

Infraestructures del Transport Aeri

Course presentation

Xevi Prats

xavier.prats@upc.edu

September 2021 – Version 3.2

ITA Lecturers

UPC researchers

Xevi Prats

ITA course coordinator

Office C3-104

Jovana Kuljanin

Office C3-119

Marc Melgosa

Office C3-121

ICARUS research group

www.icarus.upc.edu

External lecturers

Marc Pérez Batlle

Office C4-018

Ajuntament de Barcelona

Marc Torres

Office C3-018

ALG (www.alg-global.com)

Alex Ramonjoan

Office C3-018

Pildo Labs (www.pildo.com)



Introduction

First, some nice videos...

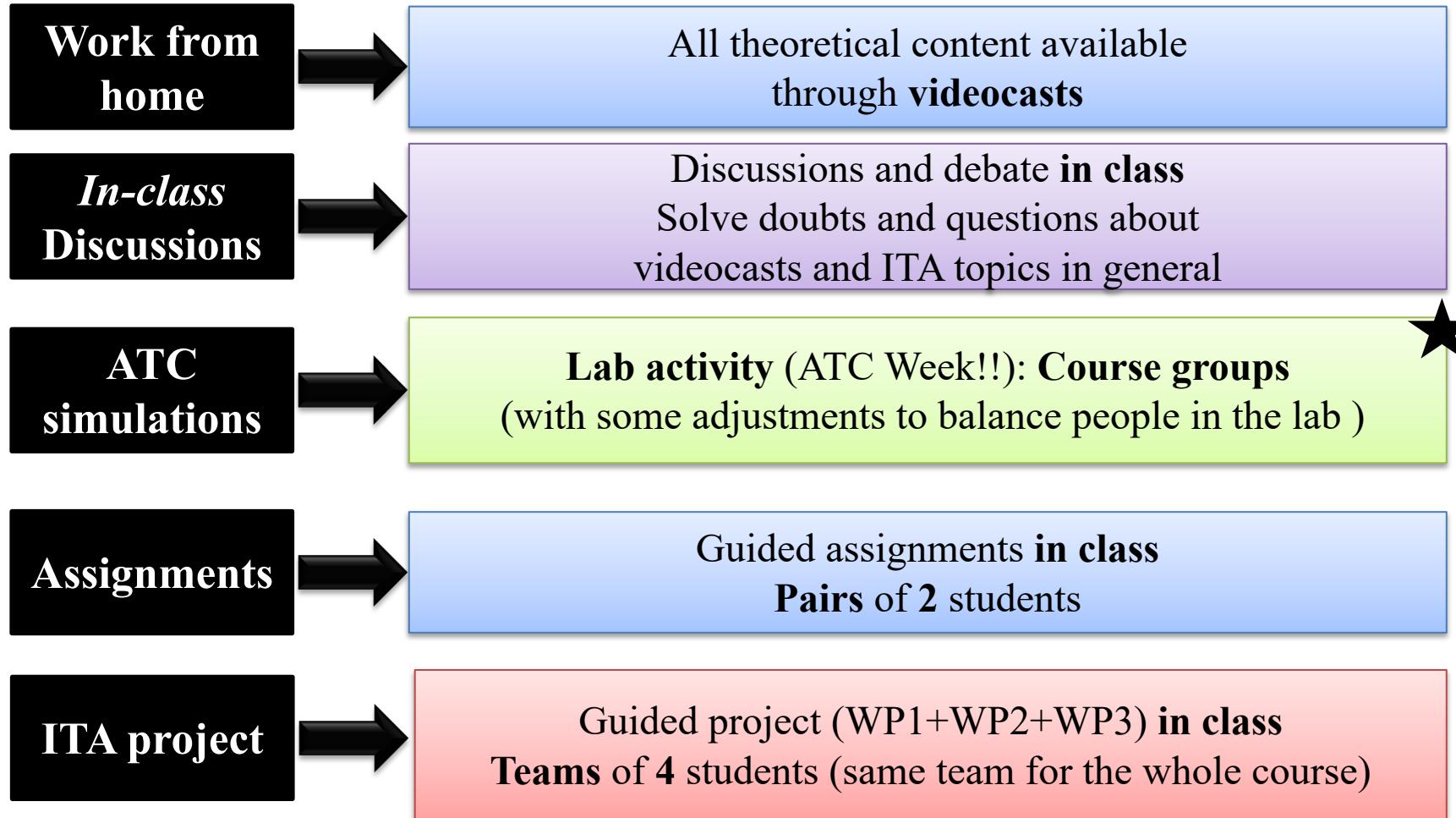
- NATS: London 24h: https://youtu.be/_jr6Ly7RBZg
- NATS: Europe 24h: <https://youtu.be/SrZSelclxWM>

(Before COVID-19 outbreak...)

- NASA: World Traffic 24h: <http://youtu.be/G1L4GUA8arY>
- NATS: London Bad Weather day: https://youtu.be/brX_VhOU3qQ



Course organization



WP: Workpackage



COVID-19 restrictions permitting

ITA planning

v1.0 Sep 12th 2021

Infraestructures del Transport Aeri (ITA) - Course Planning Fall semester 2021

Week	Day	(P) session		Day	(P) session		Day	(AD) session	
		Description			Description			Description	
1	Tuesday Sep 14th	- Course presentation lecture - Formation of project groups		Thursday Sep 16th	- Introduction to ANS lecture - Visual and instrument flight procedures teaser		Friday Sep 17th	Airspace types and classes assignment	
	Lecturer/hours	Morning: XP 2 Afternoon: MPB 2		Lecturer/hours →	Morning: XP 2 Afternoon: MPB 2		Lecturer/hours	Morning: AR 2 AR 2	Afternoon: AR 2 AR 2
	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V
2	Tuesday Sep 21st	Work from home (and buffer session)		Thursday Sep 23rd	- Visual and instrument flight procedures discussion - ASM teaser		Friday Sep 24th	- Airspace types and classes assignment support - AIP overview	
	Lecturer/hours	Morning: XP 2 Afternoon: MPB 2		Lecturer/hours →	Morning: XP 2 Afternoon: MPB 2		Lecturer/hours	Morning: AR 2 AR 2	Afternoon: AR 2 AR 2
	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V
3	Tuesday Sep 28th	- ASM discussion - ATS teaser		Thursday Sep 30th	- ATS discussion		Friday Oct 1st	2h00 WP1 KOM + WP1 support	
	Lecturer/hours	Morning: MM 2 Afternoon: MPB 2		Lecturer/hours →	Morning: XP 2 Afternoon: MPB 2		Lecturer/hours	Morning: AR 2 AR 2	Afternoon: AR 2 AR 2
	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V
4	Tuesday Oct 5th	- (3A11/3A21): NEST assignment - (3A12/3A22): IFR routes assignment		Thursday Oct 7th	- (3A11/3A21): IFR routes assignment - (3A12/3A22): NEST assignment		Friday Oct 8th	2h00 WP1 support	
	Lecturer/hours	Morning: MM 2 JK 2 Afternoon: MM 2 JK 2		Lecturer/hours →	Morning: JK 2 MM 2 Afternoon: JK 2 MM 2		Lecturer/hours	Morning: AR 2 AR 2	Afternoon: AR 2 AR 2
	Class →	3A11: 025V 3A12: TBD	3A21: 025V 3A22: TBD	Class →	3A11: 025V 3A12: TBD	3A21: 025V 3A22: TBD	Class →	3A11: 025V 3A12: 025V	3A21: 025V 3A22: 025V
5	Tuesday Oct 12th	NO CLASS		Thursday Oct 14th	1h00 TEST: Airspace types and classes - CNS teaser		Friday Oct 15th	2h00 WP1 support	
	Lecturer/hours →	Morning: MM 2 Afternoon: MPB 2		Lecturer/hours	Morning: AR 2 AR 2	Afternoon: AR 2 AR 2			

All course organisation in the
ITA planning

Unique official source!



ITA planning

Any update in the ITA planning or regarding *Atenea* contents will be **always** communicated via the *Atenea* Forum

Version and issue date

V1.0 Sep 17th 2014

Changes with respect to previous version

CHG: initial version

Infraestructures del Transport Aeri (ITA) - Course Planning						
Session	Day	Problems/Lab session description		Day	AD session description	Remarks
1	Thursday Sep 18th	1h30	Course presentation Group formation 1h30 Introduction to ANS lecture	Friday Sep 19st	WP1 kick-off WP1 support	For Friday 19th: bring at least two laptops Per group with Matlab/Octave installed
2	Thursday Sep 25th	1h00	Conventional radionavigation systems review test (TAE) 3h00 CNS/ATM lecture	Friday Sep 26th	WP1 support	



Videocasts

You are responsible to check the ITA planning yourselves in order to see the activities planned for next session

- Teaser in class → videotcasts at home → discussion in class

NOTE: large theoretical presentations (typically lasting 2h-6h) have been divided into many thematic videotcasts (15' long) for your convenience.

NOTE: Plan your time at home accordingly to watch the videotcasts before next discussion session

Description			Description				
	Tuesday Sep 14th	- Course presentation lecture - Formation of project groups		Thursday Sep 16th	- Introduction to ANS lecture - Visual and instrument flight procedures teaser		
1	Lecturer/hours	Morning: XP 2	Afternoon: MPB 2	Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2	
	Class →	3A11: 025V	3A12: 025V	Class →	3A11: 025V	3A12: 025V	
2	Tuesday Sep 21st	Work from home (and buffer session)			Thursday Sep 23rd	- Visual and instrument flight procedures discussion - ASM teaser	
	Lecturer/hours	Morning: XP 2	Afternoon: MPB 2	Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2	
	Class →	3A11: 025V	3A12: 025V	Class →	3A11: 025V	3A12: 025V	
3	Tuesday Sep 28th	- ASM discussion - ATS teaser			Thursday Sep 30th	- ATS discussion	
	Lecturer/hours	Morning: MM 2	Afternoon: MPB 2	Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2	
	Class →	3A11: 025V	3A12: 025V	Class →	3A11: 025V	3A12: 025V	
4	Tuesday Oct 5th	- (3A11/3A21): NEST assignment - (3A12/3A22): IFR routes assignment			Thursday Oct 7th	- (3A11/3A21): IFR routes assignment - (3A12/3A22): NEST assignment	
	Lecturer/hours						

Videocasts

You are responsible to check the ITA planning yourselves in order to see the activities planned for next session

- **Assignment:** check its Statement of Work (SoW) **before the session** in order to see eventual **special requirements** (previous work, special material to bring at class...)

		Description				Description				
1	Tuesday Sep 14th	- Course presentation lecture - Formation of project groups				Thursday Sep 16th	- Introduction to ANS lecture - Visual and instrument flight procedures teaser			
	Lecturer/hours	Morning: XP 2	Afternoon: MPB 2			Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2		L
	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V
2	Tuesday Sep 21st	Work from home (and buffer session)				Thursday Sep 23rd	- Visual and instrument flight procedures discussion - ASM teaser			
	Lecturer/hours	Morning: XP 2	Afternoon: MPB 2			Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2		L
	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V
3	Tuesday Sep 28th	- ASM discussion - ATS teaser				Thursday Sep 30th	- ATS discussion			
	Lecturer/hours	Morning: MM 2	Afternoon: MPB 2			Lecturer/hours →	Morning: XP 2	Afternoon: MPB 2		L
	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V	Class →	3A11: 025V	3A12: 025V	3A21: 025V	3A22: 025V
4	Tuesday Oct 5th	- (3A11/3A21): NEST assignment - (3A12/3A22): IFR routes assignment				Thursday Oct 7th	- (3A11/3A21): IFR routes assignment - (3A12/3A22): NEST assignment			

Assignments

- Example of SoW:

Introduction

In this assignment you have to interpret different Instrument Approach Charts (IAC) and analyze all the segments of the procedure. The charts to be analyzed are given in separate pdf files. The exercise is done in **pairs** (divide your group in two pairs) and will be done in one or two Friday AD Sessions (*Activitat Dirigida*).

Bibliography and reference documents

- [In Atenea - Reference documents]: *AIP-ES_charts_legend.pdf*
- [In Atenea - Reference documents]: *AIP-USA_IAC-charts_legend.pdf*

Special requirements

- Bring at least one computer per pair to the ITA Session(s) devoted to this assignment **or print** the two reference documents listed above.
- Print one copy (per pair) of "*IAC-charts*" and bring them to the ITA Session(s) devoted to this assignment.
- Print four copies (per pair) of "*IAC-analysis_template*" and bring them to the ITA Session devoted to this assignment. You can print in both sides of the paper bringing only 2 sheets of paper.



Assignments

- Example of SoW:

Statement of Work

Analyze each chart filling up the template of "*IAC-analysis_template*" document completing the blanks in the table. For each approach, add as many rows as necessary to describe all possible initial/intermediate segments depicted in the chart.

When referring to facilities, **provide always the name of the facility** (ex: IBA VOR, HIE NDB, I-DRO LOC, etc.). If a fix has a name in the chart, write only the name of the fix (ex: IAF LARUL), otherwise you **must clearly state how the fix is defined** (ex: IF 065°/8NM IBA VOR/DME, HIE NDB course 338° with 3NM to HR DME, etc.).

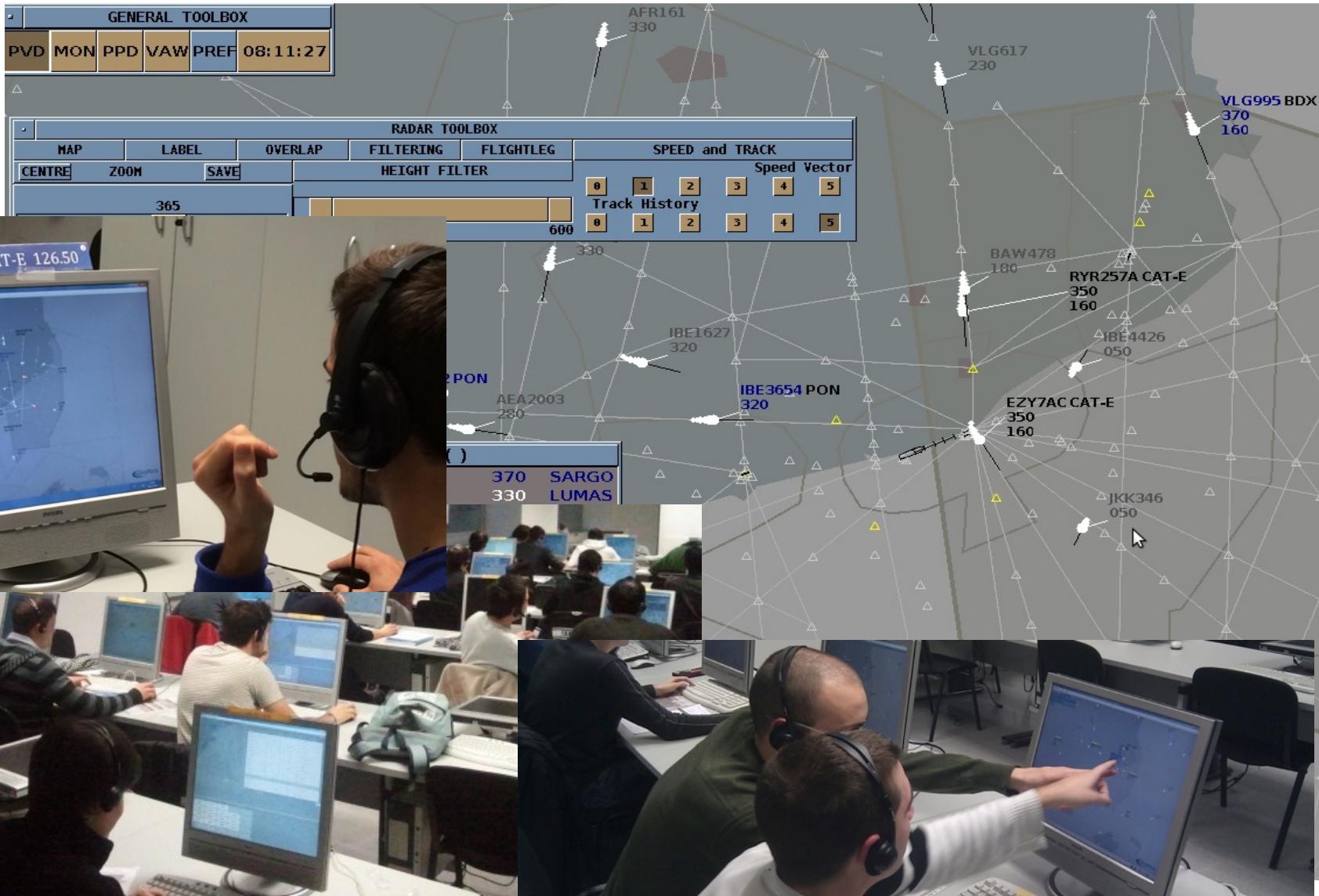
Describe in a concise and clear way the different leg types and remember to always state the name of the radionavigation aid (ex: 13NM arc IBA DME, IBA VOR radial 065°, HIE NDB course 338°, I-DRO LOC course 024°, etc.).

Assignment evaluation

One or two Activitat Dirigides (AD) will be allocated to give you support on this assignment. The lecturer will check the completeness of the assignment at the end of the session(s).



ATC simulations



ATC simulations



ATC simulations (ATC “week”)

	Tue Nov 23 rd	Thu Nov 25 th	Fri Nov 26 th	
8h00		ATC2: CTR*	ATC3: TMA	8h00
10h00	ATC1: UIR*	ATC2: CTR	ATC3: TMA	10h00
12h00	ATC1: UIR			12h00
14h00				14h00
15h00		ATC2: CTR*	ATC3: TMA	15h00
17h00	ATC1: UIR*	ATC2: CTR	ATC3: TMA	17h00
19h00				19h00
21h00	ATC1: UIR			21h00
	3A11 group	3A21 group	UIR: Upper Information Region CTR: Control area (final approach) TMA: Terminal Maneuvering Area	* Session with exceptional schedule
	3A12 group	3A22 group		

Atenea organisation

-  Biblioteca de l'estudiant
-  Dipòsit d'exàmens
-  OpenCourseWare
-  Guia docent (Català)
-  Guia docent (English)

-  Course general announcements
-  ITA planning (v1.0)
-  ITA scores v1
-  ITA WP1 debriefing
-  ITA WP4 debriefing



Official course announcements
channel (one-way)

Have you **ALL** received the
welcome announcement?



Atenea organisation

Support Material

 Presentations

 Videocasts - CNS

* Restringit

© Universitat Politècnica de Catalunya, 2020. Tots els drets reservats. Queda totalment prohibit gravar, difondre, comunicar o publicar aquests videocasts a través d'Internet o de qualsevol altre mitjà equivalent.

 Videocasts - IFR approaches

* Restringit

© Universitat Politècnica de Catalunya, 2020. Tots els drets reservats. Queda totalment prohibit gravar, difondre, comunicar o publicar aquests videocasts a través d'Internet o de qualsevol altre mitjà equivalent.

 Videocasts - IAC analysis - Enaire

* Restringit

© Universitat Politècnica de Catalunya, 2020. Tots els drets reservats. Queda totalment prohibit gravar, difondre, comunicar o publicar aquests videocasts a través d'Internet o de qualsevol altre mitjà equivalent.

 Videocasts - IAC analysis - FAA

* Restringit

© Universitat Politècnica de Catalunya, 2020. Tots els drets reservats. Queda totalment prohibit gravar, difondre, comunicar o publicar aquests videocasts a través d'Internet o de qualsevol altre mitjà equivalent.

 Past exams

 Solved exercises

 Reference documents

 Miscelaneous information

 Tarde de infarto en el espacio aéreo de Barcelona

Atenea organisation

The screenshot shows the Atenea Learning Management System (LMS) interface. At the top, there is a red brushstroke decorative element. Below it, the page title is "Atenea organisation". The main content area displays a hierarchical tree structure:

- Assignments
 - Assignments
 - NEST assignment
 - NEST doubts
- WP-1
- WP-2
- WP-3

Each item in the tree has a small icon next to it and a blue edit/pencil icon to its right. To the right of each tree item, there is a vertical ellipsis (three dots) icon.



ITA Lecturers in charge

Theoretical content	Xavier Prats + Marc Pérez + Marc Melgosa
Assignments	Marc Pérez + Marc Melgosa + Jovana Kuljanin
Project WP1	Alex Ramonjoan
Project WP2	Marc Torres + Jovana Kuljanin
Project WP3	Marc Melgosa + Jovana Kuljanin

- Check the ITA planning for details:

8	Monday Nov 16th	Videocasts available: - Communication Navigation and Surveillance (CNS) - IFR approaches	Tuesday Nov 17th	No session	Friday Nov 20th	2h00 WP2 KOM + WP2 support	
		Lecturer/hours MPB 3 XP 6 Class → Asynchronous sessions		Lecturer/hours MPB 3 XP 6 Class →		RS 2 RS 2 3A11: 134V 3A12: 134V 3A21: 133V 3A22: 133V	RS 2 RS 2 3A11: 134V 3A12: 134V 3A21: 133V 3A22: 133V
9	Monday Nov 23rd	2h00 on-line: Support session (CNS and IFR approaches)	Tuesday Nov 24th	Remote assignment: ATS flight plans	Friday Nov 27th	2h00 WP2 support	
		Lecturer/hours XP 2 XP 2 Class → 3A11+3A12: On-line session 3A21+3A22: On-line session		Lecturer/hours SV 2 SV 2 SV 2 SV 2 Class → Asynchronous sessions		RS 2 RS 2 3A11: 134V 3A12: 134V 3A21: 133V 3A22: 133V	RS 2 RS 2 3A11: 134V 3A12: 134V 3A21: 133V 3A22: 133V

Initials of the lecturer in charge
(morning and afternoon groups)

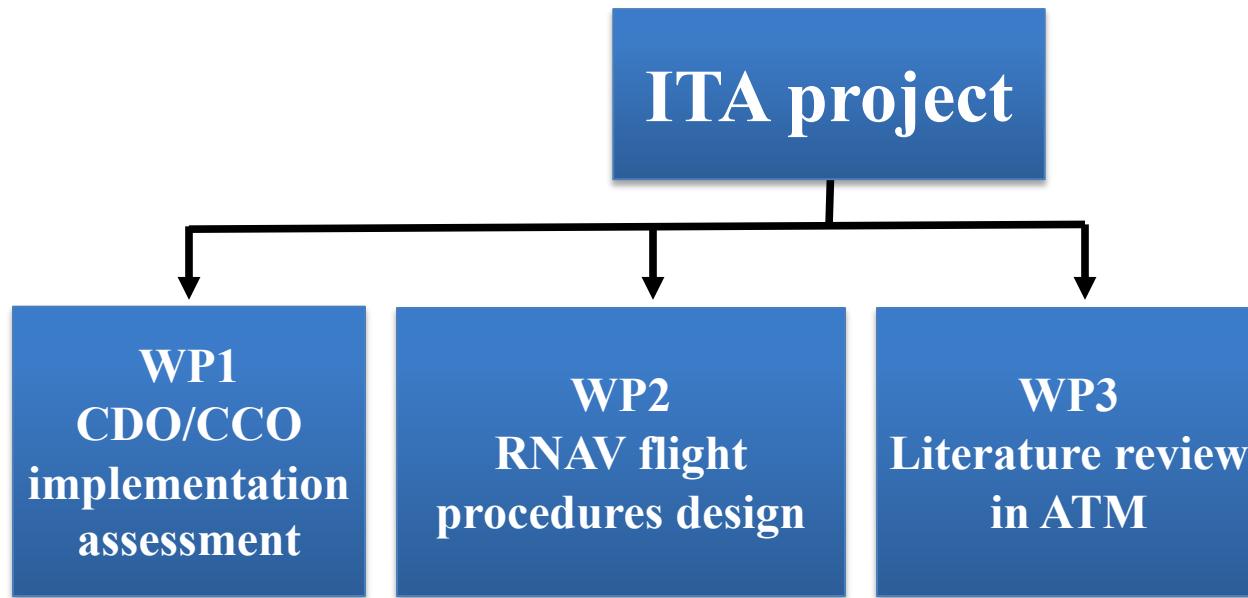
Communication channels

- ATNEA “forum” (*general course announcements*) will be used as the **only** official channel for one-way announcements.
- Students shall contact ITA faculty via **e-mail**
- For coordination or general issues contact the **ITA coordinator**
- For **support** (solving doubts, etc.) contact the corresponding **lecturer in charge** of the concerned activity to schedule a visit at the office (or teleconference)

- UPC institutional email shall be used for all communications with ITA faculty and to access to Atenea, and UPC Google services (access videocasts, Google Meets, etc.).
- All e-mails from private accounts will be automatically deleted and disregarded with no reply.
- No exceptions. Check **asap** with the UPC IT services if you experience problems with your UPC account.



ITA project



Support sessions allocated in
the course planning

Additional support given
only by the corresponding
lecturer in charge
and exceptionally

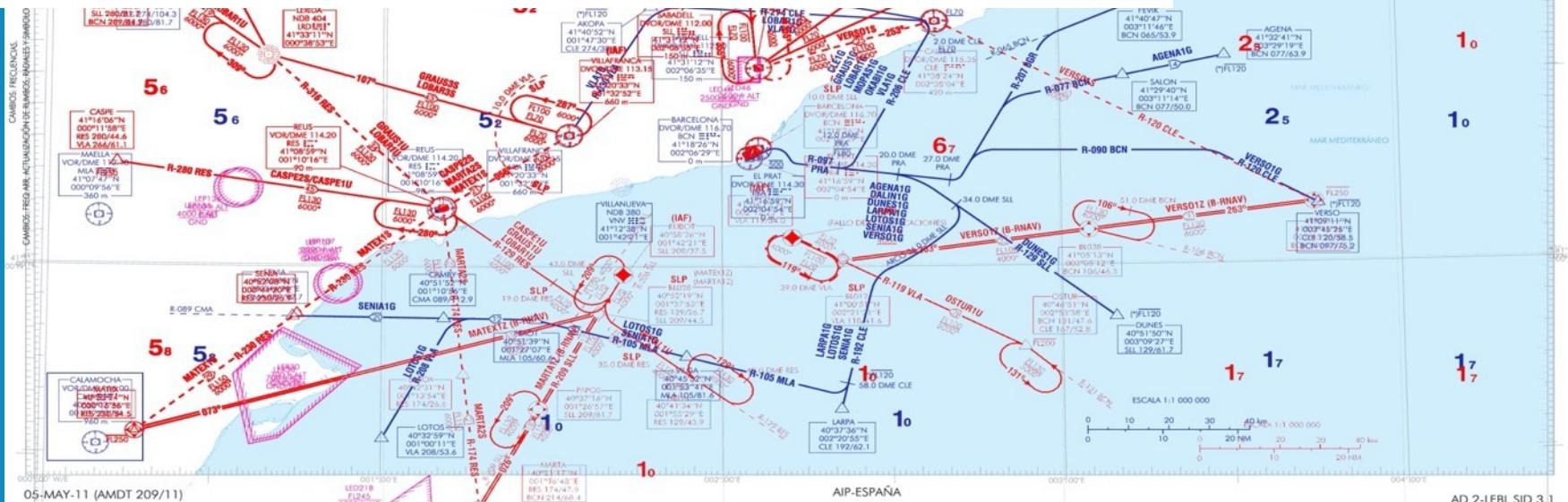
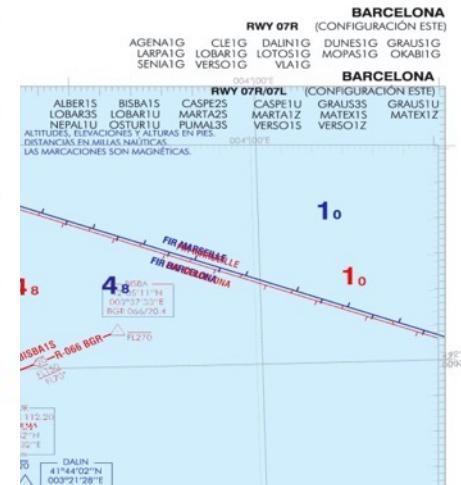
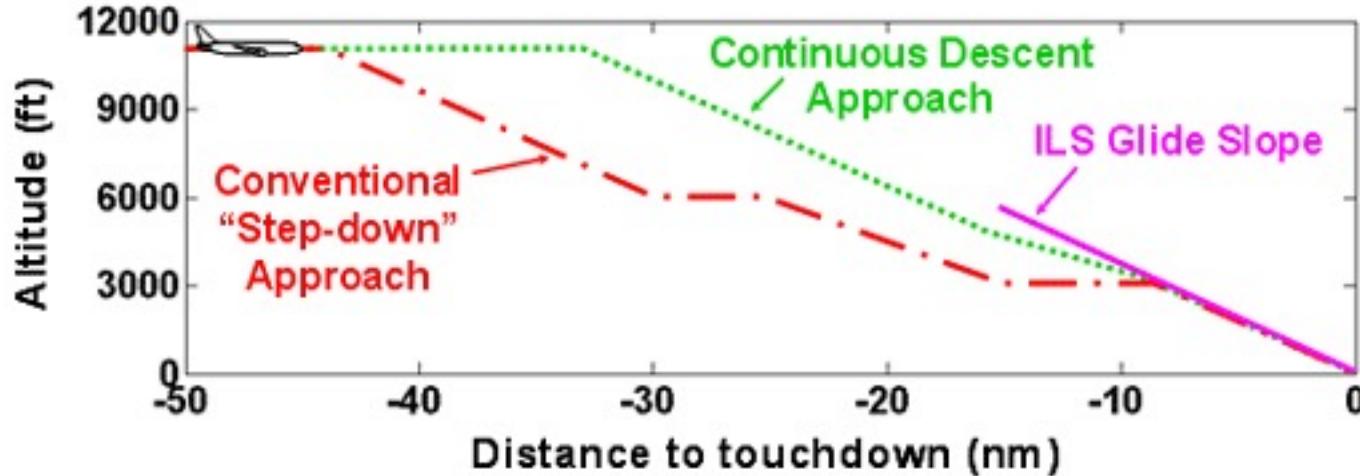
CCO: continuous climb operations

RNAV: Area Navigation

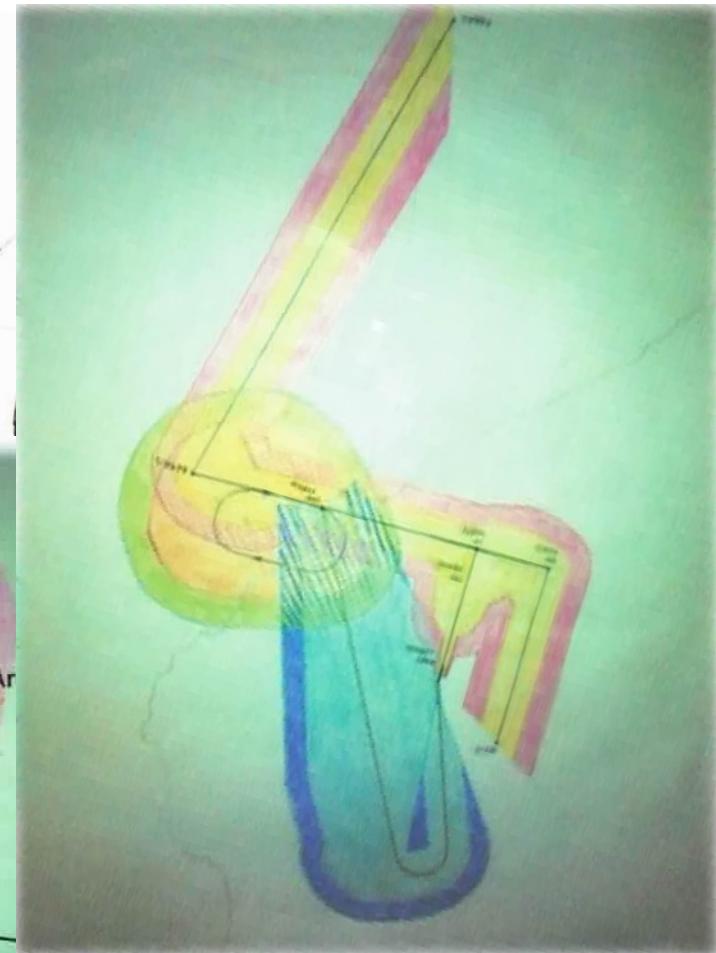
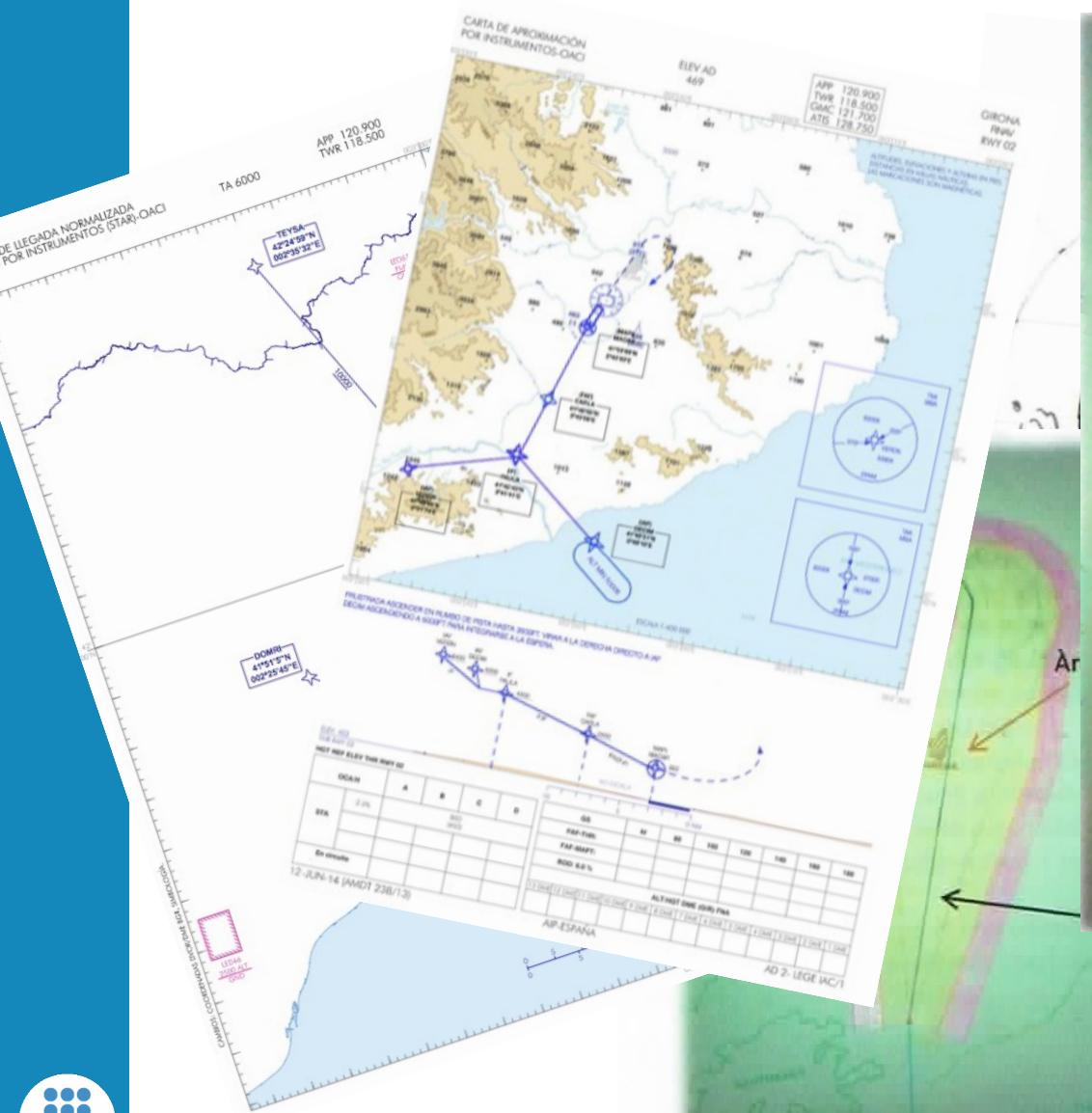
CDO: Continuous descent operations

ATM: Air traffic management

ITA project: WP1



ITA project: WP2



Trajectòria nominal

Project Deliverables

- **WP1 report deadline: Nov 14th 2021 23h55'**
- **WP2 practical test: Jan 26th 2022 (hour TBC).**
- **WP3 presentations: Dec 10th 2021 in class**

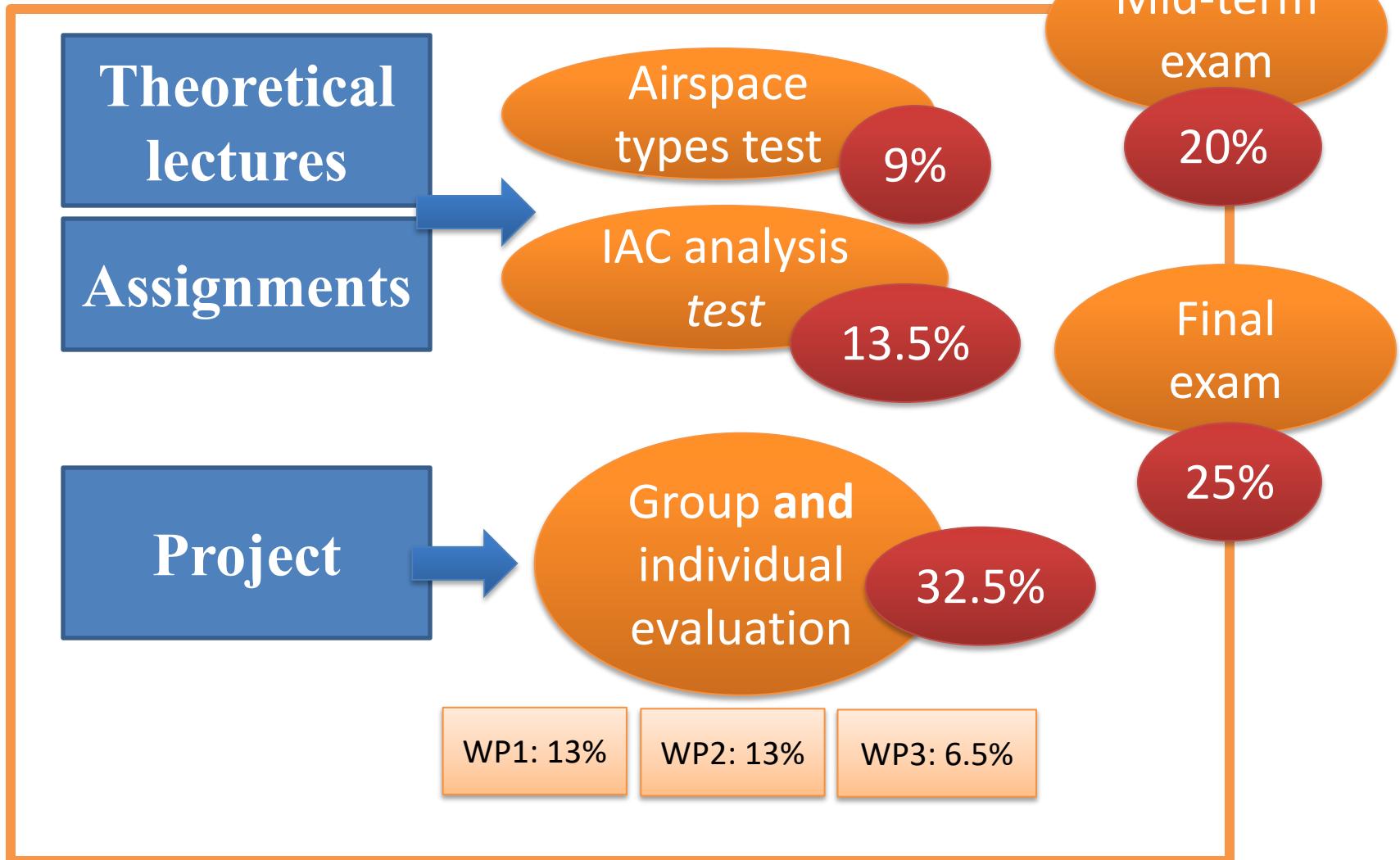
Hard deadlines
(Score=0 if delivered late)

Deliverable group score will be only given to those students with their names appearing in the cover page

→ Repeat students can keep their old WP scores if they want:

- ***All or none policy*** Either **all** WPs are repeated or **all** old scores are kept.
- If (potentially) interested: send an email to the ITA coordinator with your name **and** the last semester you were enrolled in ITA.

Course evaluation



ATC: Air Traffic Control

Introduction – 24

Infraestructures del Transport Aeri (ITA)

Xevi Prats
Sep 2021 – v3.2



This is also a
library !!!

Course bibliography

Cook, A. (Ed.), 2007. *European air traffic management. principles, practice and research*. Aldershot, England: Ashgate Publishing Limited.

Vincent P. Galotti, 1997. *The Future air navigation system (FANS) : communication, navigation, surveillance, air traffic management*. Aldershot, England Avebury Aviation.

Milovan S Brenlove, 2003. *The Air traffic system: a commonsense guide*. Ames Iowa State Press.

Michael S. Nolan, 2004. *Fundamentals of air traffic control*. Belmont, CA Thomson--Brooks/Cole.

FAA, 2004. *Airplane Flying Handbook*, U.S. Department of Transportation. Federal Aviation Administration. FAA/H/8083-3A. Available [on-line](#)

FAA, 2007. *Instrument Flying Handbook*, U.S. Department of Transportation. Federal Aviation Administration. FAA/H/8083-15B. Available [on-line](#)

FAA, 2015. *Instrument Procedures Handbook* U.S. Department of Transportation. Federal Aviation Administration.FAA/H-8083-16A. Available [on-line](#).

Jorge Ontiveros, 2001. *Descubrir el control aéreo*. Centro de documentación y publicaciones de AENA

Francisco J. Sáez-Nieto, Luis Pérez, Victor F. Gómez, 2002. *La navegación aérea y el aeropuerto*. Fundación Aena

Lucio Bianco, Paolo Del'Olmo, Amadeo R. Odoni, 2001. *New Concepts and Methods in Air Traffic Management* (Transportation Analysis), Springer.

Lucio Bianco, Paolo Del'Olmo, Amadeo R. Odoni, 1997. *Modelling and Simulation in Air Traffic Management* (Transportation Analysis), Springer.

Anne R. Isaac, Bert Ruitenberg, 1999. *Air traffic control: human performance factors*. Aldershot. Ashgate .

Moya, J. and Bernabé, M.A, 2011. Descubrir la Cartografía aeronáutica. Cent. de doc. y publicaciones de AENA

Course bibliography

ICAO, 2001. *Procedures for Air Navigation Services. Air Traffic Management*. International Civil Aviation Organisation. 14th Ed. Montreal (Canada). Doc. 4444

ICAO, 2006. *Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) - Volume I, Flight Procedures*. International Civil Aviation Organisation. ed. 5th Ed. Montreal (Canada). Doc. 8168

ICAO, 2006. *Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) - Volume II, Construction of Visual and Instrument Flight Procedures*. International Civil Aviation Organisation. 5th Ed. Montreal (Canada). Doc. 8168

ICAO, 1999. Manual of air traffic services data link applications. International Civil Aviation Organisation. Montreal (Canada). Doc. 9694

Kerczewski, R.J.; Greenfeld, I.; Welch, B.W., "Communications, navigation and surveillance for improved oceanic air traffic operations," Aerospace Conference IEEE , vol., no., pp.1799,1805, 5-12 March 2005

Parkinson, A., "Space-based ADS-B: A small step for technology a giant leap for ATM?," Digital Communications - Enhanced Surveillance of Aircraft and Vehicles (TIWDC/ESAV), 2011 Tyrrhenian International Workshop on , vol., no., pp.159,164, 12-14 Sept. 2011

Moya, J., "Contribución a la mejora de la expresión gráfica de las cartas aeronáuticas". PhD thesis. Technical University of Madrid. Department of Topography and Cartography. Jan 2016





Composition of Project groups



Thank you!!

Gràcies!!

