUM information required for an analyst to conduct effective post-blast analysis. However, if time allows, additional information on the objects observed can be of great value:

a. Section B.1 of this document discusses the method for recording the damage to the intended target vehicle.
b. Different infrastructure, both civilian and hardened, can respond differently the same VBIED yield. Therefore any information on the build standards of the infrastructure can aid analysis.

Equipment

Those responsible for collecting the above information should carry suitable and sufficient equipment to enable the basic photography, orientation, measurement and record keeping. These may include: notepad and pen, digital camera, tape measure/ruler, compass and reference scale for photography.

ANNEX B EVALUATION OF PROTECTION SYSTEM

B.1. EXPEDIENT LEVEL 1 INSPECTION AND RECORDING OF NATO VEHICLES DAMAGED DUE TO ENEMY ACTION

Introduction

Events which result in vehicle damage and human injury are unfortunate, but unavoidable consequences of warfare. However, those responsible for both vehicle capability and intelligence analysis have a duty to ensure that the information which can be gathered from such events is not wasted.

The accurate recording and analysis of the damage sustained to NATO vehicles due to enemy action has been shown to provide valuable information, which may be used to inform methods for improvement of vehicle protection. This is both in terms of enhanced technologies, TTPs and for operational intelligence purposes. The higher the precision of the data collection, the more accurate the intelligence analysis of an incident will be. All of this assists in mitigating the threat.

This annex section recognises the balance between expedient collection of information at the incident site (potentially by a non-expert), the expert examination of the vehicle conducted by a trained person following its recovery, and a detailed analysis conducted at the deployed laboratory or Home Base (L2 or L3). Experience has shown that all three efforts can be complementary. The conventions and techniques discussed in this annex section are equally applicable to all three although it is accepted that not all techniques may always able to be used at all levels. Subsequent sections in this annex discuss these L1 and L2/3 activities in more detail.

The two purposes of this annex section are to:

a. Establish a simple, common nomenclature regarding damage to NATO vehicles caused by enemy action, enabling consistent data collection and allowing partnering nations to share information and combine operational intelligence.
b. Share best practice in the capture of information on damage to NATO vehicles caused by enemy action.

Hierarchy of Information

The level of detail which can be gathered on a damaged vehicle is limited by a number of factors. In some circumstances, the urgency and danger of a situation can mean that only very limited data may be collected. The collection of small amounts of comparable data from many incidents allows more productive analysis than larger amounts of disparate, incomparable data. A consistent priority for data collection is therefore of value:

a. Date & Time of inspection, Vehicle Identifier, Geographical Location of inspection.
b. Date & Time of incident, Geographical Location of incident.
c. Estimated location(s) (on vehicle) of strike(s).
d. Photographs of the damaged vehicle, including strike point(s), and surrounding area.
e. Information on the occupancy[7] of the vehicle (e.g. number of occupants and their seat locations).
f. Information on the internal survivability elements such as seats and restraints.
g. Global movement of the vehicle.
h. A map of the vehicle debris created.
i. Detailed measurements of vehicle damage.
j. Additional environmental factors such as meteorological or atmospheric conditions.

Mechanisms for recording some of these pieces of information in a consistent manner are provided in the following sections.

Recording of Estimated Location (on vehicle) of Underbelly Strike and Damage

There are an infinite number of locations in which the underbelly of a vehicle may be struck. However, in order to facilitate meaningful analysis of large numbers of events, a system has been devised which aggregates these locations into a smaller number of generalised ‘zones’.

All vehicles, irrespective of width, are described by a grid three zones wide. Those zones on the left hand side of the vehicle are described by odd numbers whilst those zones on the right hand side of the vehicle are described by even numbers. In both cases smaller numbers of the same parity are always towards the front of the vehicle. The central spine of the vehicle is described by letters running alphabetically from the front of the vehicle.

Figure 9 shows the mechanism by which the length of the grid for a particular vehicle type might be determined.

[7] Further guidance on vehicle occupancy data gathering is contained within Section B.3 of this document.

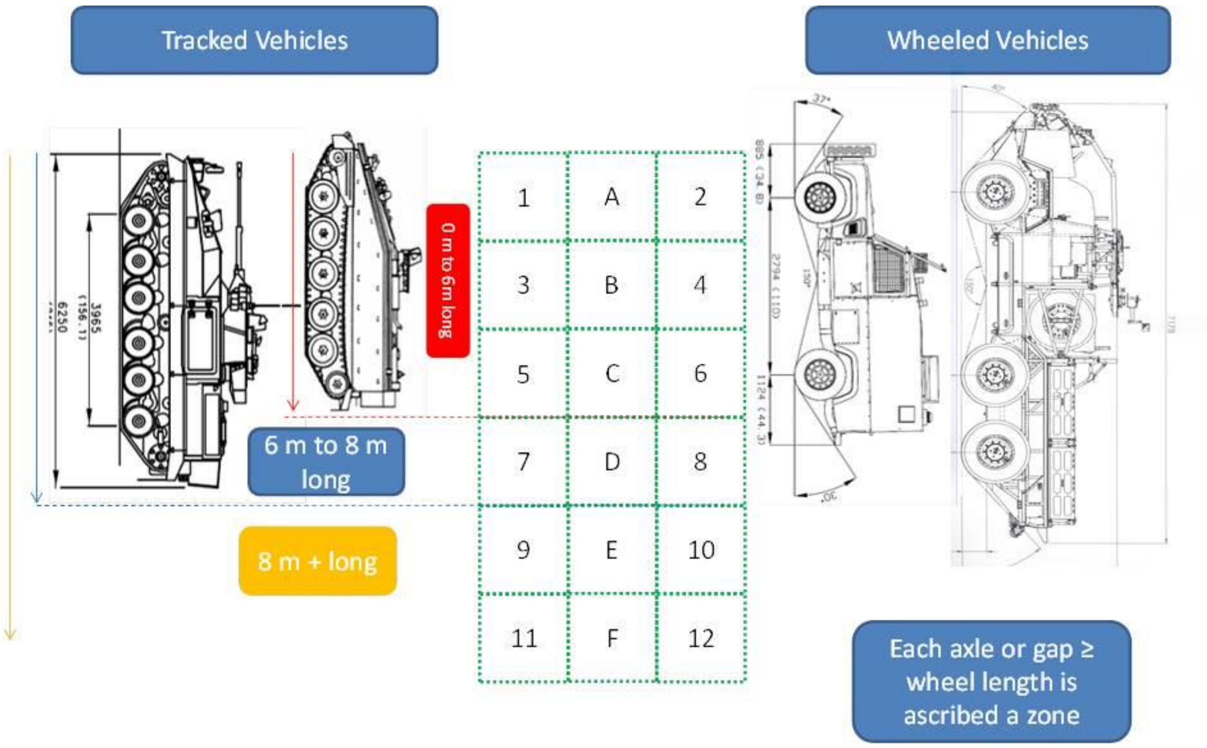


Figure 9: Derivation of zones for recording underbelly strike and damage

National identifiers may still be used. However, if the above nomenclature is employed, it should be made clear by referring to 'STANAG 2635 underbelly strike location xU', in each case.

Recording of Estimated Location (on vehicle) of Side Strike and Damage

There are an infinite number of locations in where the vehicle sides may be struck. However, in order to facilitate meaningful analysis of large numbers of events, a system has been devised which aggregates these locations into a smaller number of generalised 'zones'.

This system is inherently linked to the system for underbelly zones described above. Those zones which form the perimeter of the vehicle footprint are used to describe vertical zones on the vehicle front, side and rear.

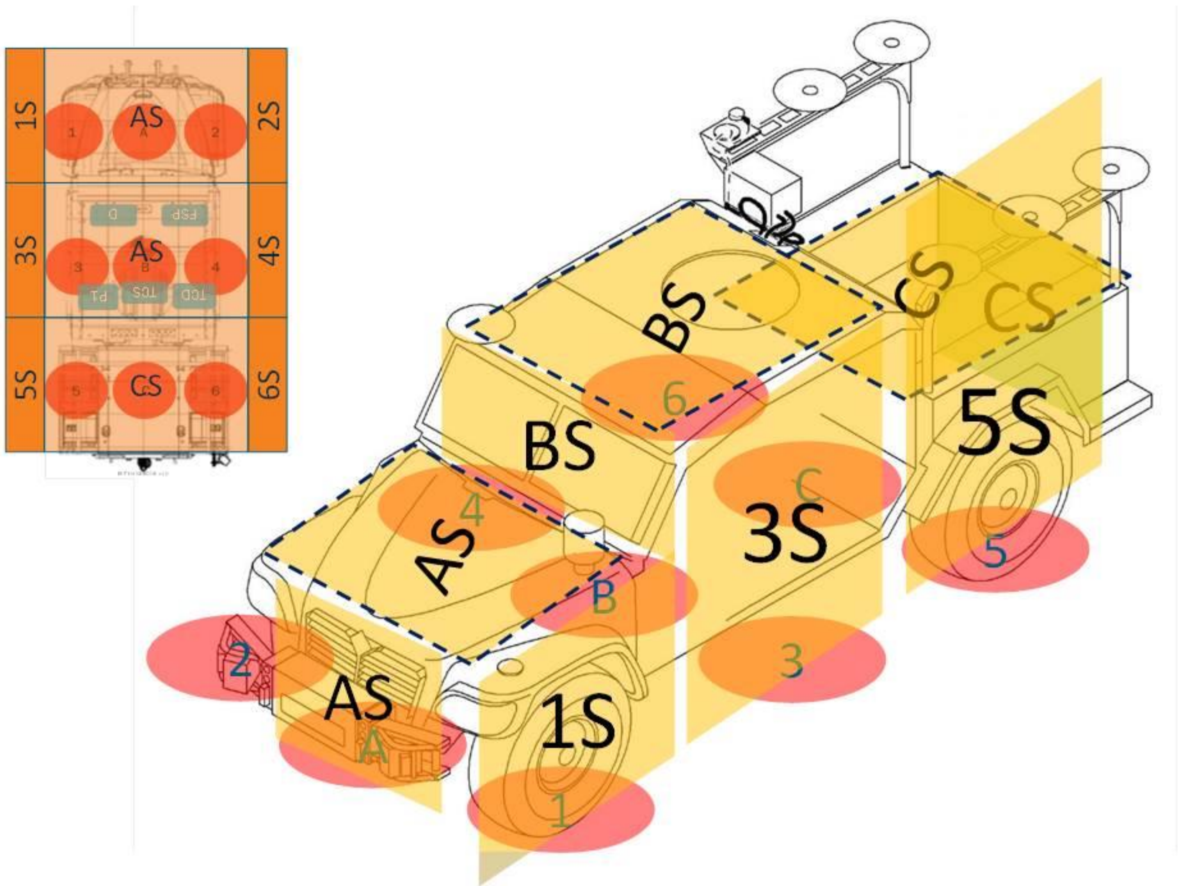


Figure 10: Derivation of zones for recording side strikes and damage

Side strike and damage zones identified with a letter prefix are always forward/rear facing, whereas those identified by a numerical prefix are always side facing.

National identifiers may still be used. However, if the above nomenclature is employed, it should be made clear by referring to STANAG 2635 side/roof strike location xS' in each case.

Photography of the Damaged Vehicle

The most efficient method for capturing the damage to a vehicle resulting from enemy action is currently conventional photography. To enable consistent interpretation of photographs, the following rules are mandated:

a. Landscape format will be used throughout the inspection. This will enable any subsequent viewer of the photographs to know that the lowest point in the photographs represents the point nearest ground level at the scene.
b. The photographs will be taken in a methodical manner such that all photographs contain images of objects or components which may also be seen in adjacent photographs.

c. Any built-in camera clock must be corrected to local time prior to the inspection taking place. If the clock cannot be adjusted, the date and time must be manually photographed. This may be achieved by photographing a digital watch or similar.
d. Adding an object of a known size, ideally with a straight edge, can provide context of size and curvature. Where possible, the object should have clearly visible graduations on it (e.g. a ruler). If this is not possible, a record of the object such as a photograph of its serial number must be provided.

Additionally, the following conventions should be adhered to, but are not mandated:

a. A photograph of a vehicle identifier such as licence plate should be taken at the start and end of each photo pack[8]. It may therefore be assumed that all photographs between these images are of the same vehicle.
b. The method of photographed annotation may be used within a photo pack to add detail to individual images (e.g. “right hand side door” written in note book and photographed).
c. As many pictures as possible should be taken. This is best achieved by a methodical approach in which a 360° walk around the vehicle is completed. Additional detail can then be obtained as time allows.
d. Detailed images should also be obtained in a methodical manner with adjacent images providing context to each other.
e. Internal pictures should be taken as well as external ones. This is important as the injury-causing damage mechanisms are often most obvious from within the vehicle.
f. Undamaged areas are just as significant as damaged ones and, if time allows, should be captured in as much detail as the damaged ones.
g. Within any single photograph, context, such as clues to the location and size of the objects in the image, is valued over detail. With high-resolution photography, retrospective zoom can be obtained, retrospective context cannot.
h. Images of the scene of the event should be captured where possible. Although ANNEX A discusses images of craters and other collateral damage in detail, additional photography of such things taken during the vehicle inspection phase is encouraged.
i. Should a vehicle be recovered to a more permissive environment for a more detailed investigation, it is essential that a fresh set of images using the above TTPs are repeated to capture the vehicle in its new state, as the recovery process can inflict further damage.

[8] As direction of approach may not always mean that the vehicle identifier is initially visible, this convention is not mandated.

Classification of Severity of Physical Damage to Protection System

It is often desirable for the performance of the vehicle protection system to be classified independent of the levels of injury sustained by the crew. This does not address the operability of the vehicle, but is simply focussing on the protection system. Whilst definitions for mobility, firepower and mission kills are established elsewhere, the definitions for physical protection systems damage are defined herein:

a. **Benign:** The vehicle has been able to continue with the mission.
b. **Moderate:** The protection system has been damaged and/or the vehicle has been flipped or rolled. Additional major components have been removed from the vehicle. The protection system is largely intact with only minor reductions in its effectiveness. [Level 2 or 3 assessment only].
c. **Serious:** Breach of crew space (as opposed to protection system) and/or the vehicle has been flipped or rolled. Additional major components have been removed from the vehicle. The protection system is damaged in some parts but still offers some protection. [Level 2 or 3 assessment only].
d. **Severe:** The protection system and/or crew space has been compromised. Major internal components have been removed. Can include flips, rolls and major components removed. Vehicles which have caught fire are also included here. The protections system offers no further protection. [Level 2 or 3 assessment only].
e. **Catastrophic:** the core vehicle has been divided into a number of parts.

Classification of Damage Type

When the vehicle is inspected it may become apparent that some of the observed damage has been sustained through mechanisms other that primary attack weapon systems. Damage observed should be classified into one of the following categories:

a. **Primary damage effects:** Damage done by the weapon system.
b. **Secondary damage effect:** Damage done after the weapons effects i.e. damage done because vehicle rolled over.
c. **Accidental damage:** Damage that is not sustained during the attack or due to the weapon system. An example may be a road traffic incident.
d. **Extraction damage:** Damage done to vehicle to remove those wounded or killed in an event.
e. **Recovery Damage:** Damage done to vehicle while being recovered.

B.2. THE INSPECTION AND RECORDING OF NATO PERSONAL PROTECTIVE EQUIPMENT SUBJECTED TO ENEMY ACTION

Introduction

One of the constituent parts of the analysis of an event (which may or may not be injurious) is to understand the contribution that the Personal Protective Equipment (PPE) may have had in changing the risk of injury (for better or worse). It is essential that suitable information is gathered to inform future incident and/or casualty analysis. This annex section includes some of the considerations in gathering such information.

The accurate recording and analysis of the damage sustained to PPE worn by military personnel has been shown to provide valuable feedback. This has guided equipment design improvements, increased user-confidence in the equipment and enabled monitoring of maintenance, modification, manufacture and durability issues. There is therefore a need for a systematic process to gather the data from a series of incidents, ensuring that trends are identified and acted upon. The quality, consistency and accuracy of the data gathered are central to the success of this process.

The aim of this process is to:

a. Document the types of data that should be gathered at the scene and how this information should be subsequently acted upon. This includes information relating to collection methods and training requirements.
b. Identify the stakeholders and additional sources of information that can benefit from or support the inspection process.
c. Identify some of the additional issues of dealing with PPE involved in incidents.

This annex section recognises the balance between expedient collection of information and equipment available to L1 personnel, compared to the preservation of evidence and information collected by a trained investigator, with some experience of forensic data gathering, and the deliberate detailed analysis conducted at the deployed laboratory or Home Base (L2 or L3). All three levels of examination should be complementary and it is essential that the personnel involved understands the whole process, and the requirements of the later examiners and analysts. Detailed PPE examination should be carried out by a trained examiner, but an initial examination at L1 may be carried out to establish information on the weapon used.

This annex section also realises that any investigations involving a fatality may undergo examinations that require full criminal justice levels of examination; these processes may not follow the guidance in this annex section. The investigations should follow the appropriate, nationally defined procedures, suitable for criminal or civil prosecution, as required.

Expedient Collection

The most important element of information collection is to gather the PPE and link it to the individual who was wearing it. It is important to consider that if the individual has been injured, their equipment may be contaminated with blood or debris resulting from the incident. This may have accompanied the individual to a medical facility. It is therefore important that the need to collect the PPE and any salient information has been distributed to medical facilities/casualty receiving stations. Throughout the expedient gathering process, appropriate controls should be put into place to handle contaminated equipment and ensure any items are suitably certified as fit for transport (considering biological hazards, freedom from explosives/energetic items, flammable/combustible materials etc.). The prime activity of personnel throughout the collection process is to preserve the PPE evidence, conforming to relevant national policy.

It may be that very little detail regarding events or actions taken is able to be gathered on-site immediately. However, there is some key information which requires to be linked to weapon assessment and vehicle inspections, as appropriate.
This includes:

a. Location and posture of the individual during the attack (prone, kneeling, seated, standing, etc.) should be recorded, including terrain (e.g. urban area, woodland etc);
b. Whether the individual was operating any particular weapon/equipment and what the individual was wearing/carrying in addition to the recovered PPE;
c. Where the PPE was recovered; and,
d. The order of events, if there were multiple attacks/events.

For mounted personnel, the following vehicle-related information should also be gathered:

a. Whether there were any impacts to the vehicle or PPE that may correspond (e.g. an impact mark on a helmet with a corresponding impact mark near the head-pad in the vehicle);
b. Whether any form of restraint was being worn;
c. Any post-incident effects, such as water ingress, fire, etc.;
d. Any loose equipment that may have been accelerated during the incident and impacted the PPE or caused injury in its own right, such as ammunition boxes;
e. The volume of occupiable space around the individual;
f. The location of any vehicle breaches that may have contributed to the damage to the PPE or injury to the individual; and,
g. The extent of activation of any energy absorbing systems, such as seat piston or deforming mechanisms.

Immediate lessons may emerge from these data gathering efforts that should be exploited. This may include equipment stowage, restraint use or immediate PPE issues (such as removal) to support lessons learned activities and TTP reviews.

If the individual requires medical treatment, any obvious (intentional) damage of the equipment during removal of the PPE should be noted; for example by cutting the clothing to minimise the movement of a casualty should be explicitly stated. Any difficulties in removing the equipment should also be noted and reported back to the relevant national authority. This can assist to inform aspects such as wear and tear on equipment through usage, TTPs and, if appropriate, equipment design.

PPE should be collected and labelled, recording any requirement to dismantle it. This includes checking the PPE for explosive items, combustible materials or any other hazards (sharps, biological contaminants, etc.).

Ideally, photographs should be taken of the PPE in an ‘as-collected’ condition and notes should be taken. The equipment, situational information and photographs should be appropriately packaged and labelled, and then sent to L2 or L3 facilities for further examination.

Where possible, these expedient processes should also be able to be undertaken at the Casualty Receiving Station. This will ensure that the data is gathered for people who are evacuated from the scene, before Level 1 exploitation is undertaken. The collection of equipment and information, at all possible locations, should be a requirement in national Standard Operating Instructions (SOIs).

Level 1 Examination

The dominant reasons for Level 1 inspection of the equipment are:

a. To certify the equipment as free from explosives (FFE);
b. To examine for any immediate evidence that may help to identify the weapon; and,
c. To check and package the material for return to a Level 2 or 3 Facility, including a return address for any personal items that may need to be returned.

If during this examination there is a need to dismantle the equipment, this should be noted and photographs taken during the process. Again, photographs should be taken of the PPE in an ‘as-examined’ condition.

L1 will then dispatch the items to the appropriate L2 or L3 facilities, which should have appropriate controls to handle contaminated equipment.

Level 2 or 3 Laboratory Analysis

Detailed analyses should be undertaken in an appropriate laboratory. The appropriate controls to handle contaminated equipment and facilities to undertake such an examination (including staff with full awareness of the equipment, hazards, and photographic and inspection facilities), needs to be in place.

The analysis should be undertaken to determine the following evidence connected with the PPE and the individual who may have worn it in the incident:

a. Was it worn by the individual? If not, determine whether there was a good reason for this, whether the individual was wearing something else, or whether there is change necessary to the TTPs, training or information relating to these items;
b. Was it correctly manufactured? If not, determine the batch/lot numbers and inform the procurement/logistics authorities of this discrepancy;
c. Was it was correctly maintained? This is routine maintenance, user assembly, etc. If the item was not correctly maintained, then the relevant procurement/logistics authority must be informed that there is potentially a training or information issue associated with the maintenance of this equipment. Where necessary, a design change may be recommended to eliminate these problems with this equipment;
d. Had the equipment been modified (including replacement by non-issue equipment)? This is to determine whether someone has modified the equipment. All equipment modifications should be reported to the relevant operational theatre and/or the procurement/logistics authority. If the modification is for a good reason or to improve the design the procurement/logistics authority may wish to adopt this change in training, information or even future amendments. If, however, the modification affects the performance, use or utility of the equipment there may be a desire to prevent this happening to other people. Even if the modification does not affect the person in their direct role, it may affect them if they change role or the equipment is transferred to someone else. Additional items may be required to replace the modified items;
e. How was the PPE used? The PPE (especially body armour and helmets) may be used to carry a variety of additional equipment. How the users fitted this equipment should be noted, especially if this means that additional items may have damaged or compromised the performance of the PPE, or may potentially be injurious in themselves (even if the additional items have not specifically caused or contributed to injury in this circumstance). The relevant procurement, logistic and operational command authorities should be informed of such concerns;

f. Was the PPE and/or its equipment damaged during the incident? The nature of any damage (location, severity, penetration/perforation/indentation/etc.) to the PPE and any other carried equipment;
g. Was the equipment damaged due to undue wear and tear? If the equipment is showing undue wear and tear it is possible that the equipment is not durable enough, or that there are equipment shortages. This should be examined by the relevant logistics authority;
h. Is there anything that may assist in identifying the device? The location and source of any items of evidential or further exploitation value (fragments, bullets, explosive residue, combustion products, etc.) Any items collected should be documented in terms of the location in which they were found, and examined further by national experts to determine the material composition, size, weight, and potential weapon or ammunition type. This information will support weapon system assessment; and
i. Are there any personal items for return? Any personal items, such as photographs, letters, personal tools, etc. that should be returned to their owner.

Before any examination is undertaken it is strongly recommended that injury patterns are identified, other equipment damage (for example vehicle damage) and the other aspects of the incident exploitation gathered. The gathering of the injury data is outside the scope of this annex section and will be subjected to national legal and medical/ethical restrictions. Where possible the barriers to casualty data access should be addressed well before any issues arise to enable consideration of the performance of the equipment in the context of the examination.

Despite the personal information included in the PPE examination, a system should be introduced that allows the dissemination of anonymised data. This may include a ‘flash-reporting’ system where headlines are included that indicate the findings in paragraphs 4.2.1 to 4.2.8 (above) for action by stakeholders.

Additional Considerations

The examination of PPE involves handling, transport and storage of items contaminated with blood, faeces and tissue. There may be other environmental contaminants (such as fuel) and the PPE may contain items of ordnance (explosive devices, ammunition, etc.) or energetic materials (batteries, matches, etc.). Suitable controls must be put in place to handle the hazards and minimise the risk of injury to personnel.

The collection, storage, handling , use and retention of aspects of the data required for PPE analyses involves handling sensitive data, such as personal identifiers, medical data, etc.. In each nation, very strict controls exist for the handling of this data. The appropriate ethical clearances, privacy impact assessments, information asset ownership permissions and controls for the handling of this data should be addressed before any data is handled.

B.3. THE RECORDING REQUIREMENTS FOR NATO INJURY DATA FOR INCIDENT EXPLOITATION

Introduction

One of the constituent parts of the analysis of an event is to understand the nature of any injuries sustained by personnel and their relationship to the mechanism of injury. It is essential that suitable casualty information is gathered to inform any subsequent casualty analysis. This annex section describes some of the considerations in gathering such information.

The aim of this process is to:

a. Document the types of data that should be gathered, both at the scene and subsequently.
b. Identify the stakeholders.
c. Highlight the need to consistently gather high quality data.

This annex section recognises the balance between expedient collection of information undertaken at the scene, and detailed validation and analysis conducted within deployed laboratory or the home nation. All levels of examination should be complementary and it is also essential that the personnel involved understand the whole process, and the requirements of the rear-based examiners and analysts.

This annex section also realises that any investigations involving a fatality may undergo examinations that require full criminal justice levels of examination; these processes may not follow the guidance in this annex section. These investigations should follow the appropriate, nationally defined procedures.

Expedient Collection

The most important element of the information collection is to gather the initial information on the type of the injuries, and where feasible, the injury circumstances as initially reported, taking into account the clarity that forms after the incident. This is mainly to add clarity to the initial reports to confirm the actual number of casualties and linked to injury severities of personnel. It is unlikely that this will provide specific detail as to the type of the injuries, however, an initial understanding of the situation should be gathered and reported.

The main reason for these collection activities is to minimise the effort required during the L2 or L3 analysis, when accounting for personnel who were incorrectly reported as injured during the initial incident (flash) report. These personnel may have been returned to their unit by the medical system, as they were incorrectly reported as injured, or their injuries were sufficiently benign that they did not require significant treatment.

It may be that very little detail regarding events or actions taken is able to be gathered on-site immediately. However, there is some key information which requires to be linked to weapon assessment and vehicle inspections, as appropriate.
This includes:

a. Location and posture of the individual during the attack (prone/kneeling/seated/standing/in a vehicle/etc.) should be recorded, including terrain (e.g. urban area, woodland etc);
b. Whether the individual was operating any particular weapon/equipment and what the individual was wearing/carrying;
c. The order of events, if there were multiple attacks/events; and
d. Where the casualty was sent for treatment.

For mounted personnel, the following vehicle-related information should also be gathered:

a. Any post-incident effects such as water ingress, fire, etc.;
b. Any loose equipment that may have been accelerated and caused injury in its own right, such as ammunition boxes;
c. The volume of occupiable space around the individual;
d. The location of any vehicle breaches that may have contributed to injury to the individual; and,
e. The extent of activation of any energy absorbing systems, such as seat piston or deforming mechanisms.

Where an incident involves a vehicle, the injuries that a crew member or occupant could sustain may be highly sensitive to their location within the vehicle. However, confusion can arise in some events and records are sometimes completed inaccurately. A recording method which provides a process to accurately record this information is detailed below:

a. Which seats were occupied at the time of the attack;
b. Of those seats which were occupied, whether the crew member or occupant was injured;
c. Of those crew injured, what triage category they were listed as; and,
d. Information on the internal survivability elements such as seats and restraints.

To this end, the objective of this method is to establish a common nomenclature for vehicle crew positions and occupants:

a. The terms Driver and Gunner and Top Cover Sentry are recognised for this purpose and are designated the crew location codes D and G. and TCS respectively.

b. The term ‘Commander’ should be avoided unless associated with a single seating location, in which case crew location code C may be used. The Commanders of many vehicles are free to select a location which best suits them and so the term often does not refer to a single location.
c. Those seated alongside the driver at the front of a vehicle are designated Front Seat Passenger (FSP). Additional front seat passengers should be designated FSP1, FSP2 with increasing distance from Driver.
d. Other occupants of the vehicle will be given the designator ‘P’ followed by a number. Occupants on the left hand side of the vehicle will be given an odd number and those on the right hand side will be given an even number. For numbers of the same parity, the higher the number, the further towards the rear of the vehicle the occupant will be. For crew members on the same side of the vehicle and in the same fore-aft position, numbering will work left to right.
e. Any stretchers will be given the designator ‘S’ followed by a number. Occupants on the left hand side of the vehicle will be given an odd number whilst those on the right hand side of the vehicle will be given an even number. For numbers of the same parity, the higher the number, the further towards the rear of the vehicle the occupant will be. For stretchers on the same side of the vehicle and in the same fore-aft position, numbering will work left to right and bottom to top.
f. On any diagrams, the lowermost point of the letter should face in the orientation of a crew member occupying that position. For example, positions P1, P3 and P5 in Figure 1 are all seated facing inwards.
g. National identifiers may still be used. However, if the above nomenclature is employed, it should be made clear by referring to ‘STANAG 2635 crew location X’ in each case.
h. Figure 11 shows an illustration of a typical vehicle with the crew location codes applied.
i. Table 3 shows an example of how the information on vehicle occupancy might be recorded following an attack.
j. Information of the type recorded above is often of a high classification and sensitivity. This document does not seek to change these classifications and provides only a means of recording data.

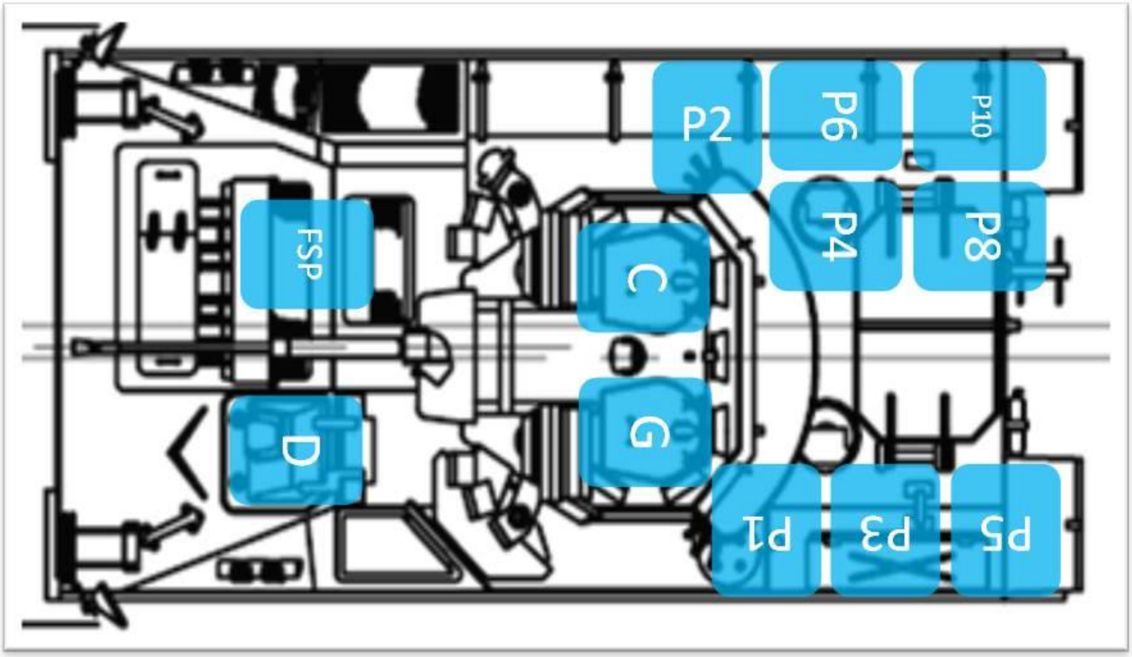


Figure 11: Derivation of vehicle crew location codes

STANAG 2298 Position Code	Occupied	Injured	Triage/Cas	Restraint worn?
D	Y	N	-	Y
FSP	N	-	-	-
C	Y	Y	CAT A	Y
G	Y	Y	?	?
P1	Y	Y	CAT B	N
P2	Y	Y	CAT C	Y
P3	N	-	-	-
P4	Y	?	?	Y
P5	Y	N	-	Y
P6	N	-	-	-
P8	?	?	?	?
P10	Y	N	-	Y

Table 3: Example vehicle occupant information record following attack

Immediate lessons may emerge from these data gathering efforts that should be exploited. This may include vehicle equipment stowage or restraint use to support lessons learned activities and TTP reviews.

Where possible, information about uninjured personnel should also be gathered. This will allow for analysis of why people were not injured.

Level 1 Data Collection

The dominant reasons for L1 data collection are:

a. To start to gather detailed information that links the individual to the threat and their injuries in a coded (analysis-friendly) format;
b. To record the status of the individual (survivor, fatality) and the nature of the event (hostile/non-hostile); and
c. To record timelines of incidents.

The individual's details and their injuries should be recorded by a suitably trained and accredited specialist. Typically this will require a level of medical and injury coding training (although providing all injuries are appropriately recorded, the coding may be carried out as part of the L2 or L3 data analysis).

Typically this will be conducted at the medical facility.

It is desirable that injury coding is also undertaken for personnel who have minor injuries. However, it is appreciated that this may introduce a significant burden. It is therefore important to concentrate on understanding the nature of the injuries sustained by the most seriously injured personnel as these will typically provide the most information on the injury mechanisms involved.

Where possible, the specialist taking note of the injuries should also record details of the PPE the individual was wearing and any additional information such as restraint use, vehicle seating position, etc. This will require additional training (by appropriate authorities within home nation) for the data gatherer to ensure that they can identify the equipment correctly – it has been shown that a reference guide describing the latest standard of equipment (PPE and vehicles) can also be beneficial in this respect. If a PPE examination process is also in place (see B.2), it is desirable that the return process is also linked with this data gathering.

Any items (fragments, bullets, explosive residue, combustion products, etc.) that may assist in identifying the device, should be recorded to confirm the locations where they were found. If possible, these items should be removed and provided to national experts to be examined further. This is to determine the material composition, size, weight, and potential weapon or ammunition type, which will support the weapon system assessment (see ANNEX A for evaluation of threat weapon systems).

Level 2 or L3 Laboratory Analysis

L2 or L3 data analysis and validation are typically conducted at the deployed laboratory or home base. This activity has two distinct phases, consisting of validation and analysis. The analysis, however, is beyond the current scope of this document. The data should be validated by ensuring that the initial injury descriptors and coding are consistent with the injuries recorded at L3. It is normal for this phase to determine that the initial coding was incorrect, so ideally this validation activity should be undertaken in a consistent manner by appropriately trained personnel at a central location.

Additional Considerations

The coding of injuries should use a system that is internationally recognised.

The release of casualty data in each nation will be reliant on national laws and the legal framework that controls the release of medical information. Typically this requires the approval of the senior medical data controllers and privacy impact assessments to ensure the use of the data is ethical and suitably controlled.

B.4. DETAILED FORWARD INSPECTION AND RECORDING OF NATO VEHICLES DAMAGED DUE TO ENEMY ACTION

Introduction

Events which result in vehicle damage and human injury are unfortunate, but unavoidable consequences of warfare. However, those responsible for both vehicle capability and intelligence analysis have a duty to ensure that the information that can be gathered from these events is not wasted.

The accurate recording and analysis of the damage sustained to NATO vehicles due to enemy action has been shown to provide valuable information which may be used to inform methods for improvement of vehicle protection. This is both in terms of enhanced technologies, TTPs and for operational intelligence purposes. The higher the precision of the data collection, the more accurate the intelligence analysis of an incident will be. All of this assists in mitigating the threat.

This annex section recognises the balance between expedient collection of information undertaken at L1, and the more deliberate collection and detailed analysis conducted at deployed laboratory facilities or home base. Experience has shown that all above efforts are complementary.

The techniques discussed in B.1 are equally applicable to the both the expedient exploitation and the detailed inspection which is discussed in this annex section.

The conventions and techniques discussed in this annex section are equally applicable to L3 activities, which are currently beyond the scope of this document.

The purpose of this annex section is therefore to provide a suggested framework for the detailed inspection and recording of the vehicle damaged sustained as a consequence of the enemy action.

Approach

B.1 of this document contains procedures for recording the general locations (on the vehicle) of strikes and damage, as well as methods for estimating the level and severity of damage. Procedures for photographic capture of the vehicle are also included. All of the above should be repeated during this more detailed inspection.

In addition to the above, the more detailed exploitation of a vehicle damaged as a consequence of enemy action can take three distinct but complementary forms:

General Inspection

a. Record all visible external damage (concentrating on area in the vicinity of the strike).
b. Record all visible internal damage (in relation to area of strike).
c. Record all superficial damage to the platform (strike related or not).

Structural Inspection

a. Inspect the integrity of the hull, platform structure and any deformation.
b. Look for fracture propagation in welds or components around complete platform.
c. Perform an in-depth inspection of platform (Lifting of floor plates/removal of outer components)

Armour Inspection

a. Identify explosively detached sections of armour.
b. Inspect complete platform armour for damage/fracture propagation.
c. Record any sections that were non-recoverable due to the tactical situation.

Recording of Estimated Location (on vehicle) and Type of Direct-Fire Strikes

Once the three inspection types discussed in Section 2 are complete, a more detailed assessment of the primary damage area may also be conducted.

Where possible, a diagram of the vehicle under investigation should be obtained, an example of which can be seen in Figure 12. Damage to the vehicle should be marked on this diagram by noting distance (in mm) of the damage from the FRONT, LEFT HAND SIDE and BASE (in that order) of the vehicle noted. Each strike is given a set of co-ordinates in terms of their distance (in mm) from vehicle FRONT, LEFT HAND SIDE and BASE (in that order). Note that due to this orientation, the y-coordinate will be a negative number.

Perforations should be noted with a circle (O) to illustrate their lateral extent whilst penetrations should be noted with a cross-through circle (Ø), again to illustrate their lateral extent. Where there is a perforation an assessment should be made on the azimuth and elevation angles of strike. An example is shown in Figure 12.

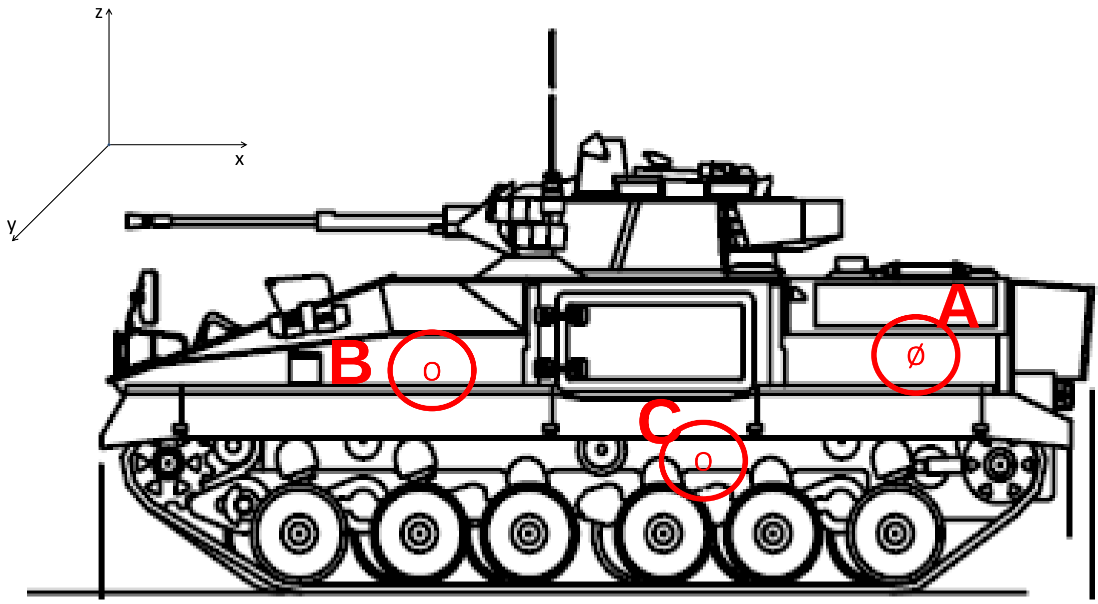


Figure 12: Example of recording individual instances of damage

Each area of damage to the vehicle must be ascribed a letter. Where possible, each damage zone should be illustrated to show its lateral extent (Figure 12).

The zone location and extent of penetration should be noted as per Table 4. It should be noted that such information may be protected by national caveats. For information which is to be shared, as much information as possible should be supplied without violating national caveats.

Layer	Co-ord	Applique/ Add-on armour	Airgap	Hull/ turret (base Armour)	Spall Liner	Azimuth Angle of Strike	Elevation Angle of Strike	Estimated Weapon Type
Depth		5 mm	10 mm	10 mm	20 mm			
Damage A	(4700, -500, 1500)							
Outer Damage Diameter (see Figure 13)								
Inner Damage Diameter (see Figure 13)								
Damage B	(1700, -450, 1400)							
Outer Damage Diameter (see Figure 13)								
Inner Damage Diameter (see Figure 13)								
Damage C	(2600, -300, 700)							
Outer Damage Diameter (see Figure 13)								
Inner Damage Diameter (see Figure 13)								

Table 4: Example method for noting individual instances of damage on vehicles

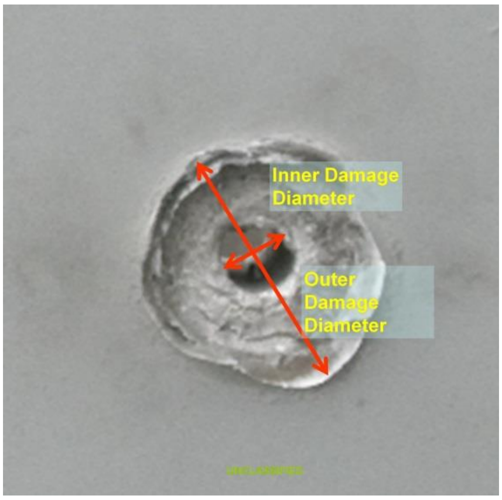


Figure 13: Picture illustrating measurements described in Table 4

Should a vehicle be recovered to the deployed laboratory or home base for a more scientific L2 or 3 investigation, it is essential that a fresh set of images using the above TTPs are repeated to capture the vehicle in its new state.

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