Ballistics & Armor Workshops

2025

Burkins & Associates Consulting, LLC • Catalog of Courses • Calendar Year 2025

BURKINS & ASSOCIATES CONSULTING, LLC

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About Our Workshops

Burkins & Associates Consulting, LLC provides a unique line of ballistic courses that can be presented either remotely or in person. We bring our instructors to your site to minimize your personnel down-time and travel costs.

Training is organized into a series of 1-hour modules which can be individually selected and combined in customized packages to meet your organization's needs. The 1-hour modules allow time for interaction and questions from the students.

This catalog provides course descriptions for our standard modules, but actual content can be tailored to your specifications. Check out our course descriptions and instructor bios, then **contact us at admin@burkinsconsulting.com or call 410.618.6348** to book your course. We look forward to seeing you!

Materials: Alloys

Aluminum Alloys

Wrought aluminum armors are widely used in combat vehicles and tactical trucks, particularly as light metal appliques. This unit, categorized by current US aluminum armor military specifications, provides an overview of significant developments in aluminum armor worldwide over the past two decades. This course covers alloy chemistries, material properties, and ballistic performance against different projectiles.

Ferrous Alloys

Wrought steel armors remain a primary structural material for combat vehicles and tactical trucks. Organized according to US armor steel military specifications, this unit provides an overview of significant developments worldwide with supporting ballistic test data to allow first order design approximations. Topics covered include alloy chemistries, processing, availability, sourcing, fabrication, and strengths & weaknesses of each armor steel.

Materials: Alloys

Magnesium Alloys

Magnesium is the third-most-commonly-used structural metal, following iron and aluminum. Used in aircraft in both World Wars, magnesium's use in ground combat vehicles has been limited due to improvements in steels and aluminum, as well as the development of composite materials. This unit provides an overview of significant developments in magnesium armor alloys, along with material properties, ballistic performance, and comparisons to aluminum and steel.

Titanium Alloys

Titanium as an element was discovered in 1791 but was not commercially viable until implementation of a process patented by William Kroll in 1946. Titanium has a lower density than steel while maintaining equal or higher strength, thereby allowing weight reductions up to 40% at equal thickness. This unit examines processing issues, ballistic data, and current applications of titanium armor in military ground vehicles.

Materials: Non-Metals

Ceramics

This course offers a 50-year retrospective of ceramic materials and evaluation methods. Low density, high hardness, and high compressive strength make ceramics look attractive, but ceramic designs need to balance these strengths against their weaknesses of low tensile strength and brittleness. This unit will discuss the impact failure of ceramics as a function of time (including dwell and encapsulation) and the evolution of ceramics for different ballistic applications.

Composites

A brief historical review of body armor systems is followed by a description of contemporary armor systems using thin laminated and multi-layer fabric materials. The main classes of fabric composites will be discussed: nylon, glass, aramid, and polyethylene. The development of newer materials within the framework of the military specifications will be provided.

Ballistics & Armor

Interior Ballistics

Interior Ballistics is the study of processes that occur inside a gun barrel. Topics include primers, propellants, projectiles, sabots, barrels (rifled vs. smooth), pressure measurement, and the packing of propellant within the cartridge case. The objective is to reduce velocity variability in testing.

Exterior Ballistics

Exterior Ballistics relates to events that occur while the projectile is in free flight from gun to target. This unit discusses common testing program issues with potential solutions. The main focus is projectile yaw with some discussion of muzzle blast and air resistance.

Ballistics & Armor

Terminal Ballistics

Terminal Ballistics is the study of the interaction between projectile and target. This unit serves as an introduction to terminology, the major projectile types, basic test methods, and general measures of armor/penetrator effectiveness that are needed to understand the other units.

Passive Armor Mechanisms

This unit provides an overview of monolithic, laminate, composite, and spaced armor technologies. General performance comparisons are examined in addition to discussing the five main penetrator defeat mechanisms. Some discussions of world-wide ballistic standards are also provided.
AN ADVANCED VERSION OF THIS COURSE IS ALSO AVAILABLE.

Data Collection & Analysis

Data Collection

Ballistic data can be collected in a number of ways during experiments. This unit compares the strengths and weaknesses of various collection methodologies, such as V50, VS-VR, PAD, and Theta 50, to name a few. Additional considerations for possible instrumentation and placement are provided.

Data Analysis

Once ballistic data have been collected during experiments, the next step is to analyze and use these data. This unit discusses the application of ballistic penetration and perforation data, scaling, empirical equations, & first-order estimations as methods of analysis. *AN ADVANCED VERSION OF THIS COURSE IS ALSO AVAILABLE.*

Munitions

Insensitive Munitions

The normal function of armor is to prevent an attacking projectile from crossing some boundary. Insensitive munitions technology, conversely, allows the projectile to cross the boundary but seeks to prevent or mitigate the damaging effects of the projectile strike. The main focus of this unit is protection under STANAG 4241 Bullet Impact and STANAG 4496 Fragment Impact. *AN ADVANCED VERSION OF THIS COURSE IS ALSO AVAILABLE.*

Fragments

Fragments from exploding munitions have posed a considerable threat to vehicles and personnel since World War I. This unit starts with a discussion of the collection of arena fragmentation data, along with the selection of fragment simulators and velocity. The strengths and weaknesses of different materials and mechanisms will also be provided. *AN ADVANCED VERSION OF THIS COURSE IS ALSO AVAILABLE.*

Government Agencies & Contractors

Heavy Machine Gun

The Heavy Machine Gun (HMG) dates back to the dawn of World War II but still finds use in metal acceptance standards in US military specifications. This course provides an overview of HMG munitions with an emphasis on strengths, weaknesses, and design implications. Some additional discussion of surrogate selection and validation are also included.

Medium Caliber

Medium caliber covers the class of guns with bore diameters greater than 20mm but less than 75mm. This course emphasizes materials and technologies that drive design selection. The implications of threat surrogate selection and validation are incorporated in this unit.

Government Agencies & Contractors

Large Caliber	Large caliber is the class of guns with a bore diameter of 75mm or more. This course provides a summary of development of large caliber projectiles and fundamentals, such as the work by Lanz and Odermatt. The content is limited to keep the material unclassified.
Shaped Charges	This unit provides the fundamentals of shaped charges and explosively formed penetrators (EFPs) from the history of their development, the basic formation of jets, and a discussion of penetration mechanics. The content is limited to keep the material unclassified.
Reactive Armor	This course traces the origins and development of reactive armor. A general review of reactive armor mechanisms against projectiles and shaped charge jets is provided. The content is limited to keep the material unclassified.

FAQs & Contact Info

WHO ARE YOUR COURSES DESIGNED FOR?

These courses are geared toward engineers, scientists, and technicians involved in ballistic research, development, and testing. The content is designed to benefit persons with intermediate knowledge but should still be readily understood by a novice. The modules provide a basic understanding of terminology, ballistic materials, test procedures, and data analysis.

WHAT IS THE MAXIMUM CLASS SIZE?

To allow for personalized attention, the minimum class size is 8 persons and maximum size is 35 persons.

HOW MUCH DO YOUR COURSES COST?

Because our courses are customized for your needs, we can tailor a program or series of programs to fit your budget.

HOW CAN I FIND OUT MORE OR BOOK A COURSE?

Email us at admin@burkinsconsulting.com or call 410.618.6348 to schedule a free half-hour consultation to find out how we can help you!

About Our Instructors

MATTHEW BURKINS, PRESIDENT

Matthew Burkins is the president of Burkins & Associates Consulting, LLC, which has provided ballistic technology training to government agencies (United States and abroad) and to private industry since 2018.

Mr. Burkins' background includes more than three decades with the US Army Research Laboratory. He has designed both guns and projectiles and has also developed armor technologies and designs for numerous current vehicle systems.

As an instructor, his main areas of focus are small to medium caliber kinetic energy technologies, as well as fragmentation threats. He also has a broad materials experience in metals, ceramics, and composite armor material technologies.

Mr. Burkins has received a number of national awards such as the Defense Standardization Program Outstanding Achievement Award (2010) and the US Army Greatest Inventions Award for the Armor Survivability Kit for HMMWV in 2004.

He is currently an Emeritus Guest Researcher at CCDC Army Research Laboratory. He resides with his family in Maryland.

About Our Instructors

WILLIAM GOOCH

William Gooch is President of WA Gooch Consulting Inc. and an Emeritus Guest Researcher at CCDC Army Research Laboratory.

As a Materials Engineer in the Armor Mechanics Branch, his team was responsible for research and development of metallic, ceramic, and composite reactive and passive armor technologies for application to US armored vehicles.

His work included armor development programs for the M60A3 and M1/M1A1/M1A2 family of tanks, M113 armor personnel carriers, the M2A1/2 Bradley infantry combat vehicles, Marine Corps light amphibious vehicles, the Future Combat System, C17 transport aircraft and the PAC3 missile system.

From 2003-2006, Mr. Gooch was fully dedicated to the fielding of armor kits to Iraq for the M1114/M1151 HMMWV tactical trucks

His extensive international experience includes serving as the US Technical Project Officer for US Data Exchange Agreements with Australia, Germany, France, and Sweden.

About Our Instructors

BRIAN SCOTT

Brian Scott is a retired R/D Ordnance Officer, having completed a concurrent civilian career focused on armor and explosives at both Dupont and the US Army Research Lab. He is internationally recognized in the armor community with the research of advanced materials including fiber based composites, fabric based body armor, reactive armor, spall liners, fire resistant armor systems, high temperature ceramic matrix composites (CMC), and combinations developed for the most recent threat applications.

Mr. Scott participated in the design of most of the US Army armor systems from 1975 until recently with heavy armor of the XM1, M1 and Bradley vehicles, body armor in PASGT, RANGER , Interceptor, ECH and others.

More recent applications have included upgraded HMMWV, MRAP, Breacher, medium weight variants and heavy armors developed for multiple threats including IED/EFP.

As part of the STANAG 4569 committee, Mr. Scott helped draft many of the standards and specifications for composite armor for the US Army and NATO.

Have more questions?
Reach out to us at:
www.burkinsconsulting.com
410.618.6348

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