# HANDBOOK OF DEFENCE LAND RANGES SAFETY

# VOLUME II

## DESIGN, CONSTRUCTION, AND MAINTENANCE OF SMALL ARMS, INFANTRY WEAPON SYSTEMS AND 40mm WEAPON SYSTEMS RANGES.

---

## BY COMMAND OF THE DEFENCE COUNCIL

## MINISTRY OF DEFENCE

# HANDBOOK OF DEFENCE LAND RANGES SAFETY
# VOLUME II - DESIGN, CONSTRUCTION AND MAINTENANCE OF SMALL ARMS, INFANTRY WEAPON SYSTEMS AND 40MM WEAPON SYSTEMS RANGES

## RECORD OF CHANGES

| CHANGE NUMBER | DATE OF CHANGE |
|---|---|
| SIX | Feb 12 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## Amendments

| Amendment No. | Amendment Record | Affected Pages | Date |
|---|---|---|---|
| 1 | | **Prelim Pages** ii, xxi. **Chap 1** - 1, 3, 5. **Chap 2** – 12, 13, 17, 21, 31, 32, 33, 38, 40, 44, 47. **Chap 5** – 4. **Chap 6** – 4, 5, 6, 7. **Chap 6 Annex A** – 6-A-1, 6-A-2. **Chap 8** – 3. **Chap 9** – 3. **Chap 11** – 1, **Chap 15** – 4, 6, 8, 10. **Chap 17** – 12. **Chap 20** – 4. **Chap 22** – 2. **Chap 23** – 12, 13. **Chap 24** – 1, 2, 3, 4, 8. **Chap 31** – 4. | Aug 12 |
| 2 | | **Prelim Pages** ii, **Chap 6** – 1, 2, 3, 7. **Chap 9** – 1. **Chap 15** – 1, 2, 3,10. **Chap 19** – 2, 7, 11, 12. **Chap 20** – 3, 4. **Chap 22** – 2, 4, 5, 6. | Feb 13 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Joint Service Publication 403 -** Handbook of Defence Land Ranges Safety (Volumes I -IV)

**Volume I:** Range Management - policy, responsibilities, authorisation, use maintenance and inspection of land ranges.

**Volume II:** Design, construction and maintenance of small arms, infantry weapon systems and 40 mm weapon system ranges.

**Volume III:** **Part 1 -** Use of fixed wing aircraft and helicopter mounted weapon systems, and unmanned aircraft systems, on land ranges.

**Part 2 -** Use of surface to air weapon systems on land ranges.

**Volume IV:** Demolitions, ordnance disposal and battle simulation .

**HANDBOOK OF DEFENCE LAND RANGES SAFETY**
**VOLUME II - DESIGN, CONSTRUCTION AND MAINTENANCE OF SMALL ARMS, INFANTRY WEAPON SYSTEMS AND 40MM WEAPON SYSTEMS RANGES**
**RECORD OF LAND RANGES SAFETY SUB COMMITTEE SAFETY NOTICES**

| SAFETY NOTICE NUMBER | DATE OF NOTICE | TITLE OF NOTICE | SUPERSEDED BY |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# INTRODUCTION

## GENERAL

1. **Aim**. The aim of JSP 403 Volume II is to give:

   a. Advice on ballistic issues to those in the Ministry of Defence (MOD) and contractors who are responsible for planning, designing, constructing maintaining and inspecting Small Arms and Infantry Weapon Systems (SA and IWS) Ranges and 40mm weapon systems (WS) ranges.

   b. Practical guidance on design, construction and maintenance standards of such ranges to ensure realistic but safe training in firing and the best possible use of the range space. With the exception of Chapter 30 which covers control of emissions from weapons, UK legislation and regulation relating to buildings and structures are not covered in this JSP but apply under normal works support to MOD facilities.

2. **Responsibilities**. All the volumes of JSP 403 are sponsored by the Chairman of the Defence Land Ranges Safety Committee (DLRSC). Authority for the content of this Volume is vested, by the Chairman DLRSC, in the Chairman of the Land Ranges Safety Sub Committee (LRSSC). Chairman LRSSC will always take into account approvals given by single Service authorities and the advice of Subject Matter Experts (SME).

3. **Associated Publications**. This Volume should be read in conjunction with Reference A1 (Volume I). Reference will also be necessary at times to the associated publications listed on pages xxii-xxiii of this Volume. In particular, attention will be required to Reference X (LUMAT). For completeness Defence Safety Environment Authority Proceedings (DSEA Procs) Members Letters (ML) and DOSG advice are referred to, since they are the formal advice on ballistics and matters related to range safety.

## SCOPE

4. **SA and IWS Range Design and Construction**. This Volume explains in detail the design and construction of standard and non-standard military SA and IWS Ranges. The Volume does not deal with the standard works requirements or conduct of firing on these ranges or the application of Weapon Danger Area (WDA) templates, both of which are covered in Reference B (Pamphlet 21).

5. **Danger Areas**. It contains the Range Danger Area (RDA) and WDA templates approved for Joint Service use. The authority for taking a DA template into use rests with the respective Project Team (PT) in accordance with Reference A1 (Volume 1).

6. **Signs and Fences**. Danger area signs and fences specified in Chapter 2 of this Volume apply to all Defence Land Ranges (DLR) and training areas.

7. **Safety Standards**. The safety standards set out in this Volume or in Range Safety Notices issued between changes to the JSP provide the minimum acceptable levels of design and construction which are to be achieved for ballistic compliance. Should the minimum standards for a range to be categorised as compliant not be met, firing must not take place without a Dispensation or Approved Range status being authorised (see Reference A1 (Volume I)).

8. **Targetry**. The targetry approved for Service use by SA, Inf and 40 mm WS on DLR is described in Chapter 29.

9. **Provisos**. The whole basis of this Volume rests on the premise that:

a. Training is completed prior to firing in accordance with appropriate Service training directives.

b. Only Service Approved Weapons and ammunition, the limitations of which are given in Chapter 2 Table 3, may be used. Other weapons and ammunition may be used as static single shot marksmanship practices but must be within the ME and MV limitations set out in this JSP.

Note 1: Service Approved Weapons are those that have a Safety Case and WDA issued by the respective Project Team (PT).

c. The ranges are run not less safely than as directed by the conduct and safety rules set out in Reference B (Pamphlet 21), and the practices in Reference C (Army Operational Shooting Policy (AOSP)) or other a Service directives authorised at not less than 2* level.

d. Firing is under the direction of a competent Range Conducting Officer (RCO). A competent RCO is one who is competent by virtue of qualification, currency, experience and maturity. He may not be authorised.

e. Ranges are maintained and inspected in accordance with current regulations.

10. **Range Inspections**. This Volume may be used to assist in inspecting SA, Inf and 40 mm WS Ranges. The construction characteristics of a particular range may differ considerably from the detail illustrated in this JSP. In all cases the principles, policy and criteria contained in this JSP should be applied. Advice should always be sought from TAS(RE) where there is any doubt on the safety of a range.

11. **Terminology**. The weapon categories of fullbore and smallbore are not used in this Volume as they are caliber related and do not account for weapon performance. SA munitions are categorised as centrefire or rimfire which enables performance to be expressed in muzzle velocity (MV) or muzzle energy (ME). Ranges are designed for specific maximum levels of MV and ME, which are stated in the relevant chapters that follow.

12. **Technical Advisory Section (Royal Engineers) (TAS(RE))**. TAS(RE) is referred to throughout this Volume. It is part of the Defence Training Estate (DTE) and provides authoritative, specific advice on range design and construction. Advice is also available from OC TAS (RE) on general principles and policy contained in this JSP. TAS(RE)'s address is:

Technical Officer
TAS(RE), Defence Training Estate
Blenheim Hall
Land Warfare Centre
WARMINSTER
Wilts
BA12 0DJ
Contact:

Technical Officer – 94381 2434

DTO2 – Ranges UK West and Northern Ireland – 94381 8747

DTO3 – UK East & Scotland and Specialist ranges. – 94381 2108

Geo Sp – Training area mapping – 94381 2433 or 94325 4719

13. **Information and Advice issued by TAS(RE)**. From time to time TAS(RE) produce the following advice:

a. **Type Standards** – Performance specifications aimed at contractors involved in the development of a range. A Type standard will be developed from this JSP for each range type. Progress of this work is recorded in Land Ranges Safety Sub-Committee (LRSSC) Minutes.

b. **Range Advice Notes –** Issued from time to time to explain and clarify range safety or construction issues that do not directly effect the safety of a range. Safety issues are covered by Range Safety Notices, issued as advance copy by LRSSC and formal issue by DLRSC.

c. **Technical Data Sheets (TDS)** – Internal research covering many aspects contained in JSP 403 not issued but available if required. Contact AO TAS (RE) on 94381 2433 for information relating to existing TDS.

## AMENDMENTS

14. Proposals for amendments should be directed, through Service representatives, to:

Technical Officer
TAS(RE) Defence Training Estate
Blenheim Hall
Land Warfare Centre
WARMINSTER
Wilts BA12 0DJ
Telephone: 01985-222434 ATN 94381-2434
Fax: 01985-222259 94381-2259

to whom queries should also be addressed.

with information copies to:

The Secretary of the Defence Land Ranges Safety Committee
Fir 3b
MOD Abbey Wood #4304
Bristol
BS34 8JH
e-mail: DSEA-DOSR DU DLRS1@mod.uk
Telephone: 030 679 35339 ATN 9352-35339
Fax: 030 679 31920 9352-31920

15. Secretary DLRSC will pass proposed amendments to the Technical Officer TAS(RE) for consideration and action. Chairman LRSSC will approve routine amendments, keeping Secretary DLRSC informed and, where necessary, seeking the agreement of the DLRSC.

## HISTORICAL RECORD

16. Issue 3 dated February 2003 replaced Issue 2 dated September 1998**,** which is to be destroyed. Issue 1 superseded Infantry Training, Volume IV, Ranges, Pamphlet No. 22, Range Construction and Regulations (All Arms), 1976 (Army Code No: 71053), on 1 April 1998. However, Pamphlet 22 may be kept for historical reference purposes only but it is no longer the authoritative document.

# CONTENTS

## VOLUME II - DESIGN, CONSTRUCTION AND MAINTENANCE OF SMALL ARMS, INFANTRY WEAPON SYSTEMS AND 40 MM WEAPON SYSTEM RANGES

## LIST OF FIGURES AND TABLES

**Chapter Fig 1. FIGURES**

## 2. TABLES

# ASSOCIATED PUBLICATIONS

Where an associated publication is referred to in this volume or any other volume of JSP 403 it is to be taken as the authoritative MOD document on the subject.

| Reference | Code | Title |
|---|---|---|
| A1 | JSP 403 Vol 1 | Handbook of Defence Land Ranges Safety Volume I - Range Management (Policy, Responsibilities, Authorisation, Use, Maintenance and Inspection of Land Ranges). |
| A3 | JSP 403 Vol 3 | Handbook of Defence Land Ranges Safety Volume III – **Part 1**: Use of Fixed Wing and Helicopter Mounted weapon Systems, and Unmanned Aerial Vehicles, on Land Ranges. **Part 2**: Use of Surface to Air Weapon Systems on Land Ranges. |
| A4 | JSP 403 Vol 4 | Handbook of Defence Land Ranges Safety Volume IV - Demolitions, Ordnance Disposal and Battle Simulation. |
| B | Army Code No. 71855 | Infantry and Armoured Training Volume IV, Ranges and Training Safety, Pamphlet 21, Regulations for Training with Armoured Fighting Vehicles, Infantry Weapon Systems and Pyrotechnics. |
| C1 | Army Code No. 71810 | Army Operational Shooting Volume 1 - Personal Weapons. |
| C2 | Army Code No. 71850 | Army Operational Shooting Volume 2 – Individual Weapons. |
| C3 | Army Code No. 71852 | Army Operational Shooting Volume 3 – Support Weapons. |
| C4 | Army Code No 71671 | Army Operational Shooting Policy Volume 4 - AFV Weapons. |
| D | JSP 315 | Service Accommodation Code. |

| | | |
|---|---|---|
| E | JSP 375 | MOD Health and Safety Handbook. |
| F | JSP 362 | Defence Lands Handbook. |
| G | JSP 434 | Defence Construction in the Built Environment. |
| H | JSP 482 | Explosives Regulations |
| I | JSP 462 | Financial Management Policy Manual. |
| J | JSP 390 | Military Laser Safety. |
| K | Army Code 71670 | Military Engineering Volume II, Field Engineering Pamphlet No. 4, Demolitions. |
| L | Army Code 71035 | Artillery Training Volume III, Field Artillery, Pamphlet No. 19, Regulations for Planning, Control, Conduct and Safety for Firing Practices. |
| M | Army Code 71687 | Helicopter Training Volume III, Ranges, Pamphlet No. 300, Regulations for the Planning, Conduct and Supervision of Firing (Helicopter Weapons). |
| O | JSP 418 | Environment Manual |
| P | AP 3205 | RAF Land Ranges Policy |
| Q | Army Code No. 71855-C | Infantry Training, Volume IV, Ranges, Pamphlet No. 21C, Regulations for Cadets Training with Cadet and Infantry Weapon Systems and Pyrotechnics. |
| R - V | Reserved | |
| W | Army Code 71053 | Infantry Training Volume IV, Ranges, Pamphlet No. 22, Range Construction and Regulations (All Arms), 1976 (**for historical reference only**). |
| X | Army Code 62230 | Limitations in the Use of Missiles and Ammunition for Training (LUMAT), Volume 2, Ammunition other than |

| | | |
|---|---|---|
| | | Field Artillery Natures. |
| Y | ACAWEWROs | Air Command<br>Weapon and Electronic Warfare<br>Range Orders |
| Z1 | | The Setting of Safety Standards - A Report by an Interdepartmental Group and External Advisers, HM Treasury, 28 June 1996. |
| Z2 | | Managing risks to the public: appraisal guidance - draft for consultation, HM Treasury, October 2004. |

## ABBREVIATIONS

| | |
|---|---|
| **AAAD** | All Arms Air Defence |
| **AC** | Alternating Current |
| **ACMT** | Annual Combat Marksmanship Test |
| **ACOP** | Approved Code of Practice |
| **ADA** | Air Danger Area - also Ammunition Danger Area (obsolete) |
| **ADH** | Air Danger Height |
| **AF** | Army Form |
| **AFV** | Armoured Fighting Vehicle |
| **AGL** | Above Ground Level |
| **AIS** | Aeronautical Information Services |
| **ALARP** | As Low As Reasonably Possible |
| **AMS** | Automatic Marking System |
| **AMSL** | Above Mean Sea Level |
| **AofS** | Angle of Sight |
| **AOSP** | Army Operational Shooting Policy (see Reference C) |
| **AP** | Armoured Piercing |
| **APDS** | Armour Piercing Discarding Sabot |
| **Apers** | Anti-personnel |
| **APSE** | Armour Piercing Secondary Effects |
| **ARA** | Army Rifle Association |
| **ARS** | Approved Range Status |
| **Atk** | Anti-tank |
| **ATO** | Ammunition Technical Officer |
| | |
| **BOD** | Base Ordnance Depot |
| **BS** | British Standard |
| **BSD** | Burst Safety Distance |
| | |
| **C** | Centigrade |
| **CAA** | Civil Aviation Authority |
| **CCTV** | Close Circuit Television |
| **CES** | Complete Equipment Schedule |
| **CGR** | Converted Gallery Range |
| **Ch** | Charge |
| **CL** | Centre Line |
| **CLAW** | Control of Lead at Work (Regulations) |
| **CO** | Commanding Officer |
| **CofF** | Cone of Fire |
| **COP** | Code of Practice |
| **CP** | Control Post |
| **CQB** | Close Quarter Battle |
| **CQBR(U)** | Close Quarter Battle Range (Urban) |
| **CQM** | Close Quarter Marksmanship |
| **CTTE** | Cine Target Training Equipment |
| | |
| **DA/Z** | Danger Area/Zone |
| **DAUG** | See UK DAUG |
| **DC** | Direct Current |
| **DCCPT** | Dismounted Close Combat Project Team |

| | |
|---|---|
| **DCDS (EC)** | Deputy Chief of the Defence Staff (Equipment Capability) |
| **DCTA** | Defence Clothing & Textile Agency |
| **DDOR** | Deputy Director Operational Requirements |
| **DEC (DEB)** | Director of Equipment Capability (Direct Battlefield Engagement) |
| **DEF STAN** | Defence Standard |
| **DE** | Defence Estates |
| **Dia** | Diameter |
| **DIO** | Defence Infrastructure Organisation |
| **Dist** | District |
| **Div** | Division |
| **DLA** | Defence Land Agent |
| **DLR** | Defence Land Range |
| **DLRSC** | Defence Land Ranges Safety Committee |
| **DOSG** | Defence Ordnance Safety Group |
| **DPA** | Defence Procurement Agency |
| **DTRO** | Defence Training Requirements Organisation |
| **DSEA** | Defence Safety & Environment Authority |
| **DSEAR** | Dangerous Substances and Explosive Atmospheres Regulations. |
| **DSTL** | Defence Scientific and Technical Laboratories (formerly Retained DERA) |
| **DTE** | Defence Training Estate |
| | |
| **EA** | Estate Advisor (was DLA) |
| **EASI** | Electronic Automatic Sequence Initiator |
| **EEC** | European Economic Community |
| **EFS** | Enemy Fire Simulators |
| **EHO** | Environmental Health Officer |
| **EHT** | Environmental Health Team |
| **EM** | Equipment Manager |
| **ENO** | Environmental Noise Officer |
| **ET(LDA)R** | Electric Target (Limited Danger Area) Range |
| **ETR** | Electric Target Range |
| **FDA** | Full Danger Area |
| **FET** | Fixed Electric Target |
| **FFA** | Field Firing Area |
| **Fig** | Figure |
| **FLOOs** | Fleet Operating Orders. |
| **FMX** | Fire and Manoeuvre Exercise |
| **FOSM** | Flag Officer Submarines |
| **FOST** | Flag Officer Sea Training |
| **FP** | Firing Point |
| **ft** | Foot/Feet |
| **ft lb** | Foot Pound |
| **ft/s** | Foot second(s) |
| | |
| **g** | Gram(s) |
| **gr** | Grain(s) |
| **GMG** | Grenade Machine Gun |

| | |
|---|---|
| **GPMG** | General Purpose Machine Gun |
| **GR** | Gallery Range |
| **GRP** | Glass Reinforced Plastic |
| **G&Z** | Grouping and Zeroing |
| | |
| **HE** | High Explosive |
| **HEAT** | High Explosive Anti-Tank |
| **HEF** | High Elevation Fire |
| **HMSO** | Her Majesty's Stationery Office |
| **HMT (RAF)** | Health Monitoring Team |
| **HO** | Hydrographic Office |
| **HQ** | Headquarters |
| **HSE** | Health and Safety Executive |
| **HT/ht** | Height |
| **HV** | High Velocity |
| **H&S** | Health and Safety |
| **Hz** | Hertz |
| | |
| **IBSR** | Individual Battle Shooting Range |
| **ILAW** | Interim Light Antitank Weapon |
| **Illum** | Illuminating |
| **in** | Inch(es) |
| **Inf Wpn Sys** | Infantry Weapon Systems (PE) |
| **IP** | Identified Project |
| **IPT** | Integrated Project Team |
| **IR** | Infra-red |
| **ITTR** | Indoor Training Theatre Range |
| **IWS** | Infantry Weapon System |
| | |
| **J** | Joule(s) |
| **JSP** | Joint Service Publication |
| | |
| **kg** | Kilogram(s) |
| **kt** | Knot(s) |
| **kph** | Kilometres per Hour |
| **kVA** | Kilovolt Amperes |
| | |
| **LANDSO** | Land (Command) Standing Order |
| **LAW** | Light Anti-Tank Weapon |
| **lb** | Pound(s) |
| **LDA** | Limited Danger Area |
| **LH** | Left Hand |
| **LMG** | Light Machine Gun |
| **LNV** | Limit of Night Visibility |
| **LofF** | Line of Fire |
| **LofS** | Line of Sight |
| **LPA** | Local Planning Authority |
| **LRSSC** | Land Ranges Safety Sub Committee |
| **LSW** | Light Support Weapons |
| **LTC** | Long Term Costings |
| **LUMAT** | Limitations in the Use of Missiles and Ammunition for Training |

| | |
|---|---|
| **LV** | Low Velocity |
| **LWC** | Land Warfare Centre |
| | |
| **m** | Metre(s) |
| **max** | Maximum |
| **ME** | Muzzle Energy (in joule (J)) |
| **MFC** | Mortar Fire Controller |
| **MG** | Machine Gun |
| **mg** | Milligram |
| **MHE** | Materials Handling Equipment |
| **min** | Minimum |
| **Mk** | Mark |
| **ML** | Member's Letter (OB) |
| **mm** | Millimetre(s) |
| **MMTTR** | Mechanized Moving Target Trainer Range |
| **MOD** | Ministry of Defence |
| **mph** | Miles per Hour |
| **MPI** | Mean Point of Impact |
| **MRATGW** | Medium Range Anti-Tank Guided Weapon |
| **MTS(R)** | Moving Target System (Rural) |
| **MS** | Mild Steel |
| **m/s** | Metres per Second |
| **MSL** | Mean Sea Level |
| **MV** | Muzzle Velocity (in m/s) |
| **MVEE** | Military Vehicle Engineering Establishment |
| **N** | Newton(s) |
| **NBSD** | Normal Burst Safety Distance |
| **NDA** | No Danger Area |
| **NLAW** | Next Light Anti Tank Weapon |
| **No.** | Number |
| **NOTAM** | Notice to Airmen |
| **NRA** | National Rifle Association |
| **NSN** | NATO Stock Number |
| **NSRA** | National Smallbore Rifle Association |
| | |
| **OBUA** | Operations in Built Up Areas |
| **OEL** | Occupational Exposure Limit |
| **OOB** | Out of Bounds |
| **OP** | Observation Post |
| **OTR** | Operational Theatre Range |
| | |
| **PA** | Public Address |
| **Pam** | Pamphlet |
| **para** | Parachute |
| **PE** | Probable Error |
| **PM** | Project Manager |
| **POD** | Protected Observation Down-range |
| **PPE** | Personal Protection Equipment |
| **Prac** | Practice |
| **DOSG1PROM** | Property Management |
| **PS** | Project Sponsor |
| **PTE** | Pre-Tender Estimates |
| **PTR** | Permanent Training Range |

| | |
|---|---|
| **QE** | Quadrant Elevation |
| **QMG** | Quartermaster General |
| **RAF** | Royal Air Force |
| **RAO** | Range Authorising Officer |
| **RAU** | Range Administrative Unit |
| **RBSD** | Reduced Burst Safety Distance |
| **RCO** | Range Conducting Officer |
| **RDA** | Range Danger Area |
| **RE** | Royal Engineers |
| **RF** | Radio frequency |
| **RFCA** | Reserve Forces & Cadet Associations |
| **RGGS** | Rifle Grenade General Service |
| **RH** | Right Hand |
| **RHA** | Rolled Homogenous Armour |
| **RM** | Royal Marines |
| **RN** | Royal Navy |
| **RNRSO** | Royal Naval Range Safety Officer |
| **ROC** | Rough Order Cost(s) |
| **RPC** | Regional Prime Contractor |
| **RT** | Reverberation Time |
| **RTAAB** | Ranges and Training Area Audit Board |
| **RTADB** | Ranges and Training Areas Development Board |
| **SA** | Small Arm |
| **SASC** | Small Arms School Corps |
| **SC105A** | Concrete Post |
| **SCOC** | Supply Chain Operations Centre |
| **SCOTS(A)** | Standing Committee On Training Safety (Army) |
| **SDA** | Sea Danger Area |
| **SF** | Special Forces |
| **SK** | Sketch |
| **SME** | Subject Matter Expert |
| **SMG** | Sub-Machine Gun |
| **Smk** | Smoke |
| **SO** | Standing Orders |
| **SOR** | Statement of Requirement |
| **STA & SPSS** | Surveillance, Target Acquisition and Special Project Support Systems |
| **STP** | Short Term Plan (was LTC) |
| **STPS** | Static Target Projection System |
| **SS105A** | Steel Post |
| **SW105A** | Wooden Post |
| **SWO** | Staff Warfare Officer |
| **TAG SASC** | Training Advisory Group Small Arms School Corps |
| **tan** | Tangent (trigonometric) |
| **TAS(RE)** | Technical Advisory Section (Royal Engineers) |
| **TAVRA** | Territorial, Auxiliary and Volunteer Reserve Association |
| **TB** | Technical Bulletin |
| **TE** | Tangent Elevation |
| **TER** | Temporary Exercise Range |

| | |
|---|---|
| **Tgty** | Targetry |
| **TO** | Technical Office(r) |
| **TOPL** | Training On Private Land |
| **TP&N** | Triple Phase and Neutral |
| **TWA** | Time Weighted Average |
| **UGL** | Underslung Grenade Launcher |
| **UK** | United Kingdom |
| **UK DAUG** | United Kingdom Danger Area User Group |
| **USA** | United States of America |
| **V** | Volt(s) |
| **VHI** | Visual Hit Indicators |
| **Vol** | Volume |
| **VTT** | Video Target Trainer |
| **WBP** | Water and Boil Proof grade Plywood |
| **WDA/Z** | Weapon Danger Area/Zone |
| **WP** | White Phosphorous |
| **WS** | Weapon System |
| **yd** | Yard(s) |

# GLOSSARY OF TERMS AND DEFINITIONS

## A

**Acceptance Trial**. An acceptance trial is a trial carried out by nominated representatives of the eventual military users of the weapon, delivery means or equipment to determine if the specified performance and characteristics have been met. (AAP-6)

**Accident**. An accident is an unintended event or sequence of events that causes death, injury, environmental damage or material damage. (also see the definition of incident) (Def Stan 00-56)

> **Training Accident.** A training accident is an unintended event or sequence of events that cause death, injury, environmental damage or material damage during the course of, or as a result of, authorised live or dry training by MOD personnel on public or private property.
>
> **Note:** Training accident defined here for ease of reference.

**Accuracy of Fire**. Accuracy of fire is the component of precision of fire which is expressed by the closeness of the Mean Point of Impact (MPI), of a group of shots, at and around the point of aim. (AAP-6)

**Acute Angle**. An acute angle is an angle of less than 90 degrees (1600 mils). Aerodynamic Drag (see Ballistic Trajectories)

**Aimer Error.** An unintended directional error by the firer which causes the shot to deviate from the intended point of impact.

**Airburst.** Airburst is the explosion of a shell or missile above the surface as distinguished from an explosion on contact with the surface or after penetration. (AAP-6)

**Air Danger Area**. An Air Danger Area (ADA) is the airspace which has been notified as such within which activities dangerous to the flight of aircraft may take place at such times as may be notified.

**Air Danger Height.** The Air Danger Height (ADH) is the maximum height above ground level at which a hazard may exist. (also see the definition of Control Zone)

> **Note**: An ADH is measured in feet above ground level. Altitude is measured in feet above Mean Sea Level (MSL).

**Air Weapons Range**. A range whose principal use is for firing or launching fixed wing or helicopter mounted weapons from the air to the surface.

**Allowable Cone of Fire** (see Cone of Fire)

**Altitude**. Altitude is the vertical distance of a level, a point or an object considered as a point, measured in feet above Mean Sea Level (MSL) (see also the definition of Elevation). (AAP-6)

**Ammunition/Munition.** Ammunition/munition is a projectile (kinetic energy projectile or shell), missile or bomb charged with explosive, propellant, pyrotechnics, initiating composition, or nuclear, biological, or chemical material for use in connection with military operations, including demolition. Certain suitably modified ammunition/munitions are intended to be used for training, ceremonial or non-operational purposes. (See also Stray Ammunition). (AAP-6)

> **Note:** Munition is the preferred NATO term. The terms are interchangeable but it is desirable to choose and use only one.

**Ammunition/Munition Danger Area/Zone** (see Weapon Danger Area/Zone)

**Ammunition/Munition Lot.** An ammunition/munition lot is a quantity of homogeneous projectiles, identified by a unique lot number, which is manufactured, assembled or renovated by one producer under uniform conditions and which is expected to function in a uniform manner.(AAP-6)

**Ammunition/Munition Natures.** For any given calibre there are likely to be a number of different ammunition/munition natures. These natures are largely distinguished by the type and make-up of the projectile. The more common projectiles are:

> **Armour Piercing.** An Armour Piercing (AP) projectile is a weapon which consists of a Gilding Metal (GM) envelope containing a hard metal penetrator.
>
> **AP Discarding Sabot**. An AP Discarding Sabot (APDS) projectile normally consists of a hard metal sub calibre projectile supported in a sabot which is discarded on muzzle exit. The projectile may be seated on an obturating pusher which is also discarded on muzzle exit.
>
> **Ball**. A ball projectile is an inert weapon which consists of a gilding metal (GM) envelope filled with a solid lead/antimony core. In some ball rounds the core may be either tipped by, or contain, a mild steel penetrator.
>
> **Baton.** Baton rounds contain a projectile, normally solid, designed to strike a target with sub-lethal force for use in riot control situations.

**Chemical.** Chemical shells contain agents which may be in liquid, solid or slurry form.

**Depleted Uranium**. A Depleted Uranium (DU) projectile is an AP projectile whose core is made of DU.

**Frangible.** A frangible projectile is designed to reduce the risk of either ricochet or splash back by disintegrating into small particles on striking a hard surface.

**High Explosive**. A High Explosive (HE) shell contains HE which may be electronically, mechanically or pyrotechnically fuzed. The shell may be designed to either produce fragments/splinters or contain a shaped charge. Shells which fulfil both functions are described as High Explosive Dual Purpose (HEDP).

**High Explosive Anti-Tank (HEAT).** An anti armour munition using the hollow or shaped charge principle.

**Illuminating.** An Illuminating shell contains a pyrotechnic illuminant.

**Incendiary/Smoke**. An Incendiary/Smoke shell contains an incendiary or smoke compound.

**Reduced Range Training Projectile.** A Reduced Range Training Projectile (RRTP) is a projectile with a reduced total energy trace compared with the operational round which it is designed to simulate. The reduction in projectile range is normally achieved by reducing mass or adjusting geometry.

**Semi-Fixed Ammunition**. Semi-fixed ammunition is an ammunition in which the cartridge case is not permanently attached to the projectile. (AAP-6)

**Tracer.** A tracer projectile is a weapon containing a pyrotechnic trace element which may be made up of one or more compounds.

**Note:** Small Arm tracer ammunition includes an envelope, normally of Gilding Metal Clad Steel (GMCS), containing a lead/antimony core.

**Angles.** The following Angles are defined: Arrival, Departure, Descent, Impact, Incidence, Projection, Safety, Sight, T, Yaw, Ballistic, Critical Impact and Gun.

**Angle of Arrival** (see Angle of Impact)

**Angle of Departure.** The Angle of Departure (AofD) is the acute angle between the horizontal plane and the line of departure.

**Angle of Descent.** The angle of descent is the acute angle between the line of impact and the horizontal plane.

**Angle of Impact** (sometimes called the Angle of Arrival). The angle of impact is the acute angle between the line of arrival, which is a tangent to the weapon trajectory, and the tangent to the ground surface at the point of impact.

**Angle of Incidence or Attack**. The angle of incidence or attack is the angle between the line of arrival (tangent to the weapon trajectory) and a line drawn at right angles to the surface of the target.

**Angle of Projection.** The Angle of Projection (AofP) is the acute angle between the line of sight and the line of departure of the weapon.

**Angle of Safety.** The angle of safety is the minimum permissible angle between the line clearing above and beside friendly troops and the line of the trajectory of the weapon. (AAP-6)

**Angle of Sight.** The Angle of Sight (AofS) is the acute angle between the line of sight and the horizontal plane (described as 'Elevation' if the target is above the line of sight, and as 'Depression' if the target is below).

**Angle T**. In artillery and naval gunfire support, the angle T is the angle formed by the intersection of the gun-target line and the observer-target line. (AAP-6)

**Angle of Yaw (of a weapon).** The angle of yaw is the acute angle of incidence between the axis of the projectile and the line of the trajectory.

**Azimuth Angle.** The azimuth angle is the angle measured clockwise in the horizontal plane between a reference direction and any other line. (AAP-6)

**Bearing.** A bearing is the clockwise angular measurement in the horizontal plane from grid north (see Angles: Switch).

**Critical Impact Angle.** The Critical Impact Angle (CIA) is the acute angle between the line of arrival of a weapon and the horizontal plane above which a ricochet should not occur.

**Note:** In UK service the CIA is taken to be 533 mils ($30^{o}$) (the angle is often rounded to 530 mils) although it has proved possible for a weapon to ricochet from a steeper angle of arrival.

**Gun Angles**. Gun angles are vertical or horizontal angles which are directly or indirectly set on the gun or associated with the gun.

**High Angle.** High angle fire is the projection of projectiles at Angles of Departure (AofD) above that at which occurs the maximum range for the gun and ammunition concerned (AofD above 45 degrees or 800 mils).

**Low Angle Fire**. Low angle fire is the projection of projectiles at Angles of Departure (AofD) below that at which occurs the maximum range for the gun and ammunition concerned (AofD below 45 degrees or 800 mils).

**Switch.** Switch is an angular correction to bearing. If it is in a clockwise direction it is called More, if anti-clockwise Less.

**Anti-Riot Weapons** (see Small Arm)

**Approval**. Approval is the formal act of authorisation, usually in document form, by the responsible authority that the product meets the stated requirement and is suitable for Service/MOD Agency use, with or without limitations.

**Note:** DLRSC Approval is required for the inclusion of any material in JSP 403 and is documented in the appropriate minute.

**Approved Range.** A range which varies from the design and build criteria specified for its type in JSP 403 or the appropriate Single Service publication. However, the resultant risk is assessed not to exceed the level authorised for a Compliant Range of the same type.

**Arc of Fire**. The arc of fire is the angle defining a left and right boundary between which the individual or group is responsible and engages targets.

**Area**. Area is the extent of a two dimensional surface enclosed within a specified boundary. Armed. A fuzing system is considered to be armed when a fuze function can be stimulated.

**Arming**. As applied to explosives, weapon or weapon systems, arming is the changing from a safe condition to a state of readiness for initiation. (AAP-6)

**Primary Arming**. Primary arming is an event that occurs at a point along the trajectory before which the fuze must not function. (OHSWG Overhead Safety Working Group)

**Proximity Arming (Secondary Arming).** Proximity arming (Secondary Arming) is an event that occurs at a point along the trajectory when the sensor of a proximity fuze, or Multi Role/Purpose Fuze (MRF/MPF) set to proximity, commences the final stage of the arming operation.

**Authorising Officer** (see Range Authorising Officer)

**Automatic Fire**. Automatic fire occurs when the trigger is pressed once and shots continue to be fired until the trigger is released; as opposed to single shot when between each shot the trigger must be released and subsequently pressed each time to fire.

**Axis of the Bore.** The axis of the bore is the line passing along the centre of the barrel. The axis may be slightly curved due to barrel droop.

**Azimuth Angle** (see Angles)

**Azimuth Resolution**. The azimuth resolution is the ability of radar equipment (or any other kind of measuring equipment) to separate two reflectors at similar ranges but different bearings from a reference point. Normally the minimum separation distance between the reflectors is quoted and expressed as the angle subtended by the reflectors at the reference point. (AAP-6)

**B**

**Backsplash.** Backsplash is fragmentation or target debris thrown back towards the firing point as a result of projectile impact.

**Notes:**

(1) This may be a projectile bouncing, projectile or target material fragmenting, or earth throw.

(2) On a range the standard minimum distance for direct fire engagement should be planned to be greater than the backsplash distance.

**Ballistic Angles** (see Angles)

**Barrel.** The barrel is that part of a weapon system through which the projectile is propelled and given direction.

**Base Line**. A base line is a survey line established with more than usual care, to which surveys are referred for co-ordination and correlation. (AAP-6)

**Base Map.** A base map is a map or chart showing certain fundamental information, it can be used as a foundation upon which additional specialised data can be compiled or overprinted. A base map is also a map containing all the information from which maps showing specialized information can be prepared.

**Bearing**. A bearing is the clockwise angular measurement in the horizontal plane from grid north.

**Beaten Zone.** The beaten zone is the pattern formed on the ground by the strike of projectiles fired on a specific point of aim and it will vary with range and the physical characteristics of the area of strike.

**Blast**. A blast is a brief and rapid movement of air, vapour or fluid away from the centre of detonation, as in an explosion or in the combustion of rocket fuel; the pressure accompanying this movement. This term is commonly used for ‘explosion ’, but the two terms may be distinguished. (AAP-6)

**Blast Wave**. A blast wave is the movement of the region of high pressure created by an expansion of hot gases in the atmosphere which results from an explosion. (AAP-6)

**Blind.** Explosive ordnance which has been primed, fuzed, armed, initiated or otherwise prepared for action, and which has been dropped, fired, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel or material and remains unexploded either by malfunction or design, or for any other cause.

> **Note:** The term 'Blind' can be used by pilots of fixed wing aircraft to indicate that they are unable to see something, but it is not used in the context of firing from the air on to land ranges.

**Bore**. The bore is the interior of a gun barrel that extends from the muzzle to the rear end of the forcing cone.

**Bomb.** A bomb is an aircraft or mortar delivered weapon.

**Bullet**. A bullet is a projectile fired from a Small Arm (SA) (small calibre delivery means).

**Bullet Catcher**. The bullet catcher is a structure or receptacle placed behind the target line for the purpose of capturing the majority of rounds fired at each target. (AAP-6)

**Burst Height (Design).** The design burst height is the height at which it is intended that the fuze, when set to proximity or mechanical time, initiates the shell, bomb or missile.

**Burst Safety Distances**. Burst Safety Distances (BSD) are hazard distances, calculated for still air at sea level, away from a fragmenting weapon, that are defined as Normal (N), Reduced (R) or Special (S). Definitions of N, R and SBSD are as follows:

> **Normal Burst Safety Distance.** The Normal Burst Safety Distance (NBSD) is the distance from the point on the ground, at or below the point of burst,

beyond which it is improbable that any fragment from a bursting weapon will travel (See Notes 1 & 2). Reduced Burst Safety Distance. The Reduced Burst Safety Distance (RBSD) is the distance from the point on the ground, at or below the point of burst, beyond which it is improbable that more than one fragment per bursting weapon could travel (See Note 3).

**Reduced Burst Safety Distance.** The Reduced Burst Safety Distance (RBSD) is the distance from the point on the ground, at or below the point of burst, beyond which it is improbable that more than one fragment per bursting weapon could travel (See Note 3).

**Special Burst Safety Distance** (for troops under various degrees of protection). The Special Burst Safety Distance (SBSD) is the distance from the point on the ground, at or below the point of burst, where it is improbable that more than one fragment could penetrate the weakest armour or other protection presented to each bursting weapon (See Note 4).

**Notes:**

(1) A fragment encompasses all parts of the shell which are accelerated by effect of explosive detonation. A shell splinter is a fragment, the size of which is the product of design.

(2) The NBSD is applied whenever civilians are involved or when 100 or more service personnel are in one area (100 x 100 metres) watching or participating.

(3) The RBSD is applied when 99 or less service personnel, without protection, are in one area (100 x 100 metres) watching or participating.

(4) The SBSD is only applied when servicemen are fully closed down in specified armoured vehicles, field defences or buildings. All specified areas must be suitably protected. Some damage to vehicles and external fittings may be expected.

## C

**Calibre.** Calibre is the diameter of the bore measured across the lands (excluding the depth of the rifling grooves) which is also used as a measure of barrel or projectile length in multiples of calibre.

**Notes:**

(1) The calibre is sometimes given as the nominal diameter of the shell or projectile.

(2) Where the projectile has a discarding sabot, the calibre of the projectile will not equal the calibre of the bore.

**Cap (Percussion Cap).** A percussion cap is a small container (normally metal) containing a flame producing explosive composition which is designed to be detonated by impact.

**Captured by Ground**. Captured by ground is when the first strike from a projectile fired within the CofF is guaranteed to impact a surface on or near the target.

**Centre fire**. Centre fire is that class of Small Arm (SA) munition which has the primer cap located centrally in the base of the cartridge case.

**Certification.** Certification is a signed statement by a qualified person that the product wholly or partially meets or complies with the approved specification(s).

**Note:** The specification may include a requirement for national legislation prior to certification.

**Clearance (Explosive Ordnance)** (see Explosive Ordnance Clearance)

**Clear Range Procedure**. A procedure followed by the Range Administering Unit and the user unit to ensure that the Range Danger Area is clear of unauthorised persons before firing commences and that it remains clear throughout the time firing is in progress. The procedure includes provision for the timely cessation of firing before it poses a risk of hazard to an intruder in the Range Danger Area.

**Clear Vision Line**. Lines projected from above and below the firer to the target to ensure that there are no distracting protrusions within the firer's peripheral field of vision in all firing postures.

**Cleared Area**. An area that has been physically and systematically processed by a demining organization to ensure the removal and/or destruction of all mine and unexploded explosive ordnance hazards to a specified depth. (Also cleared land)

**Notes:**

(1) IMAS 09.10 specifies the quality assurance system (i.e. the organization, procedures and responsibilities) necessary to determine that land has been cleared by the demining organization in accordance with its contractual obligations.

(2) Cleared areas may include land cleared during the technical survey process, including boundary lanes and cleared lanes. Areas cleared for worksite administrative purposes, such as car parks, storage locations, and

first aid posts need not be officially documented as cleared, unless national procedures so require.

**Climate Categories**. For munitions of all types the world has been broken down into areas with similar conditions. Eleven Climatic Categories have been selected to describe the land surfaces of the world. A further three have been selected to describe the conditions found at sea (away from land). Details are contained in LUMAT Volume 2/STANAG 2895.

**Closed Area / Zone**. A closed area / zone is a designated space in, over or through which, passage of any kind is prohibited. (AAP-6)

**Closed Impact Area/Zone (see also Impact Area/Zone).** A closed impact area is that part of an impact area, known or thought to contain unexploded munitions (blinds), where access is prohibited to all persons except those involved in the clearance of ordnance.

**Common User Item**. A common user item is an item, of an interchangeable nature, which is in common use by two or more nations or services of a nation. (AAP-6)

**Complex**. (See Range Complex).

**Compliant Range**. A range which meets the design and build criteria specified for its type in JSP 403 or the appropriate Single Service publication.

**Cone of Fire**. The cone of fire is the distribution of fired projectiles within a margin of error in the vertical and horizontal plane.

**Contractor Operated Range**. A range owned by the MOD and operated by a civilian commercial organisation under licence, contract or partnership arrangements with the MOD. The criteria to be met in operating the range are laid down by the MOD in the licence, contract, protocol or other instruction drawn up with the contractor. A contractor operated range is to be controlled and operated in accordance with the range management principles stipulated in JSP 403.

**Allowable Cone of Fire**. The allowable cone of fire defines an acceptable left and right boundary and a maximum safe elevation and depression for the weapon system. (defined here for ease of reference)

> **Note:** Projectiles are predicted to be fired within a margin of error off the line of sight. The error margin accounts for aimer error, weapon system inaccuracies and ballistic curve.

**Consistency** (see Dispersion)

**Control Zone (see Air Danger Height).** The Control Zone is the controlled airspace extending upwards from the surface of the earth to a specified upper limit. (AAP-6)

**Controlled Impact Area/Zone** (see also Impact Area/Zone). A controlled impact area is an area known or thought to contain unexploded munitions (blinds) where, due to public rights of way or for other reasons, public access can not be prohibited. After firing has ceased and designated routes through the area have been cleared of any blinds, controlled access is permitted.

**Control Point**. A point used to control the movements of range visitors, staff and users.

**Crew Served Weapon** (see Small Arm)

**Critical Elevation**. The Critical Elevation (Crit Elev) is that quadrant elevation required, under standard firing conditions, to give an impact angle equal to the critical impact angle on a horizontal range surface. (AAP-6)

**Critical Impact Angle** (see Angle)

**Cumulative Risk** (see Risk)

**D**

**Danger**. Danger is the circumstance under which harm or the risk of injury or damage may occur.

**Danger Area/Zone**. The Danger Area/Zone (DA/Z) is the space in which there may be a hazard which could result in a risk to personnel, equipment or property. (also see definitions of Total Energy Area/Zone & Range Danger Area/Zone)

> **Note:** The space is defined as weapon or range specific ie: Weapon DA/Z (WDA) or Range DA/Z (RDA).

**Danger Area Template** (see Template)

**Danger Area Trace**. A Danger Area Trace (DA Trace) is a technical drawing of a common composite DA which is deduced from an amalgamation of a number of Weapon DA Templates (WDA Templates). The trace is worked to a given scale and produced on appropriate material for convenient application to a map.

**Dangerous Space.** The dangerous space is a Small Arm (SA) term used to define the space between the first catch and the first graze.

> **Note:** First Catch and First Graze are defined elsewhere in this Glossary.

**Dangerous Zone**. The dangerous zone is a Small Arm (SA) term used to define the combination of the dangerous space and the beaten zone.

**Datum.** Datum is any numerical or geometrical quantity or set of such quantities which may serve as reference or base for other quantities. (AAP-6)

**Dead Ground/Space (Fire).** Dead ground/space is an area or zone within the maximum range of a weapon, radar, or observer, which cannot be covered by fire (hit) or observation (seen) from a particular position because of intervening obstacles, the nature of the ground, the characteristics of the trajectory, or the mechanical limitations of the weapon system.

**Dedicated Danger Area/Zone**. A dedicated Danger Area/Zone (DA/Z) is a space permanently designated within which specified weapons and explosives which have been fired, launched or detonated (the resulting fragments, debris, components and ricochet) will be contained.

**Trajectory Danger Area.** The Trajectory Danger Area (DA) is the identified DA beneath the trajectory of certain specified weapons. No one may be in the Trajectory DA whilst weapons are being fired unless they are authorised and suitably protected. (defined here for ease of reference, also see definition of Trajectory)

**Dedicated Impact Area/Zone** (see Impact Area)

**Defence Zone.** That part of an indoor range which may be struck by occasional predicted low angle shot, ricochet or backsplash only, at the extremities of the cone of fire.

**Defilade Position**. A defilade position is a position at an angle to the target which enables engagement from a flank.

**Defiladed Zone.** The defiladed zone is the zone which would be included in the beaten zone but for the fact that a proportion of the bullets have met an obstruction.

**Delivery Error**. The delivery error is the inaccuracy associated with a given weapon system resulting in a dispersion of shots about the aiming point. (AAP-6)

**Demolition**. Demolition is the destruction of structures, facilities or materials by the use of fire, water or explosives, mechanically or by other means. (AAP-6)

**Demolitions Conducting Officer**. The officer or senior NCO qualified as either a Demolitions Safety Officer (DSO) or a Battle Noise Safety Supervisor (BNSS), as appropriate, appointed to plan, conduct and supervise all practices and training involving the use of explosives, simulators or accessories.

> **Note:** The qualification criteria for a DSO and a BNSS are as given in Reference K.

**Demolition Firing Position.** A demolition firing position is the point or location on the ground where the firing team or crew is located during demolition operations.

**Design Approval.** Design approval is the formal act of authorisation, usually in document form, by the Responsible Authority that the design meets the stated requirements and is suitable for MOD use with or without limitations.

**Design Authorisation**. Design authorisation is the order or direction to do something to meet stated requirements, by the branch or establishment responsible for doing so (by the responsible Authority (DEF STAN 05-10)). The responsibility may be more limited, eg: Design or Technical Authorities. Their appointment and limitations are authorised by the Responsible Authority.

**Design Certification**. Design certification is a signed statement by a qualified person that the design wholly or partially meets or complies with the approved specification(s), which includes legislation.

**Detonating Cord**. A waterproof flexible fabric tube containing a high explosive designed to transmit the detonation wave. (AAP-6)

**Deviation.** Deviation is the measurement (distance or angle) by which a point of impact or burst misses the target. (AAP-6)

**Direct Fire**. Direct fire is an engagement in which the target can be seen by the firer. (AAP-6)

**Dispensation** (see Range Safety Dispensation)

**Dispensation Range.** A range which varies from the design and build criteria specified for its type in JSP 403 or the appropriate Single Service publication, and results in a level of risk which exceeds that currently accepted for a Compliant Range of the same type.

**Dispersion** (also called Consistency). Dispersion is the scatter pattern of hits around the Mean Point of Impact (MPI) of bombs and other weapons dropped or fired under identical conditions. (AAP-6)

**Dispersion Error**. Dispersion error is the distance from the point of impact or burst of a projectile or shell to the Mean Point of Impact (MPI) or burst of a number of weapons. (AAP-6)

**Dispersion Pattern.** The dispersion pattern is the distribution of a series of weapons fired from one or more delivery means under conditions as nearly identical as possible, the points of burst or impact being dispersed about the Mean Point of Impact (MPI). (AAP-6)

**Note:** The size of the area to be covered by the dispersion pattern can be estimated using range dependent probable error data (see Probable Error).

**Disposal (Explosive Ordnance)** (see Explosive Ordnance Disposal)

**Disposal Area.** A disposal area is a space which is large enough to contain all appropriate safety distances within a controlled area and has ground which is free from foreign objects likely to produce or enhance a secondary weapon hazard. The space provides a safe and efficient environment for the disposal of munitions and explosives in accordance with existing procedures.

**Disposal Site**. An area authorised for the destruction of ammunition and explosives by detonation and burning.

**Dud** (see Blind)

**Dump**. A dump is a temporary storage area, usually in the open, for bombs, ammunition, equipment, or supplies. (AAP-6)

## E

**Enfilade**. Enfilade fire is fire which strikes the side of a target.

**Exercise Trace**. An exercise trace is a technical drawing of a common composite exercise danger area which is deduced from an amalgamation of a number of Weapon DA Templates (WDA Templates). The trace is worked to a given scale and produced on appropriate material for convenient application to a map.

**Exercise Director**. The person who directs that a particular live firing training exercise or practice is to be carried out and who appoints officers to plan and conduct the training. The Exercise Director can not be the person appointed to plan or conduct the training but ensures that the plan meets the requirements of the aim of the exercise and that exercising troops are competent to undertake the training.

**Explosion (Munition).** An explosion is a very rapid transfer of heat through a layer or layers of material which is characterised by heat, flash, sound and large quantities of gas.

**Note:** An explosion can take place without oxygen.

**Explosive.** An explosive is a substance or a mixture of substances which, under external influences (initiation), is capable of rapidly releasing energy in the form of gases, heat, flash and sound. (AAP-6)

**Explosive Content.** The explosive content is the quantity of explosive filling contained in a shell, bomb, mine or missile.

**Explosive Materials**. Components or ancillary items which contain some explosives, or behave in an explosive manner, such as detonators, fuzes and primers.

**Explosive Ordnance.** All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. (AAP-6)

**Explosive Ordnance Disposal**. Explosive Ordnance Disposal (EOD) is the destruction, identification, evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance. It may include the rendering safe, or disposal of explosive ordnance which have become hazardous by damage or deterioration. (AAP-6)

**Explosive Ordnance Clearance.** Explosive Ordnance Clearance (EOC) is the destruction or rendering safe, recovery and final disposal of unexploded explosive ordnance on or from ranges and training areas, including areas formerly used as such.

**External Ballistics** (see Ballistics)

**F**

**Fail Safe.** Fail safe is a provision built into a weapon, or component part of the weapon system, so that the item reverts to a safe condition, if it, or part of it, fails to perform its design function.

**Field of Fire.** The field of fire is the area or zone in front of direct fire weapon systems within which targets can be effectively engaged.

**Field Firing Area**. An open range having no constructed bullet catchers, stop butts or backstops but with an impact area that can contain the full danger areas of authorised weapon systems, munitions and explosives within the overall range boundary.

**Firing Lane.** A firing lane is a designated zone (usually marked on the ground) in which a direct fire weapon system is located and within which it is authorised to be fired. A range may have a number of firing lanes in parallel.

**Firing Position/Point (Weapon).** The firing position/point is the location on the ground at which a weapon delivery means (excluding demolitions) is placed for firing.

**Firing Position Danger Zone.** A firing position danger zone is a space around a

firing position in which the direct effects of firing the weapon system could create a hazard to unprotected personnel or material.

**Flight Path.** The flight path is the line connecting the successive positions occupied, or to be occupied, by an aircraft, missile or space vehicle as it moves through the atmosphere or outer space. (AAP-6)

**Note:** The size of naturally formed fragments is independent of design.

**Full (Weapon) Danger Area Ranges (see Range (Zone))**

**H**

**Hand Held Weapon.** A hand held weapon is a delivery system, which is normally a Small Arm (SA) that can be carried, held and aimed by a single operator (see Small Arm (SA) for categories).

**Hard Target** (see Target)

**Hardened Site.** A hardened site is a site constructed under rock or concrete cover, designed to provide protection against the effects of conventional weapons. It may also be equipped to provide protection against the side effects of a nuclear attack and against a chemical or biological attack. (AAP-6)

**Harm.** Harm is a physical injury or damage to health, property or the environment. (P118(2))

**Hazard.** A potential source of harm.

**Hazard Area**. The hazard area is the area within which a specified hazard can be identified. A risk assessment defines what level of hazard is acceptable for a particular activity. The edge of the hazard area is the hazard boundary.

> **Note:** The assessor identifies and quantifies the hazard, the acceptor identifies and quantifies the level of risk.

**Hazard Boundary.** The hazard boundary is the outer edge of the hazard area. It is deemed that at the boundary the risk from the defined hazard is as low as is reasonably practicable.

**Hazard Identification**. Hazard identification is the process of recognising that a hazard exists and defining its characteristics. (P118(2))

**Hazard Log.** A hazard log is a record of the hazards associated with a specific project or activity and the methods by which they have been controlled. (P118(2))

**Height.** The height is the distance measured along the vertical line between a reference level surface and a point. (STANAG 4119)

**Hazard Impact Area Trace**. A Hazard Impact Area Trace (HIAT) defines the boundaries of the Weapon Danger Area/Zone on an air to surface range and is provided as a scaled overlay for use with range maps. In addition, it identifies the release conditions (with associated tolerances), the normal wind and the system aiming error. The HIAT also defines the dimensions and positioning of the release box in which the aircraft must be at weapon release.

**High Elevation Fire**. High Elevation Fire (HEF) is a variable, small arm specific, vertical firing angle for engaging targets where the CofF is elevated so that no portion touches the ground within a general firing angle of 200-1250 mils.

> **Note:** The authorised minimum firing elevation varies between ammunition natures.

**High Explosives.** High explosives are substances or mixtures of substances which, in their application as primary, booster or main charges in shells, missiles, and demolition systems, are required to detonate.

**Hill Background**. A hill background describes the situation where ground immediately behind the targets on a Gallery Range rises to form a hill beyond which no ricochet hazard is predicted to exist, so that consideration can be given to reducing the size of the Range Danger Area.

**Horizontal Error.** Horizontal error is the error in range, deflection, or in radius, which a weapon may be expected to exceed as often as not. The horizontal error of a weapon making a near vertical approach to a target is described in terms of a circular error probable. The horizontal error of a weapon producing an elliptical dispersion pattern is normally expressed in terms of range and deflection probable error. (AAP-6)

**I**

**Impact Area/Zone.** An impact area/zone is a space authorised and applied permanently, or at the time of firing, in which specified weapons may impact, detonate, break up or operate. The space must be large enough to contain ricochet but have its edge no closer to the Danger Area/Zone (DA/Z) boundary than the authorised fragment Burst Safety Distance (BSD) or other weapon hazard distance (for example: Gas). Access to the impact area/zone must be physically controlled as directed by the Range Authorising HQ and/or the Range Administering Unit.

> **Note:** See also **Closed Impact Area/Zone** and **Controlled Impact Area/Zone**.

**Incident.** An incident is any unplanned occurrence which does not fall within the

definition of accident.

**Training Incident.** A training incident is any unplanned occurrence which does not fall within the definition of training accident. (also see definitions of Accident and Training Accident).

**Indirect Fire.** Indirect fire is an engagement in which the target cannot normally be seen by the firer; the delivery means is laid mechanically or electronically using data derived from tables or computation. (AAP-6)

**Individual Risk** (see Risk)

**Indoor Range** (see Range Area/Zone)

**Infantry Weapon Range** (see Range)

**Jump.** Jump is the vertical component of the acute angle between the muzzle axis before firing and the line of departure. It can be positive or negative.

**K**

**Kinetic Energy Projectile**. (See Projectile)

**L**

**Land Range.** A land range is a range where the Danger Area/Zone (DA/Z) falls wholly or partially on or over land.

**Lands.** Lands are the set of twisting ribs raised along the interior of the bore which are separated by cut grooves.

**Limit of Fire (Ground Limits).** The limit of fire is the boundary marking off the area into which projectiles can be fired. (AAP-6)

**Limit of Fire (Angular Limits).** The limit of fire is the safe angular limit for firing at aerial targets. (AAP-6)

**Limited (Weapon) Danger Area Range (see Range (Zone))**

**Line of Arrival.** The line of arrival is the direction of motion of the weapon at any specified point on the trajectory and is the tangent to the trajectory at that point.

**Line of Departure.** The line of departure is the tangent to the trajectory at the commencement of free flight.

**Note:** In general this line should be deduced from elements measured at convenient points on the trajectory. STANAG 4119)

**Line of Fire.** The Line of Fire (LofF) is an imaginary straight line from the barrel of the weapon delivery system to the target. Known as the line Gun to Target (GT). The firer need not be able to see the target he is engaging.

**Line of Impact.** The line of impact is a line tangent to the trajectory at the point of impact or burst projected onto the horizontal plane. (AAP-6)

**Line of Sight.** The Line of Sight (LofS) is a straight line passing through the aiming device (sight) of the delivery system and the aim point on the target so that the firer can see the target he is engaging. (STANAG 4119)

**Live Firing Tactical Training**. The infantry term for the final stage of training the battle shot which brings together and practises tactical groups under realistic operational shooting conditions at levels set by the chain of command.

**Live Firing Tactical Training Area**. An area of ground contained within a range danger area boundary that is used for live firing tactical training.

**Low Angle Fire.** Low angle fire is the firing of shells or kinetic energy projectiles at angles of elevation lower than that which corresponds to the maximum range of the weapon fired with a specified propelling charge. The maximum range of the weapon decreases as the identified angle is changed (up or down). (AAP-6)

**LUMAT (Volume 1&2).** LUMAT (Limitation in the Use of Missiles and Ammunition for Training) is the UK publication detailing the limitations in the use of ammunition for training imposed by the Ministry of Defence (Weapons or Staff Branches). It does not include limitations in the use of Air Defence (AD) missiles, or ammunition designed for ceremonial guns, or for ammunition which has been authorised for local or temporary use. The following volumes are available:

**Volume 1:** Field Artillery Natures of Ammunition.

**Volume 2:** Natures of Ammunition other than Field Artillery.

**M**

**Map Range.** The map range is the horizontal distance as measured on a map.

**Map Bearing.** A map bearing is the bearing as measured on the map or obtained by computation.

**Maximum Effective Range.** The maximum effective range is the maximum distance at which a weapon may be expected to be sufficiently accurate to achieve the desired

result. (AAP-6)

**Maximum Range.** The maximum range is the greatest distance a weapon can travel under standard weather conditions without consideration of dispersion or fragmentation. (AAP-6)

**Maximum Ricochet Range.** The Maximum Ricochet Range (MRR) is the range corresponding to the angle of descent which produces the Critical Angle of Impact (CAI) for the projectile.

**Mean Point of Impact.** The Mean Point of Impact (MPI) is the location which is the arithmetic mean of the co-ordinates of the separate points of impact or burst of a finite number of weapons (projectiles or sub-munitions) fired or released at the same aiming point, under a given set of parameters. (AAP-6)

**Mean Area of Effect** The Mean Area of Effect (MAE) of a weapon to a target is not an area in the physical sense, but a quantity having the dimensions of area, which, when multiplied by the area density of targets gives the expected number of casualties.

**Misfire.** A misfire is the failure of a weapon delivery system to fire or function. (AAP-6)

**Missile.** A missile is a self propelled unmanned weapon which is internally propelled along a pre-planned trajectory towards a selected point usually to cause damage.

**Mortar.** A mortar is a mobile (mounted or portable), muzzle loading, generally smooth-bore delivery means designed to fire fin-stabilised bombs at subsonic velocities, predominantly in the high angles.

**Munition (see Ammunition).**

**Muzzle Axis.** The muzzle axis is the straight line axis of the bore at the muzzle.

**Muzzle Danger Area.** The muzzle danger area is the area immediately in front and to the side of the delivery system (weapon firing platform) into which entry should be restricted during firing.

**Muzzle Energy.** The Muzzle Energy (ME) is the kinetic energy of a projectile at the muzzle of the delivery means. The ME (joules) = $\frac{1}{2}mV^2$ (m = Projectile mass in kg, V = MV in m/s).

**Muzzle Velocity (Instrumental Muzzle Velocity).** The instrumental Muzzle Velocity (MV) is the apparent velocity of projectile at shot exist, generally computed by backward extrapolating velocity measurements to the muzzle of the delivery means.

**N**

**Negligent Discharge.** A Negligent Discharge (ND) is a shot that may be fired in any direction, and not necessarily from an approved firing point.

**Notes**

**1.** ND's most commonly occur when a Small Arm (SA)is being unloaded. However, current drills require the SA, during the unload, to be pointed down the Range towards the targets and in depression. A discharge under these conditions is thus unlikely to produce any greater hazard than that attributed to firing errors.

**2.** Occasionally a SA is fired in a random direction - the 'wild shot'. When that happens the shot may fall outside the Range Danger Area (RDA). However, the occurrence of such shots has been deemed to be very rare, and the Ordnance Board (OB) agreed that they should not be allowed for in the determination of a WDA or RDA.
(OB Proc 42577)

**Net Explosive Quantity (Content).** The Net Explosive Quantity (NEQ) is the quantity of the explosive substance in the munition.

**No Danger Area Range (see Range (Zone))**

**Normal Burst Safety Distance (see Burst Safety Distances)**

**Normal Burst Height.** The normal burst height is the intended height of burst at which the fuze, when set proximity or mechanical time, initiates the shell.
(OHSWG Overhead Safety Working Group)

**Normal Environment.** The normal environment is that which will occur during the routine processing and operation of the system in the manufacture to Target or Disposal Sequence (MTDS). It will comprise the aggregate, at a given moment, of all conditions and influences in which, by design, the system will be safe and serviceable.

**Non-Standard Ammunition.** Non standard ammunition is a round other than the standard combination (projectile and propelling charge) for which the main body of the firing table was compiled. Non-standard projectiles, normally shells include; smoke, illuminating, marker and bomblet which are often ballistically matched to a standard variant.

**O**

**Officer in Charge of Practice**. The Commanding Officer or Head of the unit or organisation firing on the area who has the overall personal responsibility for the safe conduct of the field artillery practice.

> **Note:** There are a number of artillery safety officer appointments subordinate to the Officer in Charge of Practice (OIC Practice). For a description of the Forward Indirect Fire Safety Officer (FIFSO), the Gun Position Safety Officer (GPSO), the Gun Line Safety Officer (GLSO), the Range Safety Instructor (RSI), the Launch Safety Officer (LSO) and the Command Post Safety Officer (CPSO) see Reference M.

**Open Range** (see Range)

**Open Impact Area/Zone** (see also Impact Area/Zone). An open impact area is an impact area where, after firing has ceased and all blinds have been cleared, uncontrolled access is permitted.

**Operational Theatre Range**. An Operational Theatre Range (OTR) is a range established, usually for a limited period of time, for troops deployed on operations or emergency tours. It is a training facility set up for troops to test and/or familiarise themselves with weapons systems, ammunition and explosive stores during their operational or emergency tour of duty. Responsibility for authorising use of an OTR lies with the deployed commander as directed by the appropriate level operational commander.

**One Probable Error** (see Probable Error)

**Overpressure**. The pressure resulting from the blast wave of an explosion. It is referred to as positive when it exceeds atmospheric pressure and negative during the passage of the wave when resulting pressures are less than atmospheric pressure. (AAP-6)

**Overhead Firing Area**. The overhead firing area is the area under the trajectory of the weapon between the firing position danger area and the boundary to the impact area.

**P**

**Personal Weapon** (see Small Arm)

**Planning Officer (see also Senior Planning Officer).** The Planning Officer is the qualified, current and competent person who is appointed by the Exercise Director to be responsible for the design of the live firing exercise including the definition of the firing area, arcs of fire, permitted ammunition natures, target siting, safe location of all weapon firing positions and the production of a written instruction, including safety trace, after a risk assessment.

**Plastic Explosive** (see also Explosive). Explosive which is malleable at normal temperatures. (AAP-6)

**Point of Aim**. The point of aim or aiming point is the grid reference, or spot on the ground or object, at which the weapon is aimed or above which it is intended to function.

**Point of Impact**. The point of impact is the point at which a projectile, missile or bomb impacts. (AAP-6)

**Practical 100% Area/Zone** (see Safe 100% Area/Zone)

**Probable Error**. The probable error of a random variable is that deviation from the mean which is as likely to be exceeded as not. (STANAG 4119)

**Note**: By convention the probable error is based on the normal distributions (uncorrelated and centred at the mean point of impact), and is approximately 0.6745 (rounded to 0.67) times the Standard Deviation.

> **One Probable Error.** One probable error is the unit of measurement of the horizontal error lying wholly on one side of the mean point of impact both in range and deflection, ie, plus, minus, left or right.
>
> **Note:** Defined here for ease of reference.

**Probabilistic Safety Analysis.** Probabilistic Safety Analysis is the assessment of the probability, the consequence of failure and other events that could lead to an incident or accident.

**Projectile**. A projectile is an object, capable of being propelled by a force, normally from a gun and continuing in motion by virtue of its kinetic energy. Projectiles are divided into Kinetic Energy Projectiles and Shells. (AAP-6)

> **Kinetic Energy Projectile.** A kinetic energy projectile is an inert weapon which produces effect on a target through its mass and velocity.
>
> **Shell**. A shell is a hollow projectile, filled with high explosives or other material and fired from ordnance. The shell has its primary effect through the detonation or dispersion of its contents rather than through its mass or velocity.

**Proof.** A test process that involves the initiation of an explosive, propellant or pyrotechnic charge to check the safety and functioning of an ordnance or a component, sub assembly or complete round of ammunition. (P128(3))

**Protection levels**. Three levels of protection are used for calculating safety distances: Unprotected, protected by armour and dug in with Over Head Protection (OHP). Each term is defined as follows:

**Unprotected.** Unprotected troops are those troops with some part of their body exposed to the effects of direct or indirect fire. This will range from a standing man to a man 'head - up' in an Armoured Fighting Vehicle (AFV) or a trench.

**Notes:**

(1) For training the standing man is taken as the basis for unprotected safety calculations, irrespective of how much of his body is actually exposed.

(2) For operations the standing man is also used unless he is classed as dug in with OHP.

**Protected by Armour**. Troops are defined as protected by armour if they are in a closed down AFV. It may be necessary to further sub-divide this level.

**Dug in with Over Head Protection**. Dug in with OHP is defined as troops wholly below level ground in correctly constructed trenches under 0.45 metres of OHP (sand or soil).

**Q**

**Quadrant Elevation.** The Quadrant Elevation (QE) is the angle between the level base of the trajectory in the horizontal plane and the axis of the bore when laid (sighted). (AAP-6)

**R**

**Range (Distance).** The range is the distance between any given point and an object or target. (AAP 6)

**Range (Zone).** The range is a space reserved, authorised and normally equipped for hazardous firing (weapon/laser). The following types of Indoor and Open (Outdoor) ranges are defined: (AAP 6)

**Indoor Range.** An Indoor Range is one which is fully contained in a building or other structure.

**Open (Outdoor) Range**. An Open Range is one which is exposed to the natural effects of light, wind and weather. The range may be completely open or contained partially by a structure.

**No Danger Area Range.** A No Danger Area (NDA) Range is a range where for all practical purposes the design precludes risk of injury to persons or

damage to property beyond the range floor caused by shot, direct or ricochet, fired in accordance with authorised procedures and aimed within the bounds of accepted aimer error.

**Limited Danger Area Range**. A Limited Danger Area (LDA) Range is an open range which is designed to ensure that no direct and correctly aimed shot fired within the bounds of acceptable aimer error will go beyond the range floor. However, ricochet is expected to create a hazard over a wider limited danger area.

**Full Danger Area Range.** A Full Danger Area (FDA) Range is an open range where hazard is only limited by the elevation of the delivery system and the skill of the firer.

**Notes:**

(1) The combination of maximum range, BSD, aimer error and worst case ricochet enables an appropriate FDA template to be produced for each weapon.

(2) The amalgamation of two or more FDA Range templates produces a FDA Range trace.

(3) For definitions of the three categories of range see Standard Range, Approved Range and Dispensation Range.

(4) Several types of range or several ranges of the same type can be grouped together for administrative and operating purposes (See Range Complex).

**Range Allocating Authority.** The Range Allocating Authority (RAA) is the headquarters, unit or establishment which decides who is to use a range or group of ranges and allocates time to user units accordingly. The RAA usually has control of the real estate and can often be the Range Administering Unit as well.

**Range Authorising Officer.** The Range Authorising Officer (RAO) is the officer responsible for personally certifying on the MOD Form 904 the weapon systems, munitions and explosive stores which can be used on the range, and for setting any limitations or restrictions on their use.

**Range Administering Unit.** The Range Administering Unit (RAU) is the unit or establishment tasked with administering and operating a particular range and is responsible for ensuring the production and upkeep of Range Orders. The RAU is accountable to the Range Authorising Officer.

**Range Boundary**. The range boundary is the delineation of the edge of the range area or zone.

**Range Clear to Fire** (see also Clear Range Procedure). Range Clear to Fire is a report from Range Control which confirms to the Range Conducting Officer (RCO) that the range staff are satisfied that all safety measures are in place, the area is controlled and clear of personnel and that firing may commence.

> **Note:** Some countries use other terminology (Range Red, Live, Hot, etc). The only stipulation is that all personnel (military and civilian) fully understand the appropriate term and its relevance.

**Range Conducting Officer** (see also Senior Range Conducting Officer). The qualified or authorised, current and competent person who is appointed by the Exercise Director/Commanding Officer/Head of unit or organisation to be responsible for the safe conduct of firing in accordance with the relevant Service range instructions.

**Range Control.** Range Control is the term used to describe the focal point on a range or range complex whose staff are responsible for range management and safety on behalf of the Range Administering Unit (RAU) and/or the Range Authorising Officer (RAO).

**Range Complex**. Two or more ranges operating independently within a common range boundary and administered by the same unit or establishment.

**Range Danger Area Template** (see Template)

**Range Danger Area Trace** (see Trace)

**Range Danger Area/Zone.** The Range Danger Area/Zone (RDA/Z) is the space within a range in which there may be a risk to personnel, equipment or property from firing authorised weapons. The RDA/Z must be wholly contained within the range or training area boundary. Access to, and movement within the RDA/Z must be controlled. The measures taken to monitor and control access must be detailed in Range Standing Orders (SO).

> **Note:** The boundaries on land are always marked, signed, flagged and often fenced to warn the public and to deter access; at sea, buoys may have to be provided.

**Range Event.** A range event is an activity taking place on a range.

**Range Floor.** The range floor comprises the ground from the furthest firing point to the target including any range construction intended for or capable of capturing

correctly aimed shots or preventing ricochet. The term only applies to constructed ranges.

**Range Liaison Officer.** The Range Liaison Officer (RLO) is the competent person on the Range Staff of the Range Administering Unit (RAU) who is responsible to the CO/Head of the RAU for liaison with user units/organisations. He may also hold the appointment of Range Officer, Range Manager and/or Range Safety Officer.

**Notes:**

(1) In the RAF this function is carried out by the Unit Ranges Specialist Officer (URSO).

**Range Officer.** The Range Officer is the person appointed by the Commanding Officer/Head of the Range Administering Unit, or in the case of the Defence Training Estate in conjunction with the Landmarc Support Services Area Manager, for the daily management and operation of the range. He may also hold the appointment of Range Liaison Officer and/or Range Safety Officer.

**Range Safe for Movement**. Range safe for movement means that firing is prohibited and that the area is open for authorised entry.

**Note:** Some countries use other terminology (Range Green, Dry, Cold, etc). The only stipulation is that all personnel (military and civilian) fully understand the appropriate term and its relevance.

**Range Safety Dispensation**. A range safety dispensation for a firing practice or for a particular range is a written authorisation, at 2 Star level or above, to permit a practice and/or use of a range when it does not meet currently prescribed safety criteria and live firing regulations.

**Range Safety Officer**. The Range Safety Officer is the competent person on the range staff of the Range Administering Unit who is responsible to the Commanding Officer/Head of the Range Administering Unit for the day to day safe operation of a particular live firing area or range complex and for range clearance.

**Notes**:

(1) Responsibility for the safe conduct of individual firing practices lies with the Range Conducting Officer or Trial Conducting Officer and not the Range Safety Officer. However, the latter does have the authority of the Commanding Officer/Head of the Range Administering Unit to stop an unsafe practice.

**Range Safety Officer (Air Traffic Control)**. The Range Safety Officer (Air Traffic Control) (RSO(ATC)) for RAF Academic Air Weapons Ranges (AWR) is an officer or

senior NCO of the Air Traffic Control Branch who holds a minimum endorsement of TC(AWR)L. The RSO(ATC) has overall responsibility for the safe execution of a particular range detail and for the co-ordination of the practice should more than one user be on the range.

**Range Safety Officer (Naval Gunfire Support).** The officer responsible for safety on land during Naval Gunfire Support practices.

**Range Standing Orders**. The set of orders, derived from a site specific risk assessment, which specify the control measures and procedures for the safe operation and use of the range. The Range Standing Orders (Range SO) are binding on all persons authorised to be on the range. For training ranges they are written and maintained by the Range Administering Unit. For test, evaluation, research and proof ranges they can be written and maintained by a contractor operating the ranges as long as they are approved by the representative of the Range Authorising Officer.

**Ready.** The term ready is to indicate that the delivery means is loaded, aimed, prepared and available to fire. (AAP-6)

**Reduced Burst Safety Distance** (see Burst Safety Distances)

**Ricochet**. Ricochet is the change of velocity, and hence speed and direction, induced in a projectile, missile or fragment caused by its impact with a surface.

**Ricochet Danger Area**. The ricochet danger area is an area into which a projectile, missile or fragment is liable to ricochet.

**Ricochet Template**. The ricochet template is a technical drawing which defines the boundary of prescribed ricochet hazard on a specified line of fire. The ricochet template does not take into account local variables such as topography and climate. The following definitions are agreed:

> **Maximum Ricochet Range.** The maximum ricochet range corresponding to the angle of descent which produces the critical angle of impact for the projectile, missile or fragment (normally assumed to be 533 mils), beyond which it is not expected to ricochet and within which all ricochets are expected to be constrained.
>
> **Ricochet Width Distance.** The ricochet width distance is the distance either side of the line of fire beyond which a projectile, missile or fragment would not be expected to ricochet and within which all ricochets are expected to be constrained. The distance for hard targets is a 1/4 of the Maximum Range to Ricochet (MRR). For ground targets a 1/8 of the MRR is applied.
>
> **Ricochet Height.** The ricochet height is the upper height limits of ricochet for a projectile, missile or fragment striking hard and ground targets. The height

for hard and ground targets is regarded as substantially the same as the vertex height of the normal trajectories that would be achieved by firing at an elevation of 620 mils (hard target) and 360 mils (ground target).

**Ricochet Trajectory.** The ricochet trajectory is the trajectory that begins at the point of impact and continues until the projectile, missile or fragment comes to a final rest.

**Rifling.** Rifling is the set of spiral grooves cut along the interior of the bore, leaving raised ribs or 'lands' between them.

**Twist of Rifling.** Twist of rifling is the distance along the bore, measured in calibres, in which the grooves make one complete circuit.

**Rimfire.** A type of small arms ammunition in which the initiating compound is contained within the rim of the cartridge case.

**Rimless.** Rimless refers to a cartridge case with a deep groove in the rear end, so providing an extraction rim of the same diameter as the body.

**Rimmed.** Rimmed refers to a cartridge case with a prominently raised rim at the rear end, which positively locates the case in the chamber and affords purchase for the extractor.

**Risk** (Concept). A general concept of risk is the chance, in quantitative terms, of a defined hazard occurring. It therefore combines a probabilistic measure of the occurrence of the primary event(s) with a measure of the consequences of that/those event(s). Criteria for acceptability of some predicted risk or measured risk can be set voluntarily by the organisation responsible and/or subjected to the hazard, or be set as a mandatory requirement by some regulatory organisation.

**Risk** (Definition and Key Terms). Risk is the combination of the probability of occurrence of harm and the severity of that harm. The following are key terms:

**Risk Analysis.** Risk analysis is the systematic use of available information to identify hazards and to estimate the risk to individuals or population, property or the environment.

**Risk Assessment.** Risk assessment is the overall process of risk analysis and risk evaluation.

**Risk Estimation**. Risk estimation is the process used to produce a measure of the level of risks being analysed. Risk estimation consists of frequency and consequence analysis and interpretation.

**Risk Evaluation.** Risk evaluation is the process in which judgements are made on the tolerability of the risk on the basis of risk analysis.

**Note:** Risk evaluation takes into account socio-economic and environmental factors.

**Risk Management.** Risk management is systematic application of management policies, procedures and practices to the tasks of analysing, evaluating and controlling risk.

**Risk Reduction**. Actions taken to lessen the probability, negative consequences or both, associated with a particular risk.

**Individual Risk**. Individual risk is the risk to an individual resulting from an involvement in a specified environment or event.

**Cumulative Risk.** The cumulative risk is the risk to an individual over a specified period of time from repeated exposure to a recurring event or a range of different events.

**Tolerable Risk.** Tolerable risk is the level of risk with which society is prepared to accept so as to secure certain benefits, provided the risk is properly controlled.

**Note**: To tolerate a risk means that it is not to be regarded as something that might be ignored, but rather as something that should be reviewed and reduced whenever possible. (Def Stan 00-56 & P118(2))

**Round.** Round is the name loosely used to define a combination of some or all of the following:

**Weapon** (missile or projectile) with or without fuze.

**Propelling charge.**

**Cartridge case.**

**S**

**Sabot**. A sabot is a lightweight carrier in which a sub calibre projectile is centred, to permit firing and projection from within the larger calibre barrel of the delivery means. The carrier fills the bore from which the weapon is fired and is normally discarded a short distance from the muzzle. (AAP-6)

**Safe.** The absence of risk or danger.

**Safety (Concept).** Safety relates to the freedom from risks that are harmful to a person, or groups of persons, either local to the hazard, nationally or even throughout the world. It is implied that for the consequences of an event to be defined as a hazard, i.e. a potential for causing harm, there is some risk to the human population and therefore safety could not be guaranteed, even if the risk is accepted when judged against some criterion of acceptability.

**Safety (Definition**). Safety is the quality of being free from danger or risk of injury. (Def Stan 00-56)

**Safety Angle Reduction (200 mils rule).** A reduction in the standard ricochet safety angle of 533 mils to 200 mils may be applied on a Gallery Range only, in certain circumstances, to permit the simultaneous use of different firing points on adjacent ranges. It is determined by measuring the angle formed between the flank of the firing point to be used and the nearest flank firer on the adjacent range.

**Safety Distance**. (See Burst Safety Distance and Explosive Safety Distance).

**Safe System**. A safe system is one which, under defined conditions, is not expected, through a malfunction, to lead to harm.

**Safe 100% Area/Zone**. The 100% area or zone is an Artillery term which defines space around the intended point of impact, measured in Probable Errors (PE) for range, deflection, height and fuze length within which all weapons are expected to impact or function. The size of the safety zone indicates the accuracy and consistency of the weapon system. Two 100% zones of safety are identified, the Practical 100% Safe Zone and the Safe 100% Zone. The 100% Zones do not account for fragmentation, earth throw or ricochet.

> **Practical 100% Safe Zone**. The practical 100% safe zone is the space around the intended point of impact in which all weapons, fired by single propellant lot propelling charges through barrels in the first quarter of life, are expected to impact or function. It extends 4 PE around the intended point of impact and mathematically contains 98.6% of all weapons within an area of 8 PE. The practical 100% safe zone is authorised for use during operations and with specific dispensations.
>
> **Safe 100% Zone**. The safe 100% zone is the space around the intended point of impact into which weapons are expected to impact or function. The zone takes account of variations in weapon performance due to barrel wear, manufacturing tolerances and uncertainties in determining the point of impact. The safe 100% zone for weapons fired by single propellant lot propelling charges is 8 PE around the intended point of impact (an area of 16 PE) and for mixed propellant lots 10 PE (an area of 20 PE). The safe 100% zones are authorised for use during peacetime training and expected to be used operationally when weapons are fired in close proximity to own troops.

**Safety Assessment Process**. Safety Assessment Process is the evaluation of a munition life cycle to determine the hazards to which the munition may be exposed. The assessment includes identification and examination of hazards posed by friendly munitions, enemy munitions, lasers and accidents during storage, handling and transportation (the assessment is based on analytical, empirical, experimental and historical data).

**Safe Target Area**. The safe target area is the restricted impact area in which targets for a particular practice and nature of weapon must lie.

**Safety Supervisor**. The competent person with the appropriate and current qualification/authorisation appointed to be responsible for the safe conduct of firing as directed by the Range Conducting Officer/Trials Conducting Officer in accordance with relevant Service/Agency instructions and Range Standing Orders.

**Sea Danger Area/Zone**. The Sea Danger Area/Zone (SDA/Z) is that part of the total energy zone on or over water in which there may be a risk to personnel, equipment or property.

**Senior Planning Officer** (see also Planning Officer). The Senior Planning Officer is the qualified, current and competent person appointed by the Exercise Director to co-ordinate the overall plan whenever there is more than one Planning Officer involved and whenever Joint and/or Combined live firing is to take place on a range.

**Senior Range Conducting Officer** (see also Range Conducting Officer). The Senior Range Conducting Officer (SRCO) is the qualified or authorised, current and competent person appointed by the Exercise Director to conduct live firing training when more than one Range Conducting Officer is involved and whenever Joint and/or Combined live firing is to take place on a range.

**Small Arms**. Small Arms (SA) is a general term for small calibre (normally < 20 mm) weapon systems. The following categories are defined:

> **Personal Defence Weapon.** Personal Defence Weapons (PDW) are SA which have been primarily designed for personal defence (PDW includes revolvers, pistols and sub machine guns (SMG)).
>
> **Individual Combat Weapon.** Individual Combat Weapons (ICW) are SA which have been primarily designed for initiating combat (ICW includes rifles, shotguns, Light Machine Guns (LMG)).
>
> **Crew Served Weapon.** Crew Served Weapon (CSW) are SA which have been primarily designed to provide sustained fire in support of Infantry Operations where more than one operator is required to maintain the required rate of fire (CSW includes Light Support Weapon (LSW), Medium Machine

Guns (MMG), Heavy Machine Guns (HMG) and Vehicle Mounted Machine Guns (VMMG)).

**Area Target Weapon.** Area Target Weapons (ATW) are SA which are designed to provide hazardous fragmentation over a defined target area (ATW includes grenades and individual or crew served grenade launchers).

**Note:** Mortars and anti-tank weapons are Infantry Support Weapon (ISW) systems but are not defined as a SA.

**Anti Riot Weapon.** Anti Riot Weapons (ARW) are SA which are primarily designed for use during the control of riots (ARW includes baton guns, stun guns and grenade launchers (gas and special effect)).

**Special Weapon**. Special Weapons (SW) are SA which are primarily designed for use by Special Forces, which, because of their unusual role require specific considerations. The weapon systems may be intended for personal defence or individual/team combat (SW includes PDW, ICW, CSW and ARW).

**Miscellaneous.** The miscellaneous category of SA includes weapon systems not already defined (sub-calibre weapon systems, spotting rifles, signal pistols, line throwers, explosively operated tools or devices (such as nail guns)) to which the design safety principles of SA would be applicable.

**Societal Risk** (see Risk)

**Soft Target** (see Ground Target)

**Special Burst Safety Distance** (see Burst Safety Distance)

**Special Weapons** (see Small Arm)

**Splinter** (see Fragment)

**Note:** The speed of sound in half saturated air at 60 oF is 1120 ft/s.

**Standard Deviation.** Standard deviation is a measure of dispersion around the mean.

**Stop Butt**. A Stop Butt is a structure built around or behind a bullet catcher to capture wide or high shot and ricochet off the range floor.

**Stray Ammunition**. Any item of ammunition found which is reported by military or civilian authorities.

**Sustained Rate of Fire**. The sustained rate of fire is the rate of fire a delivery system can continue to deliver for an indefinite length of time. (AAP 6)

**System Safety.** System safety is the application of engineering and management principles, criteria and techniques to identify hazards and either eliminate them or reduce the associated risks to a tolerable level.

## T

**Tangent Elevation**. Tangent elevation is the angle between the line of sight to the target and the axis of the bore.

**Target**. The target is a specific point at which fire is directed and may be defined as Ground (Soft) or Hard. Types of target are defined as follows:

> **Ground Target** (also called Soft). Ground target refers to all surfaces (including water) which, when impacted at low angle, will deform or break up.
>
> **Hard Target.** Hard target refers to all material which possesses sufficient strength and surface hardness in relation to a given projectile that at low angles of impact the target suffers little or no deformity.

**Target Area**. Target areas are grouped according to intended use. Definitions are as follows:

> **Aircraft or Air Defence Target Area**. For aircraft or Air Defence (AD) weapons the target array is suspended, fired, guided or flown through a target space above a defined target area. No weapon is to impact with a target outside the target space.
>
> **Demolitions Target Area**. For demolitions, the target area is the point or location within the surface impact area where explosive charges are emplaced.
>
> **Direct or Indirect Fire Target Area.** For direct or indirect fire ground, air or sea to ground weapons the target area is the location within the surface impact area where targets (static or moving, point or array) are positioned for engagement.

**Targetry.** Targetry is the general description which covers all the various types of target used on training ranges.

**Template**. A template is a technical drawing worked to a given scale and produced on appropriate material for convenient application. A Danger Area (DA) Template

can be produced for a single Weapon type (WDA Template) or a Range (RDA Template) built to a specific type drawing/standard which has been authorised for specific weapons. The following terms are defined:

**Range Danger Area Template**. A Range Danger Area Template (RDA Template) is a technical drawing which defines the boundary of prescribed risk from firing authorised weapons on a specified bearing line of fire, on a range built to an approved type drawing/standard. The RDA Template is to be worked to a given scale and produced on appropriate material for convenient application to a map.

**Notes**:

(1) Elements of construction will affect hazard contours and hence change the shape of specific Weapon Danger Areas (WDA).

(2) The RDA Template will only apply to a range built to the specifications laid down on the type drawing/standard.

(3) The RDA Template is type drawing/standard and weapon(s) specific.

**Weapon Danger Area Template.** A Weapon Danger Area Template (WDA Template) is a technical drawing of an approved danger area for a single delivery means and a single target, projected on a specified bearing line of fire, worked to a given scale and produced on appropriate material for convenient application to a map.

**Notes:**

(1) On a Full Danger Area (FDA) Field Firing Area (FFA) the WDA Template can be used to deduce a variable safe area by swinging the template within agreed arcs. The deduced safe area becomes a trace for the single weapon system.

(2) The combining of more than one WDA Template produces a trace.

**Temporary Exercise Range.** A Temporary Exercise Range (TER) is a temporary range taken into use for a limited period of time for a particular training purpose. A TER can be set up on a piece of land not previously used for training, on an existing training area or on an existing Field Firing Area (FFA). In the latter circumstance, no additional authorisation is required for its construction or use for weapons, ammunition, explosive stores and practices already authorised for the FFA.

**Tolerable Risk** (see Risk)

**Total Energy Area/Zone**. The Total Energy Area/Zone (TEA/Z) is the maximum two or three dimensional space around a firing point within which all weapon system effects are contained.

**Trials Specification**. A trial may typically be defined as the evaluation or installation of a material or item of equipment away from the laboratory/workshop, where the results are either deliverable to the customer (e.g. report, letter or verbal communication), or where they directly support a deliverable (e.g. hardware). A trials specification details the method for planning, defining, conducting and reporting on formal/informal trials undertaken at both internal and external trials sites. The specification is divided into:

**Trials Planning**. The management element of trials and includes resourcing, interfacing with the Project Manager, milestone reporting etc.

**Trials Personnel**. This identifies individual responsibilities, titles etc.

**Trials Plan.** The technical definition statement that specifies the work to be undertaken and associated activities.

**Trials Safety.** This identifies the safety requirements and any major legislation applicable to trials work.

**Trials Conduct**. Details those activities that occur between formal approval of the Trials Plan and publication of the Trials Report.

**Trials Reporting**. Details the method/format for producing Trials Reports.

**Trial Conducting Officer**. The competent person responsible for the safe preparation and conduct of all trials and firings carried out on a range under his/her control in accordance with a Trials Specification.

**Type Standard**. A document containing the technical elements of a design brief for a range and detailing the ballistic and functional requirements to be incorporated in the design.

**U**

**Unexploded Ordnance** (or Unexploded Explosive Ordnance). Ordnance which has been primed, fused, armed or otherwise prepared for action, and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material and remains unexploded either by malfunction or design or for any other cause.
(AAP-6)

**User Demolition Instruction**. A User Demolition Instruction (UDI) gives a detailed forecast of events and may include information extracted from the Range SO. It will be produced by the user unit and signed by the RCO.

**V**

**Velocity**. Velocity is speed in a given direction.

**Notes**:

(1) **General**. The air in front of a moving projectile undergoes compression. Sound waves are set up by the nose, shoulders and driving band, since sound itself involves a compression of the air.

(2) **Subsonic** (< Mach 0.8). If the projectile is travelling at less than the speed of sound the compression at the nose is transmitted away from the projectile in all directions and the resistance due to the compression waves is negligible.

(3) **Transonic** (Mach 0.8 - 1.2). When a projectile has a transonic velocity it is travelling at about the speed of sound, the compression waves and the projectile are travelling at the same speed. Small variations in velocity cause very marked changes in resistance, this leads to unreliable ballistic properties.

(4) **Supersonic** (Mach 1.2 - 5.0). At velocities above the speed of sound, the compression waves can no longer escape and consequently the projectile will outstrip the sound waves. Resistance at supersonic speed is mostly due to wave drag.

(5) **Hypersonic** (> Mach 5.0). At velocities above Mach 5.0 resistance is mostly due to the effects of the shock wave, at such speeds a vacuum is expected behind a projectile.

(6) **Speed of Sound**. Mach 1 is the local speed of sound. It is a function of material and temperature. For dry air at 15 oC Mach 1 is 340 m/s.

**Remaining Velocity**. The remaining velocity is the speed of the projectile at any specified point along the trajectory.

**Note:** When the contrary is not specified, or implied by the context, remaining velocity refers to that at the point of graze.

**Vertex.** The vertex is the highest point that a projectile reaches in its flight from the gun to the target, it is where the vertical component of the velocity equals zero. (STANAG 4119)

**Vertical Plane of Fire**. The vertical plane of fire is the vertical plane containing the weapon axis before firing. (STANAG 4119)

**Vertical Plane of Sight.** The vertical plane of sight is the vertical plane containing the line of sight. (STANAG 4119)

**W**

**Weapon**. A weapon is an object designed, used or capable of being used as an instrument for inflicting harm to health, property or the environment.
(The Concise Oxford Dictionary)

> **Note:**
> Within the military discipline of range safety, the weapon is normally regarded as being the projectile or missile hence the term Weapon Danger Area (WDA). The rifle, barrel, tank, gun or launcher is referred to as the delivery means. The combination of the weapon with the delivery means produces part of the weapon system.

**Weapon Danger Area/Zone**. The Weapon Danger Area/Zone (WDA/Z) is the space into which specified weapons or their fragments may travel, impact or function, given normal firing conditions. Normal firing conditions are those specified in the relevant weapon system support publications.

**Weapon Danger Area/Zone Boundary.** The Weapon Danger Area/Zone (WDA/Z) boundary is the line depicting the outer edge of a WDA/Z.

**Weapon Danger Area Template** (see Template)

**Weapon Deviation** (Small Arm). Weapon deviation around the intended point of impact is caused by a combination of 'Acceptable' or 'Unacceptable' errors.

> **Acceptable Error.** An acceptable error is one which has been identified, quantified and subsequently allowed for procedurally or through the design, construction or layout of the range.
>
> **Unacceptable Error**. An unacceptable error is one which has not been allowed for procedurally or through the design, construction or layout of the range. Unacceptable errors may result in levels of hazard and risk beyond the Range Danger Area (RDA) that are intolerable and must be reduced to a level as low as is reasonably practicable. Such errors are the result of a shot, fired unintentionally or in contravention of range orders, deviating outside the scope of acceptable error.

**Weapon System**. A weapon system is the combination of the weapon, the delivery means and all related equipment, material, services, personnel and means of delivery

and deployment (if applicable) which is required so that the weapon system becomes self-sufficient in its intended operational environment. (AAP 6)

**Weapon Free.** Weapon free is an operational term to define a weapon control status used to indicate that naval, surface to air and air to air weapon systems may be fired at any target not positively identified as being friendly.

**Weapon Hold**. Weapon hold is an operational term to define a weapon control status used to indicate that naval, surface to air and air to air weapon systems may be fired only in self defence or in response to a formal order.

**Weapon HOLDFIRE**. Weapon HOLDFIRE is an operational safety control order, normally used in an emergency to protect friendly aircraft. It will be lifted as soon as possible.

**Weapon Tight**. Weapon tight is an operational term to define a control status used to indicate that naval, surface to air and air to air weapon systems may be fired only at targets visually identified as being hostile.

**Wound Ballistics** (see Ballistics)

## X/Y/Z

**Zone.** Zone is the extent of a three dimensional space enclosed within a specified boundary.