Country	Institution	Module Description	ECTS
PT	**PrAFA**	**Avionics Systems**	**4.0**

Service **AF**	**Minimum Qualification for Lecturers**
Language **English**	○ English: Common European Framework of Reference for Languages (CEFR) Level B2 or NATO STANAG Level 3.

Prerequisites for international participants:

- English: Common European Framework of Reference for Languages (CEFR) Level B1 or NATO STANAG Level 2.
- At least 1 year of national (military) higher education.

Goal of the Module

- To present the concept of avionics systems architecture in modern aircraft;
- To present the operating principles of the main avionics systems, namely Communications, Navigation and Surveillance, including military's exclusive use systems
- To present the principles of automatic flight control, flight deck displays and air traffic management
- To present specific topics on electronic warfare

Learning outcomes		
	Knowledge	• Understands and identifies different avionic system's architectures • Understands the operating principles of the main avionics systems, namely Communications, Navigation and Surveillance, including military exclusive use systems • Understands the principles of automatic flight control, flight deck displays and air traffic management • Understands the purpose and working principles of different electronic warfare applications
	Skills	• Identifies different avionic systems' architectures, and enunciates their main characteristics • Identifies the main components of a communications system and describes the different forms of free space radio propagation • Understands the main parameters of communications system's components and is able to perform simple computations • Identifies different analogue and digital communications modulations and understands how their main working principles are implemented in an actual avionics system • Is able to describe the working principles of ground and space-based navigation aids, as well as instrument landing systems; • Identifies different types of radar systems, enunciate their working principles and describes their typical applications in avionics systems • Is able to perform simple computations for different radar systems' applications • Understands the working principles of air-data, magnetic, inertial and electro-optical sensors, identifies different technological implementation solutions for each system and enunciates their main characteristics

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		• Enunciates the principles of automatic flight control, identifies its main elements and describes the principles of navigation • Understands the technological evolution of flight deck displays and identifies different display systems architectures • Describes the workings and requirements of flight data recorders and emergency beacons • Describes the main principles of air traffic management and future trends on this subject • Enunciates the main principles of electronic warfare systems
	Responsibility & Autonomy	• Own the technical knowledge on avionics systems of military aircrafts, that contributes to enhance student's performance as future air force pilots

Verification of Learning Outcomes	
Test	• Knowledge assessment is carried out through two written tests

Module Details		
Main Topic	**Recom-mended WH**	**Details**
Avionics Technology and Architectures	4	• Evolution of Avionics Architectures • Avionics computing • Data Buses

Communications Systems	10	• Brief overview of Antennas and Propagation
		  ○ The RF Spectrum
		  ○ Electromagnetic field
		  ○ Antennas and their main characteristics
		  ○ Free space propagation equation
		  ○ Radio propagation modes
		• Brief overview of Telecommunications
		  ○ Analogue and Digital Modulations
		  ○ Multiple Access Methods
		• Aircraft voice and data communications systems
		  ○ HF, VHF, UHF and SATCOM
		  ○ Military datalink systems: Link 16

Navigations Aids	4	• Ground-Based Navigation Aids
		  ○ ADF/NDB
		  ○ VOR
		  ○ DME
		  ○ TACAN
		  ○ VOR/TAC
		• Instrument Landing Systems
		  ○ ILS
		  ○ MLS
		• Space-based Navigation Systems

Radar Systems	8	• Radar systems
		  ○ Principles of radar
		  ○ Pulsed radar
		  ○ Continuous Wave radar
		  ○ Doppler radar
		  ○ Synthetic aperture radar
		• Radar-based systems
		  ○ Air Traffic Control (ATC) Transponder (modes A, C, S)
		  ○ IFF
		  ○ TCAS

Sensors	6	• Air Data Sensors • Magnetic Sensors • Inertial Sensors • Electro-optical Sensors

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Flight Control Systems	4	• Principles of Flight Control
		• Flight Control Elements
		  ○ Principles of Fly-by-Wire
		  ○ Autopilot Flight Director System
		  ○ Principles of Flight Management System

Navigation Systems	4	• Principles of Navigation • Electronic Flight Bag • Performance Based Navigation • ADS-B • Future of Air Traffic Management (ATM) • Flight Data Recorders and Emergency Beacons
Display Systems	2	• Flight Deck Displays • Head-Up Display Visual Guidance System • Enhanced and Synthetic Vision Systems • Display System's Technologies and Architectures
Electronic Warfare	4	• Electronic support • Electronic attack • Electronic protection
Test	4	• Module examinations and review
Self-Study Hours		
All topics	50	• Self-study hours are required for the careful review of each lesson, in order for the students to assimilate and understand the presented topics.
Total WH	**100**	

List of Abbreviations:

ADF ..... Automatic Direction Finder
ADS-B ..... Automatic Dependent Surveillance Broadcast
ATC ..... Air Traffic Control
ATM ..... Air Traffic Management
CEFR ..... Common European Framework of Reference for Languages
DME ..... Distance Measuring Equipment
ECTS ..... European Credit Transfer and Accumulation System
EU ..... European Union
HF ..... High Frequency
IFF ..... Identification Friend or Foe
ILS ..... Instrument Landing System
MLS ..... Microwave Landing System
NATO ..... North Atlantic Treaty Organisation
NDB ..... Non-Directional Beacon
RF ..... Radio Frequency
SATCOM ..... Satellite Communications
STANAG ..... Standardization Agreement
TACAN ..... Tactical Air Navigation System
TCAS ..... Traffic Collision Avoidance System
UHF ..... Ultra High Frequency
VHF ..... Very High Frequency
VOR ..... VHF Omnidirectional Range
WH ..... Working Hour

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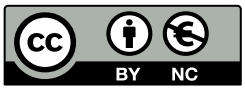

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