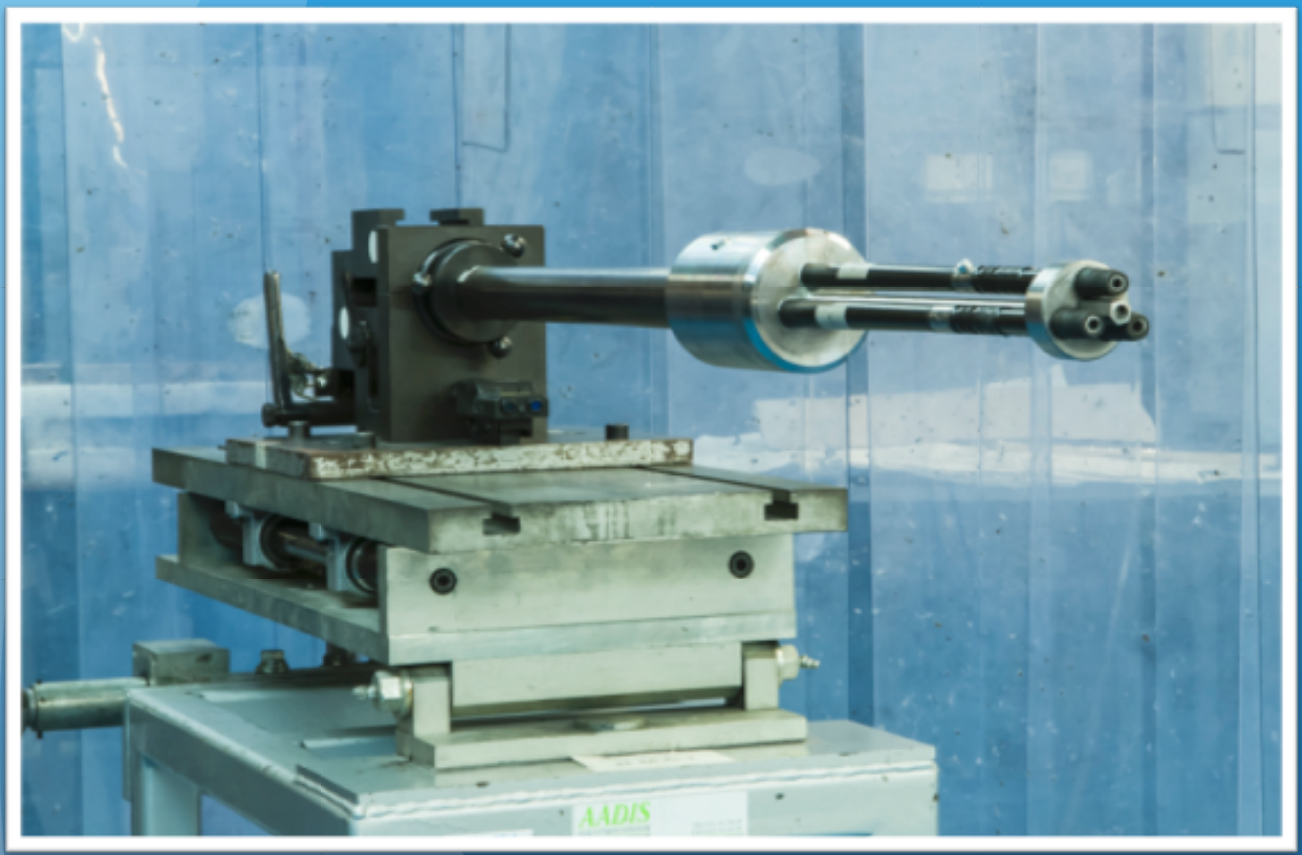
Department Weapons Systems and Ballistics

# ROYAL MILITARY ACADEMY



# Short Course Ballistics 2027

This course is intended for anyone who ...

... wants to discover ballistics or improve his/her knowledge;

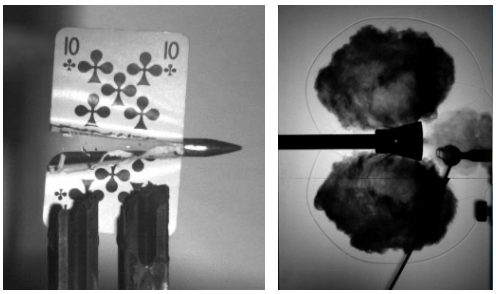
... is interested in weapons and wants to understand how they work;

... wishes to practice in a secure and instrumented laboratory.

he Department of Weapon Systems and Ballistics at the Royal Military Academy has long responded to the needs of industry and academic institutions by organizing specialized training courses in ballistics.

Applications range widely — protection, expertise, armament, ammunition, and more — reflecting the complexity of a specialized branch of applied science rarely covered in standard training programs.

This course is composed of two modules. Each forms a coherent whole and can be taken independently, though completing the theoretical concepts of the first module is strongly recommended before taking the second, more lab-oriented module.



*Ballistic protection testing: penetration trial and gelatin impact analysis*

Teaching is provided at university level, so participants should have a solid scientific background, particularly in mathematics, mechanics, physics, and chemistry.

The Department's laboratory is equipped to measure and visualize brief, high-speed phenomena, and modern computational tools enable the modeling and simulation of each step in the various ballistic processes.

Because each module is deliberately limited to one week, it is not possible to cover every topic in depth. We focus instead on the fundamental theoretical aspects, illustrated through demonstrations and hands-on sessions. As a result, the pace is intensive — something to consider when applying for this course.

## COURSE CONTENT

**The first (theoretical) module is entitled "Introduction to Ballistics".**

It covers the foundational laws and models of interior, exterior, and terminal ballistics, illustrated through numerical simulations and live-fire demonstrations in the laboratory.

Interior ballistics topics include muzzle velocity, projectile propulsion, powder combustion, pressure curves, simulation models, and loading parameters.

Exterior ballistics covers projectile flight and stability, external forces and moments, aerodynamic coefficients, and trajectory modeling.

Terminal ballistics introduces perforation modes, material characteristics, ballistic protection, projectile fragmentation, wound ballistics, and V50.

These three areas are complemented by introductory sessions on fire control, guided weapons, and reduced-lethality weapons.

**The second module, “Ballistic Applications,” is hands-on and practically oriented**.

Laboratory measuring devices deepen participants’ understanding of ballistic phenomena through metrology. The module also covers ballistic expertise, wound ballistics, and the organization and operation of small arms.

Examples include gas pressure measurement in the chamber and barrel, projectile velocity, weapon recoil, ammunition dispersion at impact, $CD_0$, V50, bullet behavior in gelatin, and hit probability. High-speed cameras are used whenever possible to capture these demonstrations on video.

**A certificate is awarded upon completion of each module.**

## TEACHING TEAM

The course is taught by members of the Department.

**Lieutenant-Colonel Alexandre Papy** is the head of the Department of Weapon Systems and Ballistics. He is a military professor whose teaching and research span interior ballistics, forensic and wound ballistics, non-lethal capabilities, and counter-UAS.

At the international level, he served as Chairman of the NATO Joint Non-Lethal Weapons Capability Group, a role in which he helped shape alliance-wide policy and technical direction on non-lethal weapons. He continues to lead the group's Standardization Subgroup and serves as custodian of STANREC 4744, the NATO standardization document governing the risk assessment of non-lethal kinetic-energy projectiles.

In recent years, he has broadened his focus to the wider field of counter-UAS, actively contributing to a range of national, NATO, and EU initiatives in this rapidly evolving domain.

**Lieutenant-Colonel Frederik Coghe** is a military lecturer specializing in material resistance and ballistic protection. His research focuses on ballistic and blast protection for personnel and vehicle applications.

Next to his academic activities, he also acts as a senior advisor for the Belgian Defence department on survivability and letality issues. As such, he was responsible for the design and implementation of cage armour systems for all the Belgian Defence armoured vehicle systems, and is a member of the Mine Safety Board, responsible for ensuring the mine safety of all armoured vehicles.

He is also the Belgian representative for STANAG 2920 and AEP-2920 and delivers technical expertise to the Belgian activities in the framework of the STANAG 4569 and AEP-55 working group.

Lieutenant-Colonel Frederik Coghe is an active member of the DYMAT society and is a former president of the Light-Weight Armour Group (LWAG), grouping European industry, academia and research institutes working in the field of armour systems. He is also a member of the International Personal Armour Committee (IPAC), and of the International Ballistics Society.

**Major Véronique de Briey** is a military lecturer whose teaching and research focus on exterior ballistics, aerodynamics, weaponeering, and forensic ballistics. She is the Belgian representative for the NAAG ICGIF/SG2 and member of the STANAG and AOP-4355 ToE working group, dealing with trajectory models. She works as a forensic expert for the Belgian Ministry of Justice.

**Senior Captain Tom Vancaeyzeele** is a military teaching assistant specializing in artificial intelligence, survivability, and probability computation applied to armament and ballistics. He has been responsible for Quality Management of the department's ballistics laboratory under ISO/IEC 17025 accreditation, including scope extensions for multiple ballistic impact resistance test standards. He also acts as counsellor to the Belgian Defence Staff on Weapon Danger Area analysis particularly regarding guided weapons.

**First Lieutenant Thibaut Peeters** is a military teaching assistant specializing in fire control, survivability, and probability computation applied to armament and ballistics. He is Belgian representative in the Artillery Systems Cooperation Activities (ASCA) working group.

**Dr Cyril Robbe** is a senior researcher specializing in experimental ballistics, ballistic metrology, the evaluation of non-lethal weapons, the experimental evaluation of Behind Armour Blunt Trauma, Wound ballistics, and small calibre internal ballistics.

He's president of the Technical Subcommission of the C.I.P., member of the Joint Non-Lethal Weapon Capability Group – Non-Lethal Kinetic Energy (JNLWCG NLKE) Team of Expert, member of the European Working Group on Non-Lethal Weapons (EWG) and member of the communication Committee of the International Ballistic Society (IBS).

**Dr Nestor Nsiampa** is a researcher specializing in terminal ballistics with a particular focus on numerical simulation for solid deformation. In recent years, his research has focused on the development of finite element models of the human body to investigate its biomechanical response to ballistic impacts, both with or without ballistic protection. His work encompasses impacts from kinetic energy non-lethal projectiles and from small caliber projectiles, with the aim of gaining a deeper understanding of injury mechanisms and assessing the associated risk of injury.

**Dr Ana Ferreira** is a researcher specializing in terminal ballistics with a strong focus on numerical modelling and simulation tools for the evaluation of ballistic phenomena and protection systems. Her work focuses on the development and application of advanced computational models to investigate ballistic impact mechanisms, assess protective systems, and improve the understanding of injury risks associated with ballistic threats.

She is also member of the International Personal Armour Committee (IPAC)) and serves as Treasurer of VPAM.

Also present in the laboratory are **Major Jurgen Grossen**, head of the laboratory, **Senior Captain Joeri Weckx, Adjudant Gabriel Kempeneers**, Technical Advisor at AFTE, **1SgtMaj Bart Dekimpe, 1st Corporal Chief Bart Verhulst** and **Mr Hughes Noel**. Their specialties lie in the knowledge and use of small arms and ammunition, measuring devices, and the many tools that are indispensable for the execution of shooting sessions.

## PRACTICAL INFORMATION

⇒ **Schedule 2027**

Introduction to ballistics (theoretical module):
25 – 29 Jan 2027 (minimum 15 persons).

Ballistics applications (practical module):
14 Jun – 18 Jun 2027 (minimum 8, maximum 15 persons, a second session is possible depending on the number of registrations).

⇒ **Registration Fees**

Introduction to ballistics (Theoretical module): € 2.500 excluding VAT

Practical module (Ballistics applications): € 3.700 excluding VAT

Fees include course materials, lunches, refreshments during breaks, and a course dinner on Thursday evening at a restaurant in Brussels.

The course is free of charge for Belgian military personnel and offered at half price for Belgian law enforcement personnel.

⇒ **Course language**

The course is taught in English.

⇒ **How to register?**

Registration is open to participants from EU and/or NATO member states. Registration, including participant details and purchase order, must be submitted by Monday, December 07, 2026. **Payment is due at least two weeks before each module begins.** Cancellations are accepted up to two weeks before the course start date, and replacement participants are welcome.

**Point of Contact**

Véronique de Briey
Department of Weapon Systems & Ballistics
Royal Military Academy
30 Avenue de la Renaissance
BE-1000 Brussels, BELGIUM
veronique.debriey@mil.be
http://www.rma.ac.be/abal/