



WHITE EAGLE  
AEROSPACE



Advanced Missile Aerodynamics

MAKE YOUR CAREER SOAR

# Welcome

Thank you very much for your interest in White Eagle Aerospace. Since our founding in 2006, we have become a trusted leader in professional technical training and education throughout the aerospace industry.

As a fellow aerospace professional with nearly 40 years of industry experience, I understand the critical need for ongoing technical training in the workplace. White Eagle Aerospace was established in order to meet this pressing need.

For many years, we have recognized a looming crisis in the aerospace workforce. Throughout the industry, there is an increasingly bimodal distribution of aerospace professionals. One end of that distribution contains young, well trained, highly motivated, but very inexperienced professionals. The other end of that distribution involves individuals who have been around for a long time, have a great deal of experience and are on their way out of their chosen profession. This leaves a valley between the two.

Who is going to pass the baton to the upcoming generation of aerospace professionals? Where will they get their knowledge – knowledge that goes beyond academia and even graduate degrees? Much of what they need to know is not available in today's standard university curricula. What they need is:

- Specialized knowledge over a range of disciplines.
- Knowledge provided by an experienced expert in the field.
- Knowledge conveyed by a master instructor.

White Eagle Aerospace recognizes these issues and provides effective solutions for your workforce. We are pleased to present you with this brochure, which outlines our Advanced Missile Aerodynamics (AMA) professional short course. Our team of industry experts and master instructors is dedicated to your success. Should you have any questions about our course catalog or desire more information on how we can help MAKE YOUR CAREER SOAR, please contact us today.

Best Regards,



John Terry White,  
President/CEO  
White Eagle Aerospace



## About Our Company

**Whether you are new to the aerospace industry or have years of professional experience, we are your provider-of-choice for expert technical training.**

**Acquiring key knowledge, critical lessons-learned and technical know-how are crucial ingredients for success in today's complex and highly competitive aerospace market. Our nationally-acclaimed short courses cover a wide range of highly useful technical subjects. Each course is delivered by a subject matter expert who is also an expert technical instructor.**

**We offer you comprehensive technical training in essential topics, with minimal time away from work – all at a price that fits today's tight training budgets.**





# Target Audience

**The Advanced Missile Aerodynamics (AMA) short course features an in-depth treatment of engineering-level estimation methods used to predict the aerodynamics of tactical missiles, ballistic missiles, launch vehicles, sounding rockets and projectiles.**

This course is intended for those seeking an advanced knowledge and understanding of classic missile aero force and moment prediction methodologies. Emphasis is placed on techniques pertinent to the preliminary design environment.

Participants must have a sound background in basic missile aerodynamics to gain maximum benefit from course material. Aerodynamicists, airframe designers, wind tunnel test engineers, flight test engineers and flight control specialists particularly will benefit from taking this advanced course. Knowledge and skills obtained are immediately useful in the work place.

Delivered by a master instructor and subject matter expert with nearly 40 years of professional aerospace experience, this 5-day intensive training course will provide participants with invaluable real-world knowledge, enhanced understanding and improved competency in this key discipline.

## Course Format

White Eagle Aerospace courses are offered as on-site trainings to groups and organizations worldwide. In order to better serve you, we offer special group discounts on a tiered basis. Our instructors can often customize course content to fit your organization's unique needs – or offer additional workshop days as needed. Please submit an inquiry via our online form to learn how we can help MAKE YOUR ORGANIZATION SOAR!

## Who Will Benefit

- Aerodynamics Engineers
- Flight Test Engineers
- Airframe Designers
- Launch Vehicle Designers
- Missile Defense Technologists
- Missile Systems Engineers
- Wind Tunnel Test Engineers
- Operations Research Analysts
- Flight Control Specialists
- Flight Simulation Specialists
- Stability and Control Specialists
- Systems Engineers
- Program Managers
- College Students





# Course Description

**The Advanced Missile Aerodynamics (AMA) short course provides an advanced training experience in classic engineering-level prediction methodologies used in the estimation of missile and missile-like vehicle aerodynamics characteristics.**

This rigorous short course has direct application to a wide variety of missile classes, including: tactical missiles, ballistic missiles, launch vehicles, sounding rockets and projectiles. Participants will learn about Slender Body Theory and its pervasive influence in aero prediction methods. They will also come to understand the technical basis of the classic component build-up approach, body alone aero prediction methods and the Equivalent Angle-of-Attack method for lifting surfaces.

Course material features technical details related to a myriad of diverse topics, including: local surface inclination pressure methods, mutual aerodynamic interference, 6-DOF aerodynamic modeling schemes, area ruling fundamentals and inlet aerodynamics. Technical briefings are provided for a number of significant historical missile programs. These case studies provide valuable insights and lessons learned that are directly applicable to job performance.

This intensive technical short course is unique in terms of its topic and breadth and depth of subject matter. A course of its equal is not to be found among the curricula of any other present-day university or continuing education provider.

## Key Course Topics

- Slender Body Theory
- Equivalent AoA Method
- Component Build-Up
- Body Alone Methods
- Pressure Methods
- Aerodynamic Interference
- 6-DOF Aero Model Schemes
- Launch Vehicle Aero
- High-Temperature Effects
- Flush Airdata Systems
- Transonic Area Rule
- Supersonic Area Rule
- Inlet Aero Effects
- Body Crossflow Effects
- Shock-Expansion Method
- Newtonian Theory
- Aero Database Sources
- Viscous Interaction
- Aerodynamic Uncertainty
- Force Accounting
- Aero Prediction Codes
- Historical Flight Programs





# Course Outline

The **Advanced Missile Aerodynamics (AMA)** short course is an intensive 5-day training program that provides a maximum training experience to aerospace professionals with minimum time away from work.

## Advanced Missile Aerodynamics Module Overview

Day	Module	Lecture Title	Key Topics
1	1	Missile Coordinate Systems	Body Axis System, Maneuver Axis System, Panel Axis System, steering control schemes, axis transformations.
	2	Fluid Mechanics	Conservation equations, displacement and deformation, fluid elements state of stress, vorticity, velocity potential.
	3	Slender Body Theory	Conservation laws, irrotationality, velocity potential, perturbation theory, axisymmetric flow.
2	4	Component Build-Up Methodology	Component build-up, NACA TR-1307, body upwash, wing carryover, vortex downwash, lift interference factors.
	5	Equivalent Angle-of-Attack Methodology	Angle-of-attack effect, body carryover determination, roll angle effects, control surface deflection effects.
3	6	Body Alone Aero Prediction Methods	Allen and Perkins Method, Brevig and Rausch Method, Baker Method, Jorgensen Method, Clark and Trimmer.
	7	Local Surface Inclination Pressure Methods	Linear Theory, Higher-Order Theory, Newtonian Theory, Tangent Wedge, Tangent Cone, Shock Expansion Theory.
	8	Mutual Aerodynamic Interference	Body upwash, panel carryover, vortex effects, component airloads, body alone, body-tail, body-wing tail airframes.
4	9	Aerodynamic Modeling Schemes	Panel-panel interference, 1 <sup>st</sup> Order and 2 <sup>nd</sup> Panel Schemes, Dual Panel Scheme, Combined Panel Scheme.
	10	Launch Vehicle Aerodynamics	Trajectory loads, aeroacoustical loads, compartmental venting, buffeting, stage separation, wind effects.
5	11	Area Rule Fundamentals	Aircraft wave drag, Transonic Area Rule, Moment of Area Rule, Supersonic Area Rule, wave drag prediction.
	12	Inlet Aerodynamics	Inlet types, inlet operating modes, additive drag, boundary layer bleed drag, bypass drag, cowl drag.



# Aerospace History

**Much has transpired during the 100-plus years of powered flight. We are both the beneficiaries and stewards of the technological progress that previous generations have bequeathed to us.**

However, many professionals in today's aerospace workforce have little knowledge of the key people, events and innovations that comprise the history of their own profession. While we cannot live in the past, we must learn from it if we are to be successful now and in the future. Further, like our predecessors, we must protect and preserve this legacy knowledge for succeeding generations.

It is for these reasons that White Eagle Aerospace strongly emphasizes aerospace history in its technical short courses. This is done through the mediums of special presentations, videos and field trips. The Advanced Missile Aerodynamics (AMA) short course features several key historical programs.

## Featured Programs

- Patriot
- Harpoon
- Jupiter
- Redstone
- Nike Hercules
- Tomahawk
- Hellfire
- Delta
- SPRINT ABM
- STANDARD Missile
- SNARK





# Information at a Glance

**The Advanced Missile Aerodynamics (AMA) short course features an in-depth treatment of engineering-level estimation methods used to predict the aerodynamics of tactical missiles, ballistic missiles, launch vehicles, sounding rockets and projectiles.**

This advanced technical short course is intended for those seeking an advanced knowledge and understanding of classic missile aero force and moment prediction methodologies. Emphasis is placed on techniques pertinent to the preliminary design environment.

Delivered by a master instructor and subject matter expert with nearly 40 years of professional aerospace experience, this 5-day intensive training course will provide participants with invaluable real-world knowledge, enhanced understanding and improved competency in this key discipline.

## Contact White Eagle Aerospace

**White Eagle Aerospace**  
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[training@whiteeagleaerospace.com](mailto:training@whiteeagleaerospace.com)  
**520-219-0526**

## Key Course Information

- **Instructor:** J. Terry White
- **Duration:** 5 instructional days; 32 instructional hours
- **Materials:** 1) Comprehensive set of course lecture slides in bound form and 2) DVD containing course lecture slides, images, videos, reference documents and homework solutions.
- **CEUs Awarded:** 3.2
- **Format:** Our courses are primarily offered as on-site trainings to groups and organizations. In order to better serve your organization, we offer special group discount rates on a tiered basis. For pricing plans, please submit an online inquiry.
- **Individuals:** If you are an individual wishing to join an existing group course, please submit a request via our online form.
- **Individual Cost:** \$1,960





# J. Terry White

## Aerosciences Instructor

**John Terry White is president and CEO of White Eagle Aerospace. With headquarters in Oro Valley, Arizona, White Eagle Aerospace is a leading provider of engineering consulting, professional training, history of flight lectures and technical publication services to the aerospace community.**

White's nearly 40 years of professional aerospace experience includes the NASA Space Shuttle Program, NASA X-43A Flight Project, and United States Navy STANDARD Missile Program. During his extensive career, he has served on the engineering technical staff of Rockwell International, General Dynamics Corporation, Hughes Missile Systems Company, NASA Dryden Flight Research Center and Raytheon Missile Systems.

In 2009, White completed a 2-year assignment as manager of the Aerodynamics Department in the Guidance, Navigation, and Control Center at Raytheon Missile Systems in Tucson, Arizona. In this capacity, he was responsible for all aerodynamics work performed at the world's largest tactical missile producer. White resigned from Raytheon in 2010 as an Engineering Senior Fellow in Aerodynamics.

White has authored more than 180 technical papers on a wide variety of aerospace and aerospace subjects. His teaching credentials include 15 years as an instructor in the Aerospace Engineering Department of the California State Polytechnic University, Pomona, 10 years as an instructor in the professional development program at Raytheon and 6 years developing and teaching courses at White Eagle Aerospace. Those who have taken his courses say that White brings an uncommon passion and extensive technical knowledge to the training environment.

White is particularly well known for his inspiring aerospace history lectures and presentations. These "techno-histories" are intense, fast-paced reviews of historically-significant events in United States aerospace history. He has lectured extensively on aerospace history topics at the USAF Test Pilot School, the Society of Experimental Test Pilots, the National Aeronautics and Space Administration, the American Institute of Aeronautics and Astronautics, academia, and industry. White also serves as a motivational keynote speaker for aerospace conferences, business functions, commemorative events, public service organizations, special interest groups, and private business.

### Courses Offered

- **Aerodynamics for Engineers**
- **Aerospace Lessons-Learned**
- **Advanced Missile Aerodynamics**
- **Aerospace Vehicle Performance**
- **Basic Missile Aerodynamics**
- **Fundamentals of Earth Reentry**
- **Fundamentals of Gas Dynamics**
- **Fundamentals of Hypersonics**

### Contact Information

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