

# AEROSPACE

## SHORT COURSES

### Advanced Avionics (AERO0010)

Instructor: Albert Helfrick

#### Course Description

Advanced Avionics covers systems that will be the mainstay of CNS (communications, navigation and surveillance) in the future. Course material reviews the basic theory of navigation, and provides a thorough introduction and survey of global navigation satellite systems (GNSS), with emphasis on GPS. Modern surveillance systems based on Mode-S and ADS-B are also covered, as are both wired and wireless communications systems. This course includes in-class exercises that involve college-level mathematics.

This course covers some of the same topics as *Fundamental Avionics* (taught by the same instructor), but in much greater detail. *Fundamental Avionics* is not a prerequisite for this course. Additional subject matter covered in this course was previously included in *Introduction to Performance-Based Navigation (PBN) and Required Navigation Performance (RNP)* (also taught by the same instructor), which is no longer offered. *Advanced Avionics* will provide a good review for those who may have studied these subjects previously.

#### Course Highlights

- The art and mathematics of navigation
- Electronic systems used for navigation
- The use of space-based navigation
- Electronically-guided approaches and landing
- The operation of the surveillance systems needed for safe aircraft separation
- The need for communications in modern aviation navigation and safety
- Examples of widely-used wired and wireless communications systems
- Discussion of actual implemented systems and those planned for future use
- Systems required for PBN and RNP
- Emphasis on state-of-the-art systems
- Includes problem solving exercises

#### Who Should Attend?

This course is intended for engineers involved in the design and development of avionics components and systems.

#### Learning Objectives

This course will provide the student with an understanding and knowledge of:

- the art and mathematics of navigation

- electronic systems used for navigation
- the use of space-based navigation
- electronically-guided approaches and landing
- the operation of the surveillance systems needed for safe aircraft separation
- the need for communications in modern aviation navigation and safety
- some widely-used wired and wireless communications systems

## **Course Outline**

### **Part 1**

- Introduction to advanced avionics
- Fundamentals of navigation, frames of reference, charting, path definitions
- WGS-84 Earth Model
- Geodesy
- Altitudes, geographic, orthometric, barometric
- Lines of position
- Dead reckoning
- Radio navigation
- In depth coverage of Global Navigation Satellite Systems, GNSS (primarily GPS)
- GNSS integrity monitoring

### **Part 2**

- Advanced GNSS subjects
- Distance measuring equipment, DME
- Accuracy and Precision
- Inertial Navigation

### **Part 3**

- Surveillance systems, Mode-S, TCAS, ADS-B
- Performance based navigation, PBN, applications and examples
- PBN/RNP in global airspace, ICAO involvement, stakeholders
- The FAA's plans for the future of PBN/RNP
- Certification and approval for operating in PBN/RNP airspace

### **Part 4**

- Determining actual navigation performance, ANP
- Assessing errors
- Setting PBN/RNP navigation specifications
- Creating and validating PBN/RNP routes
- Path definition
- Q and T routes
- Terminal procedures and approaches

## **Part 5**

- Wide Area Augmentation System, WAAS
- WAAS Functions
- Ionospheric corrections
- Error data, ephemeris
- WAAS enabled approaches, protection limits
- Communications systems
- Legacy communications systems
- Digital communications, VHF Data link, SATCOM, mode-S
- Airport communications systems, AeroMACS
- Wired, on-board data communications

## **Classroom hours / CEUs**

35.00 classroom hours

3.5 CEUs

## **Certificate Track**

Avionics and Avionic Components

## **Course Fees**

Early registration course fee: \$2,595 if you register and pay by the early registration deadline (45 days out).

Regular registration course fee: \$2,795 if you register and pay after the early registration deadline.

## **Course Materials**

Course materials, including outlines, presentation copies, and supplementary materials, will be accessible through Canvas, KU's online learning system. Instructions to access Canvas will be provided upon completed registration. Students are required to bring a computer or other electronic device with PDF-viewing capabilities with them to class each day. If you require accommodation contact us at [professionalprograms@ku.edu](mailto:professionalprograms@ku.edu) and we will work with you on an accessible solution.

## **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**

**Albert Helfrick** is Professor Emeritus and former chair of the electrical and systems engineering department at Embry-Riddle Aeronautical University. Previously, he was director of engineering for Tel-Instrument Electronics, a manufacturer of avionics test equipment. Before entering academia, he was a self-employed consulting engineer for four years where he and his company designed fire and security systems, consumer items and avionics. He has more than 50 years of experience in various areas of engineering including communications, navigation, precision testing and measurement, radar and security systems. He performed radiation hardening on military avionics, designed test equipment for the emerging cable television industry, designed general aviation avionics for Cessna Aircraft and precision parameter measuring and magnetic systems for Dowty Industries. Helfrick is the author of 12 books, numerous contributions to encyclopedias, handbooks and other collections. He has more than 100 technical papers and presentations, served as an expert witness in a number of civil cases and testified before Congress. He holds five U.S. patents, is a registered professional engineer in New Jersey, a Life Senior Member of the IEEE, and an associate fellow of the AIAA. Helfrick has received the AIAA Dr. John Ruth Digital Avionics award. He holds a B.S. in physics from Upsala College, M.S. in mathematics from New Jersey Institute of Technology and a Ph.D. in applied science from Clayton University.

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