

Navigation and Air Traffic Control Techniques

Code: 101750
ECTS Credits: 6

Degree	Type	Year	Semester
2501233 Aeronautical Management	OB	3	2

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

To be able to assimilate the subject correctly, the knowledge of CNS (Communications, Navigation and Surveillance) given in the "telecommunications in the Aeronautical Sector" subject (second course) is requested.

Objectives and Contextualisation

This course introduces the student to the world of new technologies for aviation. It is divided into four blocks: Communications, Navigation, Surveillance and Air Traffic Management (ANS). With this basic division in 4 blocks, an analysis of the traditional / current technologies and procedures is carried out, as well as the main technological and procedural developments that are arriving in the process of change that the world of aviation is currently living, along with a prospection based on the key elements that are requested from the future ATM system, which explain many of these changes that are already being lived, and which allow us to predict with some accuracy what will be its evolution in the coming decades.

Competences

- Communication.
- Identify, develop and maintain the necessary resources to meet the tactical and operative needs inherent to air transport activities.
- Personal attitude.
- Personal work habits.
- Thinking skills.
- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.
- Use new technologies in airline management.

Learning Outcomes

1. Assess the performance of the new ADS-B technology.
2. Communicate knowledge and findings efficiently, both orally and in writing, both in professional situations and with a non-expert audience.

3. Critically assess the work done.
4. Describe new navigation systems.
5. Describe the new aircraft-tower communications: Datalink.
6. Develop critical thought and reasoning.
7. Develop curiosity and creativity.
8. Develop independent learning strategies.
9. Develop the ability to analyse, synthesise and plan ahead.
10. Identify the aeronautical environment.
11. Identify the potential benefits of the new 4D trajectory management.
12. Identify the technological resources necessary for the airside management of operations in the terminal control area.
13. Identify the technology that aircraft must have on board to meet needs of communication, navigation and surveillance.
14. Maintain a proactive and dynamic attitude towards career progression, personal growth and continuous professional development. Have the will to succeed.
15. Make efficient use of ICT in communicating ideas and results.
16. Manage routes in accordance with the new ATFM manual.
17. Manage time and available resources. Work in an organised manner.
18. Understand the new surveillance systems.
19. Use English as the primary language of professional communication.
20. Work independently.

Content

Theoretical Classes

Theory Block I:

Topic 1: INTRODUCTION.

- ANS concept: CNS / ATM, AIS, SAR and MET
- ATC: Operation, structure, type

Topic 2: CNS; COMMUNICATIONS.

- ACARS, AOC and FANS: ACARS, DARTINK, ACAR, ARINC 623 and FANS. Link 2000+: ATN Network, Datalink AOA, VDL-2, CPDLC, Documentation.

Topic 3: CNS; NAVIGATION

- RNAV. The PBN concept. GNSS: GPS, GLONASS and GALILEO. Augmentation Systems: SBAS (EGNOS), GBAS.

Topic 4: CNS; SURVEILLANCE.

- Secondary radar type S (ELS and EHS), ADS-B (ES). TCAS Multilateration. CASCADE program

Topic 5: ATM; AERIAL TRAFFIC MANAGEMENT.

- ATS, ATFM AND ASM
- SESAR and NEXTGEN programs. Technologies: SATCOM, VDL, GNSS, ADS-B, ADS-C. Services: CPDLC, D-FIS, D-TAXI, 4DTRAD. Programs: CDM, TA, AIR, OPTIMI.
- TRM (human factors in ATC)
- Future proposals

Theory Block II:

Topic 1. SESAR:

1. Introduction to performance of CNS / ATM systems

2. Analysis of deficiencies and limitations of the current CNS / ATM system
3. Introduction to CFMU / Network Manager and Traffic and Capacity Management (Demand and Capacity Balancing)
4. Introduction to the ATC (tasks, responsibilities, and HMI used by the Controllers)
5. SESAR Program: Characteristics of the Services planned for the ATM of the future. A detailed description of objectives and the technological, political, social and international context, as well as the most relevant concepts and definitions of SESAR.

Topic 2. SWIM:

1. SWIM concept and analysis as a future Intranet for the management of information and services in the context of global air transport.
2. Concept of Collaborative Decision Making (CDM) through SWIM.
3. SWIM Architecture (topologies of logical and physical networks) and standards used (IP, XML, SOA: Service Oriented Architecture, ...)
4. Data formats: AIXM, AICM, FIXM, FICM, WIXM, WICM. Digital NOTAMS and METEO services
5. Profiles, access and information management.
6. Current and future applications through SWIM.

Topic 3. Trajectory management I:

1. Introduction to the best flight paths from the point of view of fuel, emissions and time: Free Route, Direct Route, Great Circle, Rhumb, Line navigation. Procedures CCD and CDA. Importance of meteorology. Cost Index
2. New concepts of flight path management (4D Trajectories)
3. 4D navigation: 4D trajectories, 4DFMS, 4Dcontracts and 4DTRAD
4. Importance of the Trajectory Prediction (TP) systems for airspace and traffic planning
5. New concepts of dynamic management of airspace and traffic configuration. Trajectory Based Operations (TBO)
6. Future collaborative and dynamic planning among the various stakeholders (Network Manager, Airlines, Air Traffic Controllers, Airports).

Topic 4. Trajectory management II:

1. Traffic and resource management at airports and in the vicinity of airports: Time-based / Wake Vortex separations and ATC procedures, Dynamic Route Allocation, Point-Merge
2. New methods and standards of traffic separation. Time-Based SeMTCD, Automated Conflict Resolutions, Self-separation, Strategic de-confliction.
3. Safety Nets (STCA, APW, MSAW, ACAS / TCAS ...)
4. UAVs / RPAs and their integration into non-segregated space
5. Strategic De-confliction (anticipation of the separation of aircraft during the planning phase) as a key element of SESAR to allow TBO and PBO (Performance Based Operations)
6. Uncertainty at the ATM

Contents Practical classes

Exercises in simulation environments (ATC and pilot) and other tools to deepen learning from the experience of the student, especially to better understand the limitations of the technologies and processes of the current ANS system and to identify areas of improvement as well as anticipate which technologies and processes have more expectations of evolving in a future ANS system.

Contents Projects

Research and critical discussion about the current state of technologies and processes that are studied in class. Specialized work on one of the topics proposed by the teacher and which must be related to the specific levels and at the general level with the contents of the subject.

Methodology

The general methodological approach of the subject is based on the principle of multivariate strategies, so it is intended to facilitate the active participation and the construction of the learning process by the student. In this sense, lectures will be considered in a whole group, practical activities, participatory debates and follow-up processes of the student's work.

In order to develop the subject and seminars, "Power Point" presentations and short videos will be used.

All the subjects are complemented with practical sessions of laboratory. Also distributed to the material students to do the exercises: Aeronautical Letters, Sheets of Loading ...

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Sessions of practical problems	15	0.6	3, 1, 18, 4, 5, 8, 9, 7, 6, 17, 12, 10, 13, 14, 20
Theory Classes	30	1.2	1, 18, 4, 5, 8, 9, 6, 16, 12, 10, 13, 11, 20
Type: Supervised			
Seminars	5	0.2	9, 7, 6, 16, 10, 11
Type: Autonomous			
Development research work	30	1.2	3, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 10, 13, 11, 14, 20, 19
Seminars Preparation	20	0.8	3, 2, 8, 9, 7, 6, 15, 17, 14, 20, 19
Study	45.5	1.82	3, 1, 18, 4, 5, 8, 9, 7, 6, 17, 16, 12, 10, 13, 11, 14, 20, 19

Assessment

According to the Academic Regulations of the UAB, the evaluation process of this subject will consist of:

- A system of continuous evaluation.
- A recovery mechanism for the evaluation of the subject

In this subject the continuous assessment note consists of:

- Two theory exams (35% and 35%), classroom exercises delivered and internship reports (15%) and group synthesis work (15%). The minimum grade required for each of the evaluation processes to do average is 3.5 out of 10.

The dates of continuous evaluation and submission of works will be published in the Virtual Campus may be subject to possible changes in programming for any reason, although always will be informed with the possible or appropriate anticipation.

Conditions to approve and Recovery mechanisms

To pass the subject it will be necessary to obtain at least 5 points out of 10. The recovery process is only for the two theory exams (corresponding to Blocks I and II).

The student can apply for recovery whenever he has submitted to a set of activities that represent at least two-thirds of the total grade of the subject. Of these, students who have an average of all the activities of the subject with a grade equal to or greater than 3.5 may be presented in the recovery.

Procedure for review of qualifications

For each evaluation activity, a place, date and time of revision in which the student can review the activity with the teacher will be indicated. In this context, claims may be made on the activity grade, which will be evaluated by the faculty responsible for the subject. If the student does not appear in this review, this activity will not be reviewed later.

Qualifications

Granting a Dincstition grade is the decision of the faculty of the subject. The regulations of the UAB indicate that Dincstitions can only be granted to students who have obtained a final grade equal to or greater than 9.00 with a maximum of 5% of the total number of students enrolled.

A student will be considered "not assessment possible" (NA) if he has not been presented in a set of activities the weight of which equals a minimum of two-thirds of the total grade of the subject.

Ethical considerations and disciplinary measures

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, any irregularities committed by the student that could lead to a variation of the grade of an evaluation act will be scored with a zero. Therefore, copying or allowing to copy a practice or any other evaluation activity will involve failing with a grade of zero, and if it is necessary to pass it to pass, the whole subject will be suspended.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Problems solving and Laboratory Practices	15	0	0	3, 1, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 16, 12, 10, 13, 11, 14, 20
Research work and oral presentation on the extension of some of the topics discussed in class	15	0.5	0.02	3, 1, 18, 2, 4, 5, 8, 9, 7, 6, 15, 17, 16, 12, 10, 13, 11, 14, 20, 19
Theory Examination I	35	2	0.08	1, 18, 4, 5, 12, 10, 13
Theory Examination II	35	2	0.08	1, 18, 4, 5, 8, 9, 6, 16, 12, 10, 13, 11, 14, 19

Bibliography

Warning: See virtual campus for extensions and updates of this bibliography

Basic bibliography

- Global Operational Data Link Document (ICAO).
- Link 2000+ Guidance to Airborne Implementers (Eurocontrol).
- ATC Data Link Operational Guidance for LINK 2000+ Services (Eurocontrol).
- Flight Crew Data Link Operational Guidance for LINK 2000+ Services (Eurocontrol).

Complementary bibliography

- Pilot's Handbook of Aeronautical Knowledge (FAA).
- Aeronautical Information Manual (FAA).