

AEROSPACE

SHORT COURSES

Fundamentals of V/STOL Rotorcraft (AERO0331)

Instructor: Harold Rosenstein

Course Description

This course will present key aspects of vertical flight and rotorcraft challenges through a review of the historical evolution, basic principles and enabling technologies. It will cover the fundamental principles underlying rotorcraft flight, flight performance, rotor limitations, configurations and conceptual design. Emphasis is placed on relating rotorcraft aerodynamics to airplane aerodynamics for those making the transition.

Who Should Attend?

This course is designed for engineers, engineering managers, pilots, administrators and educators who are involved in rotary wing design, testing, evaluation or other technical aspects. The course is also suitable for entry- through intermediate-level students, engineers and pilots who are new to the industry.

Learning Objectives

- Understand how helicopters work compared to fixed wing aircraft
- Learn the terminology used by rotorcraft engineers
- Understand the basics of rotorcraft performance and conceptual design
- Understand the flight performance, strengths and weaknesses of the many rotorcraft configurations

Course Outline

Day 1

- 1.0 Introduction
- 2.0 How Helicopters work
- 3.0 Historical Perspective
- 4.0 The Rotor System
 - 4.1 Rotor Hub fundamentals

Day 2

- 4.2 Rotor blades
 - 4.3 Rotor airfoils
- 5.0 Rotorcraft Limitations
- 6.0 Rotorcraft Flight Performance

- 6.1 Basic elements
- 6.2 Methods of powered required
- 6.3 Properties of the standard atmosphere

Day 3

- 6.4 Turbohaft engine characteristics and power available
- 6.5 Aircraft performance and efficiency
- 7.0 V/STOL Configurations
 - 7.1 We have been there before
 - 7.2 Configurations
 - 7.2.1 Helicopters
 - 7.2.2 Tiltrotors
 - 7.2.3 High-performance V/STOL
 - 7.2.4 Experimental compound helicopters
 - 7.3 Electric/Hybrid rotorcraft
 - 7.4 Wind turbines
 - 7.5 Rotorcraft Scaling Issues

Day 4

- 8.0 Conceptual design for the smart buyer
 - 8.1 Design process & levels of preliminary design
 - 8.2 Conceptual design process
 - 8.3 One hour helicopter conceptual design
 - 8.4 Case study 1
 - 8.5 Case study 2
- 9.0 The challenges ahead
 - 9.1 Next generation V/STOL
 - 9.2 Urban Air Mobility
 - 9.3 Space age rotorcraft
- 10.0 Wrap-up
- 11.0 Appendices

Classroom hours / CEUs

28.00 classroom hours
2.8 CEUs

Certificate Track

Flight Tests and Aircraft Performance

Course Fees

Early registration course fee: \$2,295 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: \$2,495 if you register and pay after the early registration deadline.

U.S. Federal Employee Discount

This course is available to U.S. federal employees at 10% off the registration fee. To receive the federal employee discount, you must enter the code **FGVT116** during the checkout process. Please note that you must validate your eligibility to receive this discount by entering your U.S. government email address (ending in .gov or .mil) when creating your online registration profile. This discount is available for both the early registration and regular registration fees.

Canada Department of National Defence Discount

This course is available to Canada DND employees at 10% off the registration fee. Please contact the DND Procurement Authority (DAP 2-3) for details. Please note that you cannot register using our online system when requesting this discount. This discount is available for both the early registration and regular registration fees.

Instructor Bio

Harold Rosenstein was the Chief Engineer, Phantom Works-The Boeing Company's Advanced Development organization-with responsibility for new concepts, research programs and preliminary design. He retired in 2013 with 50 years of experience in developmental and production programs ranging from rotorcraft to large fixed-wing transport aircraft, both manned and unmanned. He has held various assignments with increasing levels of responsibility supporting Boeing's advanced fixed wing transports and V/STOL developments, including the development of the V-22 tiltrotor and the RAH-66 helicopter. He has taught university-level seminars on V/STOL engineering at Penn State, Nanjing University and the American Helicopter Society. He also belongs to numerous technical societies including the American Helicopter Society (AHS), and is a Senior Member-Emeritus of the American Institute of Aeronautics and Astronautics (AIAA). Mr. Rosenstein received the prestigious Paul E. Haueter Award from the American Helicopter Society for "Significant contributions to VTOL aircraft development" and holds numerous patents. In addition he is a Technical Fellow of the American Helicopter Society for "Notable and outstanding contributions to the vertical flight community."

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